July 10, 1923. 1,461,409

H. E. WHITE

STEEL FORM FOR CONCRETE CONSTRUCTION

Filed Aug. 15, 1921 10 Sheets-Sheet 1

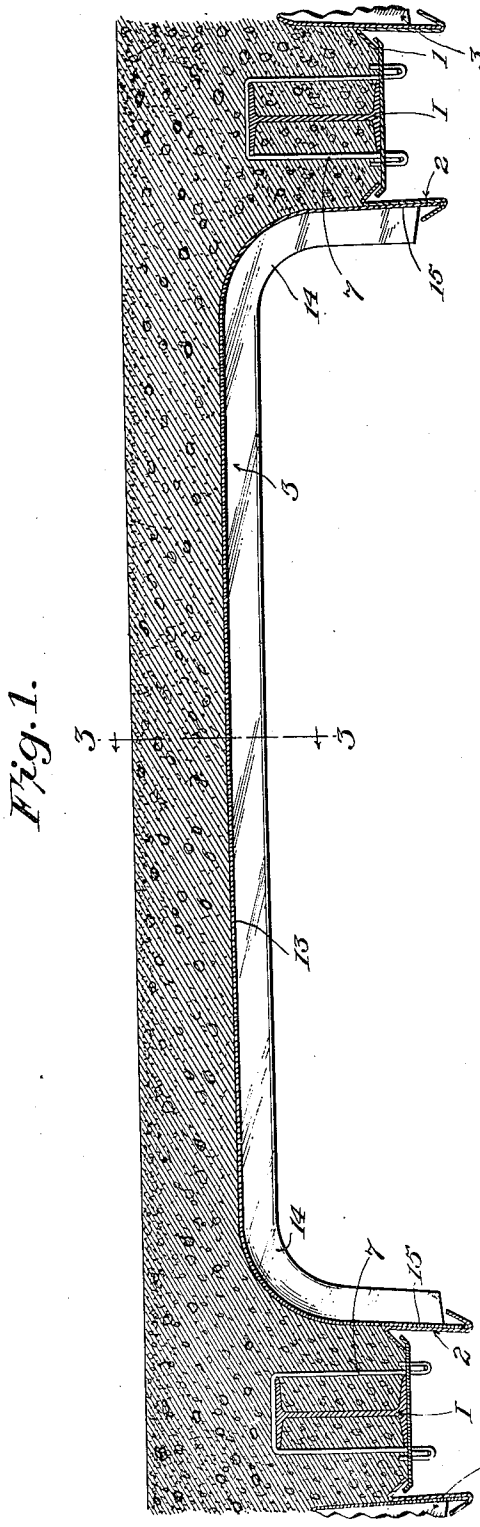


Fig. 1.

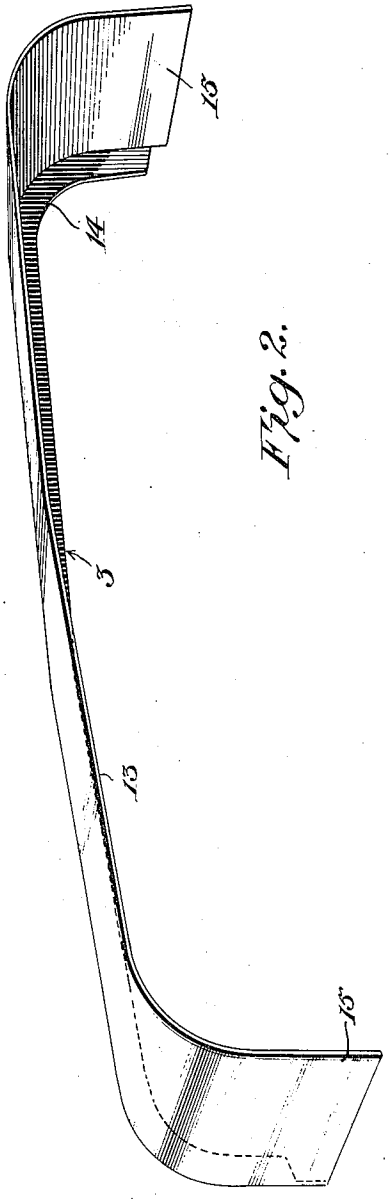


Fig. 2.

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STEEL FORM FOR CONCRETE CONSTRUCTION

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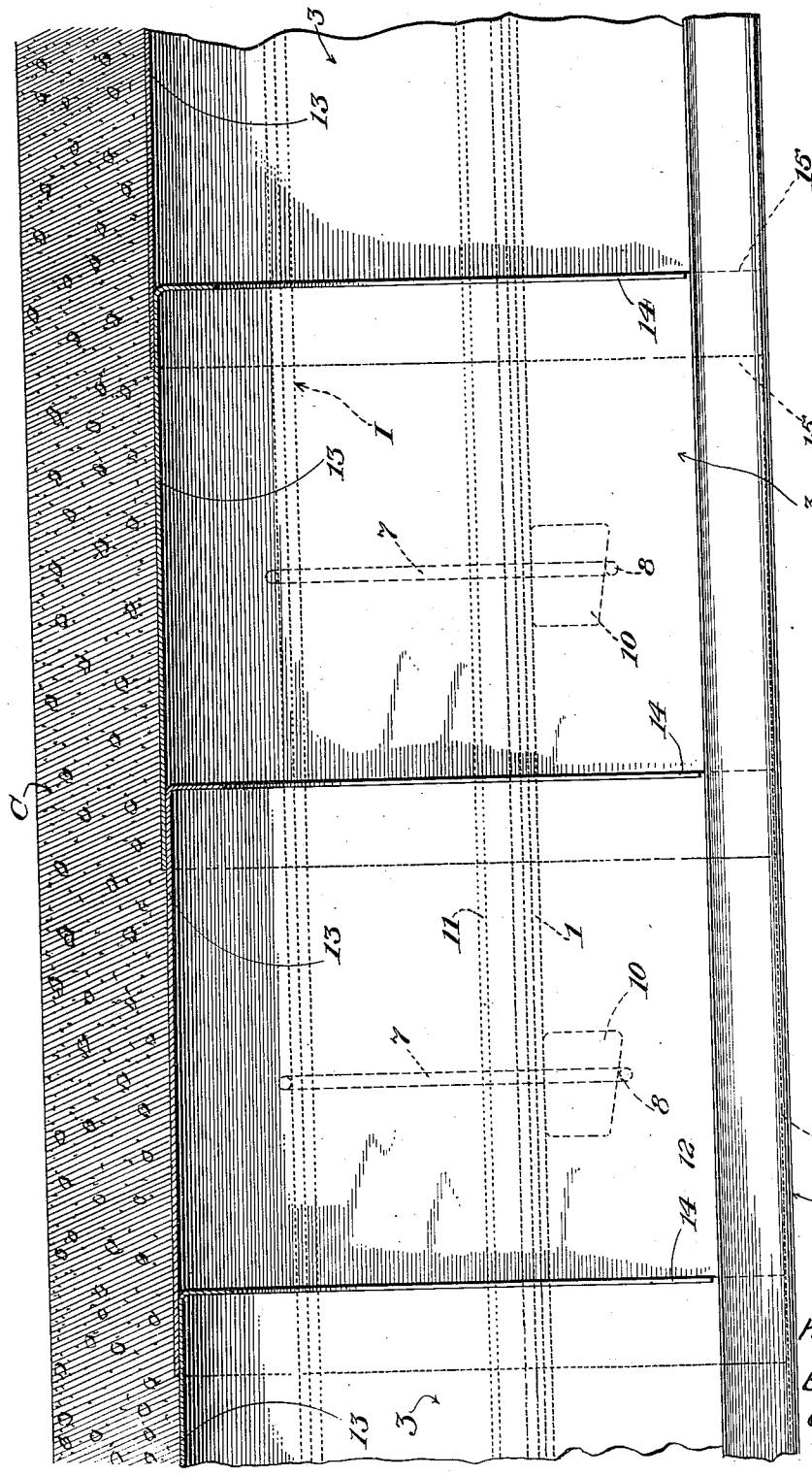


Fig. 3.

