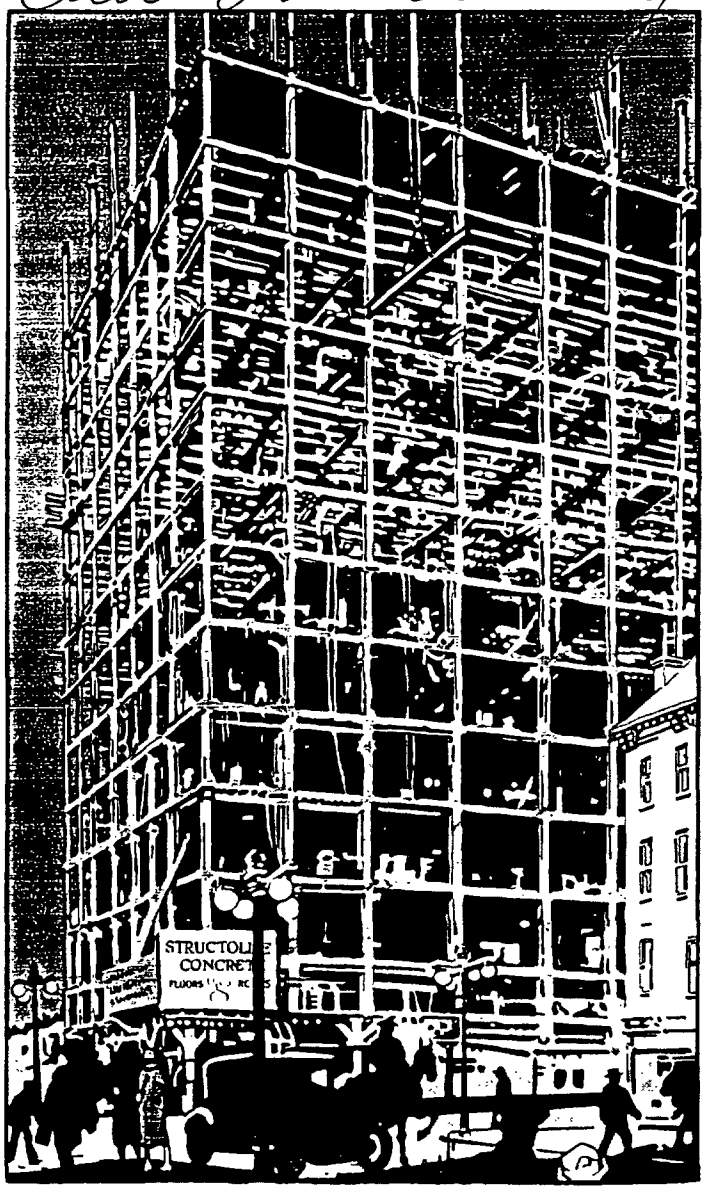
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USG-928



STRUCTOLITE CONCRETE

FLOORS USG ROOFS

UNITED STATES GYPSUM COMPANY
CHICAGO

88007 1221

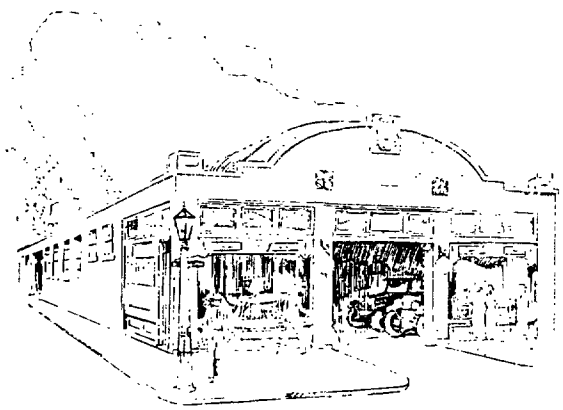
FOREWORD

FOR many years builders have been looking for a quick-setting cement which would speed up the installation of floors and roofs. They have demanded that this material be fireproof, light in weight, an excellent insulator and withal, it should be economical.

Some years ago Structolite (structural gypsum) was developed and after exhaustive tests both in the laboratory and actual construction, was found to meet, in an ideal way, the strictest requirements of modern building practice.

We strongly recommend Structolite to the architect, the contractor and the owner for use in light occupancy buildings, such as offices, apartments, garages, hotels, hospitals, school buildings and residences.

USG



STC-3 Copyrighted 1926 by United States Gypsum Company, Chicago

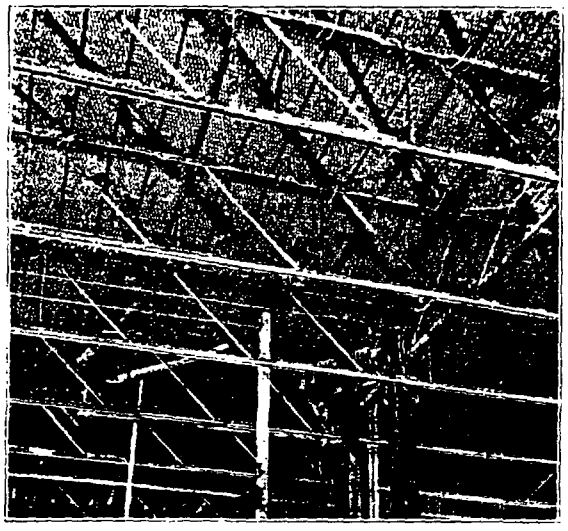
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Modern Building Requires Structolite

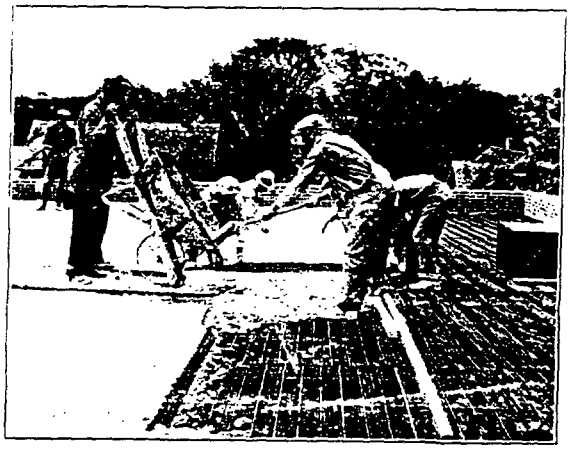
The last decade has brought about many astounding improvements in the broad field of materials for building purposes. None has been more timely than that shown by manufacturers of steel products available for floor and roof construction. The standard rolled section has been supplemented by junior beams, pressed and welded sections, bar joists and others of a more or less similar character.

In many classes of buildings there has been a limited use of fireproof floor and roof construction, due to the relatively high cost of fireproof systems as compared with combustible construction. The economy of Structolite concrete poured on expanded metal reinforcement in the joist system has overcome this objection, for, with the available light weight steel members, many variations can be developed. Their use means economy.

Apartments, office buildings, garages, hotels, hospitals, school buildings and residences will use this economical design, and at the same time secure fireproof, insulating, sound deadening, durable and speedily installed floors and roofs.



