UNITED STATES DEPARTMENT OF COMMERCE · W. Averell Harriman, Secretary

NATIONAL BUREAU OF STANDARDS · E. U. Condon, Director

BUILDING MATERIALS *and* STRUCTURES

SUPPLEMENT NO. 2 TO REPORT BMS17

Sound Insulation

of

Wall and Floor Constructions

ISSUED SEPTEMBER 15, 1947

This supplement reports the results of sound-transmission measurements made on a number of additional types of construction since the issuance of the original report in March 1939, and the first Supplement issued December 20, 1940

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Building Materials and Structures Report BMS17
Supplement Number 2

by ALBERT LONDON

KEY TO PANEL NUMBERS

The results of sound-transmission tests on panels having numbers less than 200 have previously appeared in BMS17 and the first Supplement thereto. Page numbers referred to in this report are those of BMS17.

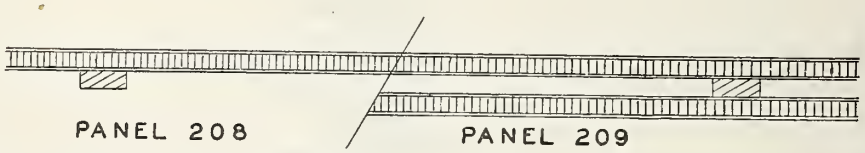
With the appearance of this Supplement a new system of classifying sound-transmission panels has been inaugurated. Each panel is assigned to one of the following classes:

Classification of sound-transmission structures

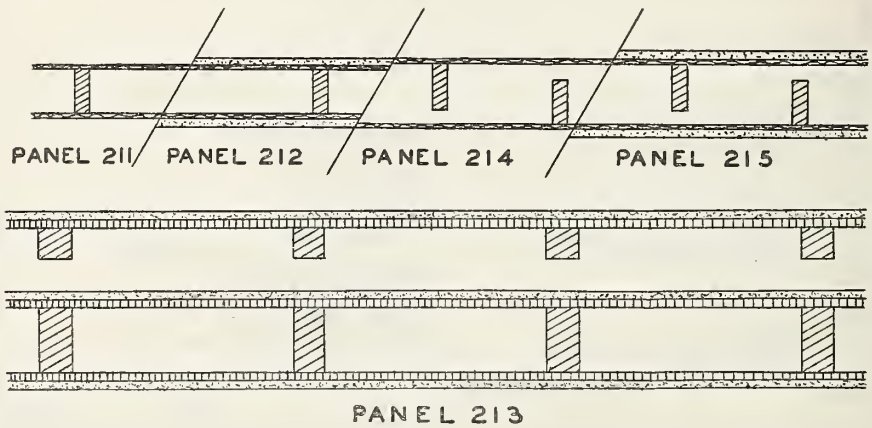
WALLS	
Class 2: Panel Nos. 201 to 299.	*Wood and steel studs:* Steel studs. Wood studs.
Class 3: Panel Nos. 301 to 399.	*Brick, tile, and masonry:* Brick. Cinder block. Clay tile. Glass brick. Gypsum tile.
Class 4: Panel Nos. 401 to 499.	*Clips and special nails.*
Class 5: Panel Nos. 501 to 599.	*Solid plaster:* Solid plaster with studs. Studless plaster partitions.
Class 6: Panel Nos. 601 to 699.	*Miscellaneous walls:* Doors. Single layers of material. Thermax.
FLOORS	
Class 7: Panel Nos. 701 to 799.	*Wood and steel joists:* Steel joists. Wood joists.
Class 8: Panel Nos. 801 to 899.	*Masonry floors:* Concrete slab. Concrete and tile combination. Flat arch concrete.
Class 9: Panel Nos. 901 to 999.	*Miscellaneous floors:* Prefabricated sheet steel floor.

In order to avoid confusion, the panel numbers that have appeared in publications prior to this report, i. e., those less than No. 200, have not been changed.

PANEL 201.—*2- by 4-in. wood studs, 16 in. o. c.; wood lath, ½-in. gypsum-plaster facings (cf panel 163, page 12, BMS17).*
PANEL 202.—*2- by 4-in. wood studs, 16-in. o. c.; ½-in. gypsum plaster on ⅜-in. gypsum lath (cf panel 148, page 14, BMS17),*
PANEL 203.—*Similar to panel 202, except ½-in. Vermiculite plaster faces on gypsum lath. The Vermiculite plaster mix consisted of 2½ ft.³ of Vermiculite aggregate to 100 lb. of gypsum.*
PANEL 204.—*Similar to panel 203, except ⅞-in. Vermiculite plaster faces on ⅜-in. perforated gypsum lath.*
PANEL 205.—*2- by 4-in. wood studs, 16 in. o. c.; ½-in. gypsum plaster facings on ½-in. fiberboard lath (cf panel 123, page 12, BMS 17).*
PANEL 206.—*2- by 4-in. wood studs, 16-in. o. c.; fiberboard facings, joints at stud (cf panel 120, page 12, BMS17).*
PANEL 207.—*Similar to panel 206, except ¾-in. fiberboard facings.*



