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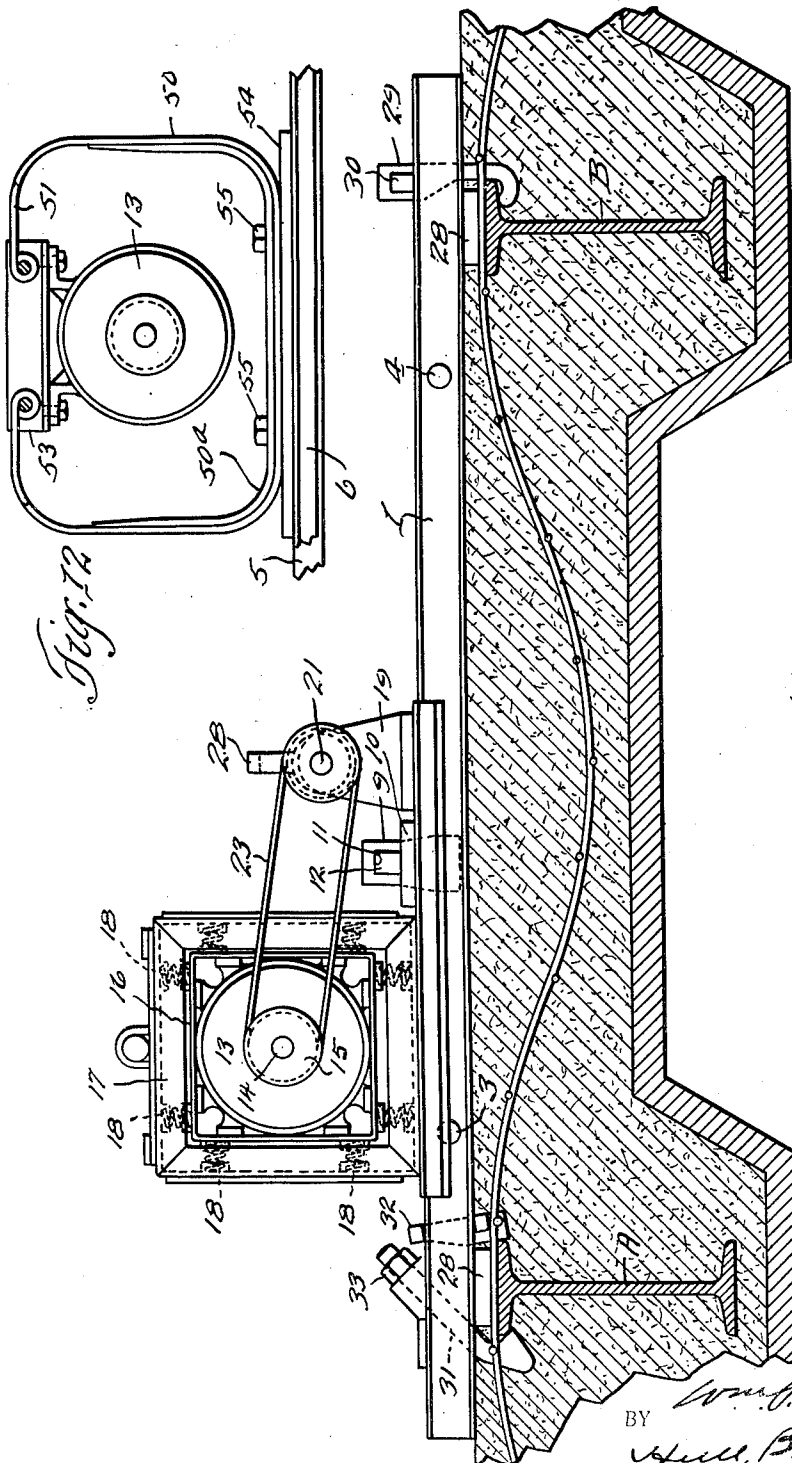
W. P. DAY

1,970,740

METHOD FOR EMPLACING CONCRETE IN BUILDING CONSTRUCTION

Filed Aug. 12, 1933

5 Sheets-Sheet 1



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Aug. 21, 1934.

