

Dec. 22, 1936.

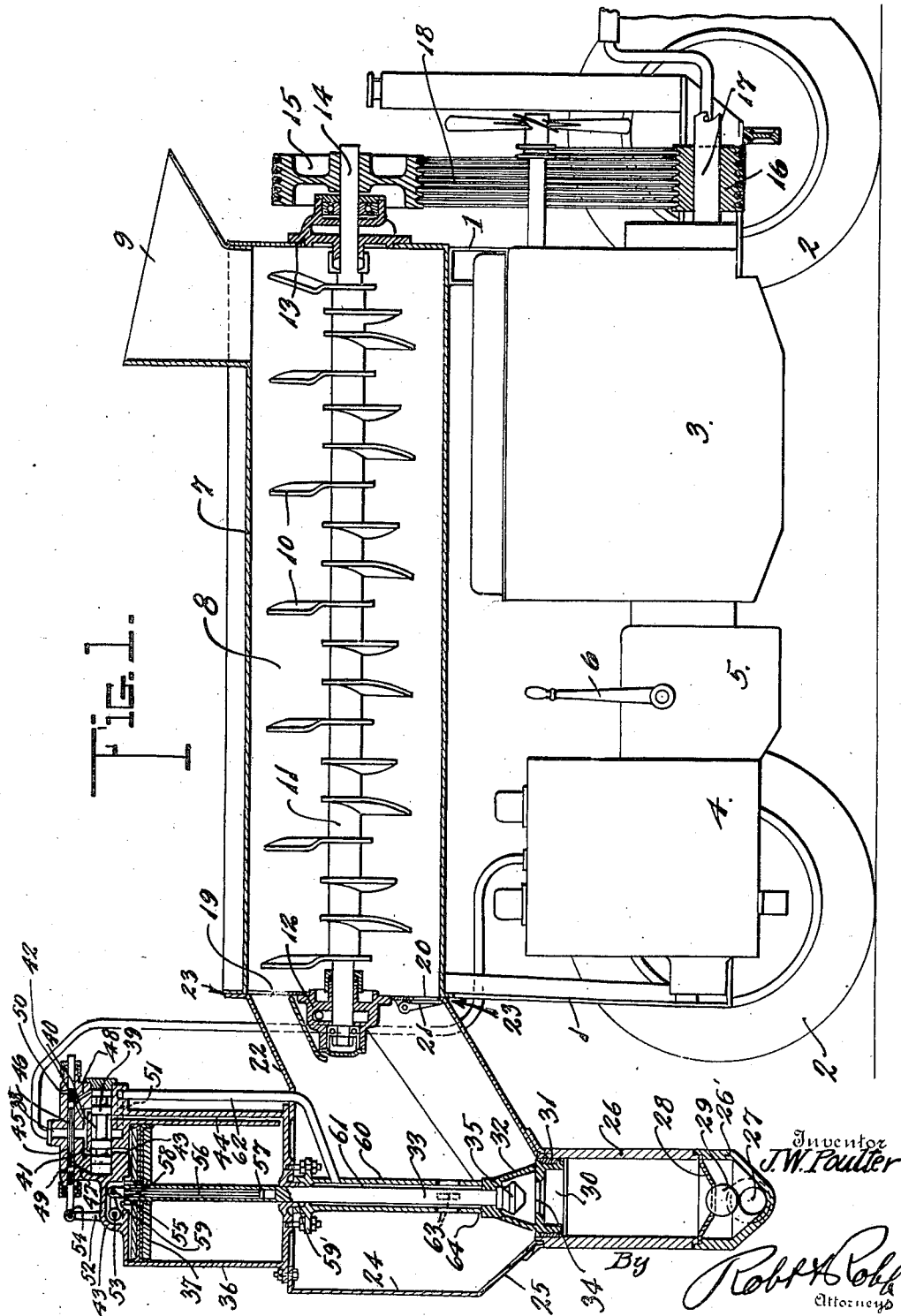
J. W. POULTER

2,065,022

CONVERTIBLE APPARATUS FOR EMPLACING PLASTIC MATERIAL

Filed Dec. 5, 1933

2 Sheets-Sheet 1



Dec. 22, 1936.

