Jan. 16, 1940. J. N. HELTZEL 2,187,080

ROAD BUILDING MACHINE

Filed Nov. 21, 1935 5 Sheets-Sheet 1

FIG. 1.

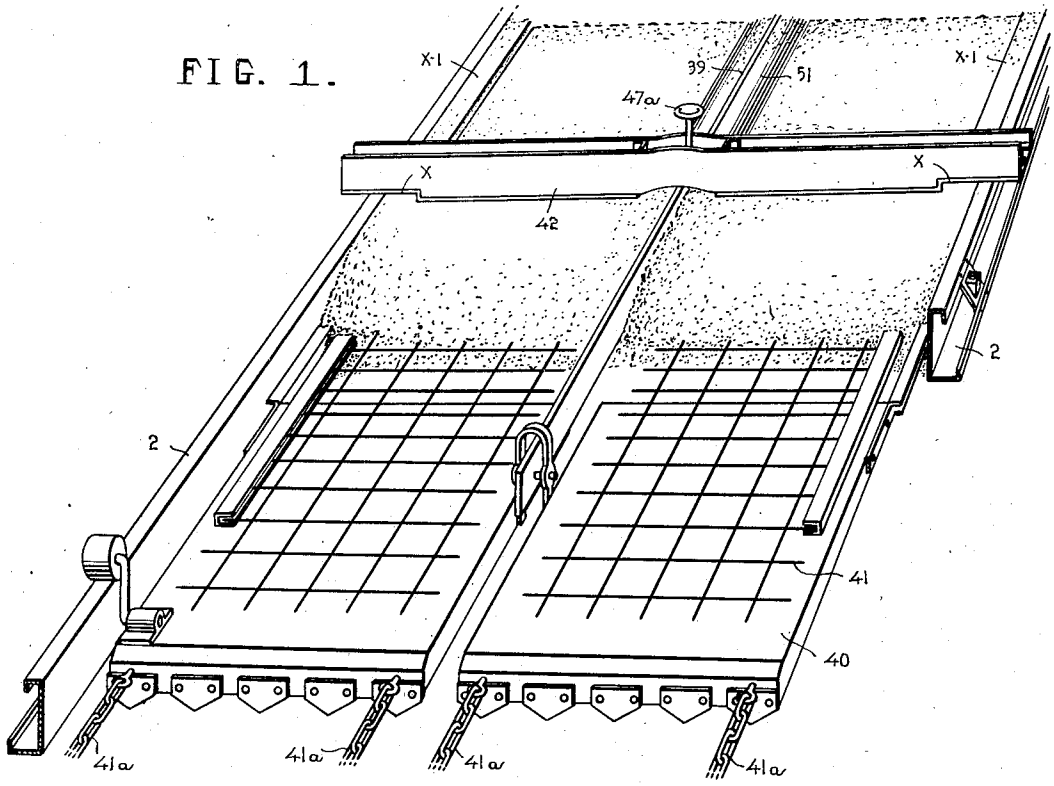
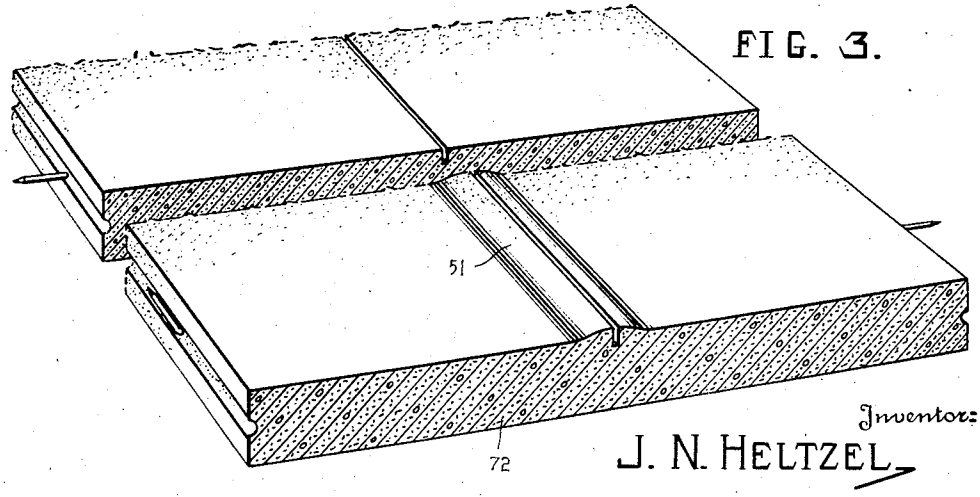


FIG. 3.



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ROAD BUILDING MACHINE

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FIG. 2.