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STEEL FORM FOR CONCRETE CONSTRUCTION

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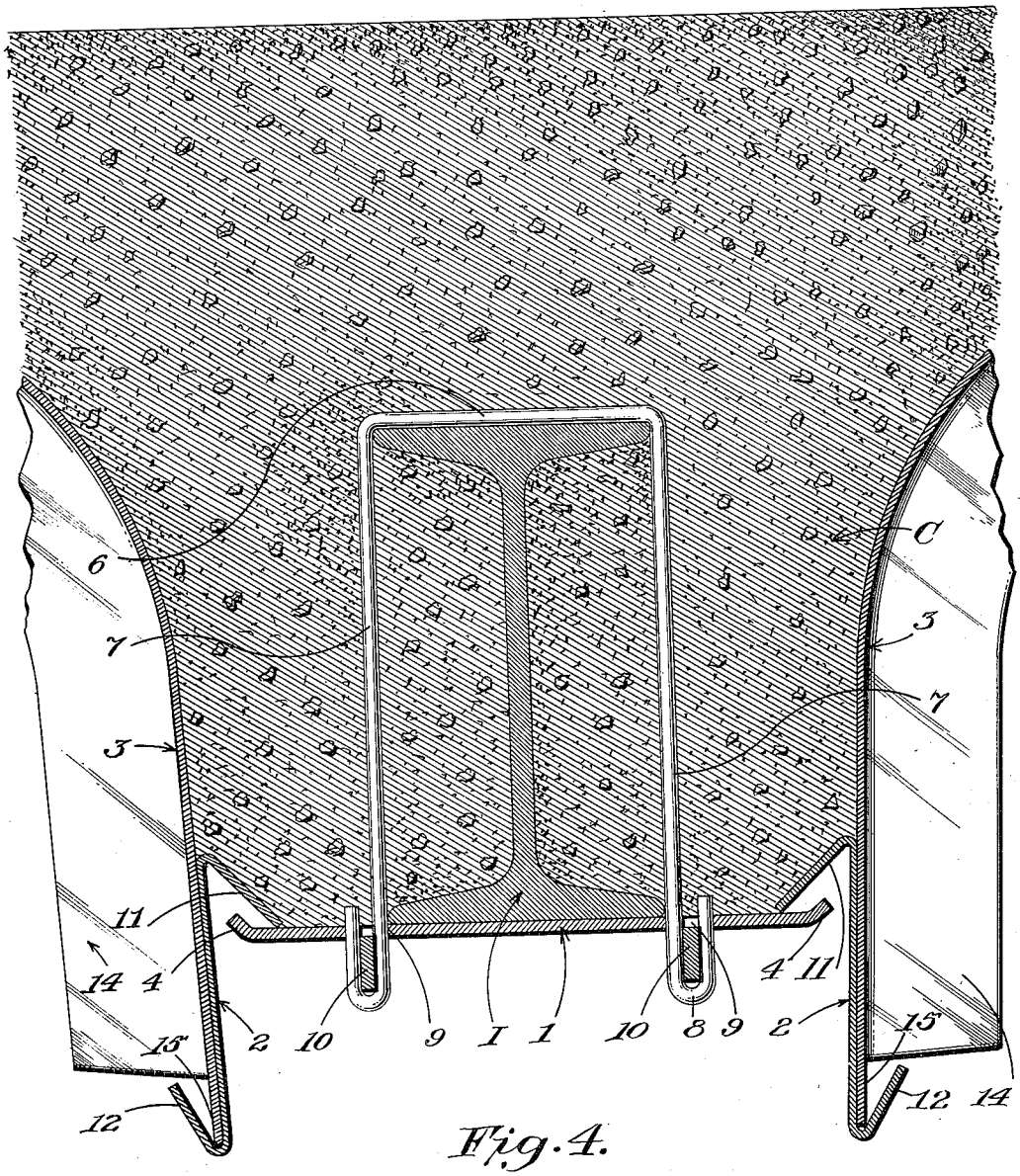


Fig. 4.

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STEEL FORM FOR CONCRETE CONSTRUCTION

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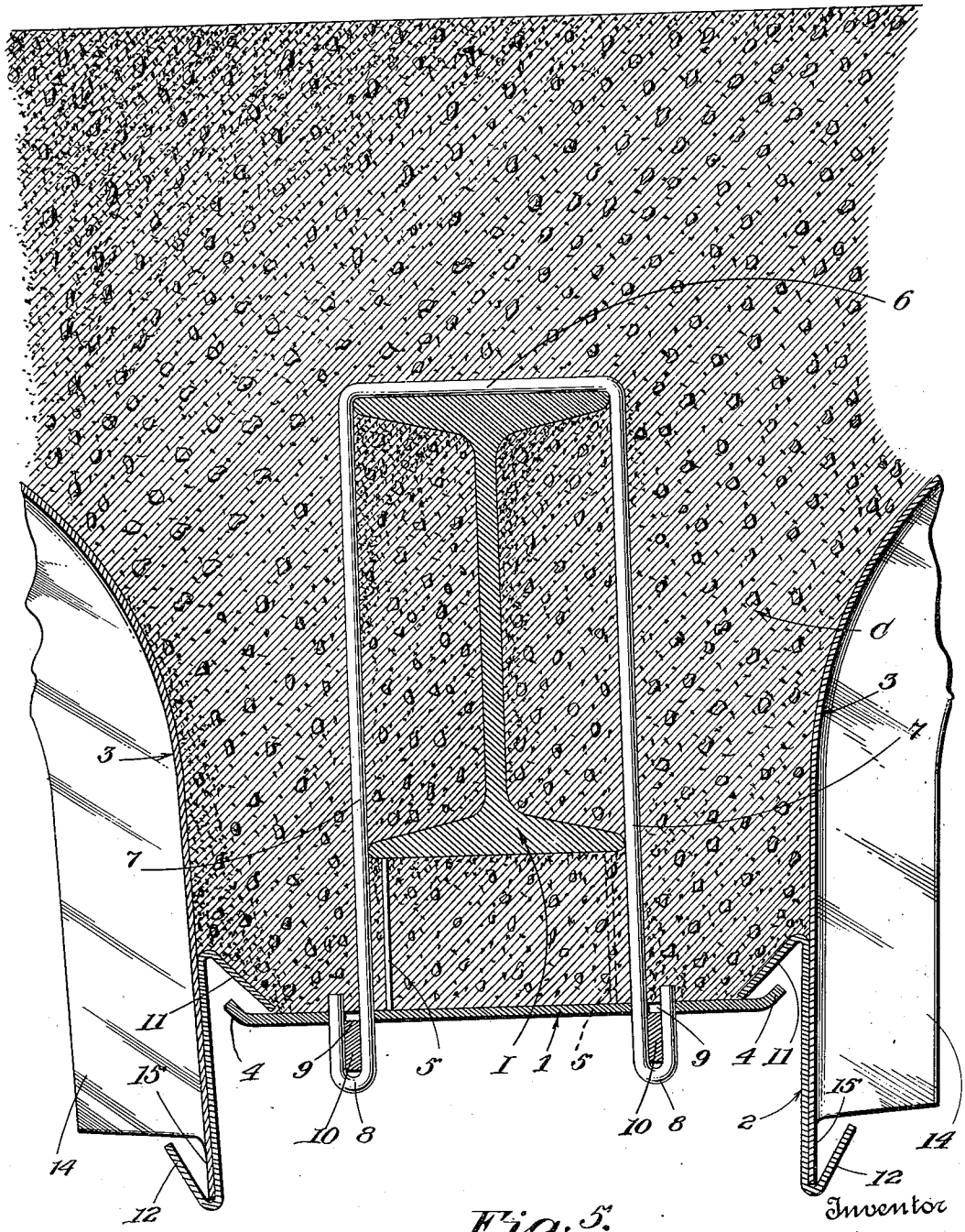


