No. 824,594. PATENTED JUNE 26, 1906.

E. M. SCOFIELD.

CONCRETE STEEL CONSTRUCTION.

APPLICATION FILED AUG. 1, 1904.

4 SHEETS—SHEET 1.

Fig. 4.

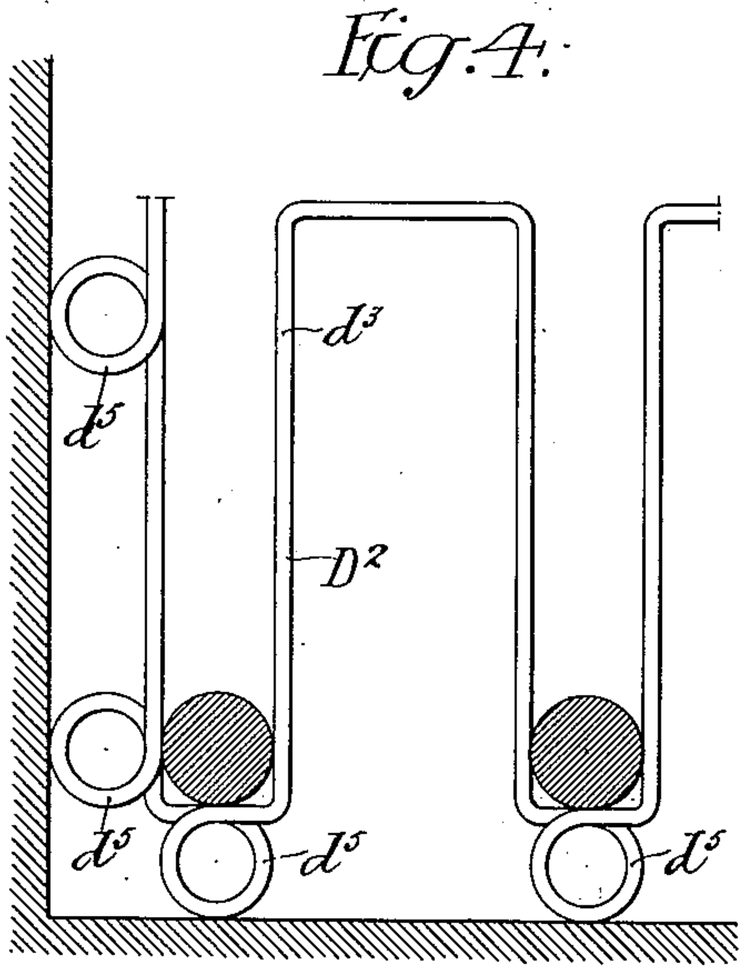


Fig. 2.

Fig. 5.

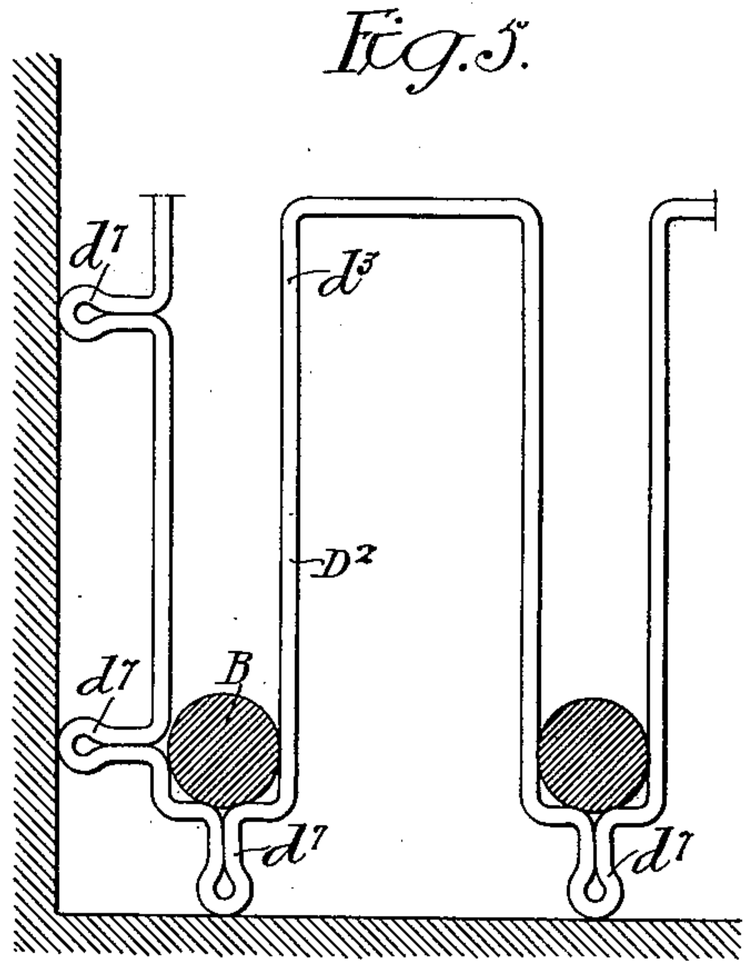


Fig. 3.

