Dec. 16, 1958 G. R. FREEMAN 2,864,290

APPARATUS FOR FORMING CONCRETE CURBS AND THE LIKE

Filed April 11, 1955 3 Sheets-Sheet 1

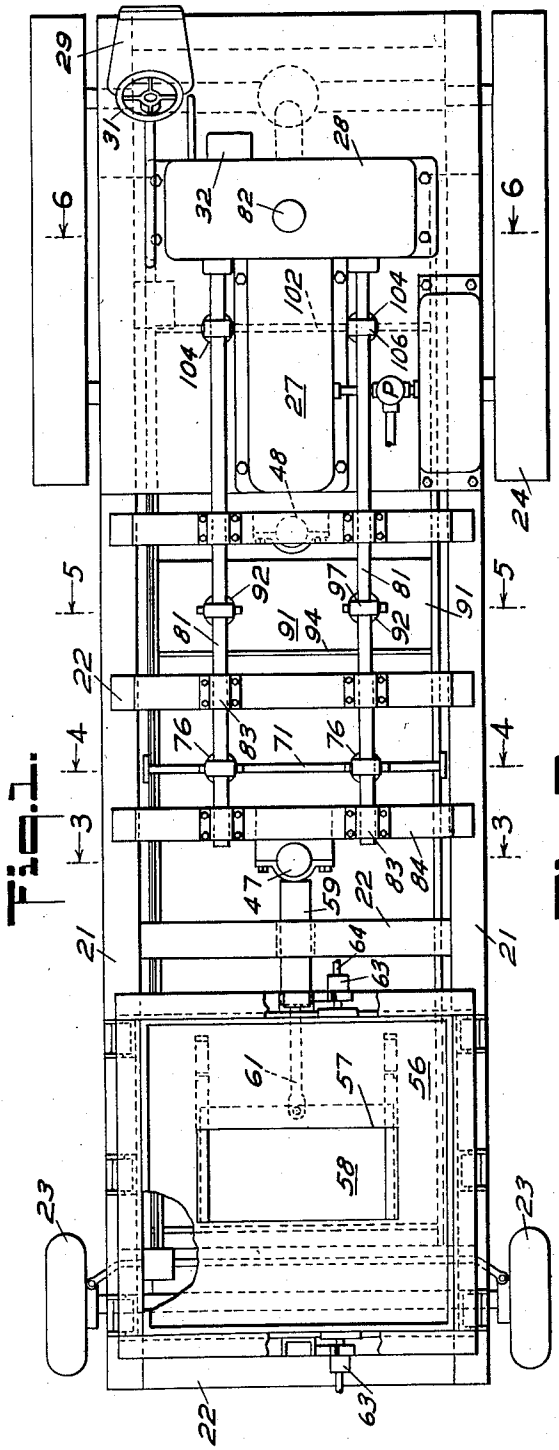


Fig. 1.

