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3,363,524

CURB EXTRUDING MACHINE

Filed Dec. 28, 1965

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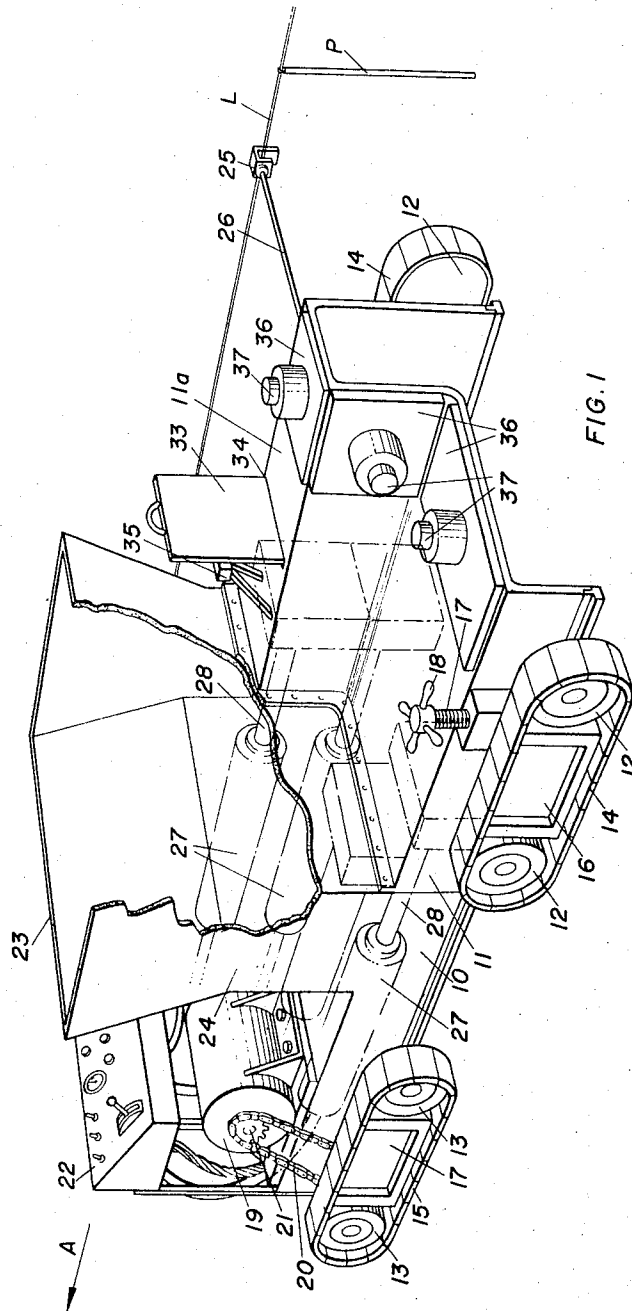