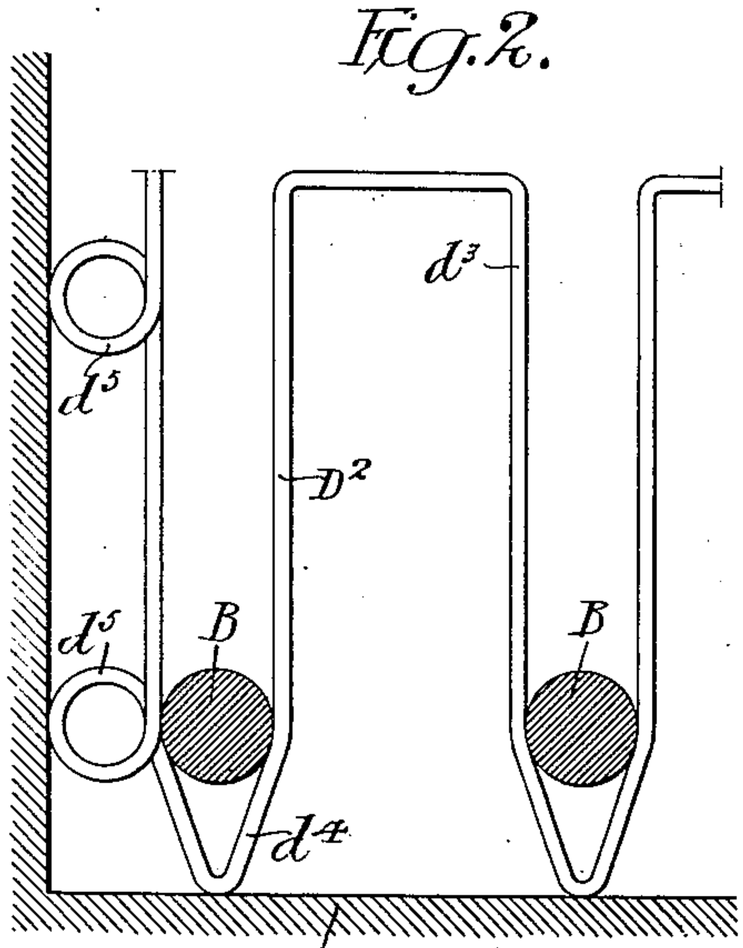
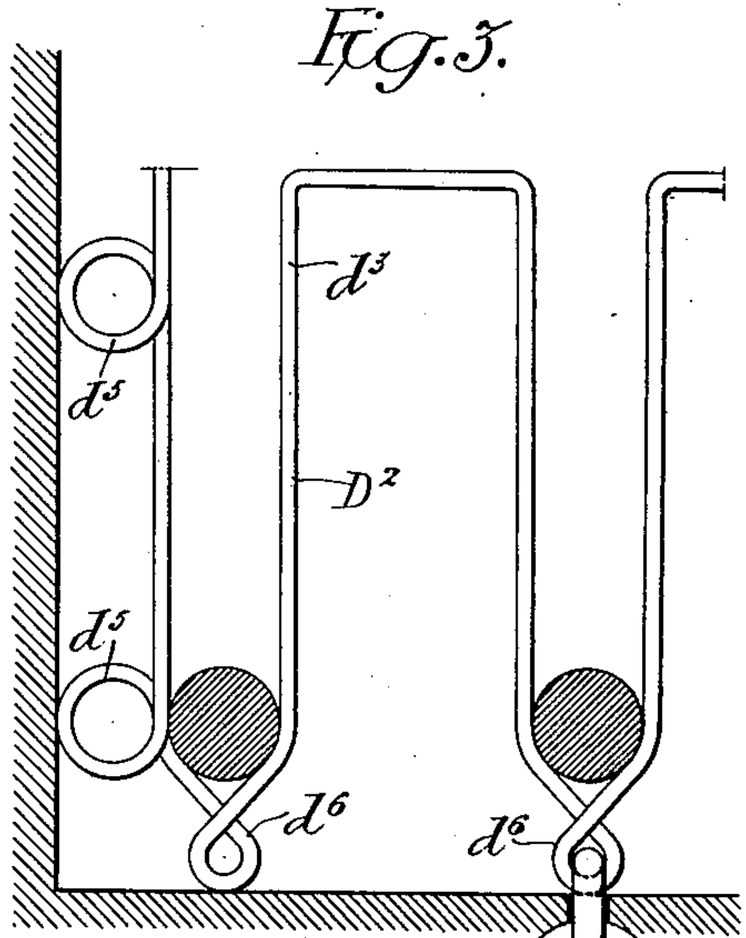
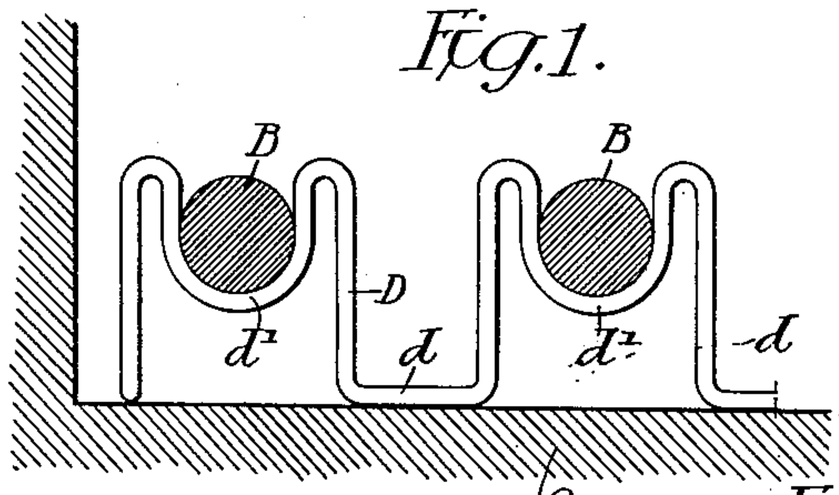


Fig. 1.





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Inventor:
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by his Attorneys,
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4 SHEETS—SHEET 2.

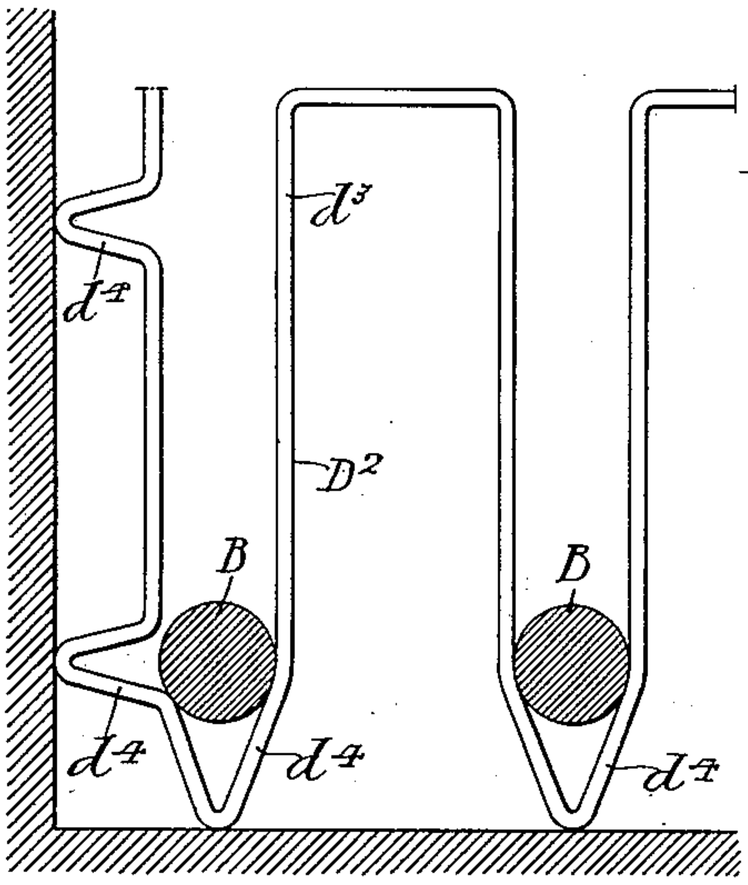


Fig. 6.