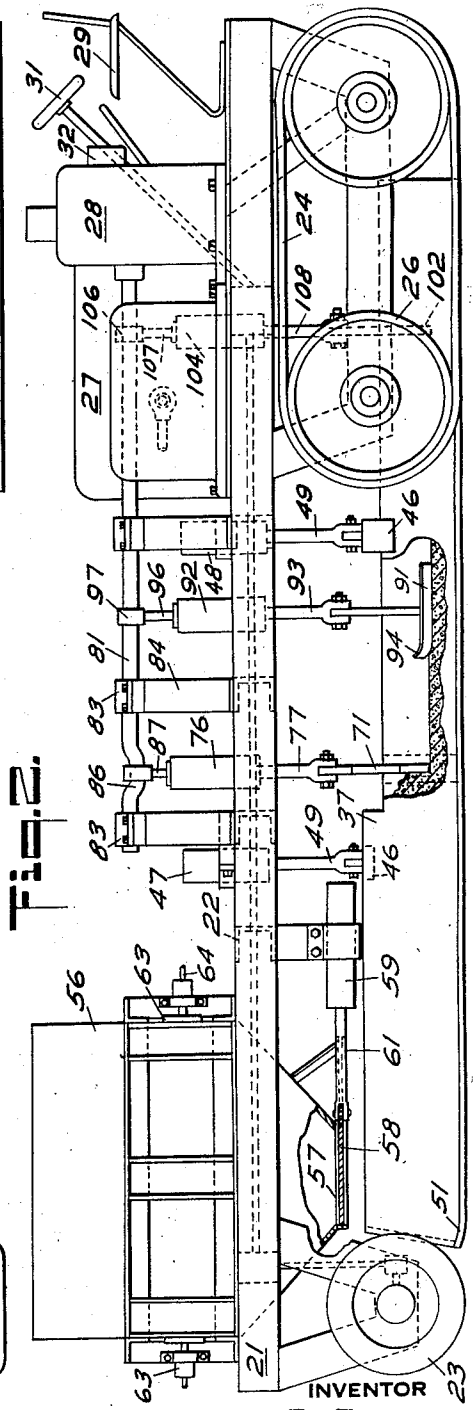


Fig. 2.

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APPARATUS FOR FORMING CONCRETE CURBS AND THE LIKE

Filed April 11, 1955 3 Sheets-Sheet 2

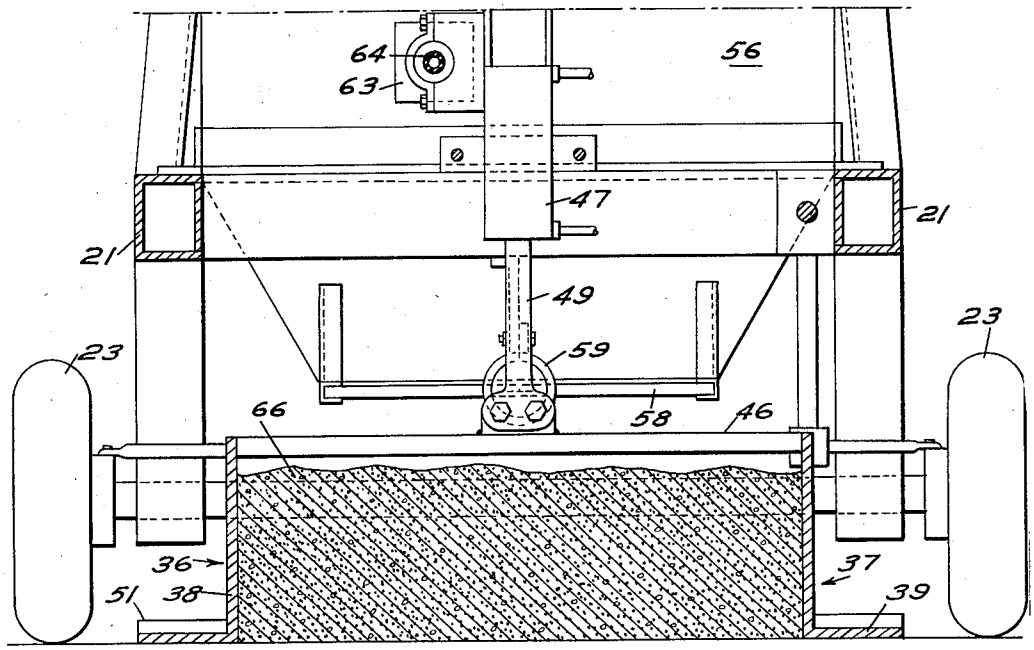


Fig. 3.