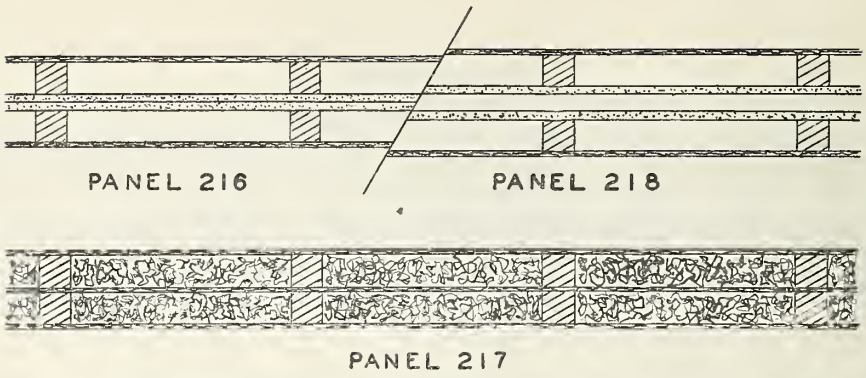
PANEL 208.—*1⅛-in. wallboard nailed on one side only of a 1⅛-in. stud. Wallboard consisted of a ⅞-in. cane-fiber center and ⅛-in. cement-asbestos sheet facing on both sides of the fiber sheet.*
PANEL 209.—*Similar to 208, except 1⅛-in. wallboard facings on both sides of 1⅛-in. studs located 40 in. o. c.*
PANEL 210.—*¼-in. fiberboard facings, on 2- by 2-in. wood studs, 16 in. o. c.*



PANEL 211.—*¼-in. plywood facings glued to 1- by 3-in. studs.*
PANEL 212.—*Same as 211 with ½-in. plaster board nailed to both plywood faces.*
PANEL 213.—*Same as panel 205, except an auxiliary wall consisting of an additional thickness of plaster on fiberboard lath was added to one side only. It was attached to original construction by means of 2 by 2's fastened to top and bottom plate, within a 4-in airspace.*
PANEL 214.—*1- by 3-in. staggered studs, ¼-in. plywood glued to both sides.*
PANEL 215.—*Same as 214 with ½-in. plasterboard nailed to the existing plywood faces.*

TABLE 1.—*Sound-transmission loss—wall structures*

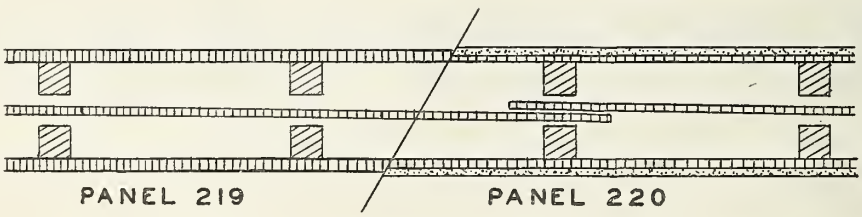
Panel No.	Transmission loss (decibels) at frequencies (cycles per second)										
	128	192	256	384	512	768	1,024	2,048	4,096	Average, 128 to 4,096	Weight, lb/ft²
WOOD STUDS											
201	35.3	31.6	24.1	36.7	34.4	31.7	37.4	45.3	61.0	37.5	17.1
202	33.4	23.9	24.5	30.2	28.3	37.7	35.5	41.7	58.8	34.9	15.0
203	27.2	23.5	20.0	31.0	26.9	35.6	35.9	38.1	54.7	32.6	9.6
204	31.3	24.9	21.8	34.2	30.7	37.9	37.8	45.9	65.5	36.7	12.9
205	28.3	27.3	30.9	37.8	40.7	44.4	46.3	46.7	65.6	40.9	12.6
206	15.9	19.0	21.9	32.4	28.1	33.3	37.9	49.7	51.8	32.2	3.8
207	20.7	17.8	21.4	26.6	30.7	32.1	37.6	49.3	52.7	32.1	4.3
208	20.9	23.3	24.3	28.4	28.4	27.5	23.1	40.5	38.3	28.3	----
209	28.7	32.5	30.7	35.3	37.5	42.2	41.5	49.9	59.6	39.8	8.3
210	14.5	10.9	16.8	27.7	26.7	36.1	36.7	47.1	50.8	29.7	----
211	15.5	16.3	17.7	19.7	25.9	26.9	28.5	36.9	33.1	24.5	2.5
212	26.5	33.5	33.0	40.5	38.9	44.1	46.2	50.3	50.5	40.4	6.6
213	41.2	45.6	44.4	48.6	50.2	51.4	52.1	55.8	72.1	51.3	18.2
214	14.4	16.6	19.6	23.1	28.2	29.9	32.9	39.6	30.2	26.1	2.6
215	39.7	37.1	39.0	45.2	47.7	49.6	50.9	53.8	54.8	46.4	7.0



