NBS SPECIAL PUBLICATION 370

Research and Testing Facilities of the Engineering Mechanics Section, National Bureau of Standards, Washington, D. C.

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NATIONAL BUREAU OF STANDARDS

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[1] Headquarters and Laboratories at Gaithersburg, Maryland, unless otherwise noted; mailing address Washington, D.C. 20234.
[2] Part of the Center for Radiation Research.
[3] Located at Boulder, Colorado 80302.
[4] Part of the Center for Building Technology.

ERRATA SHEET

Research and Testing Facilities of the
Engineering Mechanics Section, National Bureau of Standards,
Washington, D. C.

By the Staff of the Engineering Mechanics Section
Daniel J. Chwirut, Coordinator

NBS Special Publication 370

On page iii, CONTENTS, the page numbers should read:

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Research and Testing Facilities of the Engineering Mechanics Section, National Bureau of Standards, Washington, D. C.

By the Staff of the Engineering Mechanics Section
Daniel J. Chwirut, Coordinator

Mechanics Division
Institute for Basic Standards
National Bureau of Standards
Washington, D.C. 20234

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CONTENTS

Research and Testing Facilities of the Engineering Mechanics Section

Staff, Engineering Mechanics Section

Mechanics Division

National Bureau of Standards, Washington, D.C.

The principal characteristics of the force measuring and generating equipment and related research facilities available in the Engineering Mechanics Section of the National Bureau of Standards are described.

Key words: Engineering Mechanics Section; force generating equipment; research facilities; testing machines.

1. Introduction

This paper contains a compilation of information about the major equipment of the Engineering Mechanics Section of the National Bureau of Standards. These facilities support the Section's mission, which is to develop and maintain standards of force, to conduct research and development on methods for measuring force, strain, displacement and acceleration in structures and on the response of materials and structural elements to forces.

This paper is intended to describe the characteristics and features of the various pieces of testing equipment in the Engineering Mechanics Laboratory as a guide to the capabilities of the Section in mechanical testing. No attempt has been made to discuss the program of the Section, and no attempt has been made to include similar equipment that is maintained elsewhere in NBS for use of other Sections in their missions. In the listings, the machines are identified by manufacturer in order to give the reader a better understanding of the facilities. It should not be inferred from this that the Bureau particularly recommends or endorses these manufacturers since equipment of comparable quality is usually available from a number of domestic and foreign manufacturers.

Throughout the paper, machine capacities and dimensions are given in U.S. customary units unless the machine scale is graduated in other (metric) units. This is in accord with current engineering practice in the United States. The National Bureau of Standards has adopted and recommends the use of SI units wherever possible, but exceptions are made in areas where SI units have not yet been generally employed and might not be readily understood. Readers interested in making use of the coherent system of SI units will find conversion factors in the ASTM Standard Metric Practice Guide, ASTM Designation E 380-70 (available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa. 19103). Conversion factors for units used in this paper are:

Length	1 in = 0.0254* metre
	1 ft = 0.3048* metre
	1 lb = 0.4536 kilogram
Mass	1 ton = 9.072×10^2 kilogram
	1 lbf = 4.448 newton
Force	1 kgf = 9.807 newton

*Exact value.

Inquiries regarding the facilities described in this report, or their possible use, should be directed to:

Chief, Engineering Mechanics Section
Mechanics Division, IBS
National Bureau of Standards
Washington, D.C. 20234

2. Engineering Mechanics Building

The Engineering Mechanics Building was designed specifically to house the force generating and measuring systems and related equipment contained therein. The building consists of two general test areas; several special purpose laboratories including the force and weight rooms containing deadweight testing machines; a machine shop; offices and a conference room. An exterior picture and floor plans are shown in figure 1. The room numbers specified in this report may be identified by referring to the floor plans in the figure.

2.1 Technical Laboratory Space

The laboratory space available for use in carrying out the program of the Engineering Mechanics Section consists of two large general test areas, several special purpose laboratories, and the force and weight rooms containing deadweight testing machines. The principal features of these laboratories are summarized in table 1.

2.2 Machine Shop, Room 143

This shop houses most of the machine tools required for the fabrication of test fixtures and specimens and for general support of the research and testing program. Available tools include lathes with swings up to 48 in, vertical and horizontal milling machines, a shaper, a radial arm drill, a variety of power saws, and numerous smaller items. Other machine shop equipment available in the building includes hot riveting and dimpling machines, heat treating ovens, a sheet metal brake, and several small drill presses.

2.3 Electric Power Service

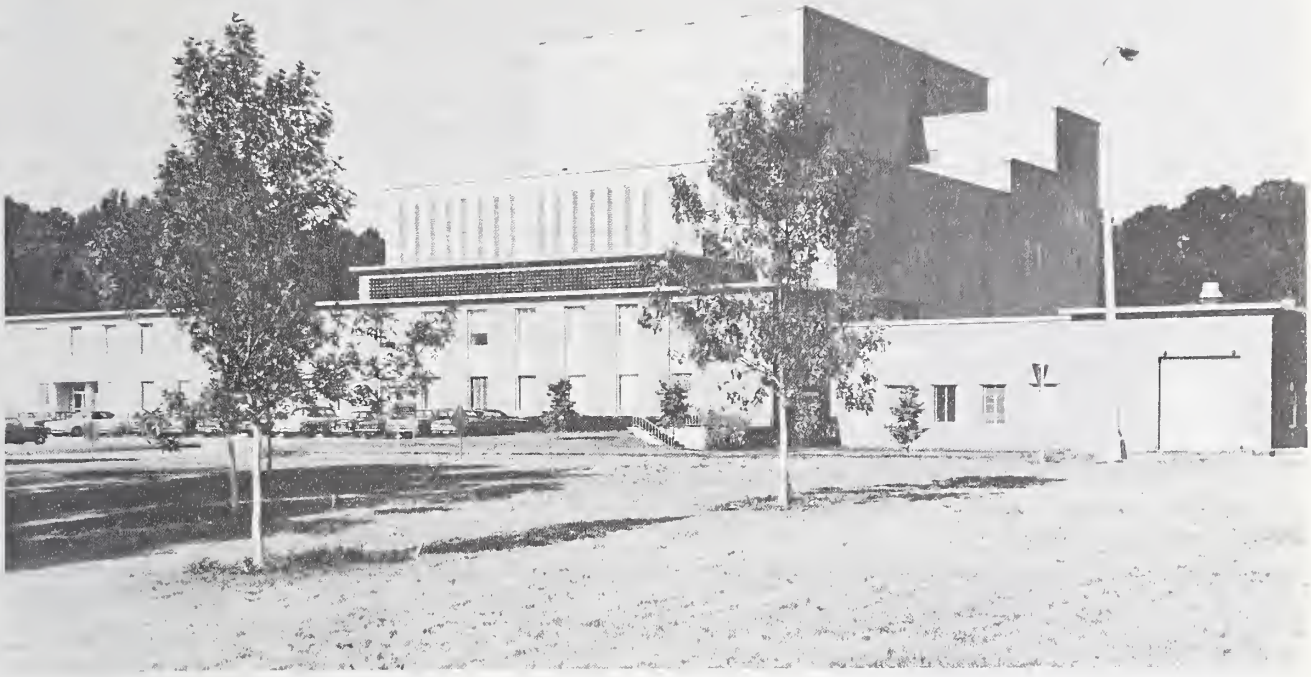
All laboratories in the building are supplied with 117-V ac power, and most of the laboratories are equipped with a bus-bar ground system which is independent of the electrical power system. Several laboratories are equipped with dc power from batteries which is available in 10-V increments up to 240 V. A special battery system is provided for rooms 227 through 231. This special system contains two battery banks, one of pasted plate cells and the other of Planté cells. Power is available from each of these battery banks in 2-V increments up to 48 V. Rectified 120/240-V dc power is available in rooms 227 through 231, and is also used to power some of the testing machines and cranes in other locations within the building. In addition, various locations throughout the building are supplied with 208-V 3-phase and 480-V 3-phase power.

2.4 Other Services

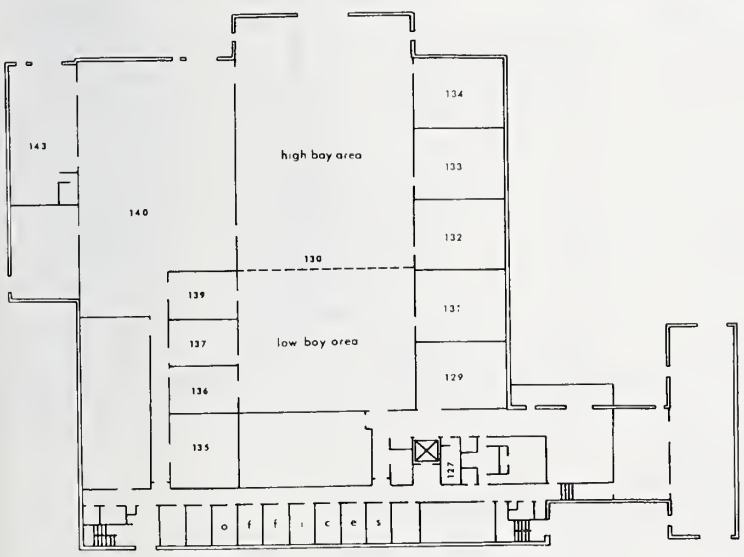
The Engineering Mechanics Building is supplied with compressed air, natural gas, and standard electrical frequencies. Outlets for these utilities are located in most laboratories. In addition, steam and 44 °F chilled water are available in the building.