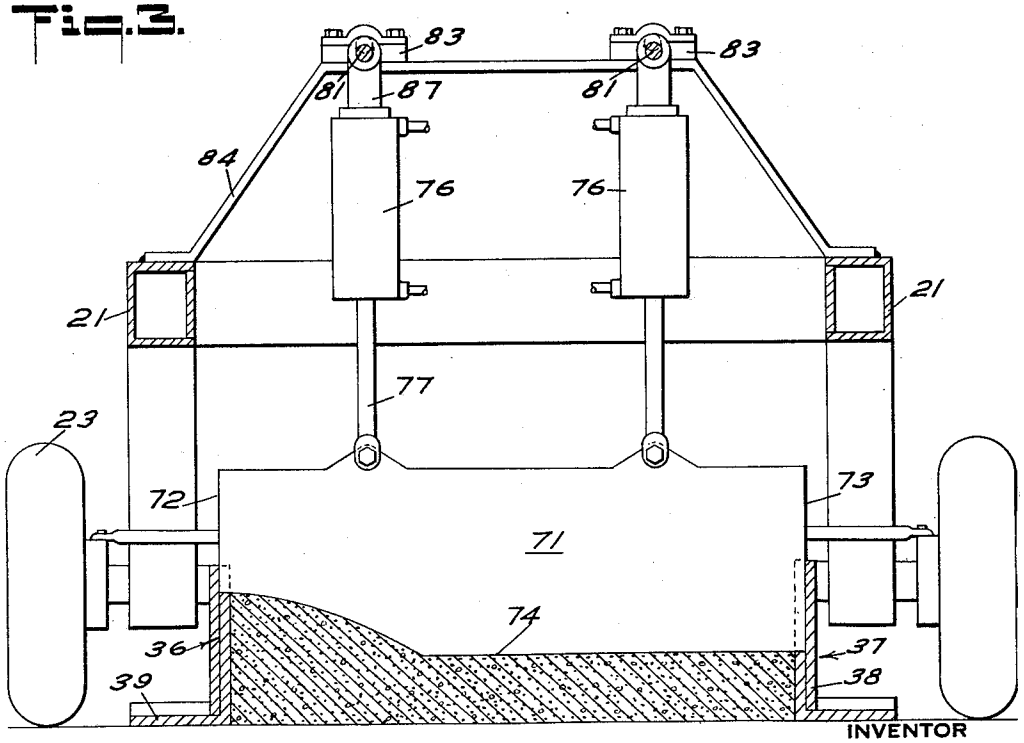


Fig. 4.

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APPARATUS FOR FORMING CONCRETE CURBS AND THE LIKE

Filed April 11, 1955 3 Sheets-Sheet 3

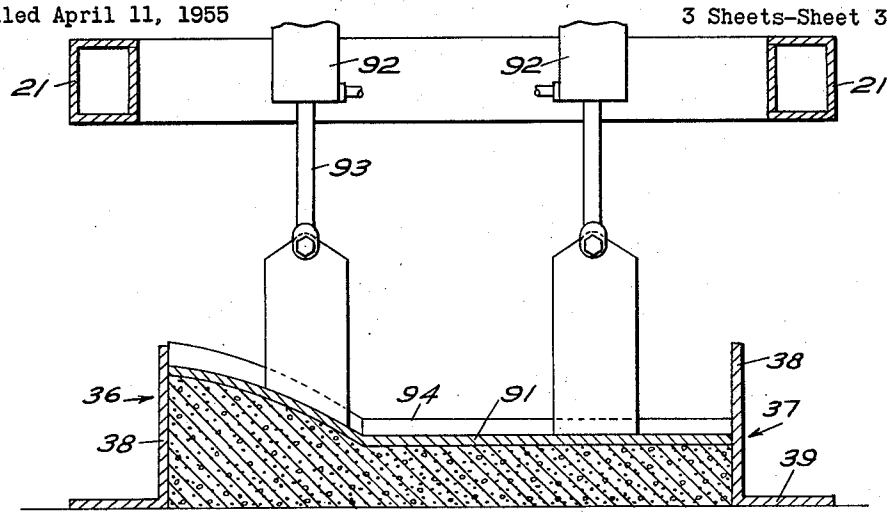


Fig. 5.