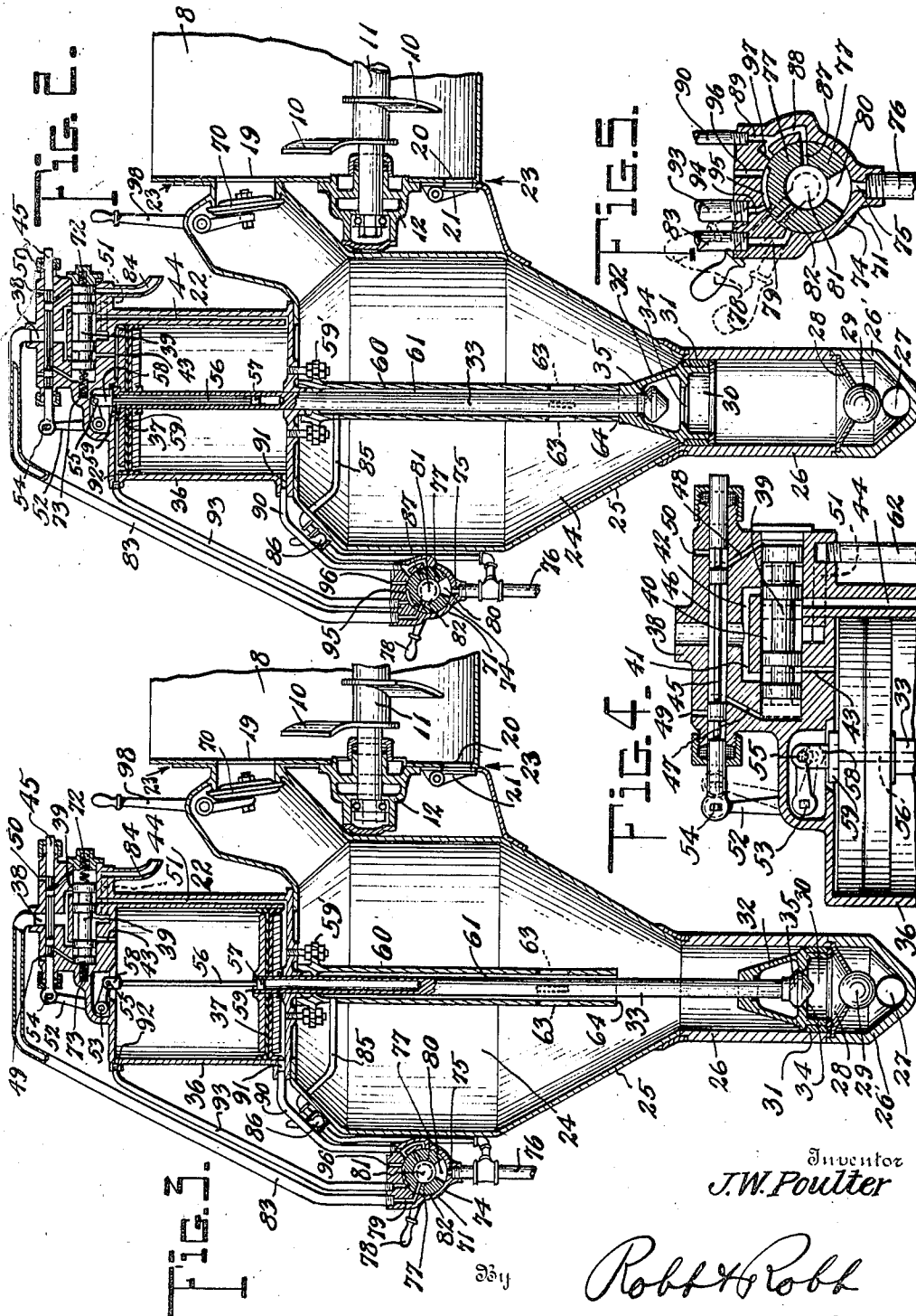
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,065,022

CONVERTIBLE APPARATUS FOR EMPLACING PLASTIC MATERIAL

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Application December 5, 1933, Serial No. 701,047

15 Claims. (Cl. 103—5)

The present invention relates to apparatus for handling and emplacing plastic or semi-fluid materials, and particularly for forcing a filling material beneath a pavement surface which has become sunken due to settlement of the subgrade, or for other reasons is below the desired elevation. The treatment of so-called rigid pavements, foundations, and the like, for the purpose of restoring the same by elevating the sunken portions thereof to the desired level was first disclosed and broadly covered in my prior Patent No. 1,915,032, granted June 20th, 1933, followed by my Patent No. 1,929,215, granted October 3rd, 1933, and has attained a definite status in the art of highway construction. As a result of my discoveries and developments, it is no longer deemed necessary to tear up or resurface sunken or badly broken, choppy and uneven sections of pavement as was customary and the commonly accepted practice prior thereto, complete restoration of the pavement being now attainable at a very nominal and very small fraction of the originally required maintenance expense by the practice of the inventions of the aforesaid patents.

In my copending application Serial No. 542,153, filed June 4th, 1931, now Patent No. 1,969,324, there is disclosed a practical unitary apparatus for mixing and pumping a mud filler in the practice of the inventions of my prior patents. This apparatus comprises essentially, a mixing device primarily designed for thoroughly mixing soil, a binder and water, and a mechanically driven pumping device arranged to receive the mixed mud filler and adapted to force the same beneath the pavement slab or other structure, the mixer and pump having the construction of a portable unit.

The complete equipment for a crew engaged in elevating sunken slabs heretofore has comprised, in addition to the foregoing apparatus, and the trucks for hauling the soil and water, a conventional portable compressor unit with the usual pneumatic drills and pavement breakers for drilling the holes in the pavement through which the filler is to be forced and for cutting stress relief slots in the pavement where necessary. There is thus tied up with each crew a separate compressor unit, thereby materially increasing the outlay for equipment for each crew.

To the end of providing a single unitary apparatus for carrying out the complete process from the initial preparation of the pavement to the final elevation thereof, the present invention has for an object the utilization of an air

compressor for operating the drilling equipment in the usual manner, but in addition it is made available for forcing the filling material beneath the pavement by the action of compressed air directly upon the filler where the resistance to the introduction of the materials is sufficiently low so that this may be accomplished by the pressure normally available at the compressor.

Due to the fact that this pressure at the compressor is limited, and the resistance to the flow of the materials beneath the slab is frequently greater than will be overcome by the pressure produced by the usual compressors available for this purpose, particularly in the case of initially starting the filler beneath the slab, it is an object of the invention to provide a pneumatic pump, operable by the compressed air produced by a compressor, the pump mechanically acting upon the filler material to drive or force the filler beneath the slab under a much greater pressure than would be attained by the use of the compressed air alone directly acting upon the filler.

An important object of the invention, therefore, is to provide a pneumatically operated mechanical pump unit for emplacing a mobile fluid, and which is convertible to a purely pneumatic pressure emplacing unit, or conversely.

Another object of the invention is the provision of a unitary apparatus for preparing a mobile filler suitable for backfilling and elevating pavements or like structures, which apparatus includes pneumatic means for emplacing the filler as or subsequent to the preparation thereof.