Quick-set Structolite insures minimum of dripping—Note clean appearance



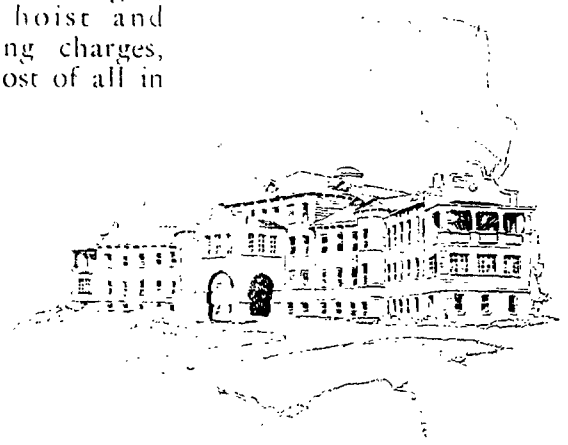
Small crew making a record for speedy erection on large theater roof

Structolite Meets These Requirements

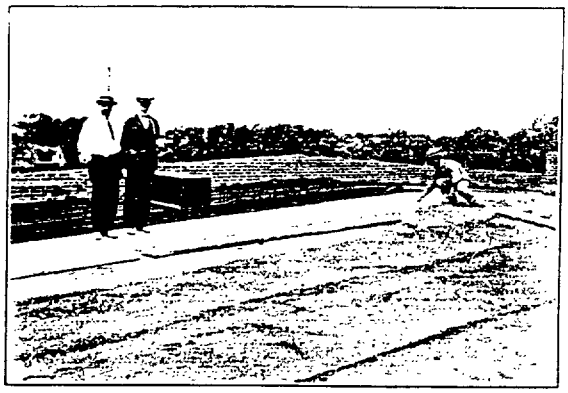
Structolite is a quick set insulating gypsum cement and when properly mixed with aggregate produces Structolite Concrete. Structolite Concrete develops 60 per cent of its ultimate strength within one hour after being poured. This permits work to continue on top of the slab, favoring more rapid erection and eliminating costly protection of the slab over a longer period of time. The plasticity and quick set reduces to a minimum the leakage through the mesh, consequently the loss from this source is practically eliminated.

Light Weight

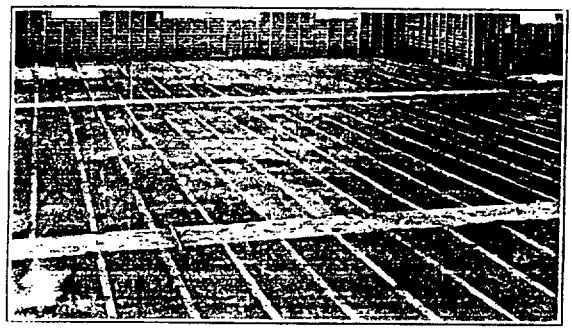
Light weight materials contribute to a decided saving in present-day construction. When needlessly heavy roofs, floors and walls are used the owner is penalized not only in the freight, haul, hoist and handling charges, but most of all in



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Walking on Structolite deck within an hour after pouring, work speeds materially

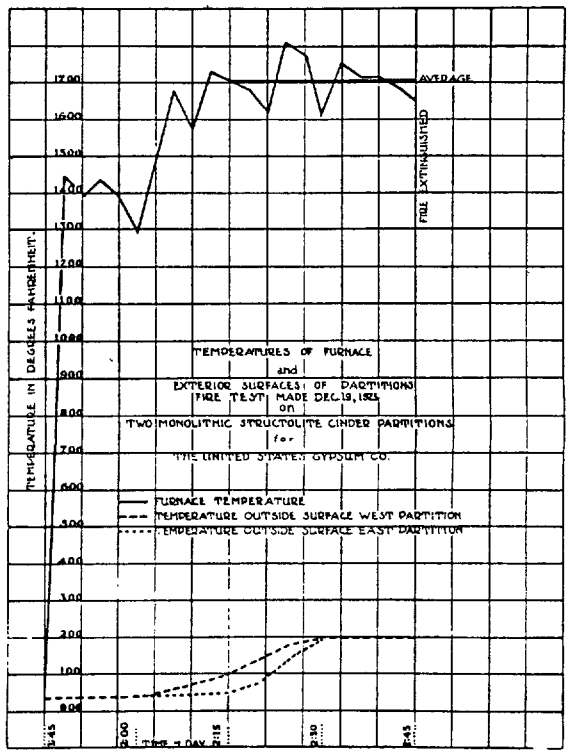


Ready for the wearing surface. Nailing screeds if necessary, are set before pouring

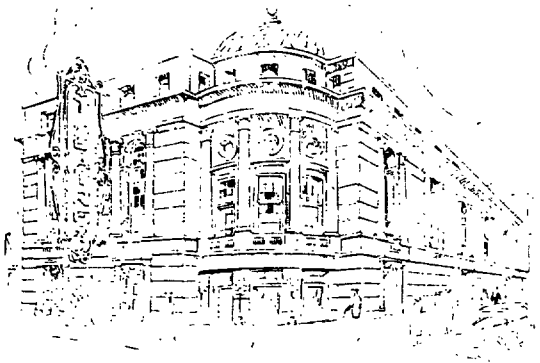
the additional dead load, requiring heavier framing, foundations and footings. *Weighing only 90 pounds per cubic foot, Structolite Concrete is more than one-third lighter than Portland cement concrete.*

Fireproof

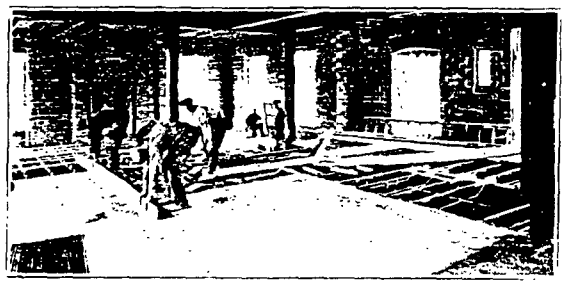
One of the most important advantages in Structolite Concrete is its fireproof quality. Fire applied to a Structolite surface cannot raise the temperature of the slab higher than 212 degrees Fahrenheit until complete calcination has taken place and the water of crystallization entirely vaporized. The application of fire results in a thick steamy area of uncalcined gypsum which is a most effective barrier to fire. The fire test curve in the following diagram shows the remarkable results of a fire test conducted by the Building Department of the City of New York, co-operating with the Civil Engineering Department of Columbia University at the university testing laboratories in December, 1923. Walls 3 inches thick and 9 feet high by 14 feet long were subjected to a maximum temperature of 1,810 degrees Fahrenheit. An average temperature of 1,707 degrees Fahrenheit was maintained within this structure for one hour. Immediately following, a stream of water from a 1⅛-inch nozzle at a distance of approximately 8 feet and a nozzle pressure of 50 pounds was directed against the superheated wall



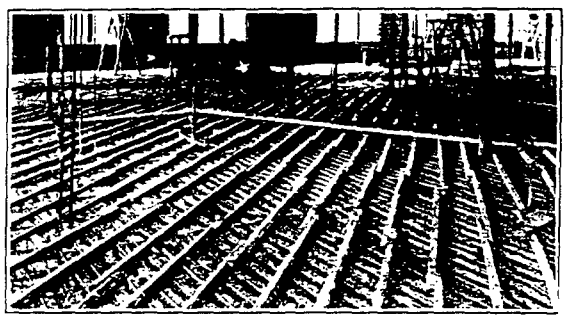
This curve shows the average temperature on the interior walls, which was maintained at 1707° Fahr. for the required period. The maximum was 1810° Fahr. Notice that the outsides of these walls, only three inches thick, did not exceed 210° Fahr.



