

R. B. HARTMAN.
 REINFORCEMENT SYSTEM FOR CONCRETE BEAMS.
 APPLICATION FILED APR. 23, 1907.

1,240,137.

Patented Sept. 11, 1917.

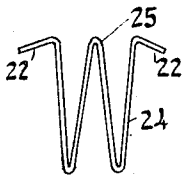


Fig. 1

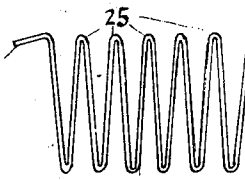


Fig. 2

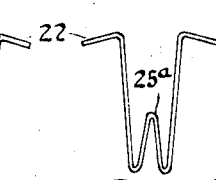


Fig. 3

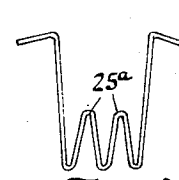


Fig. 4

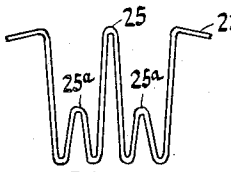


Fig. 5

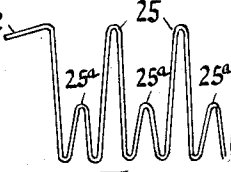


Fig. 6

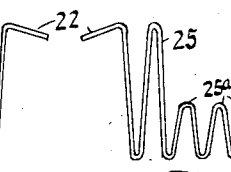


Fig. 7

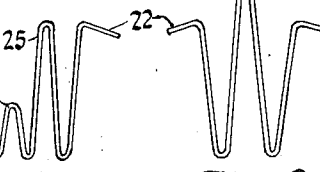


Fig. 8

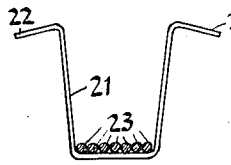


Fig. 9

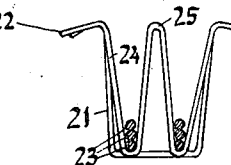


Fig. 10

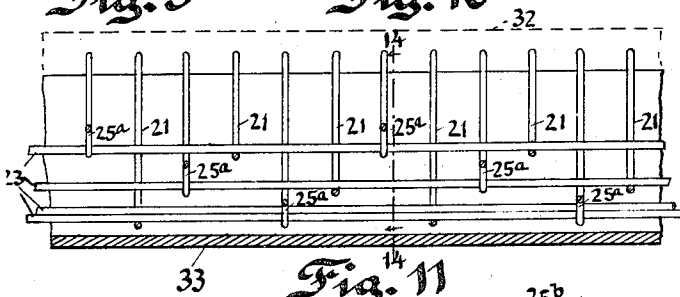


Fig. 11

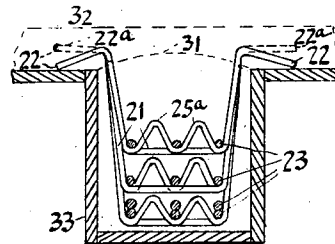


Fig. 12

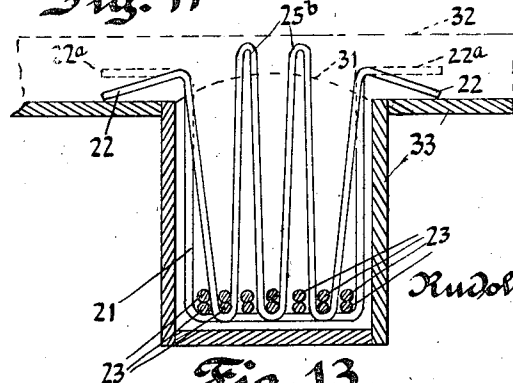


Fig. 13

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REINFORCEMENT SYSTEM FOR CONCRETE BEAMS.

1,240,137.

Specification of Letters Patent.

Patented Sept. 11, 1917.

Original application filed November 18, 1905, Serial No. 288,068. Divided and this application filed April 23, 1907. Serial No. 369,765.

To all whom it may concern:

Be it known that I, RUDOLPH B. HARTMAN, of Milwaukee, Wisconsin, have invented an Improved Reinforcement System for Concrete Beams, of which the following is a specification.

My invention relates to structural concrete work, and has to do more particularly with that which is known as armored or reinforced concrete, in which metal and concrete are united together to form beams, slabs, and other structural forms.

The present application is a division of my United States Patent application No. 288,068, filed Nov. 18, 1905.

In my present invention I aim to provide an improved system and disposition of the reinforcing-rods in beams and similar structures which bear the weights or loads transversely.