Fig. 5.

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Attorney

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STEEL FORM FOR CONCRETE CONSTRUCTION

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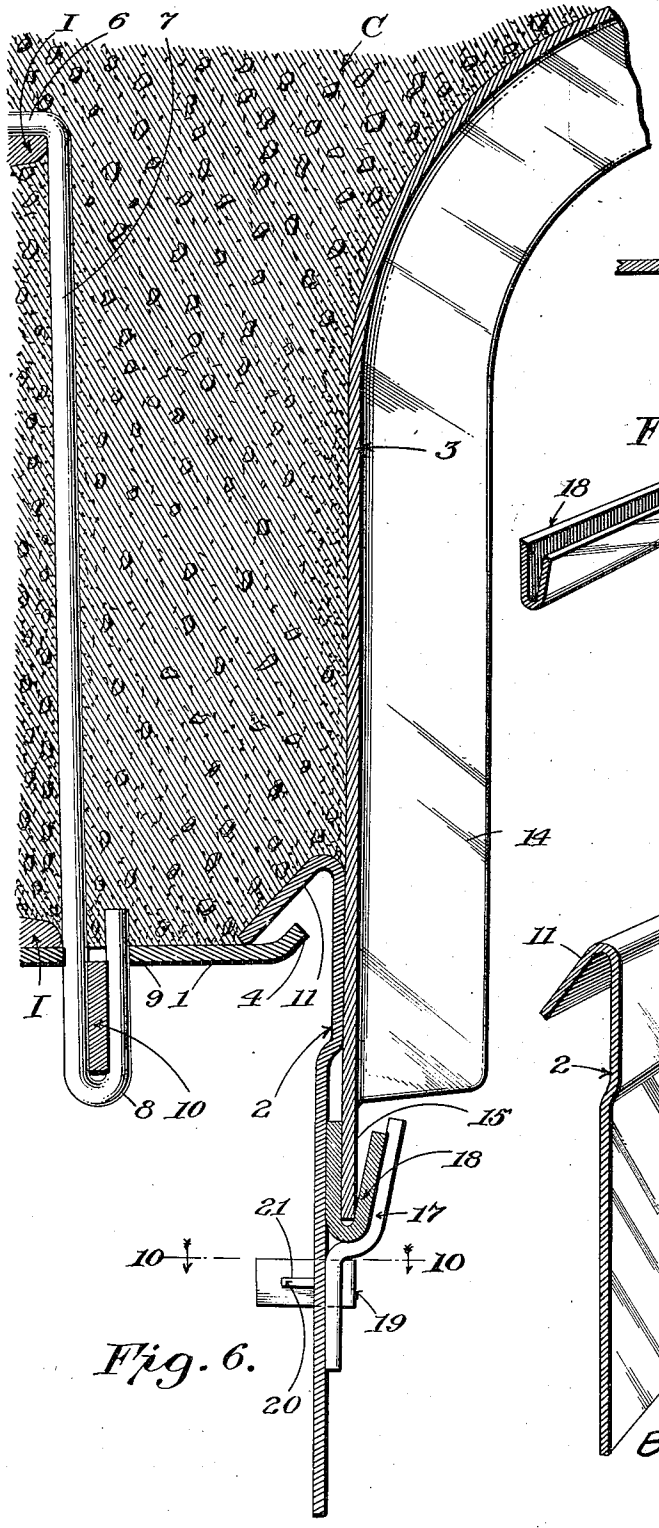


Fig. 6.

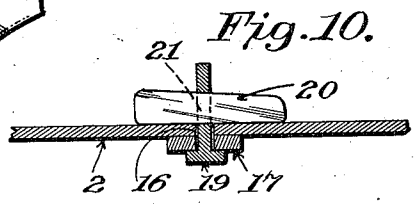


Fig. 10.

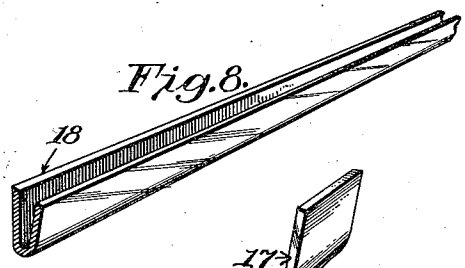


Fig. 8.

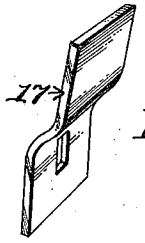


Fig. 9.

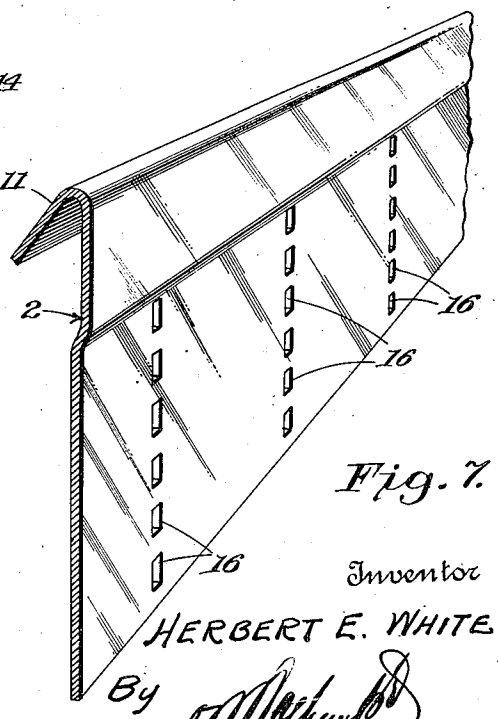


Fig. 7.

