July 22, 1958 P. S. MAIWURM 2,844,023

CONCRETE JOISTS

Original Filed Aug. 30, 1951 3 Sheets-Sheet 1

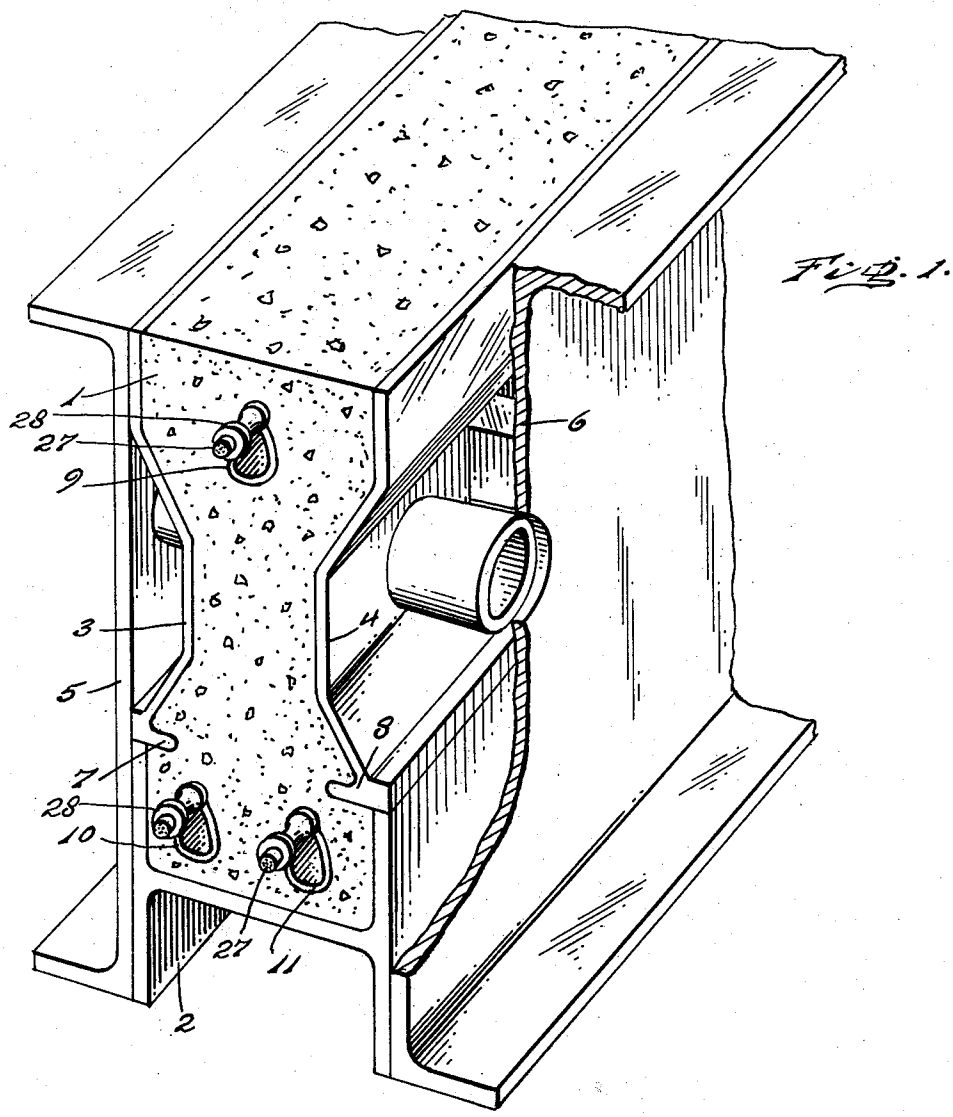



Fig. 1.

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Fig. 2.