One feature of my improved construction lies in my novel form of stirrups for supporting the reinforcing longitudinal rods; a second, in the frame-work of reinforcement for the beams or slabs.

By the use of my improved construction I am enabled to dispose the reinforcing-element to greater advantage than in former constructions, whereby the whole shall be accurately determined by the proportions of concrete and metal, and the same mass of concrete and metal may be made to sustain a considerably greater load than it otherwise could do.

My invention consists of the constructions and combinations which will be hereinafter explained in connection with the accompanying drawings, wherein—

Figures 1 to 10, inclusive illustrate various forms of supporting-stirrups for longitudinal reinforcement of beams.

Figs. 11 and 12 show one disposition of a reinforcement frame-work in connection with the form in which the beam is molded.

Fig. 13 shows another disposition of framework for a concrete beam.

In these drawings every reference letter and numeral refers always to the same part.

In my system of beam reinforcement I provide the usual series of longitudinal reinforcing-rods, and a series of transverse reinforcements in the form of stirrups, which act simultaneously as supports for the longitudinals and as means for holding the beams together transversely and also in

some cases vertically. The simplest form of these stirrups is shown in Fig. 9, the stirrup being designated 21 and being formed of a rod bent into U-shape as shown and having on its ends outwardly and downwardly bent legs or prolongations 22. In Fig. 9 the longitudinal reinforcing-rods 23 are shown as laid along the bottom, in juxtaposition to one another although this is not usually the most advantageous manner of disposition, owing to the fact that it divides the concrete above said rods from that below it.

A more developed form of my stirrups, designated 24, is shown in Fig. 1, this form having the intermediate or bottom portion of the stirrups bent upwardly as at 25, so that the stirrups take the form of the letter W. In the case of wide beams the central upward bend may be repeated two or more times as shown in Fig. 2. The intermediate bend or bends need not extend to the top of the beams, but may be of shorter or longer form as shown at 25^a in Figs. 3 and 4, and at 25^b in Fig. 8; or again the forms of Figs. 3, 4, and 8 may be combined in various ways as shown in Figs. 5, 6, and 7, or 25^b may take the place of one or more 25's in Figs. 5, 6, and 7.

The intermediate bends 25^a and 25^b are not merely vertical transverse ties between the top and bottom of the beam against disruption vertically, but also reinforce it against longitudinal and lateral horizontal shear. In addition to this function of reinforcement they also provide means for properly spacing the longitudinals 23. A simple disposition of reinforcing-frame composed of stirrups and longitudinals is shown in Fig. 10. The forms of Figs. 1 and 9 of stirrups are here disposed alternately at regular intervals in the beam form and the longitudinal rods are simply thrown in and assume the positions shown. This offers the great advantage that no measurements or careful inspection are necessary, and that skilled labor may be dispensed with, as, the proper shaped stirrups being provided, it becomes almost a matter of necessity that the longitudinal reinforcing-rods should be disposed in their proper positions and properly separated from each other, allowing concrete material between each pair of rods or pair of sets of rods.

The arrangement of Fig. 11 is more particularly adaptable to beams on the ends

of floors and the like, as the stirrups of Figs. 1 to 10 can not be properly placed. The stirrup 26 is in this instance bent in U-shaped form without the prolongation 22, but one end has an eye 27 formed thereon and beyond this a horizontal prolongation 28. A longitudinal rod is placed through the eyes 27 of a series of such stirrups thus holding them upright in position; while the horizontal prolongation 28 serves as means for tying the beam to the floor-slab, the top of which is indicated at 29 in dotted lines, the relative position and shape of the form being also shown in dotted lines at 30. This form of stirrup may also have an intermediate bend 25 as shown in the form of 26^a of Fig. 12. In Figs. 11 and 12 the straight vertical ends marked 26 in Fig. 11 might also have the hooks of previous Figs. 1 to 10, inclusive added.

A complex beam-structure formed of a combination of my improved stirrups with longitudinal beams is shown in Figs. 11 and 12, these figures representing the skeleton structure of the beam in place in the form and the beam itself and floor-slabs being indicated in dotted lines. This is a more complex structure than would ordinarily be used, but is illustrated merely to show the variety and complexity of the forms to which my improved structure is adaptable. The form of stirrups of Fig. 4 is here used in combination with that of Fig. 9, each being in three sizes and alternately disposed, thus giving places for 9 sets of longitudinal rods each of which may consist of one or more rods.