Inventor

HERBERT E. WHITE

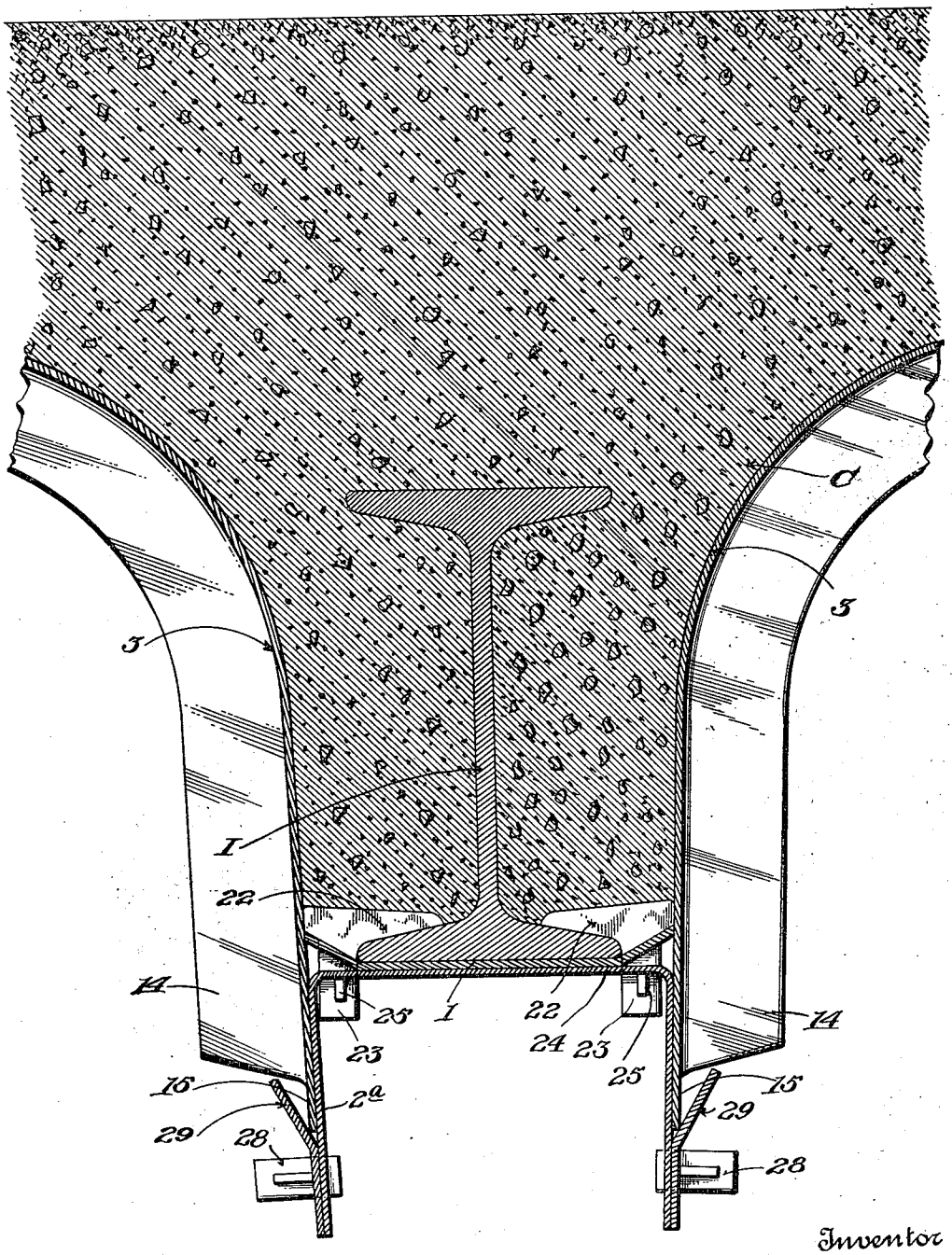
By Matthews & Matthews Attorney

July 10, 1923. 1,461,409

H. E. WHITE

STEEL FORM FOR CONCRETE CONSTRUCTION

Filed Aug. 15, 1921 10 Sheets-Sheet 6



Inventor

Fig. 11. HERBERT E. WHITE.

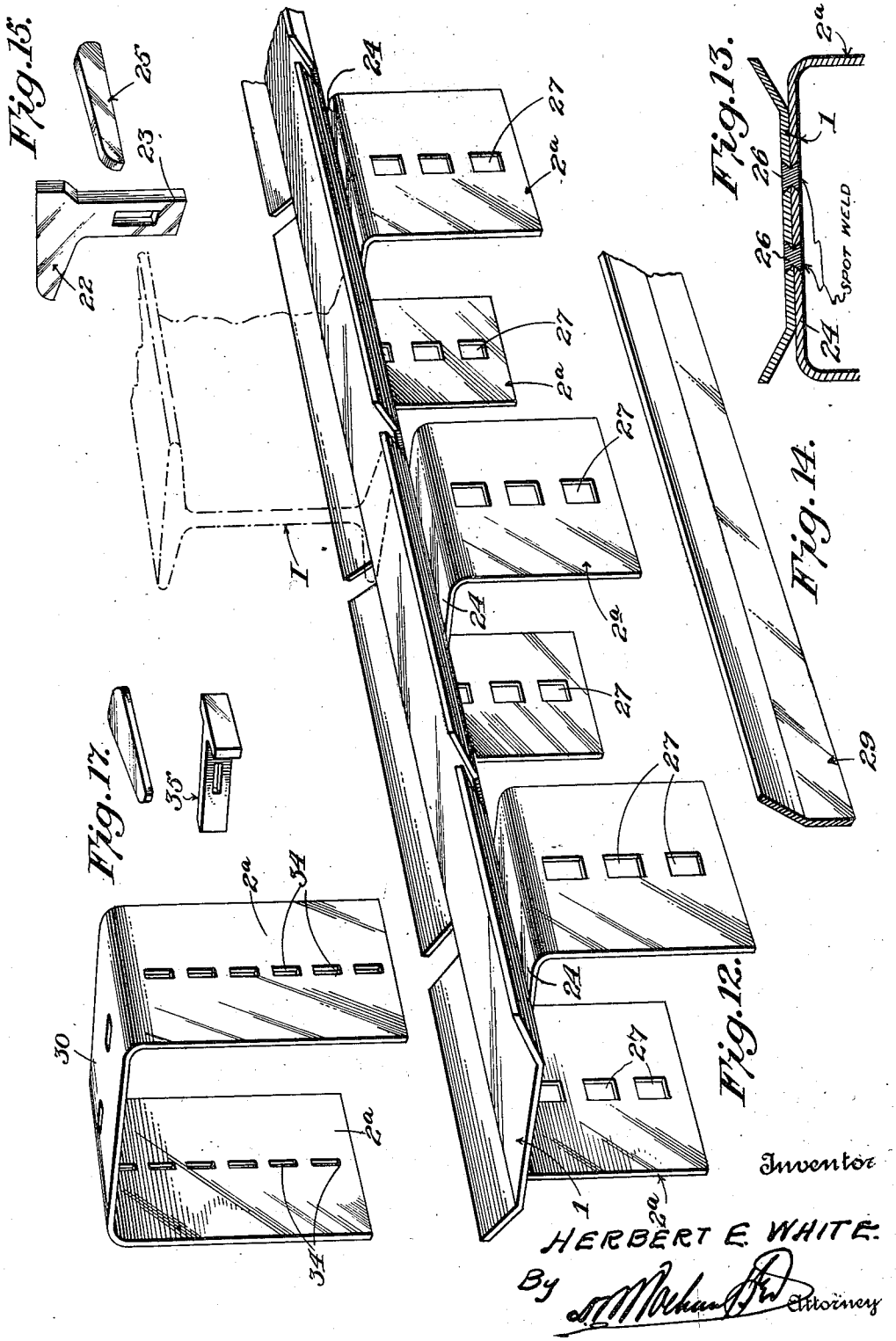
By Attorney

July 10, 1923. 1,461,409

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STEEL FORM FOR CONCRETE CONSTRUCTION

Filed Aug. 15, 1921 10 Sheets-Sheet 7



Inventor

HERBERT E. WHITE.

