UNITED STATES PATENTS ON POWDER METALLURGY

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By
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PREFACE

Patents are disclosures of inventions, in return for which the inventor is given the right to exclude all others from making, using, or selling his invention for the term of 17 years. After this period the invention becomes public property. Patent literature is a valuable source of technical information, for, by these disclosures, the development of an art may be traced through a long period of time.

This publication, based on a collection search of United States patents of the present series, which began in 1836, represents more than a century of progress in the art of powder metallurgy. Patents issued up to January 1, 1947, are included.

The collection search was made for the National Bureau of Standards by Invention, Inc., under the direction of Raymond E. Jager, president. R. E Pollard, metallurgist, of the Bureau's staff, edited the abstracts, eliminating those not pertinent to powder metallurgy, and revised the classification.

E. U. Condon, *Director.*

CONTENTS

[1] Where the production of metal powders is for a specific application, see also subheads under section V.

[2] See also, "Explosives," section V, 9, for loose photographic flash powders.
[3] See also, "Coating and molding," section V, 4, for specific processes.
[4] See also, "Packing materials," section V, 19, and "Welding rods and composition," section V, 24.

UNITED STATES PATENTS ON POWDER METALLURGY

By Raymond E. Jager and Rolla E. Pollard

ABSTRACT

A total of 2,253 United States Patents pertaining to powder metallurgy are classified under four main headings: production, handling and working, alloying, and applications. Under these main headings, the patents are listed by number in chronological order, together with the name of the inventor and a short abstract of the patent. Patents issued up to January 1, 1947, are included.

I. INTRODUCTION

Patent literature is a valuable source of technical information that undoubtedly would be more widely used if compiled listings of all patents relating to a particular subject were available. Unfortunately, a collection search of patents is a laborious and time-consuming job that requires expert knowledge of the intricacies of the United States Patent Office classification system. It is the purpose of this report to provide a comprehensive list of patents relating to powder metallurgy, classified in related groups and with a short abstract of each invention, to simplify the study of patent literature on this subject.

The collection search on which this report is based was exhaustive, and the report, therefore, covers the field of powder metallurgy, comprehensively. More than 50 subclasses in the United States Patent Office were searched thoroughly and nearly one hundred fifty other subclasses were examined. All patents issued since September 1942, regardless of classification, have been examined and those relating to powder metallurgy have been included in the report, up to January 1, 1947.

The term "powder metallurgy" usually is applied to the art of making objects by pressing and heating metal powders which may or may not contain nonmetallic additions. This excludes some of the most important industrial uses of metal powders such as paint pigments, metallic coatings, catalysts, etc. However, the methods of production, handling and classification of metal powders are very much the same whether the powder is used as such or is pressed and sintered. For this reason, some of the applications named above are included in the report. Many metallurgical processes in which metal powders are produced as a step in refining or processing ores are omitted. The machines used in powder metallurgy, such as grinding mills, presses, briquetting machines, furnaces, etc. generally are omitted because in most cases they were obtained from other arts with little structural change. However, some machines developed for particular applications of powder metallurgy, such as bearings or magnetic dust cores, are included. Most of the devices used in testing metal powders such

as sieves, flow meters, turbidimeters, air separators, etc. also were borrowed from other arts and generally are omitted unless developed particularly for metal powders.

Classification of 2,253 patents would be difficult even in a less heterogeneous field than powder metallurgy. However, an attempt has been made to organize the report so that the patents on a given phase of the art can be ascertained by use of the table of contents. It will be noted that the patents are classified under four main headings: Production, handling and working, alloying, and applications. Subheadings under each of these are in alphabetical order according to the first, or key, word. Under each of the subheadings the patents are arranged in numerical order according to the patent numbers, which means that they are also in chronological order. Many of the patents might be classified in any one of several classes. However, as each patent is listed in only one place, the classification has been arranged whenever possible according to the final product. In other words, those of a general nature are placed under the first three headings while those pertaining to a particular article are placed under Applications. An exception to this will be noted in Section IV, 3, wherein, under a general heading describing very hard metal compositions, are listed such particular products as cutting tools so that most of these closely related applications may be found in one group.

II. PRODUCTION OF METAL POWDERS

1. Atomization, Vaporization, Spraying Molten Metal, or Physically Contacting It With Other Fluids, To Obtain Fine Particles

Patentee	U. S. Patent No.	Subject
Feix	15, 733	Melted metal granulated by rotary motion in cold water.
Perry	99, 588	Molten iron granulated by stream of cold water.
Wood	143, 485	Molten slag or cast iron granulated by continual motion of water.
Small	282, 579	Comminuted solder made by running molten solder in blast of air.
Randolph	305, 758	Stream of cold water projected against stream of molten alloy or solder.
Bosworth	373, 766	Jet of steam forced on molten lead decreases oxidation, present with blast of air.
Tilghman	446, 986	Chilled iron globules made by atomization using high-pressure steam or gas; alkali used to prevent rust.
Tilghman	446, 987	Same as 446,986, except drying is accomplished in nonoxidizing atmosphere.
Madden	702, 736	Melted fusible material sprayed from rotating vessel.
Pohl	706, 475	Material melted, sprayed into a retort, evaporated and condensed.
Bertou	719, 725	Liquefied metal mixed with an elastic fluid, such as superheated steam at high pressure; pulverization obtained upon sudden expansion.

II. PRODUCTION OF METAL POWDERS—Continued

1. Atomization, Vaporization, Spraying Molten Metal, or Physically Contacting It With Other Fluids, To Obtain Fine Particles—Continued

Patentee	U. S. Patent No.	Subject
Rowley	720, 382	Steam applied to molten metal.
Fuchs	721, 293	Reducing molten metal to fine particles by stream of water under high pressure.
Maxim	796, 338	Molten metal poured in stream of gas or vapor under pressure.
Martyn	952, 828	Molten metal forced on series of blades.
Neil	1, 036, 689	Blast of air, gas, or steam, under pressure forced on molten metal; solidifies before any appreciable oxidation.
Neil	1, 049, 314	Molten metal in flattened condition atomized by jet of heated fluid.
Ellis	1, 141, 177	Molten lead exploded by jet of steam.
Holley	1, 156, 079	Molten lead and jet of superheated steam forced into expansion chamber.
Freeman	1, 245, 328	Molten metal forced into hollow, inclosing jet or stream of gas, traveling at sufficient velocity to break up particles.
Huldt	1, 298, 722	Zinc and other metals volatilized in electric furnace.
Hall	1, 306, 060	Molten metal continuously passed through gas and then liquid.
Tebbetts	1, 327, 743	Aluminum pulverized by agitating it while in molten state.
Odam	1, 328, 446	Materials atomized by combustion of gases formed by heating materials.
Baer	1, 347, 927	Molten bronze cooled by water before hammering process.
Nicol	1, 351, 865	Jet of hydrogen directed on molten magnesium.
Lewicki	1, 355, 984	Molten metal and compressed air forced against cold metal wall.
Nicol	1, 356, 780	Molten magnesium discharged in jet of gas of sufficient velocity to tear into particles.
Hall	1, 501, 449	Molten metal directed against jet of steam in rotary motion.
Andrasek, et al	1, 523, 624	Soft metal is melted, poured into a bag of refractory sieve material, and this bag is rubbed against a warm plate so metal will pass through as grains.
Hall	1, 545, 253	Nozzle intended for use in disintegrating apparatus.
Gaughan	1, 546, 926	Molten zinc delivered into heated fluid under pressure.
Williams	1, 635, 653	Two molten metals which do not alloy, or only partially alloy, mixed and atomized at high temperature.
Hall	1, 659, 291	Molten metal struck with rotating flow of disintegrating gas.
Podszus	1, 671, 683	Jet of liquid metal broken up and forced in layers of liquid to prevent particles from coming in contact with each other.
Martin	1, 780, 201	Metal pellets produced by forcing molten metal between rolls in presence of water.

II. PRODUCTION OF METAL POWDERS—Continued

1. Atomization, Vaporization, Spraying Molten Metal, or Physically Contacting It With Other Fluids, To Obtain Fine Particles—Continued

Patentee	U. S. Patent No.	Subject
Williams	1, 856, 679	Molten metal subjected to whirling stream of aeriform fluid under pressure.
Seil	1, 859, 992	Stream of liquid metal subjected to stream or gas at high velocity.
Takata	1, 938, 876	Atomized molten lead impinged on revolving blades of a fan.
Hegmann	2, 006, 891	Blast of air on molten metal.
DeBats	2, 040, 168	Molten metal scattered integrally and in droplet form into cooling liquid.
Hall, et al	2, 059, 230	Apparatus for granulating molten material by spraying.
DeBats	2, 061, 696	Molten metal forced on centrifugal spraying machine in gaseous atmosphere.
Teeple	2, 076, 798	Molten metal poured through perforated plate of predetermined size and contour; varying sized shreds are produced suitable for packing purposes.
Stecher	2, 134, 091	Molten material cooled by fluid and discharged from vibrating plate.
Maier	2, 207, 746	Apparatus for converting metals into vapor state for condensation.
Ferguson	Reissue 22,494 of 2, 209, 964	Molten metal passed into gaseous chamber under pressure.
Hiller	2, 213, 365	Molten metal forced over rotatable flinger wheel.
Best	2, 255, 204	Phosphorus alloyed with molten brass before atomization to make particles rounded.
Hart	2, 280, 703	Metal heated with nonreactive liquid, beat until granulated and cooled by nonreactive liquid.
Harder	2, 301, 805	Stream of water directed against stream of molten iron.
Truthe	2, 304, 130	Molten metal directed on rapidly rotating disc and simultaneously supplying stream of cold water.
Maier	2, 304, 469	Apparatus for converting metals and metal powders into vapor state.
Landgraf	2, 305, 172	Producing metal powders by causing molten metal and stream of cooling liquid to impinge on rapidly rotating disc.
Landgraf	2, 306, 449	Producing metal powders by impinging molten metal on rotating elements, first rotating element being supplied with stream of cold water.
Best	2, 308, 584	Producing metal powders by atomizing molten metal in jet of gas.
Marette	2, 310, 590	Forming metal shot by subjecting molten metal to stream of water.

II. PRODUCTION OF METAL POWDERS—Continued

1. Atomization, Vaporization, Spraying Molten Metal, or Physically Contacting It With Other Fluids, To Obtain Fine Particles—Continued

Patentee	U. S. Patent No.	Subject
Timmins	2, 322, 327	Granulating ferroalloys to free gangue materials by rapid chilling of molten metal and slag product.
VanHoorn, et al	2, 336, 138	Vaporization of metals by mixing and heating metal powders with refractory binder and applying to a core between turns of spacing helix.
Ervin	2, 341, 704	Disintegrating molten metal utilizing closely spaced series of jets of air, gas, vapor or steam under pressure into which is injected a heavier-than-air or nonexpansible liquid, thereby attaining more uniform disintegration.
Brooke	2, 343, 443	Electric arc furnace especially adapted for use in vaporizing metals.
Hiller	2, 358, 068	Producing metal powders by beating and flinging particles of molten metal into gaseous atmosphere.
Lepsoe	2, 371, 105	Producing metal powders which comprises enclosing stream of molten metal in flux and disintegrating by jet of atomizing gas.
McCoy	2, 380, 253	Producing granulated metal by heating to plastic state while adding silica-gel to granulate, then removing granulating agent.
Wulff	2, 381, 022 2, 381, 023 2, 381, 024	Iron and iron alloy powder production apparatus, in which iron is quenched, shotted, disintegrated and magnetically separated into carbon-poor powder concentrate and a carbon-rich powder tailing.
McManus, et al	2, 382, 432	Aluminum powder is prepared by depositing vaporized aluminum on a nonretentive surface.
Comstock	2, 384, 892	A stream of molten metal is comminuted by contacting it with stream of water at a pressure not less than 100 pounds per square inch.
Paddle	2, 402, 441	A process for reducing metals to powdered or granular form by subjecting a molten stream of the metal into contact with a blast of gaseous fluid.
Seliger	2, 403, 463	A method of reducing iron to particle form by forcing the metal in a semiliquid state through a foraminous plate.
McManus, et al	2, 405, 662	Aluminum powder is produced by condensing aluminum vapor on an endless belt, detaching the film which is formed, and ball-milling and screening to produce the powder.

II. PRODUCTION OF METAL POWDERS—Continued

2. Chemical Precipitation

Patentee	U. S. Patent No.	Subject
Wilcox	12, 815	Copper is recovered from cupric sulfate solution by use of sulfur dioxide as precipitant.
Henderson	60, 514	Copper is precipitated from an acid solution of its ore by powdered iron, the production of which is also described in the patent.
Wilcox	96, 525	From acid solutions used in cleaning copper and brass goods, copper is precipitated by iron.
Dahne	159, 647	Gold is precipitated in form of brown powder; ore is treated with aqueous chloride of lime and hydrochloric acid; sulphurous acid is used as precipitant.
Gutzkow	205, 187	Silver is precipitated from an amalgam of silver and copper in sulphuric acid by action of copper.
Schaeffer	267, 723	Gold-containing ore is subjected to the action of bromine; gold is then separated from resultant bromine solution by oxalic acid or iron sulphate as precipitant.
Hunt, et al	483, 924	Metallic copper is precipitated by metallic iron or electric current from acid solution of copper, nickel and iron.
Jackson	490, 659	Pure, fine powdered precious metal is produced by chlorinating ore, dissolving in hyposulphite solution, and electrolytically treating in presence of zinc plates.
Carter, et al	513, 174	Apparatus precipitates gold and silver from cyanide solution by zinc balls which are continuously agitated to remove deposited gold from them.
Sutton	521, 899	In separation of gold as powder from its chloride solutions, the solution is mixed with a hydrocarbon liquid which entrains the precipitated gold powder.
Jacobs	624, 040	Silver and gold are precipitated in metallic form from chloride or cyanide solutions by phosphide of hydrogen.
Hood	629, 905	A zinc-antimony-mercury alloy, granulated by pouring into water, is used for precipitation of gold.
Vanino	630, 951	Pure silver is extracted from haloid salts by mixture of salts with a watery solution of alkaline agents and addition of formic aldehyde.
Martino	635, 793	Gold is obtained from combination with metalloids by adding calcium carbide to dry, finely divided ore; on addition of water, free gold and acetylene hydrids of metalloids are produced.
Martino, et al	637, 140	Gold is precipitated from aqueous chloride or bromide solutions by adding metallic carbide thereto to form hydrocarbon gas.
Merrill	684, 578	Precipitant of zinc ground to great fineness by addition of grit such as silica, emery, etc.

II. PRODUCTION OF METAL POWDERS—Continued

2. Chemical Precipitation—Continued

Patentee	U. S. Patent No.	Subject
Waterbury	689, 835	Precipitation of copper in form of slimes is rapidly effected by passing compressed, heated air upward through precipitant and solution.
VanArsdale	723, 949	Metallic copper is precipitated from solution containing cupric sulphate by impregnating solution with sulphur dioxide and heating it.
Guzman	729, 760	Finely divided silver is precipitated from solution with cupric chloride and cuprous chloride using granulated copper as precipitant.
Porter	778, 547	Metallic copper is thrown down as "red copper" from copper cyanide solution subjected to action of zinc-dust and ammonia.
Wilcox	790, 238	Metallic copper is precipitated from cupric sulphate solution by dosing with sulphur dioxide in a closed vessel, under heat and pressure.
Gutensohn	790, 429	Finely divided nickel, copper, etc., are obtained from acid solution by admixture of second solution containing alkali and resin; resin is distilled from mass of resin and metal formed.
Gin	793, 186	Metallic copper is precipitated from cuproso-cupric sulfite dissolved in sulfurous acid on heating under pressure.
Hendryx	860, 661	Stream of gold or copper-bearing solution is passed through agitated bed of granulated zinc or iron, the metal precipitated being carried off by the stream.
Jumau	870, 786	Pure copper is precipitated from a copper salt which is heated under pressure with a sulfite.
Robertson	886, 866	Gold, silver and copper are precipitated, from solution obtained by mixing ore and aqua regia, on iron scrap from which gold values may be scaled off.
Potter	894, 902	Metallic copper is precipitated from cupric sulfate solution charged with sulfur dioxide and subjected to heat and pressure; the spongy product may be pressed into ingot form without further refining.
Wadhams, et al	900, 453	In process of separating constituent metals from speiss containing Co, Ni, Ag, and Fe silver is cemented on copper shot.
Jumau	924, 076	Pure metallic copper is precipitated from copper salt solution by treatment thereof with carbon monoxide gas, under heat and pressure.
Jumau	924, 077	Reducing agent used, and claimed (instead of carbon monoxide) is hydrogen.
Jumau	930, 967	Copper salt solution is heated, under pressure, to a high temperature in presence of sulfurous acid, and pure metallic copper is precipitated.

II. PRODUCTION OF METAL POWDERS—Continued

2. Chemical Precipitation—Continued

Patentee	U. S. Patent No.	Subject
Jumau	930, 968	Copper salt solution is subjected to heat and pressure in presence of sawdust, wood shavings, etc.
Merrill	1, 063, 567	Reducing conditions (exclusion of oxidizing gases) are maintained throughout precipitation of metal from solution by agitation with zinc powder, etc.
Schaaf, et al	1, 069, 981	Comminuted or finely divided copper is precipitated from solution by charging copper solution with gaseous peroxide of nitrogen and lower oxides of nitrogen and subjecting to heat and pressure.
David	1, 075, 093	In a cyclic extraction process, copper is precipitated by powdered electrolytic iron, solution then re-electrolyzed producing fresh precipitant.
Weidlein	1, 089, 096	Metallic copper is precipitated by sulfur dioxide from a copper sulfate solution; copper powder may be compressed to form anodes.
Urquhart	1, 090, 661	Gold and silver are precipitated from cyanide solutions on granulated zinc, mass agitated to free gold from zinc and further subdivide zinc for reuse.
Mills	1, 123, 778	Process for precipitating precious metals utilizes a granular zinc, aluminum, etc. precipitant at surface of a filter medium through which pregnant solution is withdrawn.
VanArsdale	1, 147, 466	Copper is precipitated from solution by adding sulfur dioxide thereto and neutralizing free acid formed during precipitation.
Towne, et al	1, 156, 383	Gold or silver is seaparated from a cyanide solution by zinc economically used by process in a powdered form.
Conklin	1, 160, 849	Metallic precipitant is eliminated from precipitate by moving precipitant in form such as balls rather than shavings, etc., through pregnant solution.
Weidlein	1, 201, 899	Copper precipitation according to 1,089,096; present method circulates solution through precipitating apparatus, heating to effect precipitation and recirculating with fresh solution.
Weidlein	1, 223, 454	Apparatus for precipitation according to 1,201,899.
Crowe	1, 281, 249	Process and apparatus which exclude oxidizing gases during precipitation of gold from cyanide solutions by replacement.
Langer, et al	1, 291, 030	Nickel-copper matte is separated by precipitating copper from acid solution using finely divided nickel, reduced from the original matte, as the precipitant, and electrolyzing residual solution.
Gordon	1, 323, 588	Gold powder is precipitated from cyanide solution by using aluminum plate dipped in mercuric chloride as precipitant.

II. PRODUCTION OF METAL POWDERS—Continued

2. *Chemical Precipitation*—Continued

Patentee	U. S. Patent No.	Subject
Nelson	1, 326, 463	Copper is precipitated from a sodium bisulfate-sodium chloride solution with finely divided steel as precipitant; additional sodium chloride prevents adherence of copper to steel.
Laist	1, 333, 985	Method and apparatus for precipitating copper from hot copper sulfate solutions with sulfur dioxide.
Bragg	1, 395, 755	To prevent adherence of copper to walls of precipitating chamber, sulfur dioxide is introduced into hot copper sulfate solution rather than cold.
Hahn	1, 397, 684	In precipitation of silver by addition of zinc dust to silver-cyanide solution, doping solution with sodium hydroxide is found to conserve cyanide.
Wilcox	1, 416, 147	Method and apparatus for precipitating metallic copper as a continuous operation.
Bardt	1, 423, 070	Fine powder copper precipitate, free of metallic contaminants such as iron, is produced by using sugar waste liquors, etc., containing polysaccharides as precipitants.
Adams	1, 430, 140	Method and apparatus for increasing precipitation of metallic copper by return to the solution of gas and steam collecting above copper sulfate solution during introduction of SO_2.
Weisberg	1, 448, 475	Silver is precipitated from photographic solutions by adding sugar and alkali as precipitants.
Laist	1, 461, 918	Copper, free from sulfur compounds, is precipitated from copper sulfate solution by adding SO_2 in liquid rather than vapor phase which enables its quick entry into solution.
Clark	1, 472, 115	Metallic copper is precipitated under high temperature and pressure by formic acid or aliphatic aldehydes, etc., eliminating regeneration of free H_2SO_4 such as SO_2 provides.
Platten	1, 480, 110	Spongy lead may be precipitated by passing a pregnant brine solution over metallic iron.
Stack	1, 487, 125	In process of refining impure tin bullion, metals such as arsenic and lead are precipitated as compounds and bismuth as a metal powder.
Becket, et al	1, 492, 282	Precious or heavy metals are precipitated from cyanide solution by alloy of silicon and activating metal such as calcium.
Becket	1, 492, 283	Heavy or precious metals are precipitated by powdered silicon from cyanide solutions.

II. PRODUCTION OF METAL POWDERS—Continued

2. Chemical Precipitation—Continued

Patentee	U. S. Patent No.	Subject
Clark	1, 503, 229	In recovering metallic copper, metallic impurities are first precipitated from solution as salts by increased temperature and pressure.
Weisberg	1, 527, 942	Silver is precipitated from photographic solutions by ferrous hydroxide in presence of an alkali.
Bardt	1, 592, 173	Metallic, crystalline copper is precipitated from copper salt solutions by heating them with cellulose material which has been treated with inorganic acid reacting liquid under heat and pressure.
Levy	1, 624, 172	Metallic silver as dark black crystals is precipitated from waste hypo solutions by adding zinc hydrosulphite thereto.
Mattenklodt, et al	1, 639, 610	Cement copper is precipitatedf rom solution containing chlorides and sulfates and other metal salts.
Christensen	1, 643, 922	Copper is precipitated from sulfate solution by tumbling with lead shot, the tumbling continuously freeing shot of sulfate coating.
Smith	1, 649, 786	Platinum is recovered from a catalytic mass by dissolving mass in hydrochloric acid and reacting with zinc.
Bagsar	1, 671, 004	Nickel is precipitated from nickelous chloride by powdery zinc, reaction being speeded by keeping temperature at 40° to 90° C or higher.
Muller, et al	1, 686, 391	Spongy gray silver precipitate and pale red metallic copper powder are successively precipitated by water gas from ammoniacal solution.
Tainton	1, 739, 772	Gold or silver is precipitated from cyanide solution with zinc, lead or copper as metal higher in electrochemical scale. From mixed deposit of granular form, zinc is dissolved out to leave silver.
McGregor	1, 753, 015	Plant and process for precipitating copper by iron from acid solution in which batches of iron are disposed in series so solution passes from oldest batch to newer batches.
Wilson	1, 792, 262	Finely divided metals and metal-metal alloys or colloidal suspensions thereof are formed, e. g., by precipitating copper from acid solution by powdered zinc. A finer precipitant produces a finer precipitate.
Alleman	1, 805, 199	To obtain colloidal lead, for antiknock motor fuel, dimethyl-didiethyl-methyl lead is decomposed in an inert solvent by heat.
Queneau	1, 872, 169	From fume of zinc ore treatment, cadmium as one impurity, is removed as metallic dust.
Hull	1, 876, 942	Platinum sponge, i. e., black powder is precipitated from a solution of chloride salts thereof by zinc.

II. PRODUCTION OF METAL POWDERS—Continued

2. Chemical Precipitation—Continued

Patentee	U. S. Patent No.	Subject
Drouilly	1, 963, 893	Finely divided activated aluminum is used to precipitate finely divided iron from ferrous sulfate solution.
Tobelmann	2, 008, 373	Precipitated copper is purified by redissolving finer and impure portion and reprecipitating.
Parker	2, 042, 121	Gold is precipitated from saline solutions by powdered nickel to which gold powder adheres.
Keyes	2, 070, 134	Iron for precipitating copper is formed by pouring molten iron into water forming hollow spheroids which serve to precipitate copper in flake form rather than powder.
Mills, et al	2, 100, 865	Zinc particles, used to precipitate gold or silver from cyanide solutions, are made more effective by contacting with lead salt.
Scott, et al	2, 177, 412	Metal powders of very fine particle size are produced, e. g., by reducing a nickel halide by reaction with solution of sodium addition compound of naphthalene, filtering, and washing precipitate with organic solvent and water.
Hamprecht, et al	2, 189, 263	In its electrolytically deposited form nickel is a quicker precipitant for copper than nickel remelted after deposition, according to patent.
Lee, et al	2, 204, 898	Precipitated silver is easily separated from continuously agitated precipitant in form of blocks, rod or balls.
Doran	2, 271, 970	Indium is precipitated in sponge form easily removed from precipitant, by using metallic aluminum as precipitant.
Dearing	2, 292, 207	Silver is precipitated from acid-oxidizing photosolutions by iron or steel of carbon content and crystalline size lower than those of gray cast iron.
Hay	2, 367, 022	Separation of copper from mixture of copper with more electropositive metal using aqueous acid solution.
Renzoni	2, 367, 239	Purification of cobalt precipitates containing lead, iron, copper and nickel with sulfur dioxide as reducing agent.

3. Electrical Processes, Electrolysis, Electroplating, Etc.

Moebius	310, 302	Silver is refined from base bullion and precipitated on cathodes in loose spongy state, whence it is removed by brushes.
Sachs, et al	521, 991	A metallic conductor in fine state, maintained in motion, is interposed between suitable electrodes during process of electrolysis.
Huber, et al	522, 415	Same as 521,991 except nonmetallic conductor is used.

II. PRODUCTION OF METAL POWDERS—Continued

3. Electrical Processes, Electrolysis, Electroplating, Etc.—Con.

Patentee	U. S. Patent No.	Subject
Douglas	563, 144	Copper is extracted from solid cuprous chloride suspended in electrolyte; strong current produces crystalline spongy copper mass.
Clark	598, 313	Finely divided lead produced by changing acetate of lead solution into acetate of zinc solution and depositing lead by electric current.
Bary	700, 399	Molten metal in a stream is pulverized by having an intermittant electric current, with quick interruptions, flow through the stream.
Hybinette	805, 969	To separate nickel-copper alloy, nickel-copper anode is electrolyzed in nickel sulfate and weak acid solution, and copper is cemented out of solution.
Edison	821, 626	Metal scales for admixture with nickel hydroxide in storage-battery electrodes of 0.0002 inch thick cobalt nickel alloy.
Edison	865, 687	Metallic nickel flakes; layers of nickel are formed on copper layers, copper later being dissolved out.
Edison	865, 688	Cobalt or nickel flakes formed as above.
Cowper-Coles	923, 411	Zinc dust produced by electrodepositing zinc in spongy form and subsequently drying in a reducing atmosphere.
Edison	936, 525	Metallic cobalt or nickel or cobalt nickel flakes about $\frac{1}{16}$ inch in size.
Greenawalt	968, 651 968, 652	Copper, gold and silver are separated from ore by precipitating gold and silver with electrolytic powdered copper and casting this as anodes, depositing copper and recovering gold and silver from anode slimes.
Hybinette	1, 128, 313	Copper and nickel are separated by cementing copper on a copper-nickel-sulfur slab prepared for spongy deposit by having previously been made porous in an electrolytic bath.
Stevens	1, 194, 438	Metallic cadmium is deposited on cathode in coherent, or in noncoherent form which falls from the cathode, in process for its recovery from ores, flue dusts, etc.
Keyes, et al	1, 196, 699	Tungsten powder produced by electrical precipitation using fused sodium tungstate.
Niemann	1, 222, 789	Gold and selenium are separated by electrolytic precipitation from ore containing gold and selenium and retorted to recover gold bullion in finely powdered form.
Tainton	1, 251, 302	Gold is removed from a dilute aurocyanide solution by precipitation in loose spongy form on a cathode which reciprocates to cast off gold which is recovered by filtration or settlement.
Ellis	1, 299, 565	Catalysts for hydrogenation produced by electrical action on nickel and carbon.

II. PRODUCTION OF METAL POWDERS—Continued

3. Electrical Processes, Electrolysis, Electroplating, Etc.—Con.

Patentee	U. S. Patent No.	Subject
Tainton	1, 334, 419	Electrolytic cell for precipitation of metals by method like 1,251,302 or in solid form.
Hybinette, et al	1, 382, 361	Copper-nickel matte is leached of greater part of copper, part of remaining matte reduced to metal powder onto which copper leached out by electrolyte is cemented, thus purifying electrolyte.
McGall	1, 397, 008	Oxidizable metals finely divided in non-oxidized condition by electric current.
Allingham	1, 403, 463	Silver is precipitated, chemically, and in metallic form by a process which first subjects pregnant electrolyte to electric current to cause precipitation of unwanted metals as hydroxides.
Slepian	1, 440, 502	Fine metal powder produced by providing metallic electrodes with porous screens and passing low current between while immersed in electrolyte.
Leech	1, 461, 276	Tin "paste" or "sludge," for coating paper, of very fine particles is deposited at cathode, and has no adherence in itself or to cathode.
Pearson, et al	1, 462, 421	Chromium group metal powders are produced by electrolysis and a final reduction in hydrogen.
Van Arsdale, et al	1, 508, 629	Molybdenum sesquioxide is deposited on the cathode, which requires half the reducing agent the trioxide requires, and which, when reduced, produces a powder.
Carl	1, 687, 056	Silver is recovered in finely distributed form not adhering to cathode, from its alloy with other precious and base metals.
Breuning, et al	1, 732, 179	Nickel flakes for use in alkaline accumulators; a sheet of coherent layers of nickel is formed, cut in pieces and acted on by weak acid which penetrates between and separates layers.
Koehler	1, 777, 371	Copper deposited in feathery state due to presence of gas evolved from electrolysis.
Cain	1, 794, 585	Dry metal powders are moistened with benzol, and benzol evaporated off to give floating characteristics for use in forming metal films which float on an electrolyte and are integrated into thin foils by action of electric current.
Drouilly	1, 799, 157	Metal powder produced by electrolysis employing electrolyte of a salt of metal to be obtained.
Balke	1, 799, 403	Tantalum powder containing one-tenth of 1 percent carbon; a fused bath of potassium fluotantalate and tantalic oxide is electrolyzed to produce a mass which is ground and purified.

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II. PRODUCTION OF METAL POWDERS—Continued

3. Electrical Processes, Electrolysis, Electroplating, Etc.—Con.

Patentee	U. S. Patent No.	Subject
Driggs	1, 815, 054	Tantalum powder is produced by depositing it from a fusion mixture of alkali metal halides, a double alkali tantalum halide compound and an ionizable oxygen containing tantalum compound soluble in the halides.
Driggs	1, 821, 176	Chromium, etc., powder is deposited from a bath of calcium chloride and an ionizable chromium compound.
Driggs	1, 835, 025	Powders of group IV metals are deposited from a bath of alkali metal chlorides and a double halide compound of the desired metal.
Driggs	1, 842, 254	Uranium powder is prepared by electrolytic decomposition of a double halogen compound thereof in solution in bath of alkali halogen compounds.
Driggs, et al	1, 861, 625	Powdered uranium is deposited on a removable floating type cathode from a fused bath of alkali and alkaline earth halides containing a quadrivalent uranium halide.
Hughes, et al	1, 869, 214	Flaky metallic thallium is recovered from cadmium sulphate solution utilized in manufacture of cadmium, by first producing thallous sulphate which may then be electrolyzed.
Driggs	1, 874, 090	Chloride compound used in electrolytic dissociation of fused salts of rare refractory metals to increase particle size.
Lucas	1, 959, 376	Metal powder produced by electrolysis and deposited in nonoxidizing medium.
Jensen	1, 968, 490	Powdered metallic chromium produced by electrolysis with sufficient current density to produce non-adherent deposit to be comminuted.
Teats	2, 011, 882	Pure flake thallium is deposited on cathodes in process for recovering thallium from cadmium-thallium sulfate solution.
Teats	2, 060, 453	Thallium sponge is deposited on cathodes in process for separating cadmium and thallium.
Sternfels	2, 099, 873	Flake chromium is prepared by machine and process for depositing chromium from bath on a flexible belt cathode and then flexing belt to remove curly flakes therefrom.
Hardy	2, 157, 699	Uncontaminated metal-powder produced by introducing iron-bearing material into electrolysis.
Jephson	2, 213, 864	Copper in powdered form recovered from scrap brass by electrolysis.
Fisher	2, 216, 167	Metal powder is deposited on plurality of electrodes immersed in electrolyte. (Improvement on Koehler 1,777,371).
Mantell	2, 233, 103	Finely deposited nickel powder produced by electrolytic deposition from an alkaline aqueous solution.

II. PRODUCTION OF METAL POWDERS—Continued

3. Electrical Processes, Electrolysis, Electroplating, Etc.—Con.

Patentee	U. S. Patent No.	Subject
Bauer	2, 287, 082	Iron powders produced by electrolyzing ferrous chloride solution in presence of formic acid.
Hannay, et al	2, 313, 338	Electrodeposition of pure sponge zinc from substantially neutral zinc sulphate solution.
Young	2, 347, 450	Copper sponge deposited from bath of alkali metal cyanide and copper cyanide at 600° C. is readily disintegrated to copper powder.
Urban	2, 366, 298	Recovering iron powder from spent pickle liquors by electrolysis, using mercury cathode, the mercury being distilled off, leaving powdered iron.
Lovell, et al	2, 373, 320	Aluminum is electrolytically produced in powdered form from aluminum bromide solution, using a vibrating cathode. Naphthaline, etc., added to electrolyte prevents agglomeration of aluminum particles into larger masses.
McNitt	2, 374, 762	Producing light metals by electrolysis of a fused salt of light metal.
Globus	2, 385, 269	Iron powder is electrolytically extracted from ore in which metal appears in high valence form; metal is recovered as ions of lower valence.
Mehl	2, 389, 734	Electrolytic process for producing iron powder using aqueous solution of caustic soda.
Johansson	2, 391, 903	A method of producing spherical metal powders by electrolysis, an anode being the metal to be powdered, a salt metal electrolyte being a less noble metal anion, and a cation being capable of forming a volatile salt.
Kroll	2, 413, 411	Pure iron powder is produced by electrolyzing an anhydrous electrolyte of molten ferrous chloride between a consumable anode of impure iron and a cathode from which deposited iron powder is stripped.

4. Mechanical Comminuting of Metal to Powder by Cutting, Rolling, Crushing, or Other Mechanical Operations

Brandeis	8, 365	Copper broken down by iron or steel rollers; soap applied to make bright, brilliant, and durable.
Brandeis	Reissue 9,667 of 53,563.	Metal particles shaved from an ingot; then flattened by rollers with polished steel surface to make powder bright and brilliant.
Parmelee	187, 303	Impalpable scales separated from metallic ingots by cutters, making finer powder.
Yielding	417, 622	Furnace with lifting plate in its melting pan for breaking metal to be reduced to powder.

II. PRODUCTION OF METAL POWDERS—Continued

4. Mechanical Comminuting of Metal to Powder by Cutting, Rolling, Crushing, or Other Mechanical Operations—Con.

Patentee	U. S. Patent No.	Subject
Mertes	612, 593	Ingot is shaved by a hand-cranked rotary cutting tool in preparation of amalgam fillings for teeth.
Ott, et al	657, 883	Bronze colors produced from granular metal powder by crushing and annealing.
Coleman	666, 409	Metal guided by rollers to comminuting tool.
Buhne	684, 043	Roller with impressions used on metal to give desired form.
Huth	726, 932	Manufacturing bronze powder by stamping bands formed from liquid metal.
Bailey	846, 384	Metallic lead subjected to action of rapidly moving heaters; uniformly conveyed by currents of air or gas to chemical agents if desired for lead pigments.
Baer	1, 347, 928	Molten metal cooled by water jets and subjected to hammering action while treated with olive oil, etc.
Gilmore	1, 396, 108	Apparatus for disintegrating or shredding metal cuttings or scrap.
Bing	1, 415, 861	Turning chips reduced by fine grinder beneath knife rollers.
Philipp	1, 420, 742	Cutting element cooperating with knife roller disentangles and reduces turning chips.
Hill	1, 465, 941	Cast-off scrap metal reduced to chips by grinding mill.
Podzus	1, 573, 017	Hard metals are finely powdered in chamber by high velocity whirling currents of air circulating in all directions.
Kramer	1, 596, 051	Feed mechanism for eddy mills supplies material to be ground so that torque applied to propeller shafts remains the same.
Podzus	1, 621, 270	Metal powders of colloidal fineness are produced by whirling fine particles in strong air currents with coarse particles.
Podzus	1, 647, 249	To round metal powder particles, they are milled together in a closed chamber by propellers.
Bing	1, 665, 806	Bulky scrap metal disintegrated and foreign bodies removed by current of air.
Kramer, et al	1, 671, 678	Mill similar to 1,685,956 but having additional stirrer members mounted on propeller shafts.
Podzus	1, 685, 956	Mill having oppositely positioned air propellers in a curved-walled casing.
Philipp	1, 687, 886	Rotary knives in contact with stationary knives reduce difficult waste material.
Podszus	1, 703, 634	To pulverize metal particles, they are caused to impinge on each other by opposed gas currents; particles are coated with a lubricant.
Kramer	1, 793, 096	Beetling mill having converging walls that confine particles to path of beetling rotor.
Kramer	1, 793, 097	Beetling rotor with blades having ledges for deflecting particles.

II. PRODUCTION OF METAL POWDERS—Continued

4. Mechanical Comminuting of Metal to Powder by Cutting, Rolling, Crushing, or Other Mechanical Operations—Con.

Patentee	U. S. Patent No.	Subject
Kramer	1, 793, 098	Method and apparatus for sifting powders produced by beetling mills.
Kramer	1, 798, 886	High-speed beetling mill having serrated beetling rotors.
Kramer	1, 802, 658	Charging regulator for beetling mills.
Kramer	1, 814, 559	Beetling mill casing to which charge is introduced counter to direction of rotation of beetling members.
Kramer	1, 846, 209	Separator for particles issuing from beetling mills using air blast separately regulated from that of the mill.
Kramer	1, 846, 210	Separator where particles fall downwardly over diverging plates while air is forced upwardly between plates.
Schubardt	1, 857, 879	Producing heavy metal powders by mechanical comminution.
Kranz, et el	1, 910, 612	Uniform sponge made by feeding metal strands on to rotating member to form loops and braiding these loops.
Kramer	1, 932, 741	Manufacturing disintegrated bronze foils by subjecting metal powder to falling action of balls in rotary drum.
Boothman	2, 017, 850	Aluminum bronze powder produced by rolling coated aluminum.
Zeiss	2, 037, 672	Molten metal is mixed with solid material such as sand in presence of inert gases, stirred and cooled so as to solidify in powdered form.
Stecher, et al	2, 047, 391	Solid comminuted material made directly from molten material by allowing noltem material to solidify on cold surface; material then comminuted by rotary tools.
Slade	Reissue 21,039 of 2,052,426.	Method of and apparatus for grinding, applicable to the production of very fine metal powders.
McCune	2, 087, 806	Irregularly shaped metallic scrap disintegrated by sets of rollers at varying speeds.
Kramer	2, 136, 445	Rotary drum in which pulverulent bronze is produced with aid of steel balls.
Clements, et al.	Reissue 22,452 of 2,164,198.	Carburized iron or steel quenched above critical temperature to render it brittle for powdering.
Tour	2, 199, 191	Metal flakes produced by passing molten or plastic metal through chilled rotating rolls.
Junker, et al	2, 254, 805	Components of metal mixtures separated by heating to specific temperature and subjected to mechanical stress to reduce lowest melting metal to powder.
Croll	2, 259, 457	Metallic material crushed in presence of a water solution of a saponin which carries away crushed particles and leaves mass for recrushing.
Ziehl	2, 263, 603	Producing flaked lead by ball milling operation.