PANEL 216.—*Two sets of 2- by 2-in. studs, 2 sheets ½-in. gypsum board inserted in 1-in. space between studs, ¼-in. plywood face glued to studs on each outer side, total panel thickness 4¾ in.*

PANEL 217.—*Two sets of 2- by 2-in. studs, ¼-in. plywood sheet inserted in ¼-in. space between studs, ¼-in. plywood faces, slightly compressed paper-backed mineral wool inserted in both airspaces, total panel thickness 4¾ in.*

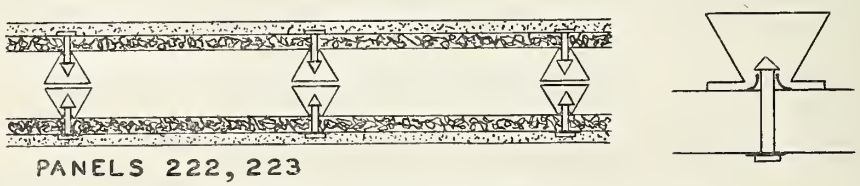
PANEL 218.—*Two sets of 2- by 2-in. studs, ½-in. gypsum board nailed to inside face of each stud, leaving 1-in. airspace between gypsum boards, ¼-in. plywood faces glued to outer face of stud.*



PANEL 219.—*Two sets of 2- by 2-in. studs, ½-in. fiberboard stood loose in 2-in. airspace between studs, ¾-in. fiberboard faces; total panel thickness 7 in.*

PANEL 220.—*Similar to 219, with ¾-in. fiberboard faces replaced by ½-in. fiberboard and ½-in. gypsum plaster for facings; total panel thickness 8 in.*

PANEL 221.—*Double steel partition similar to panel 160A, page 16, BMS17; each section of the panel consisted of ¾-in. channels, 12 in. o. c., to which was attached expanded-metal lath and a ¾-in. heat-insulating plaster face, both sections rested on a 1½-in. cork base, the distance from face to face being 5 in.*

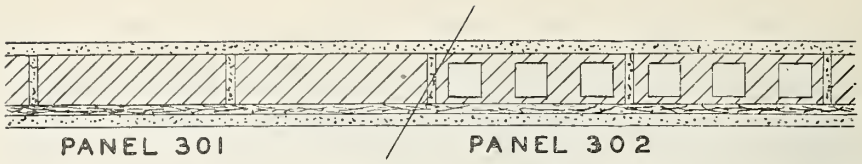


PANEL 222.—*Two special metal nailing studs back to back; held in position by a top and bottom plate; 1 in., 6 lb/ft³ density fiber-glass board and a paper backed metal lath attached to stud by means of a special nail; ¾-in. gypsum-plaster facings.*

PANEL 223.—*Same as 222, but density of fiber-glass board was 4½ lb/ft³.*

TABLE 1.—*Sound-transmission loss—wall structures*—Continued

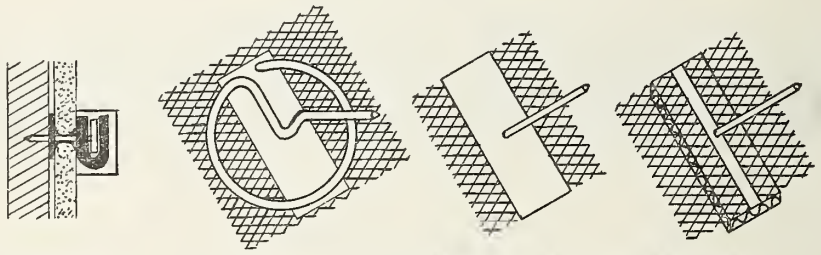
Panel No.	Transmission loss (decibels) at frequencies (cycles per second)										
	128	192	256	384	512	768	1,024	2,048	4,096	Average, 128 to 4,096	Weight, lb/ft²
WOOD STUDS—Continued											
216	17.9	25.3	28.6	30.6	32.3	37.3	41.5	49.3	51.3	34.9	7.9
217	20.3	30.9	30.8	34.6	36.7	40.7	41.1	48.7	49.9	37.1	5.1
218	27.0	24.0	28.6	33.2	37.4	41.9	45.9	55.2	54.9	38.7	7.4
219	27.9	28.8	28.2	39.4	40.3	42.9	48.3	61.6	67.5	42.8	6.2
220	42.4	47.5	47.5	50.8	49.3	51.4	55.0	53.5	73.1	52.3	14.3
STEEL STUDS											
221	31.5	36.7	42.7	48.1	45.3	49.8	51.1	47.3	61.5	46.0	9.1
222	44.4	47.3	50.5	52.8	52.8	57.6	58.4	57.5	68.3	54.4	----
223	41.4	47.3	47.3	53.1	51.7	54.7	55.3	55.0	67.0	52.5	----



PANEL 301.—*3-in. gypsum tile laid in portland cement; ⅝-in. Sprayo-Flake on one side; ¾-in. gypsum plaster on top of Sprayo-Flake and on other side.*