BB007 1224



Screeding to finish for concrete topping



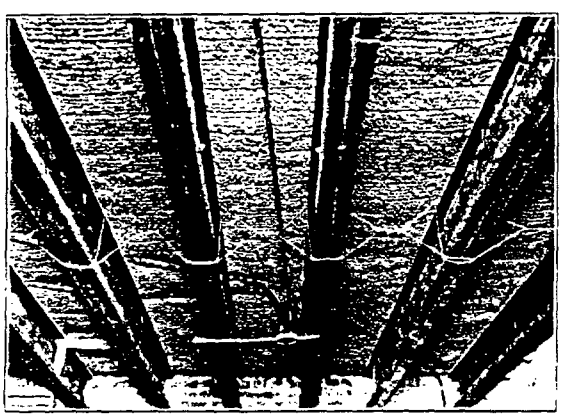
Nailing strips clipped diagonally to joists preparatory to pouring Structolite

for 2½ minutes. The official report on this test states: "The exterior surface of these partitions as they appeared on the day following the test showed no visible sign that they had gone through a one hour fire and water test." Some of the form marks were still visible indicating that calcination from this intense heat and the washing action of the hose stream had not progressed to a depth sufficient to damage materially the structural strength of the wall.

Insulation

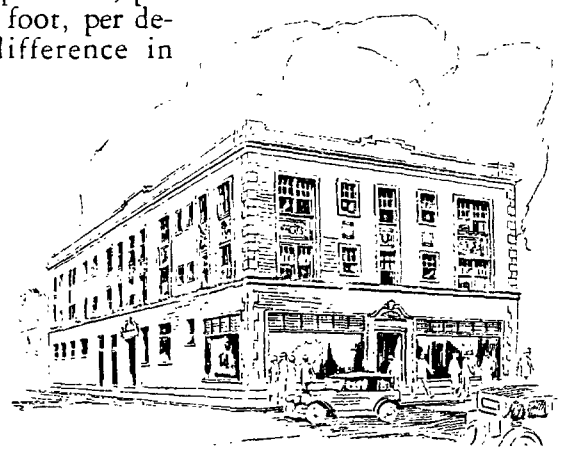
Gypsum has long been recognized as the only structural building material possessing insulation to an efficient degree. Structolite is gypsum treated mechanically and chemically to increase density and compressive strength. Naturally, Structolite possesses all the insulating qualities of calcined gypsum. The principal advantage of Structolite *lies in this combination—structural strength and high insulation in the one material*, tending to simplify construction and thereby reduce costs.

Wall Construction	*Conductivity in B. T. U. loss per hour, per sq. ft. per degree difference in Temperature*
Siding, sheathing, studs, lath and plaster on inside	.37
Siding, paper, sheathing, studs, lath and plaster on inside	.30
8" Cement block, stucco, plaster on inside	.35
8" Brick wall plastered on inside	.36
8" Brick wall furred and plastered on inside	.28
6" Clay tile stucco, plaster on inside	.46
8" Clay tile stucco, plaster on inside	.32
6" Clay tile stucco, furred and plastered on inside	.40
8" Clay tile stucco, furred and plastered on inside	.30
6" Clay tile, brick veneer and plaster on inside	.27
8" Clay tile, brick veneer and plaster on inside	.23
6" Clay tile, brick veneer, furred and plastered on inside	.22
8" Clay tile, brick veneer, furred and plastered on inside	.20
6" Structolite, ¾" stucco, ½" plaster on inside	.16
8" Structolite, ¾" stucco, ½" plaster on inside	.127
6" Structolite, ¾" stucco, furred and plastered on inside	.143
8" Structolite, ¾" stucco, furred and plastered on inside	.115
6" Structolite, furred ¾" stucco, ½" plaster on inside	.129
8" Structolite, furred ¾" stucco, ½" plaster on inside	.106
6" Structolite, 4" brick, ½" plaster on inside	.12
8" Structolite, 4" brick, ½" plaster on inside	.0995
6" Structolite, 4" stone, ½" plaster on inside	.152
8" Structolite, 4" stone, ½" plaster on inside	.121
6" Structolite, 4" stone, furred and plastered on inside	.136
8" Structolite, 4" stone, furred and plastered on inside	.111



Structolite floor systems present clean underside for piping and conduits

The impressive table is for the purpose of calculating the heat loss in B. T. U.'s (British thermal units) per hour, per square foot, per degree difference in



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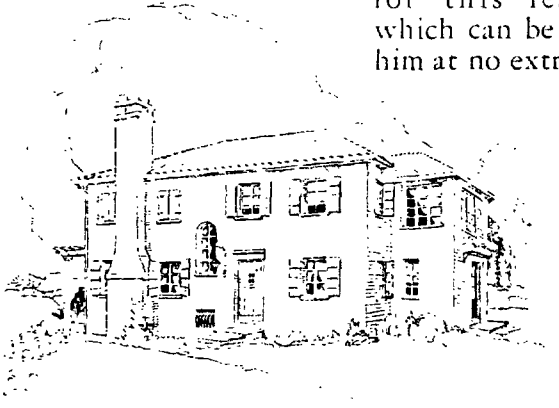
A rush job successfully done with Structolite

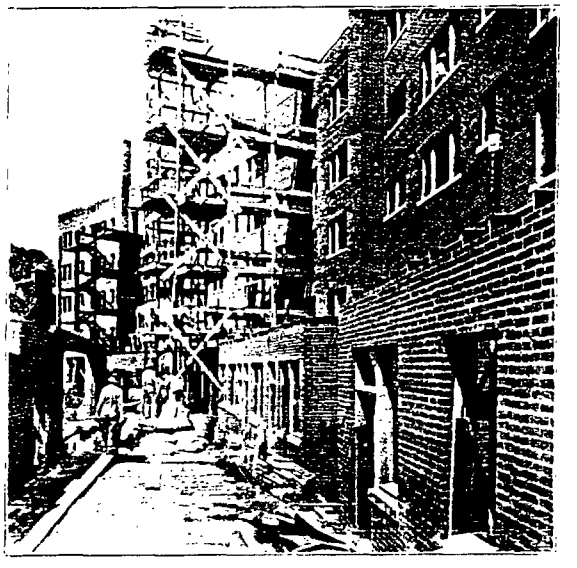
temperature for different materials. The values given here are compiled from the results of tests at Pittsburgh Testing Laboratory, University of Illinois, published data by the American Society of Heating and Ventilating Engineers, and tests conducted by Dr. Severinghaus, of Columbia University on Structolite.