The invention has for a further object the provision of a receptacle or hopper for the reception of a suitably prepared filler and from which the filler is directed to the point of emplacement by a pneumatically driven mechanical pump of the reciprocating piston or plunger type, the apparatus further embodying suitable control means for rendering the plunger inoperative whereby the apparatus is converted into a direct acting pneumatic pressure emplacing means for the filler, as distinguished from the indirect pneumatic action when the piston is employed to create the pressure on the filler.

A further object of the invention is the provision of a mobile fluid emplacing apparatus wherein pneumatic pressure is employed directly, indirectly or combinatively, at will, as the medium for emplacing the fluid at a desired point.

Other and further objects and advantages of the invention will be hereinafter set forth and

the novel features thereof defined by the appended claims.

In the drawings:—

Fig. 1 is a side elevation of a unitary apparatus embodying the improved features of my invention, certain of the parts being shown in longitudinal section;

Fig. 2 is a fragmentary view of an apparatus generally similar to Fig. 1, but embodying a modified form of filler emplacing unit;

Fig. 3 is a view similar to Fig. 2, showing the operative parts of the mechanical pump in another position assumed during operation of the machine;

Fig. 4 is an enlarged, detail, sectional view of the valve mechanism for controlling the operation of the pump; and

Fig. 5 is an enlarged, detail, sectional view of the control valve for converting the units of Figs. 3 and 4, from a direct to indirect pneumatic pressure unit, or conversely.

Briefly, the treatment of pavements, according to the patents hereinbefore referred to is as follows:—One or more holes of suitable size are drilled or otherwise formed through the pavement, the location of which holes depends upon the disposition of cracks in the pavement and the location and extent of the settlement, whereupon a mobile filler is pumped or otherwise forced (preferably progressively to avoid the creation of undue stresses in the pavement) through the holes under pressure beneath the pavement until the sunken portions are elevated to the desired level. Super-elevation, as in banking curves, or other elevation of the entire structure may be attained in a similar manner.

The nature of the mobile filler is such that it is readily flowable without disintegration under pressure, and is capable of solidifying comparatively quickly to provide a permanent support for the pavement upon the attainment of the desired elevation thereof. An inexpensive and readily procurable filler may be had by suitably mixing the following ingredients in the approximate proportions stated (by volume):—soil—25 parts; binder (cement, lime, or the equivalent)—1 part; water—12 parts (100 gallons per cubic yard), or enough water to produce a consistency between that of thick cream and mortar. The most satisfactory soil is preferably a loam, but any available soil may be employed providing the sand or clay content is not too great. There will thus be produced a suitable filler in the nature of a mud excellently adapted for the purposes herein. Other suitable filler compositions may be devised, but for the purposes hereof, reference will be made to apparatus particularly applicable to the handling of a mud fluid.

Like reference characters designate corresponding parts in the several figures of the drawings.

Referring now to Fig. 1 of the drawings herein, 1 denotes generally a mobile frame equipped with wheels 2 for transportation of said frame from place to place. Mounted on said frame is a source of power 3 such as a conventional internal combustion motor to which is suitably connected a conventional compressor 4 through the medium of a transmission 5, reference character 6 designating a control lever for controlling the operation of the compressor by the motor.

Also driven by said motor 3 is a mixing unit generally designated 7 comprising an elongated tank or compartment 8 suitably mounted on the frame. The tank is provided at one end with

a hopper 9 for the reception of the materials to be mixed therein. Rotatably mounted within said tank are suitable mixing paddles or blades 10 arranged, as for example, on a shaft 11 extending longitudinally of said tank and suitably journaled at opposite ends as at 12 and 13. The paddles or blades 10 are given a pitch such that they normally tend to pass the materials longitudinally through the tank from the receiving end to the opposite end during rotation of the paddles, thereby insuring a thorough mixing of the materials. Rotation of shaft 11 and the paddles 10 fixed thereto may be accomplished in any suitable manner as by providing shaft 11 with an extension 14 on which is fixed a pulley 15. A corresponding pulley 16 mounted on the crank shaft 17 of engine 3 may be arranged to drive said pulley 15 by a suitable belt or power transmitting means 18.

Located at the end of tank 8, opposite from the hopper end is a discharge opening 19 through which the materials may be discharged as they are passed from the receiving end to the discharge end of the tank. This opening is preferably located a substantial distance above the bottom of the tank so that the materials will be forced to pile up at the discharge end before being discharged. In this manner, the thoroughness of mixing is facilitated. A clean-out opening 20 may also be provided, as the tank should be preferably cleaned or flushed out after use. A door or closure 21 is provided to normally maintain the clean-out opening 20 closed during use of the mixer.

Attached to the rear or discharge end of the mixer unit is the emplacing unit or pump generally designated 22, which may be in the form of an attachment which may be applied to or detached from the mixer unit in any suitable manner on a plane indicated by the arrows 23. The emplacing unit comprises in one form, as shown in Fig. 1, a tank or receptacle 24 constituting in effect a hopper, the lower portion of the tank as at 25 being inwardly tapered for discharge of the materials received from the mixer unit into said tank and out thereof at the bottom, the taperer facilitating discharge of the materials from said hopper by gravity and without leaving any appreciable amount of material to collect in corners or on the sides of the tank. Suspended from the bottom of tank 24 is a pressure cylinder 26 having its upper end arranged to receive the materials from said tank, and provided at its lower end with a cylinder head 26' having therein a discharge opening 27 to which may be coupled a flexible hose or other suitable conduit for the purpose of directing the materials to the desired point of emplacement, as described in my previous patents and copending Patent No. 1,969,324 referred to. Adjacent the lower end of said cylinder 26 is a diaphragm 28 having an opening therethrough, and constituting a valve seat. Ball valve 29, having a specific gravity less than the specific gravity of the mix handled by said units, is interposed between the diaphragm 28 and the discharge opening in the cylinder head, the ball and seat constituting a check valve means as will hereafter more fully appear.