PANEL 302.—*Same as 301, except core consisted of 3-in. clay tile.*

PANEL 303.—*Hollow clay-tile panel constructed of 4- by 12- by 12-in. hollow clay tile with 1-in. shells similar to panels 141 and 142, page 18, BMS17, except for ⅝-in. Vermiculite plaster facings. The Vermiculite plaster mix consisted of 3¼ ft³ of aggregate to 100 lb of gypsum.*



PANEL 401.—*Head of nail imbedded in felt and covered with sheet iron; ¼-in. felt pad between stud and gypsum lath.*

PANEL 402.—*Nail similar to 401; no felt pad between stud and perforated gypsum lath.*

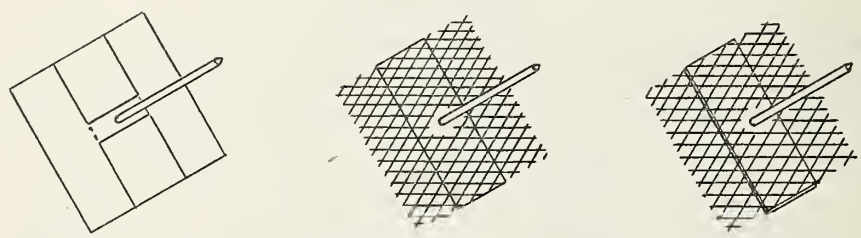
PANEL 403.—*Nail head consisting of a ring of steel rod integral with nail itself; similar to 405 below without cardboard.*

PANEL 404.—*Same as 403, except solid gypsum lath was used.*

PANEL 405.—*Nail head consisting of a ring of steel rod integral with nail itself; corrugated cardboard and expanded-metal-lath strip applied to head of nail; gypsum board held snugly against stud.*

PANEL 406.—*Ordinary nail with head encased in metal-lath square; metal strap girdling the metal-lath square; gypsum lath snug against studs.*

PANEL 407.—*Ordinary nail with head encased in corrugated cardboard and metal-lath square encompassing the cardboard but not touching nail; gypsum lath snug against studs.*



PANEL 408.—*Ordinary nail with head encased in corrugated cardboard, metal strap girdling the cardboard square, but not in contact with nail; gypsum lath loose against studs, approximately 1/32-in. play.*

PANEL 409.—*Nail similar to 401, gypsum lath snug against studs.*

PANEL 410.—*Ordinary nail with head encased in thin cardboard, metal-lath square over cardboard, which was highly compressed.*

PANEL 411.—*Nail similar to 410, but head of nail was encased in felt and then covered by a metal-lath square; lath snug against studs.*

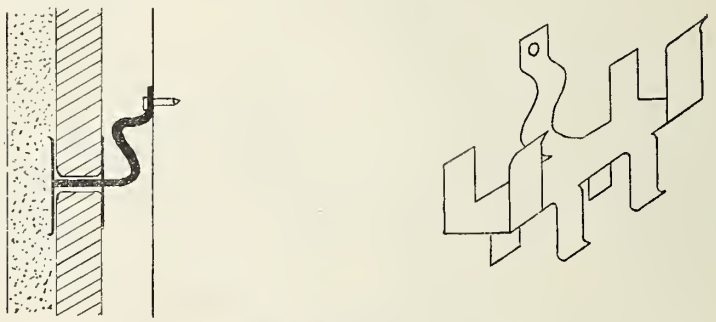
PANEL 412.—*Same nail as 411; ¼-in. felt pad between stud and gypsum lath.*

TABLE 1.—*Sound-transmission loss—wall structures*—Continued

Panel No.	Transmission loss (decibels) at frequencies (cycles per second)										
	128	192	256	384	512	768	1,024	2,048	4,096	Average, 128 to 4,096	Weight, lb/ft ^{2}
TILE AND MASONRY											
301	39. 8	34. 7	32. 1	36. 0	34. 3	40. 5	44. 3	51. 8	64. 0	41. 9	27. 5
302	37. 9	34. 5	28. 6	35. 2	34. 1	37. 8	43. 9	56. 8	62. 9	41. 3	29. 6
303	28. 8	34. 3	37. 8	35. 0	35. 8	35. 5	39. 0	47. 5	50. 9	38. 3	25. 2
SPECIAL NAILS											
2- by 4-in. wood studs, 16-in. o. c., plaster facings of ½-in. gypsum plaster on ⅜-in. gypsum lath; lath held by special nails with resilient heads, nails driven into the joints between lath.											
401	19. 3	30. 4	34. 0	38. 2	39. 3	44. 3	46. 4	51. 8	63. 4	40. 8	13. 6
402	28. 6	36. 3	33. 8	37. 5	40. 5	43. 1	45. 6	49. 6	66. 0	42. 3	15. 8
403	23. 0	29. 3	30. 3	36. 5	38. 7	39. 0	41. 2	47. 7	62. 2	38. 7	15. 9
404	22. 6	24. 7	33. 1	35. 6	36. 7	43. 3	43. 2	43. 9	62. 3	38. 4	14. 5
405	27. 3	26. 5	34. 0	38. 2	39. 0	42. 3	42. 6	43. 9	61. 1	39. 4	15. 2
406	31. 0	30. 7	31. 3	36. 1	38. 9	42. 6	45. 0	47. 7	61. 5	40. 5	14. 8
407	28. 6	32. 8	31. 8	36. 2	39. 5	45. 5	45. 2	49. 6	62. 9	41. 3	14. 4
408	33. 9	31. 1	32. 1	38. 9	39. 6	45. 3	45. 1	50. 8	63. 5	42. 3	14. 8
409	30. 8	33. 3	34. 7	35. 8	38. 9	44. 1	46. 8	50. 1	63. 9	42. 0	15. 2
410	30. 9	31. 5	33. 2	40. 6	41. 7	46. 8	48. 0	48. 3	65. 1	42. 9	13. 6
411	31. 6	33. 4	31. 0	36. 6	41. 0	46. 6	48. 1	50. 2	65. 9	42. 7	14. 3
412	36. 1	37. 7	36. 9	42. 2	45. 1	51. 0	52. 6	54. 5	67. 7	47. 1	14. 0