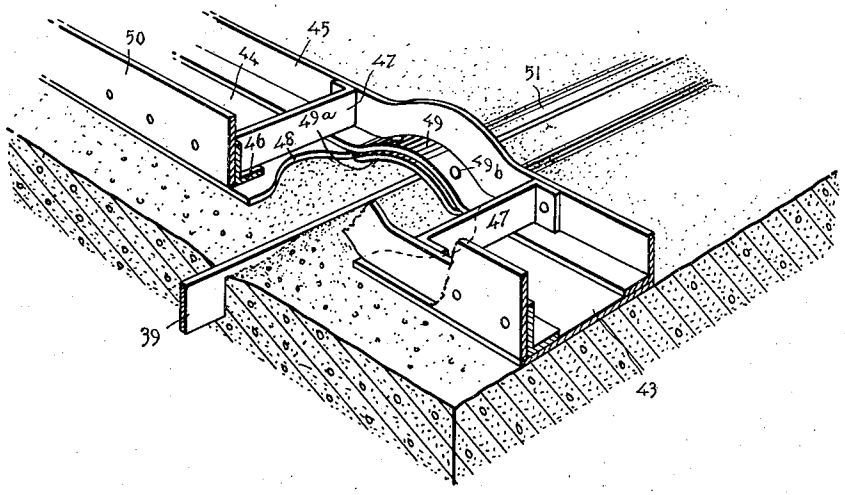
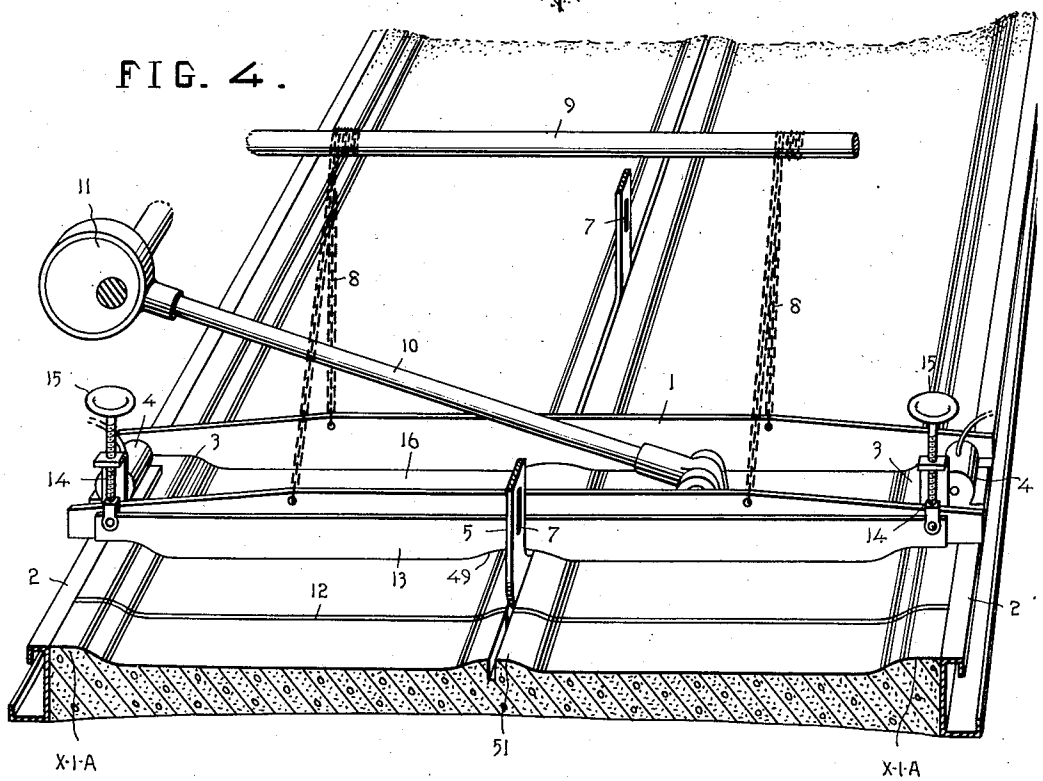


FIG. 4.



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ROAD BUILDING MACHINE

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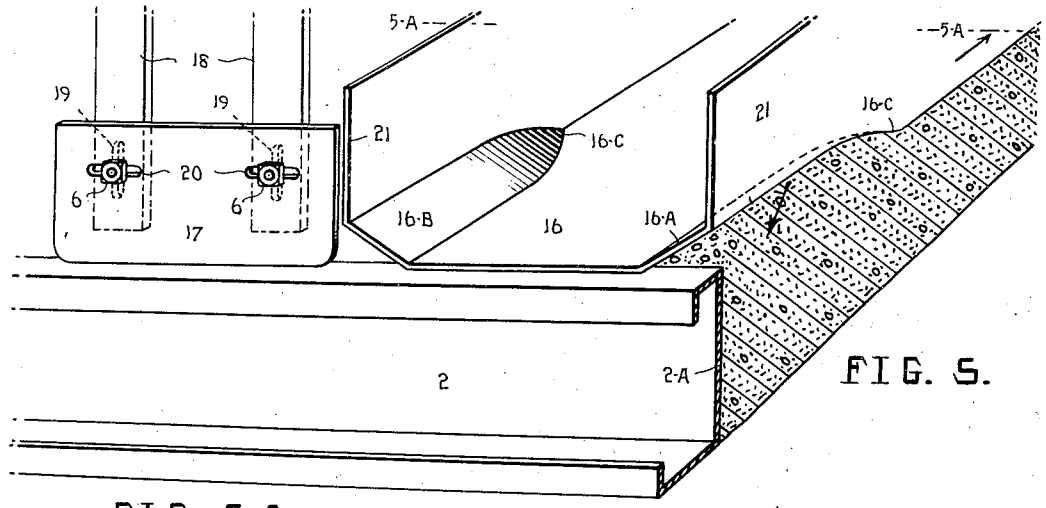


FIG. 5.

FIG. 5-A.

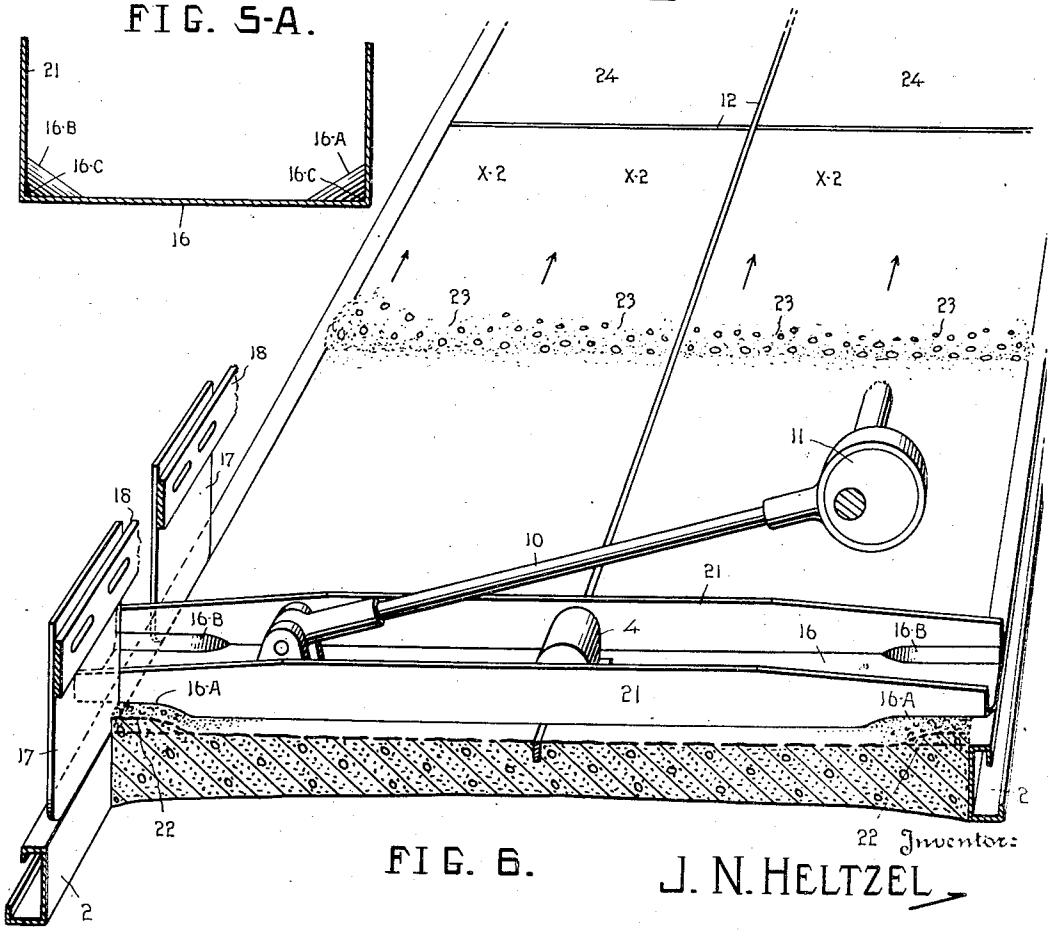


FIG. 6.