II. PRODUCTION OF METAL POWDERS—Continued

4. Mechanical Comminuting of Metal to Powder by Cutting, Rolling, Crushing, or Other Mechanical Operations—Con.

Patentee	U. S. Patent No.	Subject
Lykken	2, 294, 920	Machine for pulverizing materials such as iron chips and turnings.
DeLosSinden	2, 301, 084	Conveyor particularly adapted for handling fine powdered metal.
Moreland, et al	2, 301, 136	Control apparatus for regulating flow of comminuted or granulated metals.
Stephanoff	2, 325, 080	Apparatus for comminuting and/or drying molten materials.
Clark	2, 327, 402	Grinding or pulverizing sponge metal in ball mill.
Gavin	2, 334, 258	Producing finely divided metal by grinding in presence of lubricant, drying and polishing particles in presence of leafing agent to impart leafing characteristics.
Wulff	2, 354, 727	Producing stainless steel powder from contaminated residues which comprises crushing, screening, and magnetically separating.
Landgraf	2, 356, 599	Apparatus for comminuting liquid materials, especially metals.
Robinson	2, 360, 893	Apparatus for effecting pulverization and dispersion of metal powders in aqueous or oleagenous bases.
Wiegand	2, 361, 253	Apparatus for grinding hard metals.
Rennerfelt	2, 362, 772	Producing fine ferrous metal powder by subdividing high carbon content ferrous metal material, decarburizing, disintegrating soft material formed, and thereafter carburizing powder.
Zipper	2, 363, 769	Cutting apparatus for reducing such materials as aluminum and magnesium.
Tholand	2, 366, 371	Making metal powders by subdividing carbon-containing ferrous metal in liquid state, then solidifying, disintegrating, and decarburizing.
Pagendarm	2, 368, 870	Apparatus for comminuting metals such as magnesium, aluminum, and the like.
Wolff	2, 381, 413	Powdered copper is used in making a lining for a charge container for grinding metal.
Wiegand	2, 392, 019	Grinding and separation of materials, including metals, by projecting a stream of fluid and material particles moving at high speed against an anvil or against a counter-stream of particles.
Hall, et al	2, 394, 052	A method of producing magnesium powder by disintegration of massive metal without dusting and danger of explosion.
Wulff	2, 394, 578	Steel powder is produced from contaminated scrap by emulsifying it with soda ash and sodium silicate, then disintegrating.
Do	2, 407, 862	A method of producing metal powders of high alloy content; one use of the product being for bearings.

II. PRODUCTION OF METAL POWDERS—Continued

5. Reduction of Powdered or Granulated Ores, Metal Oxides, Carbonyls, or Other Metal Compounds by Heat, Gases, Etc.

Patentee	U. S. Patent No.	Subject
Bischof	74, 791	Iron oxide heated with pulverized coal or coke, and copper and silver separated by precipitation of copper in solution.
Seymour	115, 243	Granulated iron ore heated and mixed with pulverized carbon; metalized iron then separated by magnetic ore separator.
Hinde	121, 872	Crushed ore subjected to processes of calcining, reducing, and carbonizing.
Lyttle	183, 691	Bricks of ore subjected to action of hot gases, free from oxygen.
Tourangin	268, 840	Sponge iron produced by passing carbonic oxide through mass of unheated ore.
Cowles, et al	324, 659	Aluminum produced as an amorphous powder by reduction of ore with tin, copper, manganese, etc., and separating alloying metal from Al by amalgamation, etc.
Mond	455, 227 455, 228 455, 229	Finely divided nickel containing impurities such as cobalt, etc., combines with carbonic oxide leaving impurities behind, and may then be converted to coherent pure nickel metal.
Edison	727, 118	Iron compound reduced by hydrogen in presence of heat and then flooded with water to prevent oxidation.
Moore, et al	Reissue 12,856 of 791,928.	Finely divided ore at red heat subjected to action of reducing gas and passed beneath molten bath.
Jones	880, 799	Finely divided ore is reduced with lump coke and separated from gangue by gravity, magnetic separation, etc.
Ramage	949, 003	Hydrogen and water gas passed over copper ores at low red heat.
Thomson	960, 441	Tungsten oxide reduced with hydrogen.
Blau	985, 386	Oxygen compounds of tungsten reduced by excess quantity of gaseous reducing agents at low temperature.
Mathesius	1, 003, 627	Preheated metallic oxide ores and reducing gases mixed.
Kerr	1, 032, 007	Heated steam and air alternately forced on heated ore.
Becket	1, 081, 567	Finely divided commercially pure ferrotungsten for use as an addition to steel is made by oxidizing and reducing crude ferrotungsten.
Becket	1, 081, 568	Tungsten metal or alloy is produced from high phosphorus and carbon ferrotungsten by above method plus magnetic separation or leaching to remove phosphorus and iron.
Cleaves	1, 235, 655	Pure tungsten may be obtained, e. g., from finely subdivided ferrotungsten by subjecting latter to action of a hydrogen halide, at a temperature to form an iron halide.
Edison	1, 275, 232	Same as 727,118 except nitrogen is used replace hydrogen before exposing to air.

II. PRODUCTION OF METAL POWDERS—Continued

5. Reduction of Powdered or Granulated Ores—Continued

Patentee	U. S. Patent No.	Subject
Pfanstiehl	1, 283, 286	Metallic oxides (such as tungsten) heated in atmosphere of rapidly moving hydrogen at equal temperature.
Carson	1, 287, 221	Carbon freed from natural gas or petroleum mixed and heated with iron ore to deoxidize it.
Bleeker, et al	1, 311, 379	Magnesium condensed in liquid or solid form from magnesium vapor.
Marden	1, 437, 984	Halide of metal to be formed and aluminum heated; further heated to volatilize all salts.
Schleicher	1, 548, 854	Metallic antimony is obtained from reduction of sodium pyroantimonate to an alloy of antimony and sodium which is pulverized and washed with water to remove sodium.
Marden	1, 659, 209	Oxide of rare refractory metal heated with magnesium and a fluxing agent to produce metal powder.
Marden, et al	1, 704, 257	Difficultly reducible oxides heated to reacting temperature with alkaline earth metal and an alkaline earth halide.
Marden	1, 728, 940	Stable uranium formed by reducing uranium oxide with calcium in presence of calcium chloride; salts of reaction removed with solvents.
Marden, et al	1, 728, 941	Gases removed from rare refractory metals by heating metal oxide with calcium and calcium chloride in presence of alkali metal.
Rich	1, 741, 955	Chromium metal powder produced by heating chromium oxide and subjecting to strong, free flow of pure hydrogen.
Mittasch, et al	1, 759, 660	Undiluted iron carbonyl brought in contact with fused iron.
Muller, et al	1, 759, 661	Metal carbonyls of metals decomposed in hot free space of heated vessel.
Hartenstein	1, 819, 164	Iron ore mixed with peat reduced by hydrogen and cooled in absence of air.
Schlecht	1, 836, 732	Metal carbonyl decomposed by introducing it with inert gases into hot free space of heated vessel.
Hornsey	1, 841, 602	Mixture of iron ore and solid carbonaceous fuel treated in rotary kiln at high temperature.
Dickson	1, 874, 253	Producing powdered lead by stirring heated lead to which has been added pitchblende and uranium.
Hansgirg	1, 884, 993	Magnesium by reduction, vaporization and condensation.
Naumann	1, 921, 536	Production of molybdenum and tungsten carbonyls suitable for thermal decomposition into compact metal, powder, or sponge.
Kalling, et al	1, 964, 402	Reducing agent added to mixture of ore and solid carbonaceous material in rotating heat zone.

II. PRODUCTION OF METAL POWDERS—Continued

5. Reduction of Powdered or Granulated Ores—Continued

Patentee	U. S. Patent No.	Subject
Muller	2, 004, 534	Metal powders, such as iron, nickel, cobalt, molybdenum, prepared in pure state by termal decomposition of metal carbonyls.
Hansgirg	2, 074, 726	Magnesium by reduction, vaporization, and condensation.
Erdman	2, 088, 165	Magnesium by reduction, vaporization, and condensation.
Basel	2, 096, 009	Iron compounds reduced by hydrogen at specific temperature in making semipyrophoric iron.
Schmalfeldt	2, 107, 549	Pure oxygen introduced in rotary reducing drum with iron ores and reducing gases.
Drapeau, et al	2, 170, 814	Production of pure copper powder by oxidizing pieces of copper, such as wire, shot or punchings, then reducing the powdered oxide.
Schmid	2, 207, 879	Iron oxalate heated in presence of indifferent gases to produce semipyrophoric iron.
Stephan	2, 217, 569	Water added to pulverized iron in presence of iron halides; air added and product reduced by hydrogen.
Hardy	2, 236, 441	Hot reducing gas passed over bed of metallic particles in "tabling" movement.
Hardy	2, 236, 474	Hot reducing gases passed over bed of iron ore particles in motion.
Madaras	2, 243, 110	Reducing gas circulated through successive chambers of ore.
Wellman, et al	2, 261, 196	Metal powder produced by carbonaceous reduction of mixture of oxidic compounds of lead and oxidic compounds of one or more certain other metals.
Maier	2, 265, 180	Converting metal ores into powder by vaporization.
Comstock, et al	2, 273, 834	Titanium tetrachloride subjected to action of sodium in presence of oxygen or nitrogen compound as an embrittling agent.
Brassert	2, 277, 067	Producing metallic bodies directly from powdered iron ore without melting.
Roseby	2, 279, 013	Mixture of nickel and iron compound heated in reducing atmosphere and crushed to powder.
Brassert	2, 287, 663	Reduced ore compressed to form metal pellets or briquettes in protective atmosphere.
Brassert	2, 290, 734	Continuous heat process produces iron and steel products of homogeneous form.
Zintl, et al	2, 301, 663	Reducing difficultly volatile metal oxides at high temperatures with the aid of silicon.
Stern	2, 302, 981	Aluminum powder produced by passing comminuted aluminum scrap through successive heating zones which causes brittleness and fragmentation of scrap.
Patterson	2, 307, 064	Treating metal oxides to remove gangue before reducing to form high grade metal powder.
Dill	2, 307, 997	Reducing crushed metallic oxide by contacting it with gasified hydrocarbon or superheated vaporized hydrocarbon oil.

II. PRODUCTION OF METAL POWDERS—Continued

5. Reduction of Powdered or Granulated Ores—Continued

Patentee	U. S. Patent No.	Subject
Payne	2, 311, 962	Reducing preheated iron ore concentrates with preheated reducing gas.
Burruss et al	2, 323, 305	Producing high-purity iron powders from iron oxides by continuous process in reducing furnace.
Doerner	2, 328, 202	Magnesium oxide is thermally reduced with carbon and magnesium vapor is shock-cooled by hydrocarbons to finely divided solid metal which forms a paste with the hydrocarbons. Paste is briquetted, and Mg distilled out and condensed.
Terry et al	2, 329, 862	Process and apparatus for decarburizing and/or deoxidizing metal powder containing carbon or metal oxides by heat treatment.
Pidgeon	2, 330, 142	Recovering volatilizable metals by thermal treatment of metal-containing materials.
Pidgeon	2, 330, 143	Thermal reduction by ferrosilicon of magnesium-containing materials.
McCarroll, et al	2, 330, 724	Reducing magnesium oxide with carbon in producing metallic magnesium.
Shaub, et al	2, 330, 751	Reducing magnesium oxide with finely divided carbon in producing magnesium powder.
Patterson	2, 331, 419	Furnace adapted to treatment of finely divided metal oxides and the like with gaseous treating agents.
Lykken	2, 333, 111	Apparatus and method for producing iron powder by reducing finely divided ores.
Patterson	2, 334, 434	Reduction of finely divided metal oxides in furnace with gaseous treating agents.
Spooner	2, 334, 451	Magnesium produced by carbothermic reduction of magnesium oxide.
Maier	2, 341, 844	Reducing violet chromic chloride by hydrogen in producing chrome metal.
Queneau	2, 342, 368	Flash reduction operation for producing zinc from oxidic zinc material using carboniferous reducing agent.
Lewis	2, 343, 780	Iron or nickel powders produced by reduction of powdered ores with natural gas rich in hydrogen.
Crane, et al	2, 348, 194	Method of condensing zinc vapors formed by reducing zinc substances.
Davis	2, 349, 408	Apparatus for producing metallic magnesium by reduction of magnesium oxide-containing raw material.
Davis	2, 349, 409	Producing metallic magnesium by reduction of magnesium oxide-containing raw material.
Kleckner	2, 349, 556	Producing magnesium from magnesium minerals containing iron.
Arimori, et al	2, 349, 927	Manufacturing metallic magnesium from magnesia-containing ores by reduction, vaporization and condensation.
Jeffery	2, 351, 765	Reducing ores with reducing gases on pellets formed of ore and vaporizable liquid, producing porous spongy metal pellets.

II. PRODUCTION OF METAL POWDERS—Continued

5. Reduction of Powdered or Granulated Ores—Continued

Patentee	U. S. Patent No.	Subject
Twiford	2, 352, 418	Apparatus for use in recovering metal powders from ore.
Sayers	2, 353, 193	Producing magnesium by reduction and volatilization utilizing helium as condensing agent.
Gardner	2, 353, 614	Electric furnace especially adapted to extraction by distillation of metals from ores.
Gentil	2, 354, 253	Producing magnesium directly from its oxygen compounds using aluminum or calcium as reducing agent.
Payne	2, 359, 578	Apparatus for producing metal powders by reducing ores by electromagnetic induction
Brassert, et al	2, 361, 925	Preparing solid objects such as pellets-briquettes of substantially pure manganese powder by reducing manganese oxide.
Darrah	2, 364, 195	Furnace for producing magnesium by removing carbon dioxide from magnesium carbonate using non-carbonaceous reducing agent.
Hodson, et al	2, 365, 194	Reducing iron ores in finely divided state in carbonaceous gaseous atmosphere.
Brassert	2, 367, 262	Producing metal powders from their ores by down drafting, first, hot oxidizing gases and then reducing gases on finely divided ores.
Patterson	2, 368, 489	Producing metal powders by gaseous reduction of finely divided metal compounds without substantial fusion.
Pidgeon	2, 370, 812	Thermal production of magnesium by ferro-silicon reduction under reduced pressure.
Whiton, et al	2, 370, 898	Producing metallic magnesium powder by thermal reduction of magnesia-containing materials with ferrosilicon.
Hansgirg	2, 372, 571	Producing metallic magnesium by direct reduction of magnesium silicates; iron-chromium-titanium alloys produced in granular form as a byproduct.
Burruss, et al	2, 373, 657	Producing metal powders by reducing divided metal oxides with reducing gases.
Bowen	2, 377, 478	Furnace for producing metallic magnesium from magnesium-containing compounds by vaporizing reduced metal and chilling suddenly to freeze it into a powdered form.
Fill	2, 377, 486	Producing carbonyl iron particles by thermal decomposition of ferro-pentacarbonyl.
Coxe	2, 377, 676	Reducing iron ore by dissolving in molten borax, adding alkali metal cyanide and leaching extraneous material from iron powder.
Hansgirg	2, 379, 576	Producing metallic magnesium by direct reduction of magnesium silicates using powdered ferro-silicon.
Doerner	2, 380, 097	Sludge separator for handling atomized mist containing metal particles and vapors of volatilized liquids produced by 2,328,202.

II. PRODUCTION OF METAL POWDERS—Continued

5. Reduction of Powdered or Granulated Ores—Continued

Patentee	U. S. Patent No.	Subject
Doerner	2, 380, 098	Automatic reamer for keeping orifice of thermal reduction furnace free of sludge carrying metal powder. See 2,328,202.
Kirk	2, 380, 449	Metallic magnesium by reduction and vaporization of magnesium oxide with carbon.
Drapeau, Jr	2, 381, 440	High density compressible iron powder produced by controlled oxidation and reduction of iron powder.
Silvasy, et al	2, 384, 971	Metallic oxide ores are reduced directly to pure metal powder by apparatus which reduces powdered metal carried in suspension of hydrocarbon gas, then separates metal out.
Cooper	2, 387, 979	Finely divided magnesium oxide mixed with finely divided calcium silicide are heated to produce metallic magnesium powder.
Brassert, et al	2, 389, 133	Apparatus for reducing finely divided metallic ores.
Westling	2, 391, 496	Finely divided metal compounds or ores are reduced and prevented from sintering in furnace which agitates charge and maintains good contact of charge with reducing gas.
Orgorzaly	2, 393, 704	Powdered ores of zinc and magnesium are reduced by heating with finely divided carbon to produce metals.
Burwell	2, 394, 362	Tungsten ore is powdered and then roasted prior to the extraction of pure tungsten.
Fill	2, 395, 999	A method and apparatus for making ferropentacarbonyl, useful in making finely divided iron for magnetic cores.
Urquhart	2, 397, 993	A method to produce nodules or balls of iron with greater or lesser slag inclusion by reduction of metallic oxide.
Rennie	2, 398, 114	Production of molybdenum by reduction of molybdenum trioxide.
Munday	2, 398, 443	Production of magnesium powder from magnesium ores by reduction.
Byrns	2, 399, 096	Production of magnesium containing mixtures for use in the preparation of magnesium metal by reduction.
Caldwell	2, 399, 984	Method and Apparatus for gaseous reduction of iron oxide to form metal powder.
Rennie	2, 402, 084	Powdered molybdenum trioxide in boats is reduced by H_2 to produce pure molybdenum which is also (presumably) in granular form when reduction is completed.
Newkirk et al	2, 404, 650	A kiln for producing powdered iron by the reduction of iron oxide.
Brassert	2, 404, 944	An apparatus for reducing finely divided metallic ores by reducing gases.
Firth	2, 413, 492	Pure iron powder is produced by digesting low grade ore with sulphuric acid, evaporating the sulphate solution, calcining the crystals, washing out impurities, reducing and powdering the recovered iron.

III. HANDLING AND WORKING METAL POWDERS

1. Coating Individual Grains of Powder, With Metallic or Nonmetallic Coatings

Patentee	U. S. Patent No.	Subject
Sachs, et al	521, 992	Metal powder with core of one metal and shell of another made by immersing core in solution of a salt of a metal more electronegative.
Edison	839, 371	Battery grid pocket material is made by coating 20–60 mesh nickel hydroxide with adhesive, then flake-like metallic nickel, cobalt, nickel-cobalt or graphite.
Hardy	2, 155, 592	Refrigerator tray, etc., made by impregnating porous metal powder with repellent substance, which prevents congealed liquid from adhering to metal by freezing.
Hardy	2, 155, 593	Ice cube tray comprising wax impregnated aluminum powder.
Drapeau, Jr., et al	2, 173, 100	Dry, non-segregating free-flowing metal powder containing liquid non-reactive therewith in quantity 0.0025 to 0.03 percent by weight.
Mantell	2, 182, 567	Metal powder particles having cores and coatings of dissimilar metals produced by electrolysis.
Drapeau, Jr., et al	2, 216, 769	Carbonizable liquid or plastic solid is introduced in copper and other metal powders to form metal powder coated with carbon film.
Drapeau, Jr., et al	2, 216, 770	Powdered metal, coated with organic compound, is heated to carbonize compound.
Lebedeff	2, 253, 632	Finely divided lead is produced by treating molten lead particles with stearic acid to prevent coalescence.
Carney	2, 273, 832	Metal powder for molding having core of high melting point metal coated with low melting point metal.
Shaw, et al	2, 286, 237	Particles of copper powder are given a surface alloy coating of copper with other more electropositive metal.
Balke, et al	2, 289, 897	Steel powder is plated with iron.
Drapeau, et al	2, 294, 895	Treating copper metal powders for stability by coating particles with film of metallic tin.
Cooke	2, 374, 331	Coating finely divided mica with aluminum in sealed chamber.
Castor	2, 398, 517	A method of coating finely divided particles with metal consisting of an evacuated chamber and means for generating a metal vapor in the chamber; then allowing powdered metal to fall through the vapor in the chamber.

III. HANDLING AND WORKING METAL POWDRES—Con.

2. Classifying, Separating and Purifying Metal Powders

Patentee	U. S. Patent No.	Subject
Work	194, 797	Magnetic ore separator for separating brass filings from iron and steel cutting tool particles.
Moebius	480, 956	Bullion in powder form containing silver and gold produced from an amalgam which has been comminuted, and the base metals oxidized and leached therefrom.
Greene	597, 113	Plate for collecting gold dust and powder from auriferous sand, made of zinc, mercury and metallic sodium.
Marden	1, 665, 635	Readily oxidizable metal powder such as uranium purified by washing with alcohol in which is dissolved an acid which will form, with impurities in metal powder, compounds soluble in the alcohol.
Schwarz	1, 739, 992	Mixed shavings of white and red metals are separated by heating and first drawing off greater part of molten white metal, cooling residue, scouring white metal by hard red metal to produce a fine white powder separable from red particles mechanically.
Stout	1, 822, 939	Shotted, copper, broken cathode copper, etc. is billetted and treated with cleansing gas at temperature below melting point of copper, then heated and pressed to a solid mass.
Thurneyssen	1, 826, 583	Iron is removed from a less readily oxidized metal by atomizing the alloy, oxidizing the iron, and treating the resulting powder to remove the oxide. The process is repeated and pure metal separated.
Mitchell	1, 961, 065	Granulated tin-iron alloy is prepared for treatment with a chloridizing agent to remove tin as tin chloride. Tin and iron oxides in granular form may be reduced and kept granular by temperature and agitation for further treatment.
Monson	2, 007, 545	Dry dross of 70 to 80 percent anitmony, and an antimonial lead alloy is produced in mixed powder and particle form in recovering antimony from antimonial lead.
Doom	2, 030, 357	Tin is removed from columbium alloys by introducing silicon into alloy, comminuting and leaching the alloy.
Bucher	2, 040, 804	Berryllium spangles or finely divided metal powder produced by using alkali salt of weak acid to dissolve beryllium hydroxide and purify beryllium.
Hanson	2, 050, 319	In freeing scrap-radiator alloy of copper from residue of tin and lead, granulated and powdered forms of the alloy are roasted to oxidize the copper so it may be removed by leaching.
Lausberg	2, 068, 296	From Monel metal scrap, in H_2SO_4, copper is precipitated at temperatures above 100° C and under increased pressure.

III. HANDLING AND WORKING METAL POWDERS—Con.

2. Classifying, Separating and Purifying Metal Powders—Con.

Patentee	U. S. Patent No.	Subject
Lutz	2, 084, 154	Copper powder-containing sludge from copper wire-drawing machine is treated with noncorrosive solvent and separated by centrifugal filter.
Austin	2, 107, 277	Hydrogenated powder heated to exhaust gases in recovering commercial tantalum from scrap.
Kemmer	2, 130, 886	Distillation of metals or metal powders and recovery of the metal in coherent form by condensation.
Richter	2, 145, 433	In separating tin and other constituents of alloys, the alloy to be treated may be pulverized to 200-mesh size before further treatment.
Mann	2, 237, 867	Sponge iron powder made by processing decarburized steel scrap.
Fahrenwald	2, 293, 939	Silica free iron powder produced by passing gaseous hydrofluoric acid over iron oxide ore or sponge iron in the furnace before reduction.
Gentil	2, 312, 811	Recovering pure metals by distillation and condensation in furnaces.
Stewart	2, 324, 960	Recovery of copper powder from wire-mill sludge.
Robertson	2, 325, 881	Device for separating particles of different densities, such as recovering fine gold from sand, in which eddy currents are eliminated.
Wiegand	2, 328, 240	In a system for grinding hard metals, abrasives, etc. to 200 mesh size, e. g., a device is provided for classifying particles.
Mathieu	2, 328, 479	Recovery of metals, such as magnesium, from natural gas in electric furnace by thermal reduction in vacuum.
Holmes	2, 331, 395	Electrolytic recovery of metals, such as antimony from tetrahedrite concentrate.
Frantz	2, 331, 769	Magnetic separator for removing iron and iron-bearing particles from stream of dry materials.
Smail	2, 332, 403	Recovery of zinc dust from byproducts of galvanizing operations.
Rathjens	2, 334, 217	Method and apparatus for separating, segregating and contacting metal powders.
Davis	2, 336, 470	Separation of powdered metals of different specific gravities.
Followill, et al	2, 338, 501	Apparatus for magnetically separating precious metal particles.
Ogg	2, 341, 805	Recovery of zinc by indirect heating in retort mixture of zinc oxide, carbonaceous material and silicon powder.
Guyard	2, 342, 733	Pulverized bismuth-lead-arsenic alloy is treated with nitric acid eventually producing precipitated metallic bismuth and lead nitrate.

III. HANDLING AND WORKING METAL POWDERS—Con.

2. Classifying, Separating and Purifying Metal Powders—Con.

Patentee	U. S. Patent No.	Subject
Rothgarn	2, 343, 803	Apparatus for dry separation of heavy mineral particles such as gold, from broken up ore material.
Kellerman	2, 348, 479	Ore separating apparatus especially adapted for use in separating gold or other heavy metals from crushed ore, etc.
Bierly	2, 349, 697	Producing selenium powder by eliminating impurities from selenium-containing solution.
Hay	2, 352, 096	Separation of copper from metals electropositive to copper by treating aqueous acid solution of copper and metal salt.
Williams	2, 356, 717	Separation and recovery of suspended particles such as powdered catalysts from vapors or gases by adding ammonia and subjecting to electrostatic separation.
Wulff	2, 371, 665	Classifying metal powders which comprises producing white cast iron powder and subjecting to magnetic separation.
Griffiths	2, 372, 321	Apparatus for separating stainless steel particles from abrasive particles employed in grinding operation.
Kalischer	2, 379, 158	Apparatus for determining particle size characteristics of powdered material, particularly metal powders.
Truesdale	2, 389, 701	Pneumatic sizer for metal powders, particularly zinc dust.
Boehler	2, 392, 636	A method of determining the fineness of almost any finely comminuted substance.
Boehler	2, 392, 637	A method and application for determining the surface of comminuted material.
Merle	2, 395, 286	Aluminum powder is used in a process for chemically purifying and refining metal.
Kroll	2, 396, 792 2, 396, 793 2, 396, 794	Impure Nickel or nickel alloys are purified by a displacement reaction by suspending the powdered metal in a molten metal chloride bath or by heating compacted mixtures of the powdered metal and powdered salt in an inert atmosphere.
Johnson	2, 398, 792	An electorstatic process of separating fine powdered material by classifying according to their differences in specific gravity, magnetic permeability, electrostatic susceptibility, or particle shape.
Trent	2, 407, 752	Hard metal carbides are recovered from coarse crushed scrap material; the scrap is fused with zinc, the product is cooled, and the alloy is removed by a solvent, leaving behind the hard particles.

III. HANDLING AND WORKING METAL POWDERS—Con.

3. Molding, Compressing or Briquetting, Bonding, and Sintering or Heat-Treating for These Purposes

Patentee	U. S. Patent No.	Subject
Glass	1, 008, 254	Metals containing copper briquetted by treating with ammonia in presence of copper oxide, pressing and heating.
Lowendahl	1, 051, 814	Manufacturing porous metal blocks by pressing and heating metallic powder commingled with ammonium nitrate.
Weintraub, et al	1, 071, 488	Apparatus and process for sintering powdered boron into coherent rods.
Trenzen	1, 074, 993	Tungsten is rendered ductile by heating amorphous metal to high temperature and pressing it at moment of heating when metal would crystallize. Metal may be in form of sintered bar.
Pfanstiehl	1, 282, 122	Ductile tunsten is produced by compressing tungsten powder to critical point and heating.
Pfanstiehl	1, 305, 975	Tungsten powder compressed by applying pressure; then relieving pressure to allow uniform expansion.
Pfanstiehl	1, 315, 859	Fine tungsten powder is compressed under high pressure.
Pfanstiehl	1, 321, 125	Tungsten and like metals compressed by placing powder between metallic cup and a die; subjecting interior of cup to fluid pressure, expanding and thus compressing powder.
Duryea, et al	1, 371, 671	Pressure applied to metallic particles suddenly raised to high degree in briquetting.
Montgomery	1, 510, 745	More compact briquette produced by series of compressing operations.
Hunt	1, 555, 978	Metal stock produced by subjecting mixture of comminuted metals to high pressure.
Bakken	1, 594, 347	Pure sublimed magnesium in crystalline form whose particles are discrete may be worked into wire after heating under pressure and extruding.
Rentschler, et al	1, 648, 962	Compact body of uranium powder heated in vacuum to specific temperature.
Pirani	1, 747, 133	Manufacturing bodies of great density by pressing and sintering tungsten powder and zirconium oxide powder.
Cooper	1, 775, 589	Comminuted beryllium pressed into coherent body and melted under nonreactive molten flux.
Reinhardt, et al	1, 878, 539	Ferrous articles made by heating cold-molded sponge iron.
Balke	1, 905, 882	Columbium compressed into bar after electrical reduction from ore.
Beckmann	1, 918, 893	Producing porous body comprising finely divided metals or brasses dispersed in porous matrix.
Koenig, et al	1, 919, 730	Producing porous metals comprising heating into a foam and drying mixture of metal powders, liquid and foam producing agent.

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III. HANDLING AND WORKING METAL POWDERS—Con.

3. Molding, Compressing or Briquetting, Bonding, and Sintering or Heat-Treating for These Purposes—Continued

Patentee	U. S. Patent No.	Subject
Short	1, 922, 402	Articles briquetted from finely divided metals sintered.
Walter	1, 925, 292	Bodies to be sintered moved past heating surfaces of electric furnace with constant movement of rotation.
Calkins	1, 927, 626	Producing porous metallic material by sintering briquette of powdered copper and iron in sodium aluminum fluoride bath.
Calkins, et al	1, 958, 704	Producing porous metal structure comprising powdered tin, copper and graphite and lubricating agent comprising powdered boracic acid.
Duftschmid	1, 969, 396	Producing porous metallic articles by sintering layers of metal powders of different compositions.
Hardy	2, 001, 134	Producing objects from metal powders coated with metallic soap which is decomposed by sintering.
Hardy	2, 027, 532	Making articles from metal powders by compressing without drying after washing.
Schellens	2, 042, 635	Producing porous metal body employing metal particles coated with films of lower-melting-point metal.
Schulz	2, 082, 126	Manufacturing porous metallic bodies by sintering mixture of metal powders of large particles with metal powders of small particles.
Conway	2, 100, 537	Metal articles similar to wrought iron made by hot working compacted scrap or iron powder, the particles of which have been coated with oxide.
Weitzenkorn	2, 111, 344	Making metallic briquettes utilizing as a binder a metalliferous product which is of value in manufacture of iron and steel.
Burkhardt	2, 122, 053	Manufacturing porous metallic bodies by sintering metal powders.
Graham	2, 123, 416	Method of extruding metals and alloys by coalescence of particles.
Tietig	2, 133, 761	Making porous metal objects by reducing mixture of dissimilar metal powders and metal oxide.
Hardy	2, 134, 366	Producing metal sheets by pressure exerted by spaced rolls on metal powders.
Patterson, et al	2, 175, 850	Manufacture of steel objects by compression and heat treatment of metal powders.
Drapeau, et al	2, 181, 123	Compressibility of powdered metals improved by treatment comprising mechanical deformation and heating.
Bolesky, et al	2, 182, 741	Making porous metal articles by heating briquette of metal powders and powdered vegetable material having natural oil content.
Koehring	2, 187, 086	Making sintered porous metallic elements from noncompacted metal powder and solid lubricant.

III. HANDLING AND WORKING METAL POWDERS—Con.

3. Molding, Compressing or Briquetting, Bonding, and Sintering or Heat-Treating for These Purposes—Continued

Patentee	U. S. Patent No.	Subject
Lenel	2, 187, 589	Making porous iron articles by sintering briquette of powdered iron.
Koehring	2, 190, 237	Making porous metal structure by sintering loose metal powders on strong metal back.
Lenel	2, 191, 936	Manufacturing porous iron articles by sintering briquettes of sponge iron and carbon.
Kurtz	2, 192, 792	Briquettes sintered in molten metal bath which impregnates them.
Schlecht, et al	2, 198, 042	Producing porous metal bodies by sintering metal powders of iron group.
Hardy	2, 198, 612	Compression of metal powders in mold at less-than-atmospheric pressures.
Klinker	2, 200, 369	Metallic molding powders produced by sintering, in reducing atmosphere, a mixture of a powdered metal and oxide-coated powder, and regrinding.
Davis, et al	2, 203, 895	Briquettes containing carbonaceous material heated in oxidizing atmosphere; heated in reducing atmosphere for sintering.
Gertler	2, 206, 395	Producing malleable metal from chromium and other metal powders.
Jones	2, 215, 723	Producing porous precious metal articles by sintering metal powders.
Koehring	2, 217, 802	Mold containing metal powder heated in sintering furnace having nonoxidizing atmosphere.
Kurtz	2, 219, 423	Method of forming porous metal articles by sintering briquetted metal powders.
Lenel	2, 226, 520	Making porous iron articles of composition of iron and phosphorus using iron powder.
Berghaus, et al	2, 227, 176	Pressed metal bodies sintered in vacuum with inactive gas.
Berghaus	2, 227, 177	Similar to 2,227,176 except sintering is done in a sealed electrically conducting housing.
Hildabolt	2, 227, 308	Making porous cored metal objects by sintering metal powders in suitable mold.
Hardy	2, 228, 600	Metal particles bonded by alternating currents of high frequency during diffusion welding.
Goetzel	2, 235, 835	Desirable temperature for heat treatment of metal powders determined by influence on alternating current.
Boegehold	2, 238, 382	Forming objects of ferrous metals by compressing and sintering powdered iron and iron carbide.
Wellman	2, 240, 971	Method of spreading powdered material uniformly in mold for compressing.
Marvin	2, 241, 095	Making porous metal structures by sintering metal powders on supporting member.
Goetzel	2, 247, 370	Similar to 2,235,835 except apparatus is provided with a "clock catch" to regulate temperature.
Koehring, et al	2, 251, 410	Second metal powder layer briquetted directly on porous plated metal.

III. HANDLING AND WORKING METAL POWDERS—Con.

3. Molding, Compressing or Briquetting, Bonding, and Sintering or Heat-Treating for These Purposes—Continued

Patentee	U. S. Patent No.	Subject
Brassert	2, 252, 697	Metal objects produced by pressing and working, without melting, reduced sponge iron particles or other metal.
Whipple	2, 253, 003	Uniform compression of finely divided substances obtained by plungers in mold cavity.
Hardy	2, 259, 465	Forming objects by compression and/or heat treatment of metal powders.
Calkins, et al	2, 267, 372	Producing window screen material comprising compressing and sintering comminutee metal.
Pecker, et al	2, 271, 091	Apparatus and method of sintering materials in greatly reduced area.
Olt	2, 273, 589	Making porous metal bodies by attaching low melting constituent metal directly to surface of high melting constituent metal.
Boegehold	2, 289, 571	Sintered bronze articles from powdered copper-tin alloy.
Lenel	2, 291, 734	Highly porous ferrous articles produced by heating mixture of iron powder and another metal powder, such as nickel, to which phosphorus has been added.
Marvin	2, 293, 843	Porous metal sheet material having each side of different porosity made by sintering segregated metal powders on supporting surface.
Hull	2, 298, 885	High density sintered products employing flexible pad placed on top of pressed metal powders before sintering to prevent soft spots.
Linz	2, 302, 615	Briquette comprising mixing and compressing molybdenum trioxide powder and iron powder.
Linz	2, 302, 616	Briquette comprising mixing and compressing tungstic dioxide, tungstic oxide and metallic tungsten, and iron powders.
Shaw	2, 309, 018	Composite element comprising porous metal layer bonded to a more dense metal layer.
Bowen	2, 310, 061	Porous metal parts comprising die lubricant, in form of metal salt, mixed with metal powder and sintered.
Grob	2, 311, 940	Machine for forming solid briquettes from cast iron chips, the briquettes being given a "skin" to preserve center portion of briquette from oxidation during subsequent melting.
Wagenhals	2, 323, 169	Bonding refractory metal powders to base metal by a film of low welding temperature alloy or metal.
Patterson	2, 326, 163	Furnace adapted to treatment of metal powders in solid state with various gaseous treating agents.
Koehring	2, 327, 804	Sintering powdered metal briquettes in furnace in controlled atmosphere.

III. HANDLING AND WORKING METAL POWDERS—Con.

3. Molding, Compressing or Briquetting, Bonding, and Sintering or Heat-Treating for These Purposes—Continued

Patentee	U. S. Patent No.	Subject
Koehring	2, 327, 805	Bonding together powdered iron by sintering with a lower melting point metal.
Mann	2, 330, 438	Sintering metal powders wherein sintering is accomplished by heat obtained from molten metal.
Hensel, et al	2, 331, 909	Producing toothed parts, such as gears, sprocket wheels and racks, from metal powders.
Stern	2, 332, 277	Briquetting fine magnesium or magnesium alloy scrap, such as turnings.
Olt	2, 332, 746	Porous material which comprises distributing metal powders upon metallic strip material and simultaneously grooving metal powder.
Cremer	2, 336, 982	Press particularly adapted to the compression of metal powders to form coherent mass of predetermined shape.
Marino	2, 338, 344	Sintering mixture of copper, tin and tungsten powders.
Cutler	2, 338, 491	Compressing metal powders in mold cavity with plunger.
Marvin	2, 341, 732	Manufacture of porous metal sheets by sintering metal powders which have been compacted between belts.
Olt	2, 341, 739	Making cylindrical porous articles by distributing metal powders into cylindrical form, and holding in place centrifugally while sintering.
Ellis	2, 341, 860	Chambered metallic fitting made by forming a composite briquette of the different work pieces from metal powders.
Cremer	2, 342, 037	Compression of metal powders in die which comprises lining die with metal flakes, such as aluminum, copper and brass, to make ejection of compact body easier.
Agnew	2, 343, 270	Apparatus for sintering metal powders.
Jones	2, 343, 978	Process of compressing and heat treating brass or bronze powders to form nonporous articles having high tensile strength and elongation.
Ernest, et al	2, 348, 197	Apparatus for molding granular material having top and bottom member movable relative to mold.
Harris	2, 348, 294	Wind box for sintering machines for metal powders.
Hartley, et al	2, 349, 266	Producing iron or steel product by heating compacted powder of iron ore containing sulfur, phosphorus, titanium or silicon.
Pecker, et al	2, 350, 971	Forming articles of dry metal powders in layers by pressure welding.
Goetzel	2, 352, 316	Shaped bodies resembling steel formed by sintering pure iron powder, carbon and steel under cover of coherent refractory mass.

III. HANDLING AND WORKING METAL POWDERS—Con.

3. Molding, Compressing or Briquetting, Bonding, and Sintering or Heat-Treating for These Purposes—Continued

Patentee	U. S. Patent No.	Subject
Koehring	2, 354, 523	Apparatus for sintering metal powders wherein metal parts are rotated relative to walls of furnace for equalizing temperature of metal powders.
Cremer	2, 355, 954	Apparatus for sintering metal powders having die wall coated with flat-lying overlapping metal flakes having thereon leafing agent of insulating character.
Misfeldt	2, 356, 338	Method of making extrusion moldings of metal which comprises heating and forcing through restricted orifice and directing into mold.
Kurtz	2, 357, 407	Method of briquetting metal powders in die having cavity therein.
Talmage	2, 360, 528	Apparatus for briquetting metal powders.
Koehring	2, 362, 701	Apparatus for hot pressing metal powders.
Vignos	2, 363, 371	Forming briquettes from finely divided metallic substances using binding agent produced by exothermic chemical reaction.
Ross	2, 372, 605	Apparatus for hot pressing metal powders.
Lum	2, 376, 706	Briquetting, sintering and treating metal powders with vinyl compounds.
Morris	2, 379, 540	Ram for compacting metal powders in a die, having a striking face of toothed form which is rotated simultaneously with blows of the ram.
Linz	2, 381, 675	Small amounts of powdered metals may be added to metallic oxides to produce self-reducing briquettes for use in alloying.
Boegehold, et al	2, 382, 601	Method of sintering powdered iron articles using mill scale and powdered white iron or steel.
Crowley	2, 386, 544	Method of molding lightweight metallic bodies from powdered metals, resin and stearic acid.
Goetzel	2, 386, 604	Metal powders are molded into a body under pressure by a series of compacting steps.
Fuller	2, 387, 013	Turncock may be molded by sintering metal powders under pressure.
Thomas	2, 389, 566	Apparatus for controlling the feed of fine solids in a sintering machine.
Marvin	2, 390, 160	Hollow cylindrical objects are formed from noncompacted metal powder that is mixed into a slurry with a binder and rotated in a heated shell.
Naratil	2, 391, 588	Finely divided roasted zinc sulfide ore is prepared for sintering by a method possibly applicable to other materials. Charge is formed into coherent flakes, wetted, and pelleted.
Toulmin, Jr	2, 393, 130	A method and apparatus for hot pressing metal powders.

III. HANDLING AND WORKING METAL POWDERS—Con.

3. Molding, Compressing or Briquetting, Bonding, and Sintering or Heat-Treating for These Purposes—Continued

Patentee	U. S. Patent No.	Subject
Bellamy	2, 397, 831	Metallic particles mixed with a vaporizable temporary binder and a hydrated metal hydroxide capable of forming colloidal-like suspensions are formed into a molded article, and heated in a reducing atmosphere.
Rasmussen	2, 398, 719	A method of making porous metal articles of controlled density by shaping a briquetting die for a different contour than the article ultimately desired and then sizing the article.
Allison	2, 407, 123	A press for use in powder metallurgy.
Langhammer	2, 411, 379	An apparatus for making briquettes from powdered metal materials.
Grene	2, 412, 145	An apparatus for heat-treating metal powders or small particles.