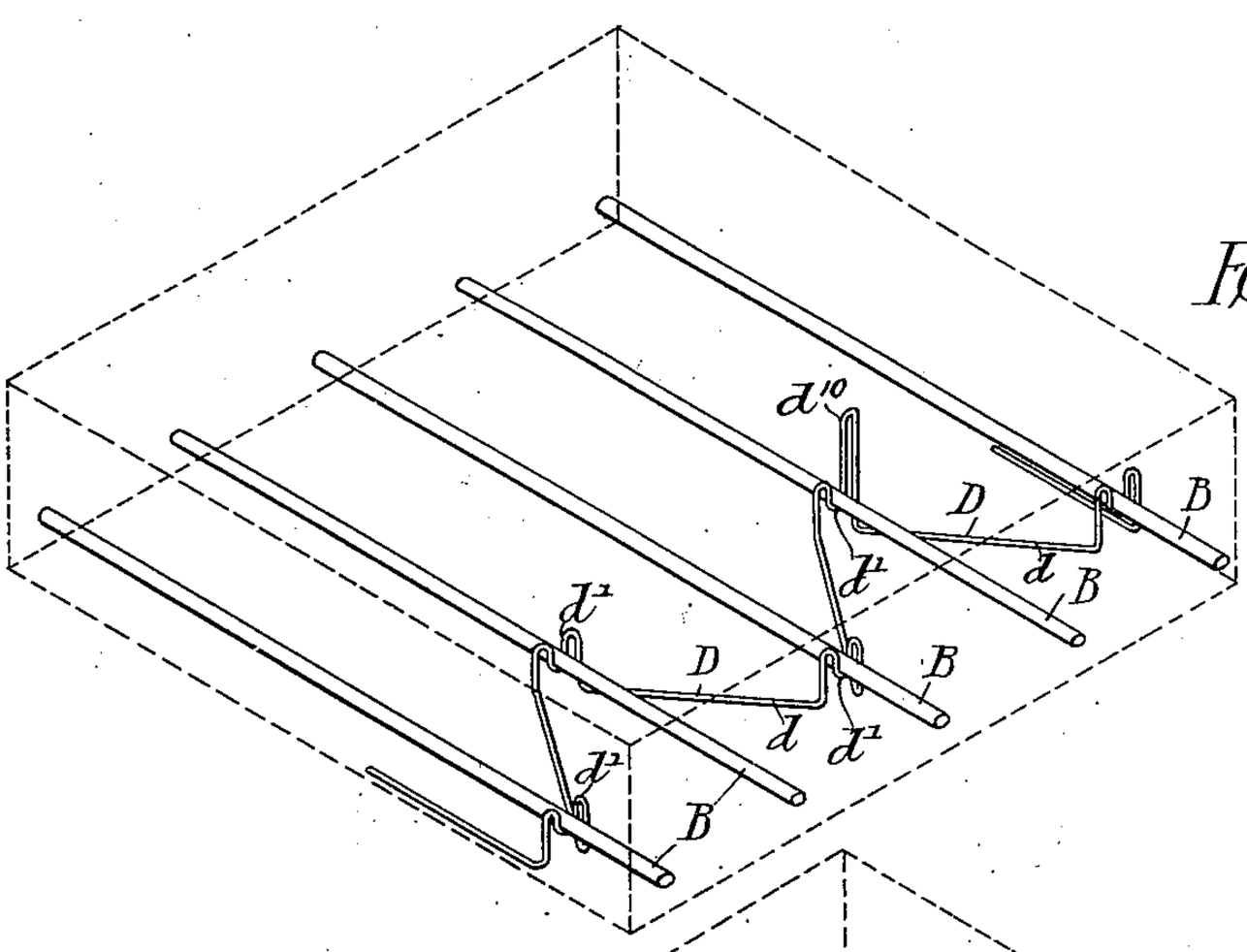
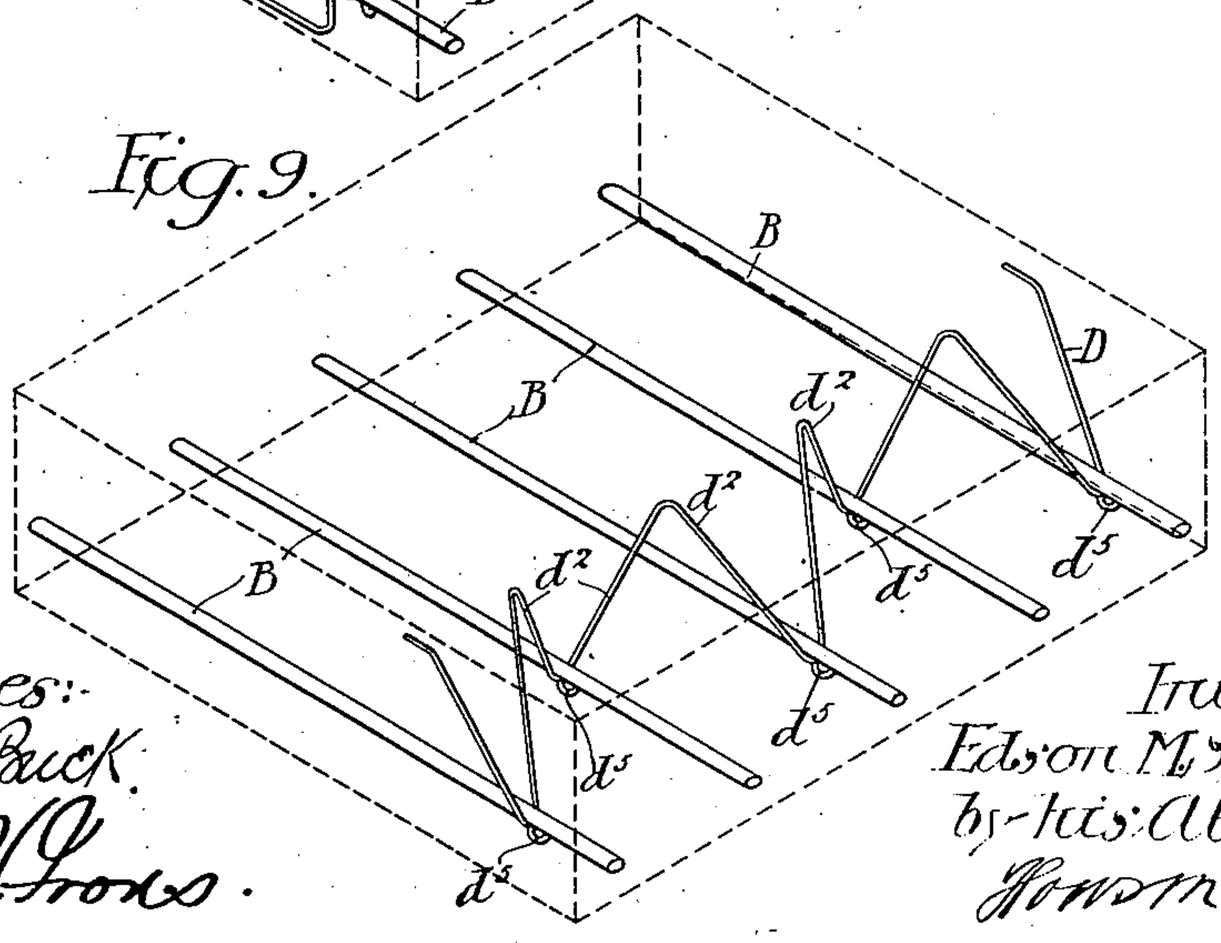


Fig. 8.

