

May 8, 1956

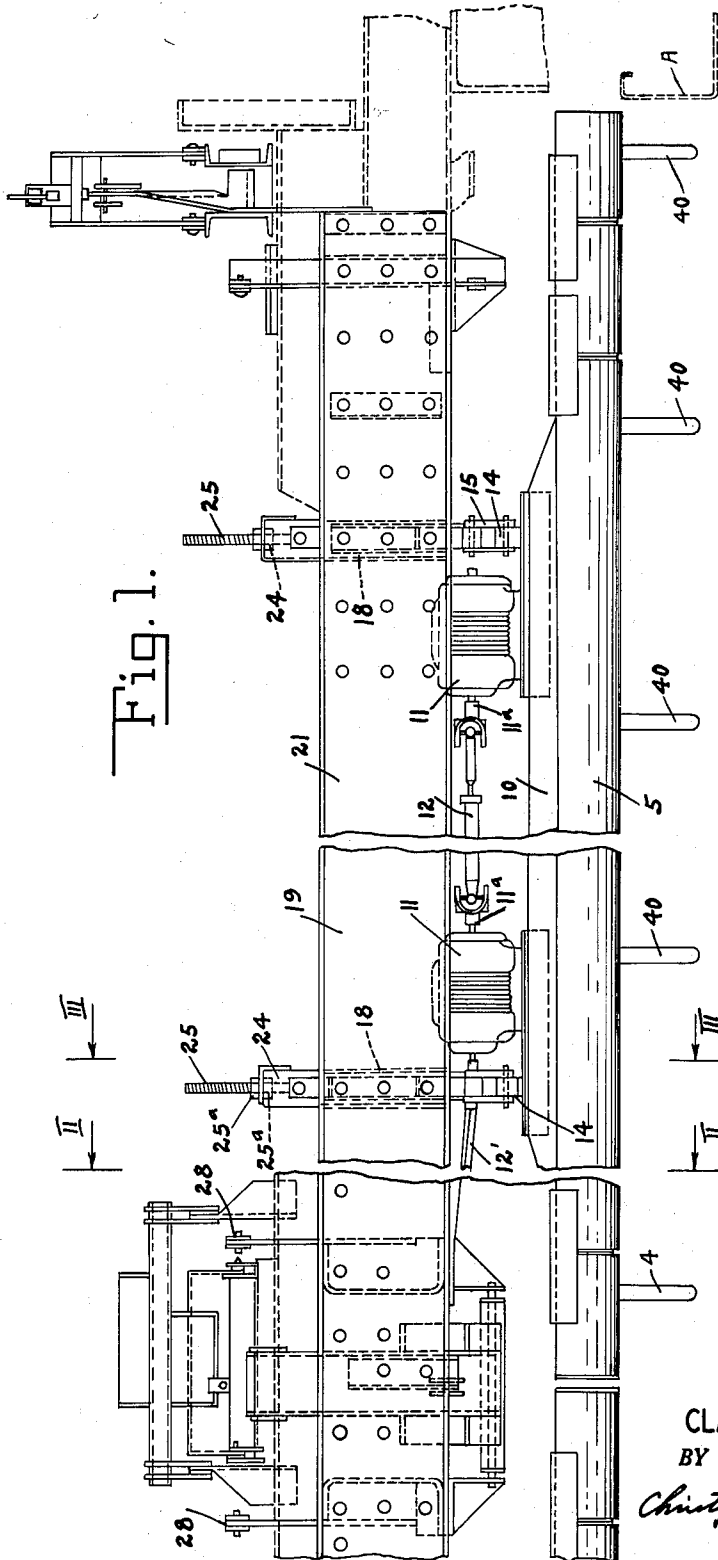
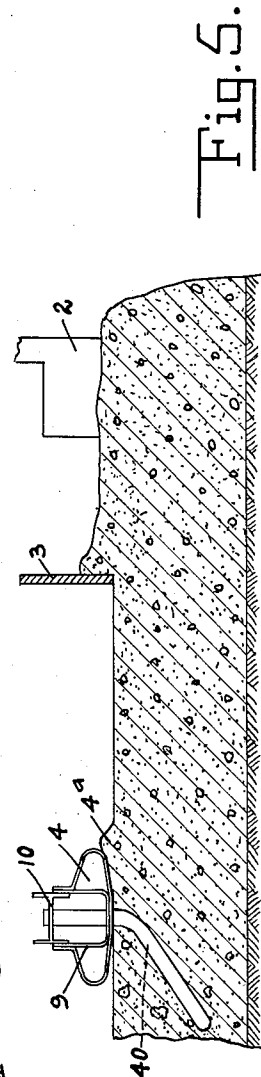
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2,744,456