IV. ALLOYING OF METAL POWDERS

1. Alloy Powders

Riker	336, 590	Powdered metal alloy produced by uniting metals and continuously agitating combined mass.
Sang	946, 738	Manufacturing brass dust by heating mixture of copper dust and zinc dust.
Heskett	1, 421, 471	Powdered metal alloy produced by compounding metals of different melting points and allowing to cool, effecting self-disintegration.
Veazy	1, 680, 825	Metallic nickel and magnesium are heated until enough magnesium is absorbed to make nickel pulverizable.
Short, et al	1, 992, 549	Producing powdered iron and zinc alloy by heating and agitating treatment.
Schlecht, et al	2, 041, 493	Producing pulverulent alloys of metals capable of forming metal carbonyls by thermal decomposition of carbonyl mixture and heating particles coated with "substance hindering fritting together" (such as refractory substance).
Alexander	2, 287, 771	Producing finely divided powdered alloys by decomposition of powdered metal mixtures.
Boegehold	2, 289, 569	Producing low melting point alloy powders by briquetting and sintering powder mixture.
Wulff	2, 356, 807	Producing alloy powders from contaminated alloy powders which comprises heating in annealing range in fused salt bath.
Wulff	2, 359, 401	Alloy steel powder consisting of steel powder homogeneously admixed with copper powder.

IV. ALLOYING OF METAL POWDERS—Continued

1. Alloy Powders—Continued

Patentee	U. S. Patent No.	Subject
Wulff	2, 361, 443	Stainless steel powder produced from alloys, such as chromium-nickel, aluminum-magnesium, etc.
Wulff	2, 368, 282	Stainless steel powder produced from grinding residues of alloy steel casting industry.
Cordiano	2, 370, 396	Steel powder comprising fritted agglomerates formed by heat treatment of iron particles and ferrous alloy particles containing carbon.
Tholand	2, 372, 696	Producing high speed steel powder by disintegrating and decarburizing ferrous metal alloy.
Wulff	2, 373, 158	Powdered brass having core of brass of relatively high zinc content and integral case of lower zinc content.

2. Alloys Made by Compressing and Heating, Sintering or Reducing Mixed Powdered Constituents

Canda	304, 500	Solidified compound metals comprising metal powders produced by welding or soldering with heat and under pressure.
Polte	735, 293	Making articles of wolfram and lead by forcing particles together and pressing into shape.
Gesner	815, 419	Production of articles consisting of particles of alloy of iron and hydrogen compressed and fired.
Bontempi	835, 495	Powdered iron-hydrogen alloy shaped, compressed, heated, and impregnated with metalliferous material.
Kuzel	912, 246	Manufacture of alloys comprising metal powders by precipitation.
Tone	929, 518	Treating aluminum-silicate ores to produce a silicon and iron alloy in which finely divided iron may be used in the furnace charge.
Ladoff	1, 040, 699	Producing alloy from powdered oxides of metals by heating in reducing atmosphere.
Kreusler	1, 110, 303	Powdered metals, such as tungsten and nickel, mixed with agglutinant and heated.
Kaiser	1, 167, 827	Third metal added to powdered mixture of two metals before sintering to increase ductility.
Ladoff	1, 221, 873	Similar to 1,040,699 except that small quantity of compound, with lower reducing temperature, is added during process.
Fahrenwald	1, 236, 384	Producing alloy of tungsten and molybdenum by compacting powdered mixture, sintering, forging, and mechanical cold working.
Deppeler	1, 350, 709	Alloy of tungsten formed by compressing tungsten powder into tablets and adding to alloying metal.

IV. ALLOYING OF METAL POWDERS—Continued

2. Alloys Made by Compressing and Heating, Sintering or Reducing Mixed Powdered Constituents—Continued

Patentee	U. S. Patent No.	Subject
Keyes	1, 377, 982	Molded moistened bar of molybdenum-tungsten dried, heated and passed through hydrogen in manufacturing molybdenum-tungsten alloy.
Laise	1, 418, 081	Alloy produced by reducing oxide mixture of metals and heating under pressure.
Williams	1, 453, 057	Iron, steel and steel alloys produced by reducing iron oxide to powder and treating.
McMahon	1, 506, 246	Steel alloy material produced by heating mixture of powdered electroyltic metal with metal-containing material.
Gero	1, 566, 793	Alloying rare metals by coating particles with volatile protecting agent and sintering.
Boving	1, 636, 763	Alloy produced by molding mixture of metal powders in presence of gas under pressure.
Marden	1, 731, 255	Producing tungsten alloy by compressing and sintering.
Cooper	1, 732, 326	Alloys of thorium and refractory metal produced by processing powder mixtures.
Ramage	1, 741, 953	Tungsten-tantalum alloy formed from treating mixtures of their oxides.
Heany	1, 759, 454	Producing alloy comprising powdered uranium oxide.
Smith	1, 775, 358	Finely divided iron united with other metals under temperature and pressure.
Smith	1, 793, 757	Iron alloys formed by compressing and heating powdered metals.
Davey	1, 829, 635	Reducing mixture of metal compounds to form alloy.
Walter	1, 856, 607	Producing sintered alloy comprising mixing vegetable oil, as binding material, with metal powders before pressing and sintering.
Brace	1, 916, 410	Forming alloys between refractory metal and chemically reactive, volatile metal, by treating powdered metals.
Hardy	1, 922, 038	Manufacture of stainless metal, including powder of metal to give desired stainless quality.
Kempf, et al	1, 944, 183	Alloy consisting of aluminum and silicon compressed from comminuted materials.
Hensel, et al	2, 128, 089	Making article of manufacture for use as alloy addition agent to molten metal comprising chromium powder.
Willey	2, 147, 329	Making wear-resistant metal alloy by treating metal powders.
Schwarzkopf	2, 148, 040	Producing steel bodies or alloys from powdered iron and carbon.
Welch	2, 152, 006	Producing Hadfield manganese steel articles employing iron- and manganese-containing powders.

IV. ALLOYING OF METAL POWDERS—Continued

2. Alloys Made by Compressing and Heating, Sintering or Reducing Mixed Powdered Constituents—Continued

Patentee	U. S. Patent No.	Subject
Cooper	2, 156, 802	Making lead alloys by reducing, compressing and sintering lead oxide and reducible metal.
Schlecht, et al	2, 159, 231	Producing nickel alloy articles comprising powdered nickel by treatment.
Schlecht, et al	2, 159, 604	Producing metallic articles from alloys employing metal powders by processing.
Alexander	2, 163, 224	Producing metal alloys by treating metal powders.
Smithells	2, 183, 359	Heavy metallic material produced by cementing together large grains of tungsten by tungsten-nickel-copper alloy.
Comstock	2, 188, 873	Making articles from powdered components by heat treatment.
Howe	2, 192, 741	Making sintered alloy with metal powders.
Smith	2, 193, 435	Finely divided iron alloyed by using acid slag
Balke, et, al	2, 205, 386	Producing metals and alloys by interaction of metal oxide and metal carbide.
Schwarzkopf	2, 205, 865	Producing alloys by molding, heating and extruding mixtures of metal powders.
Koebel	2, 205, 888	Setting for diamonds composed of alloy comprising metal powders.
Devereux, et al	2, 206, 616	Producing osmium composition by mixing, pressing together and heating powdered osmium and lower melting point metal.
Schwarzkopf	2, 225, 424	Producing steel alloys from powdered metals by processes of densifying, extruding, heating and solidifying.
Kirkham	2, 260, 226	Method of introducing powdered alloying metal into molten metal.
Sanders, et al	2, 278, 592	Producing alloy by molding metal powders.
Jones	2, 287, 251	Manufacture of nonporous metal articles by compacting metal powders under pressure.
Brassert	2, 291, 685	Briquettes of ferro-manganese produced by reducing mixtures of powdered ores and pressing.
Bernstorff, et al	2, 291, 865	Metal alloy comprising heating powdered reactive metal and less reactive metal.
Linz	2, 300, 943	Alloying molybdenum with ferrous alloys by heating, adding powdered aluminum as reducing agent.
Linz	2, 300, 944	Alloying tungsten with ferrous alloys by heating, adding powdered aluminum as reducing agent.
Kelly	2, 307, 512	Adding tungsten powder to copper melt in making copper base precipitation hardening alloys.
Devereux	2, 312, 324	Osmium alloy comprising pressing and sintering osmium powder and platinum powder.
Dean	2, 329, 698	Manganese alloys produced by compressing and heating mixture of metal powders.
vanWert	2, 330, 018	Alloy comprising copper, nickel and aluminum powders used in thermocouple element.

IV. ALLOYING OF METAL POWDERS—Continued

2. Alloys Made by Compressing and Heating, Sintering or Reducing Mixed Powdered Constituents—Continued

Patentee	U. S. Patent No.	Subject
Kalischer	2, 333, 573	Making steel by compressing and sintering metal powders.
Deppeler	2, 337, 314	Manufacture of alloys which comprises contacting molten metal bath with highly compressed pellets of a thermit containing aluminum as a reducing agent.
Gardner	2, 353, 612	Producing alloys from crushed beryllium and manganese.
Hensel, et al	2, 362, 007	Copper-chromium alloys which comprise sintering copper, chromium and phosphorous powders.
Udy	2, 362, 512	Producing low-carbon ferro-chromium and other chromium-bearing alloys from finely divided ores.
Patterson	2, 368, 943	Brass objects produced by compression of copper and zinc powders, and small amount of phosphorus.
Udy	2, 370, 608	Producing ferro-alloy product for use in production of alloy steel and iron by chilling and granulating molten ferro-chromium.
Gregg, et al	2, 378, 548	Adding bismuth in finely divided form to steel to improve machining characteristics.
Toleik	2, 383, 026	Metal powders are used in preparing aluminum alloy.
Boegehold, et al	2, 402, 120	An iron powder mixture particularly adapted for the formation of sintered iron articles.

3. Alloys Employing Metal Powder as the Binding Material for Metallic Carbides, Nitrides, or the Like, in the Production of Very Hard Articles, Such as Cutting Tools, Etc.

Kuzel	899, 875	Peptisating coagulated colloids of refractory metals so they have a high agglomerating power for metal powders.
Potter	1, 030, 327	Producing carbosilicon using silicon carbide and silicon.
Liebmann, et al	1, 343, 976	Process of hardening refractory metals to be used as substitute for diamonds.
Liebmann, et al	1, 343, 977	Producing hard material to be used as substitute for diamonds by pressing, baking and sintering refractory metal powder and powdered carbon.
Baumhauer	1, 512, 191	Porous sintered tungsten carbide tool impregnated with molten metal.
Schröter	Reissue 17,624 of 1,549,615.	Producing hard metal alloy using tungstic carbide and lower melting point metal.
Schröter	1, 551, 333	Tools or dies made from sintered refractory metal powders and surface hardened by heating in an atmosphere containing vapors of carbon or boron compounds.

IV. ALLOYING OF METAL POWDERS—Continued

3. Alloys Employing Metal Powder as the Binding Material for Metallic Carbides, Nitrides, or the Like, in the Production of Very Hard Articles, Such as Cutting Tools, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Laise	1, 633, 258	Producing refractory metal alloy comprising compressed tungsten and decomposed refractory metal nitride and a base metal.
Schröter	1, 721, 416	Hard metal composition comprising powdered tungsten carbide and auxiliary metal.
Schröter	1, 728, 909	Making tools from hard metal alloys comprising mixture of hard metal carbide powder and soft metal.
McKenna	1, 737, 255	Producing alloy comprising tungsten carbide and beryllium.
Diener	1, 740, 009	Tools made by subjecting powdered carbon containing tungsten to heat and pressure.
Schrobsdorff	1, 742, 417	Cutting, etc. tools are cast from an alloy made from powdered tantalum and a metal that does not combine with carbon.
Gilson	1, 756, 857	Producing hard metal composition comprising powdered tungsten, carbon, and iron element.
Schröter, et al	1, 757, 846	Producing hard and rigid bodies of any desired shape from carbides, alloys, etc.
Kiernan	1, 760, 413	Producing zirconium articles by compacting and sintering substantially pure zirconium powder.
Adams	1, 775, 014	Hard metal composition made by pressing and sintering tungsten carbide and cobalt, iron or nickel powders.
Hoyt	1, 794, 229	Producing hard metal composition comprising powdered tungsten carbide and cementing metal.
Kelley	1, 794, 300	Producing hard metal composition comprising tungsten carbide and cobalt.
Hoyt	1, 803, 189	Hard metal sintered composition comprising boron carbide, cobalt and tungsten.
Walter	1, 803, 882	Metal composition comprising sintering tungsten nitride and bringing in contact with molten metal.
Gebauer	1, 809, 780	Producing formed metallic articles of great hardness from metal powders.
Walter	1, 811, 068	Alloy comprising powdered, mixed, compressed and sintered aggregate of tungsten carbonitride and auxiliary metal.
Mills	1, 812, 357	Manufacture of tungsten carbide in electric arc furnace using divided tungsten and divided tungsten carbide.
Strauss	1, 812, 811	Sintered hard metal alloy comprising tungsten carbide and cobalt.
Comstock	1, 815, 613	Sintered aggregate of finely divided tungsten carbide embedded in a matrix formed of finely divided alloy steel.
Taylor	1, 819, 927	Metal stencil comprising sintered composition of tungsten carbide and cobalt.

IV. ALLOYING OF METAL POWDERS—Continued

3. *Alloys Employing Metal Powder as the Binding Material for Metallic Carbides, Nitrides, or the Like, in the Production of Very Hard Articles, Such as Cutting Tools, Etc.*—Continued

Patentee	U. S. Patent No.	Subject
Welch	1, 822, 426	Composition of matter comprising heating under pressure mixture of tungsten carbide, chromium- and copper-coated cobalt.
Taylor	1, 823, 709	Producing openings through hard metal compositions by dissolving quartz stem embedded in hard sintered metallic structure.
Comstock	1, 826, 454	Finely divided silicon carbide with finely divided nickel or iron as a binding agent sintered and shaped to form cutting tools.
Comstock	1, 826, 455	Finely divided tungsten carbide with high speed steel used as a binder.
Comstock	1, 826, 456	Finely divided zirconium oxide with nickel used as a binder.
Comstock, et al	1, 826, 457	Vitrified zirconium oxide bonded in a matrix of sintered particles of high-speed steel.
Voigtlander, et al	1, 829, 950	Manufacturing carbides of difficultly meltable metals comprising mixing with carbon and melting in electric carbon furnace.
Kelley	1, 831, 567	Cemented composition consisting largely of tungsten carbide and manganese as cementing material.
Welch	1, 833, 099	Method of making cutting tool by coating tungsten carbide particles with cobalt prior to pressing and sintering.
Woods, et al	1, 839, 518	Manufacturing tungsten carbide by melting powdered tungsten and carbon and immersing discharge in liquid bath.
Lohmann	1, 840, 457	Carbide tool alloy formed by mixing powdered metallic oxides with tantalum, forming into a briquette and molding.
Hoyt	1, 843, 768	Producing hard metal composition by mixing, heating, and applying pressure to mixture of powdered tungsten, carbon, and auxiliary metal of the iron group.
McKenna	1, 848, 899	Cutting tool and die material made of powdered tungsten (50%) and powdered columbium and tantalum carbide (50%) welded together.
Laise	1, 858, 244	Substitute for diamonds formed from a mixture of powdered tungsten and silicon bonded with powdered metal of the iron group.
Laise	1, 858, 300	Tool alloy formed of tungsten carbide, aluminum oxide and finely divided metal of the iron group.
Walter	1, 864, 567	Alloy of azotized character containing carbides, nitrides, or carbonitrides mixed with auxiliary metals, iron, nickel, etc., in the powdered state, pressed and sintered.
Sessions	1, 874, 641	Production of carbide alloy powders by reduction of mixtures of salts of refractory metals such as tungsten, chromium, or molybdenum.

IV. ALLOYING OF METAL POWDERS—Continued

3. Alloys Employing Metal Powder as the Binding Material for Metallic Carbides, Nitrides, or the Like, in the Production of Very Hard Articles, Such as Cutting Tools, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Stoody, et al	1, 876, 175	Making metal carbides by sintering mixture of finely divided metal and paste of carbon with distilled petroleum oil.
McKenna	1, 892, 653	Manufacturing composition of matter by welding together finely divided tungsten carbide and tantalum.
Genuit	1, 893, 078	Producing sintered hard metal alloy comprising tungsten carbide, molybdenum, and tantalum.
Kropf	1, 893, 144	Producing alloy of high fusion point from tungsten carbide, molybdenum and tantalum.
Taylor	1, 895, 354	Producing hard-metal composition particularly suitable for cutting tools from powdered cobalt and oxide of tough metal.
Agte, et al	1, 895, 959	Hard alloy made by melting, or pressing and sintering a powdered titanium carbide and nitride mixture with a small percent of metal of the iron group.
Petersson	1, 896, 643	Making tungsten alloys by heat treatment of tungsten carbide and metal oxides.
Hoyt	1, 904, 049	Diamond charged cutting tool bit made from a mixture of powdered cobalt, powdered tungsten carbide and diamond dust compacted and sintered.
Taylor	1, 904, 100	Wheel-dressing tool made of cemented carbides.
Taylor	1, 904, 568	Making disk-like cutting tools from sintered hard-metal composition consisting largely of tungsten carbide and cobalt.
Fetkenheuer	1, 910, 532	Tool alloy made from a mixture of powdered titanium carbide, tantalum carbide, and powdered cobalt.
Taylor	1, 918, 064	Method of making strong cemented carbide discs.
Stoody	1, 924, 384	Tungsten carbide alloy formed by heating a mix of tungsten powder, nickel, and copper in a carbon crucible.
Schwarzkopf, et al	1, 925, 910	Tool alloy formed of titanium carbide, molybdenum carbide intimately mixed with an auxiliary metal of the iron group.
Kelley	1, 928, 453	Sintered tool bit composed of powdered tantalum carbide and a binder of cobalt and aluminum.
Kelley	1, 936, 435	Sintered tool bit composed of powdered tantalum carbide and a powdered binder of tungsten and cobalt.
Balke	1, 937, 185	Making hard alloys of tantalum carbide powder.
Krusell	1, 939, 991	Making diamond cutting tool comprising embedding diamond in molded tungsten carbide and cobalt.
Kelley	1, 940, 308	Making metal carbides by heating powdered metal and carbon in hydrogen atmosphere.

IV. ALLOYING OF METAL POWDERS—Continued

3. Alloys Employing Metal Powder as the Binding Material for Metallic Carbides, Nitrides, or the Like, in the Production of Very Hard Articles, Such as Cutting Tools, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Kelley	1, 947, 206	Sintered tool composition of powdered columbium carbide and a powdered binder of the iron group.
DeBats	1, 950, 356	Applying cutting surfaces to articles comprising mixture of tungsten carbide and alloyable metal.
Schwarzkopf	Reissue 22,207 of 1, 959, 879	Hard metal alloy comprising sintering mixture of two powdered metallic carbides and powdered auxiliary metal.
Kelley	1, 960, 055	Sintered tool bit composed of powdered tantalum carbide and columbium carbide with a binder of powdered iron and molybdenum.
Walter	1, 961, 468	Sintered alloy using a powdered hard double carbide of chromium-tungsten with a binder of metal from the iron group.
Balke	1, 968, 067	Hard metal alloy produced by uniting refractory metal powder with boron.
Welch	1, 973, 422	Producing hard metal composition by welding together titanium carbide, tungsten and aluminum.
Comstock	1, 973, 428	Sintered tool composition of milled-together tungsten, tantalum, and titanium carbides and cobalt.
Moers, et al	1, 973, 441	Sintered hard metallic alloys produced by adding powdered metal to boron carbide.
Duhme, et al	1, 979, 372	Making hard metal bodies comprising powder of hard metal carbide and powder of binding metal.
Comstock	1, 981, 719	Hard cemented carbide containing tungsten carbide, tantalum carbide, alumina and a metal from the group of cobalt, nickel, and iron.
Comstock	1, 982, 857	Producing hard cemented carbide materials for cutting tools by cementing or sintering metal powders.
DeBats	1, 989, 186	Forming rolls for metal rolling machines having working surfaces of hard alloy of iron nitride by molding, compressing, and hot working iron nitride powder.
Schroter	1, 991, 912	Sintered hard tool alloy of vanadium carbide and one or both of carbides of tantalum and niobium, with a binder from the iron groups.
Holzberger	1, 992, 372	Manufacture of hard metal alloys comprising powder carbides of such metals as titanium.
Tigerschiold, et al	1, 996, 220	Making tools from sintered hard metal carbides in powder form.
Comstock	1, 998, 609	Making hard carbide materials comprising grinding hard metal carbide.
McKenna	2, 011, 369	Hard composition of matter comprising welding particles of tantalum carbide and tungsten.

IV. ALLOYING OF METAL POWDERS—Continued

3. Alloys Employing Metal Powder as the Binding Material for Metallic Carbides, Nitrides, or the Like, in the Production of Very Hard Articles, Such as Cutting Tools, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Schroter, et al	2, 015, 536	Sintered tool alloy of tungsten carbide, titanium carbide, and a metal from the iron group.
Walter	2, 018, 752	Sintered alloy of tungsten carbide or carbonitride, pure tungsten, and a metal of the iron group.
McKenna	2, 021, 576	Finely powdered tantalum carbide, tungsten carbide, and zirconium metal welded together under pressure by alternating current.
Fetkenheuer	2, 023, 413	Making hard metal comprising titanium carbide in powdered form.
Becker, et al	2, 026, 958	Sintered tool alloy of powdered vanadium carbide, niobium carbide, or tantalum carbide added to a powder mixture of tungsten monocarbide and cobalt.
Boecker	2, 027, 763	Process of making hard sintered metals from metal powders.
Comstock	2, 033, 513	Sintered tool alloy of powdered tungsten carbide, tantalum carbide, cobalt, and titanium oxide.
Walter	2, 036, 245	Sintered alloy of, e. g., azotized tungsten carbide, tungsten and cobalt.
McKenna	2, 039, 822	Producing hard composition of matter wherein particles of tantalum carbide and tungsten are in welded relation.
Becker	2, 040, 592	Sintered alloy of tungsten carbide, one or more of the metals iron, cobalt, and nickel, and hard mixed crystals of carbides or carbides and nitrides of metals of the IV and V groups of the periodic system.
Schjoth	2, 042, 684	Producing composition of matter from metal powders suitable fur cutting tools.
Laise	2, 044, 853	Making cutting tools employing refractory metal oxides and binder metal.
Wirth	2, 048, 239	Producing sintered alloy of carbon, chromium, and tungsten.
Pinta	2, 049, 317	Making hard alloy by sintering mixture of at least two hard carbides and metal binders therefor.
Tigerschiöld	2, 051, 972	Process for producing sintered hard metal alloys from mixtures of tungsten, titanium or tantalum with one or more inorganic compounds of an auxiliary metal.
Kelley	2, 053, 151	Cemented carbide tool alloy of tantalum carbide powdered and mixed with a binder of iron and molybdenum.
Taylor	2, 053, 977	Laminated cemented carbide tool bit with top layer of tantalum carbide bonded to bottom layer of tungsten carbide.
Schröter, et al	2, 059, 041	Tool alloy of powdered zirconium and powdered boron.

IV. ALLOYING OF METAL POWDERS—Continued

3. Alloys Employing Metal Powder as the Binding Material for Metallic Carbides, Nitrides, or the Like, in the Production of Very Hard Articles, Such as Cutting Tools, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Balke	2, 067, 166	Producing tantalum carbide alloy comprising deoxidized tantalum carbide and metal of iron group.
Powell, et al	2, 070, 451	Hard metal alloy comprising metal powders and hardening agent.
Lemaigre	2, 074, 847	Sintered alloy of titanium carbide, tungsten carbide and a binder alloy of tungsten and cobalt, all of which are powdered and intimately mixed.
Moers	2, 075, 742	Shaped sintered bodies of tungsten carbide, titanium carbide and a high percentage, 25 to 40 percent, of an auxiliary metal of the iron group.
Kratky	2, 076, 952	Producing hard metal alloys by building up layers of pressed powdered metal carbide and auxiliary metal.
Hinnuber	2, 077, 239	Sintered tool alloys of a refractory nitride and a refractory boride or silicide and 1 to 25 percent of a metal such as cobalt or nickel.
Reichmann	2, 082, 354	Making sintered shaped bodies by casting into molds and sintering an electrolyte and powdered metal and metal carbide.
Laise	2, 084, 349	Making wear resisting material for cutting tools by carburizing and boronizing mixture of refractory metal powders and base metals.
Cole, et al	2, 088, 838	Producing resistant material from chromium and boron by igniting mixture of their oxides and aluminum.
Sturgis	2, 088, 981	Producing cutting tool composition by heat treatment of metal powders.
Kratky	2, 089, 030	Producing hardened material for cutting tools from hard carbides, nitrides and the like.
Schwarzkopf	2, 091, 017	Sintered tool alloy of two carbides of tungsten, molybdenum, etc. in the form of mixed crystals and powdered nickel, cobalt or chromium.
Fodor, et al	2, 093, 656	Manufacture of bodies containing metallic carbides comprising carbide of finely divided hard metal and softer matrix metal.
McKenna	2, 093, 844	Tool alloy made from ground macrocrystalline carbide, or multicarbide, ground with metallic tungsten, molybdenum, nickel, cobalt or iron.
McKenna	2, 093, 845	Producing hard compositions of matter from metal powders for use in construction of cutting tools.
Balke	2, 106, 161	Producing hard alloy by heating mixture of tantalum carbide, nickel and tungsten powders.

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IV. ALLOYING OF METAL POWDERS—Continued

3. Alloys Employing Metal Powder as the Binding Material for Metallic Carbides, Nitrides, or the Like, in the Production of Very Hard Articles, Such as Cutting Tools, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Balke	2, 106, 162	Producing hard alloy by heating mixture of tantalum carbide, nickel and molybdenum powders.
Seljesaeter	2, 108, 618	Sintered alloy of tantalum nitride, tantalum carbide and cobalt.
Comstock	2, 108, 797	Producing hard cemented carbide composites by sintering mixture of hard metal carbides and powdered cementing metal.
Cooper	2, 113, 171	Producing hard carbide material by pressing and sintering powdered carbon and tungsten.
McKenna	2, 113, 355	Cutting tool alloy containing a new compound, tungsten titanium carbide, cemented in a matrix of finely divided cobalt, nickel, etc.
McKenna	2, 113, 356	Forming hard composition of matter comprising cementing under reduced pressure mixture of fine carbide material and metallic binder in presence of magnesium.
Marth	2, 116, 399	Producing shaped bodies from hard metallic carbides and auxiliary metal by heating.
Marth	2, 116, 400	Producing hard substance alloy by sintering powdered auxiliary metal by heating.
Padowicz	2, 119, 487	Producing hard metal alloy by heating in reducing atmosphere mixture or tungsten carbide and concentrated solution of a cobalt salt. Powdered tungsten is used as a starting material.
Padowicz	2, 119, 488	Cutting tool alloy in which powdered metal is used to form its carbide and then combined with an organic salt of cobalt, reduced and sintered.
Beer	2, 119, 489	Finely divided metallic tungsten tantalum, etc., are mixed with cobalt or nickel organic salts, reduced, carburized, formed and sintered.
Ritzau	2, 121, 448	Producing hard metal composition by pressing and sintering finely divided tungsten carbide, cobalt, tungsten and chromium.
Schwarzkopf	Reissues 21,520 and 22,166 of 2,122,157.	Tool alloy formed from ternary mixed carbide crystals powdered and mixed with powdered auxiliary metal.
Hinnuber	2, 123, 046	Sintered hard metal alloy in which finely powdered vanadium nitride, titanium carbide and nitride, cobalt and tungsten carbide may be used.

IV. ALLOYING OF METAL POWDERS—Continued

3. *Alloys Employing Metal Powder as the Binding Material for Metallic Carbides, Nitrides, or the Like, in the Production of Very Hard Articles, Such as Cutting Tools, Etc.*—Continued

Patentee	U. S. Patent No.	Subject
McKenna	2, 123, 574	Similar to 2,123,575 and 2,123,576, below-except that major constituent of coms minuted macrocrystalline multicarbide is tantalum carbide or columbium carbide and minor constituent is metal carbide of this group embedded in matrix.
McKenna	2, 123, 575	Producing hard composition of matter consisting of comminuted macrocrystalline columbium carbide, tungsten and nickel.
McKenna	2, 123, 576	Similar to 2,123,575 except that a comminuted macrocrystalline multicarbide, consisting of titanium carbide and columbium carbide, is used.
Wirth	2, 124, 020	Sintered alloy comprising chromium, tungsten and carbon.
Hinnuber	2, 128, 146	Sintered alloy of cobalt, and titanium, vanadium and tungsten carbides.
Willey	2, 133, 495	Making hard compact metal by subjecting to pressure and heat powdered metal, such as tungsten, carbon and an auxiliary metal.
Lucas	2, 133, 867	Sintered composition of 0.25 to 0.50% chromium carbide, cobalt, and tungsten and titanium carbides.
Kieffer	2, 134, 305	Method of forming hard metal alloys from carbides.
Ridgway	2, 141, 617	Method for producing boron carbide alloy by electrically heating boron oxide and carbon.
Dawihl, et al	2, 162, 574	Hard metal alloy which may be pressed and sintered containing metal of the iron group, chromium, and titanium and tungsten carbides.
Chelius	2, 166, 795	Sintered hard alloys of vanadium and molybdenum carbides, auxiliary metal from the iron group and tungsten carbide.
Kelley	2, 167, 516	Sintered composition of tungsten carbide, tantalum carbide and a binding metal of the iron group.
DeBats	2, 167, 544	Making hard metal articles, such as rolls for rolling mills, by compressing in mold and heating metal powders.
Dawihl, et al	2, 169, 090	Sintered tool alloy of tungsten carbide, vanadium carbide, titanium carbide and molybdenum carbide and a metal such as iron, nickel or cobalt.
Schwarzkopf	Reissues 21,730 and 22,073 of 2,170,432.	Cemented hard metal made, e. g., from vanadium carbide, tungsten carbide and an auxiliary metal from the iron group.

IV. ALLOYING OF METAL POWDERS—Continued

3. Alloys Employing Metal Powder as the Binding Material for Metallic Carbides, Nitrides, or the Like, in the Production of Very Hard Articles, Such as Cutting Tools, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Schwarzkopf	Reissues 21,731 and 22,074 of 2,170,433.	Hard metal alloy comprising at least two hard carbides and auxiliary metal from iron group.
Boecker	2, 171, 391	Producing hard materials from metal powders and vanadic or titanic acid.
Boecker, et al	2, 173, 749	Preparing hard metals comprising mixed carbides.
Romp	2, 176, 802	Making hard metal alloys by compressing and sintering powdery mixture of tungsten carbide and cobalt.
Hensel	2, 180, 984	Producing metal composition comprising metal nitrides, refractory metal and low melting point metal.
Wissler	2, 189, 387	Making hard compositions by electrically heating, then cooling, carbide of difficulty fusible metal and binding material, such as pitch.
Kieffer	2, 191, 666	Tool element for drilling and mining employing metal powders, such as tungsten and molybdenum.
Wright	2, 193, 413	Producing hard metal carbide alloys comprising heating and applying pressure to a metal carbide and an auxiliary metal.
Engle	2, 195, 297	Making hot pressed hard metal compositions from hard metal carbide particles.
Dawihl, et al	2, 196, 009	Producing hard alloys by sintering mixture of several metal carbides without auxiliary metal.
Kieffer	2, 198, 343	Sintered tool alloy of tantalum and titanium and molybdenum carbides, bonded with nickel or cobalt.
Balke	2, 202, 821	Producing hard metal alloy comprising tungsten-carbide, tantalum-carbide and binder metal, such as cobalt.
Schwarzkopf	2, 205, 864	Manufacturing hard faced metal bodies by sintering compacted metal powders.
Balke, et al	2, 207, 708	Producing hard metal alloys by surrounding carbide and auxiliary metal during sintering process with loose particles of nonradioactive refractory metal carbide.
McKenna	2, 220, 018	Producing articles of tortuous shape from sintered hard metal compositions.
Dawihl, et al	2, 224, 595	Producing cutting tools consisting of finely divided crystallized aluminum oxide and softer ductile metallic material.
Simons	2, 228, 916	Making alloy by heating and exerting pressure on metallic carbide and lower melting point metal.
Comstock	2, 244, 052, 2, 244, 053	Methods of forming hard cemented carbide products from hard metal carbides and binding metal by sintering.

IV. ALLOYING OF METAL POWDERS—Continued

3. Alloys Employing Metal Powder as the Binding Material for Metallic Carbides, Nitrides, or the Like, in the Production of Very Hard Articles, Such as Cutting Tools, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Dawihl, et al	2, 246, 165	Producing sintered hard metal from pulverulent materials.
Dawihl, et al	2, 246, 166	Producing sintered hard metal alloy comprising metal carbide and auxiliary carbon alloy of lower melting point.
Schwarzkopf	2, 246, 387	Sintered tool alloy of titanium and tungsten carbides and metal of the iron group.
Kratky	2, 252, 129	Producing hard bodies for cutting tools from finely powdered refractory materials.
Wirth	2, 253, 476	Producing metal alloy by sintering metal carbide in molten bath of matrix-forming metal.
Cockrum	2, 261, 228	Applying hard wear resisting facing to tools using paste formed from metal powders.
Romp	2, 263, 520	Making sintered hard metal alloys by heating in gaseous atmosphere in mold.
Schwarzkopf	2, 265, 010	Cemented hard metal composition of refractory carbides and cobalt or nickel, powdered and sintered.
Schwarzkopf	2, 265, 110	Producing hard metal tool alloy comprising tungsten carbide, titanium carbide and auxiliary metal of iron group.
Taylor	2, 271, 960	Producing extruded material consisting of mixture of metal carbides and plasticizing agent, such as dry starch.
Clark, et al	2, 275, 420	Fabrication of hard metal bodies from metal powders by sintering.
Matush	2, 279, 003	Tool surface of sintered titanium-cyanocarbide, embedded in a matrix of a chromium-iron alloy.
Clark, et al	2, 284, 638	Producing hardenable carbon steel from powdered iron and powdered iron carbide.
DeLamatter	2, 286, 672	Making hard metal articles from hard, unbonded metallic carbides.
Jerabek	2, 292, 694	Hard facing metallic objects, such as earth working tools, by melting on surface with an electric arc mixture of metal powders.
Merle	2, 307, 939	Powdered hard metals, such as tungsten, metal carbides, etc. added to stream of molten metal, applicable in manufacture of cutting tools.
Clark, et al	2, 295, 334	Producing hardened steel articles wherein iron carbide is added to iron powder.
DeBats	2, 313, 227	Roll for metal rolling mills comprising heating and compressing powdered mixture of tungsten carbide and auxiliary metal, such as cobalt or nickel.
Gordon	2, 332, 071	Manufacture of hard rollers using hard metal carbide and binding material, such as cobalt.
Eglinton	2, 334, 755	Two-part rotary cutting tool comprising cutting element of hard but relatively brittle refractory metal and shank of softer but less brittle metal.

IV. ALLOYING OF METAL POWDERS—Continued

3. Alloys Employing Metal Powder as the Binding Material for Metallic Carbides, Nitrides, or the Like, in the Production of Very Hard Articles, Such as Cutting Tools, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Taylor	2, 348, 172	Apparatus for extruding rods, tubes, etc., which may consist of mixture of hard metal carbides and binder metal therefor.
Ollier	2, 349, 052	Cemented tool elements containing, e. g., tungsten carbide and two types of binder, such as cobalt, and a mixture of iron and steel powder, ball milled in several steps prior to sintering.
Perry	2, 362, 302	Drying cemented carbide compositions containing metal powder and an organic plasticizing medium, with sodium chloride.
DeLamatter, et al	2, 363, 575	Hard metallic bodies produced from tungsten carbide.
Troy	2, 367, 978	Hardening of metals by nitriding, utilizing comminuted tin to protect surfaces not to be hardened.
Engle	2, 368, 458	Manufacturing cemented carbide articles by sintering one or more hard metal carbides and cementing metal, such as cobalt.
Clark, et al	2, 369, 211	Steel of extreme hardness produced from metal carbide and powdered iron.
Suwa	2, 388, 020	Metal powders are used in sintering a universal type grinding tool.
Gauthier	2, 392, 285	Method of attaching carbide tip to cutting tool
Chandler, et al	2, 395, 461	In a method of forming diamond dust cylindrical drills, metal powders are used as a binder.
McKenna	2, 395, 570	Powdered metals are used to make a cutting tool tip.
Lindquist	2, 401, 087	Powdered metal is used in the manufacture of an improved diamond drill bit.
Lindquist	2, 410, 512	Powdered iron is used as the principal ingredient in setting a diamond for industrial tool use, without the formation of iron carbide. Copper is added as a sintering agent and brass as a brazing agent.

V. APPLICATIONS OF METAL POWDERS

1. Abrasive Tools, Other Abrasive Articles and Materials, Polishing Compositions, Employing Metal Powders

Forbes	262, 034	Glass-polishing powder composed of lead, tin, and copper calcined and mixed with water into pasty condition.
Lindsey	373, 239	Grinding and polishing material comprising pulverized steel.
Lindsey	466, 277	Grinding and polishing material composed of tempered particles of fractured steel.
Kann	511, 779	Grinding and polishing material comprising fractured steel mixed with softer or more friable material, such as rouge.

V. APPLICATIONS OF METAL POWDERS—Continued

1. Abrasive Tools, Other Abrasive Articles and Materials, Polishing Compositions, Employing Metal Powders—Con.

Patentee	U. S. Patent No.	Subject
Ringstrom	604, 569	Abrading material coated with metal powder and bonded with molten metal.
Bachman	686, 839	Particles of iron for grinding and cutting stones, glass, etc., is formed by forcing molten iron on drum in cold water.
Waddell	755, 589	Cake or stick to be rubbed on razor strops to improve quality comprising finely divided aluminum mixed with hard grease, such as cocoa butter.
Marius, et al	918, 069	Method of casting particles of abrading material in metallic matrix to form an abrading mixture.
Marius, et al	934, 412	Producing composition of matter comprising abrasive substance embedded in metallic matrix.
Sottile	1, 024, 156	Composition to be used on razor strops comprising water, powdered steel, axle grease, powdered glass, and anisette oil.
Tolputt	1, 057, 187	Polishing composition consisting of a hydrated oxide and powdered metallic lead incorporated with agglutinant binder, such as stearin.
Yasuda	1, 216, 643	Composition for cleaning and polishing iron composed of powdered aluminum, dehydrated alum and powdered crystalline silica.
Fisher	1, 624, 783	Polishing composition comprising intimate mixture of finely divided metal powders, pumice and oil.
Gauthier	1, 625, 463	Producing diamond lap (grinding implement) from diamond particles and finely divided metallic particles.
Mason	1, 632, 909	Producing buffing compound comprising abrasive, binder and aluminum.
Martin	1, 886, 285	Abrasive material; molten metal is supplied to larger stream of water at rapid rates; forms regular particles.
Bethel	Reissue 21,789 of 1,931,370.	Abrasive tool comprising molded, compacted mixture of granular metal and granular abrasive material held by brittle, nonmetallic bond.
Taylor	1, 996, 598	Abrading tool having a cutting portion of diamond dust in a sintered binder composition of tungsten carbide and cobalt.
Buckner	2, 027, 087	Producing abrasive sheet by showering magnetically coated abrasive particles on sheet having adhesive surface in a magnetic field.
DeBats	2, 027, 963	Synthetic diamonds comprising fine diamond particles embedded in metal matrix.
Kann	2, 062, 093	To form abrasive material, molten metal is discharged on a rotatable surface.
DeBats	2, 068, 848	Method of forming diamondiferous abrasive compositions from tungsten and carbon powders, and diamond particles.

