

Dec. 27, 1927.

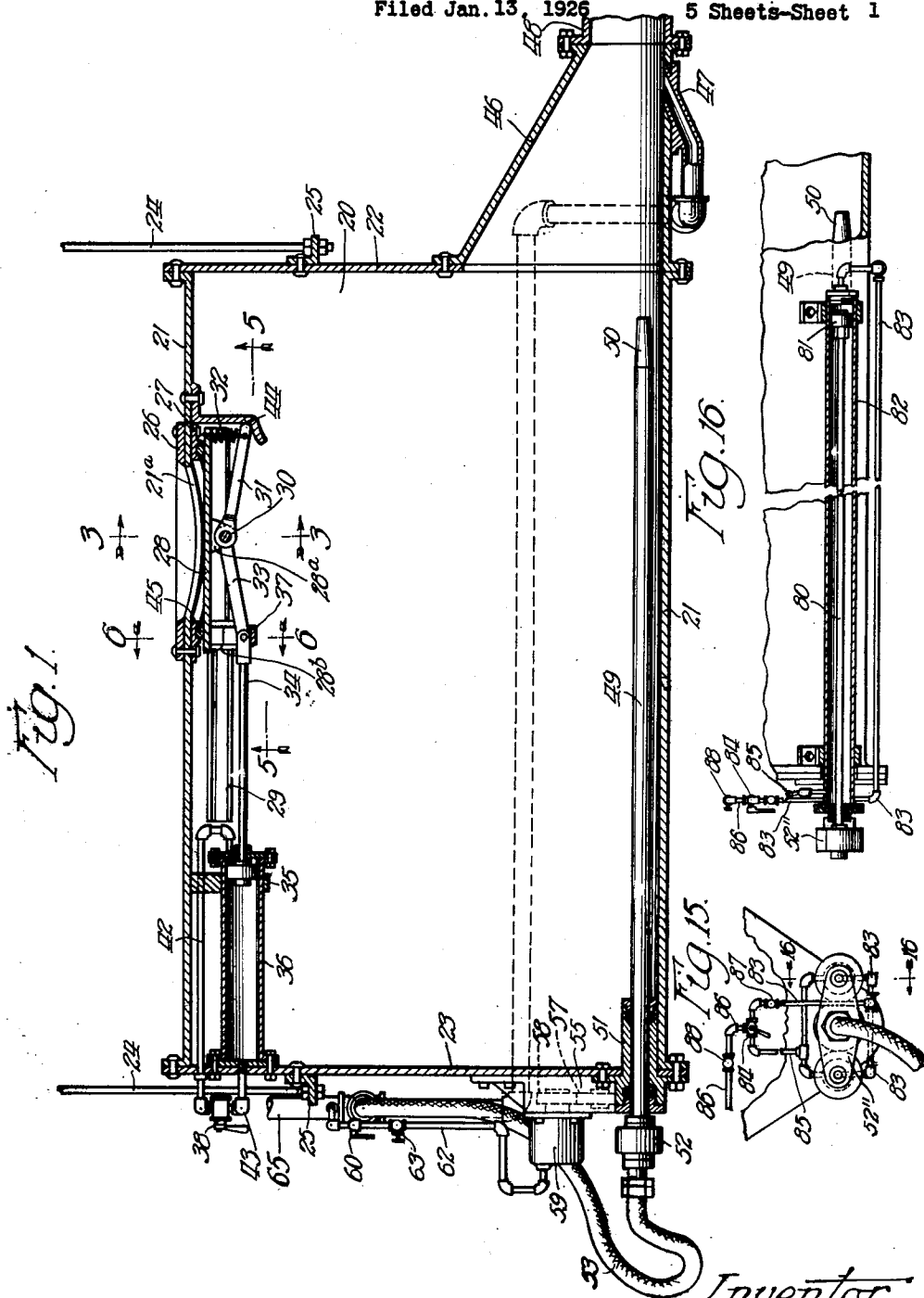
1,653,631

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CLOSURE FOR PNEUMATIC CONCRETE CONVEYERS

Filed Jan. 13, 1926

5 Sheets-Sheet 1



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5 Sheets-Sheet 2

Fig. 2.