TABLE 1—*Features of technical laboratories in the Engineering Mechanics Building*

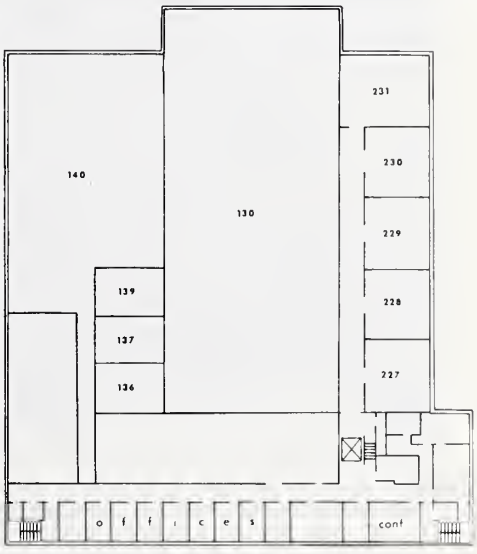
Room number	Features
127	Photographic darkroom.
129 131 132 133 134	These are the weight rooms for the deadweight force calibration machines. In addition to this principal function, several of these rooms, notably 129, have adequate space for the performance of experiments which require some degree of seclusion. Room 129 is temperature controlled.
130	Room 130 is a 75×165-ft room consisting of 2 bays with different ceiling heights. The high bay is 85 ft in height and is serviced by a 30-ton overhead crane. Access to this bay from the outside is through a 20-ft wide 14-ft high roll-up door. The low bay is 40 ft in height and is serviced by a 25-ton overhead crane. The travels of these cranes overlap to permit load transfer between bays.
135	Room 135 contains 2 universal testing machines. This room is temperature controlled.
136 137 139	These rooms are used for specimen preparation, measurement, and instrumentation, and for the assembly of experiments. Room 137 has 480-V 140-A 3-phase electrical service. It is also equipped with an exhaust hood. Room 139 contains a small, universal fatigue testing machine.
140	Room 140 is a 66×108-ft room which contains the majority of the testing machines in the building. Access to this room from the outside is through a 12-ft wide by 14-ft high roll-up door. Part of this room is serviced by 2 10-ton overhead cranes.
227 228 229 230 231	These are the force-measuring rooms of the deadweight force calibration machines and are situated directly above the weight rooms described above. They are used almost exclusively for the calibration of precision force measuring devices. These laboratories are all temperature controlled.



(a) Exterior



(b) First floor plan



(c) Second floor plan

FIGURE 1 The Engineering Mechanics Building

3. Deadweight Force Calibration Machines

The deadweight machines of the National Bureau of Standards serve as the standards of force for the United States. A calibration service for precision force measuring devices provides the means for disseminating these standards throughout the country. There are seven deadweight machines covering the range from 10- to 1-million pounds-force.

The four larger machines have a stack of weights which are transferred sequentially to a loading frame. A schematic view of a typical arrangement of this type is shown in figure 2. The smaller machines have a lesser number of weights of different denominations which can be added to the loading frame in any combination. A schematic view appears in figure 3. Final adjustments to the masses of all weights were made by comparison with multiples and sub-multiples of the national standards of mass. The adjusted values included corrections for both the deviation from standard gravity at the Gaithersburg location and air buoyancy for normal atmospheric conditions. The weights, as adjusted, apply loads in nominal pound-force units with uncertainties not exceeding 0.002 percent of the load. Two of the machines also have the capability of applying loads in nominal kilogram-force units.

The principal features of these deadweight force calibration machines are given in table 2.

TABLE 2—*Principal features of deadweight force calibration machines*

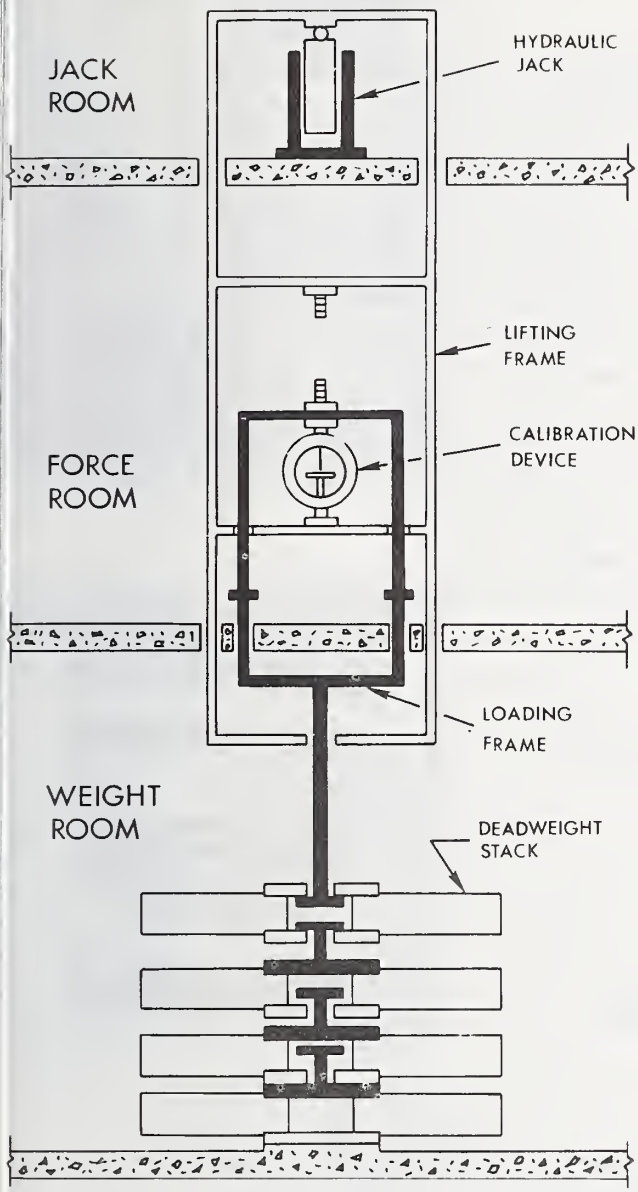
MANUFACTURER: NBS
NUMBER OF MACHINES: 7

Capacity, lbf specifications	1,000,000	300,000	112,000	112,000	25,300 (11,500 kgf)	6,100 (3,050 kgf)	500
Force room No	231	230	228	229	227	227	227
Material of weights	AISI 410	AISI 410	AISI 410	[a]	AISI 302	AISI 302	AISI 302
Minimum load, lbf	50,000	10,000	3,000	3,000	200	100	10
kgf					500	100	
Load increments, lbf	50,000	[b]	1,000	1,000	100	50	5
kgf					500	50	
Specimen size limitations:							
Clear space between screws, in							
T [c]	46	36	28	28	26	25.2	11.5
C [c]	34	36	28	28	19.5	18.5	11.5
Clear space between crossheads, in							
T	175	98	85	85	36	30	22
C	78	65	40	40	30	24	10

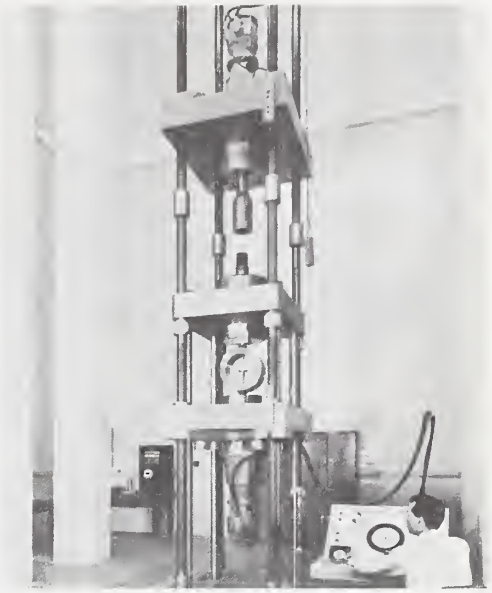
[a] 10,000-lbf weights are cast iron, 1,000-lbf weights are cast steel. A protective paint covers all weights of this machine.

[b] Weights are arranged to provide 10 equal increment tests loads to devices of 100,000, 200,000, and 300,000-lbf capacities.

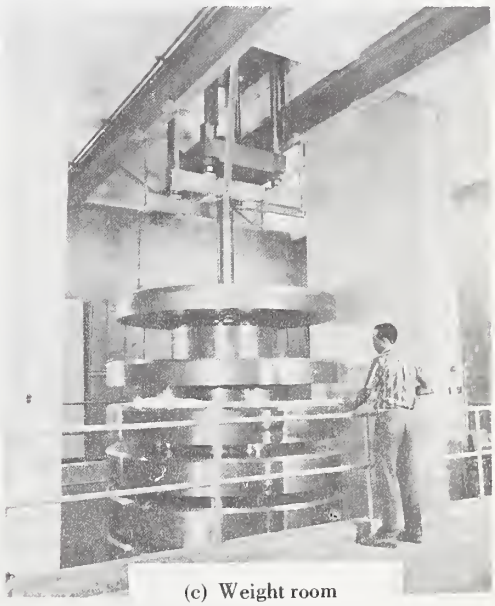
[c] T indicates machine applying tensile load, C indicates compressive load.