With a floor or roof of Structolite Concrete it is not necessary to add expensive insulators to secure warmth in winter and cool comfort in summer.

Soundproof

Sound-proof construction is highly essential in many types of buildings. In apartments, hospitals, schools, hotels and residences the added advantage of sound-proof floors cannot be over emphasized. In apartment construction it will at once be appreciated and the tenant frequently is willing to pay a premium for this feature which can be given him at no extra cost



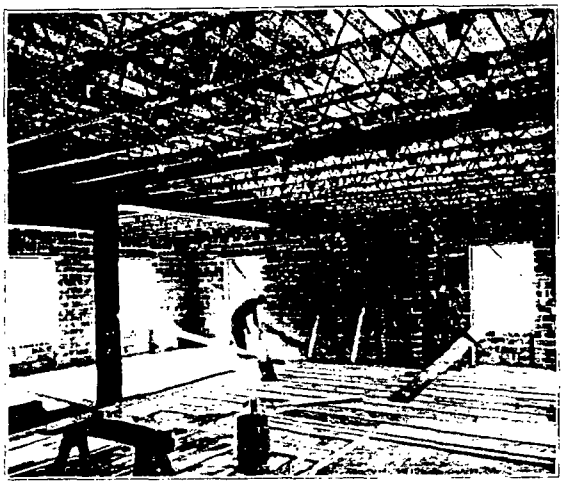


Standard equipment handled this large apartment with Structolite floors throughout

by the use of Structolite Concrete. The minute cells in Structolite rapidly absorb sound, reducing reverberation and preventing conduction through the wall to adjoining space.

Adaptability

Any wearing surface may be applied to a Structolite Concrete floor or roof slab. The roof surface is particularly recom-

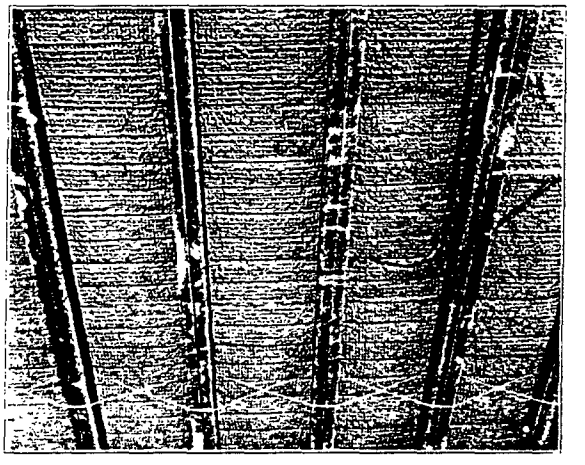


Even the wood floor could burn without damaging the Structolite

BB007 1226



An ideal roof deck surface for a built-up roofing applied by mopping specification



Any type of ceiling may be attached to this undersurface

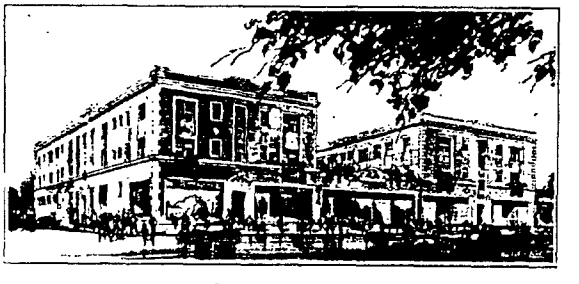
mended for built-up roof covering applied by mopping specifications. No additional equipment or unusual care is required to install Structolite Concrete. Any ceiling construction may be applied under this type of work. For instance, plaster board may be clipped to the underside of the floor joists and plaster applied in the usual manner, leaving adequate space within for piping and conduit work. The use of an attached ceiling of this character will increase the fireproof insulation and sound-deadening qualities of the floor system.

Where an attractive under-surface is desired Sheetrock can be substituted for expanded reinforcement and the joists painted a light battleship gray to harmonize with the Sheetrock, making a very attractive under-surface, having more the appearance of a finished ceiling than a floor construction. In the use of Sheetrock it is applied so that joints are hidden by the joists. Welded steel fabric is laid on the fireproof wallboard, and then a Structolite mixture is poured to the desired thickness.

Carpet, linoleum, or rubber tile may be applied successfully, as outlined in specifications on page 14. The remarkable strength of this type of slab makes it adaptable to any light occupancy building, thus permitting of its use througnout the construction field.



Weighs only 90 pounds per cu. ft. when dry—even in wet condition it is easily handled and "worked" into place



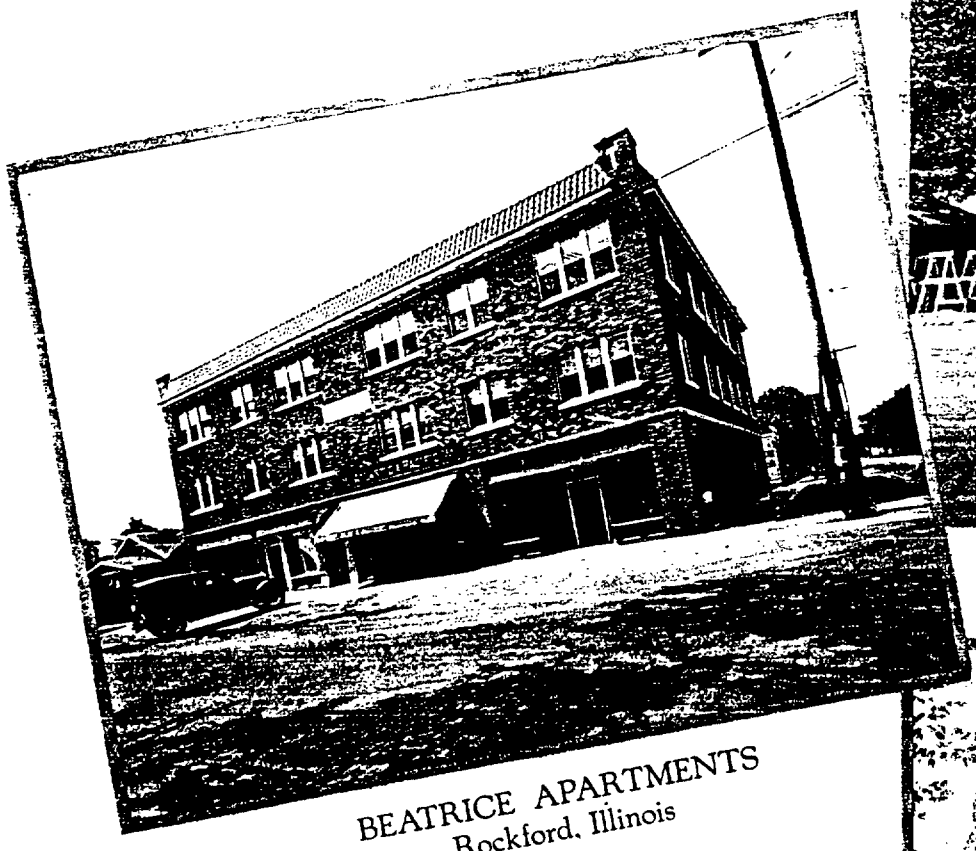
Apartments such as these should always have Structolite floors