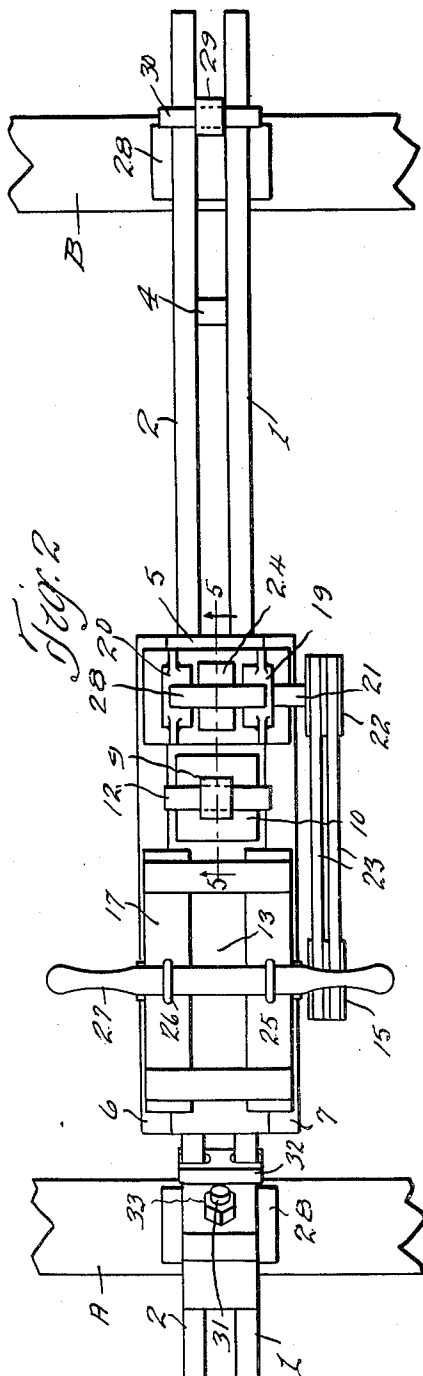
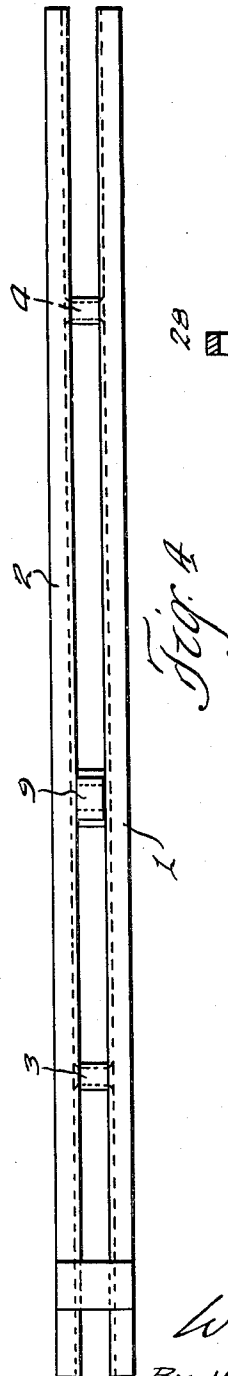
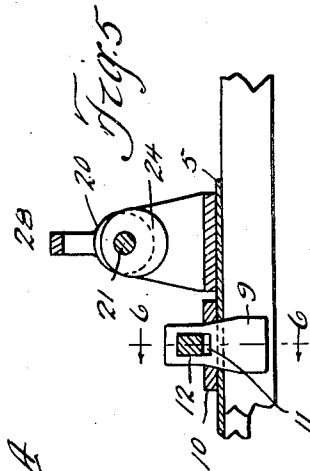
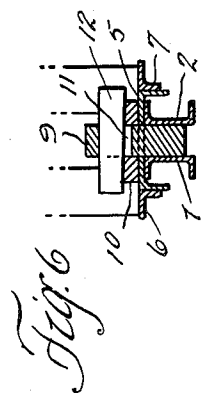
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METHOD FOR EMLACING CONCRETE IN BUILDING CONSTRUCTION