(a) Schematic

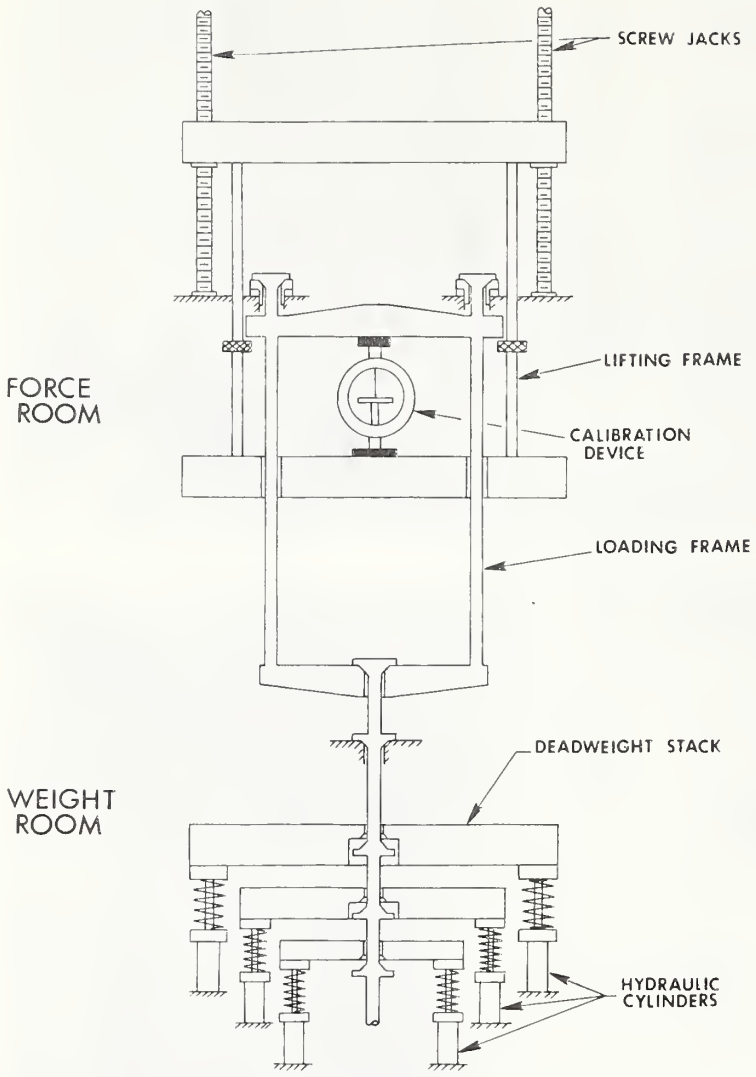


(b) Force room

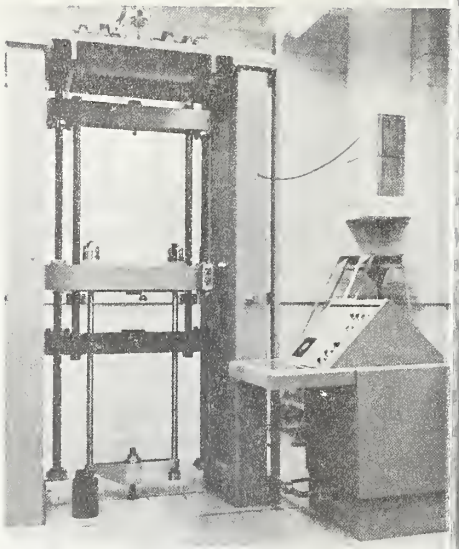


(c) Weight room

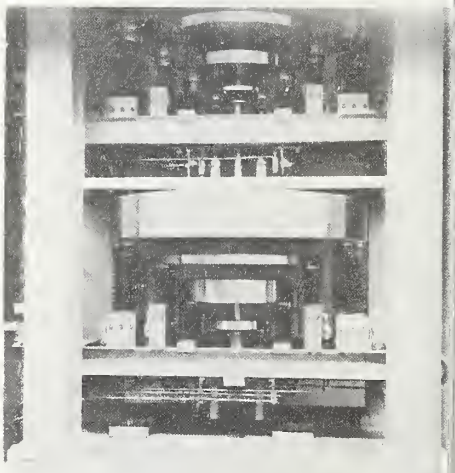
FIGURE 2 1,000,000 lbf deadweight force calibration machine.



(a) Schematic



(b) Force room



(c) Weight room

FIGURE 3 6100 lbf (3,050 kgf) deadweight force calibration machine.

4. 12-Million-Pound-Force Universal Testing Machine

The 12-million-pound-force universal testing machine is believed to be the largest testing machine in the world. The test frame rises 78 feet above the floor and can accommodate specimens with lengths up to 53 feet in tension, 58 feet in compression, and 90 feet in flexure. The foundation, hydraulics, and major electrical power facilities are located in a pit extending 23 feet below the main platen of the machine. This machine is shown in the artist's conception and the photograph in figures 4 and 5. The principal features are given in table 3. A more complete description of this machine is given in reference 1.

The functions of this machine are twofold: to serve as a testing machine for the mechanical testing of structures, both independently and in conjunction with the tie-down floor system, and to provide a means of applying the forces required for the calibration of force measuring devices having capacities greater than 1-million pounds-force.

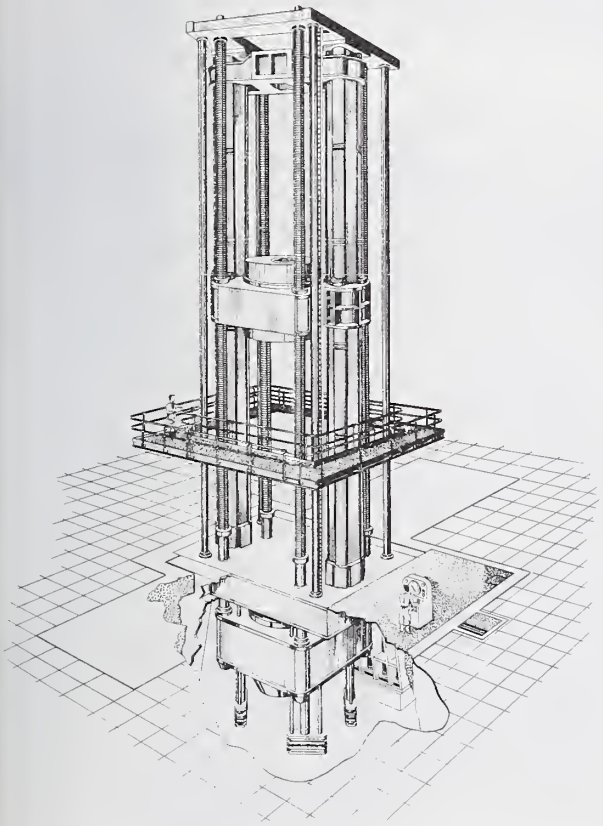


FIGURE 4 Artist's conception of 12,000,000 lbf universal testing machine.

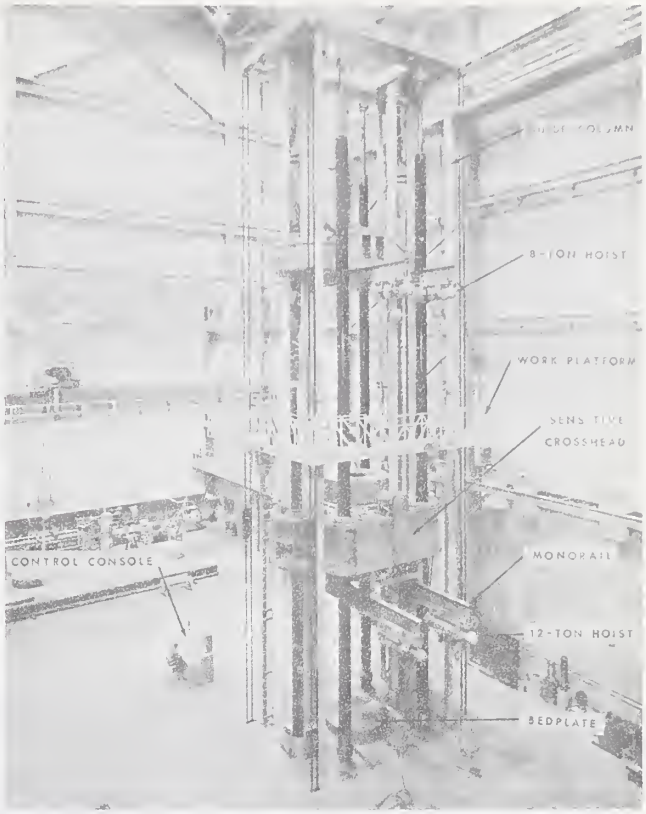


FIGURE 5 12,000,000 lbf universal testing machine.

TABLE 3—*Principal features of the 12-million-pound-force universal testing machine*

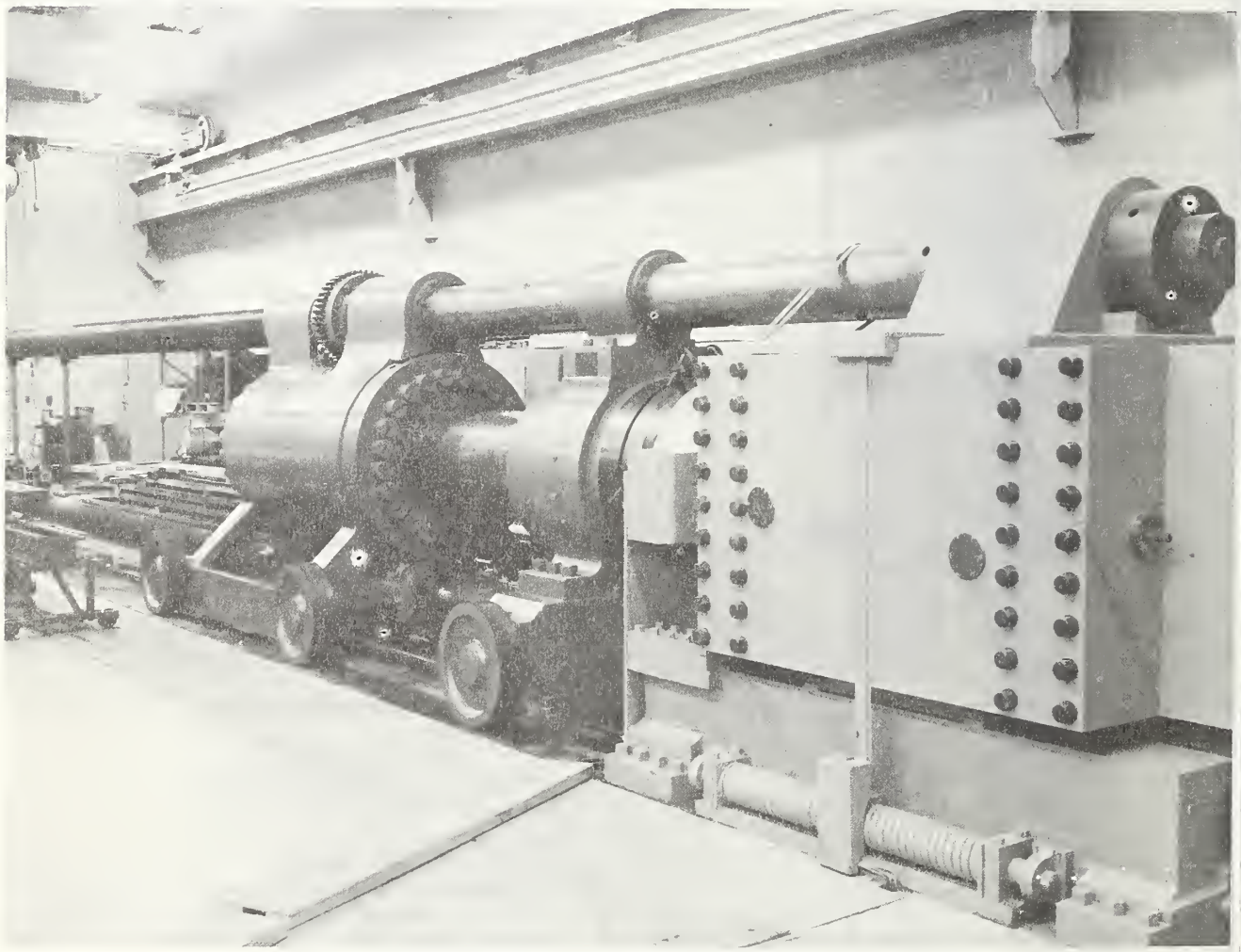
MANUFACTURER: Bliss
NUMBER OF MACHINES: 1
GENERAL DESCRIPTION: 3 crosshead, vertical, hydraulic
LOCATION: Room 130
SPECIFICATIONS:
- Modes: tension, compression, flexure
- Capacity, lbf: T—6,000,000
  C—12,000,000
  Flexure—see Special features below
- Load Ranges, lbf: 12,000,000
  6,000,000
  3,000,000
  1,200,000
  600,000
  120,000
- Specimen size limitation:
  - Clear space between crossheads, ft:
    T—53
    C—58
  - Clear space between screws, ft: 8.3
- Maximum stroke, ft: 5
- Load sensor: hydraulic capsule
- Special features: This machine has a 17-ft wide tie-down floor extending 35 ft to each side of the machine. The floor contains 126 anchor points, each with a capacity of 150,000 lbf. Using this floor, flexure tests can be run to bending moments of up to 20-million lbf-ft.