V. APPLICATIONS OF METAL POWDERS—Continued

1. Abrasive Tools, Other Abrasive Articles and Materials, Polishing Compositions, Employing Metal Powders—Con.

Patentee	U. S. Patent No.	Subject
Van der Pyl	2, 072, 051	Grinding wheel formed of diamond particles bonded with a metal powder.
Willey	2, 074, 038	Producing diamond embedded abrading tool by heating tungsten, nickel, and carbon powders and distributing true diamonds throughout.
Van der Pyl	2, 077, 345	Making abrasive wheels comprising diamond grains united with a bond of aluminum and silicon.
Laise	2, 107, 122	Producing hard metal abrasive composition comprising refractory metal powders alloyed with base metal powder and bonded with base metal.
Vanlandingham	2, 135, 926	Razor hone comprising molded body of sulphur containing finely divided carborundum, aluminum, and lamp black.
Benner et al	2, 136, 931	Making abrasive articles by forming and sintering mixture of amalgam-coated abrasive particles with metal powder free from mercury.
Boyer	2, 137, 200	Producing abrasive article consisting of abrasive comprising diamonds, sintered bond therefor, and hardening agent.
Boyer	2, 137, 201	Producing abrasive article consisting of abrasive material comprising diamonds embedded in sintered metal matrix.
Boyer	2, 137, 329	Producing abrasive article comprising diamonds and sintered metal bond of ductile copper-base solid solution.
Moulton, et al	2, 145, 888	Making abrading tool comprising sintered mixture of pulverized metal and abrasive particles secured in grooves in base of tool.
Van der Pyl	2, 150, 886	Making grinding wheel comprising diamond particles mixed with resin.
Ervin	2, 159, 433	To form abrasive material, molten metal is discharged on stream of liquid other than water having oily character.
Fitz-Randolph	2, 173, 833	Producing abrasive article comprising diamonds and sintered metal bond of tin alloy.
Fitz-Randolph	2, 173, 834	Metal-bonded abrasive article consisting of abrasive comprising diamonds and sintered bond of tin and iron powders.
Boyer, et al	2, 173, 835	Metal-bonded abrasive article comprising abrasive particles and sintered bond.
Van der Pyl	2, 189, 259	Making grinding wheel comprising diamond grain and powdered metal.
Benner, et al	Reissue 22,373 of 2,193,265.	Abrasive article produced by compacting and sintering metal powders.
Boyer	2, 197, 655	Abrasive article in which abrasive grain is bonded by metal alloy.
Boyer	2, 200, 258	Producing boron carbide composition as abrasive article.

V. APPLICATIONS OF METAL POWDERS—Continued

1. Abrasive Tools, Other Abrasive Articles and Materials, Polishing Compositions, Employing Metal Powders—Con.

Patentee	U. S. Patent No.	Subject
Fitz-Randolph	2, 223, 063	Metal-bonded abrasive article comprising diamonds and a bond of zinc and iron powders.
Van der Pyl	2, 226, 506	Making laps and other abrasive articles comprising mixture of comminuted abrasive and bond.
Van der Pyl	2, 238, 351	Abrasive comprising abrasive grains bonded with hard, friable, sintered metal bond.
Bevillard	2, 240, 829	Making cutting tool comprising diamonds within a cast matrix.
Kuzmick	2, 243, 105	Making abrasive tool comprising bonded mixture of metal particles, abrasive particles and nonmetallic bond.
Small	2, 254, 549	Making sintered powdered metal composition adapted for use as a matrix in preparation of abrasive tools.
Kuzmick	2, 258, 774	Manufacture of abrasive products comprising abrasive particles of metal powders bonded with synthetic resin.
Van der Pyl	2, 282, 912	Making grinding wheel comprising mixture of comminuted abrasive and comminuted metal.
Dawihl	2, 285, 909	Grinding tool of diamond powder sintered with tungsten and titanium carbides and a binder compound Co_3W_3C, which resembles pure cobalt in action.
Crompton	2, 292, 991	Producing flexible abrasive product by combined soldering and rolling process, affixing abrasive grains to metal sheet.
Van der Pyl	2, 301, 721	Abrasive grains bonded with a sintered metal bond formed of metal powders in giving antislip properties to a floor product.
Bernstorff, et al	2, 306, 423	Grinding and cutting disk comprising sintering and tempering beryllium powder with copper powder and diamond dust.
Kurtz	2, 319, 331	Abrasive article comprising diamond or silicon carbide particles coated with metal and glass, set in a mount of sintered metal powder.
Ervin	2, 330, 038	Abrasive material produced by subjecting molten metal between two convergently meeting streams of liquid.
Lombard, et al	2, 332, 241	Batch composition for grinding wheel may contain, in addition to clay and abrasive, a small percent of aluminum powder.
Eash, et al	2, 336, 001	Metallic blasting and abrasive material incorporating powdered silicon, nickel and chromium.
Van der Pyl	2, 339, 208	Abrasive grains embedded in sintered metal bond comprising a copper and tin alloy secured on a flexible sheet metal backing.
Kelleher	2, 339, 270	Abrading tool comprising mixture of chromium and copper heat joined with each other.

V. APPLICATIONS OF METAL POWDERS—Continued

1. Abrasive Tools, Other Abrasive Articles and Materials, Polishing Compositions, Employing Metal Powders—Con.

Patentee	U. S. Patent No.	Subject
Kelleher	2, 349, 825	Abrading tool comprising abrasive particles uniformly dispersed through sintered mixture of chromium, copper and nickel.
Benner, et al	2, 352, 246	Abrasive article comprising abrasive grains incorporated in sintered mixture of copper, tin and lead.
Hammill, et al	2, 353, 236	Diamond tool for dressing or truing an abrasive wheel having diamond set member of a fused or sintered powdered metal matrix.
Kelleher	2, 358, 459	Abrading tool comprising abrasive particles uniformly dispersed throughout sintered mixture of nickel, copper and tin.
Seligman et al	2, 360, 798	Abrasive tool comprising diamond particles securely held in an electrodeposited metallic matrix.
Pare	2, 361, 492	Diamond saw comprising number of metal blades having diamond particles embedded therein.
Anderson	2, 362, 979	Abrading machine having abrasive element formed by compressing suitable metal powder impregnated with diamond dust.
Kott	2, 367, 404	Abrasive composition comprising diamond particles dispersed throughout porous, sintered metallic body and impregnated with silver solder alloy.
Kott	2, 367, 405	Abrasive composition comprising diamond particles, coated with film of platinum-group metal and nickel powder, dispersed in metallic matrix.
Kott	2, 367, 406	Abrasive comprising diamond particles dispersed throughout sintered mixture of metal powders.
Kott	2, 367, 407	Abrasive comprising diamond particles dispersed throughout sintered mixture of metal powders.
Martin, et al	2, 371, 700	Abrasive article comprising metal powder abrasive grains and resinoid bond therefor.
Humphrey, et al	2, 376, 254	Metal powders may be bonded with diamond fragments in grinding wheel.
Coes	2, 377, 995	Powdered iron pyrite used as pore filler in vitrified grinding wheel which may contain silicon carbide.
Ellis	2, 379, 569	Magnetic abrasive tool utilizing powdered steel or nickel.
Wiegand	2, 387, 548	Apparatus for grinding or reducing in size hard metals for abrasives.
Liden, et al	2, 396, 015	Diamonds are set by packing them in unsintered powdered metal and then another metal is poured into the powder.
Sachse	2, 404, 598	Metal bodies, in which minute grains of abrasive materials are uniformly distributed, are molded and compressed under pressure.

V. APPLICATIONS OF METAL POWDERS—Continued

1. Abrasive Tools, Other Abrasive Articles and Materials, Polishing Compositions, Employing Metal Powders—Con.

Patentee	U. S. Patent No.	Subject
Bevillard	2, 405, 086	Powdered copper, nickel, iron, titanium, etc., are used as a matrix on an abrasive wheel.
Kratky	2, 409, 363	Metal powders may be added to the grinding powders used with a tool for polishing lenses, jewels, hard carbides, etc.

2. Bearings and Bearing Materials

Gwynn	101, 863	Manufacture of metaline (of powdered tin) to be used in lining journal boxes.
Gwynn	101, 864	Manufacture of metaline (of powdered zinc) to be used in lining journal boxes.
Gwynn	101, 866	Manufacture of metaline (of powdered plastic bronze, to be used in lining journal boxes.
Gwynn	101, 867	Manufacture of metaline (of powdered type metal) to be used in lining journal boxes.
Saunders	122, 408	"Antifriction" metal alloyed from iron fillings resin, tar, glass, zinc, antimony and lead.
Gwynn	138, 645	Manufacture of journal-box linings by subjecting to pressure of rollers alternate layers of a fabric and finely divided metaline.
Gwynn	138, 646	Same method as in 138,645 on wood.
Gwynn	140, 774	Same method as in 138, 645 on wire cloth.
Gwynn	140, 775	Same method as in 138,645 on perforated metal sheets.
Behrens	189, 684	Producing antifriction compound suitable for journal boxes by molding and pressing metal powders and graphite.
Canda	269, 636	Manufacturing bearings by subjecting to pressure mold containing mercury and powdered metals.
Canda	313, 916	Manufacturing antifriction material comprising mixing lubricant with powdered metals before molding and heating.
Douglas	379, 531	Producing antifriction composition by adding unctuous substance, such as paraffin or graphite, to mixture of powdered metal and sulphur.
Martin	569, 759	Producing composition of matter composed essentially of metal particles and asbestos fibers to be used in journal boxes and bearings generally.
Haley	590, 369	Making self-lubricating bearings from compound of glass, lead, plumbago and antimony tempered with brass and aluminum.
Meadows	778, 789	In forming bearing metal, constituent metals are mixed in molten state; small solid pieces are formed and evenly distributed.
Stewart	857, 845	Producing journal bearings by compressing lubricant-coated, shredded, antifriction bearing metal.

V. APPLICATIONS OF METAL POWDERS—Continued

2. Bearings and Bearing Materials—Continued

Patentee	U. S. Patent No.	Subject
Jones	981, 767	Bearing metal of large percentage of chippings and turnings of Babbitt metal.
Gilson	1, 071, 044	Making bearing compositions by reducing and compressing mixture of graphite and metallic compound.
Gilson	1, 177, 407	Producing bearing material comprising mixing, reducing and compressing copper, tin and lead alloy with graphite.
Simpson	1, 258, 953	Wire mesh or cloth is disintegrated by series of severing blades to form bearing metal.
Dower	1, 390, 197	Producing self-lubricating bearing including subjecting to heat and pressure intimate mixture of graphite with powdered metal.
Adams	1, 477, 797	Bearing material comprising intimate mixture of tungsten and copper.
Koehler	1, 479, 859	Producing antifriction composition by heating, to melt metal with lowest melting point, mixture of finely comminuted metals of different melting points.
Adams	1, 552, 184	Composition of sintered tungsten impregnated with copper suitable as bearing material.
Williams	1, 556, 658	Making bearing materials by packing, sealing and heating in lamp black compressed mixture of finely divided copper, tin and graphite.
Koehler	1, 599, 618	Producing metallic phosphides from metal powders and powdered phosphorus for use as bearing material.
Claus	1, 607, 389	Making bearings by heating compressed mixture of powdered metals in mold having a removable core member.
Claus	1, 624, 904	Method of and apparatus for forming bodies by pressure, particularly self-lubricating bearings from mixed powders of metals and lubricating material.
Williams, et al	1, 642, 347	Bearings made from compressed mixture of finely divided metals.
Williams, et al	1, 642, 348	Alloy produced by heating, in presence of volatile flux, compressed mixture of alloyable metals and volatile material.
Williams, et al	1, 642, 349	Mixture of alloyable metals and nonalloying material capable of decomposing, compressed and heated.
Claus	1, 648, 721	Method of and machine for forming bodies by pressure, particularly porous or self-lubricating bearings from mixtures of powdered metallic and lubricating materials.
Claus	1, 648, 722	Making bearing material by heating in closed container compressed mixture of finely divided copper, tin, zinc and graphite.
Williams	1, 661, 245	Making bearing composition by heating molded mixture of fine metallic particles.

V. APPLICATIONS OF METAL POWDERS—Continued

2. Bearings and Bearing Materials—Continued

Patentee	U. S. Patent No.	Subject
Davis	1, 679, 408	Apparatus for molding mixtures of powdered metal and graphite in the manufacture of porous bearings.
Short	1, 703, 177	Making bearings comprising pressed-on metal powders.
Falkenberg	1, 703, 577	Journal bearing alloy containing tungsten powder.
Koehler	1, 714, 564	Producing antifriction material of metal powders for use in bearings.
Lee	1, 714, 679	Bearing alloy produced by adding comminuted brass to molten Babbitt metal.
Williams	1, 738, 163	Producing porous metal bodies for bearings by heating compressed mixture of powdered metals and deoxidizer.
Weiger	1, 751, 780	Bearings which carry electric current made of sintered tungsten carbide and copper.
Seabury	1, 753, 581	Producing bearing by baking in mold mixture of metal powders and electroplating with copper or brass and immersing in lubricating oil.
Williams, et al	1, 753, 632	Machine for and method of surfacing and sizing bushings formed by heating and compressing metal powders to an exact predetermined size.
Williams	1, 761, 506	Copper-lead bearing alloy made by compressing and heating fine, solid particles of mixture.
Williams, et al	1, 766, 865	Producing alloy for bearings of metal powders.
Brincil	1, 771, 615	Making porous bearing by immersing in acid bath to dissolve powdered metal, molded mixture of finely divided resinous product, finely divided solid lubricant and finely divided metal.
Blackmore	1, 797, 752	Powdered bearing metal pressed on bearing back.
Lemming, et al	1, 806, 300	Method of and machine for forming hollow bushings, or other apertured articles from powdered materials.
Short	Reissue 21,495 of 1,819,272.	Making bearings by welding preformed porous metallic lining to a reinforcing member by holding together and heating.
Lemming, et al	1, 820, 235	Apparatus for highly compressing metal powder or other finely divided material into bushings having portions of different diameters.
Davis	1, 834, 687	To form powder for bearings molten metal is discharged under pressure against baffle.
Short	1, 834, 746	Producing bearing comprising reinforcing member secured to metallic facing formed of layers differing in porosity.
Sherwood	1, 856, 661	Oxide free copper powder for bearing parts is precipitated from acid-dissolved copper scrap, compacted in ball mill, and mixed with tin and graphite.

V. APPLICATIONS OF METAL POWDERS—Continued

2. Bearings and Bearing Materials—Continued

Patentee	U. S. Patent No.	Subject
Patch	1, 871, 912	Piston for liquid meter having bearing surface formed of porous bronze impregnated with lubricant.
Sherwood	1, 873, 223	Producing porous metal from powdered metal and stearic acid for use in bearings.
Calkins, et al	1, 896, 939	Manufacturing bearings by sintering compressed powdered metals in opening in connecting rod bearing.
Sherwood	1, 916, 338	Forming porous metal bearing comprising compressing powdered metal into a briquette and immersing in molten cyanide bath.
Six	1, 920, 022	Producing lined cylindrical bearing by bonding powdered metal to inside of cylindrical shell of stronger metal of higher melting point by heating.
Short, et al	1, 930, 287	Powdered materials for bearings are compressed in one continuous operation by means of a movable conveyor.
Sherwood	1, 937, 465	Producing bearing by sintering briquette formed from powdered metals, leaving iron in unalloyed condition.
Wilharm	1, 959, 775	Producing bearing metals by compressing two or more alloyable powdered metals and a soap.
Calkins	1, 974, 173	Formation of bearings in which finely comminuted iron particles are bonded together with lower melting point metal.
Noftzger	1, 983, 184	Making bearings employing wax with finely divided metals.
Harshaw	1, 986, 197	Producing metallic composition by electrodepositing one metal upon particles of another for use in manufacture of bronze bearings and bushings.
Short	1, 992, 548	Producing porous composition from comminuted materials useful in manufacture of bearings.
Noftzger	1, 998, 144	Making bearings comprising powdered muscovite, bearing metal, wax, and resin.
Jefferies, et al	2, 024, 767	Piston for internal combustion engine comprising compressed mixture of metallic particles, including aluminum and silicon.
Hardy	2, 033, 240	Producing lead-copper bearings by compressing plated metal powders having cores of low melting point metal and coatings of higher melting point metal.
Sherwood	2, 065, 618	Producing metal from powdered iron oxide for use in bearings.
Koehring	2, 075, 444	Making bearing material by sintering, then cooling, briquette of finely divided copper, lead, and tin.
Koehring	2, 096, 252	Making copper-lead bearing by briquetting and sintering mixture of molten lead and copper powder.
Koehring	2, 097, 671	Making bearing comprising heating briquette of zinc stearate powder and powdered metals.

V. APPLICATIONS OF METAL POWDERS—Continued

2. Bearings and Bearing Materials—Continued

Patentee	U. S. Patent No.	Subject
Kirk, et al	2, 108, 339	Producing bearings from raw rubber evenly loaded with composition of metallic lead impregnated with castor oil.
Davis, et al	2, 127, 994	Finely divided material for bearings is briquetted in mold cavity by axially moving plunger.
Kiefer	2, 129, 844	Making bearing comprising molding and sintering mixture of unalloyed finely divided oxide of copper with ammoniacal salt.
Davis	2, 132, 867	Porous metal bushing made by forcing into cylindrical outer metal sleeve, briquetted and sintered bushing material, and heating to bond it to sleeve.
Gillett, et al	2, 149, 596	Producing bushings from scrap material by maintaining under pressure in electric current comminuted particles.
Koehring, et al	2, 158, 461	Making bearings by fixing metal layer of sintered finely divided powder to high melting metal backing.
Wills	2, 177, 853	Porous bearing metal comprising compressed and sintered mass of powdered metal and dry lubricant, i. e., vermiculite.
Calkins, et al	2, 178, 529	Producing porous metal bearing material from powdered metals.
Hodson	2, 187, 348	Making bearing by applying heat and pressure to base coated with spray of initially solid material in thermoplastic state.
Fisher	2, 191, 460	Producing metallic composition of powdered copper, tin, lead, and zinc for use in bearings.
Lignian	2, 195, 749	Method of forming annular oil recesses in bushings made by briquetting and sintering mixture of metal powders.
Sandler, et al	2, 196, 875	Making bronze bearings from metal powders by sintering.
Boegehold	2, 198, 240	Bearing comprising rigid metallic sponge secured to strong metal back.
Koehring	2, 198, 253	Making bearing by sintering uncompacted metal powders laid loosely on metal backing and impregnating with molten lead.
Koehring	2, 198, 254	Similar to 2,198,253 except impregnated with molten lower melting metal or alloy.
Koehring	2, 198, 702	Producing metal bushings by sintering in mold, eliminating compacting the metals.
Jones, et al	2, 213, 523	Sintered agglomerated white cast iron powder bonded by iron-phosphorus eutectic in making bearings.
Hildabolt, et al	2, 214, 104	Producing porous metal article for use in bearings consisting of porous matrix of sintered iron powder coated with soft metal.
Schuttler	2, 219, 095	Producing piston rings, especially for light metal pistons of internal combustion engines, by sintering metal powders under pressure.

V. APPLICATIONS OF METAL POWDERS—Continued

2. Bearings and Bearing Materials—Continued

Patentee	U. S. Patent No.	Subject
Calkins, et al	2, 222, 251	Making bearings by applying compressed powdered metal to sheet metal backing by sintering and bonding together.
Sandler, et al	2, 226, 263	Making steel backed bronze bearing by sintering.
Langhammer, et al	2, 229, 330	Making bearing by compressing and sintering powdered metals.
Fetz	2, 234, 371	Making composite bearings having layer of bearing metal strongly bonded to metallic backing by compressing and heating metal powders.
Vogt, et al	2, 239, 800	Making bearings by introducing metal salt into formed body of finely divided metal and reducing metal salt to metal.
Darby	2, 246, 462	Producing bearing alloy with copper base and lead particles contained therein.
Hensel	2, 250, 099	Producing antifriction composition by sintering and impregnating metal powders.
Hall	2, 252, 714	In preparing copper powder for bearings, reducing gas is passed over copper oxides on movable belt.
Dawihl, et al	2, 253, 969	Bearing counterparts for machine tools sintered from carbides and lower melting point metal.
Wellman	2, 259, 094	Making bodies of compacted powdered material applicable to production of bearings.
Darby, et al	2, 260, 247	Making bearings with steel backs and copper-base alloy linings by sintering.
Woods	2, 262, 983	Applying hard surfacing layer to bushings by heating to fusing point comminuted material placed in position on bushing, and distributing molten metal uniformly by centrifugal force.
Koehring	2, 289, 658	Producing bearing by sintering loose metal powders on metal backing.
Morris, et al	2, 293, 400	Bearing, made by dropping pressed metal powder article into air-free bath of lubricating oil, having interstices substantially free from air.
Hensel, et al	2, 294, 404	Bearing comprising pressing and sintering lead powder coated with silver powder.
Tormyn	2, 299, 192	Bushings and bearings comprising compressing and sintering copper powder to bearing or bushing surface.
Koehring	2, 300, 048	Porous bearing material comprising gravity deposition of metal particles on supporting surface.
Shutt	2, 301, 756	Bearing comprising compacting and sintering mixture of powdered selenium with ferrous-base powdered metals.
Bagley, et al	2, 302, 660	Making bearings by coating inside of bearing shell with finely divided bearing metal and heating.
Bilde	2, 307, 874	Sleeve bearing which comprises molding outer bearing ring element of nonmetallic material around inner ring of metal powders.

V. APPLICATIONS OF METAL POWDERS—Continued

2. Bearings and Bearing Materials—Continued

Patentee	U. S. Patent No.	Subject
Murray	2, 325, 071	Bearing comprising finely divided lead-indium particles bonded to supporting member.
Teeple	2, 326, 000	Molded self-lubricating bearing incorporating powdered antimony, lead and/or copper, and/or bronze with graphite and asbestos.
Lignian	2, 332, 733	Bearing which comprises impregnating porous metal bearing blank, formed by compressing porous metal powders, with suitable bearing material.
Calkins	2, 337, 588	Piston packing ring of a sheet-like porous bearing metal layer of powdered, copper, tin, and graphite.
Kendall	2, 349, 281	Pulley bearing having backing member made of zinc, magnesium or aluminum.
Kendall	2, 352, 206	Controlled temperature bearing in which backing material may be made of zinc, magnesium or aluminum for which powder metallurgy methods are particularly adapted.
deGraaf	2, 361, 897	Ball or roller bearings for high vacuum vessels having coating formed of lead powder, preventing cutting, friction and the like.
Cate	2, 362, 353	Prodcuing bearing ring from dissimilar metal powders.
Hensel	2, 364, 713	Bearing formed of composition of powdered iron, nickel or cobalt compacts impregnated with mercury for use against steel or other surfaces which do not amalgamate.
Hill	2, 365, 552	Self-alining bearings having bearing members molded from powdered metal, sintered and repressed to size.
Koehring	2, 365, 562	Lining bore of porous metal bearing with soft metal powder and impregnating with oil.
Kendall	2, 368, 549	Antifriction bearing utilizing metal powders in backing member to conduct heat away from bearing.
Hensel, et al	2, 372, 202	Bearings made by pressing metal powders using suitable dies, sintering and applying age-hardening heat treatment.
Hensel, et al	2, 372, 203	Manufacture of bearings from copper powder containing nickel or cobalt with silicon and phosphorus.
Hardy	2, 374, 747	Annular linings for tubular bearings which comprises compacting layer of metal powders on inside wall.
Podell	2, 376, 722	Mixing attachment bearing utilizing sintered bronze soaked in oil as orificed antifriction blocks.
Hensel, et al	2, 377, 882	Bearing produced from relatively coarse silver powder.
Skehan, et al	2, 378, 588	Ball bearings utilizing silver particles as coating on working surfaces.
Hensel	2, 379, 232	Metallic composition particularly applicable for bearings produced from powdered copper and bismuth.

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V. APPLICATIONS OF METAL POWDERS—Continued

2. Bearings and Bearing Materials—Continued

Patentee	U. S. Patent No.	Subject
Hensel	2, 379, 434	Bearing formed of metal composition of copper and thallium powders.
Hensel	2, 379, 435	Bearing formed of metal composition of copper, lead and thallium powders.
Knox	2, 389, 438	Track shoe uses a metal bushing made of powdered bronze mixed with a ferrous material.
Stokes, Jr., et al	2, 389, 561	Mold for forming bushing bearings of powdered metal.
Guinee	2, 392, 917	Use of powdered copper in the fabrication of copper coated bearings.
Tarbel, et al	2, 393, 203	Use of powdered metal to form a porous, lubricant-impregnated bearing.
Hensel	2, 393, 905	A bearing alloy of gold and thallium, the latter in the form of eutectic particles.
Hensel, et al	2, 393, 906	A bearing made from a sintered copper base metal composition.
Shafer	2, 397, 164	Powdered iron is used in a self-alining bearing assembly.
Shriver, Jr	2, 397, 626	Powdered iron, lead, or graphite is used making bushings.
Elfstrom	2, 398, 364	A method of forming and shaping a sintered hollow cylindric bushing to conform to the shape of a shaft on which the bushing is carried.
Rozner	2, 403, 460	Compressed powdered metal bushings and a porous powdered metal floating seal having lubrication characteristics is used in connection with ball bearings.
Lowey	2, 404, 808	A bearing having sintered powdered metal facings integrally bonded to a reinforcing member of solid steel or copper.
Whitney	2, 411, 073	Iron powder of special characteristics is used in a method of making iron or iron alloy for bearings; the powder is made by electro-deposition.

3. Chemical Processes Employing Metal Powders or Employing Catalysts Which Comprise Metal Powders

Frink	43, 983	Finely pulverized or precipitated metallic copper is used in amalgamating silver ores with little loss of mercury.
Phillips	114, 848	To prevent loss of mercury during amalgamation with gold, zinc chips and strips of copper are added.
Vigneron	547, 824	To make mercury more effective in amalgamation with precious metals, powdered aluminum is acted on by copper sulphate and introduced into mercury.
Rice	794, 552	Finely divided copper or silver is added to mercury containing gold amalgam to unite with the gold.

V. APPLICATIONS OF METAL POWDERS—Continued

3. *Chemical Processes Employing Metal Powders or Employing Catalysts Which Comprise Metal Powders*—Continued

Patentee	U. S. Patent No.	Subject
Langer	815, 717	Nickel carbonyl formed by passing carbon monoxide over heated, finely divided nickel.
Rice	875, 381	Finely divided iron used to combine with sulphur and reduce zinc content in treating sulfid ores to remove zinc.
Gepp	1, 395, 811	In electrolytic process for producing zinc to make lithopone, zinc dust is used to precipitate cobalt.
Raney	1, 563, 587	Preparing catalytic nickel by fusing together nickel and silicon, pulverizing mass and dissolving silicon with solvent.
Snelling	1, 617, 353	Powdered tellurium, prepared by precipitation or grinding, is used as a precipitant for gold and is separated therefrom by volatilization of tellurium.
Raney	1, 628, 190	Metallic nickel in catalytic state is produced by alloying it with aluminum and dissolving aluminum with solvent.
Gaus, et al	1, 812, 399	Iron carbonyl produced by whirling powdered metal mixed with a liquid such as paraffin oil, inert against the metal but capable of dissolving carbon monoxide, in a chamber with gaseous carbon monoxide.
Mittasch, et al	1, 816, 122	Improvement on the production of iron carbonyl from action of carbon monoxide on finely divided iron.
Murray	1, 839, 800	In recovering indium and zinc from ore by electrolysis, zinc dust is used to precipitate metals such as gold, silver, copper, and indium.
Brandt	1, 868, 044	Production of iron carbonyl wherein metallic iron is mixed with finely divided copper to increase yield.
Kramer	1, 901, 656	Stable suspensions of materials capable of forming metal carbonyls, in which the metal in suspension may be nickel powder.
Raney	1, 915, 473	Preparing catalytic material by treating with hydrogen gas powdered alloy of catalytic material, such as nickel, and aluminum or silicon.
Hardy	1, 922, 037	Forming agglomerated mass of alkali metal with another metal for use as deoxidizers using metal powders.
Schlecht, et al	1, 941, 111	Metal carbonyls are produced by passing carbon monoxide upward in a pressure vessel filled with a suspension of iron in iron carbonyl.
Schlecht, et al	1, 944, 849	Nickel and other metal carbonyls are produced, granular and powdered reaction material being used together.

V. APPLICATIONS OF METAL POWDERS—Continued

3. Chemical Processes Employing Metal Powders or Employing Catalysts Which Comprise Metal Powders—Continued

Patentee	U. S. Patent No.	Subject
Bennett	1, 975, 076	In production of metallic carbonyls, carbonyl-forming metal is converted into oxide-free metal powder by amalgamating metal with mercury and vacuum, distilling the mercury from amalgam.
Harrison, et al	2, 070, 079	Production of nickel catalyst using briquetted powdered nickel matte to which powder, finely divided copper, or iron may be added.
Holzwarth	2, 214, 765	For precipitating silver from photo processing baths a metal higher in electromotive series than silver is finely divided and dispersed in an organic colloid such as gelatin.
Groombridge, et al	2, 234, 245	Producing composition for use as catalyst by reducing sintered mixture of finely divided copper oxide and iron.
Danciger	2, 242, 115	Metal carbonyls manufactured by charging a selected metal in finely divided condition into the contact tower in form of a spray or cloud.
Mowlds	2, 245, 217	For precipitating unwanted metals from zinc sulfate solution, 50 pounds zinc dust treated with a wetting agent equal 200 pounds untreated zinc dust in activity.
Michael	2, 254, 806	Producing catalyst by pressing and treating with hydrogen sintered iron powder and alkali metal compound.
Hellriegel	2, 267, 099	Production of molybdenum carbonyl using molybdenum powder as an ingredient.
Klemme, et al	2, 292, 570	Preparing catalyst for hydrocarbon conversion by treating powdered iron or iron oxide with steam to which hydrogen has been added, and reducing oxides.
Quisling	2, 293, 359	Preparing acetyl salicylic acid which will not cake using antielectrostatic and/or interspersing agents, such as aluminum powder.
Aehnelt	2, 305, 657	Decolorizing and purifying liquids, such as saccharine juices, by contacting with aluminum powder and an adsorbent.
Overhoff	2, 307, 421	Porous silver catalyst produced from silver powder and oxygen-containing compound of silver.
Dean	2, 317, 153	In production of electrolytic manganese, a solution containing salt of a hydrxoy amine and impure manganese salt is agitated with powdered manganese to remove copper, iron, etc.
Connolly	2, 324, 067	Catalyst for desulfurization of hydrocarbons employing aluminum powder or flakes.
Thomas	2, 325, 287	Catalytic masses suitable for hydrocarbon conversion using metal powders and other ingredients formed into pellets used as packing material.

V. APPLICATIONS OF METAL POWDERS—Continued

3. Chemical Processes Employing Metal Powders or Employing Catalysts Which Comprise Metal Powders—Continued

Patentee	U. S. Patent No.	Subject
Zeltner	2, 326, 275	Hydrogenation catalyst prepared by treating powdered alloy, consisting essentially of nickel, with weak organic acid.
Berger, et al	2, 326, 324	Maintenance of dielectric stability of insulating oils such as are used in high voltage power cables, by adding hydrogenation catalyst, such as nickel, platinum, cobalt or copper to oil.
Ipatieff, et al	2, 327, 189	Dehydrogenation of hydrocarbons using metal powders, such as copper, zinc and alumina, which may be formed into pellets.
Hahn	2, 328, 140	Hydrogenation catalyst comprising mixture of powdered nickel and magnesium, and aniline.
Pitzer	2, 328, 846	Catalyst, useful in hydrocarbon conversion, made from metallic aluminum amalgamated in mercury and dissolved in dilute acid.
Nord	2, 329, 933	Platinim metal catalysts comprising colloidal solution of palladium, soluble vanadium compound, and protective colloid.
Nord	2, 329, 934	Platinum metal catalyst comprising colloidal solution of metal of platinum group and homogeneous nonresinous synthetic organic polymer.
Bennett, et al	2, 330, 664	Oxidation catalyst comprising mixture of platinum metals with metal oxide.
Archibald, et al	2, 331, 292	Producing catalyst which comprises heating an alumina and impregnating with a dehydrogenating metal or metal compound.
Kirkpatrick	2, 331, 915	Hydrogenation catalyst produced by coating finely divided particles of inert substantially nonporous material such as fused alumina with mixture of noble metal compound and alkali metal nitrate.
Davies	2, 335, 585	Manufacture of antimonyl derivatives of saturated aliphatic acids utilizing antimony powder.
Houghton	2, 339, 929	Preparing catalytic material utilizing metal of the group nickel, copper and cobalt.
Sabia	2, 340, 021	Producing nickel catalyst by passing nitric acid vapors over nickel.
Seabury, et al	2, 347, 131	Manufacture of litharge ingredient for storage batteries utilizing some powdered lead.
Seabury, et al	2, 347, 132	Converting Barton litharge to red litharge utilizing some powdered lead.
Reygagne	2, 348, 849	Refining carbon and silicon in cast-iron by pouring molten cast iron into bottom of ladle containing carbon iron scrap and hammer-scale and stirring.
Edwards, et al	2, 353, 657	Treating castings to reduce shrinkage cavities with gaseous oxygen and particles of combustible metal.

V. APPLICATIONS OF METAL POWDERS—Continued

3. Chemical Processes Employing Metal Powders or Employing Catalysts Which Comprise Metal Powders—Continued

Patentee	U. S. Patent No.	Subject
Gwynn	2, 364, 970	Producing catalysts by treating mass of metal, such as nickel, silver, etc., with acid of phosphorus and decomposing salt formed to convert it to catalytically active form of metal.
Marek	2, 365, 202	Preparing ferric hydrate adapted for removal of hydrogen sulfide from liquid or gaseous media by atmospheric corrosion of moist finely divided metallic iron.
Brown	2, 367, 263	Transferring molybdenum from spent catalyst to fresh solid catalytic material by vaporization and condensation on catalyst carrier.
Lutz	2, 367, 296	Making leaded phenol resins comprising finely divided carbon black added to resinous material containing lead particles.
Adeline	2, 370, 610	Carbon-free ferro-manganese produced by mixing manganese ores with scrap aluminum and igniting.
Rochow	2, 380, 995	Powdered silicon and copper, pressed into pellets, are heated with methyl bromide to form methyl tribromosilane and dimethyl dibromosilane.
Rochow, et al	2, 380, 996	Methyl chloride is used to react with powdered metal catalysts.
Patnode	2, 380, 997	Preparation of powdered metal catalysts for uses as above.
Sprung, et al	2, 380, 998 2, 380, 999	Catalyst of 2,380,995 is contacted with hydrogen or nitrogen in adition to the hydrocarbon halide.
Streicher	2, 384, 501	Catalyst is prepared by alloying platinum with base metal, chemically removing base metal from alloy leaving finely divided platinum.
Breuer	2, 391, 004	Iron powder, produced by treating an iron-aluminum alloy with an alkaline solution, is used as catalyst in refining butadiene.
Wallingford, et al	2, 391, 530	Magnesium turnings are catalyzed with chloroform in the metallation of beta keto esters.
Aitchison	2, 392, 353	Pulverulent iron is used in a flux forming fuel mixture. Used to produce holes in concrete, rock, or other meltable minerals.
Schmidt	2, 392, 952	In producing resin alcohol, catalysts are activated by depositing them on an inert metal powder.
Harder, et al	2, 393, 160	Suspensions of finely divided iron-carbon alloy in water containing a corrosion-inhibitor used in a heavy media separation process.
Johnson	2, 393, 636	Powdered metal is employed as a heat-carrier material in the conversion of hydrocarbons.

V. APPLICATIONS OF METAL POWDERS—Continued

3. *Chemical Processes Employing Metal Powders or Employing Catalysts Which Comprise Metal Powders*—Continued

Patentee	U. S. Patent No.	Subject
Johnson	2, 393, 909	A finely divided Ni catalyst is used to protect against damage due to high temperature by solid coolants.
Gerhold	2, 394, 164	Metal powders are used in fused salt mixtures to prevent corrosion of containers.
Foster	2, 395, 263	Finely divided aluminum or iron may be used to prepare metal halide catalysts.
Patterson	2, 395, 291	Aluminum powder may be used in preparing a porous aluminum chloride catalyst.
Weber, et al	2, 395, 307	Heavy metal pellets are used in the preparation of organic salts.
Griffith, et al	2, 396, 569	Powdered zinc coated with copper and tin is used to purify zinc electrolytes used in the recovery of zinc from zinc ores.
Hemminger	2, 397, 485	Iron particles are used in a preheater or other vessel separate from reactor for a hydrocarbon conversion process to avoid corrosion.
Taylor	2, 397, 767	Powdered copper is used in making copper soap.
Schutte	2, 398, 725	A method of magnetic separation by introducing a comminuted or finely divided magnetic material such as powdered iron, used in separating nonmagnetic mixtures, one component of which combines with or adheres to the magnetic particles.
Cadwell	2, 398, 768	Powdered metals are used in exothermic reaction charge to produce molten metal for welding operations.
Somerville	2, 400, 029	Copper powder is used as an additive in compounding synthetic rubber.
Somerville	2, 400, 057	Metallic copper may be used as a vulcanization accelerator in producing a synthetic rubber.
Benning, et al	2, 401, 897	Large amounts of zinc dust are used as a catalyst in the preparation of tetrafluoroethylene.
Griffith, et al	2, 405, 302	A purification agent for electrolytes comprising zinc dust coated with indium and copper.
Bahlke, et al	2, 405, 395	Powdered tungsten may be used as a heat transfer material in a process for making acetylene.
Salminen, et al	2, 407, 207	Raney nickel is used as a reducing agent in a process of producing *P*-phenylene diamines.
Birch, et al	2, 407, 214	Raney nickel may be used as a catalyst in the production of an aviation or motor fuel.
Boettger, Jr., et al	2, 408, 036	Powdered copper, nickel, or brass are used to make a matrix for use in electrolytic pinacol production.
Dickey, et al	2, 412, 209	Raney nickel is used as a catalyst in the preparation of aliphatic amines.
O'Loughlin	2, 413, 153	A pelleted block nickel catalyst is used in the hydrogenation of nitrohydroxy compounds.

V. APPLICATIONS OF METAL POWDERS—Continued

4. Coating and Molding Methods and Compositions, Including Paper Metallizing, Electrical Coatings, Etc.

Patentee	U. S. Patent No.	Subject
Sorel	924	For coating copper, iron, etc., with zinc the metal is surrounded with pulverized zinc and charcoal and heat treated.
Goodyear	4, 005	India rubber fabric is filled with metal filings, etc., to render it firm.
Erhard	44, 944	Silk or other fiber flock is applied to varnished paper with bronze, German metal and steel powders.
Brown	52, 673	For coating wood, paper, glass, etc., alkaline silicate is used as an undercoat over which metal powders are applied dry or in carrier.
Noggerath	72, 601	Metallizing fabrics with metal powders to give appearance of open-work metal.
Batchelder	89, 274	In surfacing fabrics with bronze or metal powders, powder is applied over size and coated fabric calendered.
Muller	122, 636	To stamp lead pencil bronze powder applied to varnished surface, and impressed with heated die.
Wood	148, 795	Coating for rolled iron or steel, of pulverized metals, borax, flake white and lime, fused and repowdered.
Dreyfuss et al	190, 477	Finishing cardboard for perforating by calendering cardboard coated with mixture of finely divided metallic zinc, glue, starch and wax.
Peterson, et al	209, 625	Sized paper is bronzed in a chamber where bronze powder is kept circulating.
Boettger	211, 961	Bronze powder is applied to wood, porcelain, glass, etc., over a coat of soluble glass.
Hofer	215, 222	Molding is gilded by coating with whiting, gold-size, starch size and bronze dust.
Wohlfarth, et al	218, 102	Applying metal powders to floor and wall coverings by mixing with soluble glass and imprinting upon surfaces before hardening.
Cunningham	226, 497	To coat hard rubber, ivory, glass, etc.. metal powder, etc., is applied over varnish coat and given over-coats of varnish and collodion.
Laurense, et al	229, 427	Applying gilding and bronzing powders to moldings by brushing on in liquid form.
Howes	242, 649	To ornament metal buttons, solder filings are sprinkled over layer of gold or silver filings, and solder melted to fasten gold.
Tuttle	245, 328	Sheet packing of rubber, paper, etc., is coated with adhesive, a layer of brass, iron, etc., filings and calendered.
Juel	252, 383	Producing metallic textile fabric comprising textile base and burnished coating of metal powders and caoutchouc.
Paul	258, 108	Decorative glass is first coated with adhesive, then with metal powders, chips or filings.