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5 Sheets-Sheet 2



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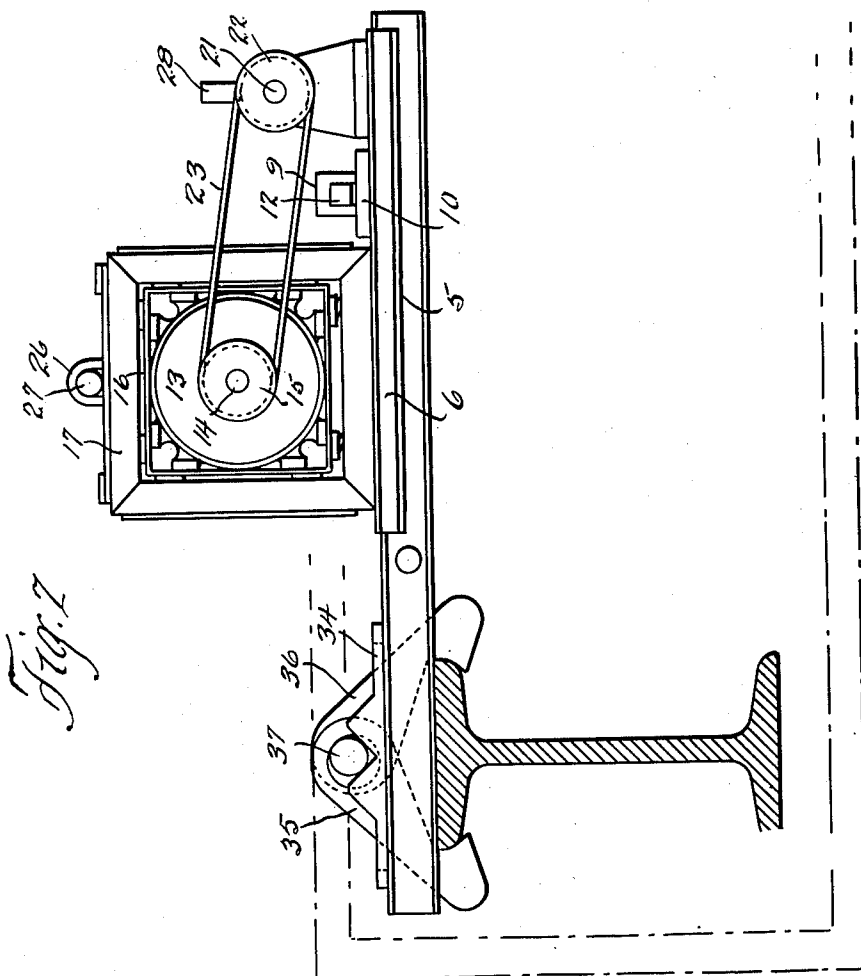
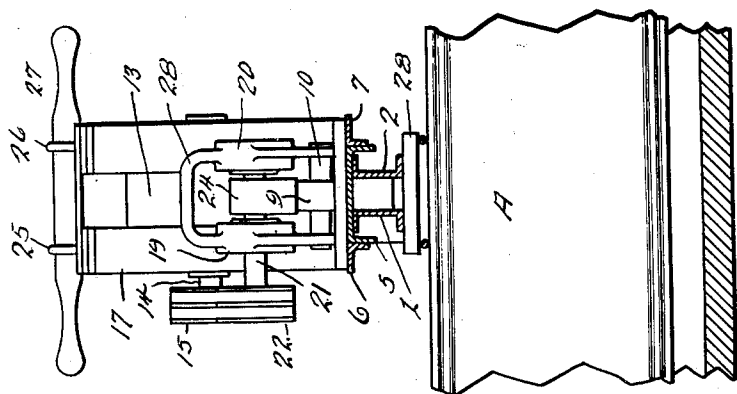
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METHOD FOR EMLACING CONCRETE IN BUILDING CONSTRUCTION