Fig. 13 shows another dispositive of beam-structure employing the stirrup of Fig. 9 in conjunction with that of Fig. 8, or rather a form similar to Fig. 8 but having two intermediate bends 25^b which extend above the level of the top of the beam. The purpose of these extra-long intermediate bends is here illustrated. The top of the beam, that is, the surface to which the concrete is first filled up is shown by the curved line 31, and it will be observed that the ends of the intermediate bends extend well above this level, and thus serve as a binding means between the beam and the floor-slab which is filled in afterward, and the upper surface of which is designated by the dotted line 32. The beam-and-floor-form is designated by the numeral 33.

The legs or extensions 22 on my stirrups perform two independent and important functions. When first formed the stirrups have their legs 22 bent slightly downward so that their ends rest upon the top of the form 33 and the sides of the beam as shown, thus serving as temporary supports for the stirrups, and as the line of support is above the center of gravity the stirrup will hold itself in place vertically without any fur-

ther support, and there will be no protrusion of reinforcing material through the bottom of the beam. It is thus rendered absolutely certain that the reinforcing material shall be in its proper place. After the beam-form is filled up with concrete, to the level 31, and the latter has sufficiently hardened, the legs or extensions 22 are bent upwardly into the dotted-line position 22^a of Figs. 12 and 13; and in this position they serve as ties or binders between the beam and floor-slab, holding the latter against tension forces which tend to pull away the slab from the beam laterally, as well as against vertical forces tending to displace the beam relative to the slab.

It will be also seen that this combination enables the longitudinals to be closely and evenly spaced, a part of same being placed in the loops between the intermediate bends 25^b and part outside of said loops and between the legs of the bends, being supported transversely by the bottom of the stirrups 21.

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

1. A stirrup for supporting reinforcing members for concrete beams and the like, comprising a rod bent into one or more V-shaped portions, and having the upper free ends thereof downwardly turned and adapted to bear upon the mold forms to thereby suspend the reinforcing members above the bottom of the mold.

2. A stirrup for supporting reinforcing members for concrete beams and the like, comprising a rod bent into one or more V-shaped portions, and outwardly extending prolongations upon the upper free ends thereof, and which are adapted to support the reinforcing members upon the upper surface of the sides of the form in which the concrete is poured, said extensions being bent at an acute angle to the upright members of the V-shaped portions and adapted to meet the form support at an acute angle.

3. A stirrup for supporting reinforcing members for concrete beams and the like, comprising a rod bent into zigzag form and having the upper free ends bent at an acute angle to the outer members and adapted to bear upon the top surface of the sides of the mold form, whereby the main portion of the reinforcing member depends below the support of said free ends and is suspended thereby above the bottom of the mold.

4. A reinforcing framework for concrete beams and the like, comprising a plurality of stirrups disposed at intervals along the beam, each of said stirrups having downwardly extending portions bent into one or more loops and outwardly and downwardly diverging arms adapted to rest upon lateral supports such as mold boards or floor tile,

to thereby support the loop portion above the bottom of the mold, and also serve as shear reinforcement members for the beam, and longitudinal reinforcing rods extending between adjacent stirrups and supported in the loop portions thereof.

5. A reinforcing framework for concrete beams comprising a plurality of stirrups disposed at intervals along the beam and which consists of a rod having downwardly bent portions joined across the bottom and outwardly bent downwardly turned prolongations on the upper ends thereof which are adapted to rest on the sides of the concrete form while the beam is being poured, said stirrups being alternately of different depths, and as many sets of longitudinal reinforcing rods supported in the stirrups the respective depths, whereby the rods are supported at different levels and above the bottom of the mold.

6. The process of constructing reinforced concrete beams which consists in placing at intervals along said beams a plurality of stirrups having downwardly bent portions and outwardly and downwardly extending prolongations resting on the sides of said form, placing longitudinal reinforcing members in said stirrups, pouring the concrete beams, bending up said prolongations into substantially horizontal position after the concrete so poured has partially set, and finally pouring a slab over and in continuity with said beam; whereby said prolongations form bonds between the beam and slab.

7. A reinforcing framework for concrete beams and the like comprising first a set of stirrups each of which has downwardly extending portions at the sides and a horizontally extending portion joining the ends of said downwardly extending portions, and means at the upper ends for supporting the stirrup in a suspended manner from the sides of the mold at the top, whereby the stirrup and reinforcing members are entirely held above the bottom of the mold; secondly a second set of stirrups alternating with the first, and each of which has downwardly extending loops at the sides, and an intermediate up-and-down zigzag portion connecting the lower ends of said downwardly extending portions and means at the upper ends for supporting the stirrup in a suspended manner from the sides of the mold at the top whereby the stirrup and reinforcing members are entirely held above the bottom of the mold; thirdly, a set of one or more longitudinal reinforcing bars resting on the first set of stirrups and passing under the second; and fourthly, a second set of one or more longitudinal reinforcing-bars supported by and resting on both sets of stirrups.