V. APPLICATIONS OF METAL POWDERS—Continued

4. Coating and Molding Methods and Compositions, Including Paper Metallizing, Electrical Coatings, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Hartnagel	274, 594	Window shades are sized and coated with metal powders.
White	278, 206	Leather, or other fabric is first coated with gutta-percha or rubber adhesive, then with bronze powder.
Brown	304, 069	Process of metallizing wood by applying zinc in plastic state.
Gehring	310, 042	Process of overlaying or decorating glass, porcelain and metal articles with aluminum or aluminum-bronze.
Martin	321, 234	Producing clouded, colored or bronze surface on paper by applying color in a wash and absorbing surplus color.
Trout	335, 725	Manufacturing wall-paper employing silicate of soda and bronze powder for ornamentation.
Edge	360, 283	To decorate jewelry, copper wire is arranged on gold backing in a pattern, gold or silver filings sweated together around copper, and copper eaten away.
Laval	368, 839	Glass is silvered by process which applies to final coat of silver-lining bronze powder.
Storey	369, 414	To design-coat oilcloth, pattern is printed in cement, metal powder dusted over it.
Pennington	380, 515	Incorporating powdered metallic zinc in wrapping paper for metallic articles to prevent rusting or tarnishing.
Wheeler	437, 468	Scissors handles, etc., are finished by coating with gold size, etc., applying metal powder and baking.
Buckman	451, 261	Before tinning metal sheets, sheets are united by coating edges to be joined with paste containing metal powder.
Kennedy	470, 492	Coating for iron comprising tobacco juice mixed with pulverized metal.
Ash, et al	509, 280	Paper, wood, etc., are metal plated by first coating with varnish carrying powdered metal, immersing in silver nitrate from which silver precipitates in a film.
Gross	546, 446	Bright steel tube bicycle frames are coated with size, baked to give size tack, dusted with aluminum bronze powder, baked varnished and baked.
Tooker	603, 296	In gilding china, gold precipitated by mercury is used with other ingredients.
Coleman	629, 426	Coating for metal ship bottoms, etc., of layer of paint with comminuted soft metal, second coating of paint, and layer of comminuted copper.
Coleman	629, 427	Wood exposed to sea water is coated with powdered copper embedded in the wood.
Dickey	639, 537	Sheet iron and steel are protected by coating with mixture of powdered aluminum and lead oxide, then hammering or rolling.

V. APPLICATIONS OF METAL POWDERS—Continued

4. Coating and Molding Methods and Compositions, Including Paper Metallizing, Electrical Coatings, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Coleman	682, 173, 682, 174	Protective coating for chemical holding tanks, etc., is applied by first coating with paint, then with comminuted metal or alloy, applying finely divided solder, and heat treating.
Coleman	682, 914	Coating for metal ship bottoms of layer of paint, layer of finely divided vegetable insulation with powdered copper hammered into coatings.
Ahrle	694, 227	Photographic plates are coated with varnish base, softener, and bronze powder.
Cowper-Coles	701, 298	Powdered, partially oxidized zinc is applied to metal to be coated, and the whole heat treated.
Coleman	717, 080	Corrosion and high temperature resistant coating for metal, of outer layer of powdered metal or alloy, and intermediate layer of comminuted soft metal.
Coleman	741, 227, 741, 228	Coating for ship bottoms of varnish and paint over which 80-mesh copper is blown and hammered in.
Coleman	741, 769	Coating for ship bottoms of layer of paint, layer of ground and oiled wood and layer of copper powder.
Reuhl	800, 017	Process of finishing moldings by applying mixture of powdered bronze fluxed with suitable liquid carrying, adhering and protecting mediums.
Coleman	819, 125	Coating for ship bottoms; coating is of paint and powdered copper as in preceding patents, but applied in number of layers.
Cowper-Coles	829, 386	Metal is coated with antimony by applying antimony in powdered form and heat treating.
Rauhoff	830, 003	Waterproofing cement blocks by applying powdered metallic iron held in suspension in water, particles oxidizing and expanding to fill pores of block.
Ludewig	846, 585	Bronze printings having silk-like appearance; bronze powder is mixed with soluble powdered carrier applied over solvent which renders carrier transparent.
Connell	886, 349	Railway rail is given track coating of pulverized nickel, manganese, etc., mechanically worked into surface.
Norton	896, 751	Iron or steel sheets are coated along seams with varnish and aluminum bronze powder.
Paton	904, 444	Iron or steel sheets are varnished, aluminum powder brushed on, and burnished.
Gauntlett	910, 369	To coat metal articles, finely divided metal is mixed with equal or greater quantity of powdered silica or carbon, packed around metal article and the whole heated.

V. APPLICATIONS OF METAL POWDERS—Continued

4. *Coating and Molding Methods and Compositions, Including Paper Metallizing, Electrical Coatings, Etc.*—Continued

Patentee	U. S. Patent No.	Subject
Scott	931, 503	Coating articles by dipping in bronze liquid bath containing bronze powder and blowing air through for uniform coating.
Sang	948, 663	Iron or steel articles are coated by immersing in copper or zinc dust, and passing electric current there through.
Rossi	986, 504	To coat steel with titanium, powdered alloy of titanium and iron is packed against steel and heated.
Price	995, 289	Cloth for theater curtain is given metallized coating by suitable under-coats and surfacing of aluminum and ultramarine blue powder.
Burgess	1,014, 749, 1, 014, 750.	To coat iron or steel article, zinc-iron alloy in granular form is applied and the whole heated.
Avis, Jr	1, 029, 522	For coating aluminum with tin, composition of stannous chlorid, zinc chlorid and powdered tin is used.
Benrath, et al	1, 031, 616	Producing threads having metallic luster by passing through mixture of metallic bronzes or powders with solutions of cellulose acetates.
Wickel	1, 047, 867	Metal foil paper for hot-embossing is made by coating tissue with melted carnauba wax, and bronzing.
Kaufman	1, 060, 098	Manufacture of metallic paper by applying on waterproof or grease-proof paper, with engraved roller, paste of metal powder, and adhesive liquid such as shellac.
Marino	1, 077, 357	Ceramic surfaces are metallized by coating with iron or other metal fluoride, and precipitating iron by another metal.
Jones	1, 082, 123	Moving picture screen; oilcloth base is softened, coated and metal powder rubbed into coating.
Gilson	1, 091, 057	To protect metals against corrosion they are heated in nonoxidizing atmosphere with powdered mixture of pure aluminum, aluminum oxide and a chloride.
Schoop	1, 128, 059	Producing coherent metallic coatings by projecting finely divided unmolten metal onto surface by a reducing gas.
Pannill	1, 149, 940	Moving picture screen; canvas is coated with linseed oil and Japan drier, aluminum or gold powder rubbed in.
VanAller	1, 155, 974	To protect iron and copper from oxidation they are heated with aluminum powder to alloy aluminum with surface iron or copper.
Atuesta	1, 157, 283	Before being given a black finish ferrous articles are sherardized using zinc dust of 80 to 92 percent metallic zinc.
Maddy, et al	1, 161, 944	To protectively coat metal frames of buildings in situ, powdered lead, etc., is mixed with mercury salt and fused on frames.

V. APPLICATIONS OF METAL POWDERS—Continued

4. Coating and Molding Methods and Compositions, Including Paper Metallizing, Electrical Coatings, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Collins, et al	1, 169, 529	In coating metals with zinc, or "sherardizing," zinc dust of 80 to 92 percent purity is found most desirable.
Kurth	1, 176, 571	Copper plates or tubes liable to attack by sea water are protected by firmly pressing iron filings into the surface.
Stolle, et al	1, 178, 551	For hardening ferrous articles, article is locally heated and powdered metal, alloy, or carbon sprayed on surface, thus eliminating packing article in dust and heating.
Koch	1, 223, 399	Bronzed paper; first a varnish-proof coating is applied to paper, then tacky varnish, then powdered metal.
Fahrenwald	1, 236, 383	Tungsten or molybdenum is coated with gold by applying powdered gold or gold salt in cleansing flux and heating.
Bernheim	1, 244, 414	Iron articles are coated with zinc by heating in 50 percent zinc powder and 50 percent aluminum powder.
Edison	1, 266, 778	Projection screen; oil cloth is heated until tacky and powdered aluminum or mixtures containing it rubbed on.
Honeywell	1, 281, 374	Varnishing balloons; cloth is varnished and mixture of aluminum powder and French chalk rubbed in.
Krummling	1, 282, 014	Mouthpieces for cigarettes made by squirting coating of liquid mixture of metal powders at intervals on web of cigarette paper.
Ward	1, 294, 001	Dry galvanizing; finely powdered zinc is mixed with flake graphite, which permits a higher percentage of zinc to be employed.
Wise	1, 312, 716	Sheets to be dry galvanized are curved and stacked together with metal powder between them, and spaced apart by asbestos strips, etc. This prevents deforming of sheets.
Willmott	1, 320, 950	For stamping book covers, die face is greased, metal powder applied to die, and die impressed on thermoplastic coating on book.
Ruder	1, 346, 062	Metals are rendered inoxidizable at high temperatures by surface alloying in contact with aluminum powder.
Kelley	1, 365, 499	Iron or steel is heated with powdered metallic chromium under nonoxidizing conditions, to form surface alloy.
Schweinert	1, 366, 963	Bores in tire valves are rust-proofed by revolving casings and zinc dust in a barrel, with application of heat.
Meade, et al	1, 376, 961	Coloring and finishing surface of grain-leather by coating with metal precipitated from soluble compound.

V. APPLICATIONS OF METAL POWDERS—Continued

4. *Coating and Molding Methods and Compositions, Including Paper Metallizing, Electrical Coatings, Etc.*—Continued

Patentee	U. S. Patent No.	Subject
Sorensen	1, 380, 847	Providing ferrous metal articles with corrosion resisting coating consisting of mixture of caustic alkali, water, metal powder and metal oxygen compound.
Meade, et al	1, 385, 184	Finishing leather with coating including selenium powder.
Grinlinton	1, 431, 395	For tinning copper, brass, etc., powdered tin is mixed with a carrier, and powdered stearic acid is used for a flux.
Wickel	1, 465, 107	Manufacturing metal-coated paper whose surface consists of metal powder and binder of bituminous substance.
Koperski	1, 481, 610	Finishing wood by applying mixture of metal dust and varnish to wood having filler coat.
Cavanaugh	1, 510, 654	Ornamenting and soil-proofing fabrics by applying liquid carrier or binding medium containing metal powders to impregnated fabric.
Stewart, et al	1, 513, 349	Zinc dust of 65 to 75 percent metallic zinc, and 3 to 7 percent iron is applied to metal articles, in revolving barrel with application of heat.
Tesse	1, 521, 055	Coating areoplane cloth with flexible coating containing metal powder imprisoned between two layers of rigid cellulose ester.
Robinson	1, 539, 512	Roofing material; powdered copper in nitrated cellulose is sprayed on asphalt base roofing felt.
Wysocki	1, 541, 550	Capping a bottle by applying a solution containing aluminum powder.
Martin	1, 557, 530	Producing metallic screens for luminous projections by applying coating of gold and aluminum powders.
Pfeil	1, 565, 495	A protective aluminum coating may be applied to iron, etc., by protecting aluminum powder therefor from oxide coating. A powder is formed an oil is added.
Pfeil	1, 565, 496	Tin-coated ferrous metal is heated until tin melts; finely divided aluminum is applied thereto until tin will absorb no more.
Morgan, et al	1, 567, 163	Preventing discoloration of canned foods by mixing insoluble metallic compound in powdered form in lacquer coating for containers.
Buzza	1, 572, 180	Parchment greeting card; parchment is heated, printed, sized, dusted with bronze powder.
Fleming	1, 574, 615	Roofing material; fibrous material coated with bituminous material is surfaced with bronze powder.
Whyte	1, 600, 156	Separating paint for relief designs on non-absorbent wall surfaces, over which may be applied gold or bronze powder.
Grimm	1, 614, 611	Coating for paper made by mixing metal powders with shellac and waxy substance.

V. APPLICATIONS OF METAL POWDERS—Continued

4. Coating and Molding Methods and Compositions, Including Paper Metallizing, Electrical Coatings, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Grimm	1, 617, 946	Producing tinted, burnished, metal-coated paper employing metal powders, a hard resin, a soft gum, and a dry wax.
Richards	1, 647, 055	Laminated powdered metallic lead-and-dipped-rubber glove for X-ray operators.
Powell	1, 662, 865	Decorative coating for metal articles comprising mixture of lacquer and gold-bronze.
Brandus	1, 705, 057	Telephone cable armor comprising molding mixture of iron powder and finely divided lead alloy.
Lay	1, 711, 603	Aluminum alloy powders of great uniformity, for coating metal, are obtained by adding aluminum to powdered clay base in small amounts, igniting in inert atmosphere and repeating until desired percentage of aluminum is obtained in powder.
Kelley	1, 718, 563	Protecting metal against oxidation at high temperatures consists in heating in hydrogen atmosphere, with mixture of powdered chromium and silicon.
Cole	1, 729, 065	Powder for coating iron or steel articles by revolving in cylinder contains emery, copper-zinc precipitate, aluminum powder, and other ingredients.
Dely	1, 735, 000	To facilitate welding together of copper particles used to coat steel or iron plates, copper particles are mixed, for application, with sodium fluoride.
Schoop	1, 758, 473	Producing metal coatings by applying a reducing melting flame to mixture of metal powders and liquid combustible in closed chamber.
Watkins	1, 766, 417	Forming a film of a plating metal on the metal to be plated by coating with plating suspension in finely divided condition and heating.
Neuber, et al	1, 790, 615	Metalizing fibrous materials comprising precipitating metal on material by reduction from metallic salt solution.
Johnson	1, 804, 991	Coating metal surfaces with bath containing metal powders and liquid vehicle, including linseed oil, certain gums, and certain metal salts.
Watkins	1, 810, 409	Plating alloy of two metals is applied on ferrous base by first plating with zinc, then applying copper particles in spreading medium, and heating.
Watkins	1, 816, 922	Concrete has a permanent coating of rubber, bonded thereto by reaction product of iron and copper sulphate. Powdered iron is applied in paste form.

V. APPLICATIONS OF METAL POWDERS—Continued

4. *Coating and Molding Methods and Compositions, Including Paper Metallizing, Electrical Coatings, Etc.*—Continued

Patentee	U. S. Patent No.	Subject
Taylor	1, 825, 252	Rubber hot water bottle, shower curtains, etc., are decorated with metal powder dusted over adhesive. Powder may be coated with organic dye.
George	1, 832, 199	Producing "frosted effect" by impregnating woven fabric with liquid composition including metal powders and China wood oil.
Crawford	1, 833, 317	Projection screens; fabric is prime-coated, and aluminum powder and mica dusted on and varnished over.
Marshall	1, 853, 369	Chromium alloy coating for carbon steel articles may be obtained by heating in contact with two-mesh chromium and bleaching powder. Bleach dissociated giving off halogen which displaces any air in treating chamber, eliminating oxidation.
George	1, 877, 394	Treating fabric comprising passing it through liquid bath containing a metallic pigment, such as aluminum powder, and then passing through rolls.
Griffiths	1, 885, 344	Fountain pen sac is coated with aluminum powder.
Turner	1, 893, 830	Producing wire fabric by coating with aluminum powder in suitable vehicle, such as spar varnish.
Howe	1, 899, 569	Iron is given smooth chromium coating at low temperature (900°C) by using mixture of granular zinc and chromium powder, zinc vapor preventing oxidation.
McKay	1, 940, 315	Applying colored lustre finished to rubber articles by coating with mixture of aluminum powder and colored rubber ink.
Menshon	1, 942, 763	Producing marking designs on fibrous materials by applying suspension of metal powders in dilute silicate solution.
Swenson	1, 968, 269	Metallic coating composition for decorating candles comprising mixing metal powders with solution of solvent and ester gum.
Frisch	1, 979, 031	Dusting composition for rubber dolls which may contain powdered magnesium and aluminum.
Jones	1, 998, 506	Mounting for leaf and powdered metals consisting of adhesive coated aluminum foil.
Brumbaugh	2, 004, 567	Enamel on metal, ceramics, etc., is spray-coated with metal powder, and heated to fuse enamel and metal.
Bradley	2, 009, 573	Wire is dry galvanized with zinc dust by drawing wire through a heated, agitated bed of the dust.
Knapp	2, 020, 787	Improvement on 1,833,317; fabric of screen is embossed into raised and depressed areas, depressions carrying metallized coating, to increase diffusion of light.

V. APPLICATIONS OF METAL POWDERS—Continued

4. Coating and Molding Methods and Compositions, Including Paper Metallizing, Electrical Coatings, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Humphner	2, 032, 845	Adhesive tape having metallic coating of metal powder, casein, clay and wax, and pressure-sensitive coating on opposite sides of web of paper.
Taylor	2, 034, 008	Artificial threads are coated with metal powders, etc., continuously with their extrusion.
Moore	2, 041, 297	Producing metallic coated membrane by applying coating containing metal powder and a resinous, fatty or waxy substance.
Ihrig	2, 046, 629	Iron or steel is heated in contact with an organic salt of an acid of nickel, etc. Salt decomposes, nickel powder adhering to iron or steel surface.
Damitz	2, 060, 928	Cork and pulpboard closures for food or medicine containers are coated with shellac base dusted with metal powder or other pigment.
Waitman	2, 072, 229	Metal is tinned by dipping wet sponge in dry mixture of stannous chloride and a tartrate, and then in pulverized zinc and rubbing on metal surface.
Reardon, et al	2, 078, 808	Dry powdered base for metallic coating composition comprising metal powder and powdered synthetic resin material.
Hefter	2, 081, 234	Stoneware, porcelain, etc., are coated first with lacquer containing bismuth over which precious metal powder is applied.
Frost	2, 083, 441	Producing lacquer-coated sheet material with mineral coating containing metallic pigments and adhesive dispersed in water.
McBurney	2, 087, 094	High metallic luster on fabrics, etc. is obtained by applying, over specific base coat, aluminum dust, buffing, and baking.
Matthews	2, 091, 714	Protective coating for mirrors comprising depolymerized chlorinated rubber containing metallic filler of metal powders.
Enders	2, 097, 024	Iron or steel is coated by packing and heating in mixture of aluminum and silicon powders.
Allan, et al	2, 101, 887	Producing effects on textile materials with aluminum powder or other metal powder in cellulose acetate solution.
Kolb	2, 103, 538	Protective coating for reflectors comprising powdered metallic pigment and glycerol phthalate.
Lanenstein, et al	2, 105, 888	Silicon coating applied by heating in contact with powdered silicon and sodium chloride.
Ihrig	2, 109, 485	Impregnating metals with silicon by heating in contact with a siliconizing agent such as powdered silicon ferro-silicon or silicon carbide.
Hartwick	2, 111, 395	Resin film for coating barrels for alcoholic beverages comprising metal powder as the stabilizing pigment.

V. APPLICATIONS OF METAL POWDERS—Continued

4. Coating and Molding Methods and Compositions, Including Paper Metallizing, Electrical Coatings, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Clayton	2, 120, 434	Producing water-proof vehicle top cover by treating with liquid latex mixed with aluminum powder.
Marr	2, 123, 537	Powder-spraying apparatus.
Hall, et al	2, 125, 341	High luster metallic finish for coated cellulose derivative fabrics. Acetate film is superimposed over metal powder.
Vatter	2, 139, 431	To coat ceramic bodies, highly refractory powdered base metal in an organic binder is applied and sintered.
Higgins	2, 139, 824	Lustered fabric prepared by 2,087,094 is given one coat of transparent nontarnishing composition which may be colored.
Karl	2, 143, 948	Coatings that stick to paper, leather, cellophane, etc. are made by applying design with lacquer, dusting on metal powder, fluxing, and fusing molten metal over metal powder.
Smith	2, 150, 789	Producing metallic coating on cement surfaces by applying mixture of caustic alkali and metal powder.
Ariotti	2, 151, 312	Producing hammered metal finish by applying, by a splattering operation, coating composition comprising metal powder, synthetic or resinous base, and a solvent.
Cooper	2, 157, 594	To chromize ferrous metal, it is embedded in chromium powder and ferrous chloride, and heated in closed vessel.
Ihrig	2, 157, 902	Impregnating metals with silicon.
Smith	2, 161, 104	Metallic coating comprising metal powder mixed with aqueous or alcohol solution of a salt.
Humes	2, 163, 601	Adhesive-protective coating for typewriter ribbons containing aluminum powder.
Ihrig	Reissue 20,719 of 2,163,753.	Coating metals with silicon.
Waite	2, 169, 078	Imprinted cigarette paper is coated with cloud of bronze dust.
Antrim	2, 213, 644	Making transfer device for repeated manifolding use comprising metal powder mixed in inking solution.
Long	2, 236, 911	Glass is mirrored by depositing powdered metal, etc., while glass is in tempered state 400° to 200° C.
Larson	2, 254, 013	Coating for hairpins comprising metal powders suspended in natural or colored lacquer.
Davis	Reissue 22,346 of 2,275,133.	Carburizing gears employing powdered iron and iron oxide and hydrocarbon gases.
Adams	2, 279, 268	Coating for metals comprising mixing aluminum powder with zinc soap dispersed in solvent.

V. APPLICATIONS OF METAL POWDERS—Continued

4. Coating and Molding Methods and Compositions, Including Paper Metallizing, Electrical Coatings, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Ward	2, 280, 135	Conductive coating for glass containing metal powders in dispersing agent.
Rittmann	2, 282, 000	Coating paper containers for lubricating oils with lacquer containing metal powder to render waterproof and oilproof.
Wesley, et al	2, 289, 614	Nickel coating comprising nickel powder suspended in nitrocellulose lacquer or collodion.
Wick	2, 293, 420	Manufacture of lacquered shaped articles of sheet metal by means of composition which may contain aluminum bronze.
Gallagher	2, 294, 744	Coating containing aluminum powder used for wooden aging barrel for aging of whiskey.
Faust	2, 296, 840	Finishing process comprising applying flaked metal powder to greased surface.
Franks	2, 299, 813	Gasket formed of rubber, asbestos or the like, and having sealing surfaces of powdered low carbon ferrochromium.
Holton, et al	2, 301, 048	Oil-resistant coating for paper pulp containers comprising sugar syrup, comminuted inert thickener, such as graphite, mica and aluminum, and a setting agent.
Leekley	2, 302, 332	Decorative coating composition incorporating powdered metals in polyhexamethylene adipamide dispersed in liquid medium, such as furfuryl alcohol.
Davie, et al	2, 307, 027	Coating composition including metal powder, such as copper flake powder, and vehicle, such as nitrocellulose lacquer, for glass radio tubes.
MacNeil	2, 308, 704	Coating pointer and dial of indicating instruments with crushed silver to make readable against blacked-out background.
Babcock	2, 309, 377	Nonleafing aluminum paste comprising adding suitable thinner and deleafing agent to aluminum powder.
Finch	2, 310, 946	Facsimile recording paper; paper sheet, impregnated with lamp black, is coated with electrosensitive coating containing conductive metal powder.
Sorem, et al	2, 313, 596	Unemulsified asphalt composition comprising powdered zinc, lead and their oxides dispersed in asphalt to prevent corrosion.
Armentrout	2, 316, 041	Producing simulated hammered metal effect using composition, including flaked metal powder.
Benson	2, 316, 549	Coating for inside of inner tubes, to reduce static electricity, comprising powders, such as acetylene carbon black, aluminum powder, etc.
Chesler	2, 319, 585	Fabricating pencil of noncalcined type; rod is strengthened by incorporating aluminum powder in resin jacket.

V. APPLICATIONS OF METAL POWDERS—Continued

4. Coating and Molding Methods and Compositions, Including Paper Metallizing, Electrical Coatings, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Saslaw	2, 321, 523	Reclaiming a plate coated with selenium and with a counter electrode over selenium, which has broken down under voltage by pressing on selenium powder at a high temperature.
Davie, et al	2, 321, 587	Electrically conductive coatings, containing metal flakes in nitrocellulose lacquer, for glass envelope tubes or the like.
Kjellstrand	2, 322, 367	Coating for carbon paper containing aluminum powder to make paper noncurling and slip-resistant.
Peterson	2, 322, 702	Coating film of conductive material, such as powdered aluminum, used on high voltage shielded electric cable.
Hultgren, et al	2, 324, 843	Improved luminescent magnesium tungstate in a temporary vehicle of methanol and a small proportion of a cellulose material.
Ariotti, et al	2, 325, 001	Simulated hammered metal finish produced by coating including powdered aluminum bronze.
Barnhart	2, 325, 584	Lacquer employing metal powders, such as aluminum powder, used for laminating two sheets of paper together.
Porter	2, 325, 798	Paper coating in which pigments, such as aluminum, suspended in a fluid, and an adhesive, suspended in an aqueous vehicle, are used.
Crosby	2, 326, 623	Simulated hammered metal effect produced by spraying on composition including a flake-metal pigment.
Strobino	2, 328, 105	X-ray shielding glove made of pigskin impregnated with finely divided lead.
Davenport, et al	2, 328, 198	Incorporating finely divided carbon black or aluminum in paper manufacture to make highly conductive to electricity.
Harshberger	2, 332, 219	Roofing and siding material which comprises metallic flakes bonded to a base.
Harshberger	2, 332, 220	Building material comprising mica flakes coated with rosin and overlapping aluminum flakes.
Harshberger	2, 332, 221	Roofing and siding material comprising mica flakes bonded to and completely covering base except for interstices which are covered with further divided material of finer size.
Shepard	2, 335, 316	Apparatus for conditioning metal surfaces for the application of metal coatings by spraying.
Hucks	2, 335, 760	Coating composition incorporating aluminum powder.
Parmenter	2, 336, 565	Preformed sheet of construction material consisting of body of asphalt and coating of hardened hydrous Portland cement with a filler of metal filings.

V. APPLICATIONS OF METAL POWDERS—Continued

4. Coating and Molding Methods and Compositions, Including Paper Metallizing, Electrical Coatings, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Decker	2, 338, 802	Treated turpentine composition, particularly adapted as finishing composition, incorporating aluminum bronze flakes.
Daly, et al	2, 339, 840	Sheet material which may incorporate metal powders in the dope from which intermediate layers are formed.
Wampner	2, 340, 280	Coating composition having reduced tendency to liver or agglomerate comprising bronze powder, cellulose nitrate, and neutral salt of malic acid.
Matthews, et al	2, 341, 461	Coating side of photographic film not carrying emulsion layer with finely divided silver to prevent fungus growth.
Jernstedt	2, 342, 738	Corrosion resistant coating for metal surfaces which comprises a solution of iron-phosphate, free phosphoric acid, oxidizing agent, and one or more metals such as zinc, manganese, and copper.
Furstenberg	2, 342, 853	Combination inhaler, cigarette filter, and holder coated with fine metallic copper in transparent binder.
Spelker	2, 343, 031	Stencil for imparting a design to the non-planar surface of a contoured article which has conductor coating of powdered iron.
Gearhart	2, 343, 658	Thermoplastic decorative composition which may employ metal powders with resin particles.
Pike	2, 343, 925	Metallic finish enamel comprising a resin, aluminum flake, and hydroxystearin.
Lehman	2, 345, 942	Producing decorated wood surfaces utilizing abrasive particles coated with pigment.
Wampner	2, 345, 955	Coating composition having reduced tendencies to liver or agglomerate incorporating bronze powder.
Straus	2, 346, 624	Coating composition which comprisies a binding agent, metal powders, and a lubricant.
Oswald	2, 347, 923	Varnish composition utilizing calcium, lead, and cobalt.
Land	2, 348, 912	Designs produced in light-polarizing areas having backing plate with reflecting surface of aluminum flakes.
Soff	2, 351, 717	Decorating surfaces with liquid including a binder, a solvent, and suspended particles, such as aluminum powder.
Dupuis	2, 351, 940	Electroplating articles with lacquer film containing lithopone and copper powder.
Kollmar	2, 351, 974	Silvering surfaces of ceramic ware with composition comprising flux, a solvent vehicle, metallic silver and nickel compound.
Finch	2, 355, 369	Multistylus facsimile recorder incorporating aluminum powder in record sheet.
Flood	2, 355, 430	Traffic guiding stripe of adhesive layer with layer of metallic antimony embedded therein.

V. APPLICATIONS OF METAL POWDERS—Continued

4. *Coating and Molding Methods and Compositions, Including Paper Metallizing, Electrical Coatings, Etc.*—Continued

Patentee	U. S. Patent No.	Subject
Smith	2, 355, 756	Waterproofing coating for plastic material comprising finely divided pigment, such as aluminum powder, and carrying agent.
O'Loughlin	2, 355, 889	Coating composition which may comprise aluminum flakes dispersed in aqueous casein solution.
Lipsius	2, 355, 919	Coating foundation with resinous substance and heating to prepare for coating with metallic or colored powders.
Mercier	2, 356, 527	Carpets, linings, etc. having nonslip surfaces which comprise cereal straw in mass of vulcanized rubber in which zinc is incorporated.
Billing	2, 357, 073	Adhesive composition which may be incorporated with metal powders in production of abrasive papers.
Mascuch	2, 359, 436	Electro-plating spark plug conductors with metal powders.
Bacon	2, 361, 527	Uniting fibrous material, such as leather, utilizing partial polyvinyl acetal resin and plasticizer therefor, such as powdered copper or aluminum.
Clark	2, 362, 884	Aluminum-coated paper comprising layer of aqueous aluminum powder-containing coating composition.
Auer	2, 363, 489	Flatting agent for use in dull coating compositions which incorporate coated metal powders.
Soday	2, 366, 219	Adhesive composition of isoprene resin and rubber which may include metal powder as filler or pigment.
Gardner	2, 366, 850	Composition for use as liner for food containers containing flake aluminum.
Strab	2, 367, 152	Metallized paper for production of condensers made by applying metal coating on paper already having insulating coating.
Rubner	2, 368, 161	Raised, glittering markings of aluminum flakes embedded in permanent binder.
Wood	2, 368, 190	Rubber composition having filling of aluminum powder which strengthens composition.
Crist, et al	2, 368, 746	Apparatus for circulating liquid suspension of silver powder (in which quartz for high frequency electrical apparatus may be dipped for coating) to keep suspension well mixed.
Moore	2, 368, 767	Adhesive composition which may be used in pigmented coating compositions to provide binding action on pigments.
Amberson	2, 369, 200	Treating inflammable nitrocellulose dope with zinc to render noninflammable when dry.
Stratton	2, 370, 502	Shoe lasts having incorporated therein electrodes of sprayed metal powders for use in establishing electrostatic fields.

V. APPLICATIONS OF METAL POWDERS—Continued

4. Coating and Molding Methods and Compositions, Including Paper Metallizing, Electrical Coatings, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Schenkel	2, 372, 124	Illuminating sign utilizing aluminum powder in light diffusing coating to reflect light.
Jones	2, 372, 581	Preventing formation of ice on aircraft comprising mass of porous metal having antifreezing liquid applied thereto.
Taylor	2, 372, 695	Producing thermoplastic material which may have filler of metal powders.
Tognola	2, 372, 867	Spark plug having insulating sleeve coated with high heat resisting metal powder such as nickel or tungsten.
Bowers	2, 374, 524	Forming transferable silk screen stencils using protective coating of aluminum powder.
Britcher	2, 375, 766	Apparatus for spraying metal powders on paper in producing metallized paper.
Leatherman	2, 378, 714	Fireproofing composition which may incorporate pigments or metal powders for decorative effects as well as protect chlorinated organic material from decomposing effect of actinic light.
Leatherman	2, 378, 715	Fireproofing composition which may incorporate pigments or metal powders.
Wilsey, et al	2, 379, 846	Incorporating bronze powder or carbon black in lacquer coating for paper to facilitate perforating paper by electrical discharges.
Hyman	2, 380, 047	Apparatus for applying uniform coatings, which may be metal powders, to rough surfaced materials.
Brown	2, 380, 722	Finely divided lead hardened with calcium is extruded as a sheath on electric cable.
Coughey	2, 381, 205	Metallic powders are used as fillers in moldable compositions made of treated ground wood.
Kathe	2, 381, 911	Powdered copper or other metal is deposited on an electrically nonconductive surface to produce a conductive film.
Kappeler	2, 382, 065	Metal powder may be added to colloidal graphite and sprayed onto insulation web to form a wound condenser.
Rolle	2, 384, 493	Aluminum bronze powder in lacquer vehicle is used to coat metal prior to carbonizing to produce black surfaces for radio tube plates.
Knox	2, 385, 580	Finely divided silver is used in a metal-to-ceramic bonding composition.
Frosch	2, 388, 318	Powdered metals may be added to a molding and coating compound.
Collins, et al	2, 388, 600, 2, 388, 601, 2, 388, 602.	Resins produced by these inventions may be used as vehicles for carrying metal powders for coatings.

V. APPLICATIONS OF METAL POWDERS—Continued

4. Coating and Molding Methods and Compositions, Including Paper Metallizing, Electrical Coatings, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Tone	2, 389, 469	Powdered aluminum is used in making adhesive.
Sarbach	2, 389, 641	Metal powder is used as a prime coating interposed between surface and base member in applying rubbery materials to metal, glass, etc.
Nebel	2, 389, 682	Chemical formula for a protective or decorative coating for paper, etc., in which metallic powders may be used.
Ullmer	2, 389, 702	Apparatus for impregnating or coating metal articles with metal powders.
Young	2, 390, 408	Aluminum powder may be used as pigment in antifouling composition, when composition is used on seaplane hulls and pontoons.
Mudge	2, 390, 452	Powdered nickel is used to coat corrosion-resistant metal that is to be bonded to a foundation plate.
Gerhart	2, 392, 732	Aluminum powder is used in a metal coating composition.
Jernstedt, et al	2, 394, 065	Powdered iron is used in the production of protective coatings for nonferrous metals.
Reese	2, 397, 623	Copper or aluminum powder is used in making an opaque film to be applied to glass.
Kramer	2, 399, 551	Powdered tin of aluminum or lead are used with powdered copper to form coatings for selective carburization of steel.
Kline, et al	2, 400, 544	Powdered metal in diglycol stearate is impregnated on a paper web to form the conductive base of an electrosensitive recording blank.
Sigmund, et al	2, 400, 576	Zinc powder is used to coat resin covered coil heads in a process of depositing rubber on magnetic cores.
Bean	2, 402, 528	Bronzing powder is used for dusting the face of a pattern mold.
Wagner	2, 403, 836	A small amount of a lightweight metallic powder such as magnesium or aluminum powders is used in making self-sealing layers for a gasoline tank.
Wilson	2, 405, 249	Powdered metal is used to eliminate solvents from coating films by exposing the films to the effect of an alternating electrostatic field.
Morrell	2, 412, 528	Metal powders are used in coating tin cans

V. APPLICATIONS OF METAL POWDERS—Continued

5. Composite Articles in Which Metallic Powders Are Used for Facings on a Metal Backing or as Fillers

Patentee	U. S. Patent No.	Subject
Laise	1, 390, 243	Powdered material of low melting point pressed on plated material and heated.
Weiger	1, 822, 682	Valve seat of porous body of sintered tungsten impregnated with silver.
DeBats	1, 993, 774	Method of applying hard facing material such as tungsten carbide with bonding agent to dies, valve seats or other articles in powdered form and sintered in place.
Weiger	2, 004, 259	Improvement on 1,822,682—valve seat of porous body of sintered tungsten impregnated with silver.
Swartz	2, 152, 661	Making composite metallic elements by copper plating with metal powders, compressing, forming and heating steel supporting element.
Swartz	Reissue 22,282 of 2,161,597.	Bonding metal powders to steel backing by sintering.
Calkins, et al	2, 198, 654	Splined joint of coupling wherein some splines comprise compressed and sintered metal powders.
Davis	2, 199, 620	Fastening porous metal articles, comprising compressed and sintered metal powders, to supporting member.
Hildabolt	2, 225, 269	Flat composite stock comprising layer of sintered metal formed from metal powder bonded to strong metal supporting back for use in fabrication of bushings.
Marvin	2, 241, 094	Applying loose metal powder to more dense metal by sintering to bond it.
Wellman	2, 289, 311	Method for shaping composite article composed of sintered lamina bonded to metallic backing.
Koehring	2, 290, 338	Powdered metal sintered on metal backing by electrical heating.
Jerabek	2, 292, 694	Producing material for hard facing metallic articles by melting onto a surface, a mixture of iron, a boride, carbon, chromium and nickel, by electric arc.
Lubbe, et al	2, 317, 786	Pulverized tungsten carbide and binder metal such as iron or cobalt pressed and sintered into plates for attachment to tool or machine members.
Underwood	2, 331, 584	Composite article comprising layer of porous metal powder bonded to a relative nonporous supporting member.
John	2, 341, 784	Producing fillets, in hollow steel propeller blades utilizing alloy of copper, nickel, zinc and tin as fillet material.
Hardy, Jr	2, 348, 130	Projectile resistant armor plating comprising layer of yieldable material, such as rubber, with pockets of hard granulated material such as iron filings, between two layers of armor plate.

V. APPLICATIONS OF METAL POWDERS—Continued

5. Composite Articles in Which Metallic Powders Are Used for Facings on a Metal Backing or as Fillers—Continued

Patentee	U. S. Patent No.	Subject
Marvin	2, 350, 179	Composite article comprising porous metal layer bonded to supporting member of steel.
Ronay	2, 361, 962	Metal-cladding a metal surface utilizing aluminum as deoxidizer.
Schwartzkopf	2, 372, 607	Armor composed of two or more layers of different compositions preferably hard carbide or nitride bonded with cementing metal powder.
Radford	2, 376, 084	Golf ball having core filled with iron powder.
Smith	2, 384, 654	Bearing shell is lined with babbitt by whirling pulverized babbitt metal within shell while heating, then sintering and machining.
Horlacher	2, 387, 073	Rotor unit having shell of copper filled with powdered iron.
Aske	2, 390, 343	Granular copper is used as a top layer on a cast iron head portion of piston.
Alfthan, et al	2, 396, 629	Powdered copper, iron, lead, brass, etc., may be used as fillers in making shaped articles of polytetrafluoroethylene.
Alfthan	2, 400, 091	Powdered copper, iron, lead, brass, etc., may be added to polytetrafluoroethylene in a process for forming porous articles.
Burbaker, et al	2, 400, 099	A molding process for polytetrafluoroethylene, including mixtures of powdered copper, iron, lead, brass, etc., and the polymer.
Bourne	2, 401, 221	A method of impregnating porous iron made from iron powder with copper, in which the copper is heated sufficiently to cause it to flow but not enough to melt the iron.
Bangham, et al	2, 404, 208	Powdered metals are added to reinforce molded products and to prevent shrinkage cracks.
Luckhaupt	2, 406, 428	Powdered iron is used as a reinforcing agent in a plastic composition.
Magrum	2, 409, 505	Powdered aluminum may be incorporated in a lightweight plastic used to mold a shock absorber for automobiles or airplanes.

6. Dental Amalgams, Etc.

Watts	9, 691	Powdered gold for fillings is prepared by precipitation, subsequent amalgamation with mercury, dissolving out the mercury with nitric acid and heat and washing with water.
Kearsing	51, 459	Gold for dental use is made by beating it to foil and grinding foil with molasses.
Lamm	56, 765	Gold for fillings is precipitated in form of metallic leaves or crystals from solution in nitromuriatic acid by use of saccharine substances.

V. APPLICATIONS OF METAL POWDERS—Continued

6. Dental Amalgams, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Lamm	65, 398, 65, 399	Gold shreds for dental use are precipitated from solution of gold in nitromuriatic acid by (1) sugar as precipitant (2) gum arabic as precipitant.
Southworth	157, 140	Amalgam of silver, tin and mercury is filed to powder which is pressed into ready-for-use pellets for fillings.
Sutton, Jr	168, 680	Tin is deposited in spongy crystals on a strip of zinc, from a solution of muriate of tin, and is ready for immediate use as filling.
Buatt	324, 650	Producing amalgams for dental fillings of powdered gold, or gold and silver, combined with mercury, sulphur and chalk and worked into plastic mass.
Carroll	475, 382	Dental amalgam employing powdered alloy of silver, tin, copper and aluminum.
Juterbock	485, 280	Alloy for dental amalgam, made by rolling silver-tin alloy in sheets and electroplating sheets with gold after which sheets may be cut in small pieces.
Dennis	532, 724	Comminuted copper, or copper filings, are mixed with gutta percha to make a filling.
Osius	819, 249	Dental filling of powdered gold and zinc cement.
Alexander	1, 040, 838	Filling of finely divided gold, and waxy binder.
Marouke	1, 215, 678	Precipitated, powdered gold, silver and copper are mixed with mercury, and dried to a powdery state.
Kruger	1, 473, 482	Filling of dry silver powder mixed with a nonbinding solution of germicide in water.
Vogt	1, 574, 714	Dental alloy, to be powdered for amalgamating with mercury, of silver and tin plus a small amount of chromium, tungsten, vanadium, etc.
Vogt et al	1, 612, 782	Dental alloy, to be used in powdered form, consisting of silver and tin plus a small amount of nickel or cobalt.
Fischer	1, 803, 386	Powder for use as dental amalgam of finely divided silver alloy particles having a thin skin of amalgam thereon.
Hauptmeyer	1, 935, 266	Filling of 50 percent dental cement and 50 percent powdered chromium-nickel iron or steel alloy neutral to chemical agent.
Gray	1, 963, 085	Producing comminuted alloy of metals for dental amalgams of fine powder which will expand during hardening when combined with mercury.
Heiligman	2, 206, 502	Cast metallic dentures of compressed mixture of metal powders.
Kaufmann, et al	2, 271, 264	Dental alloys are finely divided by impinging melt on rapidly rotating surface sprayed with a cooling liquid.