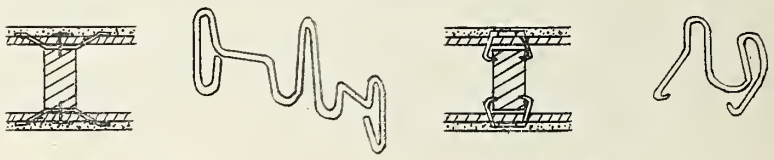
PANEL 413

PANEL 413.—*Clip, as indicated in sketch.*



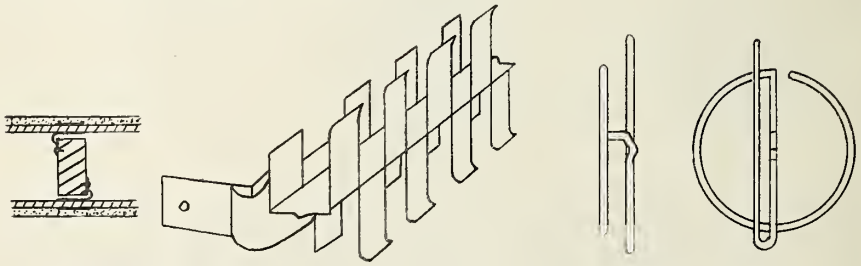
PANEL 414

PANEL 414.—*Same clip as 413, except a resilient member was introduced in the clip.*
PANEL 415.—*Clip similar to 413.*



PANEL 416 PANEL 417

PANEL 416.—*Clip attached to stud by means of large headed nail, which kept plasterboard about ⅛ in. from stud; same clip used for vertical joints of plasterboard.*
PANEL 417.—*Stud clip, as indicated; clip of 416 used for vertical joints.*



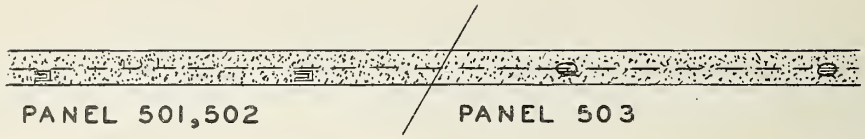
PANEL 418 PANEL 419

PANEL 418.—*Clip, as indicated in sketch.*
PANEL 419.—*Clip, as indicated in sketch.*

TABLE 1.—*Sound-transmission loss—wall structures*—Continued

Panel No.	Transmission loss (decibels) at frequencies (cycles per second)										
	128	192	256	384	512	768	1,024	2,048	4,096	Average, 128 to 4,096	Weight, lb/ft²
RESILIENT CLIPS[1]											
2- by 4-in. wood studs, 16 in. o. c., plaster facings of ½-in. gypsum plaster on ⅜-in. gypsum lath, lath held by resilient spring clips of various designs.											
413	25.7	31.5	37.2	40.6	42.1	45.7	46.7	44.3	62.1	41.8	12.4
414	39.3	41.2	39.7	45.8	42.9	44.9	46.3	48.0	63.3	45.7	14.1
415	28.6	33.3	34.6	37.1	40.1	45.2	45.4	50.5	66.6	42.4	13.9
416	37.0	38.2	39.0	39.9	41.5	44.7	44.7	49.4	66.2	44.5	14.9
417	28.9	37.6	37.6	42.0	40.0	46.6	44.3	48.9	66.5	43.6	15.5
418	41.3	44.0	41.9	44.2	44.9	48.2	48.0	48.7	62.2	47.0	14.3
419	37.1	33.0	36.8	43.8	44.2	48.2	47.9	51.9	62.8	45.1	15.1

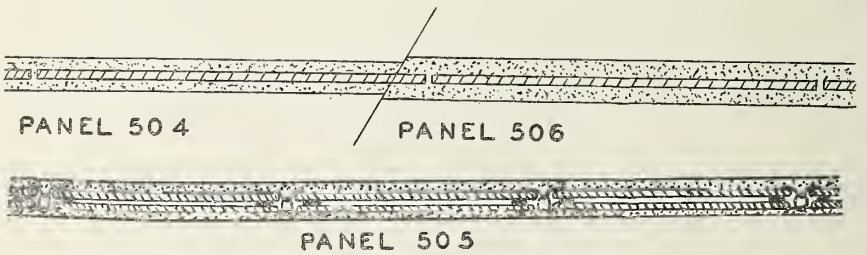
[1] See also panels 222 and 223 under steel studs, and panels 507, 508, and 509 under studless plaster.