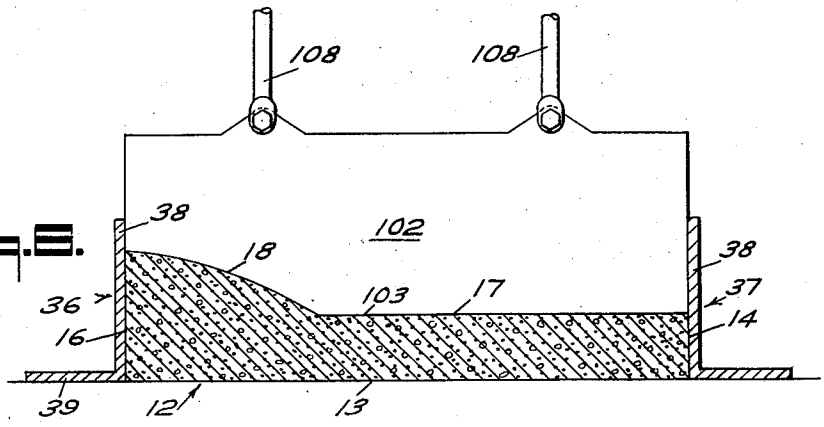


Fig. 6.

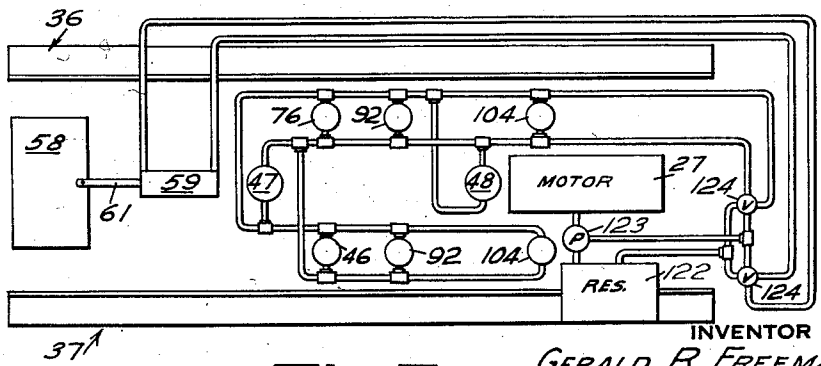


Fig. 7.

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2,864,290

APPARATUS FOR FORMING CONCRETE CURBS AND THE LIKE

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Application April 11, 1955, Serial No. 500,356

3 Claims. (Cl. 94—46)

This invention relates to the construction of concrete structures, and is more particularly directed towards apparatus for continuously forming curbing and/or combination curbing and gutters without the use of conventional stationary forms and attendant manual operations.

Although the present invention will be described in connection with the formation of a combination curb and gutter concrete structure, it should be made clear that the term "concrete" as used herein is not intended to be restricted solely to a technical definition of a mixture of sand, gravel, cement and water, but is intended to include other pourable compositions adapted for use as construction materials which set or harden after being poured. Likewise, it will become apparent that while the exemplary apparatus and method disclosed in the drawings and hereinafter described is adapted for use on a combination curb and gutter, the same general construction and method may be utilized in forming different types of curbs, as well as other longitudinally extending concrete structures.

In most urban areas, irrespective of the material used for constructing the road surface, i. e., concrete, asphalt, bricks, etc., a concrete curb is usually provided at each edge of the street, the curb generally having a flat upper surface which may be coplanar with its associated side walk and a generally vertical surface which extends downwardly to the street level. Also, it is quite common to have the edges of the street per se terminate short of the curb, and this section may be subsequently formed integrally with the curb to provide a gutter. In numerous residential areas, the modern trend is towards a combination curb and gutter arrangement in which the gutter portion, as heretofore, is substantially level with the road surface, but in which the curb extends upwardly and outwardly from the gutter along an arcuate path, thus permitting vehicles to drive over the curb into the respective private driveways which intersect the street.