FIG. 1

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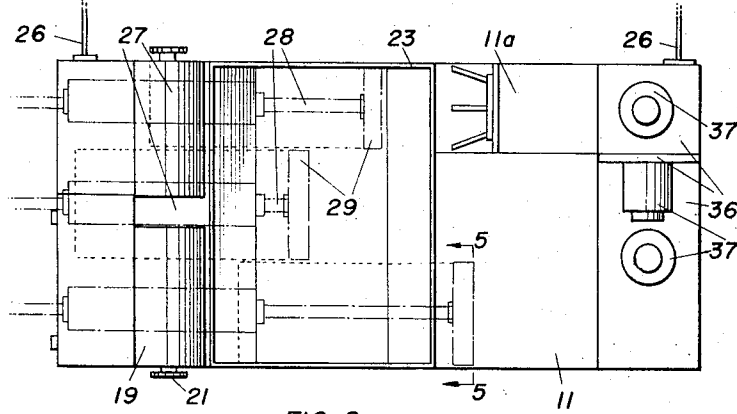
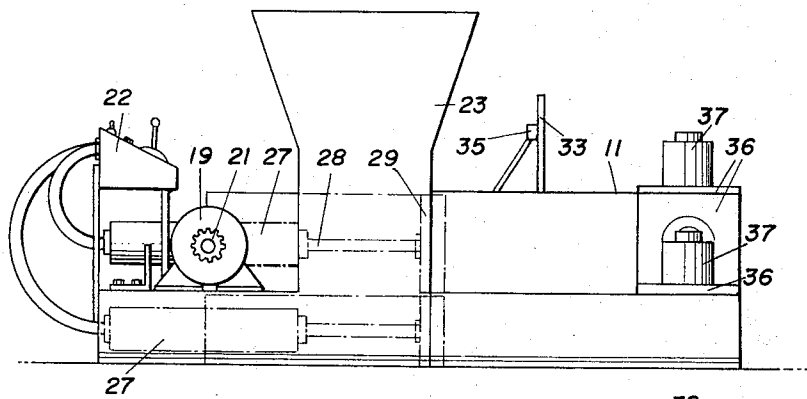
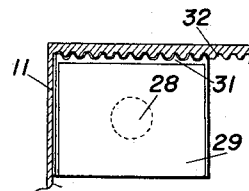
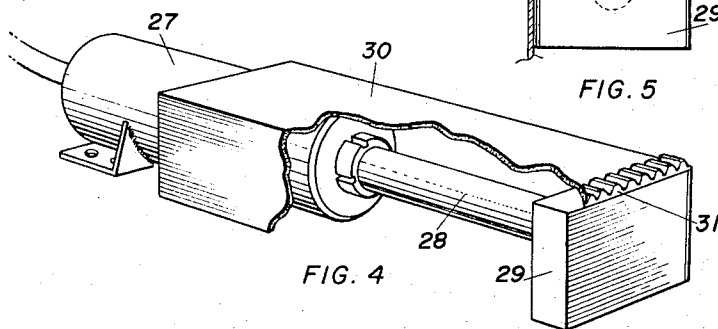
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3 Sheets-Sheet 2



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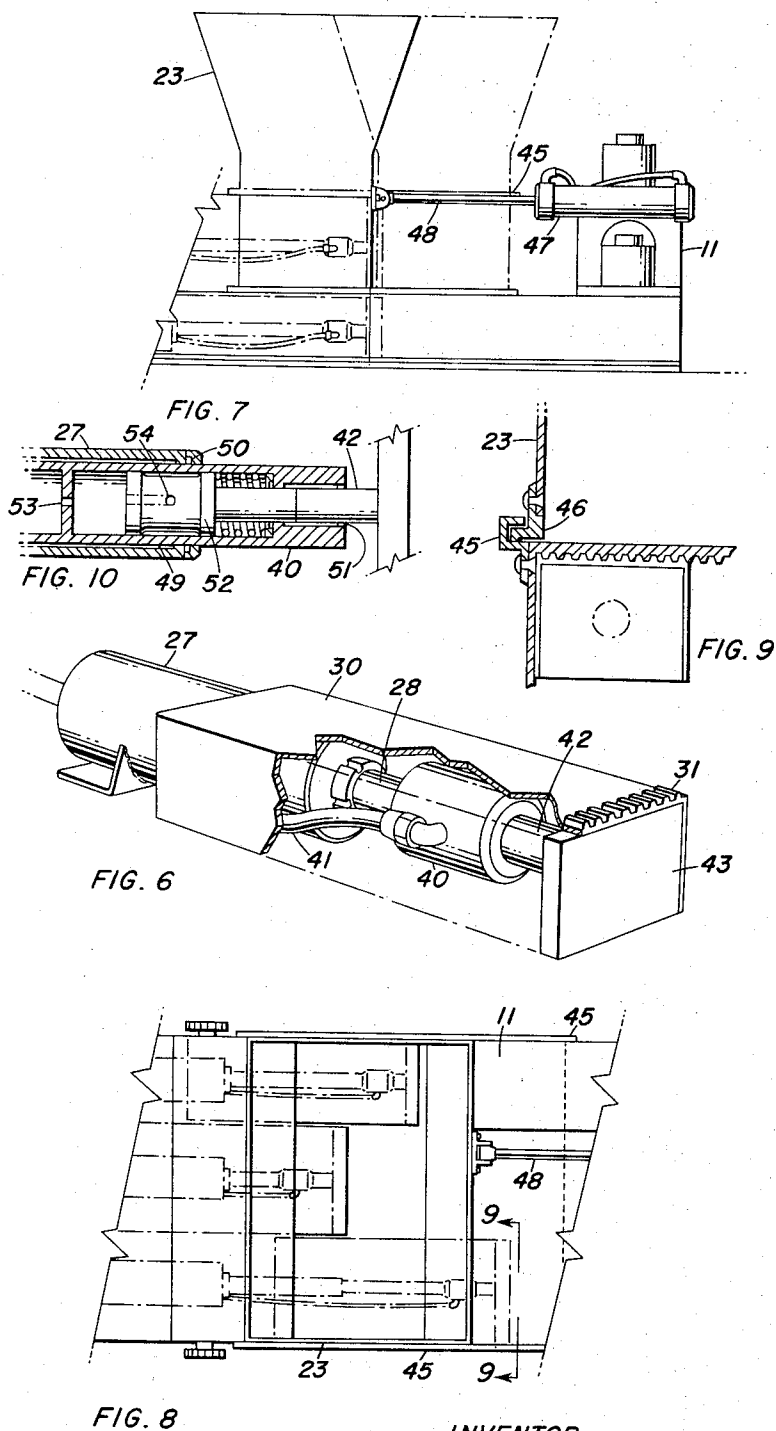
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CURB EXTRUDING MACHINE

