May 13, 1924. 1,493,470

C. W. CASH

FORM SUPPORTING MEANS IN CONCRETE CONSTRUCTION

Filed Aug. 9, 1920 2 Sheets-Sheet 1

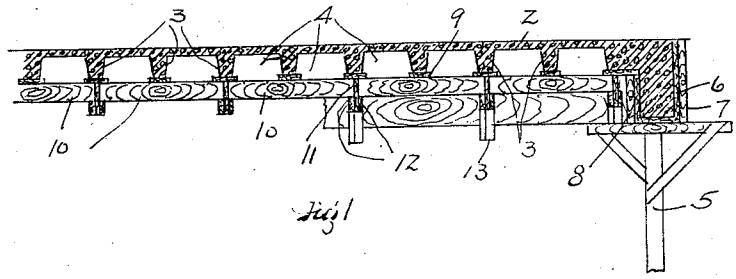


Fig 1

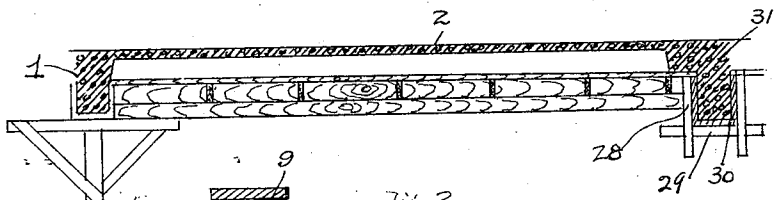


Fig. 2.

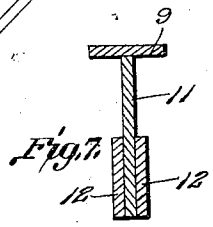
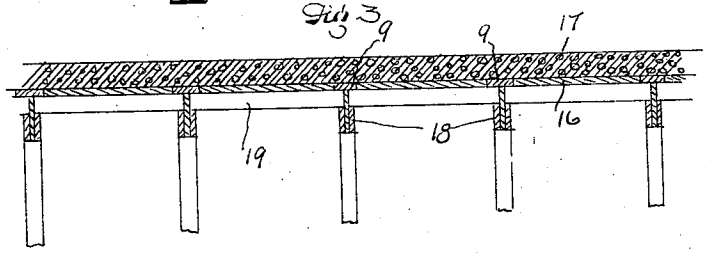


Fig. 7.

Fig 3



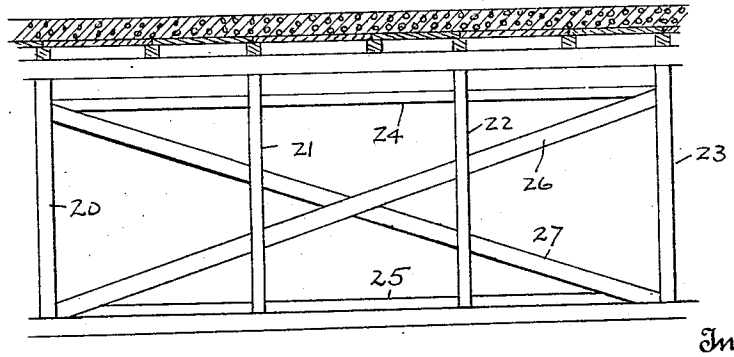


Fig. 4.

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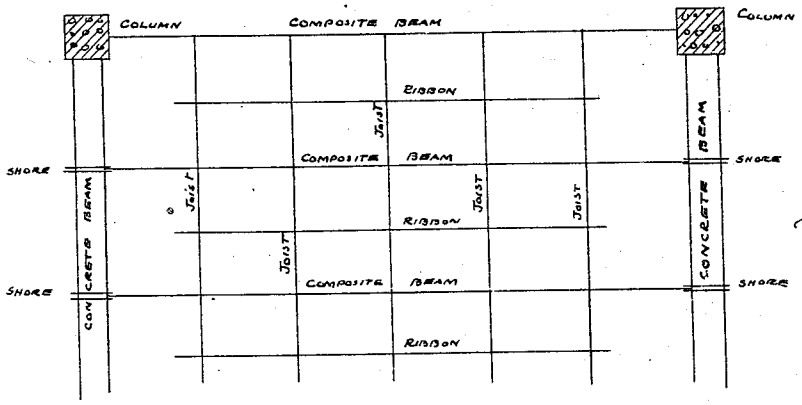