V. APPLICATIONS OF METAL POWDERS—Continued

6. Dental Amalgams, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Poetschke	2, 281, 991	Dental alloy of 80 to 95 parts comminuted silver alloy mechanically mixed with 20 to 5 parts comminuted preformed hardened silver amalgam.
Sivil, et al	2, 315, 876	Cast dentures made from comminuted cake of sintered metal powders.

7. Electrical Contacts, Brushes, Electrodes, Battery Parts, Resistors, Rectifiers, Condensers, Etc., Made With Metal Powders

Case	289, 386	Making electrodes for secondary batteries by cooling, pressing, and molding melted metal powders.
Starr	295, 456	Battery electrode; amalgam of lead filings, lead oxide, and mercury.
Eggers	413, 438	Mixture of pulverized zinc, diluted sulfuric acid, and mercury used in manufacture of battery zinc.
MacDonald	440, 173	Battery zinc is produced by adding to it an amalgam previously hardened by adding zinc in small pieces, and then adding powdered magnesium.
Irving	645, 261	Battery electrode; lead shavings are used in manufacture.
Viertel, et al	842, 730	Manufacturing electrically conducting bodies comprising pressing, molding, and heating in reducing atmosphere, mixture of metal powders and carbon.
Deats, et al	1, 067, 003	Making electrical conductors comprising subjecting to pressure and baking pulverized carbon and copper powder.
Gilson	1, 093, 614	Producing dynamo-electric brush comprising heating, pressing, and firing copper, soft alloying metal, graphite, and iron.
Moore	1, 254, 056	Metal powder for brushes is produced by forming metal sponge in an electrolyte and placing metal sponge in colloidal solution to precipitate a protecting coat on particles.
Howard	1, 257, 943	Commutator brushes are made with reduced copper compressed into blocks by heavy pressure.
Gebauer	1, 346, 192	Producing composition of matter for electrical contacts, etc., from refractory metal powder and noble metal.
Wikle	1, 375, 879	Manufacturing brushes for electrical machinery comprising bonding by pressure mixture of finely subdivided copper and powdered graphite.
Laise	1, 423, 338	Sintered contact material produced from powdered tungsten and gold, vanadium, or thorium.

V. APPLICATIONS OF METAL POWDERS—Continued

7. *Electrical Contacts, Brushes, Electrodes, Battery Parts, Resistors, Rectifiers, Condensers, Etc., Made With Metal Powders*—Continued

Patentee	U. S. Patent No.	Subject
Laise	1, 531, 666	Making electrical contacts by sintering article formed from metal powders and compacting by tumbling action.
Gillette	1, 539, 810	Welding electrode made of pressed and sintered tungsten and copper powders.
Aichele	1, 648, 100	Making electrical contacts from semiplastic mass comprising stirring acid-cleaned powdered copper and mercury into molten lead and cooling.
Kramer	1, 685, 919	Sliding contact for trolleys of fine metal powder mixed with small percent of graphite powder.
Podzus	1, 699, 205	Flake-shaped powders are bounced against each other and mill walls to form hollow spheres, which are easily lubricated with graphite in forming sliding electrical contacts.
Sherwood	1, 708, 192	Manufacture of electrically conducting bodies comprising sintering compressed metal powders with portion of preformed conductor embedded therein.
Hall	1, 728, 273	Commutator brushes and the like made by pressing powdered metals and graphite around a length of pigtail wire.
Rich	1, 731, 267	Resistance alloy produced by treating powdered metals, such as chromium and tungsten.
Marden, et al	1, 760, 367	Resistors are made from chromium powdered, sintered, and worked.
Fitzpatrick	1, 804, 924	Copper carbon brushes are made with metal disintegrated by electrolysis and washed free from electrolyte.
Bates	1, 807, 581	Producing electrical contact terminal comprising heating granular tungsten or molybdenum with copper and silicon.
Weiger	1, 860, 793	Contact material consisting of porous body of sintered tungsten or molybdenum impregnated with a conducting metal such as copper or silver.
Weiger	1, 877, 261	Sintered contact material of rhodium-tungsten alloy.
Hall	1, 878, 132	Commutator brushes made by baking pressed powders of copper, lead, and graphite.
Gwyn	1, 958, 338	Method of treating sintered tungsten contacts to increase grain size.
Weiger	1, 958, 357	Manufacturing electrical make-and-break contacts of tungsten treated to have interlocked grain structure and impurities removed.
Weiger	1, 978, 516	Composite X-ray target with active surface of sintered tungsten and molybdenum and main body of copper.

V. APPLICATIONS OF METAL POWDERS—Continued

7. *Electrical Contacts, Brushes, Electrodes, Battery Parts, Resistors, Rectifiers, Condensers, Etc., Made With Metal Powders*—Continued

Patentee	U. S. Patent No.	Subject
Langhammer	1, 980, 540	Trolley shoe made from compressed metal powders impregnated with lubricant.
Sieger	1, 984, 203	Manufacturing electrical make-and-break contacts comprising silver dispersed throughout carbide of refractory metal.
Thorausch, et al	1, 988, 861	Producing metallic plates suitable for accumulator electrodes by sintering uncompressed metal powders and volatilizable material.
Schwarzkopf	2, 030, 229	Making compound structural material, adapted to electrical purposes, comprising powdered metals.
Hensel, et al	2, 033, 709	Alloys for commutator segments and collector rings for dynamo-electric machines, etc., e. g., 0.01 to 5 percent silver, 0.05 to 5 percent chromium and balance copper, powdered and pressed, etc., to shape.
Hensel, et al	2, 033, 710	Alloy, e. g., 0.1 to 5 percent chromium, 0.1 to 5 percent cadmium, balance copper, which may be treated according to various powder metallurgical methods.
Adams	2, 034, 550	Making arcing tip comprising impregnating with molten copper U-shaped member of powdered tungsten.
Hardy	2, 053, 662	Commutator produced from compressed and sintered metal powders.
Casper	2, 056, 919	Electrical contact of sintered finely divided tungsten carbide and a binder of cobalt.
Schwarzkopf	2, 096, 924	Making composite material for electrical purposes from powdered tungsten or molybdenum and metal such as silver, aluminum or zinc.
Wohrman, et al	2, 097, 140	Making electrical contact materials by thoroughly intermixing tungsten carbide and metal, such as osmium.
Gwyn	2, 143, 375	Method of treating sintered tungsten contacts to increase grain size; improvement on 1,958,338 and 1,958,357.
Hensel	2, 145, 690	Contact material improved by addition of powdered cadmium oxide to powdered metals such as silver, gold and platinum prior to pressing and sintering.
Ruben	2, 154, 700	Making electrical contacting element comprising chromium and tin.
Hensel	2, 159, 763	Making metallic composition suitable for electrical contacting members comprising nickel, cadmium and silver.
Doty, et al	2, 162, 380	Making refractory metal composition for electrical contacting members comprising molybdenum or tungsten, silver and copper.
Kelly	2, 175, 899	Making electrical contact members comprising refractory metal bonded with conductive metals, such as copper and silver.

V. APPLICATIONS OF METAL POWDERS—Continued

7. *Electrical Contacts, Brushes, Electrodes, Battery Parts, Resistors, Rectifiers, Condensers, Etc., Made With Metal Powders*—Continued

Patentee	U. S. Patent No.	Subject
Schwarzkopf	2, 179, 960	Manufacturing agglomerated material for electrical purposes using refractory metal powder artificially provided with larger volume in comparison with surface area.
Hensel, et al	2, 180, 826	Contact made by powder metallurgical process of silver, silicon and refractory material.
Hensel, et al	2, 180, 827	Electrical contract of finely divided nickel, cobalt, or tungsten, etc., bonded and interspersed with a magnesium-zinc-silver alloy.
Hensel	2, 180, 956	Electrical contact formed from a nitride of titanium, etc., and a metal from the group of silver, copper, gold and alloys. Alloys and nitrides may be powdered.
Hensel	2, 182, 380	Preparing metallic composition for electrical contacting members comprising sintering finely divided cadmium and nickel or cobalt.
Hensel	2, 190, 477	Electrical contact which may be made by pressing zirconium carbide and silver powder together, sintering, repressing and shaping.
Emmert, et al	2, 197, 376	Sintered contact material of silver with additions of nickel and tungsten or molybdenum.
Kelly	2, 200, 087	Electrical contact member comprising refractory metal powder and alloy of silver and copper.
Kelly	2, 200, 088	Electrical contact member comprising refractory metal powders bonded with alloy of cobalt, iron and copper.
Ruben	2, 211, 583	Making electric condensers employing copper bronze particles.
Langguth	2, 213, 128	Making negative electrode for alkaline storage battery comprising porous carrier made from metal powder and cadmium.
Driggs, et al	2, 227, 445	Making contact alloy by sintering pressed pellet of powdered tungsten and nickel.
Rennie	2, 235, 504	Making starting electrodes by sintering packed mixture of metal powders and conductor in loose metal powder mixture of silica and graphite.
Young	2, 240, 821	Making iron anodes for electrolytic cells by compressing and reducing oxide-coated sponge iron granules.
Tietig	2, 244, 436	Producing porous metallic object for use as electrical contact comprising powdered metal having multiplicity of pores impregnated with lubricant.
Hensel, et al	2, 247, 755	Electric contact having a tungsten or molybdenum body with rhodium facing which may be applied in powdered form by spraying or compacting, etc.

V. APPLICATIONS OF METAL POWDERS—Continued

7. *Electrical Contacts, Brushes, Electrodes, Battery Parts, Resistors, Rectifiers, Condensers, Etc., Made With Metal Powders*—Continued

Patentee	U. S. Patent No.	Subject
Burns, et al	2, 249, 599	Electrical contact material comprising body of silver having chromium powder dispersed throughout.
Vernet, et al	2, 259, 846	Plastic thermostatic material formed from metal powders used as temperature responsive element.
Hensel, et al	2, 281, 691	Heat treating of chromium-copper alloys is claimed in this patent which prefers addition of the chromium to the copper in powdered form.
Clark	2, 283, 723	Making nonsintered electrodes comprising hard basic powders encased in thin shell of softer material by ball milling, sputtering, etc.
Mansfield	2, 285, 293	Tungsten contact having no line of cleavage in grain structure, and case-hardened in powdered cobalt, or chromium, carbon or silicon.
Cox	2, 288, 122	Making electrical contact material comprising silver powder and cadmium sulphide.
Telkes	2, 289, 152	Thermocouple assembly made by sintering metal powders in a confining insulating jacket.
Hensel, et al	2, 294, 405	Metallic composition, useful as electrical contact, comprising sinter-bonding mixture of powdered cadmium, carbon and aluminum.
Inutsuka, et al	2, 294, 755	Resistant body comprising powdered copper oxide and powdered chromic oxide.
Inutsuka, et al	2, 294, 756	Electrical resistor comprising sintering molded mixture of paraffin and powdered copper and chrome oxide.
Scheer	2, 295, 759	Capacitator wherein armature comprises powdered metal applied to mica.
Allen	2, 298, 999	Electrical contact composed of powdered silver and refractory metal.
Allen	2, 299, 000	Electrical contact having a silver tungsten or silver molybdenum base formed from mixture of powdered metals pressed into solid contact form.
Gray, et al	2, 299, 228	Electric condenser comprising pressing metallic particles into porous spongy body.
Driggs	2, 300, 558	Electrical contact comprising compressing and sintering tungsten or silicon powder with tungsten carbide.
Reeve	2, 303, 497	Electrical contact element of palladium coated silver with underlying layer of palladium-silver alloy.
Gutbrod, et al	2, 306, 263	Contact pins comprising refractory metal powders sintered into suitable mold and impregnated with highly conductive metal.
Thompson	2, 307, 474	Selenium rectifier made from powdered selenium and nonvolatile chloride salt.

V. APPLICATIONS OF METAL POWDERS—Continued

7. *Electrical Contacts, Brushes, Electrodes, Battery Parts, Resistors, Rectifiers, Condensers, Etc., Made With Metal Powders*—Continued

Patentee	U. S. Patent No.	Subject
Cox	2, 307, 668	Electrical contact comprising mixture of silver powder and cadmium oxide powder.
Hensel, et al	2, 313, 070	Electrical contacting element comprising pressed mixture of refractory metal carbide, cobalt and silver.
Wood	2, 313, 379	Mountings for electrically operated units incorporating powdered aluminum in sponge rubber.
Larsen, et al	2, 319, 240	Electric contact face plate comprising powdered contact metal, such as silver or copper, sintered to backing member.
Young	2, 325, 201	Soluble anode for electrolytic cell comprising iron granules united by bridges of metallic iron.
Brennan	2, 330, 202	Electrodes produced by spraying finely divided molten metal on base, such as wire.
Presser	2, 330, 620	Photoelectric cells comprising finely divided aluminum and gold applied to base of selenium.
White, et al	2, 331, 098	Conduit holder having cushion of electrically conductive material, such as aluminum powder.
Krellner	2, 331, 479	Electrographitic brush which comprises mixture of carbon, binder and at least one finely divided hard metal carbide.
Peters	2, 332, 809	Thermal switch of gaseous electric discharge type employing aluminum powder.
Naumann, et al	2, 338, 531	Resistor having coating of aluminum powder applied to inner surface of support.
Ewing	2, 338, 713	Electrodes or half cells utilizing plating of sponge copper.
Becker, et al	2, 339, 613	Selenium rectifier comprising selenium powder deposited on backing member of nickel and iron.
Boegehold	2, 339, 673	Heat resistant iron casting utilizing carbon, silicon and manganese powders.
Corbin, et al	2, 342, 842	Sealing electrical conductors in insulators by means of metallic coating applied in fine state to the insulator in its unfired condition.
Wolf et al	2, 343, 354	Wedges or closures for slots or openings in stators or cores of magnetic electric motors formed of magnetic metal powders.
Rawlins	2, 343, 422	Electric circuit interrupting device utilizing metal shavings as cooling means for explosive material.
Putnam	2, 343, 999	Variable inductor having stator core and shell members molded from iron powder and suitable binder.
Cox	2, 347, 172	Electrical contact tip molded from silver powder.

V. APPLICATIONS OF METAL POWDERS—Continued

7. *Electrical Contacts, Brushes, Electrodes, Battery Parts, Resistors, Rectifiers, Condensers, Etc., Made With Metal Powders*—Continued

Patentee	U. S. Patent No.	Subject
Podolsky	2, 347, 796	Electrical resistor molded from inert filler, conductive particles such as carbon, and suitable binder.
Ruben	2, 348, 311	Dry rectifier electrode element is formed with cuprous sulfide made by heating copper powder or scrap with sulfur.
Lannert	2, 353, 047	Brushes for electric motors formed of conducting material such as carbon with greater conducting material such as copper dispersed therethrough.
Saslaw	2, 356, 094	Adherent layer of selenium may be applied to rough-surfaced base plate of iron, etc., by melting selenium powder and spreading over surface. Further treatment is given selenium layer.
Hensel, et al	2, 358, 326	Electric contact formed of composition composed of nickel or cobalt particles coated with metal of palladium-platinum group with copper, silver, or gold particles interspersed.
Lichtgarn	2, 358, 406	Electrical resistance element comprising metal oxide, silica, and finely divided conductive material, such as aluminum powder.
Clark	2, 359, 970	Porous condenser electrode formed of compressed metal powders of filming metal.
Shobert, et al	2, 360, 522	Electrical contact comprising powdered contact metal and powdered cadmium oxide.
Cox	2, 361, 089	Electrical contact having tip of metal powders pressure molded to supporting member.
Loftis	2, 361, 220	Electrically conductive body suitable for commutator brushes molded from conductive material, such as graphite, and pulverulent metal, such as copper powder.
Brennan	2, 361, 378	Electrode comprising conductive layer of metal powders bonded together and having finely divided filler material in interstices prior to immersion in electrolyte.
Miller, et al	2, 364, 642	Selenium rectifier comprising compressing selenium powder against base plate at elevated temperature.
Comstock	2, 365, 249	Electrical contact comprising a compressed, sintered mixture of silver and carbonyl iron.
Hauel	2, 366, 402	Negative electrode for cadmium-nickel storage batteries utilizing finely divided iron as conductive material.
Wilson	2, 367, 453	Storage battery electrodes which may include lead particles in paste for electrodes.

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V. APPLICATIONS OF METAL POWDERS—Continued

7. Electrical Contacts, Brushes, Electrodes, Battery Parts, Resistors, Rectifiers, Condensers, Etc., Made With Metal Powders—Continued

Patentee	U. S. Patent No.	Subject
Wooten	2, 368, 060	Nonemissive electrode for electron discharge devices which has coating of finely divided metal, such as zirconium, with binder of silica.
Vernet	2, 368, 181	Pressure seal between thermostatic element and plunger. Copper powder is used as temperature responsive element.
Graves	2, 370, 400	Electrical contact comprising porous mass of copper, pores of which are substantially filled with cadmium.
Saslaw	2, 370, 493	Improving selenium rectifier by applying to selenium small amount of water before application of counterelectrode.
Barrington	2, 371, 211	Resistor comprising bonded mixture of finely divided silicon carbide, conductive metal powder and glassy bonding element.
Chilton	2, 374, 416	Electric regulator pile comprising heat conductive core and insulating tube with metal powders between to improve heat contact.
Brennan	2, 375, 211	Electrode having conductive layer of finely divided metal powders.
Peters	2, 375, 818	Commutator brush comprising carbon body with powdered heavy metal as "inertia particles."
Lowit	2, 377, 164	Electrical assembly for leading-in current in lamps, radio tubes, etc., utilizing iron wire coated with thin film of copper powder.
Saslaw, et al	2, 378, 438	Rectifier wherein powdered selenium is sintered to base plate.
Payne	2, 379, 374	Utilizing finely divided iron with mercury in laminated cell of a storage battery.
DeVore	2, 380, 505	Metallic particles may be oxidized and treated with an alkali metal in forming electrodes.
Shobert II	2, 382, 338	Silver powder is used in making an electric contact element.
Harris, Jr	2, 383, 384	Metallurgical induction furance can be made self-starting if powdered metal is used to complete secondary circuit.
Gunn, et al	2, 384, 463	Electrode of a fuel cell is coated with sintered metal particles.
Kaschke	2, 385, 578	Method of making iron powder core for radio receiver tuners.
Savage	2, 387, 614	Metal powder is used in making an improved electric brush contact element.
Shea	2, 388, 295	Unitary powdered iron body member is used in radio frequency transformer. Patent is on link coupling for the transformer.
Deyrup, et al	2, 389, 419, 2, 389, 420.	Electrical capacitors having alternate ceramic layers and layers of silver powder, fired to form unitary structure.

V. APPLICATIONS OF METAL POWDERS—Continued

7. *Electrical Contacts, Brushes, Electrodes, Battery Parts, Resistors, Rectifiers, Condensers, Etc., Made With Metal Powders*—Continued

Patentee	U. S. Patent No.	Subject
Appleman, et al	2, 389, 587, 2, 389, 588.	Powdered copper, aluminum, etc., is used in a groove in metal body in which sheath of electrical heating apparatus is carried.
Tunick	2, 389, 879	Frequency modulator provided with a powdered iron core.
Chub, et al	2, 389, 893, 2, 389, 894.	Storage battery plates made of finely divided, spongy metallic lead.
Deyrup, et al	2, 390, 025	Powdered silver layers are used in preparing electrical capacitors.
Larson, et al	2, 390, 595	Electric contact having body of powdered refractory metal and silver or copper, with the more fusible silver or copper etched out of the contact face.
Hensel	2, 391, 455, 2, 391, 456.	Tungsten, nickel and molybdenum powders may be used to form center electrode for a spark plug.
Hensel	2, 391, 459	Spark plug center electrode of loop form which may be made by powder metallurgical methods from high tungsten base alloys.
Sykes	2, 392, 429	An electrode film is formed on piezoelectric crystal using powdered metal.
Radcliffe	2, 392, 879	An electrode is manufactured by coating one side of an elongated metal strip with a suspension of powdered antiglow metallic material in a volatizable binder and the coating is baked on electrically.
Kohler	2, 393, 541	Metal powders and resin glue are combined and used to secure nonconductors. The device thus constructed is then heated and the whole article becomes a nonconductor.
Weiller	2, 394, 501	15 percent iron powder and 85 percent ferric oxide are pressed into a briquette and sintered; the product is reground, silver powder is added so that the new product is 90 percent silver; it is pressed, sintered one hour at 500° F., and repressed to make a hardened electrical contact.
McCarthy, et al	2, 394, 865	The ceramic member of a spark plug has a compression ring formed of powdered copper.
Ballard	2, 395, 442	Silver powders are used in making an electrical capacitor.
Hensel	2, 396, 100	An electric contact is formed of gold base alloy containing lead or thallium and is made by powder metallurgical methods.
Hensel, et al	2, 396, 101	An electric contact is formed of refractory oxide and silver, copper or gold, and is prepared by powder metallurgical methods.
Stubbs	2, 397, 764	A spark gap for ignition system of internal combustion engine may be made by methods of powder metallurgy.

V. APPLICATIONS OF METAL POWDERS—Continued

7. *Electrical Contacts, Brushes, Electrodes, Battery Parts, Resistors, Rectifiers, Condensers, Etc., Made With Metal Powders*—Continued

Patentee	U. S. Patent No.	Subject
Deyrup	2, 398, 176	In making electrical capacitors, a coating of silver powder is applied to a ceramic base, the electrode is covered with a vitreous dielectric by application and firing of a powdered vitreous glaze, and powdered with a second electrode by application of a second layer of ceramic silver.
Ballard	2, 399, 313	Powdered silver is used in the manufacture of electrical capacitors.
Waintrob	2, 399, 773	Copper powder is used as conductive material in forming electrical rectifier disks.
Harvey	2, 403, 657	An electrical insulating and dielectric medium in which powdered metal such as copper or silver is used.
Booe	2, 404, 824	An electrode formed of a porous or fibrous base carrying a coherent adhering layer of finely divided filmforming metal particles.
Smithells	2, 406, 172	Finely divided platinum, rhodium, iridium, ruthenium, or palladium are compacted and sintered to form articles of desirable electrical and chemical properties.
Wejnarth	2, 406, 275	Sintered metals are used in the manufacture of an electrical resistance element.
Brennan	2, 406, 345	Pelleted insulating material is coated with conductive metallic layers composed of minute particles to produce an electrode for an electrolytic condenser.
Rolfes	2, 408, 124 2, 408, 125.	Powdered nickel, silver or aluminum is used in making a "coherer plug" for safeguarding electric igniters of blasting detonators against accidental firing.
Clifford	2, 409, 664	Crushed tungsten is used in making the electrode support of an electron discharge device.
Leyshon	2, 409, 769	Zirconium, milled to a powder or dust, is suspended in a lacquer such as a solution of nitrocellulose in amyl acetate and is used as an inner coating for an electrode in a flourescent glow lamp.
Cox	2, 410, 717	Powdered Silver and molybdenum are molded to make contacts for electrical switches.
Brennan	2, 412, 201	Aluminum particles are sprayed onto wire screen, gauze or glass cloth to make an electrode for condensers, lightning arresters, etc.

V. APPLICATIONS OF METAL POWDERS—Continued

8. Expanded Materials and Pressure Processes in Which Metal Powder Releases the Gas

Patentee	U. S. Patent No.	Subject
Aylsworth, et al	1, 087, 098	Molded cementitious block in which aluminum, magnesium or zinc powder is used in contact with alkaline hydroxides to form gas bubbles to make block porous.
Schenck	1, 622, 396	Porous concrete produced by gas from aluminum powder.
Lindman	1, 791, 820	Cellular concrete produced by gas from a metal powder.
Eriksson	1, 819, 018	Porous cement produced by gas from a metal powder.
Walter	1, 829, 381	Porous cement produced by gas from a metal powder.
Nelson	1, 863, 990	Porous cement produced by gas from a metal powder.
Clark	1, 959, 658	Cement of increased coverage ability extended by gas generated from aluminum powder and alkaline hydroxides.
Stewart	1, 965, 538	Porous cement produced by gas from powdered magnesium.
Hill	2, 109, 532	Asbestos cement sheets aerated by reaction of aluminum or zinc powder with caustic solution.
Henderson	2, 119, 860	Cement expanded by reaction of aluminum powder and alkalies.
Hybinette	2, 120, 468	Concrete expanded by use of treated aluminum flakes.
Hybinette	2, 153, 837	Concrete in which aluminum flakes or powder are used as a gas-producing agent.
Brownmiller	2, 198, 601	High aluminate cements expanded by hydrogen gas released by aluminum flakes.
Scherer, Jr	2, 205, 734	Porous insulating material made with aluminum powder, a refractory composition and a viscose solution which generate gas.
Scherer, Jr	2, 205, 735	Porous insulating material in which aluminum powder is used as a gas-generating material.
Brownmiller	2, 235, 008	High aluminate cements employing aluminum powder as a gas-generating agent.
Schless	2, 235, 176	Cement-fibrous wall boards having aluminum powder applied as a raising agent by the fan belt of the board-former.
Knibbs, et al	2, 241, 604	Artificial stone which may include aluminum dust to cause porosity.
Vollmer	2, 288, 556	Permeable well packs expanded by finely divided aluminum.
Welshans	2, 301, 101	Hot top for an ingot mold of portland cement in which powdered aluminum is used as a gas-generating agent.
Bley	2, 341, 509	Viscose solution for manufacture of viscose sponges containing metal powder such as aluminum powder.

V. APPLICATIONS OF METAL POWDERS—Continued

8. Expanded Materials and Pressure Processes in Which Metal Powder Releases the Gas—Continued

Patentee	U. S. Patent No.	Subject
Baker	2, 373, 006	Means for operating well apparatus wherein gradual generation of fluid pressure is produced by chemical reaction between zinc shavings and hydrochloric acid.
Billner, et al	2, 376, 414	Utilizing aluminum powder as gas-generating agent in concrete.
Alderson, Jr	2, 387, 730	Powdered nickel or iron may be used in preparing cellular materials from ethylene polymers.
Gardner	2, 398, 703	A metalloidal honeycombed structure is made of zinc, magnesium, and aluminum particles bonded in an acidic resinous binder which in reaction with the metal produces gas to give the cell structure.
Gardner	2, 411, 202	A metal powder is used as one reactant in filling a float.

9. Explosives and Explosive Compositions, Photographic Flash Powders, Projectiles, Bullets, Rivets, Etc.

Langhammer	2, 226, 002	Sizing and finishing porous metal bullets comprising compressed and sintered metal powders.
vonHerz, et al	2, 261, 195	Explosive composition for detonating rivets employing metal powders.
vonHerz, et al	2, 293, 373	Improved charge for explosive rivet comprising explosive ingredient, good metal powder conductor and another substance of good thermal conductivity.
Weber	2, 313, 210	Wrapper for explosive cartridge containing powdered aluminum, magnesium or iron, preferably mixed with metallic oxides.
Fisher	2, 314, 614	Filling for incendiary bombs consisting of mixing magnesium dust with paper pulp and water.
Hodgson	2, 315, 853	Projectile for small caliber cartridges comprising powdered lead and iron oxide enclosed in continuous sheath.
Nickel	2, 316, 358	Flash powder for flashlight photography of sodium nitrate and magnesium powder.
Snelling	2, 333, 275	Explosive comprising aluminum powder, nitrostarch, coal dust, etc.
Holt	2, 338, 719	Dummy bomb containing pale gold bronze powder for marking purposes.
Watt, et al	2, 344, 840	Explosive composition containing ammonium nitrate grains coated with gelatinized explosive nitric ester, utilizing aluminum powder.

V. APPLICATIONS OF METAL POWDERS—Continued

9. Explosives and Explosive Compositions, Photographic Flash Powders, Projectiles, Bullets, Rivets, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Geria	2, 352, 951	Chemically heated liquid containers, particularly those used in skin and hair reconditioning therapy, utilizing aluminum or iron powder to heat surrounding liquid
Church	2, 353, 693	Applying a rotating band to a projectile which comprises encircling projectile with metal powder, compressing and simultaneously sintering and brazing to projectile wall.
Forbes	2, 354, 451	Cartridge for chain shot having fusible casing of tin, lead and bismuth using thermit in some types to melt casing.
Davis	2, 356, 149	Explosive composition utilizing aluminum powder.
Brun	2, 356, 210	Priming composition for ammunition which may utilize metal powders which do not oxidize easily, such as lead, tin, bismuth.
Calkins	2, 360, 473	Projectile driving band comprising porous metal bearing surface consisting of compressed and sintered metal powders.
Bagley	2, 369, 517	Explosive composition comprising compressed mixture of powdered basic perchlorate of lead and aluminum powder.
Hanley	2, 370, 159	Electric squib comprising flame producing mixture of finely divided selenium, lead and aluminum.
Choate, et al	2, 377, 675	Utilizing powdered aluminum or iron particles in a bomb or hand grenade.
Cadwell	2, 383, 040	Finely divided aluminum is used in an igniting powder in an exothermic reaction to produce molten metal.
Christie	2, 398, 287	An incendiary composition for filling a bullet consisting of powdered aluminum-magnesium alloy in equal amount with $BaNo_3$.
Hensel, et al	2, 401, 483	Powdered nickel, iron, cobalt, etc., are used in the making of projectiles, including shrapnel projectiles.
Burrows, et al	2, 403, 907	Powdered aluminum is used in making a black powder charge for an electric ignition assembly.
Wright, et al	2, 407, 597	Metal powders are used in the preparation of a low-freezing explosive compound.
Finkelstein, et al	2, 409, 201	Zinc dust, grained aluminum, etc., may be used in producing a smoke-producing mixture for use in munitions.
Patch, et al	2, 409, 307	Powdered iron, nickel, etc. are used to make a porous bullet impregnated with lead.

V. APPLICATIONS OF METAL POWDERS—Continued

10. Filtering Materials and Other Porous Articles

Patentee	U. S. Patent No.	Subject
Davis	2, 157, 596	Producing porous metallic sheet by heating to alloy nickel and copper powders spread loosely on graphite mold.
Davis	2, 220, 641	Producing porous metallic sheet by sintering together thin layer of intimately mixed noncompacted copper and nickel or tin powders.
Hildabolt	2, 267, 918	Producing porous sheet consisting of two different degrees of porosity by sintering two noncompacted layers of varying grain size metal powder.
Truxell, et al	2, 297, 817	Filter element made by sintering metal powders to apertured plate.
Koehring	2, 300, 048	Porous sheet for use as a filter, in which different sized metal grains are settled by gravity and sintered to produce a sheet of greater porosity on one side than on the other.
Reinsch	2, 359, 386	Fluid separating apparatus, such as gasoline filter, comprising porous metal membrane of sintered noncompacted metal powders.
Guellich	2, 378, 476	Filtering disc for coating apparatus formed of compressed and sintered metal powders.
Wright	2, 391, 609	Steel fragments or balls may be used as filtering material within a tubular holder, as an oil well screen.
Gardner	2, 394, 993	Powdered metal is bonded by rosin substances to form porous material that floats on water and is nonconductive of electricity.
Gardner	2, 395, 266	Aluminum powder is used to fill floats used for boat or aircraft hull or wing use.
Rasmussen	2, 401, 797	Metal powder, such as a mixture of 90 parts copper and 10 parts tin, is used to form a porous block for cooling and purifying oil in an internal combustion engine.
Walker, Jr	2, 404, 872	Comminuted metals may be used in the filter of an apparatus for separating immiscible fluids.
Marvin, et al	2, 409, 295	A metal lower in the electrochemical series than the metal of a porous article, is coated on the surfaces of the pores so that the surface characteristics are those of the coating metal and the porosity is not destroyed.

V. APPLICATIONS OF METAL POWDERS—Continued

11. Friction Materials Such as Brake Linings, Clutch Facings, Etc.

Patentee	U. S. Patent No.	Subject
Bluhm	Reissue 18,865 of 1,722,890.	Brake lining, etc.; powdered lead may be incorporated in textile fabric.
Boegehold, et al	1, 757, 408	Brake lining may be made by coating fibers with powdered metal, sintering after the weaving operation.
Fisher	2, 072, 070	Producing friction article for brakes and clutches by pressing and heat treating metal powders and nonmetallic material.
Swartz	Reissue 22,282 of 2,161,597.	Bonding metal powder to copper-plated steel body by heat and pressure in manufacture of brake linings, etc.
Wellman	2, 178, 527	Producing friction body for brakes and clutches by welding porous facing to ferrous metal backing.
Wellman	2, 239, 134	Producing sintered friction articles using powdered copper produced by chemical precipitation of copper from salt solutions.
Imes	2, 277, 107	Producing metallic clutch facing element comprising wire mesh within sintered mass of metal powders.
Tormyn	2, 287, 952	Making brake drum having braking surface of pressed and sintered powdered metal.
Calkins	2, 299, 877	Frictional material comprising introducing powdered asbestos into pores of layer of porous metal.
Marvin, et al	2, 332, 737	Laminated friction element which comprises compressed porous cuprous material bonded to substantially flat compressed porous ferrous supporting member.
Wellman	2, 342, 772	Apparatus applicable to production from metal powders of friction brake and clutch linings or facings.
Gleszer, et al	2, 359, 361	Composite friction element for use as brake or clutch, consisting of iron friction surface with copper backing bonded to steel plate.
Walker	2, 369, 502	Friction element comprising metal powders such as soft iron, copper or aluminum and heat hardened organic binder.
Wellman, et al	2, 381, 941	Facing layer of frictional apparatus is made of compacted powdered metals.
Salle	2, 388, 187	Metal chips or powders are used in making friction facing for brake linings.
Kuzmick	2, 389, 061	Powdered metal used in making a friction element, or for bearings, to be used alone or bonded to a metal backing.
Gilbert	2, 389, 772	Clutch disks of the invention may be formed of bronze made from powdered material.
Lowey, et al	2, 408, 430	Powdered copper, tin, iron, etc., are used as friction materials in the making of brake lining for vehicles.

V. APPLICATIONS OF METAL POWDERS—Continued

12. Heat-Conducting or Reflecting Material Such as for Heating Elements and Insulation, Respectively

Patentee	U. S. Patent No.	Subject
Jones	1, 893, 330	Permeable metal for heaters, etc., comprising bonded metallic particles which have been subjected to action of magnetic field.
Seving, et al	2, 029, 679	Metal flakes intermingled with acetate cellulose foils to provide heat-ray reflecting insulation similarly as provided by thin all-metal foils.
Munters	2, 037, 813	Insulation material comprising sheets of foil faced with heat reflecting particles, such as aluminum powder.
Doczekal	2, 110, 660	Thermal insulation comprising sheet coated with metal powders which is electrically heated.
Howe	2, 192, 742	Sintered furnace heating element employing iron and aluminum powders.
Ferguson, et al	2, 311, 526	Luting material incorporating heat conductive metal powders, such as aluminum flake.
Ziegs	2, 319, 363	Electrical heating conductor comprising metal of platinum group coated with powdered metal of earth and alkaline metals.
Schleicher, et al	2, 325, 553	Refractory faced porous insulating brick obtained by impregnating ordinary porous brick with bonded zirconium refractory.
Ferguson, et al	2, 329, 113	Heat-conductive luting material, useful in ice cream cabinets, employing aluminum flakes.
Hampton	2, 356, 583	Heat transferring element for electrically heated soldering tool having tapering portion of copper coated with iron and aluminum (calorized).
Rowland, et al	2, 357, 550	Forming glaze on insulators to which coating of metal powder may be directly applied.
Fry	2, 359, 983	Top heating unit for electric ranges in which heating resistance is embedded in disc of powdered and sintered metal.
McCormack	2, 361, 854	Refrigerating apparatus having water jacket to which is secured porous sintered metal sheet to increase condensing surface.
Hunter, et al	2, 377, 153	Insulated electric cable utilizing conductive metal powders in plastic material.
Bandur	2, 379, 947	Apparatus for detecting defects in insulation of electrically insulated conducting structures which has core of compressed permalloy (nickel alloy) powder.
Elfving	2, 406, 815	Aluminum powder may be used in metal foils comprising a heat insulation element.

V. APPLICATIONS OF METAL POWDERS—Continued

13. Incandescent Filaments, Wires, Cathodes for Tubes, Flash Bulbs, and the Like (see Also "Explosives" for Loose Photographic Flash Powders)

Patentee	U. S. Patent No.	Subject
DeLodyguine	575, 002	Filaments formed by coating platinum wire with metal oxide or condensed metal and reducing in hydrogen.
DeLodyguine	575, 668	Improvement on 575,002.
Husselman	650, 178	Incandescent lamp filament of a fused mixture of iodine, aluminum shavings and alcohol on a base of asbestos.
vonBolton	817, 732	Producing incandescing body for electric glow lamps from pure, powdered tantalum and paraffin as binder.
vonBolton	817, 733	Producing substantially pure, ductile metallic tantalum by passing electric current through compressed powders of tantalum compounds.
vonBolton	817, 734	Producing incandescing body containing ductile alloy of metals of vanadium group using metal powders.
Heany	842, 546	Electric lamp luminants made from tungsten, titanium, zircon, etc., sintered in shape from pure powdered metals or powdered metal oxides, etc.
vonBolton	891, 223	Manufacturing filaments of electric incandescent lamps by drawing to filament form heated body of tantalum powder.
vonBolton	905, 402	Filaments made with metal powders, to which the agglutinant for the powder has added carbon; this carbon is removed by heating filaments in acetic acid vapors.
Lederer	908, 682	Manufacturing incandescence bodies by reducing paste containing metal oxide, carbon and aluminum.
Zerning	908, 930	Filaments are decarbonized by adding phospham and phosphorus to metal powder for coating filament, depending on amount of carbon-containing binder used.
Kuzel	914, 354	Filament produced from alloy of finely divided refractory metal and antimony.
vonBolton	927, 935	Manufacturing filaments comprising electrically heating mixture of comminuted highly refractory metal and comminuted ductile metal.
vonBolton	930, 723	Producing filament by working tubes containing ductile metal, very ductile metal and refractory metal powder.
vonBolton	936, 403	Producing filaments by working tube of refractory metal powder in ductile metal.
Majert	946, 551	Salt of tungstic acid heated with lampblack in presence of hydrogen as reducing agent.
Schilling	950, 869	Tungsten compound heated in nonoxidizing atmosphere so that reducing agents that are separated act upon oxides of tungsten present.

V. APPLICATIONS OF METAL POWDERS—Continued

13. Incandescent Filaments, Wires, Cathodes for Tubes, Flash Bulbs, and the Like—Continued

Patentee	U. S. Patent No.	Subject
Coolidge	963, 872	Producing lamp filament by treating, to remove vaporizable components, threads of refractory material in colloidal solution.
Kuzel	969, 064	Producing filament from plastic mass containing peptisated colloidal metals.
Kitsee	971, 385	Producing filament from bar tungsten phosphide made from metal powders.
von Welsbach	976, 526	Incandescent filament composed of particles of osmium electrically welded into thread.
von Welsbach	976, 527	Finely divided osmium paste is coated on a base of an organic thread to form a filament.
Appelberg	1, 011, 708	Treating tungsten powder by heating in vacuum before shaping into electric filament.
Weber	1, 016, 804	Finely divided tungsten and pulverized tellurium or tellurium dioxide are alloyed to form a tough filament.
Just, et al	1, 018, 502	Producing filaments by removing carbon from carbonized mixture of tungsten and organic binding medium.
Bresler	1, 023, 295	Finely divided tungsten or molybdenum are held together by a small-carbon-residue binder of ammonium viscose to make a filament coating paste.
Coolidge	1, 026, 343	Filament forming plastic is made from tungsten, etc., powder mixed with a binder of warm amalgam of cadmium, mercury and bismuth.
Coolidge	1, 026, 344	Powdered tungsten is bound together with an alloy of cadmium, lead and mercury.
Coolidge	1, 026, 382	Making filament by incorporating tungsten powder in ductile alloy, shaping and treating to drive out components except refractory material.
Coolidge	1, 026, 383	Making filament from semi-plastic mass composed of amalgam impregnated with refractory metal powder.
Coolidge	1, 026, 384	Making filament from refractory metal powders, ductile alloy as binder, and diluting compound.
Hansen	1, 026, 392	Making filaments from refractory metal powders and binder of a metal oxalate which decomposes and forms refractory oxide.
Coolidge	1, 026, 428	Iron removed from tungsten compound by firing at sufficient temperature.
Coolidge	1, 026, 429	Producing electrical conductors suitable for use in incandescent lamps by sintering refractory element impregnated with ductile metal.
Wood	1, 027, 165	Producing metal filaments by baking wire of cadmium-amalgam impregnated with tungsten to drive out mercury.