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3 Sheets-Sheet 3



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3,363,524

## CURB EXTRUDING MACHINE

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Continuation-in-part of application Ser. No. 472,107,  
July 15, 1965. This application Dec. 28, 1965, Ser.  
No. 524,368

10 Claims. (Cl. 94—46)

### ABSTRACT OF THE DISCLOSURE

This specification discloses a mobile concrete forming machine in which concrete is forced through a mold under compression and is simultaneously subjected to vibration.

The invention relates to apparatus for continuously extruding highway curbs and the like and is a continuation-in-part of United States patent application Ser. No. 472,107, filed July 15, 1965, now abandoned.

The construction of highway curbs and the like out of concrete by hand is a laborious and time consuming process and many attempts have been made to build machines for extruding curbs in place on a highway without the need for arrangement of shuttering or other hand operations. However, the majority of such prior machines have been designed to extrude normal concrete of the type requiring extended drying time and having an appreciable "slump" with the result that either such machines required to be used in association with auxiliary shuttering to support the cement or concrete, or in the alternative, they could only be used in certain limited applications where the shaping of the concrete had a relatively low or flattened profile. Such machines were in general unsuited for operation with "low slump" concrete of the type which dries virtually instantaneously because the latter type of concrete requires to be agitated and preferably compacted under pressure in order to develop its maximum strength, and such prior machines were generally incapable of either applying pressure or of agitating the concrete. In addition, some prior art machines have been designed for mounting on rails or some form of semi-permanent way, the laying of which would take at least as long as the laying of the shuttering for the manual forming of the curb and hence, any advantage achieved by the faster operation of the machine was lost in the set-up time. In addition, such prior art machines have been incapable of permitting the introduction of expansion joints at predetermined intervals along the curb and have not provided means for changing the profile of the curb to permit, for example, the forming of a driveway. A still further disadvantage was that in many cases a hand finishing operation was required to provide a smooth water-proof surface on the upper portion of the curb to provide the maximum resistance to frost and rain water damage with the result that this latter operation had to be done by a gang of workmen following the machine.

It is therefore an objective of the invention to provide apparatus for extruding concrete curbs which is adapted for operation directly on the ground and in which "low slump" concrete may be used to the greatest advantage and both compacted and agitated under pressure and in which the surface of such concrete may be subjected to a finishing operation.

More particularly, it is an objective of the present invention to provide an apparatus having the foregoing advantages in which means are provided for the introduction of expansion joints at intervals along the curb.

More particularly, it is an objective of the present invention to provide an apparatus having the foregoing

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advantages in which means are provided for assisting in the formation of driveways and the like in the finished curb.

More particularly, it is an objective of the present invention to provide an apparatus having the foregoing advantages which is provided with automatic guide means.

More particularly, it is an objective of the present invention to provide an apparatus having the foregoing advantages in which the curb shaping portion of the apparatus may be raised and lowered during operation so as to compensate for any irregularities in the ground surface.