Fig. 5

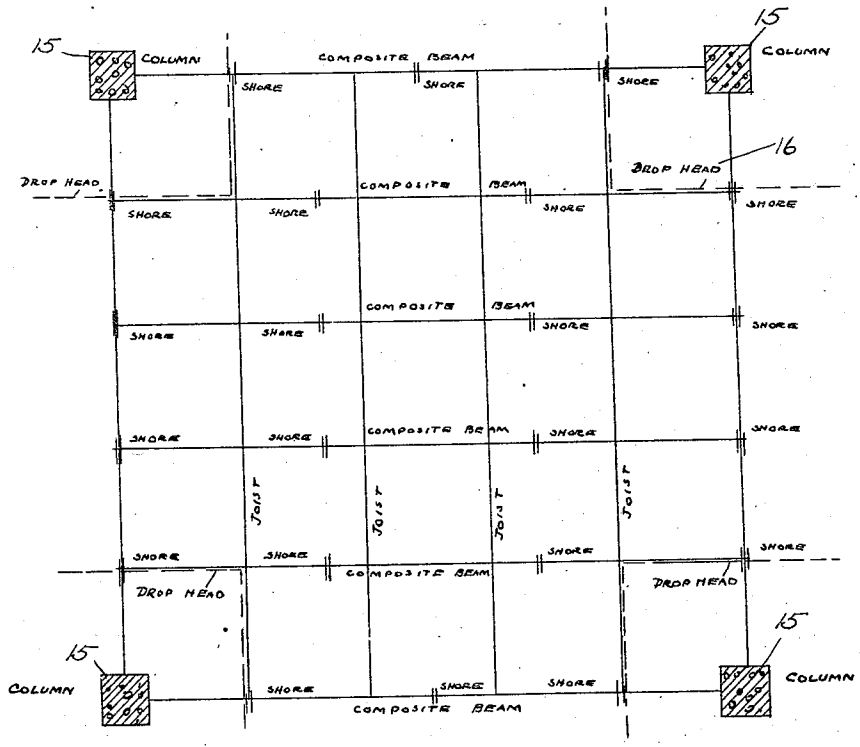


Fig. 6

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UNITED STATES PATENT OFFICE.

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FORM-SUPPORTING MEANS IN CONCRETE CONSTRUCTION.

Application filed August 9, 1920. Serial No. 402,340.

To all whom it may concern:

Be it known that I, CORNELIUS W. CASH, a citizen of the United States, and a resident of Cleveland, county of Cuyahoga, and State of Ohio, have invented a new and useful Improvement in Form-Supporting Means in Concrete Construction, of which the following is a specification, the principle of the invention being herein explained, and the best mode in which I have contemplated applying that principle, so as to distinguish it from other inventions.

The present invention, relating, as indicated, to concrete construction, is more particularly directed to an improved means for supporting the forms onto which the concrete is poured in the formation of concrete floors and the supporting beams therefor. A further object of the invention is the provision of improved form-supporting means which may be used, either in connection with floors of a flat slab type, the pan type, or tile and joist. A still further object of the invention is the provision of improved supporting means for forms which will require very much less labor to set up and very much less material, while at the same time affording an equally firm and safe support for the forms, and at the same time permit of the removal of certain parts of the supporting means before the concrete is fully set without the necessity of re-shoring the forms, as is the case today. To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims.