In practice these combined curbs and gutters are usually constructed after the grading has been completed, but prior to the laying of the road itself. The manner of construction is well known in the art, and no detailed explanation is deemed necessary, except to state that the conventional installation and subsequent removal of the heavy stationary forms and the large amount of hand finishing is costly and time consuming.

It is accordingly an object of the present invention to provide apparatus for constructing longitudinally extending concrete structures, such as a combination gutter and curb, which is simple and economical in operation, and which will form the desired structure in far less time than that required when using conventional systems of construction.

Another object of my invention is to provide apparatus of the character described which completely eliminates the conventional stationary forms and which likewise eliminates most, if not all of the costly hand operations.

A further object of the invention is to provide apparatus of the type described which is adapted to continuously form a mass of concrete into its desired form for setting, whereby it is only necessary to grade and mark the surface on which the curbing is to be positioned.

A still further object of this invention is to provide apparatus of the above character in which the entire concrete forming mechanism is disposed in a unitary movable machine, so that as the machine traverses the ground and concrete is poured into the same, it will continuously mold or form the concrete into the desired configuration.

Yet another object of the invention is to provide apparatus as hereinabove described including means for defining the lateral extent of the finished structure into which the concrete is initially poured, as well as associated means for producing any desired top contour to the structure.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of the preferred form of the invention which is illustrated in the drawings accompanying and forming part of the specification. It is to be understood, however, that variations in the showing made by the said drawings and description may be adopted within the scope of the invention as set forth in the claims.

Referring to said drawings:

Figure 1 is a top plan view of the apparatus of the present invention.

Figure 2 is a side elevational view thereof.

Figure 3 is a cross-sectional view taken substantially in the plane indicated by line 3—3 of Figure 1.

Figure 4 is a cross-sectional view taken substantially in the plane indicated by line 4—4 of Figure 1.

Figure 5 is a cross-sectional view taken substantially in the plane indicated by line 5—5 of Figure 1.

Figure 6 is a cross-sectional view taken substantially in the plane indicated by line 6—6 of Figure 1.

Figure 7 is a diagrammatic representation of the hydraulic flow distribution system utilized in the apparatus.

In broad terms, the apparatus of the present invention is arranged to deliver a quantity of concrete or the like between a pair of longitudinally extending and generally vertical form members, move the form members in the direction of the length thereof, pass laterally extending screed members through or over the concrete mass contained between the form members so as to form the upper contour of the desired structure, and oscillate one or more of the screed members during their movement thereof with the form members. In this manner, it will be understood that a longitudinally extending concrete structure may be continuously molded or formed, without requiring the use of conventional forms.

For purpose of illustration and explanation, I have chosen to illustrate the apparatus and method of the invention in connection with the construction of a combination curb and gutter, generally indicated by the numeral 12 in Figure 6 of the drawings. As illustrated, the finished structure includes a base 13 adapted to be seated on the graded ground surface (not shown), a first side wall 14 arranged to be positioned adjacent one edge of the road surface, a second side wall 16 higher than said first side wall and arranged to be positioned adjacent one edge of the sidewalk, and an upper surface comprising a first portion 17, parallel to base 13, which forms the gutter, and an arcuate portion 18 which forms the curb. It will be easily appreciated that if this structure was constructed in a conventional manner, side forms would have to be erected to define the side walls 14 and 16, a large amount of hand work would be required to produce the proper contour for the upper portions 17 and 18, and the forms would then be dismantled and removed. The apparatus and method now to be described completely eliminates the foregoing.