Economy

The economy of Structolite is the result of all these splendid characteristics. Quick set permits rapid erection, low labor costs and earlier occupancy. Light weight means a saving in floor steel, columns and footings. Good insulation saves fuel and heating plant costs. This system is more economical than a flat arch of Portland

(*Continued on page 11*)

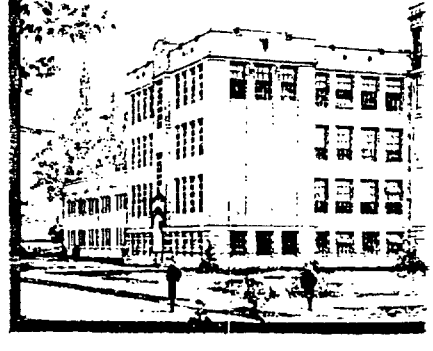
88007 1227



BEATRICE APARTMENTS
Rockford, Illinois



RIVIERA
Roches



MADONNA HIGH SC
W. J. Van de:

These Buildings are Built with St

DR. HANSEN CLINIC BLDG., Cleveland, Ohio
Geo. Ebeling, *Arch.* Jas. L. Hunting Const. Co., *Cont.*

ST. AGNES SCHOOL, Milwaukee, Wis.
M. A. Pfaller, *Arch.* Edw. Steigerwald & Sons, *Cont.*

STORE, OFFICE and APT. BLDG., Cleveland, Ohio
Max Weis, *Arch.* Ben Zuckerman, *Cont.*

SARANAC LAKE HOTEL, Saranac Lake, N. Y.
Scopes & Feustmann, *Arch.* Branch & Callanan, *Cont.*

BEDFORD SEMINARY, Bedford, Mass.
Walter Fontaine, *Arch.* Louis C. Cyr, Inc., *Cont.*

RIVIERA THEATRE, F
Wood & Drescel, *Arch.* M

MADONNA HIGH SC
W. J. Van der Meer, *Arch.* W

SURDAM RESIDENCE
Bley & Lyman, *Arch.* Al.

KARP THEATRE, Syrac
Thos. L. Tomlins, *Arch.* J

JOHNSON-BEATRICE
Sidney Cain, *Cont.*

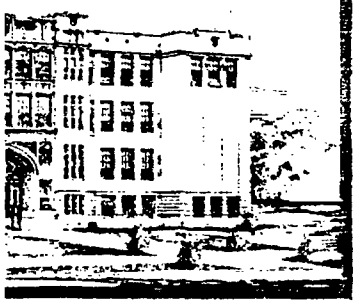
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ATRE
. Y.



KARP THEATRE · Syracuse, N. Y.
T. L. Tomlins, *Arch.*



L · Aurora, Illinois
Arch.

tolite Concrete Floors or Roofs

ter, N. Y.
& Maggio Co., Inc., *Cont.*

L, Aurora, Ill.
n Eng. & Const. Co., *Cont.*

alo, N. Y.
escher & Sons, *Cont.*

N. Y.
arp, *Cont.*

., Rockford, Ill.

SCANDROLI-ARNOLD APTS., Rockford, Ill.
Scandroli Const. Co., *Cont.*

WAUKEGAN HIGH SCHOOL, Waukegan, Ill.
Ben Zide, *Cont.*

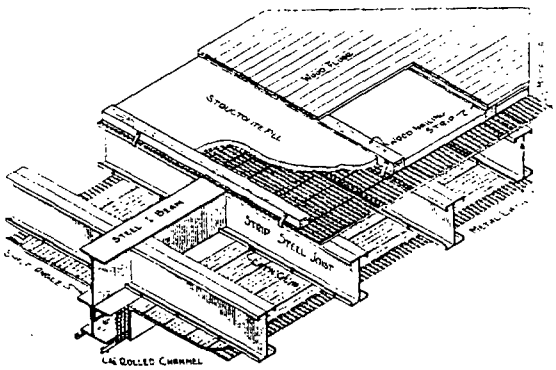
ANNUNCIATION B. V. M. PARISH, Aurora, Ill.
W. J. Van der Meer, *Arch.* Wisconsin Eng. & Const. Co., *Cont.*

STORE BUILDING, Rockford, Ill.
Bradley & Bradley, *Arch.* Tolmie Brothers, *Cont.*

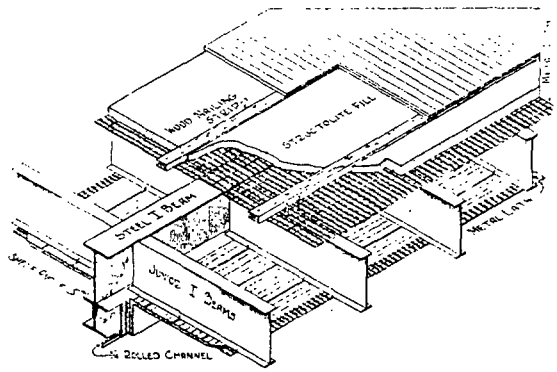
ST. PHILLIPS SCHOOL, Indianapolis, Ind.
Michaelis Bros., *Cont.*

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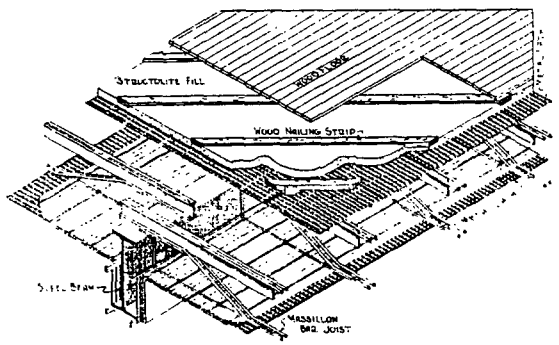
Different Joists, Ceilings and Floor Finishes in Combination with Structolite Slabs



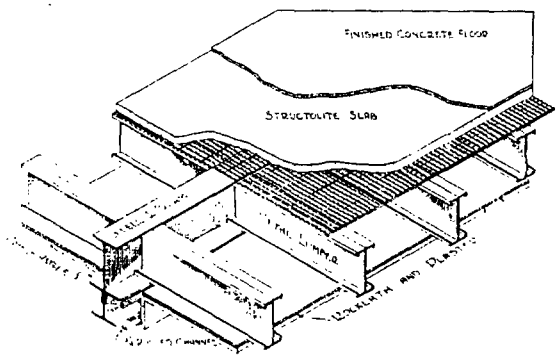
"Pressed and Welded" joist with nailing strips attached by clips. Ceiling may be Rocklath and plaster