The annexed drawing and the following description set forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawings:—

Fig. 1 is a transverse vertical section through a floor of the pan type showing my improved supporting means for the forms therefor; Fig. 2 is a similar section taken at right angles to the section of Fig. 1; Fig. 3 is a vertical section corresponding to the section of Fig. 1, but illustrating a floor of the flat slab type; Fig. 4 is a view at right angles to the section of Fig. 3; Fig. 5 is a plan view of the supporting means for the forms for a floor of the pan type, as shown in Figs. 1 and 2; Fig. 6 is a similar plan view for the supports of a floor of the flat slab type, as shown in Figs. 3 and 4; and Fig. 7 is an enlarged sectional view of the composite beam, having the cross section of an I-beam, utilized in the construction.

A concrete floor of the pan type is illustrated in Fig. 1 and consists of a series of panels, as they are termed, each panel consisting of the flooring between two parallel spaced girders. In the case of a floor of the flat slab type, as shown in Figs. 3, 4 and 6, a panel is a square section of the flooring between four columns which are reinforced by drop heads extending for some distance around each of the columns and beneath the floor proper. In Figs. 1 and 2 there is shown a panel, consisting of a concrete girder 1, a floor section 2 and a series of longitudinally spaced ribs or concrete joists 3, which extend in a direction transverse to the girders 1, and are spaced at equidistant intervals, as indicated. These joists 3 are formed by mounting a series of inverted U-shaped metal or wood pans upon suitable supports to produce the open spaces 4 and the ribs 3. It is immaterial whether metal or wood pans are employed for this purpose, in either case the pans being removed after the flooring is set. In tile flooring construction, rectangular tile are substituted for the pans of a pan floor construction, and approximately the same type of flooring results, that is, a section through the floor shows a series of downwardly extending spaced parallel ribs, connected to and supporting a relatively thin slab of concrete, which forms the floor proper, but in this case the tile remain in the floor and are held between the spaced ribs.

It is customary in present-day methods of shoring the forms for a pan floor to provide a joist underneath the bottom of each of the ribs or joists 3 of the concrete of sufficient width to support thereon the two ends of the metal pans. Each of these horizontal joists is then supported or shored by means of a series of vertical supports, which are usually 4 x 4 beams, spaced at 2 or 2½ foot intervals for the entire length of each joist. It is necessary in this method of shoring to use a very large amount of lumber, and it is usually figured that 2 square feet of lumber must be used in the forms and supports for every square foot

of final floor surface in the building. A further disadvantage of the present method is that, while the building codes of most cities permit of the removal of the shores after the first five to seven days, provided a lesser amount of shoring material is then substituted, it is impossible in the system described to remove a part of the shores without removing them all and substituting a totally new series of joists and shores for the original. While this releases some of the lumber at the end of four or five days it entails so much labor in replacing the lighter series of shores which are permitted, that there is practically no real saving in taking down the original supports and substituting lighter ones, so that usually the entire original shoring system is allowed to remain until the concrete floor is permanently set, which means that all of the lumber in the shores and supports is tied up for not less than two weeks for each floor.

My improved system of shoring involves the use of a series of T-shaped supports 5 under the forms 6 for the beams 1 of the concrete floor. Under the adjacent lower edges of each two pans is mounted a ribbon or strip 9, all of which are supported upon a series of joists 10. These joists 10 are in turn supported upon composite members, consisting of one deep relatively narrow strip or board 11, and the similar strips 12, one on either side of the strip 11 of enough less depth than the members 11 to receive between the members 12 and the ribbon, the ends of the joists 10. In any one span or panel there may be several of these composite beams, depending upon the weight of the floor and the extent of the span. For example, in a span of say 16 feet, there may be three composite members.

The composite members are supported at their ends in several ways, depending upon the depth of the concrete girders. In case of a deep concrete girder, such as is shown at the right of Fig. 2, the composite members may be nailed directly to a strap consisting of members 28, 29 and 30, which are supported at their ends upon the T-shaped supports or struts 5, and throughout the remainder of their length, by the box form 31 for the girder. In cases where the girder is not of sufficient depth for its form to have strength to support the composite members, the latter are supported in the manner shown at the left in Fig. 2, that is, by means of the struts 5.

By the use of the described system of shoring the amount of lumber or other material used for shoring and supporting the concrete forms can be reduced by about one-half, while the labor of setting up these supports can be reduced by at least an equal amount.