As best illustrated in Figures 1 and 2 of the drawings,

the apparatus for producing the structure **12** includes a ground-traversing vehicle consisting of a chassis having longitudinally extending side frame members **21**, cross-bracing **22**, front wheels **23** and rear tracks **24** mounted on conventional drive wheels or sprockets **26**. A motor **27** is mounted on the chassis for driving the vehicle, and power is supplied from the motor to the rearmost set of drive wheels by means of any suitable transmission **28** operatively connected to such wheels through any conventional type of mechanism. Preferably, the transmission is of the hydraulic type whereby the vehicle can be started and stopped with a minimum of jerking, which could prove injurious to the structure to be formed by the apparatus. The motor **27** also supplies power for other portions of the apparatus as will be hereinafter explained.

The operator is provided with a seat **29** disposed at the rear end of the vehicle and may properly guide the latter by means of a steering wheel **31** operatively connected to the front wheels **23**. Suitable operating handles for controlling the screed members, form members and the speed of the vehicle itself may be conveniently mounted on a control housing **32** positioned adjacent the operator's seat.

It will be noted that the vehicle is relatively long, and is arranged to move at low speeds. Hence, by virtue of the rear track mechanism, it is not a difficult job for the operator to follow stakes, lines or other indicia showing the line to be followed in forming the curb and gutter. While the apparatus is not capable of laying curved curbs of a relatively small radius, it can adequately perform on larger radius curves.

As above described, the structure **12** is disposed on the graded ground surface along which the vehicle moves, and as such structure includes the side walls **14** and **16**, it is necessary that the vehicle include vertically disposed and laterally spaced form members between which the structure is formed. As here shown, such form members comprise a pair of angles **36** and **37**, each having a vertically disposed web **38** and an outwardly directed horizontal flange **39**. If desired, the height of the webs forwardly of the screed elements may be greater than that rearwardly thereof, but in any event, the web height should be in excess of the height of the side walls, in order that the latter may be properly formed. Obviously, the lateral spacing between the webs corresponds to the width of the structure **12** between the side walls thereof.

In operation, the flanges **39** are adapted to slide along the ground surface, or at least immediately adjacent thereto so that the concrete structure **12** will rise directly from such surface in a uniform manner without danger of concrete, that has been poured between the form members, spreading out in any space existing between the flange and ground surface.

Consequently, to insure the proper positioning of the form members, irrespective of the elevtaion of the vehicle wheels and/or tracks relative thereto, means are provided for vertically adjusting the form members. As here shown, the respective form members are secured together by cross-members **46** for unitary vertical movement, although obviously, each of such members could be mounted for independent vertical adjustment if desired. A front cylinder **47** and rear cylinder **48**, each provided with a two-way piston, are mounted on the vehicle, and by means of links **49** operatively connected to the piston and the form members respectively, the latter may be selectively raised and lowered. Also, by virtue of the longitudinal spacing of the actuating cylinders, the front or rear end of the members may be adjusted relative to the other end. As the flanges of the members are supposed to slide along the supporting surface, I prefer to have the leading edge of each member flared upwardly as indicated at **51**, in much the same manner as the leading edge of a ski. This will avoid erratic opertaion in the event some projection lies in the path of the flange **39**.

Thus, in operation, the driver will first align the vehicle with the longitudinal axis of the structure to be formed, and then lower the form members until the flanges **39** thereof engage the ground. The forming operation is then ready to be commenced by depositing a mass of concrete between the vertical webs of the members whereby the latter will define the lateral limits of the flowable concrete mass, and consequently form the side walls of the structure **12**.

Concrete may be supplied from any suitable supply source, such as a hopper **56** carried on the front end of the vehicle, and provided with a bottom discharge outlet **57** positioned intermediate the form members. A horizontally disposed closure gate **58** is slidably mounted on the hopper, subjacent the outlet thereof, so as to control the quantity of concrete flowing from the outlet. The position of the gate **58** may be readily controlled by means of a hydraulic cylinder **59** provided with a two-way piston connected to a link **61**. The latter is connected to the gate, so that upon actuation of the piston in the cylinder, the gate may be moved so as to selectively control the volume of concrete gravitally falling from the hopper. It is expected that the concrete utilized will be on the dry side, with low slump characteristics as the forms are constantly being moved, and after passage of the vehicle, the mass must be form retaining. In any event, it is believed desirable to provide the hopper with one, and preferably two, air hammers **63**, having conduits **64** for connection to a source of compressed air. The purpose of these hammers is to insure a uniform flow of concrete when the gate is in an open position.