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ROAD BUILDING MACHINE

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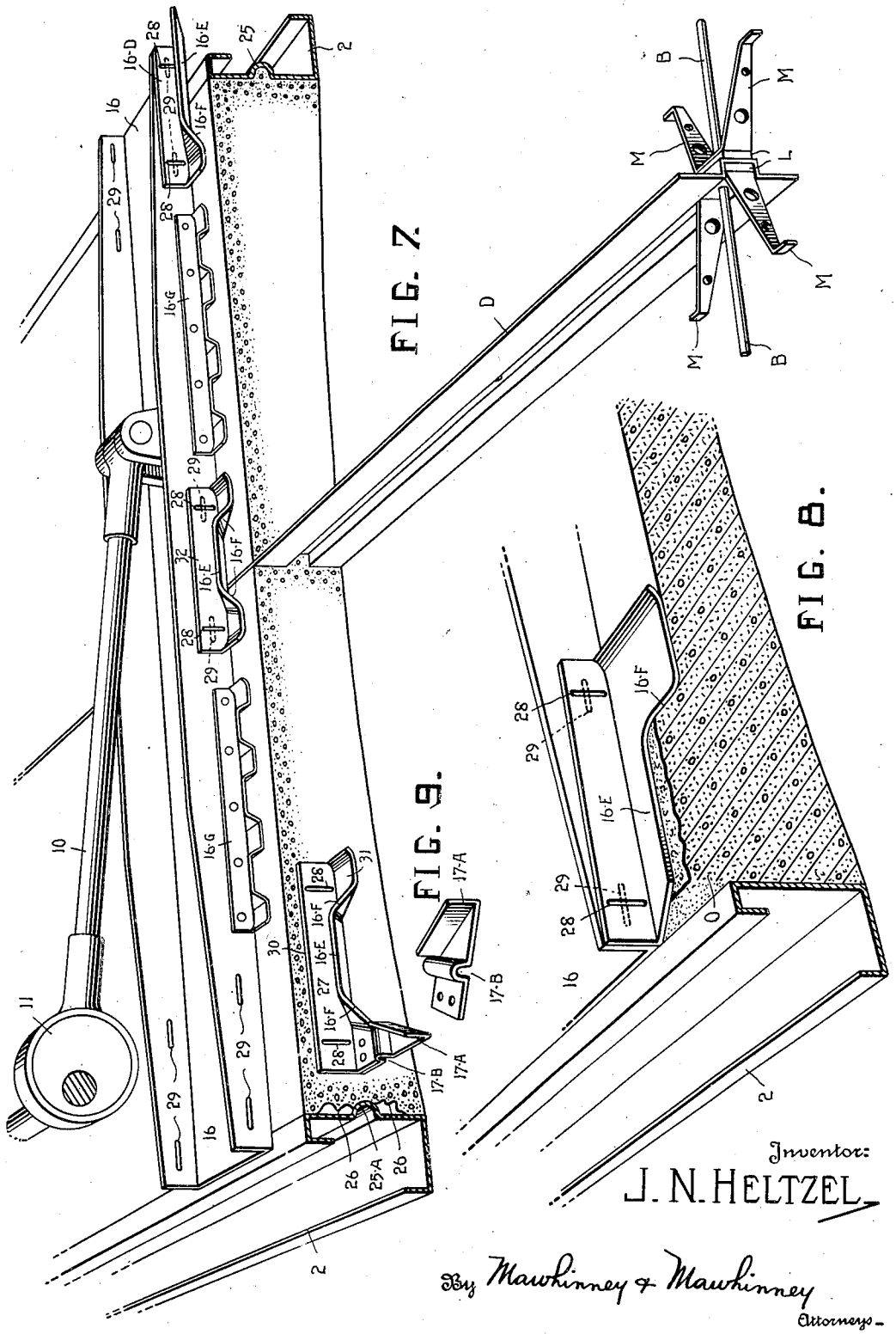


FIG. 7.

FIG. 8.

FIG. 9.