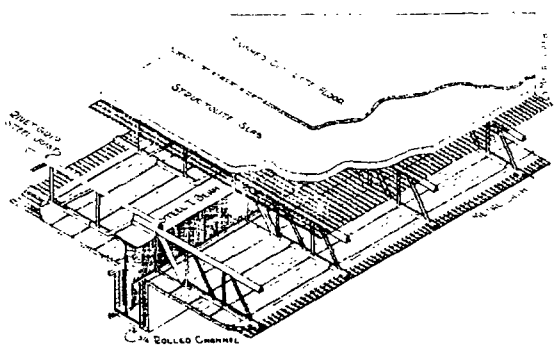
"Junior Beam" joists, finished floor of wood laid parallel to joists. Rocklath and plaster ceiling may be used



"Expanded Bar" joist with diagonal nailing strips and wood floor

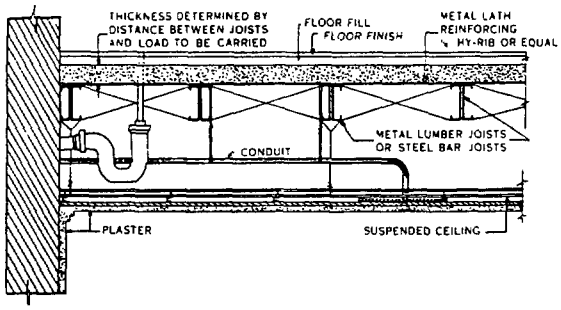


"Pressed and Welded" section with Rocklath and plaster for added insulation and protection. Concrete wearing surface



"Expanded Bar" with concrete wearing surface. Carpet, linoleum or rubber tile can be applied readily to this type

BB007 1230



The above sketch shows the use of a suspended ceiling in connection with our Structolite Concrete Floor Construction.

Note that this type of construction provides excellent opportunities to take care of piping conduits, heat and vent ducts, thus allowing a minimum thickness of floor above.

STRUCTOLITE CONCRETE WITH HY-RIB REINFORCING

TABLE OF SAFE SUPERIMPOSED LOADS IN POUNDS PER SQ. FT UNIFORMLY DISTRIBUTED

NOTE:- THE LOADS ARE THE SAFE LOADS FOR THE SLAB ONLY.

THE TABULATED LOADS ARE BASED ON A STRUCTOLITE CONCRETE MIXTURE OF 1½ PARTS STRUCTOLITE, (1) PART SAND, AND (3) PARTS AGGREGATE AND THE FOLLOWING MAXIMUM STRESESS.

FC=250 SQ. IN. E=1 250.000 FS 16.000 PER SQ. IN.

SLAB DEPTH	JOIST SPACING							
	12 INCH	16 INCH	19 INCH	21 INCH	24 INCH	28 INCH	30 INCH	32 INCH
2 INCH	825	457	340	275	221	159	136	117
2½ INCH			512	416	332	239	206	178
3 INCH				522	460	332	286	250
3½ INCH					548	396	341	297
4 INCH						458	395	343
4½ INCH							449	391

(*Continued from page 7*)

cement concrete or the tile and joist system, because there is no form work required for Structolite Concrete.

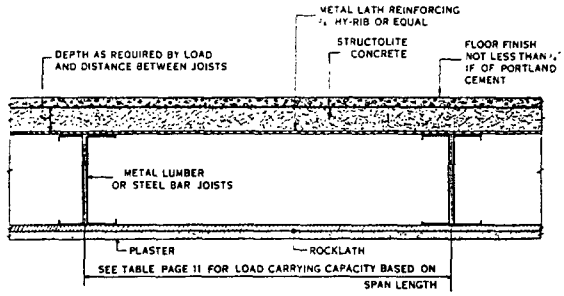
Procedure

The Structolite Concrete slab thickness and joist spacing are determined by the load to be carried and on this page is a table from which can be figured the most economical construction to meet every condition.

The joists are placed in the usual manner, firmly held in the masonry with a pin anchor, and either clipped or bolted to intermediate supports. The expanded lath is clipped on top of the joists so that the stiffening rib in the lath is at right angles to the joists and is thus held to prevent displacement while the Structolite Concrete is being poured. The Structolite Concrete is brought to its required thickness by means of screed strips which may be removed or left embedded in the slab for nailing purposes.

Quantities of material per cubic yard of mixed concrete:

Structolite	600 pounds
Sand	.28 yards
Coarse Aggregate	.84 yards



SCHEME I

CEMENT FLOOR FINISH

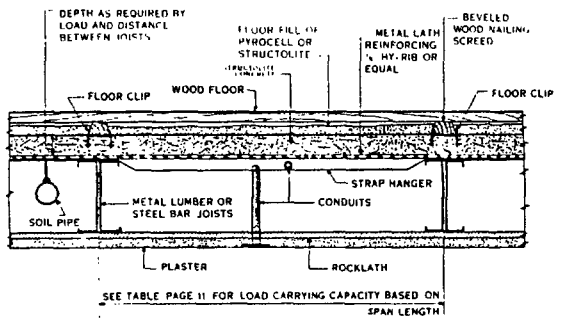
This construction used when a cement wearing surface or a Granolithic or Terrazzo floor finish is desired. Conduits and other piping can be run under the floor or in the slab.

The depth of the Structolite floor slab will be as required by the load and distance between joists.

The ceiling may be attached directly to the bottom of the metal lumber joists or may be full suspended.

If Granolithic or Terrazzo finish is to be used then the finish above the slab proper shall be as required by standard practice.

When the floor finish is cement, tile, Terrazzo or Granolithic, it is best to lay all piping before lath is placed.



SCHEME II

WOOD FLOOR FINISH OVER FILL

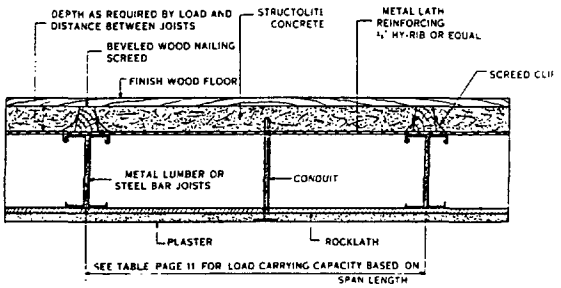
This construction used when a wood floor finish is desired. Conduits may be embedded in the floor fill, floor slab, or may be run under the floor as shown.

Where a minimum depth of floor slab is required, conduits and other piping should be run in space between the floor slab and ceiling.

Test Data

The remarkable strength of this construction was actually demonstrated by tests conducted at Fort Dodge, Iowa, during the period of March 1 to 20, 1926. The slabs tested at this time consisted of three

BB007 1231

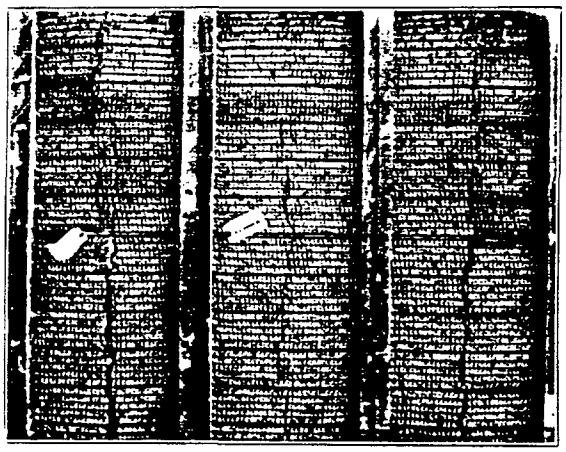


SCHEME III

WOOD FLOOR FINISH

This construction used when a wood floor finish is desired and conduits or piping are to be concealed in the floor.