In case of a flat slab construction, such as is shown in Fig. 6, where each of the columns 15 is surrounded by a drop head 16, extending several inches below the lower surface of the final concrete floor, the system of shoring must be somewhat modified, although the same principle of construction can be used. In this construction, which is shown in section in Figs. 3 and 4, the flat boards 16, which form the flat form upon which the concrete floor 17 is formed, are supported upon a series of composite beams 18, similar to those already described, and upon a series of joists 19, which correspond to the joists 10 described above. The composite beams 18 in this form, however, are supported upon a series of vertical shores 20, 21, 22 and 23, which, for convenience in handling and for accuracy of alignment in setting up, may be built together and connected by horizontal members 24 and 25 and diagonal braces 26 and 27, which form what is generally termed a bent, and which are set up and taken down as a unit. The location of the various joists, composite members and supports is indicated for one panel in Fig. 6 in their proper relation to each other and to the columns at the corners of the panel.

This method of shoring consists in first erecting a supporting system in which the members running in both directions (longitudinal and transverse) are in supporting contact with the forms, so that the supporting system may be diminished in its form supporting area of contact by removing the transverse or joist members while maintaining the composite members in their initial position undisturbed.

The ribbon strips 9 may be made an integral part of the composite member in both the system of Figs. 1 and 3 since the addition of this strip serves to strengthen the composite member greatly. This strip however, also serves as a part of the form and hence the remainder of the composite member and the joists may be referred to as in supporting contact with the forms, as in fact they have been described elsewhere.

Another important advantage of my improved method and system of shoring is that it permits the absolute standardization of the joists in a single length for any one building or length of span. Standardization will enable this system of centering to be erected to a greater extent by unskilled labor than systems at present employed, and thereby effect an additional saving in cost. At the same time the workmen are facilitated in placing the supporting members by the very much decreased number of vertical shores for each panel. Bents can rarely be used in present systems of centering because they cannot move through and between the innumerable vertical shores necessary, but by my method of construction

bents may be moved between the widely spaced supports, where their use is found desirable.

One distinct advantage of the present method of shoring is that after the concrete floor is partially set, and has set to that point which allows of the removal of the original shoring system and the substitution of a cheaper and lighter system, it is here possible to knock out the joists 10 and 19 from their resting places upon the narrow members 12 of the composite members. In this way a portion of the original shoring system can be removed without disturbing the remainder, and without the substitution of any other supporting members for the original ones which have been removed, with a consequent saving in material and labor. At the same time the remaining supporting system is undisturbed and is entirely sufficient for the safe support of the floor after the initial set has been given.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention:—

1. A shoring system for one panel of a concrete floor comprising two spaced series of shores under opposite sides of said panel, a series of parallel composite members mounted on said shores and provided with shoulders on their opposite sides, and a series of parallel joists extending transversely of said composite members, said joists fitting snugly between said members and bracing the same against lateral distortion, and being supported upon such shoulders thereof, and elements constituting the form for such concrete floor supported upon said joists.

2. A shoring system for one panel of a concrete floor comprising two spaced series of shores under opposite sides of said panel, a series of parallel composite members mounted on said shores and provided with shoulders on their opposite sides, and a series of parallel joists extending transversely of said composite members, said joists having their ends abutted against said members and bracing the same against lateral distortion, and being supported upon such shoulders thereof, ribbon strips supported upon said joists, and inverted U-shaped floor pans supported on said ribbon strips.

3. A composite wooden beam for use in supporting concrete forms, comprising a relatively thin wide plank, other planks of approximately equal thickness of lesser width secured against either side of said first-named plank, said three planks having one edge in alignment, and a fourth plank of approximately equal thickness to each of said other planks and of a width approximately equal to the total thickness of the three associated planks, disposed transversely and centrally upon the other edge of said first-named plank, whereby said planks constitute an I-beam with a lower edge of enlarged cross-section as compared with its upper edge.

Signed by me, this 3rd day of August, 1920.

CORNELIUS W. CASH.