The foregoing and other advantages will become apparent from the following description of a preferred embodiment of the invention which is here given by way of example only and in which like reference devices refer to like parts thereof throughout the various views and diagrams, and in which:

FIGURE 1 is a perspective of the curb forming apparatus according to the invention with portions thereof cut-away and other portions shown in phantom form;

FIGURE 2 is a top plan view of a portion of the apparatus shown in FIGURE 1 with portions shown thereof in phantom form;

FIGURE 3 is a schematic side elevation of the apparatus shown in FIGURE 1 with the parts shown in phantom form;

FIGURE 4 is a greatly enlarged perspective view of a portion of the apparatus for compacting and agitating the concrete; and

FIGURE 5 is an end elevational view partly in section along the line 5—5 of FIGURE 2;

FIGURE 6 is a cut-away perspective view of a further embodiment corresponding to the portions illustrated in FIGURE 4;

FIGURE 7 is a side elevational view of a still further embodiment;

FIGURE 8 is a top plan view of the embodiment of FIGURE 7;

FIGURE 9 is a section along the line 9—9 of FIGURE 8; and

FIGURE 10 is a sectional side elevation of a further embodiment.

From FIGURE 1 it will be seen that the curb extruding machine according to the present invention comprises a main body portion 10 to one end of which may be bolted the curb shaping form 11 of any desired shape and which is interchangeable to provide curbs of different shapes for different highway requirements. The machine is supported on any suitable track laying type of system such as wheels 12 and 13 supporting tracks 14 and 15 and being themselves supported by any suitable suspension means indicated generally as 16 and 17. Adjustment means such as jack screw 17 and hand wheel 18 may be provided for raising and lowering the curb shaping member 11 relative to the tracks 14 and wheels 12. Any suitable motor indicated generally as 19 which may be driven, for example, by electricity, compressed air, or gasoline, is connected by means of chain drive 20 and drive sprocket 21 to one of wheels 13 for driving the machine forwardly in the direction of the arrow A, a similar drive system being provided on the opposite side of the apparatus which is concealed from view and not shown for the sake of clarity. A control panel 22 is provided at the forward end of the vehicle which is accessible to an operator either walking beside the machine or standing upon body portion 10.

A concrete hopper or container 23 is provided above main body 10 feeding downwardly through chute portion 24 thereof which may be continuously replenished by a suitable supply vehicle (not shown) travelling beside the instant apparatus and feeding into hopper 23.

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As is the usual custom in this type of construction, the line of the curb to be layed is defined by means of a string or guide line indicated as L supported on spaced posts indicated as P, these forming no part of the present invention and being shown here by way of explanation. However, in order that the present apparatus may be correctly guided and lay the curb in the desired location, guidance is taken directly off the line L by means of at least two line sensing members 25 provided at the forward and rearward ends of the apparatus (only one being shown here for the sake of clarity) and supported in spaced relation to one side of the apparatus by means of cantilever arms 26. Sensing devices 25 are provided with any suitable form of pressure or contact sensitive electrical means for sensing contact of the line L with one or other side wall of the members 25 and applying a correcting electrical signal to the control mechanism of the apparatus for applying a corrective factor to the guidance system thereof by any suitable means, or, which may merely provide a visible readout to an operator who may immediately make the necessary guidance corrections. It will be appreciated, that the apparatus may be normally moving relative slowly at the rate of possibly one-half mile per hour and accordingly, any such corrections in guidance whether made automatically or by hand will effectively be instantaneous having regard to the relatively slow rate of forward movement of the apparatus and indeed, in many cases, it would be sufficient merely if the guidance error indication were in the form of a bell for example, or a flashing red or green light. However, it is considered desirable that such guidance should be taken directly off the line L which is layed in position by the surveyor of the entire roadway system or under his supervision and control since the possibility of multiplication of error arising from the laying of intermediate guidance systems such as rails or the like is thereby avoided, and in addition, the very considerable expense and wastage of time involved in the laying of guidance rails and the like is thereby eliminated.

As has been stated above, the apparatus according to the present invention is specifically intended for use in relation to "low slump" concrete of a type well known in accordance with the standardized definitions accepted in the art and layed down by specification in the building and contracting trades. As stated, the forming of such low slump concrete into a well finished and highly durable curb requires at least two separate functions namely, in the first place the concrete must be compacted and formed under preferably high-frequency vibratory agitation and pressure, and, in the second place, the surfaces of such curb which are to be exposed to constant weathering should preferably be free of any exposed gravel or large stones and in fact, appear as a completely smooth finished cement surface thereby offering the smallest possible pores.