CONDITIONER FOR SMOOTHING AND VIBRATING CONCRETE

Filed July 13, 1954

2 Sheets-Sheet 1



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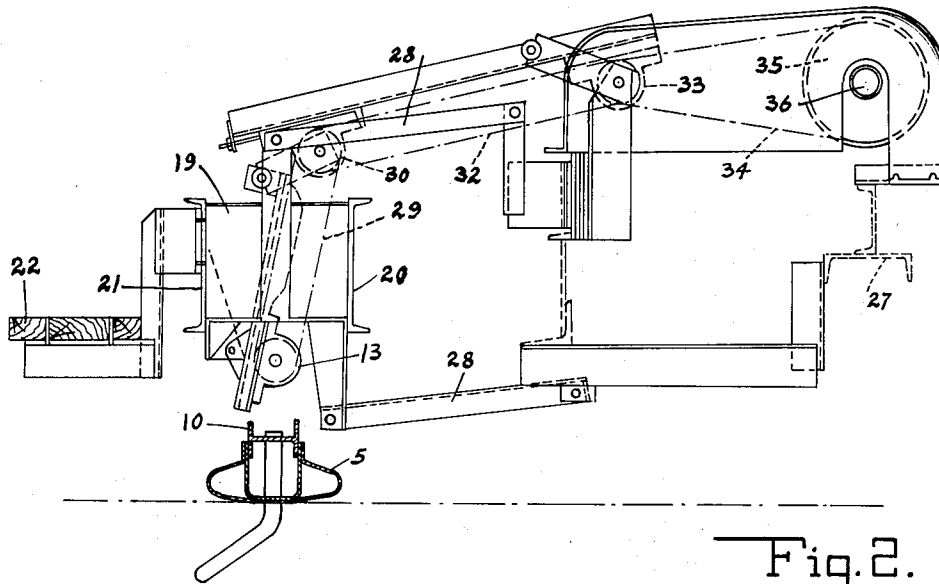


Fig. 2.

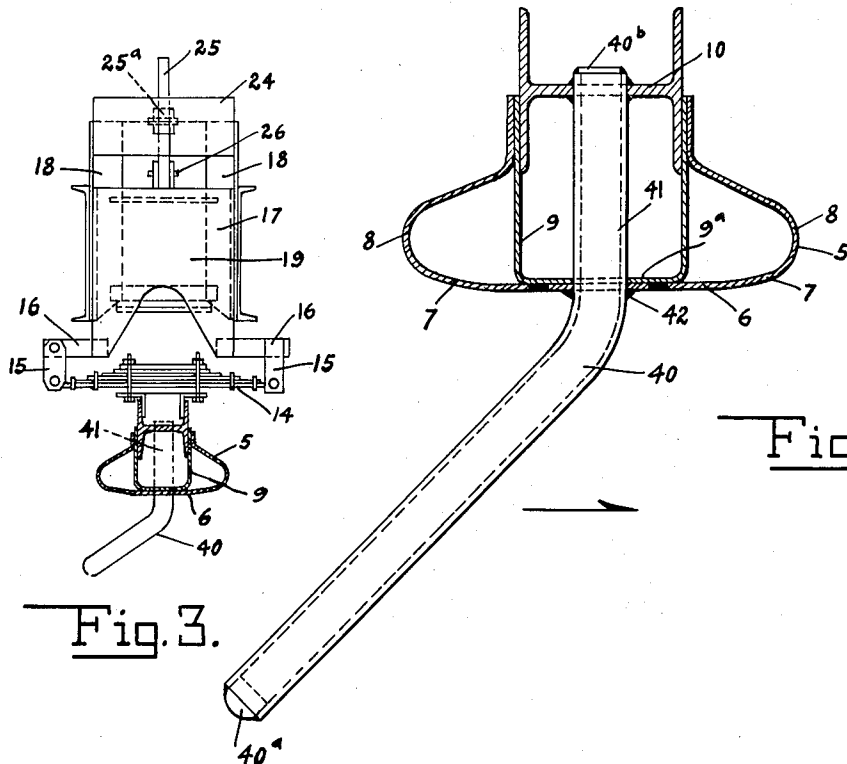


Fig. 3.