Fig. 9.



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No. 824,594. PATENTED JUNE 26, 1906.

E. M. SCOFIELD.

CONCRETE STEEL CONSTRUCTION.

APPLICATION FILED AUG. 1, 1904.

4 SHEETS—SHEET 3.

Fig. 7.

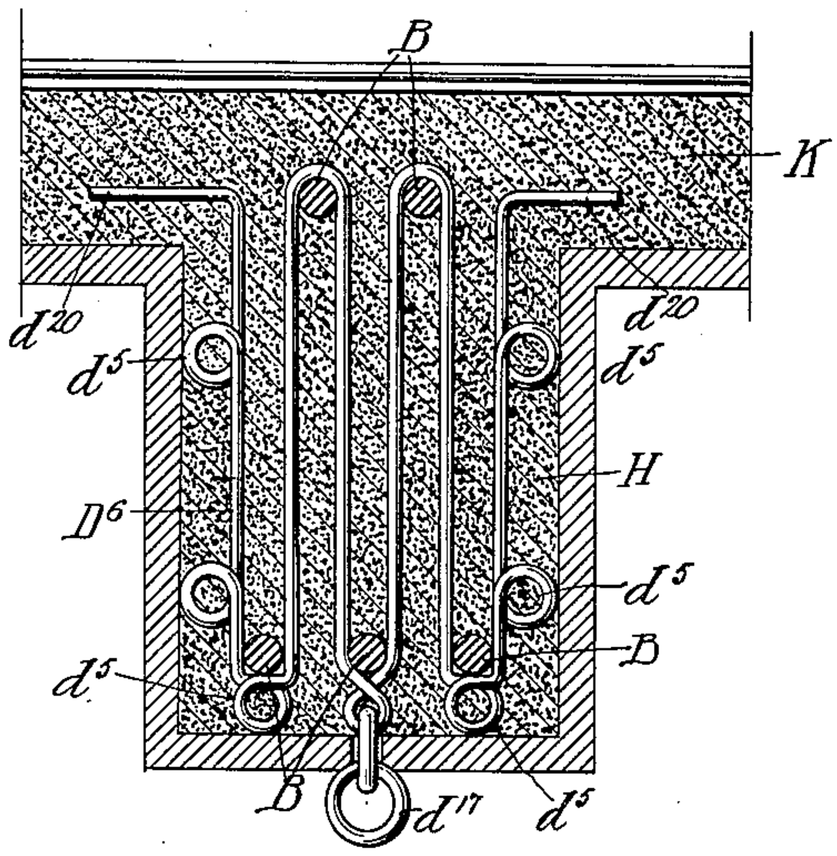
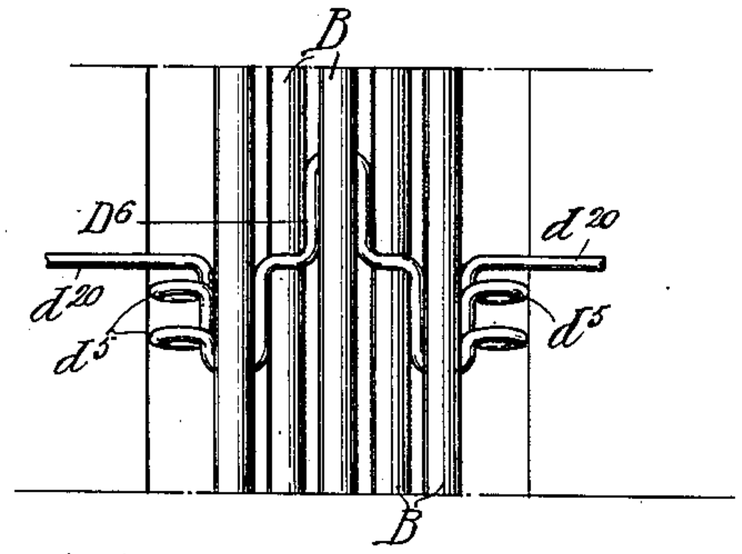


Fig. 18.



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by his Attorneys:
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No. 824,594. PATENTED JUNE 26, 1906.

E. M. SCOFIELD.

CONCRETE STEEL CONSTRUCTION.

APPLICATION FILED AUG. 1, 1904.

4 SHEETS—SHEET 4.

Fig. 10.