For this purpose, pressurized agitation means are provided in the form of a plurality of air operated pressures cylinders 27, in this case, four of such cylinders are provided, which are mounted in spaced parallel relationship and connected by suitable means (not shown) to a source of air pressure supply, preferably through control panel 22 which incorporates means for programming the operation of cylinders 27 whereby the same operate in sequence so that only one is withdrawn rearwardly while the other two are moving forwardly or vibrating. Cylinders 27 are each provided with connecting rods 28 extending therefrom at the free end of which is mounted the vibratable pressure plate unit 29 preferably incorporating high-frequency vibratable means which are operable continuously apply a high-frequency vibration for compacting the concrete during its forming and extrusion. Pressure members 29 are provided with shrouds 30 of rectangular shape butted around the periphery thereof and extending rearwardly therefrom over the full extent of connecting rods 28 and overlapping at least a portion of

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cylinders 27 whereby to avoid feeding of concrete behind pressure members 29 when the same are moved forwardly. In addition, pressure members 29 are provided along their upper straight edges with a series of deep serrations or teeth 31 which are shaped and adapted to mate with corresponding indentations 32 formed in the upper surface of the forward end of form 11, the purpose being to provide a combing action to the concrete being formed into form 11 whereby to cause any stones in the concrete being formed to become pressed downwardly into the main body of such concrete thereby leaving an upper surface of substantially pure cement for subjecting to a suitable finishing operation. It will of course be appreciated that while any suitable known form of high-frequency vibration means is considered to be the most desirable system for use in pressure plate units 29, other forms of vibration systems operating at lower frequencies and by a variety of means, both mechanical and even by pneumatic means will be fully effective in many instances and may well prove to be more reliable over periods of extended hard wear.

In order to provide for changing the profile of the curb being extruded, to provide a stepped portion as in a driveway for example, it will be appreciated that the forming of the finished surface of the stepped portion for the driveway will, in general, be beyond the practical limits of the apparatus, but however, it is desirable for the total quantity of concrete being extruded to be as closely as possible equal to the volume of concrete required in the stepped down portion to avoid waste of concrete and to avoid the necessity for substantially altering the shape and molding of the extruded concrete which, will have become set to at least a semi-hard condition by the time it is fully extruded and clear of the apparatus. Accordingly, the mask member 33 of a width equal to the interior width of the vertically upstanding portion 11a of form 11 is slidably insertable into form 11 through slot 34 formed therein for the purpose, and is supported by means of support bracket 35 located and oriented to support the upper end of mask member 33 which would otherwise be forced rearwardly by pressure of concrete thereupon within form 11. It will be appreciated that the location of slot 34 in form 11 is just beyond the extreme forward limit of the stroke of air cylinders 27, and that during the time when mask member 33 is lowered into form 11, the cylinder 27 in registration therewith can, by the operation of suitable control means, be taken out of operation.

In order to provide a smooth finished coat on the extruded concrete, power operated finishing means are provided comprising any suitable rotary or orbital finishing pads (not shown) concealed within housings 36 and operated by means of electrical or compressed air motors 37 continuously applying a polishing or finishing movement to the upper exposed surfaces of the concrete, the other surfaces of the curb being surrounded either by earth or by the finished roadway in accordance with known construction practices.

In operation, hopper 23 is partially filled with low slump concrete in some cases, directly from a "ready-mix" truck which may be driven slowly alongside the apparatus. The operator will then commence cyclical operation of air cylinders 27. Such operation moves each of air cylinders 27 separately in a predetermined sequence whereby three of such air cylinders 27 are applying pressure while only one is withdrawn to gather a fresh charge of concrete from hopper 23. As one cylinder 27 is operated to withdraw connecting rod 28 and pressure unit 29, sleeve 30 slides rearwardly over the respective cylinder 27 thereby leaving a clear space in front of pressure unit 29 which will immediately become filled with loose concrete whereafter cylinder 27 is operated in the reverse direction forcing the connecting rod and pressure units 28 and 29 forwardly drawing with them sleeve 30 once more. This operation pushes the