Filed Aug. 12, 1933

5 Sheets-Sheet 3



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METHOD FOR EMLACING CONCRETE IN BUILDING CONSTRUCTION

Filed Aug. 12, 1933

5 Sheets-Sheet 4

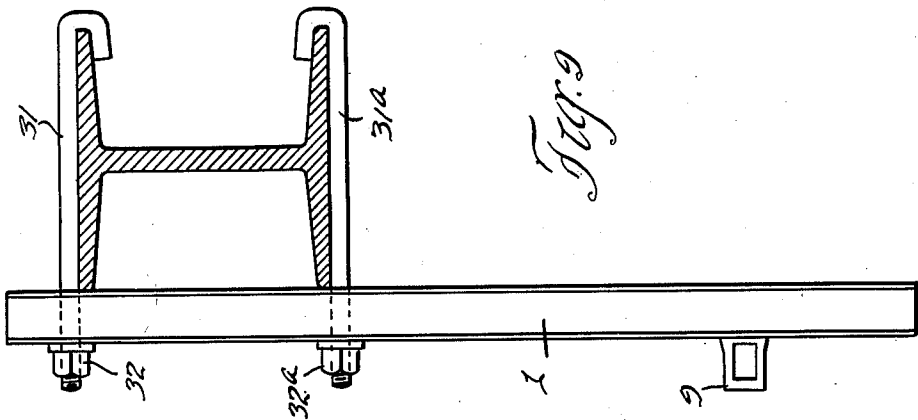


Fig. 9

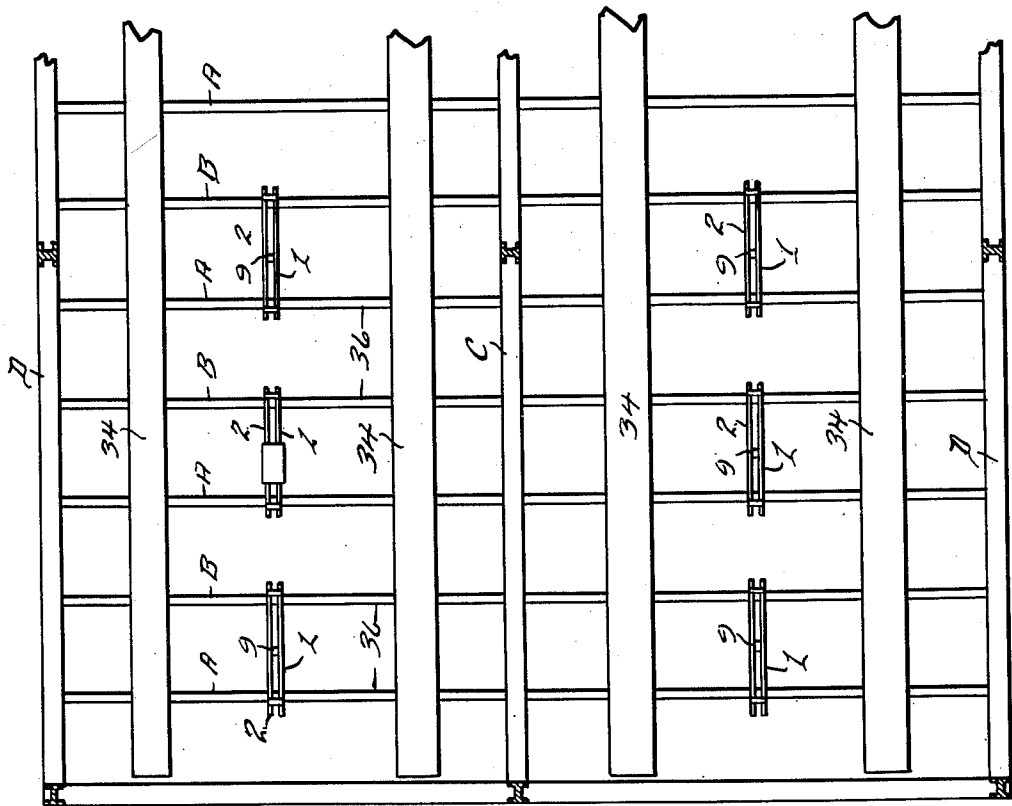


Fig. 8

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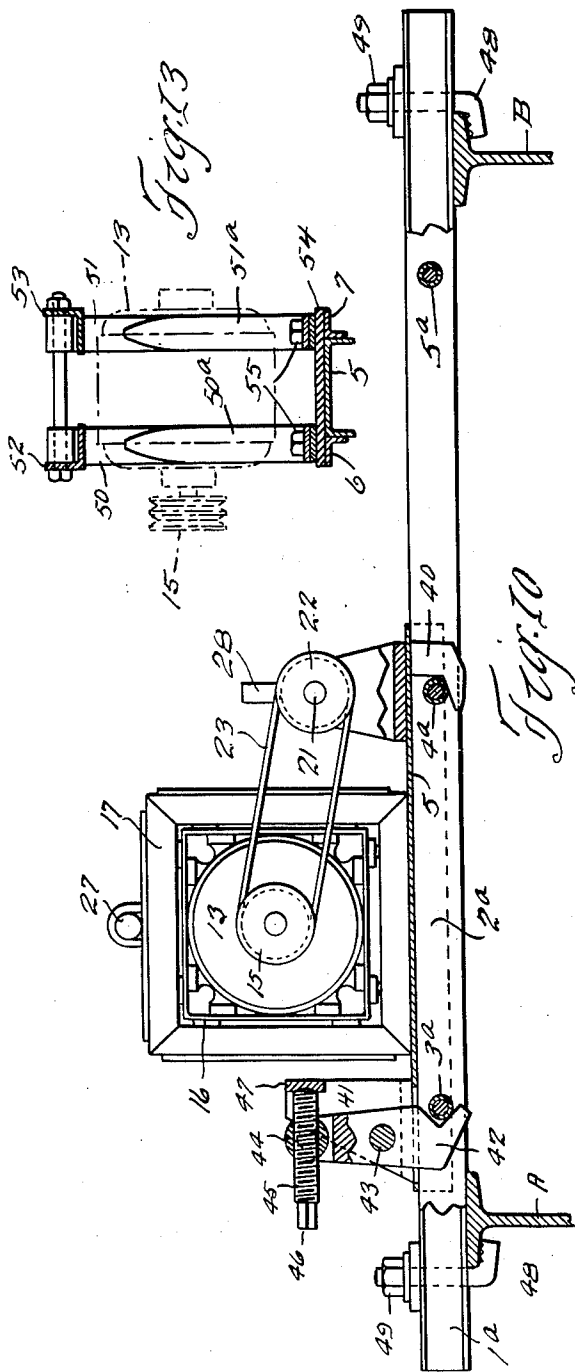
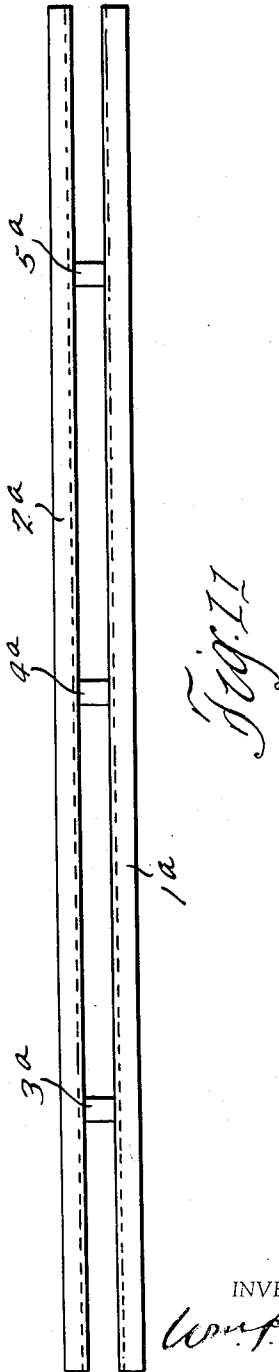
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METHOD FOR EMBLACING CONCRETE IN BUILDING CONSTRUCTION

Filed Aug. 12, 1933

5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

1,970,740

METHOD FOR EMLACING CONCRETE IN
BUILDING CONSTRUCTIONWilliam P. Day, Cleveland, Ohio, assignor to
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Application August 12, 1933, Serial No. 684,887

5 Claims. (Cl. 25—154)

This invention relates generally to a method of emplacing concrete and more particularly to a method which is especially adapted for use in forming concrete ceilings and floors having steel beams and girders and metal reinforcements, usually in the form of a wire mesh or grid.

The main object of the invention is to provide a method of emplacing concrete which is especially adapted for laying reinforced concrete floors and ceilings and which will cause the concrete to adhere to and firmly bond with the steel and tend to eliminate voids and air pockets.

Another object of the invention is to provide a power operated machine which is particularly adapted for practicing the method disclosed.

A further object of the invention is to provide a power operated apparatus which is particularly adapted for vibrating the beams and girders of a floor and ceiling, which is rigid and dependable in construction and which may be quickly moved from one part of the floor to another.

Another object of the invention is to provide a machine of the character described which will impart rapid and violent vibrations to the steel framework of buildings and in which the motor is resiliently mounted so as to prevent excessive vibration thereof.

Another object of the invention is to provide a vibrating apparatus which consists of a frame adapted to be readily secured to or detached from the beams or girders of a building and to which is detachably secured the motor and vibrator.