By Mackaye & Fox Attorneys

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H. E. WHITE

STEEL FORM FOR CONCRETE CONSTRUCTION

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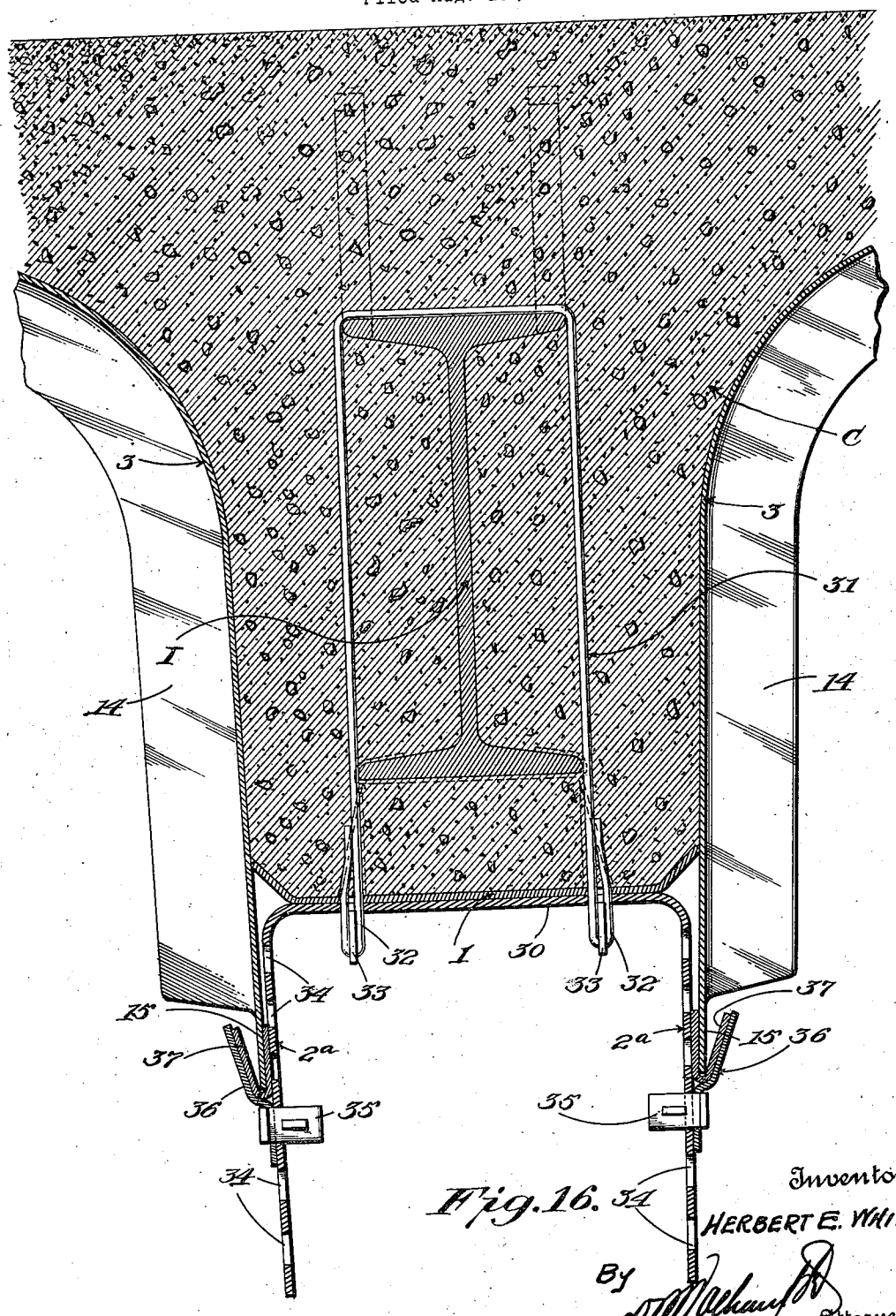


Fig. 16.

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STEEL FORM FOR CONCRETE CONSTRUCTION

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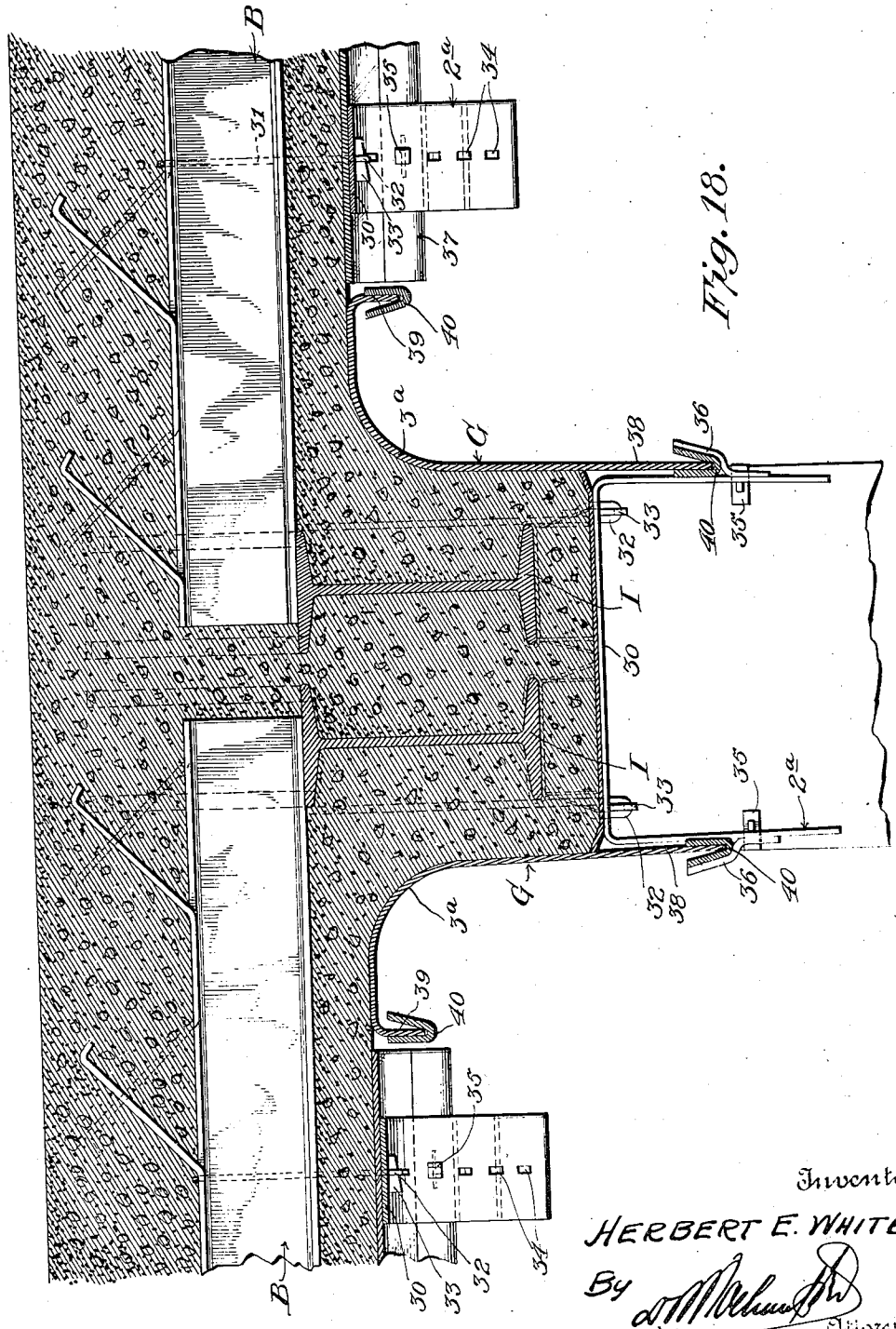