V. APPLICATIONS OF METAL POWDERS—Continued

13. Incandescent Filaments, Wires, Cathodes for Tubes, Flash Bulbs, and the Like—Continued

Patentee	U. S. Patent No.	Subject
Lederer	1, 034, 018	Preparing tungsten filaments from paste comprising tungsten dioxide and carbonaceous binder.
Arsem	1, 034, 949	Manufacturing filaments by heat treating refractory metal powder and ductile metal.
Lederer	1, 035, 883	Making filaments from paste containing powdered tungsten, oxide of zinc and suitable agglutinant.
Kuzel	1, 037, 268	Manufacturing filaments from plastic mass containing colloidal oxides and hydroxides of difficultly fusible metals then reduced.
Lederer	1, 047, 540	Tungsten filament produced by hydrogen reduction of threads formed of paste of a tungstate mixed with a binder.
Lederer	1, 071, 325	Similar to 1,047,540 with different binders and methods of forming paste.
Hansen	1, 075, 563	Filament formed by reduction in hydrogen of thread of powdered oxide of tungsten and binder.
Coolidge	1, 077, 674	Making filaments by heating and treating molded article comprising refractory material incorporated in metallic binder.
Lederer	1, 079, 777	Making filaments from paste comprising amorphous sulfur added to metal powders.
Madden	1, 081, 618	Preparing billets of refractory materials for use as filaments by applying pressure to powdered metals in pliable mold.
Coolidge	1, 082, 933	Producing ductile tungsten wire from sintered body of tungsten powder by drawing.
Scholl	1, 086, 088	Making filaments from paste of tungsten and casein and removing carbon with hydrogen.
Frech, Jr	1, 089, 757	Tungsten oxide is mixed with a small amount of a thorium compound, oxidized and reduced and ground to a fine powder especially suitable for filaments.
Gladitz	1, 091, 430	Press-mold for manufacture of bars from finely divided powders, particularly tungsten bars or rods for production of wire or filaments.
Hurwitz	1, 099, 704	Filament of tungsten powder sintered and shrunk under tension into desired shape.
Scoular	1, 104, 557	Making filaments by heating formed articles comprising paste of tungsten powder and sodium silicate solution as binder.
von Welsbach	1, 109, 886	Making electric filament wherein a platinum wire may be coated with powdered osmium in organic binder.
von Welsbach	1, 109, 888	Filament is produced from a paste of osmium, zirconium oxide and carbon which produces an alloy of zirconium and osmium.
Liebmann	1, 111, 698	Producing ductile bodies for filaments by reducing and sintering compact mass of metal powder and powdered oxide of same metal.

V. APPLICATIONS OF METAL POWDERS—Continued

13. Incandescent Filaments, Wires, Cathodes for Tubes, Flash Bulbs, and the Like—Continued

Patentee	U. S. Patent No.	Subject
Lederer	1, 116, 450	Tungsten filaments have carbon left by the binder removed by heating in an atmosphere of hydrogen.
Thowless	1, 123, 625	Tungsten powder, zirconium oxide are made into paste with a binder, extruded as a filament, sintered and given a tungsten flashing.
Rafn	1, 130, 197	Tungsten-trioxide is heated in ammonia gas; product is heated in hydrogen at high temperature.
Lederer	1, 132, 523	Making filaments from tungsten powder and aromatic substance, such as camphor, as binder.
Blau	1, 135, 154	Carbon is removed from pressed powdered metal having a carbon binder, by heating in nitrogen and hydrogen atmosphere.
Kruger	1, 154, 701	Making filaments from powdered tungsten, carbon and boracic acid.
Scoular	1, 178, 418	Tungsten powder mixed with sodium silicate solution is formed into raw filaments which are sintered and dipped in hydrofluoric acid.
Lederer	1, 180, 264	Addition of thorium oxide to filament-forming tungsten paste to delay change over of the filament into crystalline structure.
Farkas	1, 188, 057	Producing flexible filaments by passing pressed filaments through heated hydrogen reducing to pure metallic state.
Nishimoto	1, 201, 611	Powdered tungsten and thorium, pressed and sintered in stick form, are drawn into filament.
Baumann	1, 205, 080	Producing filaments from rod made by heat treating tungsten powder and auxiliary metal.
Helfgott	1, 206, 704	Producing malleable tungsten for wires by pressing and sintering mixture of coarse-grained and fine-grained tungsten powder.
Oberlander	1, 208, 629	Molybdenum filament produced by forming paste of powdered metal halide pressing into desired form and reducing in hydrogen.
Thowless	1, 226, 925	Making ductile filament by sintering compressed metal powder in mixture of dry hydrogen and vapor of refractory metal halogen salt.
Schaller	1, 256, 929	Pulverized tungsten containing 2% thorium oxide is pressed into a continuous filament, heat treated to form a long, single crystal.
Schaller	1, 256, 930	Tungsten filament of a single crystal throughout its length and cross section.
Keyes	1, 270, 842	Undesirable ingredients are removed from tungsten powder by action of a metal dissolved in ammonia, plus heating.

V. APPLICATIONS OF METAL POWDERS—Continued

13. Incandescent Filaments, Wires, Cathodes for Tubes, Flash Bulbs, and the Like—Continued

Patentee	U. S. Patent No.	Subject
Orange	1, 297, 000	Filaments formed by reducing, sintering and working tungsten oxide particles coated with a metallic film of auxiliary metal.
Pacz	1, 299, 017	For making a drawn tungsten filament free from offsetting, tungsten powders are derived from chemical compounds of tungsten having different bases.
Farkas	1, 323, 623	Drawing wire for filaments from heated bar of pressed tungsten powder.
Gebauer	1, 359, 353	Making electrodes for vacuum tubes by compacting and heat treating finely divided metal powders.
Myers	1, 363, 162	Offsetting of tungsten filaments is prevented by addition of, e. g., calcium and magnesium oxide.
Pacz	1, 410, 499	Tungsten metal is produced by reducing an oxide of tungsten with compounds containing silicon and oxygen and an alkali metal.
Hall	1, 461, 117	Non-sag tungsten filament is made by adding thoria or alumina compounds to tungsten powder at start of process.
Hall	1, 461, 118	Filament in which crystalline formation may be controlled in which thoria and silica are added to tungsten powder.
Pacz	1, 468, 073	Filament wire produced from slugs of finely divided tungsten having silicon incorporated therewith, sintered and mechanically worked.
Yunck	1, 469, 761	Ingot for forming filaments, of a cylinder of ductile metal, packed with powdered tungsten or alloy and closed, swaged to reduce diameter and composite rod heated to vaporize metal envelope.
Fonda	1, 496, 457	Filament having 1% by weight iron powder mixed with tungsten powder.
Aoyagi	1, 500, 789	Manufacturing ductile filaments by heating rods of high-fusing metals molded from metal powders, hung vertically until rods elongate to proper length.
Pacz	1, 508, 241	Nonsagging tungsten filament derived from an intimate mixture of finely divided tungsten and a compound or compounds containing oxide of tantalum or niobium or both.
Graaff	1, 552, 122	Pure tungstic acid is treated at high temperature and reduced; resultant powder is subjected to pressing, hammering, etc.
Fernberger	1, 558, 000	Crystals of a double salt of tungsten containing ammonium and potassium are converted to tunsten oxide, then to tungsten metal to be pressed, sintered and worked into filaments.

V. APPLICATIONS OF METAL POWDERS—Continued

13. Incandescent Filaments, Wires, Cathodes for Tubes, Flash Bulbs, and the Like—Continued

Patentee	U. S. Patent No.	Subject
Smithells	1, 559, 799	Tungstic oxide paste has added to it sodium chloride and thorium nitrate, mixed, dried, and reduced, sintered, then worked into wire.
Boving	1, 562, 202	Filament alloy made from powdered tungsten, e. g., exposed to the vapor of an alkaline earth metal such as barium.
Laise	1, 569, 095	Filament of alloys of powdered tungsten, thorium, and vanadium with finely divided refractory light emitting oxides interspersed throughout.
Just	1, 585, 497	Tungsten oxide serving as derivation material for tungsten powder for producing filaments, is fused preliminary to reduction, producing a powder which makes a more compact sintered rod.
Van Arkel	1, 601, 931	To increase the cross section of a tungsten filament, it is placed in tungsten chloride vapor from which tungsten dissociates and settles on the crystal. Powdered tungsten is used to produce the vapor.
Gero	1, 602, 525 1, 602, 526 1, 602, 527	Tungsten powder for forming filaments of definite crystal structure is made by mixing, with tungsten oxide, a soluble salt of alkali or alkali-earth metals, and reducing.
Fonda	1, 623, 784	Filament alloy of finely divided metallic tungsten, metallic thorium and copper, sintered, swaged, and drawn.
Gustin	1, 626, 235	Getter is applied to lamp filament by dipping portion of it into powdered aluminum.
Laise	1, 631, 493	Specially prepared tungsten metal is combined and b ıllmilled with boron nitride before sintering and forming.
Pacz	1, 635, 055	Zirconium dioxide is mixed with magnesium powder, heated, further treated and mixed with powdered tungsten and silica, reduced and worked.
Fonda	1, 648, 679	Less than 1 percent by weight of boron is added to tungsten powder before sintering, decreasing tendency of helical filament formed therefrom to sag.
Marden	1, 648, 954	Oxidation of uranium powder is prevented by alloying it with powdered aluminum and powdering the alloy. During later heat treatment, aluminum distills off.
Koref, et al	1, 650, 631	A large tungsten crystal is sintered from powdered tungsten which is then worked into wire.
DeGraaff	1, 662, 027	To produce a filament, pure tungsten acid is mixed with 0.6 percent potassium bichromate and reduced to a very fine powder, which is pressed, sintered, and worked.
Meister	1, 663, 560	Evaporation of tungsten filaments is reduced by adding powdered molybdenum to powdered tungsten in addition to doping of thorium oxide, etc.

V. APPLICATIONS OF METAL POWDERS—Continued

13. Incandescent Filaments, Wires, Cathodes for Tubes, Flash Bulbs, and the Like—Continued

Patentee	U. S. Patent No.	Subject
Marden, et al	1, 665, 636	Tungsten formed in filament by mixing tungsten powder and thorium carbide, and forming, heat treating, and working.
Schumacher	1, 668, 734	To produce a thermionic cathode a tungsten filament is heated in vacuum with powdered uranium, etc.
Gero	1, 685, 915	Target for X-ray tubes produced by cold pressing powdered thorium.
Gero	1, 719, 975	Swaged thorium rod, probably for use in making filaments, is annealed in an enclosed bomb, wherein it is packed in powdered thorium and tungsten which react with any impurities.
Fonda	1, 721, 383	Finely divided metallic tungsten mixed with, by weight, 0.5 percent metallic thorium and 0.3 percent boron nitride, made into a filament.
Van Liempt	1, 728, 814	Unicrystalline wire is formed in a coil and treated according to patent 1,601,931.
Marden	1, 728, 942	Uranium is alloyed with zinc to permit powdering, and subsequent heat treatment in vacuo for fusing uranium into coherent form to make wire, filaments, etc.
Gero	1, 731, 244	Electron-emitting body made by heat treating tungsten, molybdenum, and thorium powders.
Ramage	1, 733, 752	Nonsag single crystal filament is formed from a pressed slug of pure tungsten powder passed through a very hot zone at a very slow rate of speed in a vacuum.
Marden, et al	1, 760, 367	Resistors are made from chromium powdered, sintered, and worked.
MacFarland	1, 800, 691	Alloy for manufacturing resilient wire produced by treating powdered metals.
Noddack, et al	1, 829, 756	Rhenium is used to make electric glowers by the usual process of sintering metal powder and a binding agent. Rhenium does not form a carbide as does tungsten.
Bates	1, 896, 606	Tungsten filament produced by mixing intimately, finely divided tungsten and metallic silver, compacting and sintering to volatilize all silver, and working.
Wiegand	1, 902, 478	Hot cathode of high emission capacity made by pressing metal powder to shape and filling pores with molten barium.
McCulloch	1, 922, 254	Thermionic tube cathode is made by painting finely divided nickel in volatilizable vehicle onto porcelain tubing, and sintering coating.
Driggs	1, 965, 222	Tungstic oxide is "doped" prior to reduction to metal especially suited as incandescent lamp filaments.

V. APPLICATIONS OF METAL POWDERS—Continued

13. Incandescent Filaments, Wires, Cathodes for Tubes, Flash Bulbs, and the Like—Continued

Patentee	U. S. Patent No.	Subject
Ruben	1, 981, 878	Lamp filament is made by coating molybdenum wire with powdered beryllium metal that has been incorporated with a solution of amyl acetate in nitrocellulose.
Alexander	2, 038, 402	Filaments of refractory metals made from metal powders prepared by reducing the metal halides.
Millner, et al	2, 076, 381	Manufacturing filaments of large crystal structure comprising sintering in nonoxidizing atmosphere and heating in atmosphere containing water vapor, a rod bar or filament made of finely divided tungsten.
Braselton	2, 077, 873	Lamp filament ingot formed by reducing in hydrogen a dehydrated powder of tungsten trioxide and alkali metal tungstate, compacting product and baking, thereby volatilizing residual alkaline compound.
MacFarland	2, 078, 182	Tungstic acid and potassium fluotitanate are mixed, evaporated, heated to reduce tungstic anhydrid and decompose fluotitanate, and heated in molded form to obtain pure tungsten metal.
Southgate	2, 097, 502	Method of producing solid or hollow rods or wires by compacting metal powders in die and extruding compacted material continuously therefrom.
Abe, et al	2, 109, 762	Nonsag filament produced from a mixture of pure tungsten metal particles and oxide coated tungsten particles sintered into an ingot and reduced to large, pure tungsten particles.
Laise	2, 114, 426	Metal powder for filament produced so as to consist of a mixture of fine and somewhat coarser particles of tungsten coated with a thin film of alkaline tungstate.
Schwarzkopf	2, 172, 548	Producing electrical wires comprising sintering nickel, cobalt and iron in purest state.
Laise	2, 202, 108	Filament alloy of tungsten and a small percentage of rhenium for which tungsten and rhenium powders have been ball-milled together.
Iredell	2, 215, 645	Improving quality of tungsten wire by heating in hydrogen atmosphere.
Pipkin	2, 291, 983	Flash lamp having light-giving material composed of sensitive metal powder and oxidizing powder bonded by suitable binder.
Pirani	2, 300, 959	Cathode formed from barium aluminate or chromate and a reducing agent such as zirconium powder.
Sylvester	2, 305, 561	Flash lamp comprising exploding cartridge of powdered aluminum in bulb filled with combustion-supporting gas.
Cooper	2, 325, 041	Product adaptable for electric wire formed by heating copper body in presence of powdered copper beryllium.

V. APPLICATIONS OF METAL POWDERS—Continued

13. Incandescent Filaments, Wires, Cathodes for Tubes, Flash Bulbs, and the Like—Continued

Patentee	U. S. Patent No.	Subject
deBoer	2, 325, 667	Flash lamp in which metal foil, wire or powder may be used to yield oxygen to supplement the gaseous filling.
Germeshausen, et al	2, 331, 771	Gaseous electrical discharge tube system using alkali metal powder as active material of the cathode.
Schmid	2, 332, 116	Incandescent electric lamp comprising a bulb with a base secured thereto by cement, including finely divided conducting material, such as aluminum, which is adapted to bypass current upon failure of lamp filament.
Garner	2, 339, 392	Cathode comprising coherent refractory metal base, layer of powdered refractory metal particles sintered to base, and thorium oxide particles on and intermingled with these sintered particles.
Herrmann	2, 342, 278	Making selenium cell which comprises placing layer of amorphous selenium powder on base plate and pressing together at high temperature.
Elmendorf	2, 342, 575	Flash lamp having bulb containing loose filling of readily combustible material, such as metal foil, or filamentary wire or ribbon of aluminum or its alloys.
Atwood	2, 343, 630	Magnetic and electrostatic shield for cathode ray tube consisting of particles of electrically conductive material of high magnetic permeability such as pure iron, applied in an adhesive binder to tube.
Aicher	2, 353, 635	Cathode for discharge tubes which is made of finely divided conductive metal powder added to activating mixture, such as barium carbonate or oxide.
Pipkin	2, 361, 495	Photoflash lamps containing fulminating substance comprising mixture of sensitive metal powders.
Clark	2, 362, 468	"Getter" for cleaning up residual gas in vacuum devices utilizing refractory metal such as columbium or tantalum, in sintered, porous body.
Hefele	2, 373, 395, 2, 373, 396.	Target structure for electron discharge device comprising conducting backing element of silver having "hills and dales" of insulating material which may have metal powders added and photosensitive material attached thereto.
Kalil, et al	2, 375, 742	Photographic flash lamp employing zirconium powder.
Kurtz	2, 389, 060	Metal powders of tungsten, nickel and platinum are formed into refractory body to be coated and used as cathode for radio tube.

V. APPLICATIONS OF METAL POWDERS—Continued

13. Incandescent Filaments, Wires, Cathodes for Tubes, Flash Bulbs, and the Like—Continued

Patentee	U. S. Patent No.	Subject
Saslaw	2, 403, 026	Powdered selenium is comprsesed into a wafer and then converted to metallic form by heating to make a selenium tablet.
Laico, et al	2, 404, 802	A caesium pellet, disclosed in patent 2,178,-227, is used in a photoelectric tube; the pellet contains caesium chromate, chromic oxide, and powdered aluminum.
Stafford	2, 404, 803	Powdered aluminum, caesium chromate, and cromic oxide are compressed to form a pellet used in a photoelectric tube.
Craig	2, 405, 089	Powdered platinum, gold, and silver are used to make metallic glass for gaseous discharge tubes.
Freund	2, 405, 349	A mixture of zinc powder, zinc oxide, and some mercury oxide is used in an accumulator for electric torches or flash lamps.
Pratt	2, 409, 514	Powdered metal coatings are used for the inner wall of a cathode ray tube.

14. Insecticides

Britton, et al	2, 295, 074	Purifying phenothiazine, commonly used as insecticide, by treating with metal powder, such as aluminum, antimony, copper, or lead.
Moore, et al	2, 325, 790	Diallyl maleate, an insecticide, incorporating bronze powder.
Moore et al	2, 325, 791	Diamyl maleate, an insecticide, which may include bronze powder.
Pearce, et al	2, 344, 895	Preparing basic calcium arsenate which may incorporate zinc or other suitable metal powder for use as insecticide.
Pearce, et al	2, 368, 565	Producing zinc calcium arsenate as insecticide by heating mixture of powdered dicalcium arsenate and powdered zinc.
McLain, et al	2, 385, 636	Powdered aluminum is used with arsenous oxide as main ingredients of insecticide.
Bruson	2, 395, 454	Copper powder is used in a toxicant for insecticidal compositions and for lubricating oil compositions.

15. Lubricants and Oils

Lincoln, et al	Reissue 22,448 of 2,302,703.	Lubricant which may utilize zinc dust as thickening ingredient.
Henry, et al	2, 322, 438	Dewaxing lubricant stocks using cold, immiscible metal powders in solution of waxy oil in dewaxing solvent.

V. APPLICATIONS OF METAL POWDERS—Continued

15. Lubricants and Oils—Continued

Patentee	U. S. Patent No.	Subject
Fuller, et al	2, 326, 938	Mineral oil, which may be used as lubricant, containing iron granules.
Wulff	2, 334, 738	Lubricant comprising metal powder, such as antimony or bismuth, incorporated in hydrocarbon lubricating oil.
Howard	2, 338, 941	Refining petroleum distillates utilizing permeable mass of zinc in oxidized condition for removal of any residual heavy reaction products.
Becker	2, 339, 371	Lubricant comprising a lubricating oil, and sulfurized halogenated phosphatidic material, which may include iron particles as halogen carrier.
Cook, et al	2, 345, 239	Lubricating oil utilizing metal salts prepared by treating free amino compound with powdered aluminum.
Lincoln	2, 350, 783	Lubricating oil which may incorporate metal salts or metal powders.
Lincoln, et al	2, 353, 169	Producing lubricant utilizing finely divided metal, such as copper, as treating agent.
Downing, et al	2, 356, 661	Lubricating oil utilizing copper powder.
Amott	2, 378, 820	Lubricating oil using zinc powder or zinc oxide powder.
Lincoln, et al	2, 380, 454	Zinc dust is added to a lubricating oil to improve its characteristics.
Morgan, et al	2, 383, 148	Finely divided lead is incorporated in a lubricating grease.
Engelke	2, 392, 468	Finely divided silver is used in preparing a phosphite ester to be used as a lubricant additive.

16. Magnetic Materials and Articles

Currie	421, 067	Iron chips, filings or shavings are compacted with powdered asbestos or silicate of soda to form magnet core.
Pfannkuche	476, 816	Electric converter having a magnetic envelope of paraffin insulated iron particles surrounding primary and secondary conductors.
Fritts	874, 908	Magnet used in "current varying apparatus" of invention is made of "iron by hydrogen" insulated and formed to shape or packed in a casing.
Gerding	1, 142, 034	Magnet core having a tubular body divided in four sections down its length by a cruciform magnetic conductor, the four sections filled with iron filings.
Espenschied	1, 251, 651	Air gap for a magnetic ring core, for ring type coils used in telephone work, has increased permeability because it is molded from specially insulated iron dust.

V. APPLICATIONS OF METAL POWDERS—Continued

16. Magnetic Materials and Articles—Continued

Patentee	U. S. Patent No.	Subject
Speed	1, 274, 952	Telephone circuit loading coil core formed of 80 mesh iron particles made by "iron by hydrogen" process coated with red iron oxide and molded.
Elmen	1, 286, 965	Improvement on 1,274,952, using particles of electrolytic iron, annealed and coated with red iron oxide and compressed.
Woodruff	1, 292, 206	Improvement on 1,274,952 and 1,286,965 in which iron particles are first coated with lead, aluminum or zinc, and then insulated by coating with shellac.
Elmen	1. 297, 126	Improvement on 1,274,952, 1,286,965, 1,292,206; finely divided *hard* electrolytic iron is mixed with 5 to 10 percent finely divided *soft* iron, coated with zinc, insulated with shellac.
Elmen	1, 297, 127	Magnet core of type of 1,297,126 and others, using finely divided ferro-silicon in place of hard electrolytic iron.
Milton	1, 378, 969	Treatment of cores made according to 1,286,965; core is baked, demagnetized, and baked again.
Harris	1, 381, 460	Magnet core of type of 1,274,952 and 1,286, 965; particles used are annealed and flattened into small, thin flakes.
Elmen	1, 403, 305	Magnet core like 1,297,126, in which finely divided magnetic iron, etc., is treated with carbonizing agent to harden it.
MacKnight	1, 494, 070	Magnet core of powdered iron suspended in a fluid or mobile insulating compound.
Elmen	1, 523, 109	Magnet core like 1,297,126 and others; finely divided particle of iron and nickel are heated to alloying temperature, the sintered mass then ground into alloy particles.
Tykocinski-Tykociner.	1, 590, 399	Sound motion picture film; hygroscopic character of film is varied in accordance with image, and wet film is dusted with magnetic metal powders, etc.
Buttles	1, 609, 460	Molding apparatus particularly adapted to forming magnetcores from finely divided magnetic material.
Vawter	1, 609, 745	Magnetic core formed of a mixture of iron dust and an insulating liquid binder such as lacquer, pressed to extract part of lacquer.
Ehlers	1, 615, 685	Magnetic core probably of type of 1,297,126 and others; press form may be filled with desirably varied mixtures of finely divided insulating materials and magnetic particles to achieve uniform compression.
Ehlers	1, 618, 818	Induction coil core made of powdered magnetic material and dry insulating material, pressed and heated to fuse one ingredient.
Zickrick	1, 632, 105	Producing alloy of magnetic material and antimony reduced to finely divided state.

V. APPLICATIONS OF METAL POWDERS—Continued

16. Magnetic Materials and Articles—Continued

Patentee	U. S. Patent No.	Subject
Legg	1, 647, 737	Magnet core of type of 1,297,126 and others; nickel-iron magnetic dust is insulated by a coating of lead sesqui-oxide.
Legg	1, 647, 738	Nickel-iron magnetic alloy particles have a spongy oxide coating formed thereon which is filled with powdered quartz.
Lowry	1, 651, 957	Magnetic core of type of 1,297,126 and others; finely divided magnetic material is insulated with a mixture of magnesium borate and silica.
Lowry	1, 651, 958	Magnetic core; finely divided magnetic material is insulated with magnesium oxide and zinc oxide.
O'Neill	1, 653, 467	Sound film of paper, etc., having a trail of magnetic metal dust in binder locally polarized under magnetic needle in recorder circuit.
Andrews	1, 669, 642	Magnetic core of type of 1,297,126 and others; "perm-alloy", finely divided, is insulated by coating with silicic acid and water glass and then coating with silicic acid and ferric oxide.
Andrews, et al	Reissue 20,507 of 1,669,643.	Magnetic particles insulated with chromic acid, water glass and talc.
Andrews, et al	1, 669, 644	Magnetic particles insulated with sodium silicate, bound with synthetic resin.
Andrews	1, 669, 645	Magnetic particles insulated with mercuric nitrate.
Bandur	1, 669, 646	Magnetic particles insulated with flux of boric acid and kaolin; compressed cores may then be impregnated with zinc hydroxide; heat treatment of compressed core is also claimed.
Bandur	1, 669, 647	Magnetic particles are treated with hydrated alumina, boric acid, then with kaolin, compressed and heat treated.
Bandur	1, 669, 648	Magnetic particles insulated with oxides of particles and given secondary coating of kaolin, compressed and heat treated.
Beath, et al	1, 669, 649	Making brittle magnetic alloys by melting nickel and iron in presence of oxygen and boiling molten material.
Elmen	1, 669, 658	Magnetic dust core heat treated after compression to restore magnetic and electrical properties lost during pressing.
Karcher	1, 669, 665	Magnetic dust is heat treated prior to insulation and compression. Higher temperature gives higher permeability.
Elmen	1, 695, 041	Magnetic dust core for which particles are given a spherical shape by spraying molten metal into water. Spherical form protects coating of insulation.
Ehlers	1, 698, 300	Manufacturing bodies of pressed powdered magnetic material.

V. APPLICATIONS OF METAL POWDERS—Continued

16. Magnetic Materials and Articles—Continued

Patentee	U. S. Patent No.	Subject
Andrews	1, 703, 287	Iron-nickel alloy for dust cores made brittle by partially oxidizing while molten, solidifying, and rolling while hot until below temperature of recrystallization.
Lowry	1, 714, 683	Magnetic dust core; particles of alloy are mixed with finely divided hydrated silica, mixture evaporated, formed into core and heat treated.
Elmen	1, 715, 541	Alloy of nickel, iron, cobalt, and molybdenum which may be used in accordance with methods for making permalloy dust cores.
Elmen	1, 715, 543	Magnetic core alloy of iron, nickel and cobalt which may be reduced to powdered form for making dust cores.
Ehlers	1, 721, 379	Permeability of magnetic dust cores is increased by impregnating the pressed core with colloidal solution of magnetic material.
Swinne	1, 725, 026	Magnetic dust cores, etc., are made of finely divided magnetic particles in monocrystalline form.
Smith, et al	1, 728, 451	Magnetic alloy of iron, chromium, and silicon powdered for use in dust cores.
Given	1, 733, 592	Magnetic dust cores for which permalloy dust having too low content of one component is mixed with dust having too high content of same, enabling formerly wasted dust to be used.
White	1, 739, 052	Nickel and iron alloy embrittled with sulphur to make easily reducible for use in magnetic cores.
Harris	1, 739, 068	Manufacturing finely divided magnetic material by allowing to solidify in water molten magnetic material and embrittling agent.
Zuger	1, 741, 751	Electricity meter driving magnet core made of pulverulent iron.
Bozorth	1, 747, 854	Magnetic dust core for which magnetic particles are mixed first with silica dust, heat treated, then separated from silica dust, insulated and pressed.
Given, et al	1, 759, 612	Magnetic dust core for which particles are given a pre-annealing heat treatment.
VanDeventer	1, 774, 856	Laminated magnetic core of paper coated with continuous layer of iron dust.
Eisenmann, et al	1, 783, 560	Magnetic core of iron powder, obtained from iron carbonyl, and montan wax.
Eisenmann, et al	1, 783, 561	Magnetic core as above, using resinous condensation product of urea and formaldehyde.
Elmen	1, 784, 827	Loading coil core containing finely divided, insulated and intermixed particles of hard steel and an iron-nickel alloy.

V. APPLICATIONS OF METAL POWDERS—Continued

16. Magnetic Materials and Articles—Continued

Patentee	U. S. Patent No.	Subject
White, et al	1, 787, 606	For use in magnetic dust cores, a high yield of dust is obtained from comminuting nickel-iron-chromium group alloys by incorporating therein 4 percent copper.
Roseby	1, 789, 477	Magnetic dust core particles are coated with iron phosphate and bound with synthetic resin varnish.
Harris	1, 790, 704	Magnetic dust core; yield of dust is increased by adding to iron-nickel, or iron-nickel-cobalt within 6 percent tin, bismuth or lead.
Chaston, et al	1, 795, 639	Magnetic dust core; insulated particles are compressed, conditioned in moist air or water and heat treated. Moisture causes insulation to swell.
Kelsall	1, 809, 042	Transformer core for high frequency currents, using finely divided nickel-iron alloy loosely packed in a suitable container, rather than being compressed.
Lathrop	1, 818, 070	Magnetic dust core in which particles are insulated and bound by talc, and sodium silicate of a high silicate to soda ratio obviating use of chromic acid; see Andrews 1, 669,643.
Zimmerman	1, 818, 596	Magnetic dust core in which particles are insulated by zirconium silicate alone or combined with kaolin.
Andrews	1, 826, 711	Magnetic dust core of "permalloy" particles insulated with mixture of glue, soap, or casein, and water.
Shermund	1, 827, 376	Magnetic dust core of 8 to 10 percent finely ground mica reground with iron dust and compressed.
Wright, et al	1, 831, 280	Surgical instrument for extracting metallic chips from the body, for which the slidable core member may be filled with magnetic iron particles.
Kramer	1, 832, 937	Magnetic dust core having particles insulated with very finely disintegrated silk paper and shellac or bakelite.
Hochheim, et al	1, 838, 831	Magnetic iron powder for cores of superior permeability is prepared by decomposing iron carbonyl, and treating metal in hydrogen atmosphere.
Hochheim	1, 840, 286	Patent was applied for prior to application for 1,838,831 and claims core compressed from iron powder obtained by thermal decomposition of iron-group carbonyl.
Elmen	1, 840, 352	Magnetic dust core is annealed after compression, in an atmosphere of nitrogen or hydrogen.
Andrews, et al	1, 845, 113	Magnetic dust core; "permalloy" particles are annealed, insulated with chromic acid, talc and water glass, pressed at 200,000 lb. per sq. in. and annealed at 500° C.

V. APPLICATIONS OF METAL POWDERS—Continued

16. Magnetic Materials and Articles—Continued

Patentee	U. S. Patent No.	Subject
Gillis	1, 845, 144	Magnetic dust core annealed after compression at a temperature selected according to $T=-0.382N^2+50N-1056$; T=annealing temperature; N=percent nickel in alloy.
Best	1, 847, 860	Sound recording; phonograph record or sound film is coated with colloidal magnetizable iron in binder, light sensitive emulsion over binder.
Roseby	1, 850, 181	Magnetic dust core of short lengths of nickel-iron wire of diameter of 4 mils; powdered iron is added as filler.
Owens	1, 853, 924	Magnetic dust core for which magnetic particles are mixed with insulation in presence of volatile liquid.
Swinne	1, 855, 562	Magnetic dust core; particles are insulated by applying a hydride of boron, silicon, etc., decomposing hydride to deposit a coating and applying a chemical to coating to form an oxide layer.
Duftschmid, et al	1, 855, 739	Producing iron having valuable magnetic properties by series of heat treatments of powdered iron.
Gillis, et al	1, 855, 855	Molding dies for forming magnetic dust cores.
Lathrop	1, 857, 201	Magnetic dust core; particles are insulated by mixing with portion of insulation in a volatile liquid, drying, and repeating process.
Beath, et al	1, 859, 067	For production of metal powders for magnetic dust cores a brittle nickel alloy is made by partially oxidizing constituent metals while in molten state and working metal in solid state while hot to produce fine crystalline structure.
Brazier, et al	1, 863, 325	Magnetic dust core using osmotic kaolin, e. g., as insulating material.
Neighbors	1, 866, 123	Magnetic dust core; particles are insulated with a nonhygroscopic residue of an evaporated mixture of a water-soluble organic acid, sodium silicate and a ceramic binder.
Kramer	1, 868, 327	Magnetic dust core; binder for magnetic particles contains in admixture, fine threads of asbestos.
Gillis	1, 871, 317	Magnetic dust cores are compressed at 250,000 pounds per square inch in preference to 200,000 pounds per square inch, and annealed.
Marris, et al	1, 878, 589	Magnet core alloy powder prepared by reducing powdered nickel and iron oxides, sintering at higher temperature than that of reduction, grinding, annealing while mixed with talc to prevent resintering.

V. APPLICATIONS OF METAL POWDERS—Continued

16. Magnetic Materials and Articles—Continued

Patentee	U. S. Patent No.	Subject
Roseby	1, 878, 713	Magnet core; magnetic material is drawn to wire which is flattened into tape, tape is cut to short lengths, insulated and compressed to shape.
Linnhoff	1, 879, 361	Electric induction furnace having the induction coil surrounded by a yoke of pressed magnetic iron particles and zinc oxide.
Lathrop	1, 881, 711	Magnetic dust core; particles are insulated by mixing with kaolin and talc while dry and adding a silica sol made with sodium silicate and chromic acetate, and drying the mixture.
Chipman	1, 883, 559	Sound film; granular magnetic material is pocketed between film and coating of cementitious material.
Chipman, et al	1, 883, 562	Sound film; granular or ribbon magnetic material is embedded within two-layer film.
Polydoroff	1, 887, 380	Magnetic core of insulated finely divided particles is standardized by passing electric current through core in flux direction of core, partially breaking down insulation and bringing some particles in contact.
Hollingsworth	1, 904, 233	Magnetic dust core; preliminary annealing heat treatment of magnetic particles is given *after* insulation is applied.
Northrup	1, 904, 665	Electric furnace inductor coil is packed in an uncompressed mass of iron filings and electrically resistant particles of zircon, or zinc oxide, to eliminate stray field.
Chipman	1, 912, 887	Sound film; cementitious layer has deposited thereon a line of magnetically connected metal particles, coated over with cementitious substance and polarized.
Schumacher	1, 915, 386	Producing powdered magnetic materials by heating below fusion point mixture of powdered metals.
Schulz	1, 919, 806	Magnetic core of finely divided ferromagnetic particles insulated by copper oxide coating.
Roseby	1, 932, 639	Magnetic dust core; particles are insulated by a coating of metallic fluorides.
Ellis	1, 943, 115	Magnetic dust core; "permalloy" particles are coated with a mixture of colloidal clay, sodium silicate and milk of magnesia.
Neighbors	1, 948, 308	Magnetic dust core; particles are insulated by applying coatings of a compound of tartaric acid, sodium silicate, water and insulating material, drying between each coating to form water insoluble film.
Languepin	1, 949, 840	Magnetic sound record strip having track of metal filings or powder. Constant magnetic field is used for setting powder as it is coated on.
Roseby	1, 954, 102	Magnetic dust core of an alloy comprising 60 to 80 percent nickel and 20 to 40 percent cobalt.

V. APPLICATIONS OF METAL POWDERS—Continued

16. Magnetic Materials and Articles—Continued

Patentee	U. S. Patent No.	Subject
DeForest	Reissue 19,611 of 1,960,898.	Testing metal bodies by inducing magnetic flux in body and sprinkling with paramagnetic particles which collect along cracks and defects.
DeForest	1, 960, 899	Paramagnetic particles, for use in testing iron or steel bodies for cracks, coated with zinc oxide to prevent metal-to-metal contact between them which helps them demagnetize readily.
Jaumann	1, 965, 649	In a power transformer for radio frequency circuits, the annular mass core consists of iron carbonyl particles insulated with phenol condensation product.
Maier	1, 974, 079	Magnetic loading coil core built up of layers of different magnetic materials; layers may be sheet materials coated with metal dust to provide additional layers.
Roseby	1, 981, 468	Magnetic dust core; particles are insulated with varnish, and calcined magnesia. Mass is subjected to action of magnetic field while being molded.
Polydoroff	1, 982, 689	High-frequency inductance coil core; iron powder is insulated with China-wood oil resin varnish and dry bakelite powder. Core is partially baked in mold; baking is finished outside of mold.
Polydoroff	1, 982, 690	Selective radio circuit having a compressed magnetic core of insulated magnetic particles of 300 mesh size.
Ehlers	1, 991, 143	In radio-frequency magnetic bodies prepared from powders, greater compression or increase of density of magnetic particles is produced by rolling the particles between sheets of steel until formed into a strip or plate.
Robinson	1, 994, 534	"Field-less" coil constructed by winding a coil and filling it so it appears to be a solid disc, with mixture of iron dust and latex, after which coil is vulcanized.
Kato, et al	1, 997, 193	Permanent magnet made by molding powdered oxides of iron and cobalt with binder and sintering in a reducing atmosphere.
Duftschmid	2, 006, 987	Producing magnetic material comprising consolidating and interdiffusing powdered nickel and iron.
Vogt	2, 011, 697	High frequency magnetic core made of paper coated with almost colloidal mixture of iron particles, alcohol and shellac, and laminated.
Vogt	2, 011, 698	High frequency core material formed of insulating sheets coated with magnetic particles and laminated with chlorinated naphthalene.

V. APPLICATIONS OF METAL POWDERS—Continued

16. Magnetic Materials and Articles—Continued

Patentee	U. S. Patent No.	Subject
Hay	2, 035, 475	In recording, where different colored line records are obtained on moving paper, the point electrode is tipped with colored powder mixed with magnetic nickel or iron powder.
Oexmann	2, 041, 480	Magnetic recorder; powdered carbonyl iron or alloys are used.
Rehmann	2, 048, 222	Loud speaker magnet having cores and/or pole pieces produced by sintering powdered tungsten and powdered iron.
Vogt	2, 064, 773	Magnetic core for high frequency coil formed from oxide coated iron powder mixed with thermoplastic binder which solidifies when cool.
Cox	2, 068, 658	Loading coil core of oxide coated iron particles tumbled in aluminum vapor to convert oxide to aluminum oxide, mixed with alundum, e. g., and pressed.
Heinzel, et al	2, 075, 283	Magnetizable alloys cold worked, annealed, lightly cold worked, and annealed again, from a raw material of sintered carbonyl-derived metal powders.
Gillis	2, 076, 230	Magnetic dust core of compressed finely divided magnetic particles is sprayed with aqueous solution of lead borate, dried, and heated to fuse and glaze.
Ruben	2, 085, 830	Pressed dust magnet of metallic particles milled with powdered vanadium pentoxide (10 percent by weight) which acts as a binder on pressing and heating.
Wohlfarth, et al	2, 090, 991	Radio frequency core of magnetic dust formed into adjacent cooperating cup shaped members forming an enclosure for the coil.
Neighbors	2, 105, 092	Magnetic dust core; permalloy particles are insulated, compressed and then heat-treated in a nitrogenous atmosphere to anneal.
Betz	2, 106, 882	In magnetic detection of flaws in iron and steel, powdered nickel, iron, but preferably iron oxide are mixed to paste which may be diluted to a testing bath.
Andrews	2, 110, 967	Producing magnetic cores from powdered nickel-iron alloy.
Gillis	2, 110, 974	Magnetic dust core; dust is heat treated in presence of carburizing agent, insulated, compressed, and cores heat treated with carburizing agent.
Polydoroff	2, 113, 603	Producing compressed comminuted magnetic core for high-frequency inductance device.
Scheppmann	2, 117, 856	High frequency core of iron powder coated with amber, moistened with turpentine oil and compressed.
Zumbusch	2, 118, 285	Permanent magnet compressed from a mixture of a number if different permanent magnetic alloys in powder form whose coercive forces are equalized.