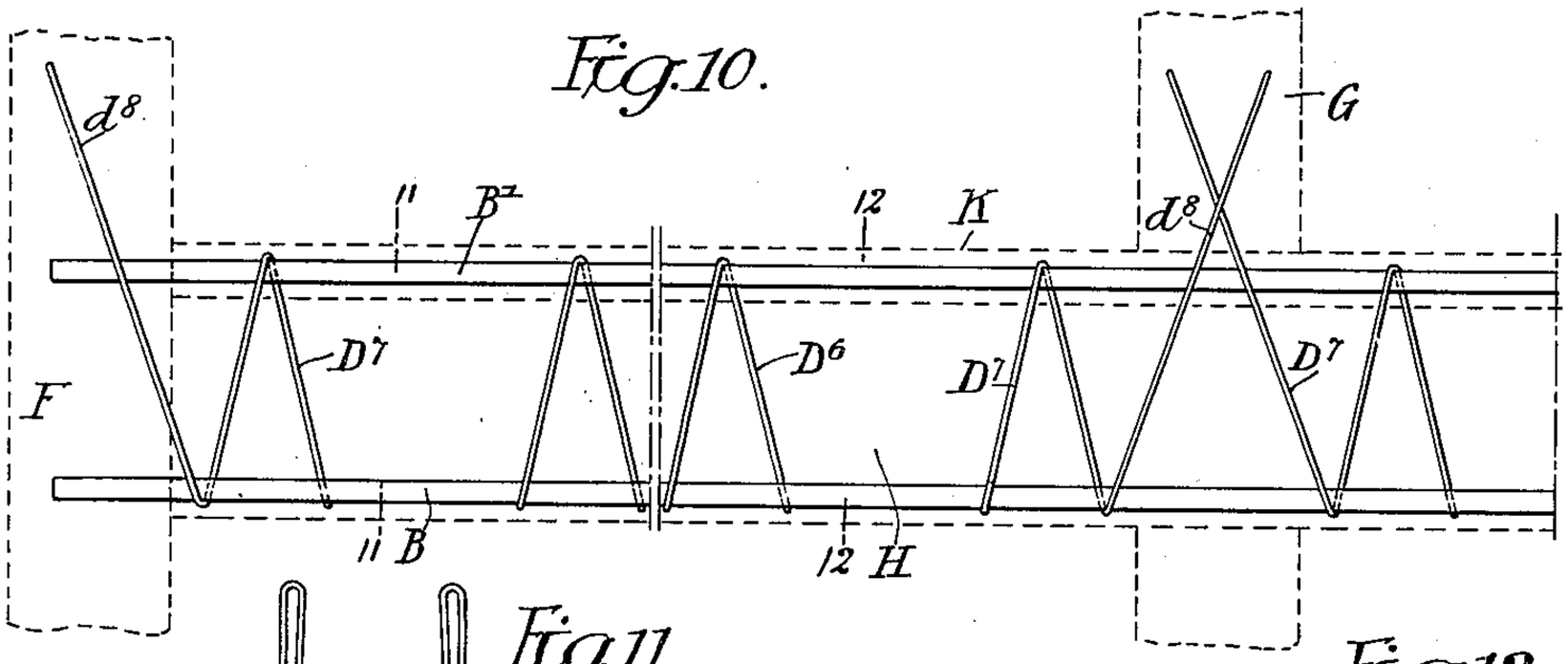


Fig. 11.

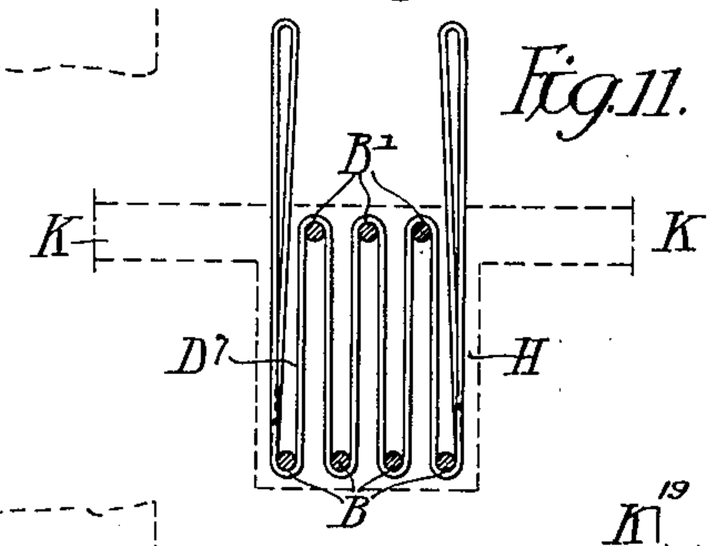


Fig. 12.

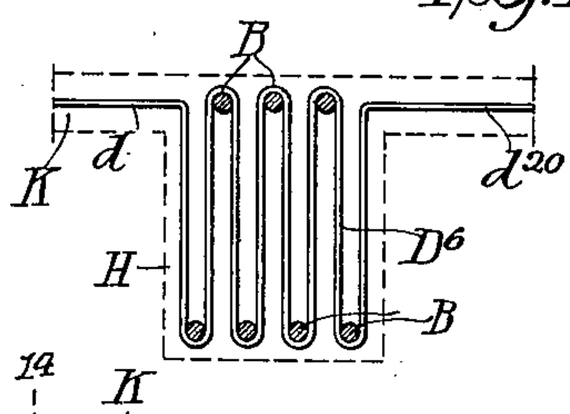


Fig. 13.

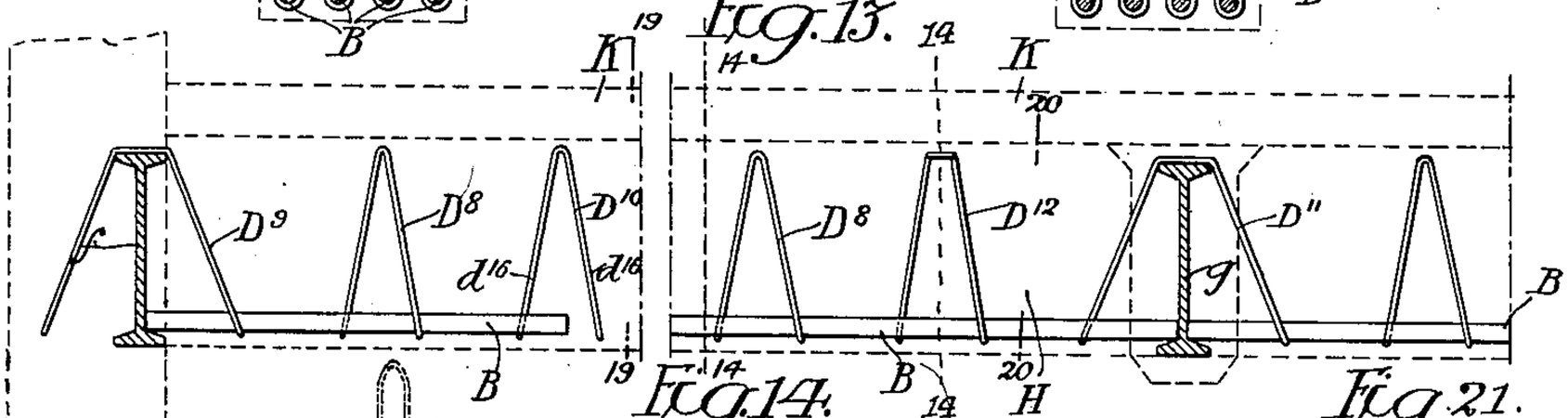
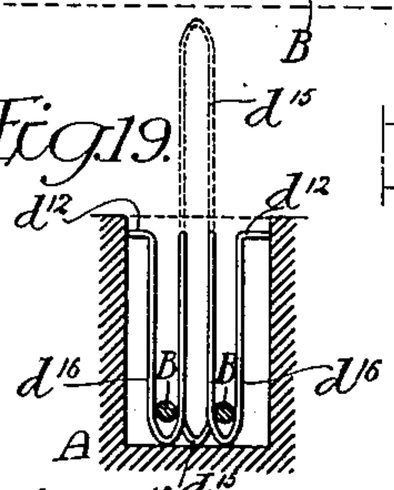


Fig. 14.