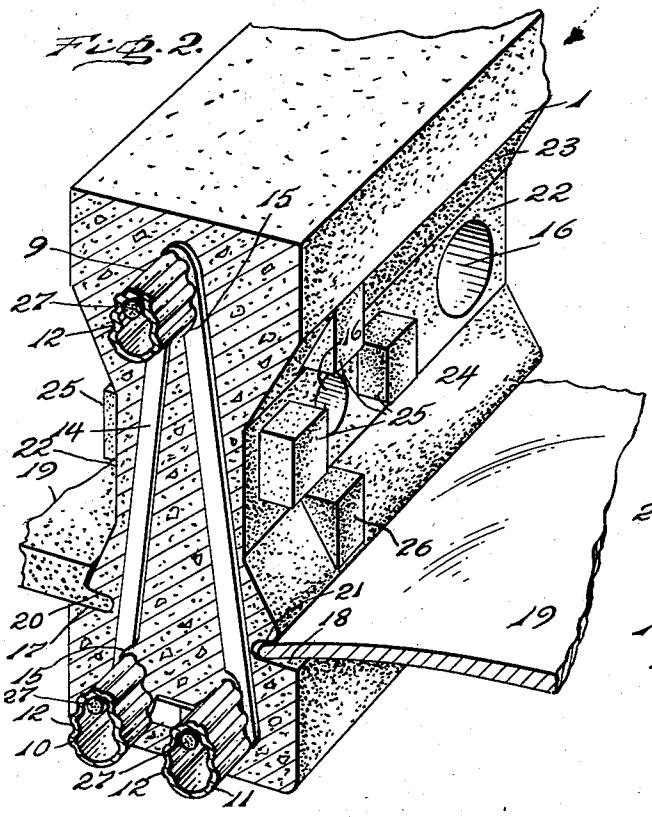



Fig. 3.

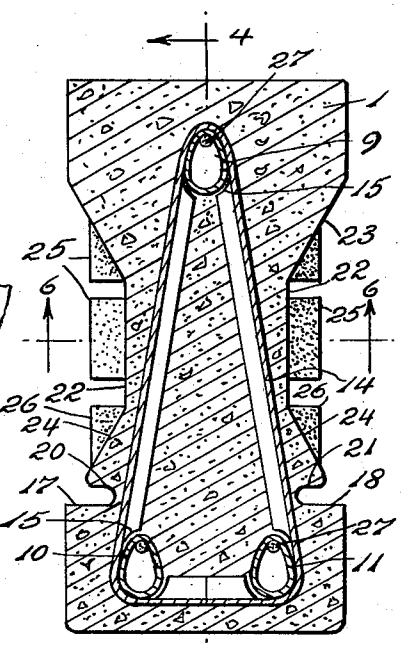



Fig. 4.

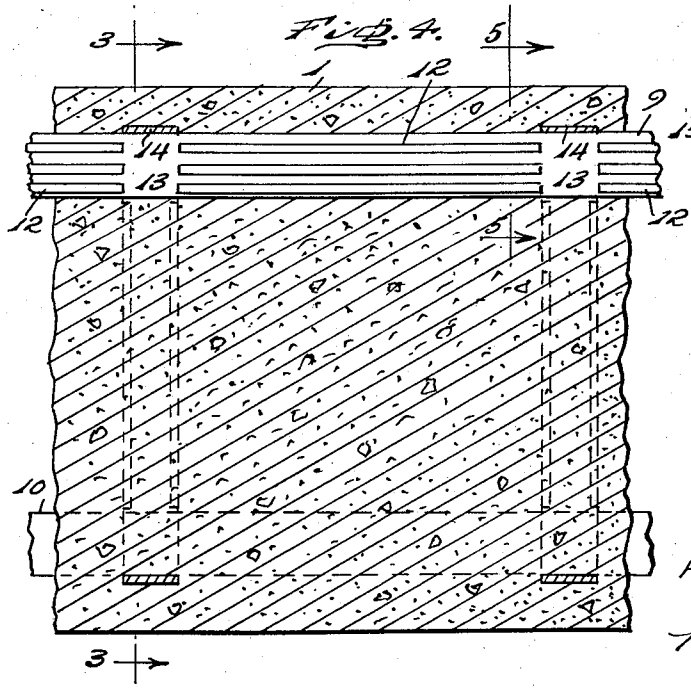



Fig. 5.