PANEL 501.—*Channels 16 in. o. c.; Vermiculite plaster; scratch coat 2¼ ft³ Vermiculite plaster to 100 lb of gypsum; brown coat 3¼ ft³ Vermiculite to 100 lb of gypsum.*

PANEL 502.—*Channels 16 in. o. c.; gypsum plaster.*

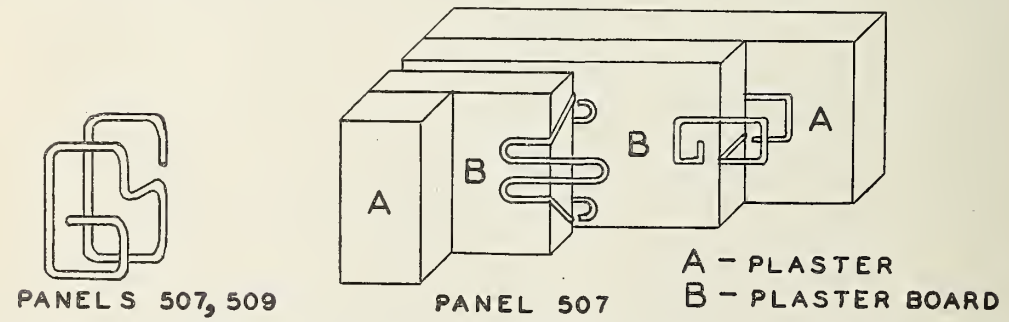
PANEL 503.—*2-in. solid plaster with expanded-metal-lath core.*



PANEL 504.—*2-in. solid plaster with ⅜-in. gypsum-lath core.*

PANEL 505.—*2-in. partition, 2 sheets of gypsum lath spaced ¼-in. apart with felt spacers, joints between lath covered with metal lath to prevent mortar from bonding two sides together, ½-in. plaster faces.*

PANEL 506.—*2½-in. solid plaster partition with ⅜-in. gypsum-lath core.*

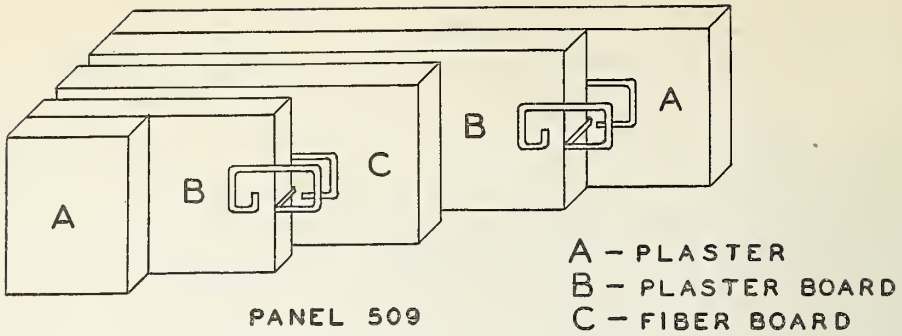


PANEL 507.—*½-in. and ⅜-in. plasterboards, held together at vertical joints partially by clip of panel 416, and by clip of sketch, with ¼-in. airspace between plasterboards due to thickness of the clips; ⅝-in. plaster facings applied to each plasterboard, total panel thickness 2⅜ in.*

ANEL 508.—*Similar to 507, except clip of panel 416 was used exclusively; two sheets of ½-in. plasterboard; plaster faces of ½ in. and 1 1/16 in.; total panel thickness 2 7/16 in.*

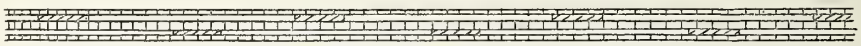
TABLE 1.—*Sound-transmission loss—wall structures*—Continued

Panel No.	Transmission loss (decibels) at frequencies (cycles per second)										
	128	192	256	384	512	768	1,024	2,048	4,096	Average, 128 to 4,096	Weight, lb/ft²
SOLID PLASTER											
2-in. solid plaster partition, one course metal lath, ¾-in. channel studs.											
501	36. 1	34. 3	33. 3	32. 7	30. 5	29. 2	27. 5	37. 5	47. 9	34. 3	8. 8
502	40. 5	36. 5	23. 2	31. 7	35. 5	33. 1	36. 3	46. 7	53. 7	37. 5	18. 1
STUDLESS PLASTER											
503	36. 6	36. 2	29. 0	33. 4	36. 1	32. 0	37. 9	47. 7	55. 2	38. 2	18. 4
504	37. 8	35. 8	27. 3	31. 5	35. 0	31. 9	35. 7	46. 5	53. 9	37. 3	16. 8
505	34. 6	35. 0	29. 2	30. 5	33. 4	39. 5	38. 3	43. 3	57. 0	37. 9	15. 3
506	38. 4	32. 3	31. 8	32. 4	34. 9	35. 7	38. 7	48. 7	54. 9	38. 6	19. 7
507	31. 4	31. 5	32. 2	36. 5	38. 1	40. 9	40. 2	49. 7	61. 5	40. 2	12. 9
508	34. 1	34. 9	34. 6	38. 0	39. 8	43. 9	40. 3	49. 6	60. 5	41. 7	13. 6