5. Static Testing Machines

The static testing machines of the Engineering Mechanics Section are used for performing mechanical tests on materials and structures. These machines, which are described on the following pages, include horizontal and vertical universal testing machines, torsion testing machines, and creep testing machines. All of these testing machines are periodically calibrated and, if necessary, adjusted to assure compliance with appropriate specifications such as ASTM Method E-4, "Verification of Testing Machines."

TABLE 4—*Principal features of 2.3-million-pound-force universal testing machine*

MACHINE TYPE: Universal Testing Machine
MANUFACTURER: Emery
NUMBER OF MACHINES: 1
GENERAL DESCRIPTION: 2 crosshead, horizontal, hydraulic
LOCATION: Room 140
SPECIFICATIONS:
- Modes: tension and compression
- Capacity, lbf: T—1,150,000
  C—2,300,000
- Maximum crosshead speed, in/min:
  - T—4
  - C—2.1
- Specimen size limitations:
  - Clear space between crossheads, ft:
    - T—21
    - C—33
  - Clear space between screws, ft: 4.5
- Maximum stroke, ft: 5
- Load sensor: hydraulic capsule



2,300,000 lbf Emery universal testing machine.

TABLE 5—*Principal features of 4 universal testing machines*

MACHINE TYPE: Universal Testing Machine
NUMBER OF MACHINES: 4
GENERAL DESCRIPTION: 3 crosshead, vertical, screw powered

Capacity, lbf specifications	600,000	400,000	100,000	50,000
Manufacturer	Tinius Olsen	Tinius Olsen	Riehle	Tinius Olsen
Location	Room 130	Room 140	Room 140	Room 140
Modes	T, C, flexure	T and C	T and C	T and C
Load ranges, lbf	600,000 300,000	400,000 80,000 16,000 4,000	100,000	50,000 5,000
Maximum crosshead speed, in/min	5	2	8	6
Specimen size limitations:				
Clear space between crossheads, ft	T—24 C—22	T—15 C—15	T—4.3 C—2.2	T—7 C—7
Clear space between screws, in	30	42	10.5	14
Load sensor	Beam and poise	Lever arm—LVDT electrical servo	Beam and poise	Beam and poise
Special features	[a, b, c, d]	[d, e, f]	[b]	[b]

[a] The 600,000-pound-force Tinius Olsen testing machine has a 2-ft-wide tie-down floor extending 13 ft to each side of the machine center line.

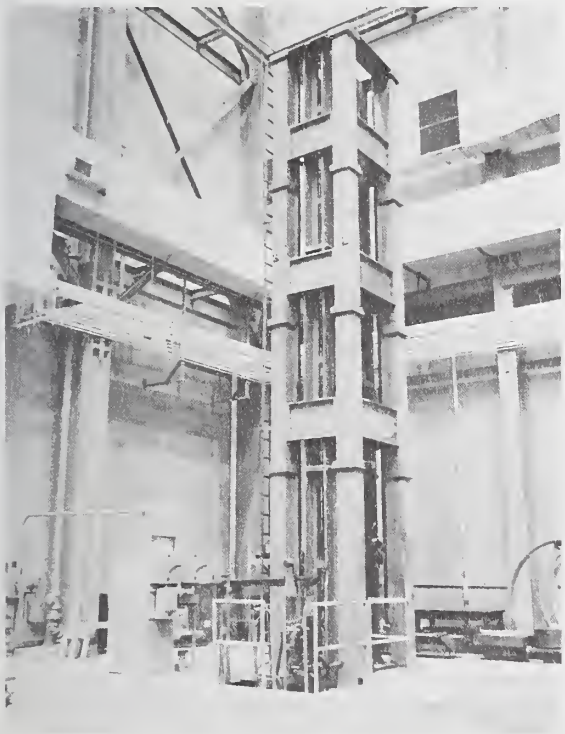
[b] These machines are equipped with a double potentiometer control circuit that permits crosshead speed to be varied over a wide range.

[c] Modifications to this machine allow a lateral vibration to be applied to a wire or rope subjected to a tensile load. The maximum lateral displacement is ±0.75 in and the maximum cyclic speed is 1,000 Hz.

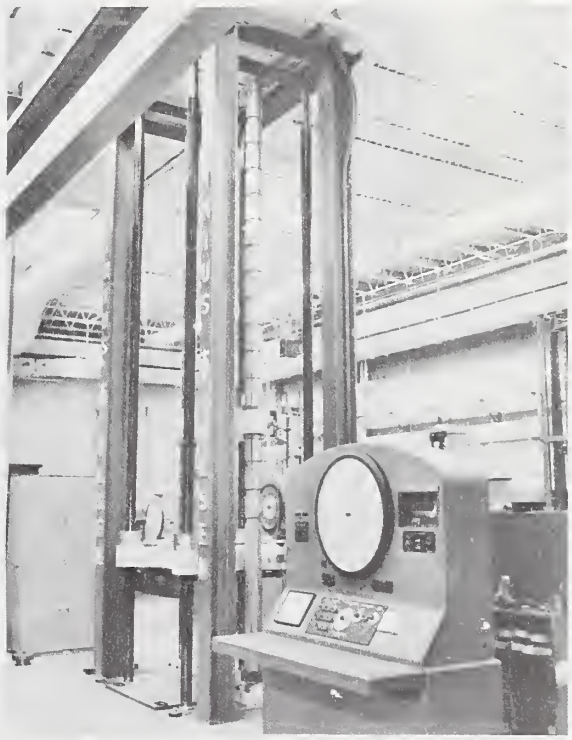
[d] These machines have the capability of maintaining a preset load for prolonged periods.

[e] This machine has an autographic load-strain recorder plug-in unit. The load signal is taken directly from the load measuring system of the machine. The strain signal is taken from an extensometer attached to the specimen.

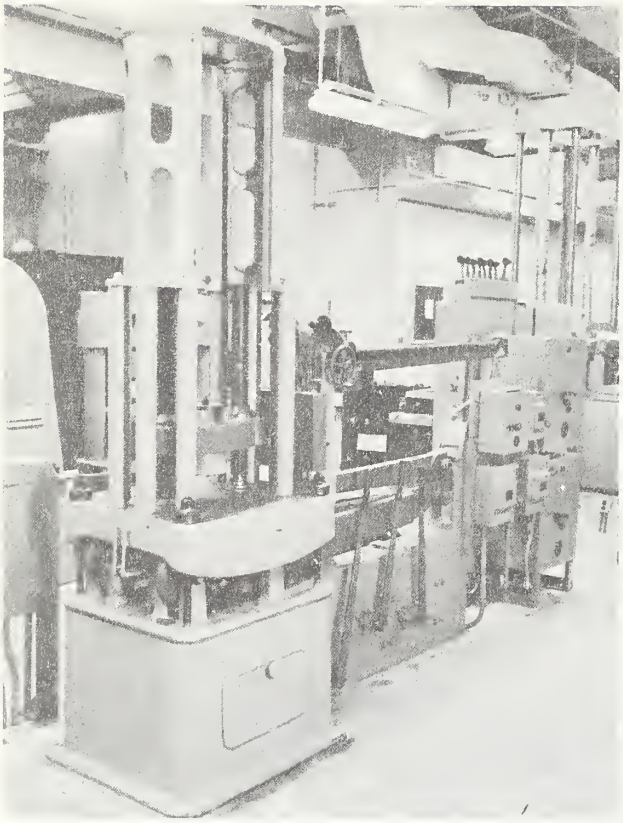
[f] This machine has a deflectometer attachment to measure crosshead travel with a resolution of 0.0005 in.