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ROAD BUILDING MACHINE

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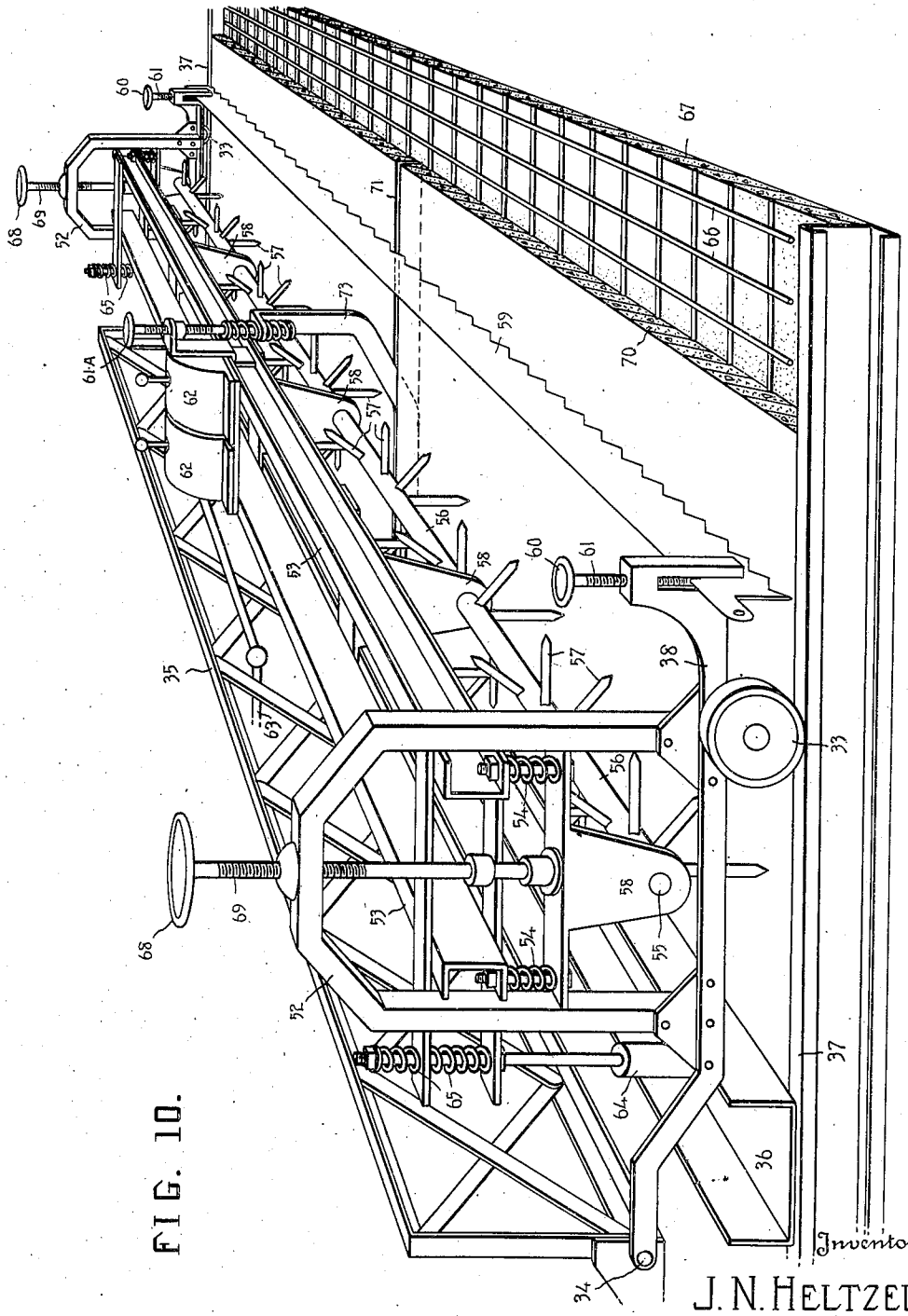


FIG. 10.

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Patented Jan. 16, 1940 2,187,080

UNITED STATES PATENT OFFICE

2,187,080

ROAD BUILDING MACHINE

John N. Heltzel, Warren, Ohio

Application November 21, 1935, Serial No. 50,934

6 Claims. (Cl. 94—45)

The present invention relates to improvements in road building machines and is a continuation in part of my prior application for Road making machines, Serial No. 475,492 filed August 15, 1930.

An object of the present invention is to provide an improved method and device for producing curb formations at the edges of a concrete road adjacent the side forms.

Another object of the invention is to produce a raised central portion in the road in and about the zone of the joint to reinforce and strengthen the material at the sides of the joint and the road slabs whereby to avoid spalling off of the plastic material.

A further object of the invention is to provide an improved form of screed and method of hanging or suspending the same whereby the screed, in addition to operating in its normal transversely reciprocating manner, may be given a rocking motion on its suspension whereby to compact the concrete in a novel way.

It is a still further object of the invention to produce an improved screed or finishing implement capable of forming "lip" curbs.

A still further object of the invention is to produce an improved screed or finishing implement for the purpose of preventing honey-combing of the concrete at the sides of the road adjacent the side forms by compacting the concrete downwardly to fill up such voids as would otherwise be apt to occur.

Still further objects of the invention are to formulate a novel character of screed or finishing implement constructed to compact excess loose material at the sides of the road downwardly beside the side forms on both forward and rearward movements of the implement and also upon lateral reciprocating movements of such implement; to provide guards for the sides of the machine to prevent the loose aggregate from spilling over the side forms; to provide detachable devices at either of the sides and/or in the center of the screed for producing compacting effects upon the concrete at the sides and center portions of the slabs.

With the foregoing and other objects in view, the invention will be more fully described hereinafter, and will be more particularly pointed out in the claims appended hereto.

In the drawings, wherein like symbols refer to like or corresponding parts throughout the several view,

Figure 1 is a perspective view of a road building machine constructed in accordance with the present invention.

Figure 2 is a fragmentary perspective view, with parts broken away and parts shown in section, and illustrating the central arched construction of the screed.

Figure 3 is also a fragmentary perspective view showing the finished form of slab.

Figure 4 is also a perspective view with parts of the roadway and side forms shown in section, illustrating a modified form of road building machine.

Figure 5 is a similar view showing a modified form of screed and guard plate.

Figure 5—A is a cross-section taken on the line 5—A—5—A of Figure 5.

Figure 6 is also a perspective view with portions of the roadway shown in section and the side forms broken away, illustrating the same form of screed with guard plates at the front and rear of the same.

Figure 7 is a similar view showing a modified form of screed in which the compacting devices are detachable.

Figure 8 is a similar view showing the compacting member in place.

Figure 9 is a perspective view of a part of the compacting member separated from the screed, and

Figure 10 is a perspective view of a finishing machine having the novel features of this invention applied thereto.

Referring more particularly to Figures 1, 2 and 3 of the drawings which correspond to Figures 6, 7 and 8 of my prior co-pending application Serial No. 475,492, platforms 40 are shown with reinforcing mesh 41 thereon. The platforms 40 are linked, as by the chains or other connections 41, to the subgrader or other machine by which the same are drawn along. The mesh 41 may be laid on the platforms 40 and, as the pouring of the concrete progresses, the platform or platforms 40 are drawn from under the mesh.

After the concrete has been poured and the mesh reinforcing installed, the screed member 42 follows, which screeds off the concrete.

The screed is shown more particularly in Figure 2 and is composed of divided base plates 43 and 44 having the side angle irons 45 and 46, between which are arranged the braces 47. The base plates 43 and 44 are separated and indented, as indicated at 48; and the angle bars are arched upwardly at a central point between the two base plates, as indicated at 49. At 50 is shown the screeding bar which encounters the concrete, this bar resting upon the base plates 43 and 44 and against the vertical web of angle irons 46.

The recessed and arched screed will supply a surplus of material in the center of the road along the joint blade 39. In both Figures 1 and 2 the raised central portion of the concrete is indicated at 51, this raised portion being formed as the screed passes over the concrete.