As will be understood, the amount of concrete deposited from the hopper upon the ground surface between the form members must be at least sufficient to produce the structure **12**, and is preferably in excess thereof so as to insure an ample volume for the screed operation. Thus, as illustrated in Figure 3 of the drawings, the concrete mass **66** is more than is required to form the same into the structure **12**. In other words, the mass must extend to the webs **38**, and occupies a height in excess of the upper surface **17** and **18** of the structure to be formed.

To produce the desired upper contour on the concrete mass, a plurality of laterally extending screed elements are utilized, each of such elements being longitudinally spaced from an adjacent element. In this manner, while the concrete mass is being retained between the webs of the form members, the screed elements, carried on the vehicle and extending between the form members, provide the means for producing the proper upper surface on the mass.

The first screed element, generally designated by the numeral **71** is positioned rearwardly of the hopper and is designed to generally form the mass to the desired upper contour and to distribute the excess concrete forwardly of the screed. Preferably, screed **71** is formed of a substantially rectangular metal plate having opposed side edges **72** and **73** which lie substantially immediately adjacent the respective opposed faces of the form member webs. The lower edge **74** of the plate is contoured complementary to that of the desired finished structure, so the disclosed embodiment includes a flat portion corresponding to structure portion **17** and an arcuate portion corresponding to structure portion **18**. The lower edge **74** is spaced from the ground and passes through the concrete mass so that the mass assumes the general form of the final structure.

It will be appreciated that in many instances, the specifications for a structure may call for different thicknesses of concrete. Hence, it is important that means be provided for vertically adjusting the height of the lower edge **74** relative to the ground. Such means may simply comprise a pair of laterally spaced and vertically disposed two-way cylinders **76** having links **77** secured at one end to the pistons and at their other ends to the upper portion of the screed. In this manner, actuation of the cylinder

may position the screed in selected positions of vertical adjustment.

Vertical oscillatory motion is imparted to this first screed element by any desired mechanism so as to increase the efficiency of the screed in levelling off the top of the concrete mass to substantially its final contour. For purpose of illustration, I have shown a pair of longitudinally extending shafts **81** driven by motor **27** and any suitable type of governor **82** so as to insure uniformity of oscillation of the screed irrespective of the load imposed on the motor by virtue of the movement of the vehicle. The shafts are supported on a plurality of bearings **83** carried by brackets **84** extending from the chassis frame **21**. Adjacent the forward end of each shaft is an offset portion **86** to which the respective cylinders are supported through a link **87**. In this manner, as the shafts rotate, the cylinders **76**, links **77**, and consequently the screed **71** will be vertically reciprocated. Preferably, the lowermost position of the screed is approximately one-quarter inch above the final contour of the structure **12** so that a small excess of concrete is available for the subsequent screed operations.

A second screed **91** is positioned rearwardly of screed **71**, and like the latter is adapted for vertical adjustment so as to permit the forming of various structure heights. Two-way cylinders **92** are provided, and their associated piston rod links **93** are connected to the screed in any suitable manner. Instead of assuming a relatively flat vertical form as in the case of the first screed, screed **91** is formed of a generally horizontally disposed plate so as to present a relatively large surface to the concrete mass. The leading edge **94** of the screed is flared upwardly for the same reason that the leading edges of the form members are turned upwardly at **51**. As best illustrated in Figure 5, the lower surface of the screed is contoured to the same extent required for the finished structure, and such surface should be disposed substantially at the final elevation of the upper surface of the structure, or, in other words, approximately one-quarter of an inch lower than the lowermost position of screed **71**. The cylinders **92** may be supported on the chassis in any suitable manner, but I have chosen to utilize links **96** extending from the upper ends of the cylinders and journalled on shafts **81** through suitable bearings **97**. It is not believed necessary to vibrate the second screed, but if vertical oscillation is desired, it will only be necessary to put an offset in the shafts at the bearing connection.