Fig. 18.

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July 10, 1923. 1,461,409

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STEEL FORM FOR CONCRETE CONSTRUCTION

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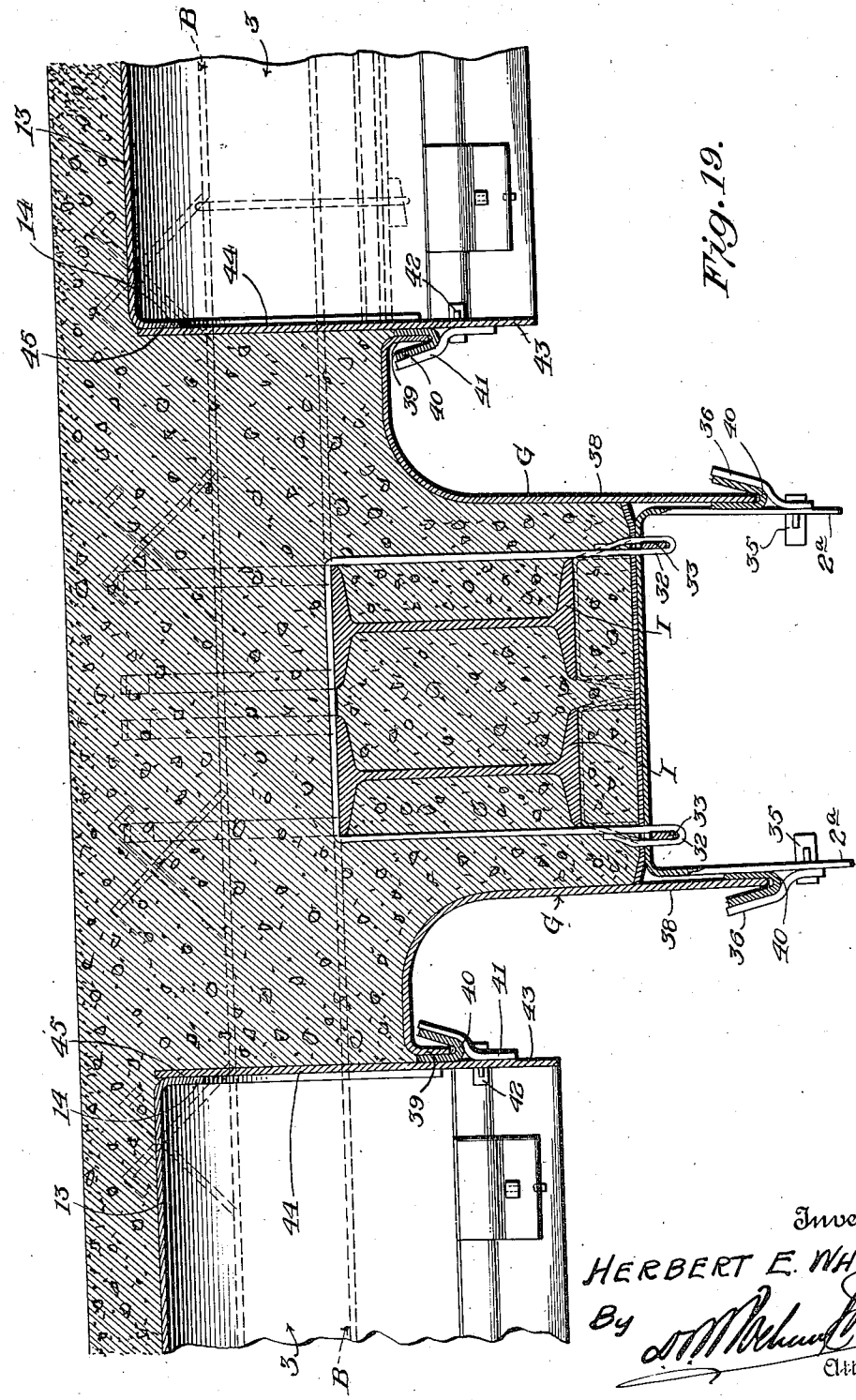


Fig. 19.

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Patented July 10, 1923. 1,461,409

UNITED STATES PATENT OFFICE.

HERBERT E. WHITE, OF YOUNGSTOWN, OHIO, ASSIGNOR TO TRUCSON STEEL COMPANY, OF YOUNGSTOWN, OHIO, A CORPORATION OF MICHIGAN.

STEEL FORM FOR CONCRETE CONSTRUCTION.

Application filed August 15, 1921. Serial No. 492,268.

To all whom it may concern:

Be it known that I, HERBERT E. WHITE, citizen of the United States, residing at Youngstown, in the county of Mahoning and State of Ohio, have invented certain new and useful Improvements in Steel Forms for Concrete Construction, of which the following is a specification.

This invention relates to the subject of concrete forms and has particular reference to a novel system of steel forms primarily intended to replace the wooden forms ordinarily used in concrete construction.

Wooden forms are extensively employed in concrete construction, but in building construction particularly are objectionable because of the expense incident to their use as they are only reusable to a limited extent, and because a wooden form is not elastic and cannot readily be made so to adapt it to varying conditions and varying adjustments with which the builder is confronted in following out his specifications for the work in hand.

Taking the above factors into consideration the present invention provides steel forms of a permanent character and having the necessary requirements of ready and easy application and convenient and facile removal, at the same time having such adjustable features as to render the forms applicable to all kinds and conditions of concrete steel construction, particularly in connection with beams and girders.

A further object of the invention, and one of practical value, is to provide a steel concrete form having an extensible and contractible characteristic, thereby making the form adjustable or variable in size to a very large extent, thus permitting the use of steel plates or units in the making of the form of convenient sizes and weights while at the same time enabling the constructor to use the form in shaping the concrete throughout any practical length, between beams. Furthermore, the improved construction form provides for ample elasticity in the form with respect to dimensions lengthwise of the metal beams as well as at right angles to the metal beams, and furthermore having sufficient vertical adjustment to adapt the forms for different depths of beams and different thicknesses of concrete.