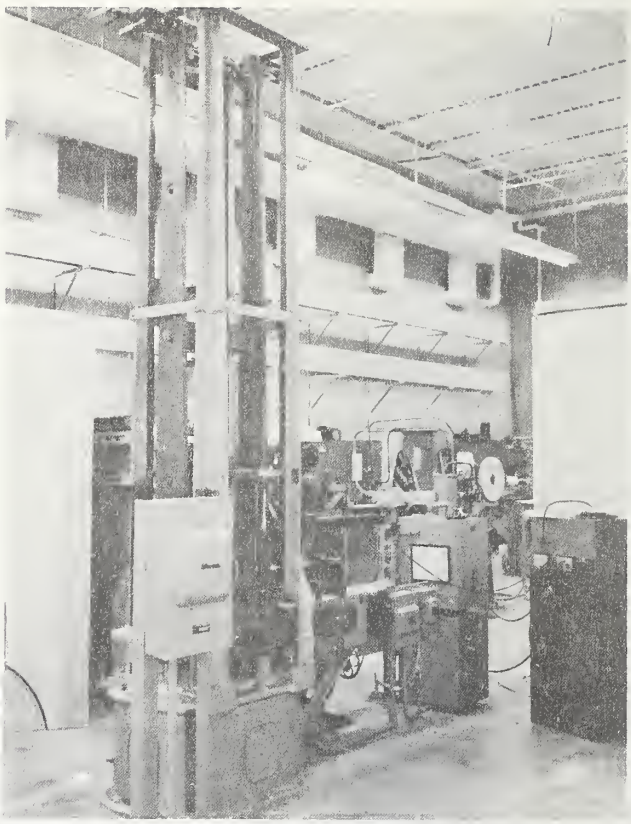
600,000 lbf Tinius Olsen universal testing machine



400,000 lbf Tinius Olsen universal testing machine



100,000 lbf Riehle
universal testing machine



50,000 lbf Tinius Olsen
universal testing machine

TABLE 6—*Principal features of 3 universal testing machines*

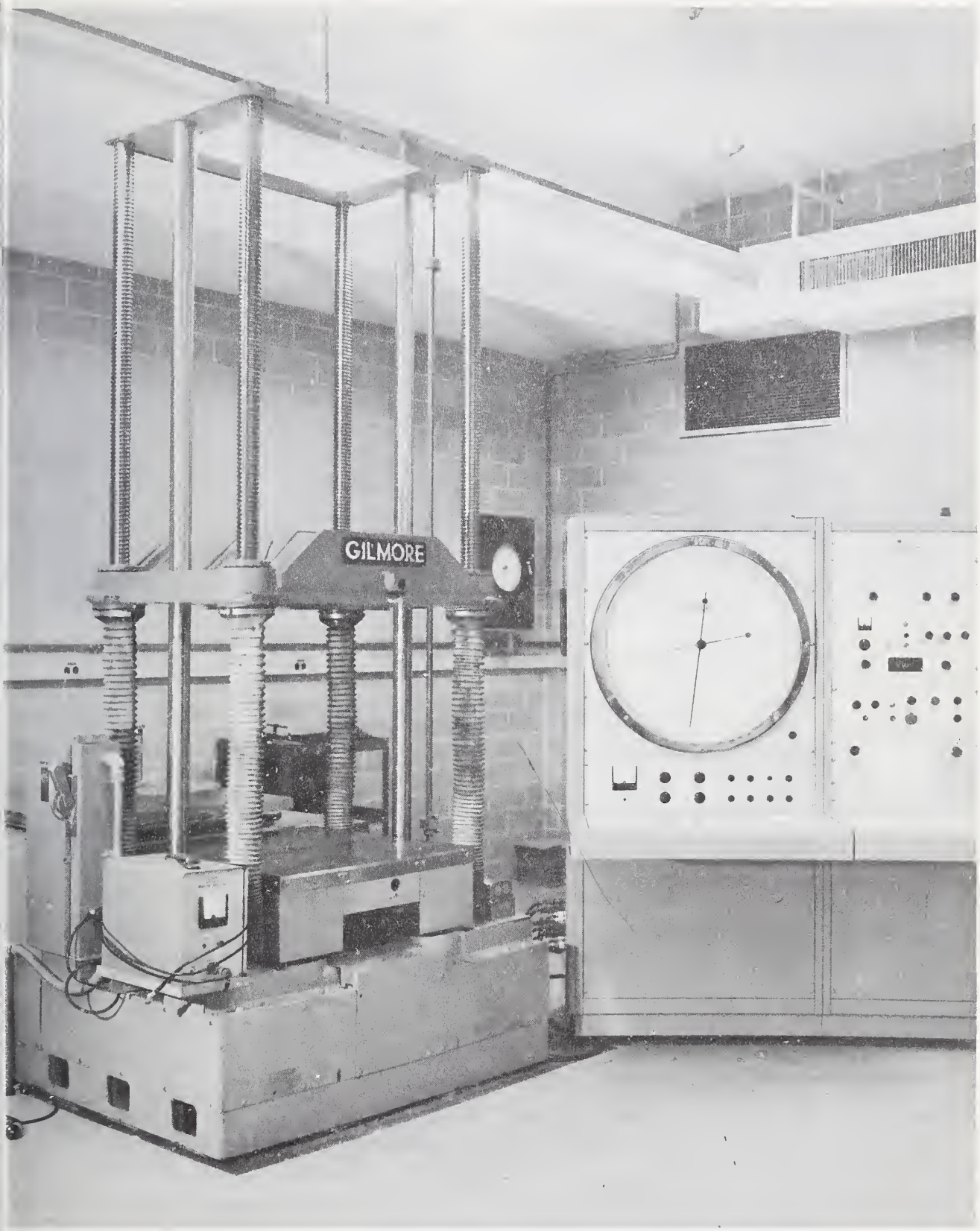
MACHINE TYPE: Universal Testing Machine
MANUFACTURER: Gilmore
NUMBER OF MACHINES: 3
GENERAL DESCRIPTION: 2 crosshead, vertical, screw powered

Capacity, lbf specifications	200,000	50,000	10,000
Location	Room 140	Room 135	Room 135
Modes	T and C	T and C	T and C
Load ranges, lbf	200,000	50,000	10,000
	50,000	20,000	2,000
	10,000	5,000	500
	2,000	500	100
Maximum crosshead speed, in/min	25 (0 to 50,000 lbf)	25 (0 to 12,500 lbf)	50 (0 to 2,500 lbf)
	10 (50,000 to 200,000 lbf)	10 (12,500 to 50,000 lbf)	10 (2,500 to 10,000 lbf)
Specimen size limitations:			
Clear space between crossheads, in	T—90	T—75	T—75
	C—90	C—75	C—75
Clear space between screws, in	36	30	30
Load sensor	Load cells electrical servo	Load cells electrical servo	Load cells electrical servo
Special features	[a, b, c]	[a, b, c]	[a, b, c]

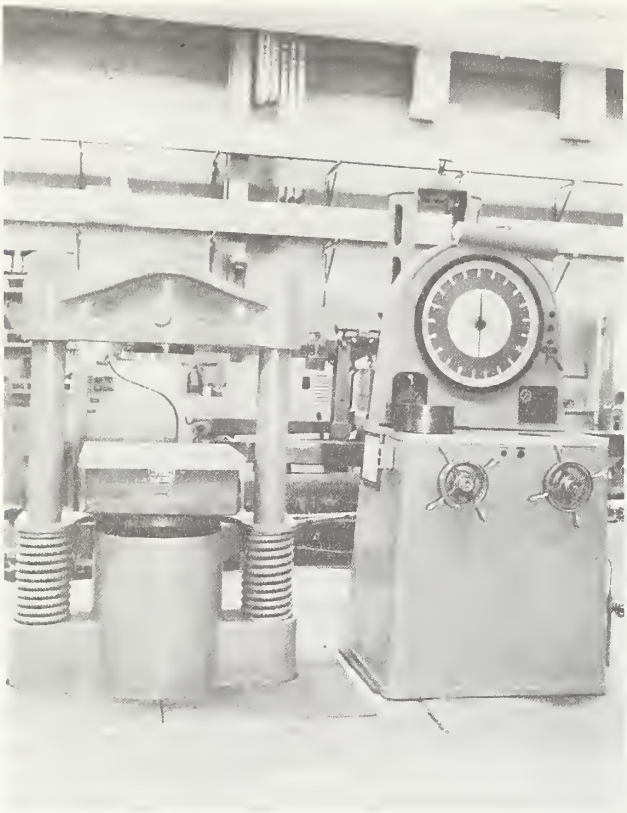
[a] These machines have the capability of maintaining a preset load for prolonged periods.

[b] These machines have an autographic load-strain recorder plug-in unit. The load signal is taken directly from the load measuring system of the machine. The strain signal is taken from an extensometer attached to the specimen.

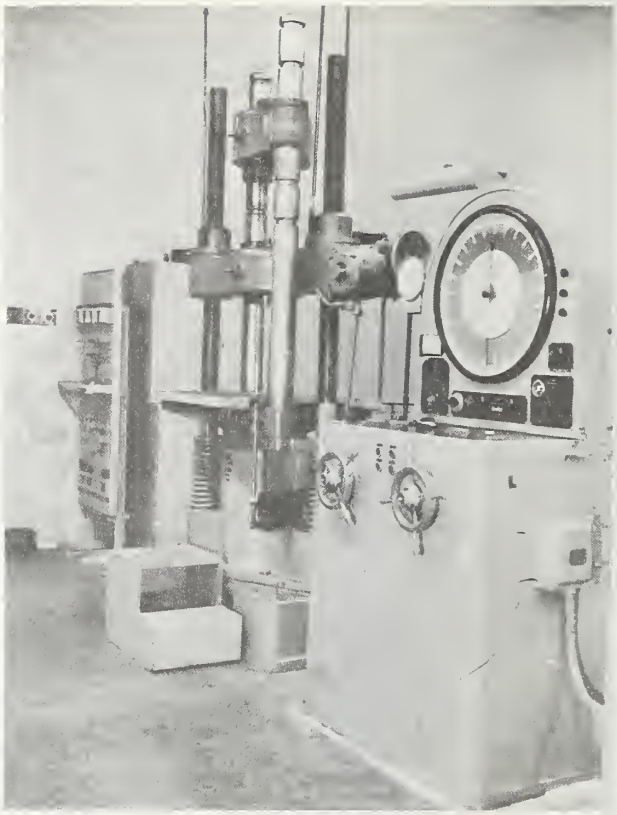
[c] An auxiliary console which can be plugged in to any of the 3 Gilmore testing machines contains controls for constant strain-rate and constant load-rate operation, maintenance of a preset strain, low speed cycling between preset load or strain limits, and digital load readout.