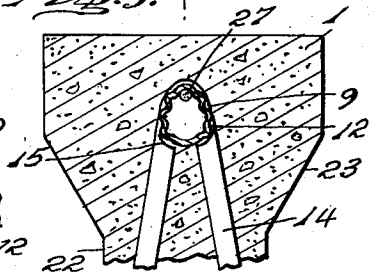
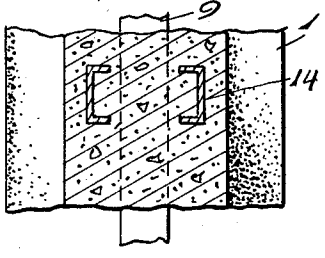



Fig. 6.




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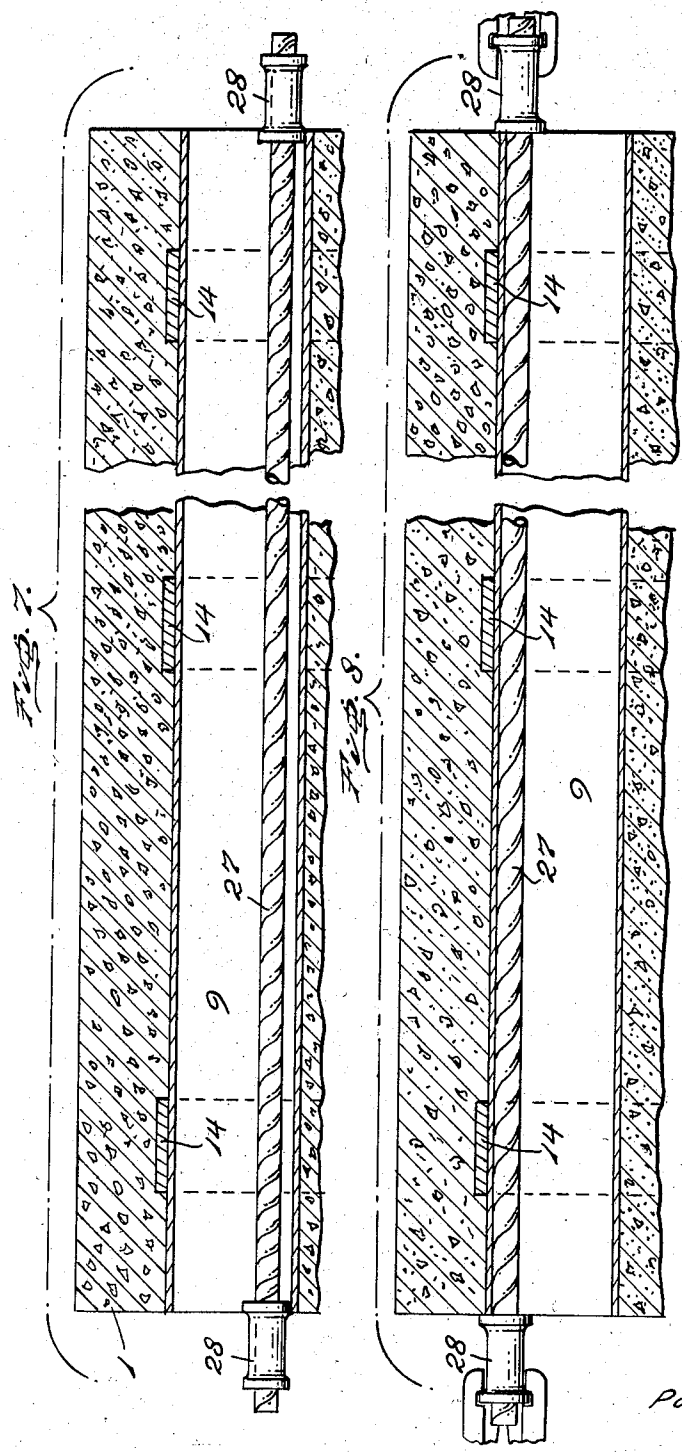



Fig. 7.




Fig. 8.