Reciprocally mounted in said cylinder is a piston 30 which may be provided with suitable sealing or packing means 31, such as a rubber ring, the piston being further provided with a bail 32 which is loosely connected to a piston rod 33. The piston has an opening 34 therethrough

constituting a valve seat for cooperation with a valve 35 carried on the end of connecting rod 33. Thus, on the upward stroke of piston rod 33, the piston rod slides loosely through bail 32 until valve 35 engages the bail to draw the piston upwardly with the connecting rod until it reaches the top of its stroke. During the upward stroke, the mix in tank 24 enters pressure cylinder 26 by passing about the bail 32 and through the opening 34 in piston 30. On the downward stroke, the connecting rod 33 moves downwardly through said bail until valve 35 engages the valve seat 34 in the piston, whereupon further downward motion of the connecting rod forces the mix out of cylinder 26, by forcing ball valve 29 downwardly away from its seat, and allowing the mix to flow out through the discharge opening 27. On the upward stroke, ball valve 29 floats upwardly against the seat 28 so as to prevent return of the discharged mix into the cylinder, and new material from tank 24 is permitted to enter the cylinder.

The mechanism for actuating connecting rod 33 and piston 30 will now be described. Mounted on top of tank 24 is a fluid pressure cylinder 36 in which is reciprocally mounted a piston 37. Piston 37 is fixed to the upper end of connecting rod 33, the length of connecting rod 33 being such that both pistons will reach the corresponding ends of their respective cylinders at approximately the same time. Air is preferably employed as the fluid for actuating the piston 37, which air may be derived from compressor 4, from which it is adapted to enter an inlet connection 38. Air admission to and exhaust from opposite ends of cylinder 36 is controlled by a balanced type piston valve 39 located in valve chamber 40. This valve includes suitably arranged piston heads which are adapted to cooperate with passages 41 and 42 leading from the intake connection 38 to valve chamber 40. Passage 43 establishes communication between valve chamber 40 and the upper end of cylinder 36 while passage 44 establishes communication between the valve chamber 40 and the lower end of cylinder 36. Valve 39 is shiftable in said chamber and the shifting movement thereof is automatically accomplished by an auxiliary valve 45. This auxiliary valve is reciprocable in valve chamber 46 and is provided with suitably spaced piston heads cooperating with passages 47 and 48 leading from the auxiliary valve chamber 46 to opposite ends of valve chamber 40. Exhaust passages 49 and 50 are provided for auxiliary valve chamber 46. The exhaust from cylinder 36 is effected through passage 51. Shifting of auxiliary valve 45 is accomplished by a bell crank 52 pivotally mounted on the cylinder 36 as at 53 and having one arm pivotally connected to the valve as at 54. The other arm of the bell crank is pivotally connected as at 55 to a member 56 telescoping within the upper end of connecting rod 33. This member 56 is provided at its lower end with an abutment 57 and at its upper end an abutment 58, which abutments are adapted to be engaged by an annular flange 59 on piston 37 at the lower and upper extremities respectively of the piston stroke. Operation of the pneumatic mechanism above described for reciprocating piston 30 may be briefly summarized as follows:

Assuming that the parts are in the position shown in Fig. 1, air enters intake 38 from compressor 4 to pass into auxiliary valve chamber 46 about the body of the auxiliary valve and

thence through passage 47 into valve chamber 40 at the left end of valve 39, forcing valve 39 to the right and thereby permitting air to flow from intake 38 through passage 41 into valve chamber 40, through passage 43 into the upper end of cylinder 36 thereby forcing piston 37 downwardly. During the downward movement of piston 37 exhaust from the lower side of the piston is permitted through passage 44 into valve chamber 40 between the innermost piston heads thereof and out through passage 51. Downward motion of piston 37 is transmitted to piston 30 by connecting rod 33, during which the mix in tank 24 is forced through discharge 27 as previously described.

As piston 37 reaches the lower extremity of its downward stroke, flange 59 engages abutment 57 on member 56 and rocks the bell crank 52 in a clockwise direction thereby shifting auxiliary valve 46 to the right, permitting air pressure to be applied from intake 38 through auxiliary valve chamber 46, through passage 48 onto the righthand end of valve 39, thereby forcing valve 39 to the left and permitting pressure to be applied from intake 38 through passage 42 into valve chamber 40, through passage 44, into the lower end of cylinder 36, thereby forcing piston 37 upwardly. During the upward movement of piston 37, exhaust at the upper side of the piston is effected through passage 43, valve chamber 40 intermediate the innermost heads of piston valve 39 and passage 51. As piston 37 reaches the upper extremity of its stroke, flange 59 engages abutment 58 and rocks bell crank 52 counterclockwise to shift auxiliary valve 46 to the left completing one cycle of operation. The upward motion of the piston 37 is transmitted to piston 30 through connecting rod 33, during which time the mix in tank 24 is permitted to flow into cylinder 26 through piston 30 as previously described.

Suitable provision is preferably made for keeping the mix in tank 24 from coming in contact with piston rod 33 at the point where it passes through the bottom of cylinder 36. A stuffing box 59' is provided about said connecting rod at this point and extending from said stuffing box is a pipe or sleeve 60 projecting downwardly within tank 24 about connecting rod 33 to provide an annular space 61 intermediate the sleeve and connecting rod. Exhaust passage 51 may be connected with this annular space as by conduit 62. Ports 63 are provided in sleeve 60 adjacent the lower end to permit the exhaust to pass out into tank 24. The application of the exhaust to the annular space 61 tends to keep the mix from flowing upwardly within the sleeve and about the connecting rod 33, thereby keeping the mix away from the stuffing box and connecting rod in the region thereof. The lower extremity 64 of sleeve 60 may be utilized to limit the upward movement of piston 30 by presenting the same in a position to engage the bail 32 of piston 30 at the upper end of the stroke.