10,000 lbf Gilmore universal testing machine



200,000 lbf Baldwin
compression testing machine



120,000 lbf Baldwin
universal testing machine

TABLE 7.—*Principal features of 4 testing machines*

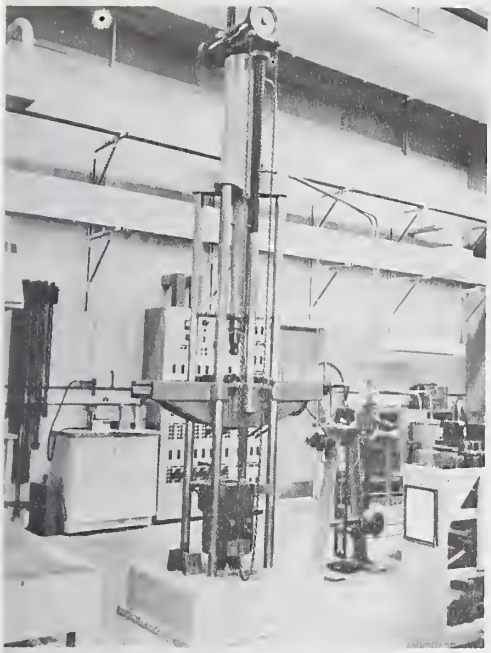
MACHINE TYPE: Testing Machine
MANUFACTURER: Baldwin
NUMBER OF MACHINES: 4
GENERAL DESCRIPTION: Vertical, hydraulic

Capacity, lbf specifications	200,000	120,000	60,000	20,000
Location	Room 140	Room 140	Room 140	Room 140
Modes	C	T and C	T and C	T and C
Load ranges, lbf	200,000 50,000 10,000	120,000 24,000 6,000	60,000 12,000 2,400	20,000 10,000 1,000
Maximum crosshead speed, in/min	6	6	6	6
Specimen size limitations:				
Clear space between crossheads, in	C−18	T−39 C−48	T−51 C−60	T−39 C−48
Clear space between screws, in	23.8	30	30	30
Maximum stroke, in	12	9.5	8.8	9.2
Load sensor	Hydraulic capsule pneumatic servo	Hydraulic capsule pneumatic servo	Hydraulic capsule pneumatic servo	Hydraulic capsule pneumatic servo
Special features		[a, b, c]	[a, b, c]	[a, b, c]

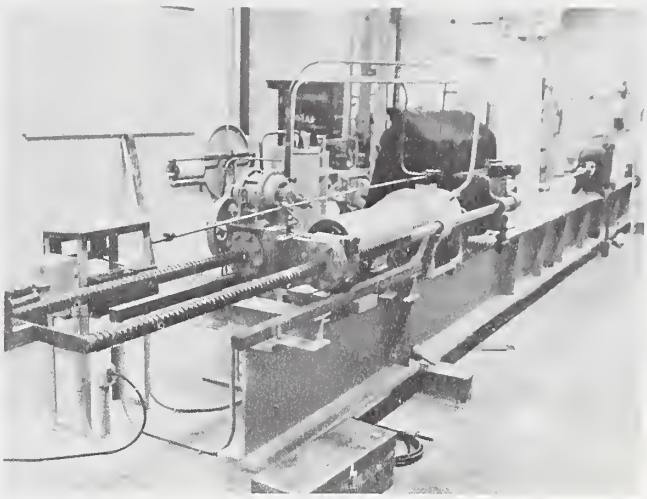
[a] These machines have the capability of maintaining a preset load for prolonged periods.

[b] These machines have an autographic load-strain recorder plug-in unit. The load signal is taken directly from the load measuring system of the machine. The strain signal is taken from an extensometer attached to the specimen.

[c] These machines have a deflectometer attachment to measure crosshead travel with a resolution of 0.0005 in.



100,000 lbf Amsler
vertical universal testing machine



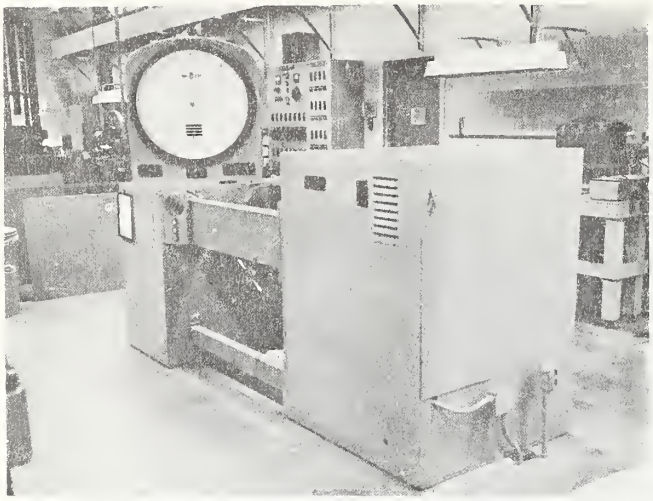
100,000 lbf Amsler
horizontal universal testing machine

TABLE 8—*Principal features of 2 universal testing machines*

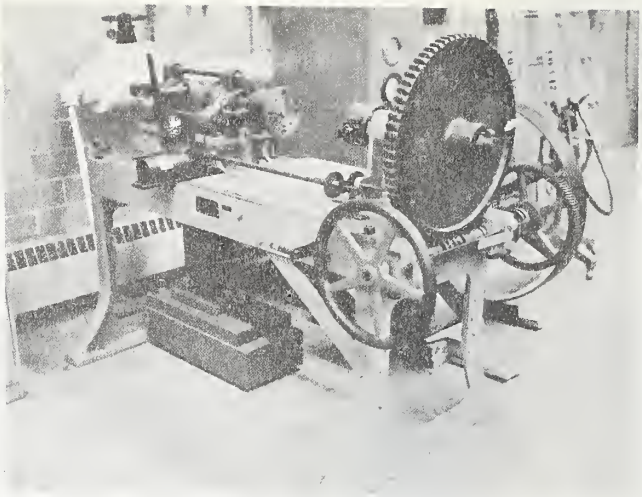
MACHINE TYPE: Universal Testing Machine
MANUFACTURER: Amsler
NUMBER OF MACHINES: 2
GENERAL DESCRIPTION: 3 crosshead, hydraulic

Capacity, lbf specifications	100,000 vertical	100,000 horizontal
Location	Room 140	Room 140
Modes	T and C	T and C
Load ranges, lbf	100,000 50,000	100,000 50,000 20,000 10,000
Maximum crosshead speed, in/min.	12	10
Specimen size limitations:		
Clear space between crossheads, in	T—59 C—57	T—144 C—72
Clear space between screws in.	T—15 C—10.5	T—24 C—14
Maximum stroke, in	16	39
Load sensor	Hydraulic pressure sensor, pendulum dynamometer	Hydraulic pressure sensor, pendulum dynamometer
Special features	[a]	

[a] The 100,000-pound-force vertical Amsler testing machine has an 8.3-in-wide flexure plate extending 26 in to each side of the machine center line.



40,000 lbf-in Tinius Olsen
torsion testing machine



150 kgf-m Amsler-Laffon-Sohn
torsion testing machine

TABLE 9—*Principal features of 2 torsion testing machines*

MACHINE TYPE: Torsion Testing Machine
NUMBER OF MACHINES: 2
GENERAL DESCRIPTION: Horizontal, screw powered

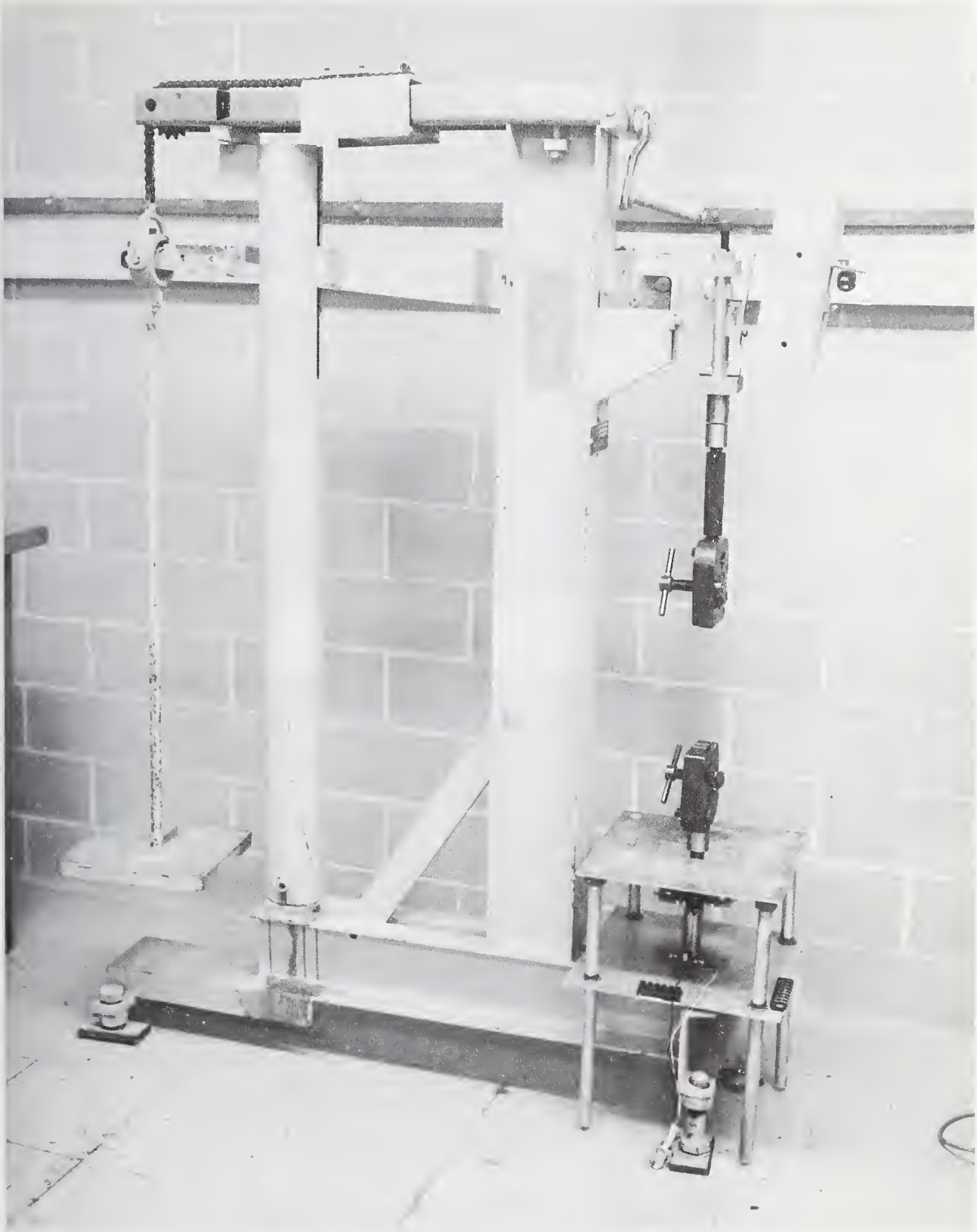
Capacity specifications	40,000 lbf-in	150 kgf-m (2,680 lbf-in)
Manufacturer	Tinius Olsen	Amsler-Laffon-Sohn
Location	Room 140	Room 140
Load ranges	40,000 lbf-in	150 kgf-m (2,680 lbf-in)
	8,000	45 kgf-m (804 lbf-in)
	2,000	15 kgf-m (268 lbf-in)
	400	
Maximum crosshead speed	0.1 rad/min	Manual
Specimen size limitations:		
Clear space between crossheads, in	25.5	17.5
Clear space between columns, in	27	18
Load sensor	Lever arm—LVDT	Pendulum—dial

TABLE 10—*Principal features of 2 creep testing machines*

MACHINE TYPE: Creep Testing Machine
NUMBER OF MACHINES: 2
GENERAL DESCRIPTION: Deadweight loading, 10:1 lever arm

Capacity, lbf specifications	6,000	5,000
Manufacturer	Budd	NBS
Location	Room 135	Room 135
Specimen size limitations:		
Clear space between crossheads, in	32.5	37
Clear space between frames, in	12	11
Special features	[a]	

[a] By the addition of some available accessory equipment, this machine can be converted to a stress relaxation testing machine; that is, to maintain a preset strain for indefinite periods of time.