Fig. 21.

Fig. 19.



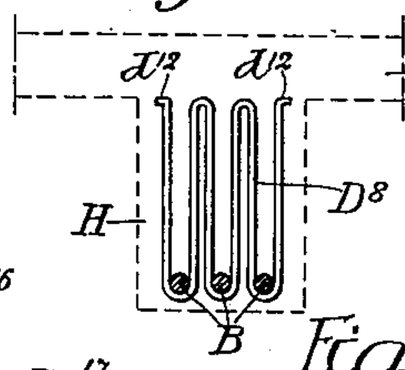


Fig. 20.

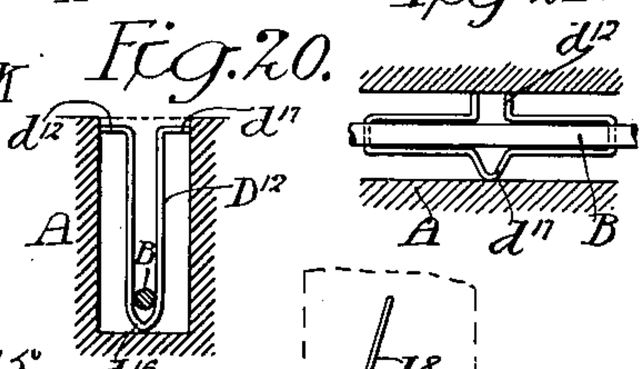


Fig. 15.

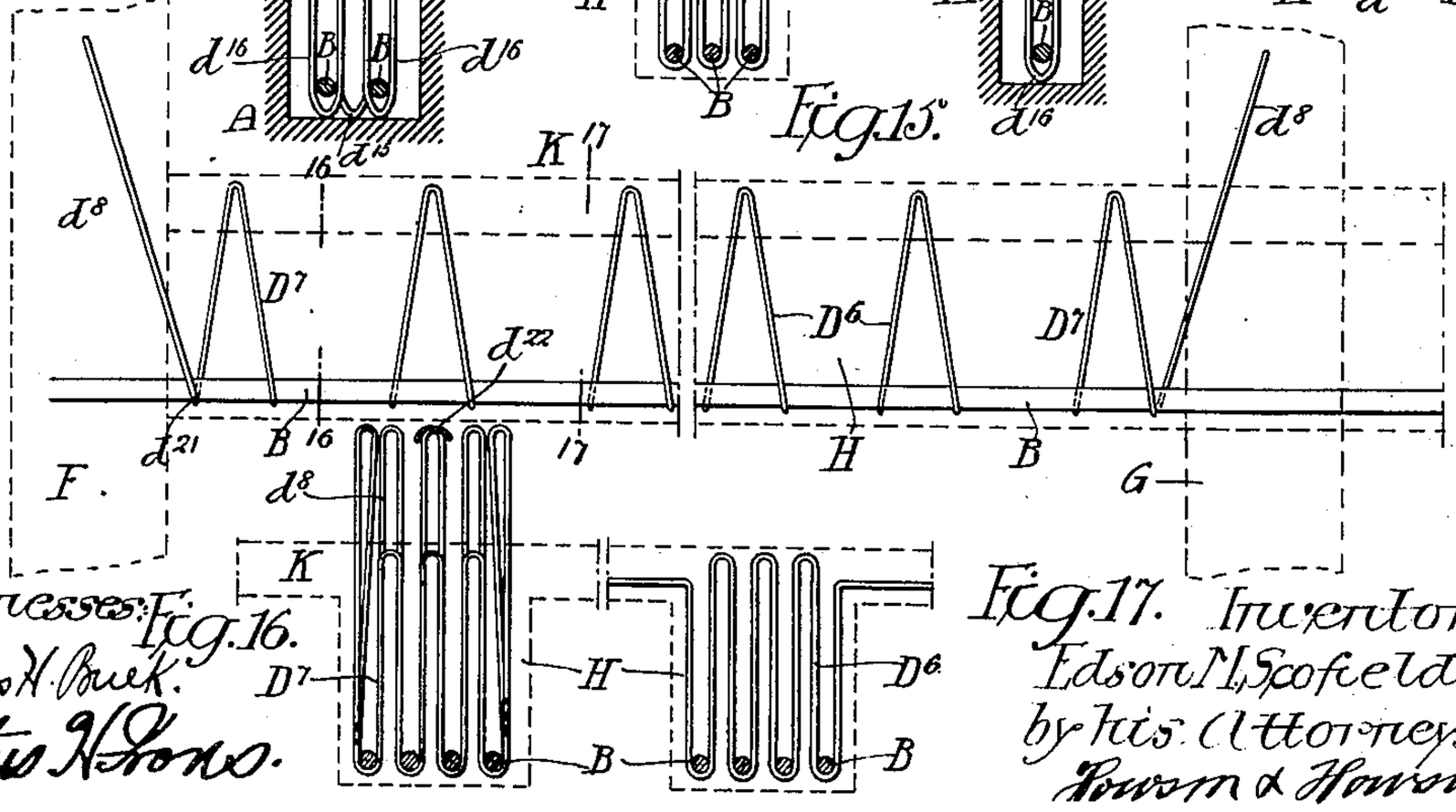


Fig. 16.

Fig. 17.

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Inventor:
Edson M. Scofield,
by his Attorneys,
Bowen & Howson

UNITED STATES PATENT OFFICE.

EDSON M. SCOFIELD, OF PHILADELPHIA, PENNSYLVANIA.

CONCRETE-STEEL CONSTRUCTION.

No. 824,594. Specification of Letters Patent. Patented June 26, 1906.

Application filed August 1, 1904. Serial No. 219,146.

To all whom it may concern:

Be it known that I, EDSON M. SCOFIELD, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Concrete-Steel Construction, of which the following is a specification.

One object of my invention is to provide means for supporting the bars used in reinforced concrete construction in such manner that they are held in any desired positions relatively to each other and to forms while the concrete is being placed and which shall be an element of strength instead of weakness in the completed structure.

Another object of the invention is to provide a spacing device which shall serve to tie the reinforcing-bars into the body of concrete in which they are placed to any extent that may be desired.

Another object of the invention is to provide a device for spacing the bars of a reinforced concrete construction, which device shall also serve to reinforce said construction against shear and as a necessary consequence tie the bars into the body of the concrete.

Another object of the invention is to provide a means for spacing the reinforcing-bars in concrete-steel construction which shall be self-supporting, as well as convenient to use and inexpensive to manufacture, and which shall be also available, if desired, for the support of hangers or other objects exterior to the concrete for the tieing of the reinforcing-bars into the body of the concrete to any extent desired and for the vertical reinforcing of the concrete against shear.