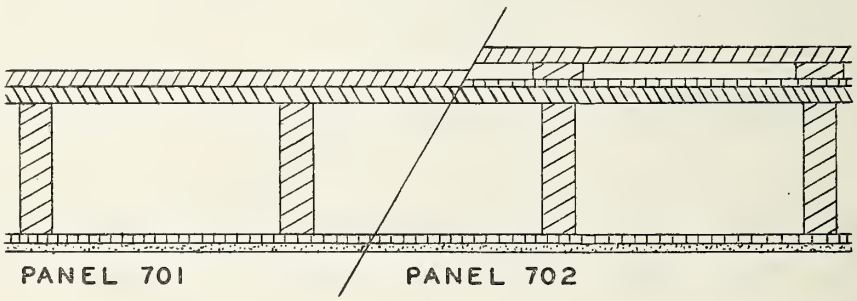
PANEL 509

PANEL 509.—*½-in. fiberboard held between ½-in. plasterboard on one side and ⅜-in. plasterboard on the other by means of clip; ¼-in. airspace between fiberboard and plasterboards; ½-in. plaster facings on plasterboards; total panel thickness 2⅞-in.*



PANEL 601

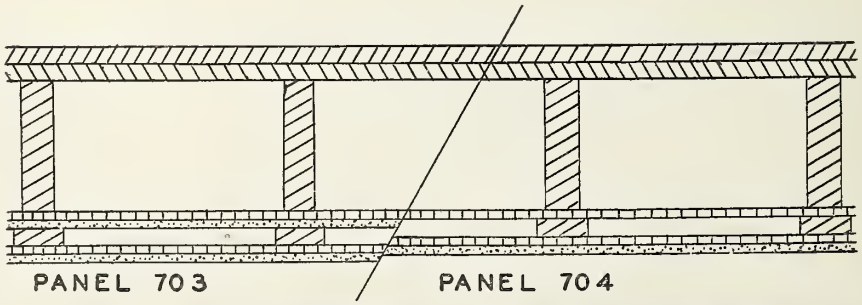
PANEL 601.—*0.34-in. fiberboard facings, 7/16-in. fiberboard located midway between the two faces, 4-in. wide and ⅜-in.-thick fiberboard strips spaced in a staggered arrangement (21 in. o. c.) between middle fiberboard and outer faces; entire unit glued together, total panel thickness 1⅞ in.*



PANEL 701 PANEL 702

PANEL 701.—*2- by 8-in. joists; ½-in. fiberboard lath and ½-in. gypsum-plaster ceiling; 1-in. pine subflooring, and 1-in. pine finish flooring.*

PANEL 702.—*Same joists and ceiling as 701; 1-in. pine subfloor; ½-in. fiberboard, 1- by 3-in. sleepers, and 1-in. pine finish floor.*



PANEL 703 PANEL 704

PANEL 703.—*Same as 701, except a second ½-in. fiberboard and ½-in. plaster ceiling was added to the existing ceiling of 701 by means of 1- by 3-in. furring strips.*

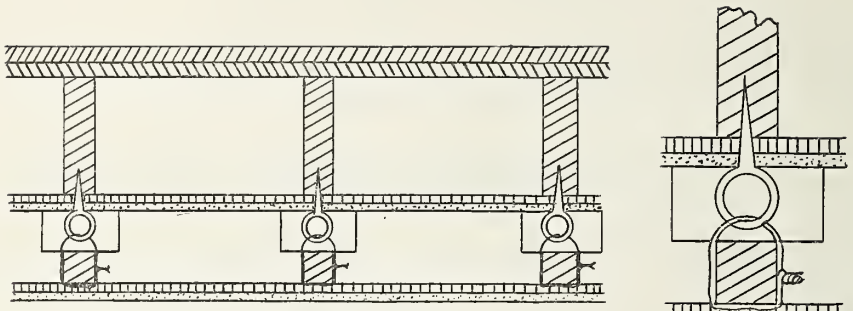
PANEL 704.—*Same joists and floor as 701, except ceiling consisted of ½-in. fiberboard, 1- by 3-in. furring strips, ½-in. fiberboard lath, and ½-in. plaster face.*