6000 lbf Budd creep testing machine

6. Dynamic Testing Machines

Some of the testing machines of the Engineering Mechanics Section, which are used for studying the response of materials and structures to dynamic forces, are described in the following pages. These include fatigue testing machines and electrodynamic shakers.

The Gilmore universal testing machines also have a cyclic loading capability as described in table 6 of this report. The 600,000-lbf Tinius Olsen universal testing machine has been modified so that cyclic lateral displacements can be imposed on rope or rods being subjected to tensile loads. This was described previously in table 5.

TABLE 11—*Principal features of 2 universal fatigue testing machines*

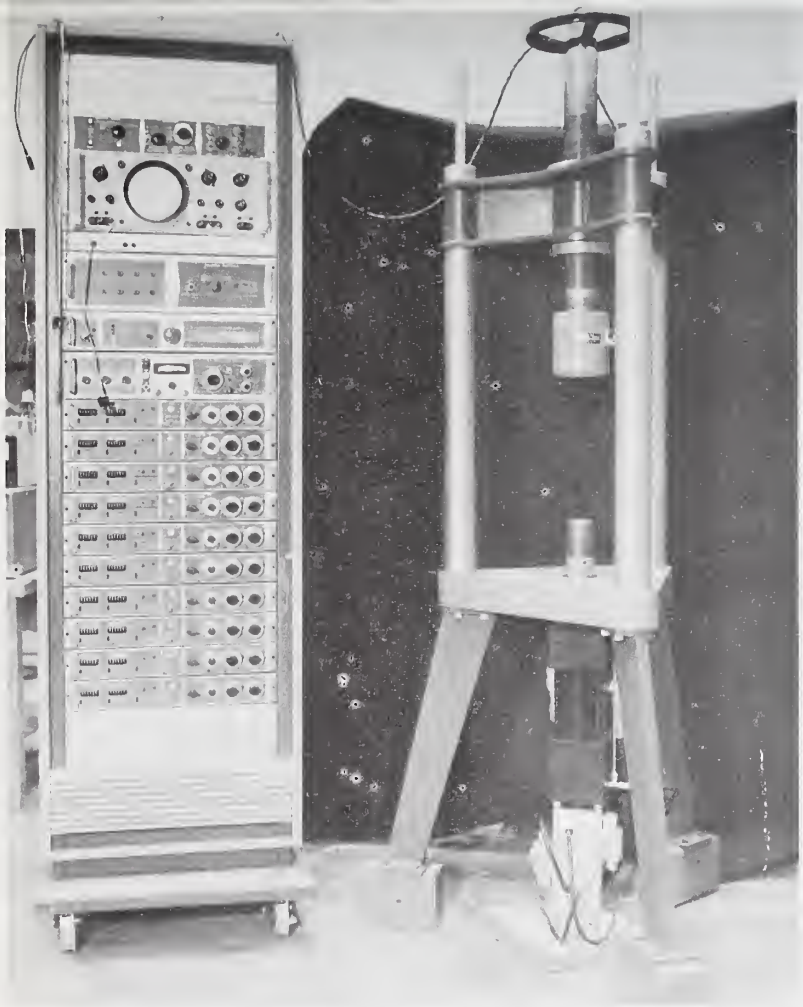
TYPE OF MACHINE: Universal Fatigue Testing Machine
MANUFACTURER: MTS
NUMBER OF MACHINES: 2
GENERAL DESCRIPTION: Closed loop, electrohydraulic, servo-controlled

Capacity, lbf specifications	50,000	10,000
Location	Room 130	Room 130
Modes	T and C	T and C
Cyclic speeds, Hz	0.01–20	0.01–20
Specimen size limitations:		
Clear space between crossheads, in	50.5	53
Clear space between columns, in	22	17
Maximum stroke, in	6	6
Load sensor	Load cell	Load cell
Displacement sensor	LVDT	
Special features	[a, b, c, d]	[a, b, d]

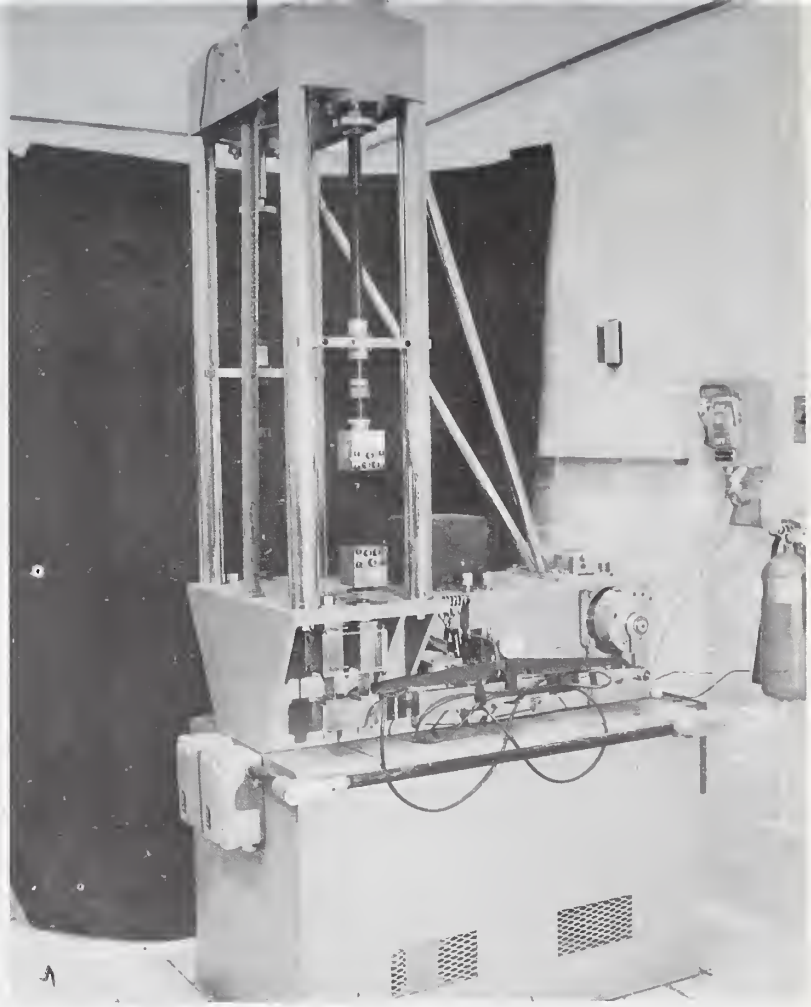
[a] These machines have the capability of maintaining a preset load for prolonged periods.
[b] These machines can be programmed to apply up to 10 load levels in blocks of fixed numbers of cycles in repeated sequence. Each step has a separate frequency control.
[c] This machine can be programmed to cycle between 2 preset displacements.
[d] These machines can be mounted on any suitable structure, frame or support for applying loads to test specimens.