The screed member 42 follows progressively back of the pouring. This screed member will preferably be a mechanically-operated screed having an eccentric, as hereinafter described, for reciprocating the screed transversely of the roadway.

The screed has the arched portion 49 as heretofore referred to. This arched portion may be completely closed on the bottom face so as to prevent any material from projecting through the screed, or it may be provided with the opening 48 which will permit surplus mortar to project through the screed to be deposited in the rear of the screed, as indicated at 51. The screed has adjusting screws 47a to vary the arched portion 49. There is an offset x at either or both ends of the screed to produce a header or curb x—1 along the edge of the road.

In Figure 2, I have shown more fully the opening in the screed, together with the arched members. The rear member 45 of the screed may be raised slightly more than the front member 46. It will be understood that the front member will depress the stone or coarse aggregate below the surface and the finer material will accumulate in the open space 48. As the screed moves forward, the finer material will project in the rear of the screed, as shown at 51.

The open space 48 may be provided with sides or braces 47 to retain the surplus material within the space 48. The joint forming member or joint material 39 is shown in place after the joint installing operation has been completed. This elevated joint 51 will eliminate the low joints which have been experienced from time to time where the plain or regular surface type of screeds have been used. The recess in the screed may be varied by adding filler plates 49a secured by bolts or suitable fastening means 49b.

In Figure 3, I have shown a slab of concrete molded as it would appear in complete form. The raised portion of the slab 72 along the longitudinal joint is indicated at 51. It will be understood that this raised screed member may be used in connection with any type of longitudinal joint forming a raised portion to guide traffic and prevent surface water entering the joint.

It is desirable in many instances to form a curb or header, such as indicated at x—1 in Figure 1, sometimes at both sides of the road, and in other cases only on one side of the road. This curb is sometimes called a "lip" curb.

The object of forming the curb by the screed member 42 is to provide means whereby the concrete contained in the curb or header is built integrally with the base portion of the roadway. This is accomplished by offsetting the lower face of the screed as indicated at x.

It will be understood that the screed is reciprocated transversely in the conventional way well known in the art. After the concrete header or curb has been formed by the reciprocating screed, suitable temporary forms may be positioned to support the concrete curb until the concrete has hardened sufficiently; thereafter, the forms may be removed. The forms referred to are of a type well known in the art.

It will be understood that the screed 42 reciprocates transversely in the conventional manner and is pushed forward progressively with the movement of the conventional finishing machine to which my improved screed may be attached.

Referring more particularly to Figure 4, there is shown a method of forming what is generally termed "lip" curbing, as indicated at X—1—A by the use of the laterally-reciprocated screed member 1. This screed may be carried forwardly and backwardly by the conventional finishing machine. This screed is provided with depressed portions 15 at opposite sides of the raised center. The screed rests on the side forms 2 and is arched upwardly, as indicated at 3 to the contour of the lip curb X—1—A. The distance between the arched or upwardly curved ends 3 of the screed is less than the distance between the lip curbs at opposite sides of the road to give the screed an opportunity to reciprocate laterally across the road without destroying the lip curbing and to better compact the same.

Also the arched central portion 49 of the screed is struck on a greater radius of curvature than the resultant raised central portion 51 of the roadway, the reciprocating action of the screed compacting the material at opposite sides of the joint.

Either mechanical or electrical vibrating devices 4 may be provided on the screed to vibrate the screed as the screed is reciprocated and pushed forward to strike off the concrete level with the tops of the forms 2 and simultaneously build up the lip curbing.

The machine is arranged for forward and backward screeding. The screed member may rest on the side forms 2 for back screeding, and to simultaneously form the lip curb with the backward movement of the machine in the same way as it would in the forward movement of such machine.

A longitudinal joint cutting blade 5 may be positioned under the screed as shown more particularly in my prior Patent No. 1,982,337, granted November 27, 1934. The joint cutting blade is provided with slots 7 to permit up and down movement of the blade when the screed is raised out of position by the lifting chains or other suitable devices 8. Such lifting members 8 are provided on each side of the screed and are carried up to the frame of the machine, being wrapped or wound around the pipe member or shaft 9, which is secured to the frame of the machine in the conventional manner.

By rotating the pipe member or shaft 9, the screed may be raised and lowered with respect to the surface of the roadway. It has been found to be very practical to raise the screed approximately six inches above the side forms when making the first strike off of the concrete, and while the screed is thus elevated to reciprocate the same by use of the arm 10 and eccentric 11 or other means, such eccentric being operated by a suitable power unit carried by the machine.

The vibrators 4 may also be operated to vibrate the screed during the operation of the initial strike-off of the material.

It is very important at this stage of the operation to understand that, when the screed is suspended on the chains 8 and reciprocated laterally by the eccentric 11, the screed will swing on an arc having a radius with pivot point at 9. Such screed motion will produce a tamping action on the concrete, and in this way the screed will serve as a tamping member, as well as a screeding member.

By operating the screed in the various man-

ners above described there will result a maximum amount of compaction to the concrete. Therefore, a very dry concrete may be used.

Modern specifications require transverse contraction joint. Such a joint is indicated at 12. A transverse joint may be produced by the blade member 13 positioned adjacent the front of the screed. The lower edge of the blade is cut to the contour of the lip curb. The blade 13 is supported and movable up and down by the screw members 14 or other devices, the same being manipulated by the hand wheels 15.

It will be understood that, when cutting the transverse joints 12, the forward movement of the machine is stopped and the ends of the screed rest on the side forms 2. The screed may be reciprocated laterally and also vibrated by the vibrators 4 as the blade 13 is moved downwardly into the concrete by the hand wheels 15 and screw members 14. It may be desirable in some cases not to reciprocate the screed when cutting the transverse joints. Instead, the joint may be produced by moving the blade 13 down into the concrete progressively while the screed is vibrated by the vibrators 4.

In practice it has been found that forms are not required for supporting the lip curb, as indicated at X—1—A, because of the fact that the curb is of a rather flat construction. However, when curbs are produced with a vertical face, as indicated in Figure 1, it is necessary in such cases to support the face of the curb by suitable form members which are positioned back of the screed after the curb material has been formed or moved up into position.

Referring more particularly to Figure 5, this figure illustrates a modification of screed construction wherein a reciprocating screed is provided with a flat base portion 16. Such flat portion rests on top of the side forms 2 on both sides of the roadway. The bottom portion 16 constitutes a wide surface and may be arched to conform to the required crown of the roadway; thus, the bottom portion 16 of the screed may perform the function of producing the finished surface of the concrete.