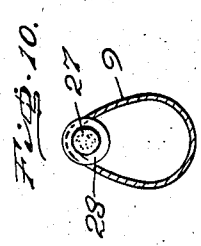



Fig. 10.

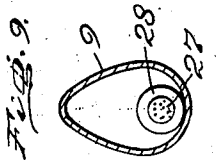



Fig. 9.

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United States Patent Office 2,844,023 Patented July 22, 1958



2,844,023

# CONCRETE JOISTS

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Substituted for abandoned application Serial No. 244,343, August 30, 1951. This application September 26, 1957, Serial No. 687,337

1 Claim. (Cl. 72—61)

This application is a substitute of my application Serial No. 244,343, filed August 30, 1951, officially allowed April 3, 1956 and now forfeited.

The object of this invention is to devise a novel concrete joist having a novel construction and arrangement of reinforcing unit comprising tubes and stirrups with prestressing means.

One important feature of the invention is to provide for the construction of an exposed beam ceiling with the joists projecting below the beam ceiling surface in fixed spaced relationship, and with shelves to support a prefabricated ceiling and with grooves extending longitudinally of the shelves for anchoring the ceiling panels thereon.

A further object of the invention is to provide the joists with holes spaced at equal distances throughout the length of the joists for supporting radiant pipes or tube grids.

The basic joist section is of the I beam type with the center of the joist reduced to a web structure with parallel surfaces equidistant above and below the diameter of the tube holes for the heating tubes, and continuing therefrom at an angle towards the sides of the joists, leaving however a proportional space in which the tube surface and the beam surface is parallel to the center vertical axis of a cross section of the joist.

The angular surfaces above and below the central web serve the specific purpose of supporting bridging between adjacent joists. Shoulders are preferably provided in between the centrally located tube holes to permit the bridging members to be slid into proper position while being held by protrusions symetrically spaced on the joists to permit the placing of the bridging members in either a vertical or a horizontal position. The object of a horizontal position is that they act as a support and hold the radiant heating coils when such coils are placed parallel lengthwise of the joist.

A further object of the invention is to fabricate a novel construction of reinforcing tubes having spaced sets of corrugations, the sets being spaced to locate the stirrups and the tubes being deformed to form seats for prestressed members when the latter are in their stressed condition.

With the foregoing and other objects in view as will hereinafter clearly appear, my invention comprehends a novel concrete joist having a novel construction and arrangement of a reinforcing unit embedded in the concrete.

The invention further comprehends a novel concrete joist provided with means to support bridging members and the ceiling panels.

For the purpose of illustrating the invention, I have shown a preferred embodiment of it which I have found, in practice, will give satisfactory and reliable results. It is, however, to be understood that the various instrumentalities of which the invention consists can be variously arranged and organized and the invention is not limited except by the scope of the appended claim



to the exact construction and organization of these instrumentalities as herein shown.

Figure 1 is a perspective view, partly broken away and partly in section, of a concrete joist and a portion of the mold and illustrative of the invention.

Figure 2 is a perspective view, partly in section, of a completed joist.

Figure 3 is a section on line 3—3 of Figure 4.

Figure 4 is a sectional view taken on line 4—4 of Figure 3.

Figure 5 is a cross section of a portion of the joist.

Figure 6 is a section on line 6—6 of Figure 3.

Figure 7 is a longitudinal section, partly broken away with a tube in unstressed condition and with a stressing member in the lower portion of the tube.

Figure 8 is a section similar to that of Figure 7 but showing the stressing member in stressed condition and seated in the upper portion of the tube.

Figure 9 is a transverse section of an unstressed tube with the stressing member in the lower portion of the tube.

Figure 10 is a transverse section of a stressed tube and its stretching member in stressed condition.

Similar numerals of reference indicate corresponding parts.

Referring to the drawings:

In Figure 1, I have shown my novel construction of concrete joist 1 as supported in the channel of a supporting beam 2 and within inner side mold members 3 and 4 and outer side mold channels 5 and 6. The mold plates 3 and 4 have inwardly extending lateral flanges 7 and 8 and the inner walls of the side mold plates 3 and 4 are shaped to conform to the outer side walls of the completed joist.