TABLE 12—*Principal features of a universal fatigue testing machine*

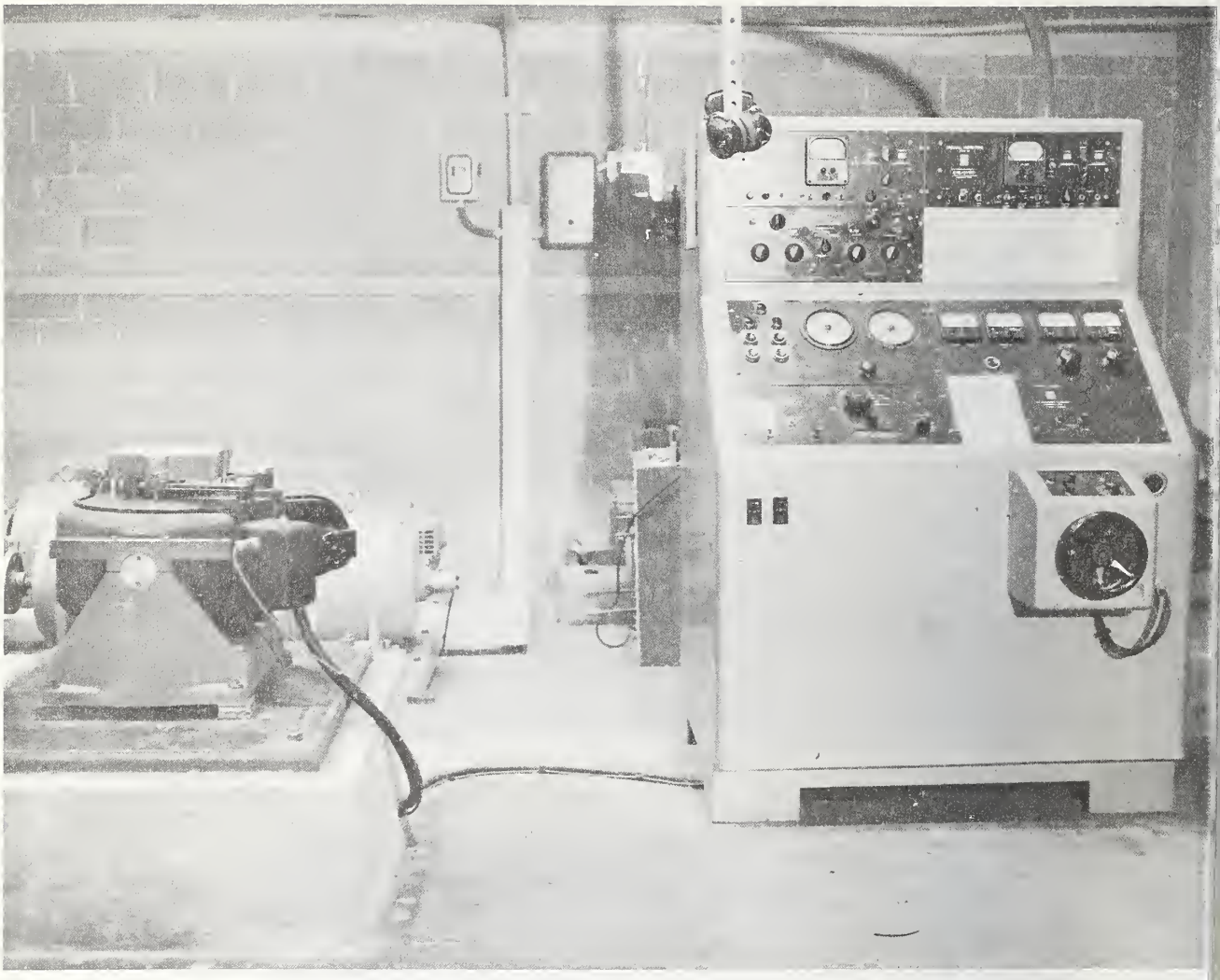
MACHINE TYPE: Universal Fatigue Testing Machine
MANUFACTURER: Krouse
NUMBER OF MACHINES: 1
GENERAL DESCRIPTION: Lever arm with adjustable rotating cam; 2 independent loading stations.
LOCATION: Room 139
SPECIFICATIONS:
Modes: tension and compression
Capacity, lbf: 5,000 at each station
Cyclic speed, Hz: 30
Specimen size limitations:
Clear space between crossheads, in: 30
Clear space between columns, in: 7.5
Load sensor: deflection beam



10,000 lbf MTS universal fatigue testing machine



10,000 lbf Krouse universal fatigue testing machine



600 lbf Calidyne electrodynamic shaker

TABLE 13—*Principal features of an electrodynamic shaker*

MACHINE TYPE: Shaker
MANUFACTURER: Calidyne
NUMBER OF MACHINES: 1
GENERAL DESCRIPTION: Electrodynamic
LOCATION: Room 130
SPECIFICATIONS:

Capacity, lbf: 600
Modes: constant displacement, constant acceleration
Speeds, Hz: 5–2,000
Maximum amplitude: Disp.—1 in peak to peak
Acc.—53.5g peak
Sensing element: velocity coil
Special features: This machine can be programmed to sweep through the frequency range up to 2,000 Hz. It can also be programmed to cross over from constant acceleration control to constant displacement control at a preset frequency.

7. Special Purpose Equipment

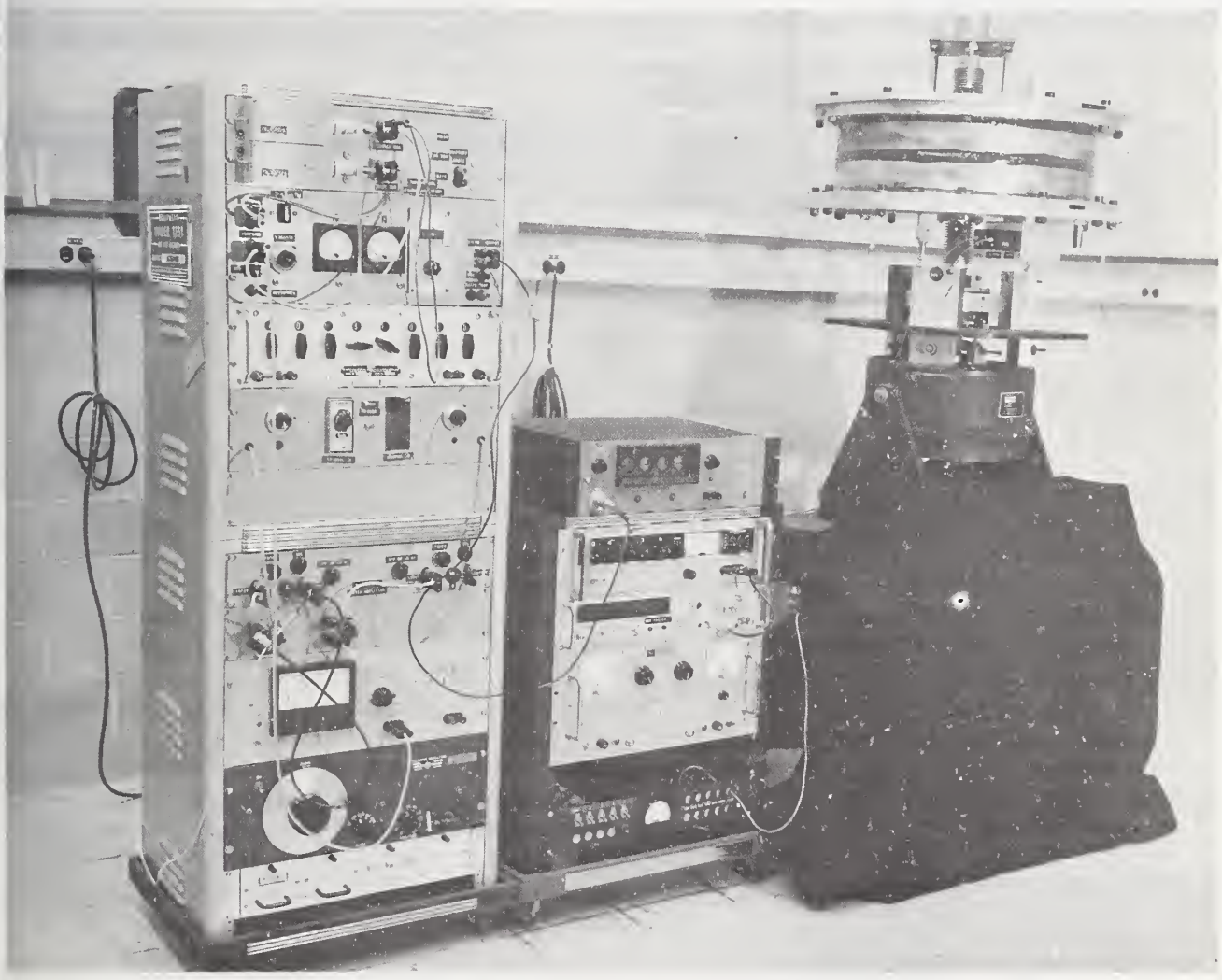
The special purpose equipment described here was purchased or built for particular research projects. This equipment can be used for purposes similar to those for which it was designed, or modified as necessary.

TABLE 14—*Principal features of the NBS damping measurement facility*

MANUFACTURER: NBS
NUMBER OF MACHINES: 1
GENERAL DESCRIPTION: Mechanical Transmissibility Measurement in Vacuum
LOCATION: Room 139
SPECIFICATIONS: The transmissibility of a material is determined by inducing a cyclic displacement amplitude on the fixed end of a fixed-free beam and measuring the free end displacement amplitude. The ratio of free end displacement to fixed end displacement is the transmissibility. This experiment is performed in a vacuum chamber.
Maximum beam length, in: 12
Maximum cyclic speed, Hz: 1,000
Maximum fixed end displacement, in: 1/2 peak to peak

TABLE 15—*Principal features of the 60,000-pound-mass platform scale*

MACHINE TYPE: Platform Scale
MANUFACTURER: Fairbanks-Morse
NUMBER OF MACHINES: 1
GENERAL DESCRIPTION: Device for comparing masses
LOCATION: Room 130
SPECIFICATIONS:
Maximum load, lb: 60,000
Test bed, ft: 10 × 10
SPECIAL FEATURES: This equipment is stored on pneumatic jacks to prevent damage when not in use and is lowered onto knife edges for operation.



NBS damping measurement facility

8. Other Test Equipment

Located within the Engineering Mechanics Building is a variety of other equipment, required for the mechanical testing of materials and structures. This equipment includes:

(a) Strain and displacement measuring devices, including LVDT's, LVDT extensometers, Tuckerman Optical strain gages, electrical resistance strain gages, a photoelastic bench, and others.

(b) Recording instrumentation, including strain-time, dc-voltage-time, load-strain, and dc-voltage X — Y recorders. Also available is a modern data acquisition system capable of handling up to 180 independent dc-voltage (10 mV to 10 V full scale) inputs or 200 strain gage signals, reading at 20 readings per second, and storing data on magnetic tape and/or roll paper.

(c) Tension and compression force measuring devices with capacities up to 3-million pounds-force.

(d) Electronic equipment, including signal generators, power supplies, amplifiers, voltmeters, phasemeters, etc.

(e) Hardness testing machines, including Brinell, Rockwell, Superficial Rockwell, Vickers, and Scleroscope hardness testers and a Tukon micro hardness tester.

(f) Heat treating ovens and test furnaces with capacities up to about 2000 °F and a refrigeration unit capable of cooling to 0 °F.

(g) Recording and indicating temperature controllers covering the temperature range of — 32 to 2000 °F.

(h) Alinement subpresses for compression testing of small material specimens.

(i) Auxiliary loading equipment, such as hydraulic and mechanical jacks, large loading frames, large springs, etc.

(j) Various microscopes for observation of materials during and after testing.

(k) Photographic equipment, including still, slide, and movie cameras for observation and measurement of specimens during and after testing.

Various combinations of these items are routinely combined into systems for use alone or in conjunction with the major equipment described earlier.

9. References

[1] Kirstein, A. F., Universal Testing Machine of 12-Million-lbf Capacity at the National Bureau of Standards, Nat. Bur. Stand. (U.S.), Spec. Publ. 355, 18 pages (Sept. 1971).

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The principal characteristics of the force measuring and generating equipment and related research facilities available in the Engineering Mechanics Section of the National Bureau of Standards are described.

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