8. A reinforcing framework for concrete

beams and the like, comprising first a set of stirrups each of which has downwardly extending portions at the sides and a horizontally extending portion joining the ends of said downwardly extending portions; secondly, a second set of stirrups alternating with the first, each of which has downwardly extending portions at the sides, and an intermediate up-and-down zigzag portion connecting the lower ends of said downwardly extending portions; thirdly, a set of one or more longitudinal reinforcing bars resting on the first set of stirrups and passing under the second; and fourthly, a second set of one or more longitudinal reinforcing-bars supported by and resting on both sets of stirrups.

9. A reinforcing frame-work for concrete beams and the like, comprising first a set of stirrups each of which has downwardly extending portions at the sides and an intermediate zigzag portion uniting the lower ends thereof and means for supporting the said zigzag portion entirely above the bottom of the mold; secondly, a second set of stirrups each of which is similar to those of the first set, but having its downwardly extending side-portions shorter whereby the zigzag portion lies at a higher level, the members of said second set alternating with the members of the said first set; thirdly, a set of longitudinal reinforcing members resting in the zigzag portions of the first set, and below the second set; and fourthly, a second set of longitudinal reinforcing members resting in the zigzag portions of the second set, and above the first set.

10. A reinforcing frame-work for concrete beams and the like comprising first a set of stirrups each of which has downwardly extending portions at the sides and intermediate straight horizontal portions uniting the lower ends thereof and means for supporting said straight horizontal portions entirely above the bottom of the mold; secondly, a second set of stirrups each of which is similar and similarly supported to those of the first, but having its straight horizontal but intermediate portion at a higher level than it, the members of said second set alternating with the members of the first set; thirdly, a third set of stirrups each of which has downwardly extending portions at the sides and an up-and-down zig-zag portion connecting the lower ends thereof, the bottom points of the zigzag portion being on substantially the same level as the horizontal straight portion of the first set of stirrups, and means for supporting said stirrups zigzag with said zigzag portions at said level, said members of the third set alternating with the members of the first and second sets; fourthly, a fourth set of stirrups, alternating with the other three sets and each of which is similarly

- formed and supported to the members of the third set but having the lower bends of its zigzag portion on a level with the horizontal straight portions of the members of the
- 5 second set; fifthly, a set of longitudinal reinforcement-bars supported by and resting upon the straight horizontal and zigzag portions of the stirrups of the first and third sets of stirrups; and sixthly, a second set
- 10 of longitudinal reinforcement-bars resting upon the straight horizontal zigzag portions of the stirrups of the second and fourth sets, and at a higher level than the other longitudinal reinforcement-bars.
- 15 11. A stirrup for supporting reinforcing members for concrete beams and the like comprising a rod bent into a loop-portion in the middle and having prolongations where-
- 20 by the reinforcing members are held above the bottom of the mold, said prolongations forming an angular bend with the loop-portion and normally extending obliquely downwardly whereby their extremities are adapted to rest on supporting members;
- 25 each of said prolongations lying in a plane, which when the prolongation is bent up at its base is adapted to lie substantially parallel with and between the upper and lower floor-surfaces.
- 30 12. A stirrup for supporting reinforcing members for concrete beams and the like

comprising a rod bent into one or more V-shaped portions and having prolongations normally downwardly turned whereby the reinforcing members are held above the bot- 35 tom of the mold; said prolongations being substantially straight for their full length and adapted when bent up at their point of union with the V-shaped portions to occupy a plane parallel to the floor surface and a 40 position between the top and bottom surfaces of the floor.

13. A stirrup for supporting reinforcing members for concrete beams and the like, comprising a rod bent to provide a central 45 loop or seat, the upper side portions of the loop formed into outwardly and downwardly diverging arms, said arms being adapted to rest upon lateral supports such as mold boards or floor blocks, and thereby 50 hold the bottom or seat portion of the stirrup above the mold and thus position the reinforcing members supported in the stirrup in determined relation within the concrete. 55

In witness whereof, I have hereunto set my hand this thirteenth day of April, 1907.

RUDOLPH B. HARTMAN.

In presence of—

JOS. M. GRUBER,
ELSIE M. HOTZ.