Fig. 4.

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CONDITIONER FOR SMOOTHING AND VIBRATING CONCRETE

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Application July 13, 1954, Serial No. 443,046

6 Claims. (Cl. 94—48)

This invention is for a conditioner for smoothing and vibrating concrete and is for a conditioner used on concrete paving machines of the type shown in Bushnell Patent No. 2,361,377, granted October 31, 1944.

In a copending application Serial No. 443,040, filed July 13, 1954, of William E. Balliet, there is disclosed an improvement in a method and apparatus for paving with concrete, wherein a paving machine such as disclosed in the Bushnell patent above referred to is provided with a conditioner arranged to vibrate vertically having a series of downwardly and rearwardly sloped fingers projecting from the under surface thereof. As described in said Balliet application, these fingers are intended to penetrate the concrete after it has been spread and before it starts to set, and as the conditioner moves along the surface of the concrete and is vibrated, the fingers transmit the vibrations to a depth considerably below the surface. Thus there is provided a method and apparatus by means of which the surface of the concrete and the concrete below the surface is simultaneously vibrated.

In the aforesaid Balliet application the conditioner vibrates only in a vertical direction and the inclination of the fingers which penetrate the concrete is of importance in that it provides an increased projected area over which the vibrations of the fingers are imparted to the concrete. In other words if the fingers were merely rods projecting perpendicularly into the concrete from the bottom of the conditioner, they would move up and down with the vibrations of the conditioner, but the area of concrete engaged at any instant of time under the fingers would be only an area corresponding to the cross section of the fingers. However by inclining the fingers the vertical vibration is made effective over a considerable area of concrete under the fingers, as well as above them.

The conditioner itself comprises a rigid metal section that extends crosswise of the area being paved, and to which is secured a sheet metal skin or shell forming the main body of the vibrator. Some light interior bracing is provided within the shell between the inside of the bottom of the shell and the rigid metal section onto which the shell is secured. Prior to the present invention, it was proposed to weld the metal fingers directly to the bottom of the conditioner, being thus welded only to the skin or shell. This was apparently a satisfactory arrangement. However the fingers have to penetrate a relatively stiff concrete; they are continuously coming into contact with large pieces of aggregate in their path of travel, which aggregate they must displace, and since they are vibrated and meet the resistance of the concrete along the entire projected area of the slope of the finger, this manner of constructing and arranging the fingers imposed a considerable strain or stress on the sheet metal constituting the bottom of the conditioner, tending to bend or distort the sheet metal to which the fingers were secured, and also overstressing the sheet metal of the conditioning element by the high frequency flexing of the metal in the area adjacent the upper end of the finger. Moreover the

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slight resilience of the metal shell provided a path through which the intensity of the vibrations to the fingers could be damped, the metal flexing without imparting the full amplitude of vibration to the inclined fingers buried in the concrete.

The present invention has for its object to provide an improved construction to more firmly and rigidly secure and support the fingers on the carrier and eliminate the damping of vibrations due to any spring of the sheet metal or any overstressing of the metal due to its rapid flexing in the region of the connection between the fingers and the shell. This and other objects and advantages are obtained by my improved construction as will be more apparent to those skilled in the art by reference to the accompanying drawings, in which:

Fig. 1 is a rear elevation of a paving machine having a conditioning element constructed in accordance with my invention;

Fig. 2 is a transverse vertical section in the plane of line II—II of Fig. 1;

Fig. 3 is a transverse section in the plane of line III—III of Fig. 1;

Fig. 4 is an enlarged detail view corresponding to the section shown in Fig. 3, but showing only the conditioner without the associated parts; and

Fig. 5 is a schematic view illustrating the manner in which the conditioner is used.

Referring to the drawings, the paving machine is of the type which is supported on wheels designed to roll on parallel forms (such as A in Fig. 1) placed along each side of the sub-grade over which concrete is to be spread. The machine illustrated may be of the type generally shown in said Bushnell Patent No. 2,361,377, and in the present application I have shown only so much of such a machine as is necessary for the understanding of my invention.