Conduits and other piping may be run in space between floor slab and ceiling if desired.



View of slab C at bottom of slab showing that reinforcing steel had failed in tension

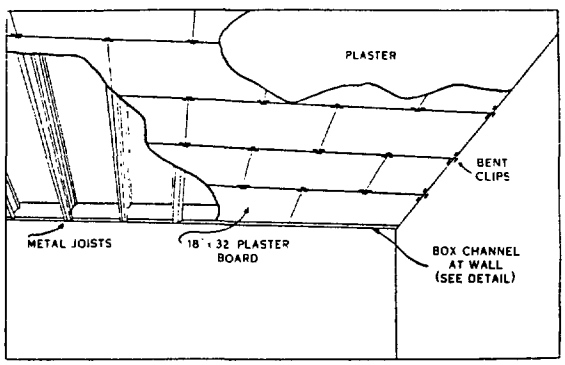
adjacent spans continuous over two intermediate supports and were constructed to a total thickness of 2 inches. These slabs are designated as A, B, C, and D, and differ in weight of reinforcement used and support spacings only. Slab A had supports spaced 12 inches on centers and was reinforced with Truscon 3/8-inch Hy-rib 3 pounds per square yard. Slab B was constructed in exactly the same manner except the distance from center to center of supports was 16 inches. Slab C was constructed similarly, but the distance from center to center of supports was 19 inches and the weight of the 3/8-in. Hy-rib was 3½ pounds per square yard. Slab D was constructed similarly, except the distance from center to center on supports was 24 inches and the weight of the Hy-rib was four pounds per square yard. These slabs were allowed to dry normally in room temperature from ten to twelve days each after which the load tests were applied. The loads were applied to the slabs by placing 1½-inch by 1½-inch wood strips exactly in the center of the span and parallel to the supports. On these strips was placed a platform of 1 x 6 lumber and this supported the test load composed of bags of cement weighing 95 pounds each. In loading slabs A and B, it was found impossible to load to destruction due to the fact that the height of the cement was such as to become dangerous to workmen in the immediate vicinity.

The following table gives the results in the ultimate load per square foot uniformly distributed on the slabs:

Slab	Mesh	Area per Panel	Panel Load Conc't'd in Center	Ult. Load per sq. ft. Uniformly Dist.
A	3/8"—3 lb. Hy-rib	4 sq. ft.	3,493 lbs.	1,747 lbs.
B	3/8"—3 lb. Hy-rib	5.33 sq. ft.	5,363 lbs.	2,012 lbs.
C	3/8"—3½ lb. Hy-rib	6.33 sq. ft.	5,470 lbs.	1,728 lbs.
D	3/8"—4 lb. Hy-rib	8 sq. ft.	4,025 lbs.	1,006 lbs.

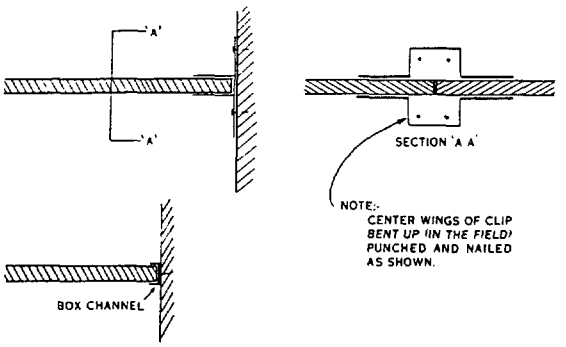
In slabs A and B ultimate load not reached. Test slab was unbroken.

The views of this test are shown in the attached cuts and will be of interest, as they give some idea of the enormous load this slab successfully supported. It was a slab typical of the one we are installing and its construction represents standard practice.

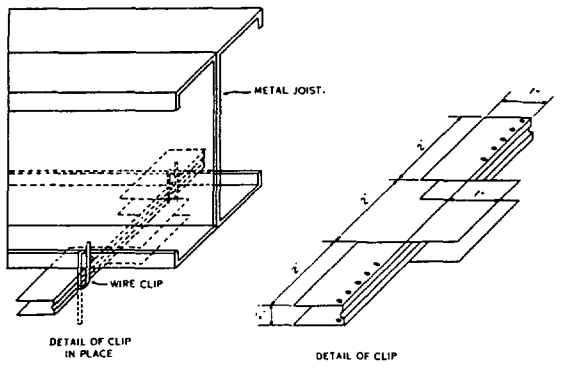


Part ceiling detail showing Rocklath clipped to metal joists

88007 1232



TYPICAL DETAILS AT WALLS



Detail and method of attaching Rocklath to metal lumber with clips

Saturated Slab Tests

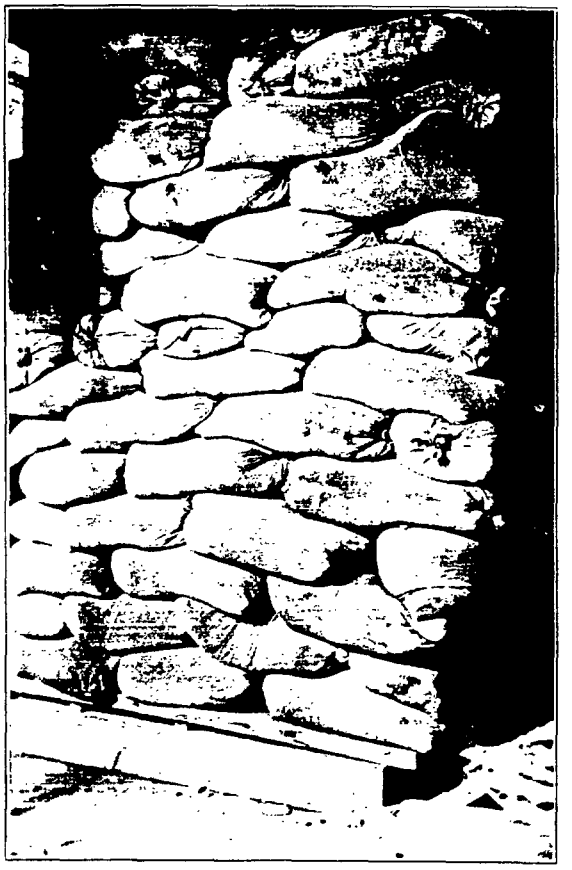
A very interesting test was conducted during April and June of 1925 to determine the load-carrying capacity of Structolite Concrete poured on permanent Sheetrock forms and reinforced with galvanized electrically welded steel fabric. The Structolite Concrete was mixed in the proportions of 1½ parts Structolite, 1 part sand, and 3 parts Anthracite coal cinders. Two thicknesses of slab were tested; 2½ inches and 4 inches on a 32-inch span.