These objects I attain as hereinafter set forth, reference being had to the accompanying drawings, in which—

Figure 1 is a front elevation, partly in section, showing my invention in its simplest form as employed to space and support reinforcing-bars at proper distances from each other and from forms. Figs. 2, 3, 4, 5, and 6 are front elevations, partly in section, showing various forms of my invention designed to not only support reinforcing-bars at proper distances from each other and from forms, but also to tie said bars into the main body of the concrete, as well as to strengthen said concrete against shear. Fig. 7 is a vertical section of a concrete-steel construction embodying all the various features of my invention. Figs. 8 and 9 are perspective views illustrating my improved spacing device as made in self-supporting form, the former employing that form of the invention shown in Fig. 1 and the latter showing the device as constructed to provide vertical reinforcement for a body of concrete in which it is used. Fig. 10 is an elevation, to some extent diagrammatic, showing my invention as applied to tie together two series of reinforcing-bars, of which one series is embedded in a floor and the other is in a beam, said figure also illustrating the construction means by which the vertical reinforcing-rods are run into walls and columns. Figs. 11 and 12 are sectional elevations taken on the lines 11 11 and 12 12, respectively, of Fig. 10. Fig. 13 is a diagrammatic side elevation of a concrete-steel beam extending between two parallel steel beams, showing my invention as applied to vertically reinforce the beams independently of the floor and showing the connection of the spacer to the metal beams used. Fig. 14 is a sectional elevation taken on the line 14 14, Fig. 13. Fig. 15 is a side elevation similar to that shown in Fig. 10 with the upper series of reinforcing-bars omitted, and Figs. 16 and 17 are sectional elevations taken on lines 16 16 and 17 17, Fig. 15. Fig. 18 is a plan, further illustrating the construction shown in Fig. 7. Fig. 19 is a section on 19 19 of Fig. 13, showing a particular method of rendering the spacing-bars self-supporting which may be used with advantage when but two reinforcing-bars are employed. Fig. 20 is a section on the line 20 20 of Fig. 13, showing a particular method of making the spacing-bars self-supporting and which may be used with advantage when only one reinforcing-bar is used. Fig. 21 is a plan view of the spacing-bar shown in Fig. 20.

As will be understood by those skilled in in the art, the best results in reinforced concrete floors and girders are obtained when the tensile properties of the steel and the compressive properties only of the concrete are utilized to the fullest extent.

Under operating conditions great difficulty has hitherto been experienced in the construction of reinforced floors and girders in supporting the reinforcing-bars in correct positions while the concrete was being placed. The importance of such proper support will be understood when it is noted that to secure the best results the steel intended to take tensile stresses must be located as near the surface of the concrete as possible, while not in any way interfering with the hold of

the concrete upon said steel. This necessitates for floorwork that the bars shall be placed from one-half inch to one and one-fourth inches from the bottom of the floor, depending upon its thickness, and in girders from one inch to two and a half inches from the bottom of the girder, depending upon the depth thereof.

When the bars are placed in position in the forms in which the girders are to be cast, it is exceedingly difficult to hold said bars in their correct positions, for not only do they rest against the form so as to be exposed when this latter is taken away from the girder, but they are also apt to be moved sidewise, so as to become bunched to an extent which results in a weakening of the beam. There is also a possibility in some cases of their being placed too high up in the beam, in which case there is a very material reduction in its strength. In order to overcome this difficulty and to properly space the bars as well as to support them at any definite distance from the form, I provide wire or bars bent as illustrated in Fig. 1 and arranged to provide a self-supporting carrier and spacer for said reinforcing-bars.

In the above-mentioned drawings, A represents the wooden or other form for a girder or floor, D the longitudinally-extending reinforcing-bars, and D the spacing device, made, as above noted, of wire or equivalent structure which beds efficiently in the concrete without tending to form planes of cleavage. In this case said wire is formed by machinery into convenient lengths, and such formed spacers are afterward cut as desired to suit the work in which they are used. Said wire or bar is made with a series of loops d, designed to rest upon the surface above which it is desired that the reinforcing-bars shall be supported, said loops being in Fig. 1 of rectangular form. Intermediate of said supporting-loops are other loops d', formed to hold the bars B at the desired distance above the form A. In order that the wire or bar may be self-supporting, I offset alternate ones of the loops d' in the manner indicated in Fig. 8, each loop d' being therefore connected, as shown, to two loops adjacent to it by means of the loops d, whose bottom portions are inclined to the lines of the reinforcing-bars B. By extending upward those portions of the spacers D between adjacent reinforcing-bars, as illustrated at d^{10} in Fig. 8, said bars may be tied into the upper portions of the concrete body to any desired extent. When the spacer is formed as in Fig. 9, the loops d^5 are depended upon to support the reinforcing-bars B at a proper distance from the form, and the intermediate loops d^2 extend nearly to the top of the concrete, serving to reinforce the same vertically against shearing stresses. Alternate ones of the loops d^5 are extended to either side of the loops d^2, so as to make the spacer self-supporting. The end elevation of this spacer is shown at D^8, Fig. 13.

Other forms of my invention for the purpose of accurately spacing the reinforcing-bars relatively to each other, as well as to the bottom and sides of the concrete forms, are shown in Figs. 2 to 7, inclusive, and Fig. 18, in the first of which the spacing wire or bar D^2 is provided with upwardly-extending loops d^3, which alternate with the pointed loops d^4, having their sides inclined to retain the reinforcing-bars B at the desired distances above the bottom of the form A. A portion of said spacing-wire adjacent to the side of said concrete form is provided with any desired number of loops d^5, by which it and consequently the adjacent one of the bars B are held at a predetermined distance from said side.

In Fig. 3 the pointed loop d^4 of Fig. 2 is replaced by a twisted loop d^6, while in Fig. 5 both the bar-supporting loops, as well as the side-spacing loops, are formed simply by bending toward each other two inclined sides of the pointed loops, as shown in Fig. 2. These are designated by the reference-letters d^7. Fig. 6 illustrates the pointed-loop construction as employed both for supporting the reinforcing-bars and for side spacing, while Fig. 4 illustrates circular loops of the form shown at d^5 employed for the same purpose. In all of these cases the upwardly-extending loops d^3 are employed for the purpose of vertically reinforcing the concrete construction and also tying the reinforcing-bars into the same, it being of course understood that in each case alternate loops are displaced, as indicated in Figs. 8 and 9, for the purpose of making the bars or wire of which they form a part self-supporting.

In Figs. 10 to 17 I have shown a number of typical constructions employing spacing-bars in such manner that they also serve as vertical reinforcing members.