By way of a general description of the invention, reference may first be made to Fig. 5 of the drawings, wherein there is shown more or less schematically a spreader 2 which is designed to engage the piles of concrete that are dumped onto the sub-grade between the road forms over the area to be paved, which spreader functions to more or less roughly spread the concrete to a depth greater than is necessary in the finished road surface. A desirable spreader is illustrated in Harrington Patent No. 2,373,828. Following the spreader and in predetermined spaced relation to it is a strike-off or screed 3, the elevation of which may be adjusted. It comprises a narrow blade set edgewise behind the spreader. It scrapes off the excess depth of concrete and the material that accumulates in front of the strike-off or screed 3 is redistributed by the spreader 2. The movement of the strike-off 3 over the surface of the concrete will open up voids and crevices and leave a rough surface when the mix contains coarse aggregate. This is particularly true with a stiff or relatively dry concrete mix which is preferable for paving purposes. As explained in the above-mentioned Bushnell patent, it is desirable to close these crevices from the bottom upwardly, and to that end there is a conditioner 4 which follows the screed and which is vibrated vertically on the surface of the concrete. The vibrations generated in the conditioner tend to fluidize the concrete and cause the cavities and fissures formed by the screed to close as if by fluid flow, the vibrations extending to a point well in advance of the conditioner 4. The conditioner is set at a level where it will tend to accumulate a small excess of concrete in front of it as indicated at 4a in Fig. 5. So much of the apparatus as herein described is fully shown and described in the aforesaid Bushnell patent and for relatively shallow concrete is entirely adequate, except that it has been found that even with the vibrating conditioning member 4, air may

be trapped and pockets formed in the concrete adjacent the forms at each side of the area being paved.

Referring more particularly to Figs. 1 to 4, the conditioning element 4 is in the form of a beam whose length transversely of the area being paved substantially exceeds its width, and with relatively wide machines there may be two or more complementary beams placed end to end where it is impractical to use one full length conditioner to span the distance between the two forms. The conditioner or beam 4 is formed with a skin plate of metal 5 shaped to provide the relatively wide bottom surface 6 and slight upwardly sloped portion 7 at each side of the flat portion 6, the plate having rounded parts 8 constituting the front and rear edges of the beam. The parts 6, 7 and 8 constitute a sheet of relatively thin metal which has the contour shown, and above the rounded portions 8 the metal is brought in to form a restricted upper part and is welded or otherwise joined to the outer faces of a U-shaped stiffening member 9 placed inside the metal shell formed by the plate 5, this U-shaped member having its bottom 9a in contact with the inside of the bottom portion 6 of the conditioner as best shown in Fig. 4. The metal plate 5 may be welded to the bottom area 9a of the U-shaped member 9. A relatively rigid metal section 10, such as an H section as shown in the drawings, is welded or otherwise secured to the top of the U-shaped member 9. In this way the device 4 provides a runner-like surface which may be moved transversely of its length along the top of the concrete with a considerable flat area to engage the concrete. It is designed to be vibrated vertically at relatively high frequency in the manner hereinafter described, and to be moved over the surface of the concrete without substantial flexing or bending.

Supported on the top of the beam are one or more vibrating elements. There are preferably two of these elements on the beam, designated generally as 11 (see Fig. 1) and they are the well-known type of construction having a housing through which extends a shaft on which is secured an eccentric weight (not shown), but such as shown and described in McCullough Patent No. 2,323,749, granted July 6, 1943. In Fig. 1 the shaft is designated 11a, and the shafts of the two units are connected through a connecting shaft 12 having universal joints at each end so that both vibrators are operated in unison and they are set so that their eccentric weights move in isochronism whereby the vibratory effect exerted is uniform along the length of the beam. One of the elements 11 has the other end of its shaft 11a coupled to a drive shaft 12', this drive shaft being connected through universal joints with a pulley 13 (see Fig. 2).