With these and other objects in view which will be apparent to those familiar with concrete construction and the method of erecting same, the invention consists in the novel construction, combination and arrangement of parts hereinafter more fully described, illustrated and claimed.

The improvements are necessarily susceptible of embodiment in various forms of construction without departing from the spirit or sacrificing any of the advantages of the invention, but certain preferred and practical embodiments are illustrated in the accompanying drawings in which,

Figure 1 is a sectional view showing a preferred form of the invention in its application to beams of the composite type wherein steel and concrete are consolidated,

Figure 2 is a detail perspective view of one of the arched plate units of the adjustable bridge form which spans and covers the space between opposite beams,

Figure 3 is an enlarged longitudinal sectional view taken on the line 3—3 of Figure 1 illustrating more plainly the extensible and contractible characteristic of the adjustable bridge form which is placed between opposite beams and runs lengthwise thereof,

Figure 4 is an enlarged detail view of the primary and preferred form of the invention shown in Figure 1 illustrating more plainly the manner of supporting and assembling different parts of the form,

Figure 5 is a view similar to Figure 4 of the same form of the invention showing the base plate assemblage spaced from the bottom of the steel I-beam to admit fireproofing concrete thereunder,

Figure 6 is a sectional view of a modification showing employment of a vertically adjustable holding stirrup on the depending hanger member of the assemblage,

Figure 7 is a detail perspective of the hanger member shown in Figure 6,

Figure 8 is a detail perspective of a channel piece forming the holding stirrup of the form shown in Figure 6,

Figure 9 is a detail perspective of the supporting clip for the stirrup of Figure 8,

Figure 10 is a detail view of the clip fastening shown in Figure 6,

Figure 11 is a view of the same character as Figure 4 but illustrating a different way of mounting the base plate and the hanger members,

Figure 12 is a perspective view of the base

plates shown in Figure 11 with a number of hangers carried thereby,

Figure 13 is a detail cross-sectional view showing the method of uniting the base plate and hangers of Figure 12 by spot welding,

Figure 14 is a detail view of the supporting clip employed with the assemblage shown in Figure 11,

Figure 15 is a detail perspective of the form supporting device for fastening and supporting the form of construction shown in Figure 11 to the I-beam structure,

Figure 16 is a view of the same character as Figure 11 illustrating a further modification of the hanger suspended from the base plate,

Figure 17 is a detail perspective view showing one of the hangers of the form shown in Figure 16 and the adjustable mounted wedge associated therewith,

Figure 18 is a sectional view showing the system of improved steel forms applied to a concrete girder reinforced with I-beams, the line of section being taken at a beam,

Figure 19 is a view of the same construction as that shown in Figure 18, the line of section being taken midway between two beams.

Like references designate corresponding parts in the several figures of the drawings.

The present invention possesses special utility in its application to concrete and steel building construction wherein I-beams constitute reinforcing and tension members for a composite beam of metal and concrete, also being adaptable to structural work including a concrete girder reinforced with I-beams. However, in all of its application certain primary features are present. Referring to these primary features attention is first drawn to the group of Figures 1, 2, 3 and 4 of the drawings. It will clearly be seen from the general view of Figure 1 that the invention includes as its principal parts a base plate 1 adapted to be supported from and by the steel I-beam I of the structural work, hanger member 2 suspended from the said base plate and an adjustable bridge form 3 supported by the hanger member 2 and bridging and covering the space between opposite I-beams. These three principal elements are characteristic in all embodiments of the invention but, as will be pointed out, may be assembled in slightly different ways according to the special requirements of any particular work.

Referring more in detail to the principal parts of the invention referred to and the manner of assembling them, a preferred construction of the invention will first be described. That preferred construction is shown in the group of figures referred to and as plainly shown in Figure 4, the base plate 1 is a continuous steel plate, that is to say, it is made up in lengths several feet long and run the entire length of the beam to be concreted and are placed end to end. This base plate is preferably formed with upturned guard flanges 4 at its edges thus giving the plate the form of a concrete pan serving to hold the concrete C which fills about the steel beam. The said plate 1 is therefore the base unit of the form since it constitutes the pan for holding concrete at the bottom of the steel beam or below the bottom of the steel beam and being supported from and by the said beam is the main support or base for the hangers which in turn support the adjustable bridge forms.

In carrying forward the invention, it will be apparent that base plate 1 may be held flatly against the bottom of the I-beam or may be held spaced below the same by means of spacing elements 5, as shown in Figure 5, where it is desired to place fireproofing concrete under the beam. However, in both of these forms of the invention, shown particularly in Figures 4 and 5 of the drawings, all other features of the invention are the same and it will now be seen that base plate 1 is simply held in its operative position by means of a suitable form supporting member designated by the reference number 6. This form supporting member in the embodiment referred to, may consist of an inverted yoke placed astride of the beam I and provided at the lower ends of its legs 7 with key loops 8 extending through openings 9 in the base plate 1 and receiving the wedge locking keys 10 which engage beneath the base plate 1 and serve to hold it in a position firmly supported by both legs of the yoke.

The flanged lateral edges of the base plate 1 serve as supports from which are suspended the hanger members 2. Each of these hanger members consists of a continuous plate provided at its upper edge with an inturned depending holding flange 11 having an engagement upon the top edge portion of the base plate 1 and inside of the adjacent guard flange 4 thereof thus providing an arrangement which provides for suspending the hanger in such a manner as to permit it to have a sufficient adjustment in and out on the edge of the plate under the beams to allow for slight curvature in the beams and slight error in placing them, which adjustment is desirable to meet those conditions.

The plate constituting each hanger member 2 is provided at its lower edge with an outturned upstanding supporting stirrup 12, the pocket of which receives an edge of the adjustable bridge form 3. It will of course be understood that hanger members 2 are adjustably suspended from both edge portions of the base plate 1 so as to receive and support the adjustable bridge forms upon opposite sides of the beam and it will also be

understood, as clearly shown in Figure 1 of the drawings, that the adjustable bridge form 3 spans and covers the space between opposite I-beams to provide for giving support and form to the span of concrete between the opposite beams.

The adjustable bridge form 3 is one of the distinctive and important features of the present invention. It has the desirable attribute of being extensible and contractible so as to be adjustable lengthwise of the structure between the beams and that function is obtained by making the said bridge form of a sectional construction. That is to say, the bridge form 3 comprises a number of telescopically overlapping arched plate units 13 (see Figure 2), bridging the interval between the base plates 1 carried by opposite beams, and each of which units consists of a sheet metal plate having the necessary arching to shape the concrete structure between the beams and provided at one edge with an outturned stiffening flange 14 and at the ends with depending legs 15. The unflanged edges of each arched plate unit 13 overlaps the flanged edge of an adjacent plate 13, as clearly shown in Figure 3 of the drawings, thus providing an arrangement whereby all of the plate units have a sliding telescopic fit. According to the amount of overlap between the several plate units 13, the length of the bridge form may be adjusted or varied to adapt the same to the length of the beams between which the form is arranged. The opposite depending legs 15 of the various units of the bridge form 3 are received in and supported by the stirrups 12 of the hanger members 2, as previously referred to.