The metal reinforcing unit for the joist is in the form of tubes with stirrups spaced longitudinally of the tubes. The tubes are deformed to be wider at their bottoms to provide for the insertion of stressing members and are compressed at their upper portions to provide a seat for such members. The tubes have preferably a triangular disposition within the concrete and are spaced from the outer walls of the joist. I have shown an upper tube 9 and lower tubes 10 and 11, preferably of identical construction. The tubes are fabricated to provide sets of longitudinally extending corrugations 12, and the spacing 13 between sets locates and positions stirrups 14, which as shown in Figure 6 are preferably channelled shaped in cross section with the side flanges at the tubes pressed in or cut away for proper fitting of the stirrups around the tubes, as indicated at 15.

At about the center of the vertical axis of the joist, a plurality of spaced holes 16 extend laterally through the webs of the joist at equally spaced distances throughout its length to provide for the support of radiant pipes or tube grids.

The mold flanges 7 and 8 form shelves 17 and 18 on which prefabricated ceiling panels 19 will rest, and longitudinal grooves 20 and 21 serve the purpose of anchoring the panels to the shelves.

The center of the joist is of reduced diameter to form a web structure having opposite sides parallel as at 22, and these sides merge into upwardly diverging walls 23 and into downwardly diverging walls 24 to form angular surfaces for supporting bridging between the joists.

Projecting shoulders 25 are provided between centrally located tube holes 16 which permit the bridging members to be slid into position, and these bridging members are retained in position by protrusion lugs 26 symetrically placed to permit the placing of the bridging members

in a horizontal position. The purpose of the horizontal position is to form supports for radiant heating coils extending parallel longitudinally of the joists. The bridging members are inserted between the upper lug and the lower lugs for a horizontal disposition.

Prestressing members **27** in the form of rods or cables have ferrules **28** fixed to their ends and adapted to receive gripping members for tensioning and prestressing such members. The tubes are so formed that the stressing rods can be moved into them and received in the bottom portion of the tubes. When tension is applied and the stressing members moved upwardly, the stressing members seat in the upper restricted portion of the tubes and are retained in place by the engagement of the ferrules with the ends of the joist.

The prestressing of the tubes may also be accomplished by forcing, hydraulically or otherwise, expansible tension and stressing material into the tubes with proper provision for closing the ends of the tubes.

The tubes are positioned in the mold as units with the stirrups. The concrete is then poured. After the concrete is set, the stressing rods or bars are inserted into the lower portions of the tubes, stressed and raised to the narrow portions of the tubes. The ferrules **28** engage the ends of the tubes and thus maintain the rods or bars **27** in a stressed state. The concrete is thereby placed under compression. The tubes are not prestressed to such an extent which would cause the tubes to buckle prior to their embedment with concrete, and, after the concrete is poured, the tubes may be further stressed to a desired extent.

The lower channel of the supporting beam **2** forms a space to receive the rollers for removing the joist from the mold.

The inner mold plates have tubular extensions to receive the mold for forming the openings or holes **16**, and this may be a rubber tube as conventionally used which can be inflated during the molding and then deflated and withdrawn.



Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

In a reinforced concrete joist, a plurality of metallic tubular members embedded therein, at least two of said members positioned in spaced relationship within the lower portion of the joist and at least one of said members being positioned in the upper portion of the joist, each member being coextensive in length with the length of the joist, each tubular member having in cross section a relatively wide lower portion and a relatively narrow upper portion, each tubular member having ribs along its length to impart rigidity thereto, said ribs being interrupted at spaced points along the member to provide a plurality of seats along the length thereof, the seats of the members being aligned transversely of the length of the joist, a plurality of stirrups surrounding the tubes, said stirrups being channel shaped in cross section with the flanges of the channels directed inwardly, said stirrups having recesses in the channels at spaced points and said seats of said tubes disposed within said recesses, a tensioned reinforcing element disposed within each tubular member, each element having ferrules at each end thereof, said elements being positioned within the upper narrow portions of the tubes, said ferrules engaging the ends of said tubular members and maintaining said elements in a tensioned state.

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