The beams or conditioner assembly 4 has transverse leaf springs 14 secured thereto across the top thereof at spaced points (see Fig. 3), and these leaf springs have links 15 at each end which are hung from transverse extension projections 16 on vertical slide blocks or shoes 17. These shoes or slide blocks are received in vertically extending guideways 18 in a supporting or carrier beam designated generally as 19, and which is shown as being comprised of parallel structural sections 20 and 21 extending across the full length of the back of the machine, the sections 20 and 21 being transversely connected at intervals to provide a box-like rigid structure. There is shown in Fig. 2 a step or running board 22 suspended by brackets 23 at the back of this carrier beam on which an operator may stand or by means of which an operator may walk from one side of the paved area to the other. Attached to the top of the structural sections forming the guideways 18 (see Fig. 3) is a transverse supporting member or bridge 24. A threaded rod 25 pivotally connected at 26 to the top of the shoe 17 passes upwardly through the bridge 24, and nuts 25a are provided so that the conditioning member 4 can be selectively elevated or lowered to a desired level with reference to the level of the screed 3.

The supporting or carrier beam 19 is hung from the back of the paving machine designated generally as 27 by parallel links 28 whereby the whole assembly heretofore described can be elevated above the road surface when the machine is being transported from one place to another, or for any other reasons which may be necessary. The pulley 13 mounted on the carrier beam 19 is driven by a belt 29 from a pulley 30, and the pulley 30 is associated with another pulley 31 which in turn is driven by a belt 32 from a pulley 33, and the axis of the pulley 33 is close to the axis about which the beam assembly is raised and lowered through the parallel linkage referred to. By reason of the arrangement just described the distance between the centers of various pulleys to each other remains constant at all positions. The pulley 33 is in turn driven by another belt 34 from a pulley 35 on a driven shaft 36 forming part of the paving machine. By reason of the arrangement described, when the machine is in operation, motion is transmitted from the shaft 36 through the various belts and pulleys to drive the vibrators 10, and it will be noted that because of the resilient suspension provided by the leaf springs 14, the conditioner assembly 4 may vibrate vertically. The various universal joints allow for the vertical adjustment and relieve vibrating stresses. The parts of the machine so far described are known and are here described for a more full understanding of my invention.

As pointed out above, it is proposed in the aforesaid Balliet application to provide a series of spaced fingers along the conditioning member at regular intervals, these fingers being sloped downwardly and rearwardly for transmitting vibratory movement from the conditioner into the concrete to a depth well below the surface. However the mounting of fingers at the bottom of the conditioner as proposed by Balliet posed a considerable problem due to the fact that fingers so secured on the bottom skin of the conditioner would tend to distort the bottom and cause a rapid flexing of the metal in the bottom, such as to stress the metal particularly under rapid vibration and thereby very materially reduce the useful life of a conditioner or a tearing out of the fingers. This difficulty is eliminated in the present invention. In the drawings the construction of the fingers is best shown in Fig. 4. These fingers are designated generally as 40, and as shown they incline downwardly and rearwardly from a point immediately under the bottom of the conditioner to a considerable depth, and to a point beyond the rear edge of the conditioner. According to the present invention each finger is provided with an upwardly-extending shank 41 that passes through an opening in the bottom plate 5 and through an opening in the bottom 9a of the U-shaped member 9, and also passes through an opening in the web of the heavy metal section 10. The upper end of the shank 41 of each of the fingers is welded where it passes through the web of the rigid section 10, and the finger is also welded to the outside of the bottom of the skin covering 5 as indicated at 42. The finger itself may be formed either of a solid rod or as shown, from hollow tubing, and a hollow tubing is preferred since it will have the required rigidity and substantially less weight for a given diameter. The lower end of the finger may have a plug 40a welded into the bottom end thereof, and there may be a plug 40b in the top end of the finger for excluding water and dirt from the top of the finger.

The operation of the machine is fully described in the aforesaid Balliet application, but in a general way, as shown in Fig. 5, the spreader 2 first distributes the concrete over the sub-grade between the side forms, after which the concrete is scraped off to a predetermined depth by the screed 3. Closely following the screed 3 is the vibrating conditioning member 4 with the rigid fingers 40 projecting from the bottom thereof into the concrete to a depth well below the surface, but above the sub-grade over which the concrete is spread. In operation a

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slight surplus of concrete is maintained at 4a in front of the conditioner, and the overall arrangement is such that as the machine travels along the forms in the direction of the arrow shown in Fig. 4, the concrete which has been spread by the spreader 2 is scraped by the screed 3 and then conditioned and smoothed by the rapidly vibrating conditioner 4, while the fingers 40 serve to carry the vibrations deep into the concrete.