In Figs. 10 to 12, inclusive, F represents a wall, and G a column, between which extends a concrete-steel beam H, carrying a portion of a floor K. In this case there is in the beam a series of reinforcing-bars B and in the floor a second series of bars B,′ which are held in properly-spaced relation to each other and to the forms before the concrete is put in place and are tied to each other and into the beam after completion of the structure by means of the spacing-bars D^6 and D^7. In all the figures the loops in the spacing-bars for supporting the reinforcing-bars above the bottom of the beams have been omitted for the sake of clearness, though it will be understood that in every case said spacing-bars may be shaped in some such form as those illustrated in Figs. 1 to 9. While the spacing-bars D^6 are preferably similar to those shown in Fig. 9, the bars D^7

have their end portions d^8 extended at an angle from the beam into the column or wall, as the case may be, it being understood that, if desired, the said ends may be bent back and hooked on to the reinforcing-bars B or formed in any desired manner best suited to tie it into the structure. Both sets of the spacer-bars D^6 and D^7 extend between the reinforcing-bars in the floor K and those in the lower portion of the beam H, it being noted that the ends d^{20} of the bars D^6 may be extended horizontally into the floor or not, as preferred, and when so extended they offer additional reinforcement to make the floor act with the girder.

In Figs. 13 and 14 there are no reinforcing-bars in the floor, the spacer-bars D^8 merely extending from the reinforcing-bars B in the bottom of the beam to the top of said beam and having their ends turned horizontally, as shown at d^{12} in Fig. 14. In this case the concrete-steel girder H is supported upon the steel wall-beam *f* at one end and upon the steel floor-beam *g* at the other end, the spacing-bar D^9 being bent over the top of the beam *f*, as shown, and being self-supporting either by hanging on this beam or by resting on the beam and on the form. The wall end of said spacer D^9 may be extended any required distance into the wall, so as to properly tie the girder into the same. The spacer D^{11} is similar to spacer D^9, except that both of its ends support reinforcing-bars B. Fig. 14 shows a spacing-bar D^8 when three reinforcing-bars B are used, while Fig. 19 shows another method of forming the spacing-bar D^{10} when only two reinforcing-bars are used. In order that this construction may be self-supporting, I bend the central loop d^{15} (shown in dotted lines) down until its extreme end rests upon the form, as in Fig. 19.

Fig. 20 illustrates a method of forming the spacer when only one reinforcing-bar is used, the two ends of the wire being bent horizontally, as at d^{12}, to engage the form on one side and a loop (shown in dotted lines at d^{17}) being bent horizontally to engage the form on the other side, thus making the spacer self-supporting when in place in the form. Fig. 21 is a plan view of the spacer shown in Fig. 20.

In Figs. 15 to 17, inclusive, the construction is similar to that shown in Fig. 10, except that there are no reinforcing-bars in the floor.

Fig. 16 shows the column-connection loops d^8, contained back around the reinforcing-bars B, as at d^{21}, and ending in the column at d^{22}, thereby reinforcing the girder against shear at its point of junction with the column or wall. In a similar manner vertical reinforcement of a beam may be increased as desired at any point by increasing the number of convolutions in the vertical reinforcing-spacers, or the same object may be accomplished by placing said spacers nearer together or by increasing the size of the material used.

I prefer to have the vertical reinforcing-spacers placed at a distance apart equal to the depth of the girder or floor. The action of these vertical reinforcing-spacers is to divide the floor or girder after the manner of a Howe truss, in which the reinforcing-bars B take tension along the bottom of the truss, the vertical reinforcing-spacers D take the tension in a vertical direction, while the concrete takes the diagonal compression between the spacers and along the top of the beam, as will be understood by those skilled in the art.

It will be noted that, if desired, the spacing wire or bar may have loops or forms different from those illustrated without in any way departing from the spirit of my invention, which is designed to cover, broadly, the use of a spacing-bar which shall maintain the reinforcing-bars in concrete-steel construction at predetermined distances from each other and from the forms for the concrete, which bar shall be preferably self-supporting and, if desired, extended above the reinforcing-bars, so as to vertically reinforce the concrete structure with which it is used.

As shown in Figs. 3 and, 7 a hanger d^{17} for fixtures or any other purpose may be hung from the spacing-bars, there being a suitable hole cut in the concrete form for the passage of said hanger during the placing of the concrete.

I have illustrated in Figs. 7 and 18 a construction which embodies all of the various features of my invention, it being noted that certain of these features were omitted from some of the figures previously referred to for the sake of clearness.

Having thus described my invention, I claim and desire to secure by Letters Patent—

1. A spacer consisting of a piece of bar material bent into a series of loops constituting supporting-legs lying adjacent to a single plane and also being of a form to constitute bar-seats, the latter being spaced to support reinforcing-bars at predetermined distances from each other, said loops being laterally displaced to one or the other side of said plane so as to lie at an angle to each other and cause the spacer as a whole to be supported in an upright position, substantially as described.

2. As a new article of manufacture a spacer consisting of a piece of bar material having bar-seats at predetermined distances from each other and bent into such form as to constitute a series of downwardly-extending supporting-legs, of which certain are bent into a loop or loops and constitute side-spacing means, substantially as described.

3. As a new article of manufacture, a spacer consisting of a piece of bar material bent as a whole into such form as to constitute a series

of supporting-legs having bar-seats placed at definite distances apart for holding reinforcing-bars at predetermined distances from each other and above a form, alternate ones of said supporting-legs being displaced laterally into different planes to engage a supporting-surface at points in different lines so as to maintain the spacer in an upright position, substantially as described.

4. As a new article of manufacture, a spacer consisting of a piece of bar material bent to form a series of supporting-legs and provided with portions bent so as to receive and hold reinforcing-bars at predetermined distances above a form, there being portions of the bars extended in elongated loops beyond the legs, substantially a described.

5. The combination of a concrete beam, a concrete floor, two series of reinforcing-bars, of which one is in the beam, with a series of substantially vertical spacing-bars placed to also serve as reinforcing-bars and extending into the concrete between said two series of reinforcing-bars, the end portions of said spacing-bars being extended into the floor, and other portions of the bars being bent as a whole to form supporting-leg portions, substantially as described.

6. The combination of a concrete beam, a concrete structure extending at right angles thereto, a reinforcing bar or bars extending longitudinally through the beam, and a vertical spacing bar or bars placed to act as a reinforcing bar or bars in engagement with said first reinforcing bar or bars, said spacing bar or bars having an end portion or portions extended into the concrete structure at right angles to the beam, and other portions bent as a whole to form supporting-leg portions, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EDSON M. SCOFIELD.

Witnesses:
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J. C. MCALPINE.