Further and more limited objects of the invention will appear as the description proceeds and by reference to the accompanying drawings in which Fig. 1 is a fragmentary view partly in section and partly in elevation disclosing my vibrating apparatus secured to beams of a building construction; Fig. 2 is a top plan view of the apparatus shown in Fig. 1; Fig. 3 is a vertical sectional view on the line 3—3 of Fig. 2; Fig. 4 is a top plan view of one of the rails on which the vibrating apparatus is mounted; Fig. 5 is a vertical sectional view on the line 5—5 of Fig. 2; Fig. 6 is a fragmentary sectional view on the line 6—6 of Fig. 5; Fig. 7 is a plan view showing the apparatus secured to a vertical stud or column; Fig. 8 is a fragmentary plan view disclosing the manner in which the apparatus is used to practice the method claims; Fig. 9 is a view in elevation showing one of the supporting rails secured to a vertically disposed stud or collar; Fig. 10 is a sectional side elevation disclosing a slightly modified form of apparatus; and Fig.

11 is a top plan view of the base member shown in Fig. 10.

The method and vibrating apparatus herein disclosed are especially adapted for emplacing reinforced concrete ceilings and floors. According to my improved method the floor of one room and the ceiling of the room below are formed simultaneously and the concrete caused to adhere to and bond with the girders as well as to such reinforcements as may be used. In my prior Patent No. 1,770,154 I have disclosed and claimed broadly a method of forming reinforced concrete construction and in this application I disclose a specific application of the same general idea together with a machine for practicing the method.

I have found that the speed as well as the force of the vibrations imparted to the girders and reinforcements materially affect the result obtained and that in forming ceilings and floors a better bond between the concrete and the steel is obtained by the use of very rapid and violent vibrations which are imparted to the beams or girders at the rate of from 2500 to 3500 per minute. It is also necessary that the vibrations imparted to the beams or girders have considerable force and according to my improved method the pressure exerted on the girders or beams at each vibration is about 1750 pounds. The girders and beams have a natural period of vibration depending upon their size and length and the speed of the vibrations imparted thereto should be such as not to be in resonance with their natural period of vibration.

Another advantage to be obtained from the use of my improved method is that I am able to use from 15 to 20 percent more concrete in the same space which greatly increases the density of the concrete as well as the strength and rigidity of the entire construction. While my improved method is particularly adapted for laying floors and ceilings, it may also be used to emplace concrete about vertically disposed columns, posts, studs or the like.

My improved method for laying reinforced concrete ceilings and floors consists essentially in enclosing the beams or girders with a mold in such a manner that the floor of one room and the ceiling of the room below may be poured simultaneously. The vibrating apparatus is rigidly secured to two or more girders. The soft concrete is poured into the mold and while it is still plastic the motor is operated to rotate the eccentrically mounted weight very rapidly, preferably at a speed of from 2500 to 3500 revolutions per minute. It has been found that the

apparatus disclosed will vibrate an area of the floor or ceiling of about 540 square feet. The machine is operated from 2½ to 3½ minutes and is then removed to another section and secured to two or more adjacent girders or beams and operated in the same manner. The motor should always be operated at approximately the same speed so that all of the girders will be given approximately the same vibration and at the same rate. It will be seen that the metal screen or grid is clamped between the vibrating apparatus and the girders so that the vibrations are imparted to the reinforcing screen or grid as well as to the girders which causes the concrete to bond both with the girders and the screen.

Referring now to the drawings the apparatus for practicing the method consists essentially of a base member or support which is made up of a pair of angle irons 1 and 2 which are held in spaced relation by means of suitable spacers 3 and 4. Detachably secured to the angle irons 1 and 2 is a channel member 5 to the opposite sides of which are secured a pair of angle irons 6 and 7. The channel 5 is provided with a rectangular opening 8 disposed adjacent one end thereof and secured between the angle irons 1 and 2 is a tapered rectangular block 9 which is adapted to project through the opening 8 in the channel 5. Secured to the channel 5 is a plate 10, the upper surface of which is tapered and which is provided with an opening which coincides with the opening 8 in the channel. The block 10 is provided with a rectangular opening 11 adapted to receive a similar shaped tapered pin 12 therein which rigidly secures the channel 5 to the angle irons 1 and 2. Carried by the channel 5 is an electric motor 13 having a shaft 14 to the outer end of which is connected a pulley 15. The motor 13 is enclosed within a rectangular frame 16 formed of angle irons. Surrounding the frame 16 and spaced therefrom is a rectangular frame 17 which is also formed of angle irons. Disposed between the frames 16 and 17 are a plurality of coiled springs 18 which provide a cushioned mounting for the motor. Disposed adjacent one end of the channel 5 is a casting shaped to provide a pair of bearings 19 and 20 which rotatably receive a shaft 21 to the outer end of which is connected a pulley 22 which is driven from the pulley 15 by means of a flexible belt 23. Eccentrically mounted on the shaft 14 is a weight 24 which is non-rotatably secured to the shaft. Secured to the outer frame 17 are a pair of hooks 25 and 26 which are adapted to receive a handle 27 therethrough. The bearings 20 and 21 are connected by a spider 28 which also serves as a handle by means of which the machine may be lifted from the angle irons 1 and 2. It will be seen that the channel 5 and with it the motor and the eccentrically mounted weight are removable from the angle irons 1 and 2 as a unit.