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concrete forwardly into form 11 and at the same time prevents the movement of any further concrete from hopper 23 downwardly around connecting rod 28. As such forward movement is continued, the vibration means within pressure unit 29 are operated and pressure on the concrete is slowly built up and maintained at a steady level thereby forcing the same along form 11 slowly and steadily. In order to permit such movement to take place, motor 19 will drive the entire apparatus forwardly at a speed just corresponding to the rate of extrusion of concrete from form 11. As the concrete passes along form 11, the combing action of members 32 within form 11 will force any large stones located in the upper surface thereof downwardly while permitting the thinner cement and fine stones to come to the surface. After passage along the length of members 32, the upper inner surface of form 11 flattens out to provide a smooth surface smoothing out the thinner cement and fine stone to provide a fine even upper surface without large stones extending upwardly therefrom and rendering the surface in a highly suitable condition for the finishing operation by means of conventional type known in the art of the rotary or orbital finishing means driven by motors 37. After extrusion from the form 11 it may be necessary for one or two men to conduct a further minor clean-up finishing operation which is only a small proportion of the total manual labor involved in the laying of such curbs by hand and which in any case can be done at a speed equal to or greater than the speed of operation of the apparatus by one or two men only. When it is desired to form a curb with a step-down for a driveway for example, mask member 33 is inserted into slot 34 and supported in position therein by means of bracket 35. The cylinder 27 in registration with mask 33 in the vertically extending portion 11a of form 11 is taken out of operation at the point where its connecting rod 28 and pressure unit 29 are in the forward point of their stroke, shroud or sleeve 30 having been first removed to permit downward movement of concrete from hopper 23 in front of the pressure unit 29 of the cylinder 27 located immediately therebeneath. The operation of the machine will then continue as before although, it will be appreciated that a portion of the curb corresponding to the width of mask 23 will have a rough unfinished surface and will require hand finishing to a considerable degree to provide a smooth and long lasting surface. However, since such driveways will normally be relatively infrequent in relation to the total curb laying operation, such additional finishing operation can readily be taken care of by the machine operators themselves without the requirement of any additional staff.

In the event that uneven ground is encountered, this will normally become apparent from the guidance means 25 contacting the line L and pressing the same downwardly. The moment such a downward movement is detected, jack screws 17 may be operated by hand to raise form 11 in relation to wheels 12 and tracks 14 thereby restoring normal level of curb once more. Similarly, if the guidance system 25 encounters a sideways pressure from line 11 the operator can take immediate corrective action by hand speeding up one or other of motors 19 to bring the apparatus back onto the true direction of the curb once more.

As stated, it is necessary that such curbs be laid at quite frequent intervals with expansion joints of known material such as tarpaper and the like. In the normal hand operation this presents no problem. However, in the case of the present invention, the insertion of such an expansion joint can be performed merely by allowing hopper 23 to become empty and then withdrawing all of connecting rods 28 and pressure units 29 by operating cylinders 27 simultaneously and over-riding their normal sequential operation. Access can then be had to the interior of the whole of form 11 and a suitable pressure joint member can then be inserted after which hopper 23 is filled once more and normal operation is resumed thereby sandwiching the pressure joint in the curb as it is being extruded.

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Again, where such expansion joint has been inserted, it will normally be found necessary that some minor additional finishing operation will be required but again, since this work is intermittent and merely requires trowelling the amount of actual hand labor involved is negligible.

While the foregoing apparatus will be satisfactory in many cases, there will be instances, particularly in the case of a curb having vertical sections of relatively great height, that more vigorous agitation and compacting action will be required. Accordingly, provision may be made for stronger agitation according to the embodiment illustrated in FIGURE 6. In this embodiment, air cylinder 27 and connecting rod 28 are coupled to and axially aligned air operated reciprocating hammer unit 40 of the design corresponding to the well known so-called "jack hammer" as used by construction workers providing a linear axial reciprocating motion in response to a continued predetermined air pressure being maintained which may be supplied as by air hose 41. A hammer shaft 42 extends from hammer unit 40 to hammer face plate 43 which is connected to shroud 30 and provided with serrated teeth 31 along its upper edge as described in connection with pressure unit 29. In this way, continued extrusion pressure is maintained by means of steady pressure in air cylinder 27 as described above, and the compacting vibration action is provided by means of a linear hammering along the axis of shaft 28 by means of hammer unit 40 and hammer plate 43. It is found that this compacting action forces the concrete into the shape of the form of mold somewhat more quickly and forcefully than is the case with high-frequency or other form of agitation and permits also faster operation.