The slabs were allowed to dry in normal room temperatures for 41 days and then were saturated with water for 48 hours. Immediately after which the test loads were applied. The test loads consisted of gypsum plaster in 100-pound bags concentrated at the ⅓ point by means of a wood loading platform. Failure occurred in the 2½-inch slab under a maximum load of 5,234 pounds (476 pounds per square foot) by the breaking of the reinforcement. Failure occurred in the 4-inch slab at 10,860 pounds (969 pounds per square foot) by the reinforcement mat breaking in exactly the same manner.

It will be seen readily that this construction is ideal for light occupancy buildings.

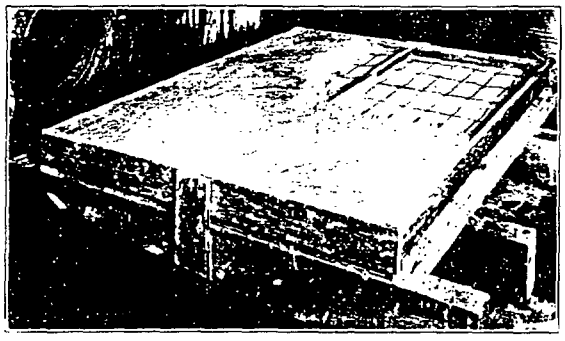
Manufacturing Service

Structolite is produced entirely within our own mills. We control the quality from the time it is mined as gypsum until it is installed as a floor or roof deck in your building. Our thorough inspection of all materials and supervision of manufacturing processes assure you of quality, uniformity and satisfaction. Our many plants, strategically located, can give you prompt and continuous service.



View of slab with total load of 16,090 pounds, equivalent to 2,012 pounds per square foot uniformly loaded

BB007 1233



Method of installing slab—Sheetrock reinforcement and Structolite

Specifications

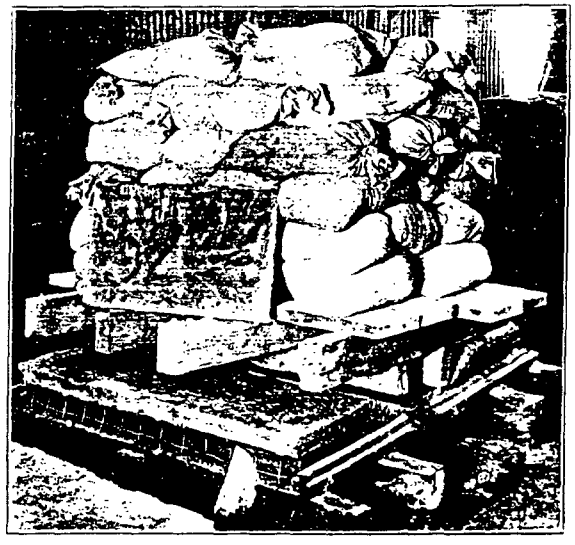
Scope of Work—All floor and roof slabs over metal lath shall be the United States Gypsum Company's Structolite construction. All slabs shall be of the thickness shown on the plans, and shall be laid level and true, and left in the proper condition required for the type of floor finish to be used.

Proportions—All Structolite Concrete used structurally in this work shall be of the following proportions, which shall be volumetric:

For the equivalent to a 1: 2: 4 Portland cement concrete:



Showing method of loading 4" slab. 10,860 pounds were applied before failure.



Showing failure of saturated slab after application of 5,234 pounds total load

1½ parts of Structolite.
1 part of sand.
3 parts of coarse aggregate.

Structolite Cement—The Structolite Cement used shall be as manufactured by the United States Gypsum Company and shall be delivered to the job in the original packages.

Storage—The Structolite Cement shall be stored in a dry place and shall be well protected from the elements.

Sand—The sand shall be clean, sharp and well graded. It shall be free from loam or other organic material.

Coarse Aggregate—Coarse aggregate shall be cinders, crushed stone, gravel or slag. Cinders shall be a good grade of powerhouse cinders, containing no large unbroken lumps, and shall be reasonably free from unburned coal, powdery ash or other soft material. The proportion of fine and coarse material shall be such as to give a reasonably well-graded aggregate.

Crushed stone shall be limestone, traprock or granite, and shall be crushed to such a size as will pass through a ¾-inch ring and be retained on a ¼-inch sieve.

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Gravel shall be clean and well graded from ¼ to ¾ inches in diameter.

Gravel and slag shall be free from clay or other soft material.

Slag—shall be air-cooled, clean and properly graded from ¼ to ¾ inches.

Water—The water used for mixing shall be clean and free from organic substances.

Mixing and Placing—The mixing of Structolite Concrete shall be done in the ordinary concrete mixer, preferably of the tilting drum type. Care must be exercised in dumping all of each batch and keeping the mixer clean generally, so that particles of set Structolite do not remain to accelerate the next batch. The speed of the drum shall not exceed 20 R.P.M. The predetermined amount of water shall be introduced into the drum first, and the drum allowed to revolve until the paddles and sides are cleaned from any material left from the previous mix. The feeding hopper should be charged, so that the coarse aggregate is delivered into the drum first to help scour it out. For the same reason if no hopper is used, the coarse aggregate should be placed in the drum first, after the water, and the Structolite last. Just enough water shall be used to insure a thorough mixing of the mass into a workable consistency. (The amount of water required will vary with the dampness of the aggregate.) As soon as the mass has become thoroughly mixed, it shall be removed immediately and placed in the slab. With a drum speed of 20 R. P. M., the entire mixing time shall not exceed two minutes after the Structolite and aggregate have been introduced into the drum. Dump at once, do not allow the drum to idle with all or part of the mix therein and further agitate the mass once the mixing is complete.

Cement or Terrazzo Finish—Where a cement or Terrazzo finish is indicated on the plans the top surface of the slab shall be left in a rough condition to insure proper bond between the Structolite and the finish. The Structolite slab shall be thoroughly wet down before the finish is applied. Cement finish shall not be less than ¾ inch in thickness. Terrazzo finish shall be applied according to standard practice and this contractor's specifications.

Composition Finish—Where composition finish is indicated on plans, it shall be applied as per manufacturer's directions.

Carpet, Linoleum or Rubber Tile Finish—Where carpet, linoleum or rubber tile finish is indicated on the plans, the Structolite slabs shall be troweled smooth and level, and the top wearing surface applied according to the directions of its manufacturer. A long-handled, double-acting trowel may be used to smooth the top of the Structolite slabs. The slabs shall not be troweled for more than one minute; two or three times over with a steel trowel is usually sufficient.

Roof Slabs—The Structolite roof slabs shall be troweled smooth and level. Where drainage fill is indicated the slab shall be left rough so that the drainage fill will bond satisfactorily with the slab proper. Before placing drainage fill thoroughly, wet down that portion of the slab on which the fill is to be placed.

Roof Covering—The roof covering shall be applied as quickly as possible after the completion of the Structolite Concrete slab, within twenty days preferably.

UNITED STATES GYPSUM COMPANY
205 WEST MONROE STREET
CHICAGO

98007 1235