In Fig. 7 there is disclosed a specially constructed means for securing the base member to a vertically disposed post or column which consists of a rectangular frame 34 which is disposed over the angle irons 1 and 2 and on which are pivotally mounted hooks 35 and 36 which are urged into gripping engagement with the beams by means of a tapered pin 37 which engages in notches provided on opposite sides of the frame.

In practicing the method the beams or girders are first enclosed within a mold in such a manner that the floor of one room and the ceiling of the room below are formed at one operation,

The metal reinforcement in the form of a wire mesh or screen extends over the top of the beams as shown in Fig. 1. Blocks 28 are first placed on the top of the beams and the base member is secured in place. One end of the base member is secured in place by means of a hook 29 and pin 30 and the opposite end is secured in place by means of specially constructed hooks 31 and 32. The hook 31 is tightened and held in place by means of the nut 33. The channel 5 which carries the motor and vibrator proper is then secured to the base member by means of the pin 12 which is driven into the opening in the block 9. When the motor is started very rapid and violent vibrations are imparted to the beams and the reinforcement. The channel 5 is so positioned that the shaft 21 is disposed about midway between the beams A and B.

In Fig. 8 I have disclosed somewhat diagrammatically the steel framework of one type of floor construction with which my method is to be used. In this view the distance between the centers of the beams A and B is six feet and the distance between the centers of the beams C and D is thirty feet. Several base members are first secured to the beams A and B in the position shown in Fig. 8, it being understood that the beams are first enclosed within a suitable mold so that a floor and ceiling may be formed simultaneously. The reference character 34 designates runways over which the wheel barrows may be rolled to deliver the concrete which in this instance is mixed in accordance with U. S. Specifications C-3 and contains 1 part cement, 2 parts sand and 4 parts cinders. The required amount of cement is first delivered into the mold to form a section of about 540 square feet of floor, and the motor and vibrator secured to one of the base members and operated for from 2½ to 3½ minutes. The motor disclosed is 3 horse power electric motor and the weight is 4 inches in diameter and 2 inches wide and mounted ⅝ths of an inch off center. The motor is preferably operated at about 3500 R. P. M. By varying the speed of the motor and/or the size and eccentricity of the weight, the force and effect of the vibrations imparted to the beams may be varied greatly. The motor and vibrator are then moved as a unit to the next adjacent base member and operated in the same manner, and so on. The motor should be operated at the same speed and for approximately the same period in each location. The area of the section of floor to be vibrated at each operation may, of course, be varied if desired or necessary; but I have found that very good results are obtained with the specifications hereinbefore mentioned. The concrete is caused to settle and to bond tightly with the beams and reinforcements and to fill up all crevices and cracks and to generally tighten up the whole steel construction.

In Fig. 9 I have disclosed means for securing the base member to a single beam or stud and in which the angle irons are held in place by means of suitable hooks 31^a and nuts 32^a.

In Figs. 10 and 11 I have disclosed a slightly modified form of apparatus for practicing the method. In this form of the invention the base member is made up of a pair of angle irons 1^a and 2^a which are secured in spaced relation by means of spacers 3^a, 4^a and 5^a. Rigidly secured to the channel member 5 of the base of the machine is a hook 40 which is adapted to engage under a spacer 4^a. Disposed at the opposite end of the machine is a bracket 41 on which is piv-

otally mounted a hook 42 which is carried by a shaft 43. The hook 42 is bifurcated at its upper end and secured thereto is a block 44 having a threaded opening therein through which extends
 5 a threaded pin 45 having a tool receiving end portion 46. The opposite end of the pin 45 bears against the central portion 47 of the bracket 41. The hook 42 projects downwardly between the angle irons 1^a and 2^a and is adapted to engage a
 10 spacer 3^a in the position shown in Fig. 10. The spacer 4^a is spaced an equal distance from the spacers 3^a and 5^a so that the vibrating unit proper can be secured to the spacers 3^a and 4^a or to the spacers 4^a and 5^a. The angle irons 1^a and 2^a
 15 are adapted to be secured to the beams A and B by means of hooks 48 which are held in place by nuts 49. The function and operation of this form of apparatus is identical with that shown in the remaining figures, although this form of the ap-
 20 paratus is more flexible and adjustable and may be more readily moved from place to place.