Referring now to Figures 2 and 3, there is shown an emplacing unit somewhat modified in form from the form shown in Fig. 1. The structure is generally similar to the Fig. 1 construction except that the tank 24 is capable of being sealed against the entrance of air as by providing a suitable valve or gate 70 for closing the discharge opening 19 of the mixer unit. The purpose of completely closing tank 24 is to provide a unit which may be operated either in a manner similar to the operation previously de-

scribed with reference to the Fig. 1 construction, or it may be alternatively operated to eject or force out the mix from tank 24 by the direct application of a fluid pressure on the mix. If desired, such a direct application of fluid pressure may supplement the mechanical ejection of the mix. To this end, as previously stated, the construction of the emplacing unit is similar to that previously described except that a control valve 71 is introduced between the compressor 4 and the intake 38. Provision is also made for neutralizing valve 39 as by springs 72 and 73 acting upon the opposite ends of the valve so as to normally maintain the valve in intermediate or neutral position when there is no pressure applied to intake 38.

Referring now to the construction of control valve 71, and its associated parts, it comprises a casing 74 having an inlet 75 adapted to be connected to compressor 4 as by conduit 76. A rotatable valve body 77 is provided in the casing to which is suitably attached a control lever 78 for manipulation thereof to different positions now to be described. In one position of the valve body, communication is established between inlet 75 and an outlet passage 79 in the casing through passages 80, 81 and 82. Passage 79 is connected to intake 38 by a conduit 33 thereby applying pressure at 38 for actuating the mechanisms in a manner exactly the same as hereinbefore described. Instead of applying the exhaust from cylinder 36 to the annular space about connecting rod 33, the exhaust is led from passage 81 to atmosphere as through exhaust pipe 34. Annular space 81 may instead be subjected to the full pressure of the compressor as by taking off pressure from conduit 76 and applying the same to the space through conduit 35. Thus the mix in tank 24 will be subjected to a direct application of fluid pressure as well as an indirect application through the pneumatically operated mechanical mechanism. A valve 86 may be interposed in conduit 35 to shut off the direct application of pressure on the mix when desired.

In another position of valve body 77, as illustrated in Fig. 5, the pressure of compressor 4 may be applied from inlet 75 through passages 80, 81, and 87, all in the valve body, and 88, 89 in the casing, conduit 90, port 91, in the lower end of cylinder 36, thereby causing the piston to be forced upwardly as shown in Fig. 2, permitting the application of pressure directly on the mix in tank 24 to force the same through piston 30 and out through discharge port 27, the pressure on the mix being applied through conduit 85 and annular chamber 61 as previously described. It is to be understood that in this position of the control valve, no pressure is applied at 38 and the mechanical pump mechanism is inoperative for automatic pumping operation. The piston, however, will be maintained in its upper position as shown as long as the control valve remains in the last mentioned position. As piston 37 is forced upwardly when the control valve is in the last mentioned position, the upper side of piston 37 is open to atmosphere through port 92, conduit 93, passage 94 in the valve casing, passage 95 in the valve body, and passage 96 in the valve casing. With no pressure applied at 38, valve 39 is maintained in a balanced or neutral position by means of the springs 72 and 73, as shown, thereby closing passages 43 and 44 so that the pressure will be maintained constant on piston 37.

In a third position of the control valve, the valve body is shifted to bring passage 82 in reg-

ister with passage 94 so as to apply pressure from 75 through 80, 81, 82, 94, 93, 92, on top of piston 37, forcing piston 37 to the bottom of the cylinder as shown in Fig. 3. During the downward movement, the lower side of the piston is open to atmosphere through 91, 90, 89, 87, 95 and 96. With the piston 37 in its lowermost position, piston 30 assumes its lowermost position, thereby positively and immediately preventing discharge of the mix from tank 24, regardless of whether pressure is applied on the mix through conduit 85, or whether the pressure is interrupted by valve 86. Thus, piston 30 serves to permit or prevent the ejection of the mix from tank 24 during the direct application of pressure thereon.

It is also to be understood that in the last described position of the control valve, no pressure is present at 38, and hence the mechanical pump mechanism is inoperative for automatic pumping, the piston 37 being maintained at the bottom of the cylinder 36.

Briefly summarizing the operation of the unit shown in Figs. 2, 3 and 5, if the hopper or tank 24 is filled with mixed materials from the mixer 7, valve 70 or door is closed, as by manipulating lever 98, thereby making tank 24 air tight. It is to be understood that the tank is constructed sufficiently strong to withstand the pressure of the average air compressor, as at 4, and sufficiently large to hold a substantial quantity of the mix. Pressure on the mix is then applied by opening valve 86 to admit air from the compressor into the tank. If the pressure required to force the mix out of discharge opening 27 and beneath a pavement slab, or other desired point of emplacement, for elevating the slab, is less than that available at the compressor, the mix will be caused to flow out of discharge opening 27 and through the hose or other conduit leading beneath the slab, assuming that the control valve has been manipulated to a position as shown in full lines in Fig. 5, with the piston 30 maintained in its uppermost position. When the desired amount of material has been forced beneath the slab, the control valve may be manipulated to another position with passage 82 in register with passage 94, thereby forcing the pistons to their lowermost positions and positively interrupting the flow of material from tank 24 by closing valve 35 in piston 30. Considerable wear on the moving mechanical parts may be avoided by utilizing direct air pressure alone on the mix where this is sufficient to force the mix beneath the slab or to any desired point of emplacement.