The final screed, or finishing screed **102** is best illustrated in Figure 6 of the drawings and is naturally positioned rearwardly of the screed **91**. The screed, like screed **71**, is a vertical plate provided with a lower edge **103** complementary to portions **17** and **18** of the finished structure. This screed does not oscillate, but like the other screeds is capable of vertical adjustment through a pair of two-way cylinders **104** journalled on shafts **81** through bearings **106** and links **107** and links **108** connected to the cylinder pistons. The edge **103** of the screed is naturally positioned at the final elevation of the structure portions **17** and **18** so as to finish off the latter.

In Figure 7 there is diagrammatically illustrated a flow diagram for controlling the various cylinders. As illustrated, a reservoir **122** is connected to a pump **123**, the latter being driven by motor **27**. The screed cylinders **76**, **92** and **104** are operatively connected to supply and return conduits, as are the rail cylinders **47** and **48**, and the gate control cylinder **59**. Suitable valves **124** control the flow of fluid to selected sides of the respective cylinders to accomplish their various functions, such valves being conveniently located in the housing **32**.

From the foregoing description, both the details of construction as well as the mode of operation should be made clear. While the mechanism is not complex, it has proven to adequately form a concrete structure in a continuous manner in place of the slow and costly batch method of forming similar structures under conventional procedures. It has likewise been found that after the vehicle has completely passed the concrete it has formed, the formed concrete will retain its shape without further attention until setting or curing takes place.

What is claimed is:

1. Apparatus for forming a longitudinally extending concrete curb structure on a supporting surface in which said structure has laterally spaced side walls and an upper contour extending therebetween, comprising: a longitudinally extending ground traversing vehicle, a pair of laterally spaced and generally vertically disposed plate-like members carried by and extending longitudinally of said vehicle, means on said vehicle for selectively raising and lowering said members, a first screed element extending laterally of and supported by said vehicle and disposed between said members, means on said vehicle for vertically oscillating said element, said first screed element being of generally flat construction and lying in a generally vertical plane, means on said vehicle for selectively raising and lowering said element whereby the lowermost oscillating position thereof may be controlled, and a second screed element positioned on and carried by said vehicle rearwardly of said first screed element and extending between said members, each of said screed elements having substantially similar lower edge portions contoured to complement the upper contour of said curb structure, and means on said vehicle for selectively raising and lowering said second screed element.

2. Apparatus as set forth in claim 1 in which the lower edge portion of said second screed element is disposed lower than the lowermost oscillating position of said first screed element.

3. Apparatus for forming a longitudinally extending concrete curb structure on a supporting surface in which said structure has laterally spaced side walls and an upper contour extending therebetween, comprising: a longitudinally extending ground traversing vehicle, a pair of laterally spaced and generally vertically disposed plate-like members carried by and extending longitudinally of said vehicle, means on said vehicle for selectively raising and lowering said members, a first screed element extending laterally of and carried by said vehicle and disposed between said members, means on said vehicle for vertically oscillating said element, a second screed element having a wider bottom edge portion than said first screed element extending laterally of and carried by said vehicle and disposed between said members, a third screed element generally parallel to said other screed elements carried by said vehicle and extending between said members, all of said screed elements having substantially similar lower contours, said first and third screed elements each generally comprising a vertically disposed plate having its lateral edges slidably engaged with the opposed inner surfaces of said plate-like members, and means operatively carried by said vehicle for vertically adjusting each of said elements relative to said members.

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