V. APPLICATIONS OF METAL POWDERS—Continued

16. Magnetic Materials and Articles—Continued

Patentee	U. S. Patent No.	Subject
Riepka	2, 146, 987	High frequency core pressed from iron powder, cylindrical and threaded, having opposite sides of threaded body flattened to obviate burr formed in pressing.
Lucas	2, 149, 782	Magnetizable mercury indicating fluid for use in measuring and gauging instruments, e. g., 14 percent by volume steel dust; 3 percent powdered graphite; 83 percent mercury.
Cox	2, 154, 730	Magnetic dust core; powdered iron, andalusite, sodium silicate and ammonium chromate heated to decompose ammonium chromate and thereby oxidize any uncoated surfaces of iron.
Legg	2, 158, 132	Magnetic dust core, temperature stabilized by using magnetic materials having opposing permeability-temperature characteristics.
DeForest	2, 158, 409	To test a weld, finely divided magnetic particles of varying degrees of fineness are applied thereto and weld subjected to magnetic field.
Schulze	2, 162, 273	Magnetic dust core; iron powder is coated first with amber varnish, second with polystyrol.
Burton	2, 164, 383	Magnetic modulator in which cores may be filled with powdered magnetic material.
Hensel	2, 167, 240	Producing magnet comprising alloy of nickel, titanium, cobalt and iron.
Legg	2, 169, 732	Powder for loading coil cores is suspended in coating bath and agitated by compressional elastic high frequency waves.
Brill, et al	2, 179, 810	Producing finely divided magnetic substance by reducing and comminuting mixed crystals of magnetic metal oxides and additional metal oxides, such as magnesium or aluminum.
Alexander	2, 184, 769	Permanent magnet alloy produced from a powdered alloy of zirconium and nickel heated at a temperature between 345° C and 800° C.
Vogt	2, 186, 659	Producing magnetic powder by cooling and collecting magnetic particles subjected to reducing gas flame.
Baermann, Jr	2, 188, 091	Permanent magnet alloy (nickel, aluminum, and steel) is powdered, molded with phenol formaldehyde resin, and magnetized during pressing.
Hale, et al	2, 191, 151	Magnetic dust core is temperature compensated by mixture of permalloy with Superla Wax or fluorspar which have larger coefficient of thermal expansion than alloy.
Howe	2, 192, 743	Sintered permanent magnet of powdered 5 to 20 percent aluminum, 10 to 45 percent nickel or cobalt, remainder iron.

V. APPLICATIONS OF METAL POWDERS—Continued

16. Magnetic Materials and Articles—Continued

Patentee	U. S. Patent No.	Subject
Howe	2, 192, 744	Sintered permanent magnet of powdered 10 percent aluminum, 17 percent nickel, 12½ percent cobalt, 6 percent copper, remainder iron.
Howe	2, 197, 642	Furnace for fabricating sintered magnet alloys containing aluminum, nickel and cobalt.
McCowen	2, 199, 526	Material for electromagnetic cable-sheaths, having high tensile strength; permalloy powder is mixed with equal bulk of polymerized ethylene at above 110° C.
Cross, et al	2, 200, 491	Producing powdered magnetic alloys by oxidizing, pulverizing and reducing nickel-iron alloy.
Wassermann	2, 205, 611	Producing iron-nickel-aluminum alloy having high magnetic properties by sintering metal powders.
Price	2, 206, 537	Producing magnetic alloy comprising tungsten, nickel, copper and iron powders.
Brinkmann	2, 214, 898	Magnetic dust core is given a thermoplastic insulating jacket of lower softening point than binder for metal powder.
Moore	2, 216, 600	Magnetic flux is directed through irregular and hollow bodies for magnetic detection of flaws by means of iron particles gathering at poles developed at defects.
DeForest	2, 217, 733	Testing apparatus employing paramagnetic particles in a body of liquid.
Whipple	2, 218, 669	Radio tuning core of compressed magnetic material with connecting eyelets molded in place at its ends.
Mayer, et al	2, 221, 983	Laminar magnetic structure built up of layers of powdered iron group metal interlaid with insulating layers of inorganic mineral oxide particles.
Bandur	2, 230, 228	Magnetic dust core has 400 mesh particles coated with magnesium hydroxide, sodium silicate, and talc, then further treated before compression.
Gottschalt	2, 231, 160	Core for coils used in oscillating circiuts, band filters, etc., having low negative temperature coefficient of inductance, squirted to desired form from 50 percent iron carbonyl powder and polystyrol powder.
Verweij, et al	2, 232, 352	For magnetic cores, powdered iron is coated by a material which does not chemically transform outside of powder particles. Powder is mixed with weakly acid ferric phosphate of equal molecular amounts of ferri-ion and phosphate-ion, dried and re-powdered.
Fischer	2, 238, 893	Nonhygroscopic loading coil core in which magnetic particles are bonded with polystyrene.

V. APPLICATIONS OF METAL POWDERS—Continued

16. Magnetic Materials and Articles—Continued

Patentee	U. S. Patent No.	Subject
Dean, et al	2, 239, 144	Producing permanent magnets by dispersing magnetic material in mercury, removing mercury and compacting into form.
Bandur	2, 241, 441	Producing magnetic core by subjecting insulated dust to succession of compressing operations.
Stier	2, 268, 782	High frequency inductance core of iron powder and semi-conducting binder containing carbon powder.
Bandur	2, 276, 453	Lubricant composition adapted to production of magnetic cores comprising compressing coated metal powders.
Bergtold	2, 277, 474	High frequency inductance coil core, U-shaped, compressed from interwoven litz wires, its two ends of compressed magnetic powder.
Boegehold	2, 289, 570	Producing magnetic alloy powder by atomizing and decarburizing molten-nickel, iron and carbon.
Jones	2, 292, 838	Method and apparatus for imparting directional magnetic properties to core samples using highly ferro-magnetic powdered alloys as magnetic material.
Wentworth	2, 298, 908	Paramagnetic particles comprising compressing spongy metal particles which have been coated with motor oil, or the like.
Verweij, et al	2, 306, 198	Magnetic cores comprising mixing powdered magnetic material with aqua ammonia solution.
Whipple	2, 307, 343	Treating compressed ferromagnetic powder core by impregnating in hot solution of water insoluble metallic soap in nondrying oil.
Kaschke	2, 330, 590	High-frequency ferromagnetic core in which iron powder is used.
Bryce	2, 333, 463	Apparatus for recording statistical records utilizing metal powders as magnetizable material.
Berge	2, 339, 137	Ferromagnetic core constructed of powdered tin oxide and iron oxide.
Harvey	2, 340, 749	Variable permeability tuning system provided with tuning cores of magnetic material, such as iron powder.
Carlisle, et al	2, 344, 023	Earphone having permanent magnetic blocks made of powdered Alnico.
Trageser	2, 351, 462	Improving magnetic properties of nickel and iron and nickel-iron alloy powders by thermal treatment in presence of inorganic halides.
Joseph	2, 352, 550	Power plant of electrically started type having powdered metal core.
Polydoroff	2, 354, 331	High-frequency inductor having magnetic core composed of comminuted metal powders compressed to desired high density.

V. APPLICATIONS OF METAL POWDERS—Continued

16. Magnetic Materials and Articles—Continued

Patentee	U. S. Patent No.	Subject
Polydoroff	2, 354, 332	Loop antenna having associated core composed of finely divided insulated magnetic particles.
Dodington	2, 357, 442	High frequency amplifier having powdered iron plunger of paramagnetic material.
Sands	2, 359, 684	Loop input system for radio receivers utilizing ferromagnetic core.
Koch	2, 361, 634	Capacity pick-up device for phonograph records having coil with powdered iron core.
Daiger, et al	2, 361, 748	Core for dynamoelectric machine molded from magnetic particles mixed with insulating binder.
Eilenberger	2, 361, 752	Magnetic recording apparatus having sound carrier of magnetic material, such as steel or nickel-aluminum combinations.
Eilenberger	2, 361, 753	Magnetic pole piece for use in magnetic recording preferably made of plasticized magnetizable powder, such as iron powder.
DeForest	2, 365, 253	In testing object for defects, paramagnetic particles which are used to reveal cracks by their attraction to those defects, are coated with water soluble dyes to render their pattern more visible.
Neighbors	2, 365, 720	Compressed ferromagnetic core consisting principally of minute particles of magnetic oxide of iron.
McClellan	2, 368, 857	Inductance unit having powdered iron core member.
Toulmin, Jr	2, 384, 215	Mixture of magnetic and other particles are alined by magnetic field, molded by vibration to compact them, induction heated, and then pressed.
Tawney	2, 387, 783	Powdered iron is used as a magnetic element with bakelite in forming an electrical transmission line.
D'Entremont	2, 391, 229	Iron powder may be used in a magnetic cement for use in forming electrical induction apparatus core.
Goldberg	2, 391, 563	Magnetite and carbonyl iron particles are insulated with a bakelite varnish and used in a high frequency coil.
Krase	2, 393, 047	Uses a finely ground ferro-alloy in producing a well-drilling mud.
Cross, et al	2, 393, 295	A compact of mixed metal powders is sintered and powdered and the powdered material is added to insulated permalloy dust in making magnetic materials.
Wells, et al	2, 400, 447	Iron powders are used in a printing ink on a wrapper to act as a magnet for controlling web registering devices.
Walstrom	2, 401, 280	Iron powder is added to drilling fluids for wells and is forced into permeable formations of a bore hole; a magnetic recorder is then used to locate the most permeable sections.

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V. APPLICATIONS OF METAL POWDERS—Continued

16. Magnetic Materials and Articles—Continued

Patentee	U. S. Patent No.	Subject
Polydoroff	2, 401, 882	Powdered metal is used in making an ultra-high frequency inductor.
Guthrie, et al	2, 407, 234	A sintered magnetic core for use in relays formed of nickel molybdenum and iron.
Sander	2, 411, 810	A powdered iron core is used in the making of an audio reactor for varying inductance.
Hansell	2, 412, 772	Powdered iron is used as a magnetic core for an electron discharge device oscillator.
Ford	2, 412, 805	An iron dust core is used in an ultra high frequency oscillation generator.
Benner, et al	2, 413, 098	An inductance core is made of finely powdered iron, litharge, and glycerin.
Tillman	2, 413, 201	A powdered iron body is incorporated in a radio frequency transformer.
Di Toro	2, 413, 607	Comminuted iron and graphite particles are used in magnetic core of a time-delay network.

17. Miscellaneous Articles, e. g., Jewelry, Chemical Dishes, Pen Points, Spectacle Frames, Small Bars and Tubes, Cigarette Mouthpieces and Like Items

Van der Meulen	882, 770	Hygienic metallic end for cigars comprising pure para rubber dissolved in benzin, with talc powder and aluminum powder.
Leiser	1, 141, 469	Manufacturing solid shapes (bars, plates, cups, etc.) by heating molded mixture of crystalline and amorphous metal powder.
Goeglein	1, 155, 652	Forming objects for jewelry by heating granular metal in mold of desired form to degree at which constituent granules coalesce.
Williams	1, 174, 646	Producing solid bodies comprising removing air from metal powders and subjecting to pressure.
Gebauer	1, 223, 322	Producing formed metal articles by molding and heating mixture of metal powders.
Pfanstiehl	1, 286, 089	Producing hollow objects, such as chemical dishes, comprising compressing metal powders around metal part and thereafter removing metal part with acids.
Gebauer	1, 342, 801	Producing composite metal bodies by molding and heating low and high melting point metal powders.
Jones	1, 354, 492	Producing iron and steel bars by heat treating "machine shop turnings."
Crowley	1, 872, 902	Molded body comprising compressed and baked mixture of powdered metal and metal jell.
Schlecht, et al	1, 882, 972	Shaped metal articles produced by sintering metal powders arranged in spatial position to make shrinkage vertical.
Comstock	2, 126, 737	Manufacturing silverware, jewelry, etc. comprising sintering metal powders, applied by use of adhesive, to presintered base.

V. APPLICATIONS OF METAL POWDERS—Continued

17. Miscellaneous Articles—Continued

Patentee	U. S. Patent No.	Subject
Pfanstiehl	2, 169, 280	Forming small shaped objects (pen points, phonograph needles, etc.) by sifting metal powder into minute cavity in rubber body and applying pressure.
Pfanstiehl	2, 169, 281	Forming small shaped objects by applying pressure to metal powders in apparatus comprising series of die blocks.
Pfanstiehl	2, 169, 966	Preparing metallic tip for small bases by compressing metal powders in small cavity in substantially incompressible plastic body.
Pfanstiehl	2, 228, 235	Hardened base metal pen nib using powdered chromium and carbon as starting materials.
Brassert	2, 252, 697	Manufacturing bars, tubes, rods, etc., comprising compressing and heating reduced metal ore.
Pickus	2, 254, 975	Pen tip of sintered powdered platinum carbide and powdered gold or gold alloy.
Kaschke, et al	2, 289, 787	Producing shaped articles, such as bars or tubes, by compression of sponge-like porous metal powder.
Francis, et al	2, 294, 169	Casting rolls for steel mills whereby metal at top of casting is kept molten longer by covering with layer of thermite mixture containing aluminum powder, iron oxide and fluorspar, and then with wood block and plate to protect from air.
Morin	2, 300, 302	Apparatus for forming castings from metal powders, particularly adaptable to manufacture of links and sliders of separable fasteners.
Schwarzkopf	2, 306, 665	Producing shaped iron bodies by pressure and sintering metal powders.
Volterra	2, 315, 302	Shaped iron bodies formed by pressure and sintering mixture of three or more kinds of iron powders.
Flynn	2, 317, 987	Surgical device, such as catheter, formed by extruding thermoplastic mass, containing lead powder, through a die.
Pickus	2, 328, 580	Pen point made of powdered ruthenium and metal of platinum group.
Jendresen	2, 339, 079	Apparatus for tipping metal bases with metal tips, such as pen points.
Goetzel	2, 342, 799	Producing shaped sintered iron bodies from powdered steel or alloy steel containing carbon.
White	Reissue 22,-653 of 2,-349,321.	Accumulator, particularly of type used on hydraulic systems of airplanes, having air inlet of sintered metal powders.
White	2, 349, 322	Accumulator having air inlet of sintered bronze metal.
Schoder, et al	2, 350, 421	Jewel consisting of mosaic pattern of metallic particles embedded in molded plastic body.
Stern	2, 358, 667	Shaped articles, such as tubes and rods, produced from magnesium and magnesium alloy scrap.

V. APPLICATIONS OF METAL POWDERS—Continued

17. Miscellaneous Articles—Continued

Patentee	U. S. Patent No.	Subject
Jarrett	2, 365, 083	Gold-filled wire for use in optical trade having a core of metal powders in lieu of solid core to decrease density.
Keller	2, 377, 632	Rolls for use in apparatus for coating sheet metal produced by sintering metal powders.
Ebert	2, 377, 678	Die pressing a charge of metal powder to form shell for a lock nut.
Baker	2, 378, 121	Light globe mountings having molded or cast members made from metal powders.
Dawihl	2, 378, 539	Making shaped forms of sinterable powder mixtures of hard metal alloys and the like.
Hopkins	2, 380, 238	Producing cast metal bodies utilizing metal powders.
Jarrett	2, 389, 981	Manufacture of gold filled bar stock utilizing powdered metals as a core, in lieu of a solid core for use in optical field.
Taylor	2, 394, 727	Powdered metals are used in making pen points.
Culver, et al	2, 402, 950	A gasoline-controlling valve is formed of powdered iron, and has incorporated into it a metal which completely closes the pores of the portions which contact liquid or gases.

18. Molds and Dies

Riker	336, 824	Matrix of compressed compound of lead and/or tin, and mercury.
Wyman	1, 822, 720	Wire drawing die consisting of a mixture of tungsten carbide and thoria milled with cobalt and sintered.
Koebel	1, 848, 182	Setting diamonds comprising embedding in comminuted alloy and heating and subjecting to pressure.
Spade, et al	1, 853, 385	Forming mold comprising impressing pattern into metal powders and introducing filling metal, such as copper, to preserve arrangement.
Roux	1, 905, 505	Wire drawing dies formed from a sintered mixture of separately formed carbides of tungsten using pure powdered tungsten and carbon to form the carbides.
Calkins	1, 940, 294	Fabricated die part comprising compressed mass of powdered iron, copper and graphite.
Williams, et al	2, 048, 309	Mold for preparing enameled cast iron for stoves is coated with copper powder to produce a blister free surface for enamel.
Schröter	2, 058, 110	Drawing die made of hard metal composition such as tungsten carbide cemented with cobalt.
Bateman	2, 064, 778	Tire mold metallized with aid of lacquer containing copper bronze powder.

V. APPLICATIONS OF METAL POWDERS—Continued

18. Molds and Dies—Continued

Patentee	U. S. Patent No.	Subject
Schwarzkopf	2, 205, 864	Manufacturing metal bodies having hardened surface, such as dies, valves, etc., by process of sintering metal powders.
Romp	2, 216, 652	Setting diamonds in diamond wire-drawing dies comprising sintering metal powders.
Francis, et al	2, 294, 170	Producing metal castings including covering clean surface of steel with exothermic insulating mixture consisting of aluminum, alumina, flourspar and calcium carbide.
Hensel, et al	2, 300, 118	Lapping carrier, used for producing extremely smooth and accurate surfaces, prepared by pressing and sintering metal powders.
Ferrier	2, 328, 794	Setting diamond in wire-drawing die while heating to compress powdered monel metal.
Parvin	2, 333, 387	Pull block for wire drawing machine having a wire engaging surface of carbon and metal powders.
Proctor	2, 352, 285	Phonograph record stampers comprising metal powders in thermosetting plastic material.
Lindemuth	2, 358, 171	Ingot mold having crevice between tapered circular portions of mold and stool filled with metal powder.
Kelly	2, 363, 337	Mold having heavy metallic backing incorporating metal powders.
Ferrier	2, 363, 406	Wire-drawing die having block of hard metal and using powdered metal as bed.
Mayer	2, 369, 067	Mold for air-cooled ribbed cylinders, etc., having core plates of iron borings or mixture of iron borings and sand.
Kurtz	2, 374, 942	Method of mounting dies utilizing powdered nickel, copper, chromium and silver.
Gantz	2, 381, 734, 2, 381, 735	Thirty to fifty mesh iron pellets are used in making green sand mold chills.
Devol	2, 387, 886	Plates for contacting molten glass, in glass sheet forming machine, are formed of pressed, powdered metal.
Seligman	2, 390, 183	Powdered metals are used in making a large sheet metal die, such as a die for automobile parts.
Miller	2, 394, 394	Molds are constructed of sintered metal powder.
Morin	2, 413, 512	Powdered metal is pressure compacted, sintered, and hardened to form duplicate die parts.

19. Packing Materials Using Metal Powders

Peelle	522, 766	Making packings comprising immersing dry packing in bath of lubricants, removing, drying and coating with metal powder, such as aluminum.
Morrison	926, 676	Packing comprising cellular structure, of iron or other suitable metallic substance, whose cells are charged with lubricant material.

V. APPLICATIONS OF METAL POWDERS—Continued

19. Packing Materials Using Metal Powders—Continued

Patentee	U. S. Patent No.	Subject
Bailey	1, 158, 770	Packing composition comprising pulverized metal mixed with natural mineral lubricant, fat, fibrous material, and powdered cork.
Sternlieb	1, 441, 951	Packing composition comprising intimate mixture of oil, chalk, flaky graphite, and spongy grains of metal, such as lead and antimony alloy, or aluminum.
Stewart	2, 101, 518	Coating fibrous material with metal powders before weaving into packing material.
Fiechter	2, 316, 778	Self-lubricating metallic packing comprising coating metal flakes with graphite, using foundry molasses as binder.
Olsen	2, 341, 944	A tamping wad using metal powder to overcome natural buoyancy of body of fibrous material.
Peters	2, 357, 602	Spark plug having metal powder disposed adjacent spindle shank which powder, when compacted, prevents gases from pressing into interior of plug.
Pollard	2, 363, 688	Packing comprising mass of discrete non-elastic metallic particles and oil-soaked wooden particles.
Fiechter	2, 372, 773	Self-lubricating semimetallic packing composed of plurality of interlocked pellets of lubricant-coated soft metal.
Larson	2, 391, 577	Iron powder and graphite are briquetted to form a porous seal ring for a shaft.

20. Pigments, Paint, Etc. (See Also "Coating and Molding" for Specific Processes)

Hoffman	18, 338	Bronzing liquid made by adding bronze powder to collodion.
Shaffner	59, 281	Manufacture of paper for promissory and bank notes by adding metal powder to pulp.
Brown	298, 941	Paint made of sublimated zinc powder and whiting.
Sachs	512, 224	Preparing mineral colors as substitute for bronze paints comprising powdered animalized mineral including bronze powder, dyed with organic dye.
Inch	546, 888	Paint consisting of granular tin and zinc, oil and a drier.
Cupper	610, 645	Crystal-aluminum-bronze composition comprising powdered aluminum and powdered glass or diamond-dust.
Schwenterley	613, 944	Producing powdered coloring composition from powdered coloring material including bronze powder and powdered binder.
Ott, et al	642, 358	Producing aluminum powder for paint by pouring fluid aluminum into water and comminuting particles so formed.

V. APPLICATIONS OF METAL POWDERS—Continued

20. Pigments, Paint, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Hall	701, 718	Manufacturing metallic pigment, for paint from pulverized alloy of iron and some other more electropositive element, such as silicon.
Sternberg	1, 110, 358	Paint composition comprising mixture of powdered ingredients including copper and anilin.
Fujita	1, 444, 870	Metallic leaf, coated with melted adhesive powder, is ground into powder.
Shimadzu	1, 584, 152	Paint comprising lead suboxide powder intermingled with metallic lead powder, with boiled oil and resin.
Brandenberger	1, 717, 140	Lead paint comprising lead powder, powdered metals adapted to prevent oxidation and a binder.
Podszus	1, 785, 283	Metals are polished for bronze paints by subjecting metal powder to continual impact between steel balls in rotary motion.
Nittinger	1, 795, 962	Rust-resisting paint comprising finely ground coal slag, electropositive zinc and binder.
Kramer	1, 832, 868	Metal particles are flattened by action of smooth steel balls in ball-mills.
Kramer	1, 909, 586	Polishing machine for bronze colors consisting of drum whose walls are contacted by rotary brushes.
Ragg	1, 915, 201	Producing metal-containing pigments by atomizing molten metal and causing to come into contact with powdery material adapted for anticorrosive paints.
Arthur	1, 920, 234	Aluminum bronze powder produced by reducing aluminum and lubricating during processing with stearic and ricinoleic acid.
Kramer	1, 930, 683	Polishing machine for bronze colors having continuous feed and exit system for powders.
Kramer	1, 930, 684	Similar to 1,832,868 except that lubricant is used.
Horns	1, 953, 111	Producing laminated material comprising passing fibrous material, utilized as surface layer, through suspension of powdered metal or pigment.
Schober	1, 953, 508	Paint vehicle with powdered aluminum-silicon alloy pigment.
Tainton	1, 954, 462	Producing metallic paint from zinc powder.
Hall	2, 002, 891	"Leafing" quality applied to flake metal by subjecting powder to action of leafing agent dissolved in volatile paint thinner.
Boothman	2, 017, 851	Producing bronze powder pigments comprising repeatedly rolling aluminum covered with lubricant to form cake of fine aluminum flakes held together by lubricant.
Murphy, Jr	2, 038, 850	Shiny, oxide-free copper powder is precipitated in absence of free oxygen, and will combine readily with oxygen in paint vehicle.

V. APPLICATIONS OF METAL POWDERS—Continued

20. Pigments, Paint, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Grady	2, 044, 292	Zinc dust paint containing water absorbent substance to retard evolution of hydrogen during storage.
Thies	2, 054, 454	Forming molded product having color effect by evenly distributing metal powder throughout thermoplastic material.
Baer	2, 071, 156	Coloring bronze powders comprising simultaneously mordanting and dyeing aluminum bronze powder.
Tainton	2, 080, 346	Metallic powder suitable as pigment consisting mainly of zinc in flake form having smooth, bright surfaces.
Stevens	2, 082, 362	Finely divided copper or copper alloy for use as paint pigment made by forming an amalgam of copper and mercury, distilling off mercury and grinding metallic residue.
Schober	2, 106, 228	Coloring and protective coating comprising powdered metallic aluminum and silicon in liquid binding medium, such as boiled linseed oil.
Kramer	2, 112, 497	Machine for manufacturing bronze powders in one continuous operation comprising comminuting and polishing.
Hoffman, et al	2, 113, 449	Producing multitoned metallic effect by projecting against surface droplets of paint having metal powder suspended therein.
Arthur, et al	2, 125, 870	Fine aluminum bronze powder produced by process of separation through a lifting air stream.
Ziehl	2, 144, 953	Making bronze or metallic paste pigments consisting essentially of metal flakes, a thinner and leafing agent.
Hicks	2, 168, 212	Synthetic metallic enamel comprising finely ground metal bronze powder, volatile solvents and synthetic resins.
Sweeney, et al	2, 176, 597	Metallic paint containing amorphous copper.
Hoffman	2, 178, 018	Producing nonleafing bronze powder coating composition by mixing bronze powder with synthetic resin varnish.
McMahan	2, 178, 179	Metal paste pigment comprising metal flakes with leafing properties stabilized by phenol.
McMahan	2, 178, 180	Metal paste pigment comprising metal flakes with leafing properties stabllized by alpha and beta naphthol.
McMahan	2, 178, 181	Metal paste pigment comprising metal flakes with leafing properties stabilized by amines.
Harris	2, 185, 194	Producing metallic pigments consisting of flaked, polished and coated metal powders, coating giving leafing quality.
Arthur	2, 193, 663	Dry powder polished in cylindrical drum by series of rotating brushes.
Alborn	2, 226, 150	Heat-resisting paint comprising an asphalt, oil-resin varnish, metallic bronze powder, and extending pigment.

V. APPLICATIONS OF METAL POWDERS—Continued

20. Pigments, Paint, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Harris	2, 234, 164	Producing metallic pigment paste from metal powders mixed with hydrocarbon solvent and stabilizing agent.
Ball	2, 245, 745	Aluminum pigmented coating composition comprising triturated aluminum powder, a drying oil and a resin.
Harris	2, 250, 955	Producing metallic pigment paste formed of metal powders mixed with ethyl butyrate solvent and stabilizing agent.
Harris	2, 250, 956	Producing metallic pigment paste formed by mixing metal powder with colloidal sol with camphor.
Powell	2, 254, 976	Producing fine metal powders suitable for paints by dissociation of one or more metal compounds in presence of suitable dispersing agent.
Danielson	2, 257, 595	Paint for simulating wood grain comprising nonleafing metal powder in flake form, coloring ingredient and binder.
Ziehl	2, 263, 603	Producing metallic paste or powder pigments by adding carbon dioxide or sulfur dioxide to lead, tin, or zinc in ball milling operation to improve leafing qualities.
Arthur	2, 272, 629	Producing metallic pigments in dry powder form by heating sludge of metallic powder and volatile liquid and subjecting to action of impact bodies.
Schroder	2, 273, 597	Producing finely divided pigments having metallic luster by decomposing certain metal salts of organic acids.
Ziehl	2, 274, 766	Wet-milling method of producing leafing copper bronze pigment using liquid hydrocarbon solvent with leafing agent in solution.
Tuwiner, et al	2, 285, 762	Flaky metallic copper suitable for use as pigment produced by electrodepositing upon a cathode carrying fatty acid radical and one hydroxyl group.
Reynolds	2, 299, 034	Metallic flakes, suitable for use as pigments, formed by disintegrating composite metal foils.
Farrell	2, 302, 305	Gloss enamel or pigmented lacquer incorporating aluminum or other flake metal.
Ryan	2, 303, 504	Tarnish-resistant bronze powder comprising distributing condensation product, such as urea-formaldehyde, on metal powder.
Eckart	2, 304, 681	Package for holding metal powder used in paints, comprising transparent plastic cup-shaped closure in cylindrical paper body to which powder adheres, enabling character of powder to be determined at glance.
Fleming	2, 312, 088	Incorporating a composition with bronze powders which improves stability of leafing property.

V. APPLICATIONS OF METAL POWDERS—Continued

20. Pigments, Paint, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Dunn	2, 323, 982	Process for making white lead using mixture of lead oxide and finely divided metallic lead.
McCord, et al	2, 326, 157	Producing activated anhydrite, calcium sulfate, used as extender pigments in paints, incorporating zinc dust.
Wobbe	2, 326, 814	Coating of aluminum paint or other metallic paint for black plate cans.
Wobbe	2, 326, 815	Aluminum paint for black plate cans.
Kopp	2, 328, 465	Metalliferous dyestuffs in which finely divided metals are used as metallizing agent.
Kirby	2, 330, 291	Azo dye using zinc dust in reaction which can be converted by heavy metallic salts to water-insoluble pigments.
Parsons, et al	2, 332, 829	Incorporating aluminum bronze powder, or similar pigment, in casein plastics to produce pearl-like effect for buttons and similar articles.
Schneider, et al	2, 341, 508	Increasing transparency difference of sound records in multilayer materials by treating with solution capable of bleaching silver but leaving granular silver unattacked.
Bruson	2, 345, 456	S-benzyl thioanmeline aldehyde condensation product which may be colored by metal powders.
Christaldi, et al	2, 345, 549	Making lasting records which comprises exposing an emulsion of zinc cadmium sulphide and manganese in the presence of moisture to ultraviolet light.
Cummins	2, 349, 571	Lacquer composition containing aluminum or bronze powder and capable of retaining powder suspended in leaf form on storage.
Rott	2, 352, 014	Photographic image transfer wherein images obtained consist of finely divided silver and silver compounds.
Mitchell	2, 353, 058	Bronze paste consisting of straight-run bronze-powder resin and volatile thinner free of sulphur and acidity.
Heltzer, et al	2, 354, 018	Light reflector sheet which may comprise water-resistant impregnated paper backing sized with coating including aluminum pigment for reflecting surface.
Swift	2, 354, 073	Gold or metallic leaf sheet comprising carrier strip of cellulose acetate with layers of adhesive material, metallic leaf and sizing thereon.
Ferst, et al	2, 355, 638	Producing color-marking element which may incorporate copper powder.
Ferst, et al	2, 355, 639	Pencil lead which may incorporate metal powders or metallic salts reducible to free metal under firing conditions.

V. APPLICATIONS OF METAL POWDERS—Continued

20. Pigments, Paint, Etc.—Continued

Patentee	U. S. Patent No.	Subject
Berg	2, 355, 902	Animated display device comprising transparent sheet having photographically produced design, developed by rubbing thereon metallic pigment, such as bronze powder.
Gerhart	2, 361, 018	Artificial drying oil which may be combined with metallic pigments to produce liquid film which will harden to firm state.
Smith, et al	2, 370, 330	Applying finely ground silver, gold or other pigment or coloring material to image on photographic plate to produce lasting image.
Murphy	2, 372, 334	Lacquer coating comprising aluminum bronze in pigmented cellulose-ester binders.
Kline, et al	2, 374, 214	Electrically conducting paper-utilizing aluminum powder in pulp.
McCord, et al	2, 379, 019	Preparation of pigmentary materials utilizing finely divided zinc.
Sturm	2, 380, 126	Marking crayon which may utilize bronze powder.
Maier, et al	2, 380, 456	Aluminum powder is added to lacquer to form an aluminum-pigmented lacquer.
Rudnick	2, 383, 566, 2, 383, 567, 2, 383, 568.	Powdered aluminum is used in preparing one layer of a photomechanical negative.
Ballard	2, 383, 704	Powdered gold, silver, etc., are used in burnish gold preparation to decorate dinnerware.
Quisling	2, 383, 990	Bronze and aluminum powders may be added as coloring to cosmetics.
Andersen, et al	2, 384, 521	Aluminum powder is used as a pigment in cellulose thermoplastic; claims are on extrusion method.
Barret	2, 385, 125	Nitrocellulose lacquer is pigmented with metal powders.
Castor	2, 387, 243	Iron powder may be plated with gold and dispersed in lacquer to give gold coating.
Farr, Jr	2, 392, 135	Aluminum powder may be used as pigment in composition used for printing ink or other coating.
Babcock	2, 393, 731	Metal powders are used in the production of metallic pigment paste.
Cooke, et al	2, 394, 843	Aluminum powder coated on mica particles is used as a pigment in metal coatings.
Ziehl	2, 399, 705	A method of increasiug the specular reflectivity and metallic luster of metal flakes for pigments by wearing off the flake surface.
Hopkins	2, 408, 515	A tin lacquer comprising powdered tin held in suspension by a vinyl-resin binder and for applying to black iron surfaces; the lacquer is fused by heating.

V. APPLICATIONS OF METAL POWDERS—Continued

21. Printing Type and Printing Plates or the Like Formed With Metal Powder

Patentee	U. S. Patent No.	Subject
Adams	99, 806	Electrotype plates are more quickly formed by coating impression wax and type with powdered tin.
Boudreaux	608, 248	Wax-impression printing blocks are given metallized surface by rubbing bronze powder on right after casting.
Decker	1, 210, 375	Printer's blanket is coated with adhesive and metal powder or other oil repellant.
Lohrey	Reissue 22, 118 of 2, 199, 265.	Making porous printing type by molding under pressure powdered nickel and copper.
Losee	2, 252, 776	Film for photogravure printing; cellulose film is coated with copper powder forming etching surface.
Menihan	2, 275, 592	Producing solid articles carrying printed matter by compressing powdered metal against engraved and inked printing element.
Ormond	2, 346, 939	Etching sensitive-coated printing rolls with printing ink which is highly absorptive of metal powders, and sprinkling tacky ink image with aluminum or bronze powders.
Chollar	2, 349, 613	Porous resiliant printing plate having filler of metal powders.
Menihan	2, 350, 564	Solid articles carrying printed matter composed of metal powder compressed into a solid and carrying ink ornamental design with some of ink incorporated in metal powder before compressed.
Toland, et al	2, 361, 665	Method of etching printing plates which may have coating containing filler particles, such as copper and zinc powders.
Alger	2, 373, 087	Intaglio printing cylinder which comprises filling recesses in copper cylinder with wax resistant, plating unrecessed portions with chromium, removing wax and filling recesses with copper.
Chollar	2, 392, 521	Powdered metals may be used as filters in a porous rubber printing plate.

22. Refractory Materials Using Metal Powders or Articles Employing Refractory Metal Powders

Pfaff	1, 159, 264	Refractory lining material consisting of a burnt mixture of powdered zirconia and silicon-carbide.
Coolidge	1, 226, 470	Preparing tubes from refractory metals by sintering, under internal pressure, metal powders in tubular mold.
Zons	1, 520, 794	Refractory alloy produced by packing and heating mixture of the powdered metals.

V. APPLICATIONS OF METAL POWDERS—Continued

22. Refractory Materials Using Metal Powders or Articles Employing Refractory Metal Powders—Continued

Patentee	U. S. Patent No.	Subject
Lederer	1, 659, 205	Producing highly refractory metals by heating sulphide of the metal in vacuum to decomposition temperature and removing volatilized sulphur.
Lorenz	1, 704, 256	Producing refractory ware by sintering refractory metal powders to metallic wool.
Smithells	1, 857, 219	Manufacturing refractory metal bodies by sintering in atmosphere of inert gas and vapor of highly electropositive metal, such as sodium.
DeBats	1, 993, 598	Refractory metal alloy employing powders of alloy components.
Laise	2, 120, 562	Producing refractory material from mixture of refractory metal powders and base metal powders.
Wolff, et al	2, 304, 723	Articles of refractory alloys or sintered metals produced by subjecting fine-grained mixture to centrifugal action to compress it before sintering.
Gitzen	2, 330, 418	Treating foundry sands using charcoal, pulverized coal and coke, carbon black, lamp black, graphite and metallic aluminum.
Crowe	2, 343, 958	Tips for oxygen cutting torches having molded piece containing the diverging jet passage formed of metal powders.
Huddleston	2, 360, 606	Valve guide provided with scraper ring of hard refractory metal composition.
Mouromtseff, et al	2, 360, 707	Electrostatic shield member for electron discharge device comprised of highly refractory metal, such as tungsten.
Schaefer	2, 364, 317	Porous, self-insulated refractory article incorporating aluminum powder.
Hensel, et al	2, 370, 242	Composition comprising refractory metal powders coated with platinum or palladium and bonded together with metal such as gold, copper or silver.
Lowit	2, 373, 405	Manufacture of seamless tubes from refractory metal powders.

23. Solder and Sealing Media (see also "Packing Materials" and "Welding Rods and Compositions")

Henderson	1, 340, 655	Composition for repairing radiators of internal combustion engines comprising two kinds of metal powders and liquid binder.
Hey	1, 947, 938	Soldering paste for aluminum is made by precipitating on tin a porous spongy body of zinc and mixing sponge with vehicle.
Parker	1, 980, 927	Solder comprising sintered solder particles with flux contained pores of mass.

V. APPLICATIONS OF METAL POWDERS—Continued

23. Solder and Sealing Media—Continued

Patentee	U. S. Patent No.	Subject
Hanak	2, 116, 891	Scrap babbitts, hard metals or antifriction metals are converted into solder metal.
Powell	2, 189, 640	Producing hard solders in form of metal powders.
Brewer	2, 301, 513	Repairing cracked cast iron parts by flowing nitric acid into crack, applying cast iron powder, and applying muriatic acid.
Schrohe, et al	2, 324, 729	Nonhardening lubricating pipe joint cement comprising mixture of castor oil, powdered barium sulphate, and flake aluminum.
Cox	2, 334, 609	Core solder produced from comminuted solder metal and fluxing material.
Merrill, et al	2, 347, 211	Composition for use as sealer which may utilize metallic flake aluminum pigment.
Geyer	2, 352, 784	Fluid seal used for sealing water pumps, etc., having washer made from carbon and self-lubricating metal, such as porous bronze.
Stoltenberg	2, 367, 445	Sealing center metal electrode in bore of ceramic insulator of spark plug by compacting metal powders in space.
Burrell	2, 377, 322	Soldering device utilizing powdered iron and/or aluminum as heat supplying material.
Chamberlain	2, 378, 687	Utilizing magnesium shavings in sealing a well bore.
Cipriani	2, 380, 579	Powdered metal is used for sealing an electrode to spark plug insulators.
Dodge	2, 387, 722	Solder in powdered form such as copper or brass is used between parts of a vaned element and fused by application of heat.
Miller	2, 403, 109	A nickel-particle flux used as an immersing agent in brazing aluminum and its alloys.
Miller	2, 403, 110	A powdered brazing mixture of an alkali metal chloride flux and an aluminum base alloy used for joining aluminum and its alloys.

24. Welding Rods and Compositions

Griffith	704, 793	A copper plate is welded to a second metal by an intermediate coating of powdered copper.
Tabet	893, 207	Copper is welded with powdered copper and a borax flux.
Morgan	1, 803, 634	Hard facing-forming welding composition having powdered tungsten as principal ingredient.
Sieger, et al	1, 848, 437	Welding electrode formed from a porous base made of powdered tungsten and carbon filled with low melting point metal such as copper.
Sieger, et al	1, 848, 438	Welding electrode formed from a porous base filled with a noble metal.

V. APPLICATIONS OF METAL POWDERS—Continued

24. Welding Rods and Compositions—Continued

Patentee	U. S. Patent No.	Subject
Taylor	1, 896, 853	Welding together two metal structures having different melting points by applying pressure, pressing and sintering two metal powders superimposed one on the other.
McCarroll, et al	1, 943, 541	Metallic powder is subjected to a reducing agent, pressed in dies and sintered to form welding electrodes.
Schlecht, et al	1, 972, 463	Producing welded metals comprising sintering mixture of metal powders obtained by thermal decomposition of metal carbonyl, with nonmetallic fluxing agent.
Ammann	1, 999, 888	Weldrod made of an iron tube filled with a sintered mixture of a chromium carbide, silicon and manganese.
Hardy	2, 121, 194	Producing welding rods comprising coherent aggregate of finely divided materials, including copper.
Hensel, et al	2, 131, 475	Pressure exerting welding electrode, 99% copper and remainder cobalt and beryllium. Metals may be powdered and briquetted.
Hensel	2, 131, 994	Welding electrode alloy formed from sintered tungsten powder filled with copper or silver alloy.
Hensel	2, 160, 659	Welding electrode of sintered tungsten and tungsten carbide alloyed with nickel and copper.
Hensel, et al	2, 266, 422	Producing pressure exerting welding electrodes by pressing and sintering copper powders.
Hardy, et al	2, 297, 554	Method of welding employing bonding element of porous but coherent mass of copper powder containing phosphorus.
Phillips, et al	2, 301, 320	Welding electrode having a nickel core, a surrounding coating of copper and an outer flux coating of metal powders.
Kihlgren	2, 303, 746	Coating for nickel arc welding rods comprising calcium and sodium fluorides, nickel-titanium alloy, carbon, and dextrine.
Kennedy	2, 326, 865	Electric welding composition using finely divided ferrous material, steel filings, powdered aluminum and copper.
Cadwell	2, 355, 627	Welding material for use in an exothermic reaction comprising mixture of aluminum powder, copper oxide and combined oxygen.
Cadwell	2, 360, 758	Apparatus (mold) for cast welding ends of rail bonds to rails by exothermic reaction involving metal powders.
White	2, 370, 100	Arc tip on arc welding electrode which may be made of iron oxide and aluminum powder.