In the event the air pressure of the compressor admitted by opening valve 86 is not sufficient to force the material beneath the slab, it may be supplemented by the reciprocation of pistons 37 and 30 caused by shifting control valve as shown in Figs. 2 and 3. The relative areas of these pistons are such that the pressure produced in this manner is greater than the air pressure directly available from the compressor. In this way the pressure produced under piston 30 and at outlet 27 is the direct pressure in tank 24, caused by admitting air through 86, plus the pressure caused by the action of piston 37 on piston 30 through connecting rod 33.

While the specific details of construction have been herein shown and described, the invention is not confined thereto as alterations may be made without departing from the spirit thereof as defined by the appended claims.

Having thus described my invention what I

claim as new and desire to secure by Letters Patent is:

1. In a portable unit for emplacing a mobile material, supply means adapted to receive said material, a pump cylinder arranged to receive the material from the supply means, a reciprocable piston in said cylinder, said piston having valve means therein serving to admit material from said supply means through said piston into said cylinder on the stroke of the piston in one direction constituting the intake stroke and preventing passage of said material through said piston on the stroke thereof in the opposite direction constituting the pressure stroke, said cylinder having a discharge opening for discharging the material therefrom under pressure of said piston, a check valve intermediate said piston and said discharge opening in the cylinder, said check valve normally closing on the intake stroke of said piston, a fluid pressure cylinder above said supply means, a reciprocable piston therein, a connecting rod extending from said last mentioned piston through said supply means to said first mentioned piston and serving to drive said first mentioned piston by the reciprocation of said last mentioned piston, a guide sleeve for said rod, and means for alternately applying a fluid pressure to opposite sides of said last mentioned piston and to said sleeve, said means serving to effect reciprocation of said pistons, maintenance of clearance of the sleeve of the material and discharge of said fluid in said supply means.

2. In a portable unit for emplacing a mobile fluid, supply means adapted to receive said fluid, a pump cylinder beneath said supply means and arranged to receive the fluid from said supply means, a reciprocable piston in said cylinder, said piston having valve means therein serving to admit fluid from said supply means through said piston into said cylinder on the stroke of the piston in one direction constituting the intake stroke and preventing passage of said fluid through said piston on the stroke thereof in the opposite direction constituting the pressure stroke, said cylinder having a discharge opening for discharging the fluid therefrom under pressure of said piston, a check valve intermediate said piston and said discharge opening in the cylinder, said check valve normally closing on the intake stroke of said piston, a fluid pressure cylinder above said supply means, a reciprocable piston therein, a connecting rod extending from said last mentioned piston through said supply means to said first mentioned piston and serving to drive said first mentioned piston by the reciprocation of said last mentioned piston, and means for alternately applying a fluid pressure to opposite sides of the last mentioned piston, said means including a fluid pressure actuated shiftable valve and cooperating passages communicating with said fluid pressure cylinder at opposite ends thereof, said passages serving as intake and exhaust passages at opposite sides of said last mentioned piston, auxiliary valve means for controlling the shifting of said first mentioned valve, means for automatically controlling said auxiliary valve means incident to reciprocation of said piston in said pressure cylinder, said last mentioned means including a member telescopically arranged in one end of said connecting rod for said pistons, and having abutment means thereon engageable by said pressure cylinder piston at the extremity of its stroke in each direction for imparting motion thereto, and means connecting said member with said auxiliary valve means and serving to transmit the motion of said member to said valve means incident to reciprocation of said piston.

mit the motion of said member to said valve means incident to reciprocation of said piston.

3. In a portable unit for emplacing a mobile fluid, a receiver for said fluid, a pump cylinder beneath said receiver and arranged to receive the fluid from said receiver, a reciprocable piston in said cylinder, said piston having valve means therein serving to admit fluid from said receiver through said piston into said cylinder on the stroke of the piston in one direction constituting the intake stroke and preventing passage of said fluid through said piston on the stroke thereof in the opposite direction constituting the pressure stroke, said cylinder having a discharge opening for discharging the fluid therefrom under pressure of said piston, a check valve intermediate said piston and said discharge opening in the cylinder, said check valve normally closing on the intake stroke of said piston, a fluid pressure cylinder above said receiver, a reciprocable piston therein, a connecting rod extending from said last mentioned piston through said receiver to said first mentioned piston and serving to drive said first mentioned piston by the reciprocation of said last mentioned piston, and means for alternately applying a fluid pressure to opposite sides of the last mentioned piston, said means including a fluid pressure actuated shiftable valve and cooperating passages communicating with said fluid pressure cylinder at opposite ends thereof, said passages serving as intake and exhaust passages at opposite sides of said last mentioned piston, auxiliary valve means for controlling the shifting of said first mentioned valve, means for automatically controlling said auxiliary valve means incident to reciprocation of said piston in said pressure cylinder, said last mentioned means including a member telescopically arranged in one end of said connecting rod for said pistons, and having abutment means thereon engageable by said pressure cylinder piston at the extremity of its stroke in each direction for imparting motion thereto, and means connecting said member with said auxiliary valve means and serving to transmit the motion of said member to said valve means incident to reciprocation of said piston.