It will be seen that as the fingers travel through the concrete in the direction of the arrows shown in Fig. 4 or toward the right in Fig. 5, a considerable pressure is exerted against the under sloping faces of the fingers, creating forces which would tend to swing the fingers in a clockwise direction as viewed in Fig. 4, i. e., upwardly about the axis of rotation, extending parallel with the axis of the conditioner 4. Likewise as the fingers are moving up and down in the concrete, forces are exerted against the under side of the fingers which are transmitted upwardly against the bottom of the conditioner, and which likewise would tend to rotate the conditioner about an axis parallel to its own longitudinal axis. If the fingers were secured only to the bottom of the skin 5, this would impose a great stress on the thin metal shell of the conditioner, but with the present invention, by having the shank of the finger extend upwardly through the conditioner and having it firmly welded or otherwise secured to the rigid section 10 and the bottom of the conditioner provide vertical rigid vibration transmitting connections and strengthen the conditioner. Thus my construction serves not only to transmit the vibrations from the beam 10 undamped into the concrete, but does so in a manner which avoids any rapid flexing or undue stressing of the bottom of the skin sheet 5 itself.

While I have heretofore contemplated the provision of a tubular sleeve or holder around the shank 41 (as disclosed for example in the Balliet patent application), I have found that such a sleeve is unnecessary with the construction shown in Fig. 4, and it is possible to use a finger of larger diameter with the same size of opening in the web of the section 10 where such a surrounding sleeve is omitted.

While I have shown and described one specific form of finger and mounting therefor, it will be understood that various changes and modifications may be made so long as the finger is provided with a vertical shank which passes through the bottom skin plate of the conditioner and is firmly mounted in and attached to the web of the rigid section 10 of the conditioning member.

I claim:

1. A conditioner for smoothing and vibrating concrete by movement over the surface thereof comprising a rigid metal section which extends longitudinally of the con-

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ditioner, a metal skin forming a hollow shell substantially coextensive with the rigid metal section having a flat bottom portion spaced downwardly from the rigid metal section and upturned sides secured at their upper edges to said rigid section, means for vibrating the conditioner vertically, and fingers on the conditioner each having an upper shank portion passing through the bottom of the shell and rigidly secured at its upper end to said rigid metal section, and each having a finger portion projecting angularly from the plane of the bottom of the shell, which finger portion is designed to penetrate and move through the concrete on which the flat surface of the shell is engaged.

2. A conditioner for smoothing and vibrating concrete as defined in claim 1 in which the shank of the finger is also welded to the metal shell where it passes through the shell so that the shank forms a rigid connection between the said metal section and the flat bottom of the shell.

3. A conditioner for operating upon the surface of concrete by movement thereover while being vibrated vertically comprising a metal skin plate shaped to provide an elongated member having a flat bottom, rounded sides, and having its edges bent upwardly and inwardly to provide a restricted top, a rigid metal section set between said edges above the flat bottom and to which the edges are secured, and a series of spaced finger members on the conditioner, each finger member having a shank portion welded at its top to the rigid metal section and passing vertically through the flat bottom of the metal skin plate and being welded also to said skin plate, said finger members having downwardly-projecting rearwardly-sloped portions below the flat bottom of the skin plate adapted to penetrate the concrete over which the conditioner moves, and means for vibrating the conditioner vertically.

4. A conditioner for operating upon the surface of concrete as defined in claim 3 wherein the rigid metal section comprises an H beam and the upper ends of the shanks of said fingers are passed through the web of the H beam and are welded thereto.

5. A conditioner for operating upon the surface of concrete as defined in claim 3 wherein there is a U-shaped channel inside the skin plate having the bottom of the channel bearing against the interior of the flat bottom of the skin plate and having its side flanges welded to opposite faces of said rigid metal section, the shanks of the fingers also passing through the bottom of said channel and passing also through the said rigid section and being welded to the top surface of the rigid section.

6. A conditioner for operating upon the surface of concrete as defined in claim 3 in which the fingers are of tubular section, and wherein the lower end of each tubular finger is provided with a plug.

References Cited in the file of this patent

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