In Figs. 12 and 13, I have disclosed still another form of vibrating apparatus which is removable from the base member as a unit and in
 25 which the motor 13 for operating the vibrator is mounted on a pair of resilient supporting members 50 and 51 shaped as shown and to which are pivotally secured a pair of angle irons 52 and 53 to which the motor is secured. The mem-
 30 bers 50 and 51 are leaf springs which are reinforced at the bottom by spring leaves 50^a and 51^a. The springs are secured to a base member 54 formed of fibre or other suitable material and which is secured to the channel 5 by suitable bolts
 35 55. This construction provides a very cheap and simple mounting for the motor. The motor and vibrator are carried by the channel 5 and are removable from the base member as a unit. In other respects, this form of apparatus is identi-
 40 cal with the unit shown in Fig. 10.

Throughout the specification and claims I have used the term "concrete" but I do not wish to be limited to any specific mixture of sand, stone, cement, cinders or other material; but have used
 45 the term broadly to mean any mixture of bonding material such as cement, cement grout or asphalt with sand, cinders, gravel, stone or any other suitable material. It also is to be understood that the embodiments of the invention
 50 herein disclosed are merely illustrative and are not to be considered in a limiting sense as various changes may be made in the particular apparatus without departing from the spirit of my invention and the invention is limited only in ac-
 55 cordance with the scope of the appended claims.

Having described my invention, what I claim is:

1. The method of forming partitions, walls, floors and the like containing a plurality of metal
 60 girders and metal reinforcements extending between said girders and in engagement therewith, which consists in clamping a predetermined number of girders and the reinforcements in engagement therewith together, enclosing said girders and reinforcements with a mass of wet flowable
 65 concrete, and then simultaneously rapidly vibrating said predetermined number of girders and

the reinforcements in engagement therewith, thereby to cause the concrete to settle and to bond with the said girders and reinforcements.

2. The method of forming partitions, walls, floors and the like containing a plurality of metal
 80 girders and metal reinforcements extending between said girders and in engagement therewith, which consists in clamping a plurality of girders and the reinforcements in engagement therewith together, enclosing said girders and reinforce-
 85 ments with a mass of wet flowable concrete, and then simultaneously rapidly vibrating said plurality of girders and the reinforcements therebetween and in engagement therewith, thereby to cause the concrete to settle and bond with
 90 the said girders and reinforcements.

3. The method of forming partitions, walls, floors and the like containing a plurality of metal
 95 girders and metal reinforcements extending between said girders and in engagement therewith, which consists in clamping a predetermined number of girders and the reinforcements in engagement therewith together, enclosing said girders and reinforcements with a mass of wet flow-
 100 able concrete, and then simultaneously rapidly vibrating said predetermined number of girders and the reinforcements in engagement therewith, and before the concrete has hardened progres-
 105 sively vibrating adjacent girders and reinforcements in a similar manner, until all the girders and reinforcements have been vibrated, thereby to cause all the concrete to settle to a uniform density and bond with the said girders and re-
 110 inforcements.

4. The method of forming partitions, walls, floors and the like containing a plurality of metal
 115 girders and metal reinforcements extending between said girders and in engagement therewith, which consists in enclosing said girders and reinforcements with a mass of wet flowable concrete, clamping a predetermined number of girders and the reinforcements in engagement therewith together, and then rapidly vibrating the clamp-
 120 ing means, thereby to simultaneously vibrate the girders and reinforcements which have been clamped together, to cause the concrete to settle and bond with the said girders and reinforce-
 125 ments.

5. The method of forming partitions, walls, floors and the like containing a plurality of metal
 125 girders and metal reinforcements extending between said girders and in engagement therewith, which consists in enclosing said girders and reinforcements with a mass of wet flowable concrete, clamping a plurality of girders and the
 130 reinforcements therebetween and in engagement therewith together, and then simultaneously vibrating all of the clamping means with a single vibrating means, thereby to simultaneously vi-
 135 brate all of the girders and engaging reinforcements which have been clamped together, to cause the concrete to settle and bond with the said girders and reinforcements.

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