4. In a portable unit for emplacing a mobile fluid, a tank adapted to receive said fluid, a pump cylinder beneath said tank and arranged to receive the fluid from said tank, a reciprocable piston in said cylinder, said piston having valve means therein serving to admit fluid from said tank through said piston into said cylinder on the stroke of the piston in one direction constituting the intake stroke and preventing passage of said fluid through said piston on the stroke thereof in the opposite direction constituting the pressure stroke, said cylinder having a discharge opening for discharging the fluid therefrom under pressure of said piston, a check valve intermediate said piston and said discharge opening in the cylinder, said check valve normally closing on the intake stroke of said piston, a fluid pressure cylinder above said tank, a reciprocable piston therein, a connecting rod extending from said last mentioned piston to said first mentioned piston and serving to drive said first mentioned piston by the reciprocation of said last mentioned piston, means for alternately applying a fluid pressure to opposite sides of the last mentioned piston, said means including a fluid pressure actuated shiftable valve and cooperating passages communicating with said fluid pressure cylinder at opposite ends thereof, said

passages serving as intake and exhaust passages at opposite sides of said last mentioned piston, auxiliary valve means for controlling the shifting of said first mentioned valve, means for automatically controlling said auxiliary valve means incident to reciprocation of said piston in said pressure cylinder, said last mentioned means including a member having abutment means thereon engageable by said pressure cylinder piston at the extremity of its stroke in each direction for imparting motion thereto, means connecting said member with said auxiliary valve means and serving to transmit the motion of said member to said valve means incident to reciprocation of said piston, and means for directing exhaust pressure fluid within said tank.

5. In a portable unit for emplacing a mobile fluid, a tank adapted to receive said fluid, said tank having its lower portion inwardly tapered, a pump cylinder beneath said tank and arranged to receive the mixed materials therein, said tapered portion of the tank serving to guide the mixed materials into the cylinder, a reciprocable piston in said cylinder, said piston having valve means therein serving to admit mixed materials from said tank through said piston into said cylinder on the stroke of the piston in one direction constituting the intake stroke and preventing passage of said materials through said piston on the stroke thereof in the opposite direction constituting the pressure stroke, said cylinder having a discharge opening for discharging the mixed material therefrom under pressure of said piston, a check valve intermediate said piston and said discharge opening in the cylinder, said check valve normally closing on the intake stroke of said piston, a fluid pressure cylinder above said tank, a reciprocable piston therein, a connecting rod extending from said last mentioned piston through said tank to said first mentioned piston and serving to drive said first mentioned piston by the reciprocation of said last mentioned piston, a sleeve in said tank through which said connecting rod extends, said sleeve defining an elongated annular space about said connecting rod, means for alternately applying and exhausting a fluid pressure at opposite sides of said last mentioned piston, said means serving to effect reciprocation of said pistons and discharge of said fluid in said tank, and means for directing the exhaust pressure fluid into the annular space about said connecting rod and adjacent to one end of the sleeve.

6. In a portable unit for emplacing a mobile fluid, a closed tank adapted to receive said fluid, a pump cylinder beneath said tank and arranged to receive the fluid from said tank, a reciprocable piston in said cylinder, said piston having valve means therein serving to admit mixed materials from said tank through said piston into said cylinder on the stroke of the piston in one direction constituting the intake stroke and preventing passage of said materials through said piston on the stroke thereof in the opposite direction constituting the pressure stroke, said cylinder having a discharge opening for discharging the mixed material therefrom under pressure of said piston, a check valve intermediate said piston and said discharge opening in the cylinder, said check valve normally closing on the intake stroke of said piston, a fluid pressure cylinder above said tank, a reciprocable piston therein, a connecting rod extending from said last mentioned piston through said tank to said first mentioned piston and serving to drive

said first mentioned piston by the reciprocation of said last mentioned piston, means for alternately applying a fluid pressure to opposite sides of said last mentioned piston, said means serving to effect reciprocation of said pistons and discharge of said fluid in said tank by the pressure of said first mentioned piston, manually operable unitary control means for rendering the alternate pressure applying means inoperative and maintaining the valve means in the first mentioned piston in open position, and means for admitting a pressure fluid into said tank when the said valve means in the first mentioned piston is in open position, whereby to discharge the fluid in the tank directly by the force of the last mentioned pressure fluid.

7. In a portable unit for emplacing a mobile fluid, a closed tank adapted to receive said fluid, said tank having its lower portion inwardly tapered, a pump cylinder beneath said tank and arranged to receive the mixed materials therein, said tapered portion of the tank serving to guide the mixed materials into the cylinder, a reciprocable piston in said cylinder, said piston having valve means therein serving to admit mixed materials from said tank through said piston into said cylinder on the stroke of the piston in one direction constituting the intake stroke and preventing passage of said materials through said piston on the stroke thereof in the opposite direction constituting the pressure stroke, said cylinder having a discharge opening for discharging the mixed material therefrom under pressure of said piston, a check valve intermediate said piston and said discharge opening in the cylinder, said check valve normally closing on the intake stroke of said piston, a fluid pressure cylinder above said tank, a reciprocable piston therein, a connecting rod extending from said last mentioned piston through said tank to said first mentioned piston and serving to drive said first mentioned piston by the reciprocation of said last mentioned piston, means for alternately applying a fluid pressure to opposite sides of said last mentioned piston, and hence indirectly to the mobile fluid in the tank, said means serving to effect reciprocation of said pistons and discharge of said fluid in said tank, and manually operable control means for transferring the aforesaid indirect application of fluid pressure on the mobile fluid in the tank, directly to said mobile fluid for direct fluid pressure discharge of the same from said tank, said control means including means for maintaining said first mentioned piston at the extremity of its stroke in one direction during said direct fluid pressure discharge.