A still further embodiment is illustrated in FIGURES 7, 8 and 9. The laying of extended lengths of curbs, as stated above, requires the insertion of periodic expansion joints, usually formed of tar paper or some such similar material. Such expansion joint material may be inserted in the manner described above. However, it has now been found to be more convenient and expeditious if the embodiments of FIGURES 7, 8 and 9 are used for this purpose. Where the insertion of an expansion joint member previously required the emptying of the hopper 23, there was a tendency for the mold member 11 to be only partially filled resulting in the expansion member becoming displaced from the normal vertical alignment in the curb. Accordingly, this may now be overcome by mounting the hopper 23 on slide rail means indicated as 45 extending along either side of the mold member 11 and engaging a slide lip 46 mounted on either side of hopper 23. Any suitable power operated means may be provided for moving hopper 23 along slide rails 45 such as a further air cylinder 47 connected thereto by the shaft 48.

In operation, when it is desired to insert an expansion joint member (not shown) the hopper 23 may simply be slid forward over mold member 11 along rails 45 thereby exposing the open portion of mold member 11 above connecting rods 28. Air cylinders 27 may then be operated to withdraw connecting rods 28 and pressure plates 43 thereby exposing the face of the concrete in the mold member 11. The expansion joint insert may then simply be dropped into place and the hopper 23 may be slid back over the opening permitting further concrete to fall downwardly thereinto and operation of air cylinders 27 may be resumed once more.

Where it is desired to eliminate the additional flexible hose lengths 41, the hammer unit 40 may constitute the whole of shaft 28, and unit 40 may be extended rearwardly into the interior of cylinder 27, as shown in FIGURE 10. It will be noted that in this case the unit 40 may be provided with side walls 49 extending along the full length of cylinder 27 and provided with piston rings such as 50 for sealing engagement therewith. Shaft 42 is slidably retained as by collar 51 and is subjected to impact shock vibration by free piston 52 reciprocably carried within side walls 49 of unit 40. Air entry port

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53 admits compressed air from within cylinder 27 and ports 54 transfer air from one side of piston 52 to the other in known manner thereby producing a vibrator action.

The foregoing is a description of a preferred embodiment of the invention which is here made by way of example only. The invention is not to be taken as limited to the specific steps described but comprehends all such variations that come within the spirit and scope of the appended claims.

What I claim is:

1. Concrete extrusion apparatus for use in the formation of concrete curbs and the like and comprising: carriage means having front and rear ends; an extrusion mold member at the rear end of said carriage means and defining a concrete flow path therethrough; concrete hopper means communicating with said mold member to pass concrete thereto; at least one pressure member to contact concrete in said mold member; vibration means connected to each said pressure member and operable to cause said pressure member to apply continuous vibration to concrete under pressure within said mold member, pressure cylinder means connected to respective said pressure members and operable to procure reciprocable movement thereof into and out of said mold member and to force said pressure members into contact with concrete therein under pressure.

2. Concrete extrusion apparatus as claimed in claim 1, including rotary surface finishing means incorporated with said mold member and operable to smooth the surface of concrete passing therethrough.

3. Concrete extrusion apparatus as claimed in claim 1, including a mask member adapted for insertion into a portion of said mold member for blanking off the same.

4. Concrete extrusion apparatus as claimed in claim 1, including at least two said pressure members arranged side by side on parallel axes and having respective said pressure cylinder means connected thereto, and control means for said pressure cylinder means cyclically operable in sequence.

5. Concrete extrusion apparatus as claimed in claim 1, including guide means on said carriage means to detect deviations of same from a predetermined path.

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6. Concrete extrusion apparatus as claimed in claim 1, including adjustment means connected between said carriage means and said mold member for raising and lowering said mold member.

7. Concrete extrusion apparatus as claimed in claim 1, wherein said vibration means comprises reciprocable piston means mounted between said pressure cylinder means and said pressure member and is operable to cause said pressure member to apply linear reciprocable shock movement to said concrete in said mold member along the extrusion axis thereof while under pressure from said pressure cylinder means.

8. Concrete extrusion apparatus as claimed in claim 1, including concrete hopper means, and slidable mounting means movably locating said hopper in communication with said mold member.

9. Concrete extrusion apparatus as claimed in claim 1, including concrete hopper means, slidable mounting means movably locating said hopper in communication with said mold member, and power operable means connected to said hopper means for moving same.

10. Concrete extrusion apparatus as claimed in claim 1, including serrations formed in the upper surface of said mold member and complementing projections on said pressure member.

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