It has been found in practice in building concrete roads that honeycombing or voiding has not been overcome by the conventional design of screeds heretofore used. It has been necessary, therefore, for workmen to spade the concrete along the side forms; however regardless of the spading of the concrete along the side forms, this voiding or honeycombing along the inside face of the forms has never been overcome, but it has compelled engineers to provide a thickened edge adjacent the side forms. I have overcome the necessity of hand spading along the edge of the forms by providing upwardly-flared walls 16—A at the forward portion of the screed, and similar upwardly-flared walls 16—B at the rear edge portion of the screed. These upwardly-flared walls terminate inwardly from the ends of the screed at points designated generally at 16—C, which may be approximately six to twelve inches inside of the side forms. When the screed is moved forward against the accumulation or body of loose concrete, the upturned wall 16—A will form a raised portion along the side forms; in other words, an excess amount of concrete will be positioned along the side forms. The volume of this material will be controlled by the height of the flare 16—A. As the screed moves forward, and is reciprocated, the bottom surfacing portion 16 of the screed forces this excess material downwardly level with the top treads of the side forms 2. The walls 16—A and 16—B flare or incline not only in a forward and rearward direction but also transversely of the roadway downwardly to the terminal points 16—C whereby these shoulders or transversely inclined or rounded end parts 16—C thrust the excess material laterally toward the side forms and in a downward direction as indicated by the arrow in Figure 5. This has the effect to pack the concrete against the vertical face 2—A of the side form 2.

The flared or inclined walls 16—A and 16—B are not carried continuously across the front or rear faces of the screed, and these walls may or may not be integral with the screed. Separate wall structures are shown in connection with subsequent figures of the drawings.

The screed 16 is reciprocated transversely of the roadway and is powered for backward and forward screeding, for instance in the manner shown and described in my co-pending application Serial No. 369,475 filed October 25, 1932. Owing to this backward and forward movement, the front and rear parts of the screed carry the flaring or inclined walls.

In the forward motion of the screed, the front flared walls 16—A virtually forms a raised curb. This curb portion is then forced down and compacted by the flat surfacing portion 16 of the screed. On the rear movement of the screed the opposed flared wall 16—B has a similar effect. After the necessary material has been forced down against the side forms, perhaps there may not be any surplus coarse aggregate with which to contend. When this stage of the operation is reached, the surface of the concrete is then considered to be completely finished, and all of the coarse aggregate that could possibly be forced down along the side forms has already been projected in position, so that, in effect, an armoured edge along the roadway is produced by the compaction of an excessive volume of coarse aggregate longitudinally along the zone of the side forms.

To prevent the coarse aggregate from rolling over the side forms, one or more baffle plates or guards 17 are provided. Such baffle plate may be supported by members 18 secured to the carriage of the machine. Slots 19 in the members 18 admit of the vertical adjustment of the baffle plate; while slots 20 which intersect the vertical slots 19 are useful to allow the baffle plate 17 a longitudinal play within the limits of the horizontally elongated slots 20. Bolts or other fastenings 6 pass through the intersecting slots to bind the baffle plates 17 to the supports 18 in the adjusted position. The two adjustments permit the baffle plate to be moved toward and from the rear vertical face 21 of the screed and also allow the lower edge of the baffle plate 17 to be lifted and lowered with respect to the top tread of the side form 2.

Referring more particularly to Figure 5—A, this figure is a cross-section taken on the line 5—A—5—A in Figure 5. The section looks in the direction of the arrow and shows the other end portion of the screed with the flared end wall sections.

Referring more particularly to Figure 6, this figure shows more comprehensively the screed and the guard plates of Figures 5 and 5—A. The front vertical face of the screed is indicated at 21, and the rear vertical face by a like number. The flared walls 16—A and 16—B are shown at

both ends of the screed. These walls function during both the forward and rear passes of the screed. The excess concrete to be thrust down against the inside faces of the side forms is indicated at 22. In this case two baffle plates 17 are provided. One baffle plate is arranged forwardly of the screed at the side of the roadway, and a second baffle plate follows the screed in substantial alinement with the front baffle. One or more baffle plates may also be mounted at the right hand end of the screed. The baffle plates may be arranged with their lower edges very close to the treads of the side forms, in which case they will prevent any excess material flowing over the top of the side forms. However, the openings immediately under the flared walls will permit excess moisture or water to drain off of the surface of the roadway over the tops of the forms and between the baffle plate 17. This is desirable because excess mortar, moisture or water are apt to produce a scaling effect on the surface of the roadway. Therefore, to prevent this scaling of the surface of the roadway provision is made to drain this excess water or moisture from the surface to the roadway by permitting the water to drain under the flared walls 16—A and 16—B.

The screed is reciprocated by the arm 10 driven by the eccentric 11, which is driven from any suitable source of power preferably installed upon the carriage or bridge. This carriage or bridge may be of a conventional type. A vibrator 4 is shown in this instance as being mounted centrally of the screed. One or more vibrators may be mounted at desired positions along the length of the screed. Such vibrator may be either mechanically or electrically operated for the purpose of vibrating the screed as the screed reciprocates transversely and moves either forwardly or rearwardly over the roadway.

Now the segregation of concrete is corrected by the forward and backward movement of the screed. In Figure 6 a transverse windrow 23 of coarse material is shown. This material has been carried backwardly in the direction of the arrows by the screed during its backward movement and while being reciprocated in contact with the road material. This backward screeding eliminates the necessity of workmen shoveling the required material back to a rearward point which has been the common practice. Backward screeding also serves to thrust the coarse aggregate in a back direction, as well as in a forward direction, and will also thrust the excess material against the side forms during the backward movement, as well as during the forward movement. This forward and backward screeding method has been described in my prior application above referred to Serial No. 369,475. Before the final forward pass of the finishing machine is made, the machine will be backed up to a point as indicated at X—2 in Figure 6, and the screed lowered in position whereby, when the screed moves forward it will reciprocate on the surface of the roadway and pick up the excess material from the windrow 23, carrying such excess material forwardly. The operation is repeated progressively throughout the length of the roadway. The finished roadway is indicated at 24 in Figure 6 and includes the installation of the joints 12.

In cases when an armored surface is desired throughout the entire surface of the road, to provide a harder wearing surface a sufficient quantity of coarse stone or aggregate—preferably dry—may be added by spreading a layer of such coarse stone or aggregate over the surface of the roadway after the concrete has received its initial screeding. Such layer of stone or coarse aggregate may be quite uniformly spread by workmen with shovels.