8. In a portable unit for emplacing a mobile fluid, a closed tank adapted to receive said fluid, said tank having its lower portion inwardly tapered, a pump cylinder beneath said tank and arranged to receive the mixed materials therein, said tapered portion of the tank serving to guide the mixed materials into the cylinder, a reciprocable piston in said cylinder, said piston having check valve means therein serving to admit mixed materials from said tank through said piston into said cylinder on the stroke of the piston in one direction constituting the intake stroke and preventing passage of said materials through said piston on the stroke thereof in the opposite direction constituting the pressure stroke, said cylinder having a discharge opening for discharging the mixed material therefrom under pressure of said piston, a check valve intermedi-

ate said piston and said discharge opening in the cylinder, said check valve normally closing on the intake stroke of said piston, a fluid pressure cylinder above said tank, a reciprocable piston therein, a connecting rod extending from said last mentioned piston through said tank to said first mentioned piston and serving to drive said first mentioned piston by the reciprocation of said last mentioned piston, means for alternately applying a fluid pressure to opposite sides of said last mentioned piston, and hence indirectly to the mobile fluid in the tank, said means serving to effect reciprocation of said pistons and discharge of said fluid in said tank, and manually operable control means for transferring the aforesaid indirect application of fluid pressure on the mobile fluid in the tank, directly to said mobile fluid for direct fluid pressure discharge of the same from said tank, said control means including means for causing said first mentioned piston to automatically assume a position with its check valve in open position to permit passage of said fluid in said tank through said piston in the direct fluid pressure discharge thereof.

9. In a portable unit for emplacing a mobile fluid, a closed tank adapted to receive said fluid, said tank having its lower portion inwardly tapered, a pump cylinder beneath said tank and arranged to receive the mixed materials therein, said tapered portion of the tank serving to guide the mixed materials into the cylinder, a reciprocable piston in said cylinder, said piston having check valve means therein serving to admit mixed materials from said tank through said piston into said cylinder on the stroke of the piston in one direction constituting the intake stroke and preventing passage of said materials through said piston on the stroke thereof in the opposite direction constituting the pressure stroke, said cylinder having a discharge opening for discharging the mixed material therefrom under pressure of said piston, a check valve intermediate said piston and said discharge opening in the cylinder, said check valve normally closing on the intake stroke of said piston, a fluid pressure cylinder above said tank, a reciprocable piston therein, a connecting rod extending from said last mentioned piston through said tank to said first mentioned piston and serving to drive said first mentioned piston by the reciprocation of said last mentioned piston, means for alternately applying a fluid pressure to opposite sides of said last mentioned piston, and hence indirectly to the mobile fluid in the tank, said means serving to effect reciprocation of said pistons and discharge of said fluid in said tank, and manually operable control means for transferring the aforesaid indirect application of fluid pressure on the mobile fluid in the tank, directly to said mobile fluid for direct fluid pressure discharge of the same from said tank, said control means including means for selectively causing said first mentioned piston to automatically assume a position with its check valve in open position to permit passage of said fluid in said tank through said piston in the direct fluid pressure discharge thereof, and for causing the said first mentioned piston to automatically assume a position with its check valve closed to interrupt the discharge of fluid from said tank.

10. In a portable unit for emplacing a mobile fluid, a closed fluid receiving hopper having an intake opening for the reception of said fluid therein, a vertical cylinder suspendingly carried by said hopper beneath the same for receiving

fluid from said hopper by the action of gravity, a reciprocable piston in said cylinder, said piston having an opening longitudinally therethrough constituting a valve seat, a connecting rod slidably carrying said piston, said connecting rod having at its piston end a valve adapted to cooperate with said valve seat in said piston, said valve engaging said seat incident to downward thrusts on said connecting rod and thereby imparting downward movement to said piston, and rising above said seat incident to upward movement of said connecting rod, said cylinder having an outlet adjacent the lower extremity thereof, means in said cylinder to limit downward movement of the piston and maintain the piston valve closed at the end of its downward stroke, whereby to interrupt discharge of said fluid, and means for imparting upward and downward movement to said connecting rod, said last named means including means for stopping and holding said piston at the end of its downward stroke, whereby to prevent discharge of the fluid through the cylinder outlet pursuant to the closure of the piston valve at the end of the downward stroke as aforesaid.

11. In apparatus of the class described, the combination of a receptacle for containing a fluid filler material to be charged and thus emplaced at a predetermined site, means operative to cause discharge of the material from the said receptacle including a mechanical pressure device arranged to act directly upon the material, fluid pressure means arranged to cause fluid pressure to act directly upon the filler material to effect discharge thereof, said mechanical means being constructed to control discharge of the filler material by said fluid pressure means for causing discharge of the material from the receptacle for emplacement at the site where it will be used, said mechanism comprising parts controlling the application of the fluid pressure to the filler material directly under the control of the mechanical pressure device.

12. In apparatus of the class described, the combination of a receptacle for containing a fluid filler material to be discharged therefrom and emplaced at a site for its use, a piston device for discharging said filler material from the said receptacle, and fluid pressure means arranged to apply fluid pressure directly to the filler material to discharge same and to operate the piston device, said piston device including means for interrupting the discharge of the filler material by the fluid pressure means.

13. In apparatus of the class described, the combination of a closable receptacle to receive a fluid material, means for discharging said fluid material by direct fluid pressure, and automatically operable mechanical means for discharging said fluid material from said receptacle, said last mentioned means including manually operable means to control the discharge of the material by said first mentioned means.

14. In apparatus of the class described, the combination of a closable receptacle to receive a fluid material, means for discharging said fluid material by direct fluid pressure, piston means for discharging said fluid material, and means coacting with said piston means and movable into one position to effect discharge of the material through said piston means by direct fluid pressure and movable into another position to interrupt said discharge, said last mentioned means constituting actuating means for the pis-

ton when the piston operates to discharge said material.

15. In apparatus of the class described, the combination of a closable receptacle to receive a fluid material, means for discharging said fluid material under pressure by direct fluid pressure, and means for discharging said fluid material from said receptacle under pressure by indirect fluid pressure, said first mentioned means being

adapted to operate independently of said last mentioned means, said last mentioned means being adapted to operate independently of said first mentioned means, and said last mentioned means also being adapted to control flow of said fluid material from said receptacle by said first mentioned means. 5

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