TABLE 1.—*Sound-transmission loss—wall structures*—Continued

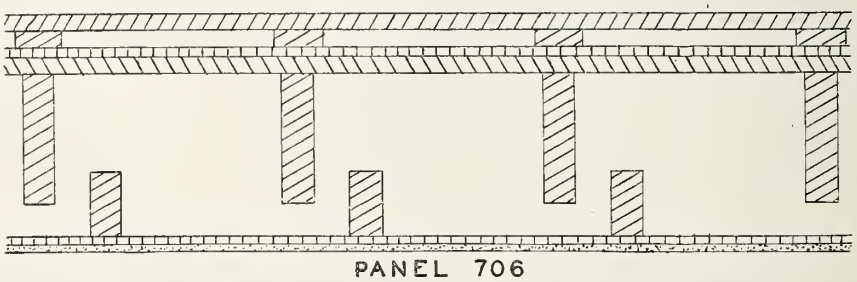
Panel No.	Transmission loss (decibels) at frequencies (cycles per second)										
	128	192	256	384	512	768	1,024	2,048	4,096	Average, 128 to 4,096	Weight, lb/ft²
STUDLESS PLASTER—Continued											
509	35. 5	41. 0	41. 3	43. 7	47. 2	49. 3	48. 4	52. 9	62. 5	46. 9	15. 9
WALLBOARD PARTITION											
601	21. 1	24. 1	21. 8	21. 9	25. 2	31. 4	35. 4	43. 2	47. 3	30. 2	3. 8

TABLE 2.—*Sound-transmission loss—floor structures*

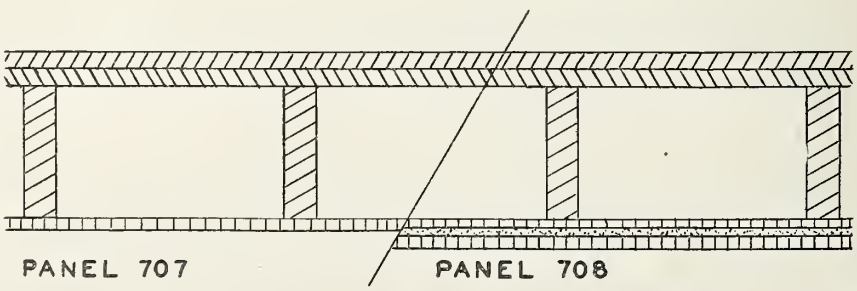
Panel No.	Transmission loss (decibels) at frequencies (cycles per second)											Weight, lb/ft²
	128	192	256	384	512	768	1,024	2,048	4,096	Average, 128 to 4,096	Tapping loss (decibels)	
WOOD JOIST												
701	23. 4	28. 3	33. 7	44. 2	46. 7	51. 6	54. 7	54. 0	69. 0	45. 1	10. 8	14. 3
702	30. 2	30. 2	36. 9	46. 7	49. 7	52. 4	56. 8	65. 3	79. 1	49. 7	12. 1	16. 2
703	31. 3	27. 8	32. 4	43. 3	44. 8	48. 6	47. 5	54. 3	79. 0	45. 4	9. 8	19. 0
704	23. 7	32. 5	37. 5	42. 8	49. 1	50. 5	55. 8	58. 2	76. 6	47. 4	14. 2	15. 9



PANEL 705.—*2- by 8-in. joists, 16-in. o. c., 1-in. pine subfloor, 1-in. pine finish floor; 1 ceiling consisting of ½-in. plaster on ½-in. fiberboard lath next to joists; an additional plaster and fiberboard lath ceiling on 2- by 2-in. joists was suspended by screw eyes and wire loops 36-in. o. c., 4 in. below upper ceiling, 5- by 5- by 2-in. fiberboard-block pads at fastenings.*



PANEL 706.—*2- by 8-in. floor joists, 2- by 4-in. ceiling joists, 2 by 8's spaced 4 in. o. c. from 2 by 4's; ½-in. plaster on ½-in. fiberboard lath ceiling; 1-in. pine subfloor, ½-in. fiberboard, 1- by 3-in. sleepers, 1-in. pine finish floor.*



PANEL 707.—*2- by 8-in. wood joists, ¾-in. fiberboard ceiling, 1-in. pine rough flooring and 1-in. pine finish flooring.*
PANEL 708.—*Same as 707, except ceiling; ½-in. fiberboard lath, ½-in. plaster, and ¾-in fiberboard face.*

TABLE 2.—*Sound-transmission loss—floor structures*—Continued

Panel No.	Transmission loss (decibels) at frequencies (cycles per second)											Weight, lb/ft²
	128	192	256	384	512	768	1,024	2,048	4,096	Average, 128 to 4,096	Tapping loss (decibels)	
WOOD JOIST—Continued												
705	46. 1	44. 5	50. 5	53. 2	54. 9	56. 6	56. 4	63. 1	74. 6	55. 5	25. 7	20. 3
706	48. 1	49. 8	49. 1	50. 7	50. 5	52. 3	53. 6	57. 9	74. 6	54. 1	24. 6	16. 7
707	21. 8	27. 9	31. 2	38. 1	39. 7	41. 1	43. 6	54. 9	62. 4	40. 1	6. 1	9. 6
708	30. 9	23. 4	30. 3	40. 0	40. 3	44. 0	47. 1	56. 2	67. 9	42. 2	10. 8	15. 8