After this layer of coarse aggregate or stone has been spread over the surface of the roadway, the machine is then moved over the roadway with the screed reciprocating and simultaneously vibrated progressively as the machine moves over the roadway.

The thrust member 16 will engage the stone or coarse aggregate, which has been spread substantially uniformly over the surface of the green concrete and, consequently, thrust down into the plastic concrete—thereby absorbing the surplus moisture and causing the mortar to be thrust around the stone or coarse aggregate and thereby thoroughly coating the coarse material by the combination screeding and vibrating process and attracting sufficient mortar to the surface to completely cover the stone or coarse aggregate and provide a smooth surface finish with the course of stone reposing very close to the top surface of the finished slab to provide a dense or armored surface devoid of surplus mortar—thereby preventing the scaling or peeling off of the top surface of the concrete. The armored surface produced by this method will prolong the life of the roadway by minimizing the abrasion action of the traffic on the surface of the road because of the fact that the top layer of stone serves as an armored surface, which will greatly prolong the life of the road.

Referring more particularly to Figure 7, there is herein shown a modified form of the screed involving the use of removable flared wall members which may be attached to the front or to the rear walls, or both, of the screed. These removable wall members are for packing the material along the side forms 2. Furthermore a central packing member may be affixed to the central part of the screed at the front or at the rear, or both, for the purpose of packing the road material along the center joint.

The object of this device is to prevent the formation of voids or honeycombing as indicated at 26 along the side forms. This honeycombing or voiding is particularly to be noted when the side forms have deformed vertical faces as shown at 25—A. The flared wall member at the left end of the screed has been removed. The wall of the screed is provided with horizontally elongated openings 29 adapted to mate with vertically elongated slots 28 to receive bolts or other fastening means for securing the wall member 27 to the screed. The wall member is designated generally at 27 and is formed with a vertical web or flange 30 and a horizontal web or flange 31. The slots 28 are produced in the vertical web 30, which vertical web is adapted to be placed against either the front or rear wall of the screed.

The removable member 27 carries a baffle plate 17—A to prevent the coarse material from being projected over the top of the side form. Such member 17—A is positioned so as to perform the function of preventing the stone or coarse aggregate from rolling over the side forms; however, the small arched portion 17—B will permit surplus water to drain off over the side forms. This arched portion 17—B will be of such dimensions as to prevent the coarse stone from moving therethrough.

The horizontal flange 31 is formed with a flared or inclined wall 16—E having end wall sections 16—F which incline not only rearwardly as does

the wall section 16—E but also flare downwardly until the same merge with the horizontal flange 31. The wall section 16—E thrusts the material downwardly and the end wall sections 16—F tend to converge the material to the central wall section 16—E whereby the material is compacted downwardly progressively as the screed is moved forward. The end wall section 16—F, owing to their transverse inclination, will also force the material downwardly as the screed is reciprocated by the eccentric 11 and arm 10. This compacting of the concrete downwardly causes the same to fill out against the side forms thus preventing the formation of voids and honeycombing.

On the opposite end of the screed there is shown a modified form of removable wall member, which is not provided with a baffle plate but which contains the inclined wall sections 16—E and 16—F. The outer wall section 16—F is omitted and this device is so mounted that it bridges over the tread of the side form 2.

In the central portion of the screed is a central detachable member 32 which is in most respects similar to the left end member in that it is adjustably secured in substantially the same manner and is formed with the central inclined wall 16—E and the two inclined end wall sections 16—F made in the lower horizontal flange. This member is not provided with any side baffle plate. The central member is positioned in the center of the screed whereby the wall section 16—E will pack the material on one side of a division plate D, which is sometimes used in road construction. In order to prevent honeycombing, this plate if deformed, requires an excessive amount of hand spading. It will be understood that by the use of the attachment 32 such member 32 will thrust coarse material down along the plate D and compact it to prevent honeycombing along the plate throughout the length of the roadway. It may be desirable to attach thrust members 16G to the screed so as to more thoroughly compact the concrete through the entire width of the road.

The edges of the roadway, as well as the middle, are considered the two weakest points in modern roads. Therefore it is important that the efficiency of the road at these points be increased to the maximum. In order to tie the road slabs together, dowel bars as indicated at B, are used at spaced intervals longitudinally of the road. Associated with the dowel bars are load transfer plates L. These plates have anchor elements M which project back into the slab to hold these plates securely in position. Therefore, the dowel bar B will bear against the shear plates L through which the bars pass and will transfer the load from one slab to the other and will prevent the concrete from shattering due to excessive loading.

Referring now to Figure 8 this figure shows at the left hand end of the screed a device similar to that shown at the right hand end in Figure 6. The recessed portion beneath the inclined walls 16—E and 16—F actually forms a curb O, representing comparatively loose, coarse material, which is progressively compacted by the shoulder or wall 16—E and by the shoulder or wall section 16—F. This curb O is thrust down along the side forms and compacted substantially by the entire weight of the screed and finished with the bottom face 18 of the screed.

Rigid requirements for high strength concrete now being demanded call for further radical improvements in vibrating apparatus. Therefore, in addition to surface vibration as described herein, I propose to attach to the finishing machine an internal vibrated apparatus, which will vibrate the concrete internally prior to the screeding operation, as well as immediately after the preliminary screeding of the concrete. The strength of concrete is greatly depreciated because of the air pockets or minute bubbles as they might be called being trapped in the plastic mass.

In order to dispose of these minute air pockets in the plastic concrete, I provide an internal means of vibration, which may be attached to the conventional finishing machine, of which 35 is the frame of said machine; 36 represents the screed of the finishing machine, which may be of the conventional type or of the improved type illustrated in this application. The screed rests on the side forms 37 and is reciprocated in the conventional manner.

The internal vibrating apparatus comprises frame members 38, which are pivoted to the finishing machine at 34. The frame is provided with wheels 33, which operate on the side forms 37. These wheels 33 are provided with rubber tires so as to prevent the vibrations being carried to the side forms.

There is a vertical housing 52 at each side of the frame. The transverse frames 53 are supported by the housings. The frames 53 are cushioned by the spring members 54. The transverse shaft 55 is supported by the transverse frames 53. There are a series of rotary members 56 supported by the shaft in a rotating position. These members 56 are provided with a series of prongs 57, which are secured to the rotary members 58, which are preferably made of tubular sections. These members 56 rotate by gravity progressively by the forward movement of the machine by projecting these pins down into the plastic concrete to the desired depth. Their contact within the plastic concrete will produce the desired rotary movement of these vibrating elements in and out of the plastic concrete progressively as the machine moves forward.