In assembling the construction, the steel beams of the structure are first placed in position and then the base plate 1 and the hangers 2 are positioned as described, after which the adjustable arched bridge forms 3 are dropped into the supporting stirrups 12 of the hangers. The reinforcing for the structure is now placed and the concrete put in position and after the concrete is set sufficiently the wedge locking keys 10 are knocked out, the base plates 1 and hangers 2 removed, after which the bridge forms are readily taken off. The parts of the form may then be reused in like manner as long as the same remain unbroken and retain their shape.

In connection with the hangers 2 for the bridge forms 3, it will be noted that the inturned depending holding flanges 11 at the front edges thereof not only provide for the lateral adjustment referred to, in conjunction with the portions of the base plate 1 inside of the flanges 4, but also constitute a part of the form to form a chamfer on the lower edges of the concrete portion of the beam, and it should also be noted at this point that the hanger members 2 are made in different depths to provide for different depths of beams, but for that feature definite provision may be made for adjustment on the hanger itself, as shown for instance in the modification of Figures 6–10 inclusive. According to that modification the depending skirt of each hanger member 2 may be provided at suitable intervals with a vertical series of adjustment holes 16 cooperating with a supporting clip 17 for holding a vertically adjustable supporting stirrup 18 at the desired elevation, according to the depth of girder being formed. In this modification the supporting stirrup 18 is a separate part bent into the form of a channel piece which constitutes the stirrup 18 and it is held against the outer side of the skirt of the hanger 2 by means of a series of the supporting clips 17 which are adjustably secured to the hanger member by the clip fastenings consisting of holding pins 19 extending through selected ones of the holes 16 and held in place by wedge-locking keys 20 fastening through openings 21 in the shanks of the pins 19 and engaging at one side of the skirt of the hanger 2. It will be clear from the group of Figures 6 to 10 inclusive that a series of clips 17 may be supported at the desired elevation on the outer side of the hanger member and will provide means for holding in position a continuous channel piece constituting the stirrup 18 which receives the lower edges of the leg portions of the bridge form 3.

In order to show the range of modification that may be resorted to, reference is made to Figure 11 of the drawings. The construction shown in that figure of the drawings omits the form supporting yoke 6 of the previous figures of the drawings and substitutes therefor another type of supporting device, namely, a hanger clip 22 engaging over the base flange of the I-beam and having a depending shank 23 extending through openings in the edge portions of the base plate and the hanger member 24 and receiving wedge locking keys 25 disposed beneath the hanger member 24 and serving to hold the base plate and the said hanger member firmly fastened to the bottom flanges of the I-beam. In this construction there is also shown the feature of uniting the hanger member 24 directly to the base plate 1 by suitable fastening means such as by spot welding 26 (see Figure 13). Said hanger member has depending leg portions 2^a provided with a vertically arranged series of adjustment openings 27 to receive wedge-locked fastening pins 28 for adjustably supporting stirrup clips 29 forming pockets to receive the leg portions of the bridge forms. From the details shown in Figure 12 of the drawings, it will be seen that the hanger members 24 may be arranged at suitable in-

tervals apart on the base plate to provide for the adjustable support of the continuous stirrup clips 29.

A further modification is suggested in Figures 16 and 17 of the drawings wherein the base plate 1 may be associated with a series of inverted U-shaped hanger members 30, and the two supported in proper positions by a yoke 31 placed astride the I-beam and having loop portions 32 extending through openings in both the base plate and the hanger member 30 and receiving the wedge-locking keys 33 disposed beneath the cross bar of the hanger member 30. The said modification of Figures 16 and 17 also includes the feature of the leg members 2^a of the hanger member being provided with a series of vertically disposed adjustment holes 34 receiving the wedge-locking fastening pins 35 which in turn hold in place supporting clips 36 for channel pieces 37 constituting the stirrups which receive the lower edge portions of the legs of the bridge form.

With reference to the forms of construction shown in Figures 11 and 16 of the drawings, it will be noted that the forms are set up in substantially the same way as already described and to take the same down after the concrete is set, it is only necessary first to remove the wedge-locking keys for the fastenings which hold the base plate to the I-beam and then disconnect the bridge form from the stirrups which support them from the hangers.

The application of the invention to a concrete girder reinforced with I-beams is shown in Figures 18 and 19 of the drawings. Referring thereto it will be seen that the base plate and hanger construction under the girder proper designated by G and also under the beams designated generally B is of exactly the same construction as that shown in Figure 16 of the drawings, and therefore similar reference numerals will apply thereto, but it will of course be understood that any of the other described forms of the invention, with respect to the base plate and the hangers, are also applicable to the girder construction shown in Figures 18 and 19. However, in order to provide for supporting the girder forms 3^a and to connect them with the forms for the main beams B, each girder form 3^a has a leg member 38 held in the supporting stirrup 37 of the hanger unit beneath the girder. The opposite edge portion of the girder form beyond the girder proper is provided with a depending holding flange 39 which engages in a supporting stirrup 40 held in position by a clip 41 secured by the wedge fastening 42 to the lower skirt portion 43 of a hanger plate 44, welded or otherwise rigidly fastened as at 45 to the flange 14 on one of the plate units 13 of the bridge form 3 for the main beam B. It will thus be seen how readily adaptable the improved system of forms may be made not only in connection with straight away beam construction, but also in structural work where the beam construction is interrupted by and consolidated with girders of any desired depth, and the depth of the beam and the depth of the girder is compensated for by the adjustable features of the forms herein pointed out.

From the foregoing it is thought that the essential features of construction and the advantages herein described of steel forms for concrete construction will now be understood without further description, and it will also be understood that various changes in form, proportion and minor details of the construction may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

I claim:

1. Forms for concrete construction including a base plate adapted to be arranged beneath the beam, a hanger suspended from the base plate and adapted to be shifted laterally and longitudinally thereon, and a form member supported from the hanger.

2. Forms for concrete construction including a base plate adapted to be arranged beneath the beam, a hanger suspended from the base plate, a stirrup adjustably locked with said hanger, and a form member supported in said stirrup.

3. Forms for concrete construction including a base plate adapted to be arranged beneath the beam and extending over the edges thereof, a hanger suspended from the extended base plate and adjustably engaging therewith a stirrup on the hanger, and an arched form supported in said stirrup.

4. Forms for concrete construction including a base plate adapted to be supported below the beam, a hanger member having adjustable suspension upon an edge portion of the base plate, and a form supported by said hanger.

5. Forms for concrete construction including a base plate adapted to be supported beneath the beam, a hanger member suspended from and laterally adjustable on an edge portion of the base plate, and a form supported by the hanger from a point beneath the base plate.

6. Forms for concrete construction including a base plate adapted to be supported beneath the beam and provided with a flanged edge portion, a hanger member having a holding flange adjustably engaging the flanged edge portion of the base plate, said hanger member being provided with a supporting stirrup, and a form supported in said stirrup.

7. Forms for concrete construction including a base plate adapted to be arranged beneath the beam and provided with a flanged

edge portion, a hanger member provided at its upper edge with a holding flange adjustably engaging an edge portion of the base plate and at its lower edge a supporting stirrup and a form detachably held in said stirrup.

8. Forms for concrete construction including a base plate, a fastening device engaging the base plate and the beam for supporting the base plate form and below the beam, a hanger supported by and depending from the base plate, said hanger carrying a channel supporting element and an arched form member supported in said element.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

HERBERT E. WHITE.

Witnesses:
C. L. MAXWELL,
R. T. TODD.