The shaft 55 and the members 56 are supported immediate of the housings 52 by a series of die frames or brackets 58, which are secured to the transverse members 53 and project down and engage the rotating members 56.

When operating the machine, the concrete is placed on the subgrade of the road and is struck off to the desired height above the side forms by the strike-off member 59, which is arranged to be adjusted up and down to and from the concrete by the hand wheels 60 and the screw members 61.

As the machine moves forward, the concrete is struck off to the desired height and the pins or elements 57 are moved down into the plastic concrete to desired depth and progressively as the machine moves forward vibrations are produced on the beam members 53 by the mechanical vibrators 62, which are actuated by the universal shaft 63, power being transmitted from a suitable power unit positioned on the finishing machine, or if desired, these vibrators may be operated electrically.

It will be understood that a large number of vibrating elements 57 penetrate the plastic concrete and are vibrated progressively as the machine moves forward and these elements pierce the plastic concrete, and as the shaft rotates, the elements are withdrawn from the plastic con-

crete progressively as the machine moves forward. Therefore, substantially all of the air pockets are punctured so the air may be released from the mass of material.

The vibrating elements **57** are pointed at their ends so as to prevent the possibility of depressing any of the coarse aggregate. It is very important that the coarse aggregate remains closely to the top surface of the concrete. Therefore, these vibrating elements are pointed to prevent any possibility of thrusting any of the coarse aggregate downwardly.

Immediately back of the internal vibrating element is positioned a screed member **36**, which reciprocates progressively as the machine moves forward so that the compaction of the concrete by the screed is materially assisted because of the internal vibration of the concrete immediately forwardly of the screed.

In order to induce maximum compaction and assist in the surfacing of very dry concrete, a sufficient number of vibrating elements **64** are supported on the vibrated frame **53** with the spring members **65** to facilitate the required vibration on the screed by the mechanical method.

It will be understood that electrical vibrators may be used in lieu of the mechanical vibrators as illustrated.

It will be understood that the vibrators may remain in position when screeding forwardly or backwardly. Therefore, the concrete may be treated by vibration both forwardly or backwardly as may be desired.

It is important to note that in the construction of concrete roads, involving the use of reinforcing mesh as indicated at **66**, the bottom course of concrete **67** is first positioned and struck off to the proper elevation by the strike-off plate **59** and during the forward movement of the machine—while the bottom course is being struck off, the vibrating elements are moved down into the plastic concrete by the hand wheels **68** and the threaded screws **69** or by some other suitable means.

After the bottom course has been struck off and vibrated, the mesh **66** is then laid and the top course of concrete **70** is placed and struck off to the proper elevation by the strike-off plate **59**. The machine is then moved forward with the vibrating elements **57** moved down into the plastic concrete. The vibrating elements will vibrate the concrete mass internally.

The vibrating elements **57** will more or less contact the reinforcing **66** so that the vibrators will cause vibrations to be carried throughout the reinforcing, as well as throughout the mass of concrete.

It is understood that the strike-off member **59** may also be used for cutting and installing transverse contraction joints if desired.

A longitudinal joint **71** may be produced by suitable joint cutting element **73**. This element may consist of a substantially flat bar as shown, which is secured to the frame **53**, and is arranged for up and down adjustment by the screw and hand wheel **61**—A. The member **73** may be moved down so as to contact the reinforcing steel **66** so that the member **73** will vibrate the steel reinforcing.

I have found that by placing a plurality of bars **73** to the frame **53** it has been found practical to vibrate concrete when used in connection with grids. I have found by this method very uniform vibrations can be supplied to grids and very stiff concrete can be effectively vibrated into the grids for bridge decks, railroad crossings and the like.

When using this apparatus in connection with the installation of grids, the vibrating elements **57** are moved down into the pockets of the steel grids, thereby vibrating the concrete internally and providing means for ejecting the air. When the grids are simultaneously vibrated by the plurality of bar members **73**, it has been found that concrete having no slump whatever is effectively compacted and voiding is entirely eliminated.

It will be understood that this joint cutter is simultaneously vibrated because of its contact with the frame **53**.

It is obvious that various changes and modifications may be made in the details of construction and design of the above specifically described embodiment of this invention without departing from the spirit thereof, such changes and modifications being restricted only by the scope of the following claims.

What is claimed is:

1. In a road building machine, a screed, means to reciprocate the screed, said screed having upwardly-arched central and end bottom portions, a transverse joint forming blade carried to move and reciprocate with the screed and having upwardly-arched central and end bottom edge portions, and means to move the blade up and down with respect to the screed.

2. In a road building machine, a reciprocating surfacing member, means for moving said surfacing member backwards or forwards, and walls carried by the forward and rear portions of the member, said walls being at the end portion of the member only and being flared upwardly in opposite directions from the base of the member, the walls also flaring toward the central part of the member and toward the plane of the working surface of said member.

3. In a road building machine, a forwardly movable and laterally reciprocating surfacing member having inclined longitudinal walls at the end portions only extending over the treads of the side forms and for a short distance inwardly of such side forms and a shield member following the surfacing member and adjustably supported with respect to the rear portion of said surfacing member and to the treads of the side forms.

4. In a road building machine, a surfacing member, means to move the member backwards and forwards, means to reciprocate the member laterally, said member having forward and rear inclined walls at the end portions only thereof for straddling the side forms and extending inwardly for a distance therefrom, said walls being flared forwardly and laterally, shields carried forwardly and rearwardly in close relation to the end portion of said surfacing member, and means to adjust said shields with relation to the treads of the side forms and the adjacent end portions of the surfacing member.

5. In a road building machine, a screed, means to reciprocate the screed, said screed having upwardly-arched end bottom portions, a transverse joint forming blade carried to move and reciprocate with the screed and having upwardly-arched end bottom edge portions, and means to move the blade up and down with respect to the screed.

6. In a road building machine, a screed having an upwardly-arched end bottom portion to

form a curb along the edge of the roadway simultaneously with the formation and surfacing of the plastic material of the roadway, a transverse joint forming blade also having an upwardly-arched end bottom portion, means for adjustably supporting said blade from said screed, means for reciprocating the screed and blade transversely of the roadway, and vibrating means on the screed above the upwardly-arched end bottom portion for vibrating the screed and the cutter simultaneously with the screed from a point above the curb.

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