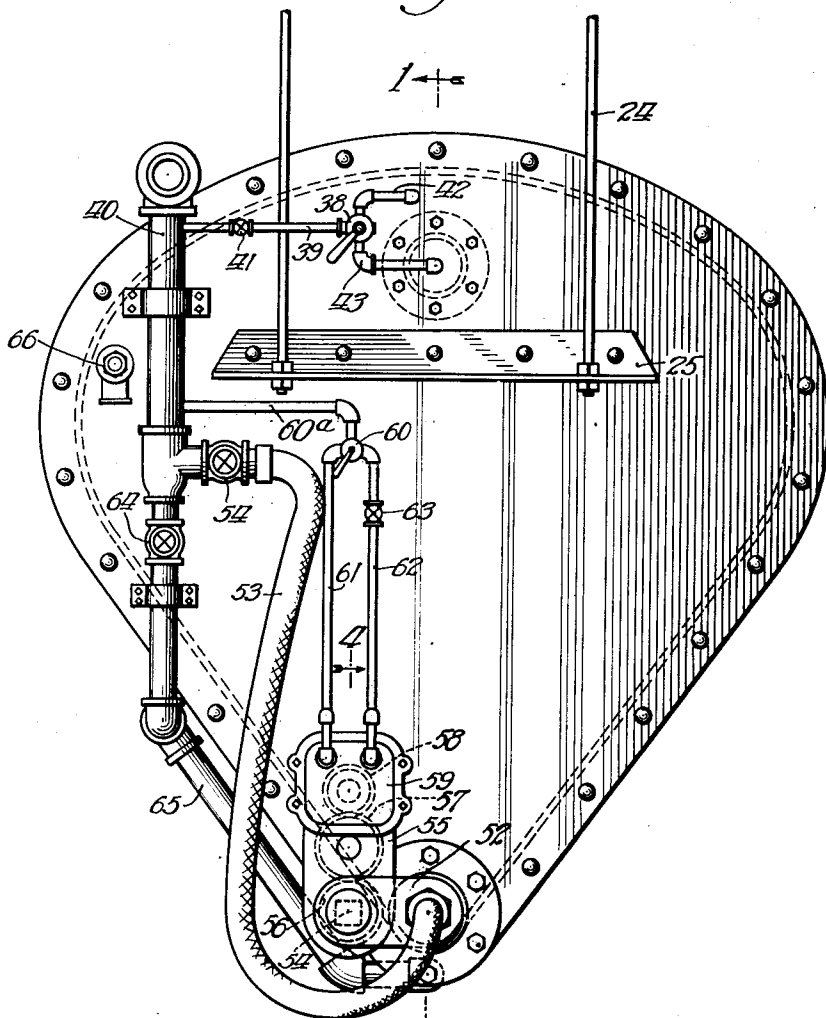
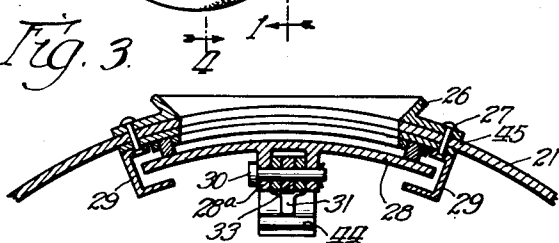


Fig. 3.



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5 Sheets-Sheet 3

Fig. 4.

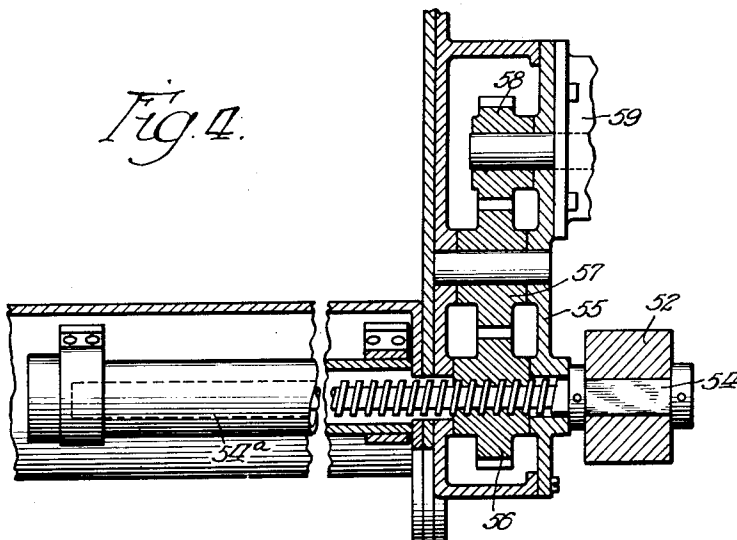


Fig. 5.

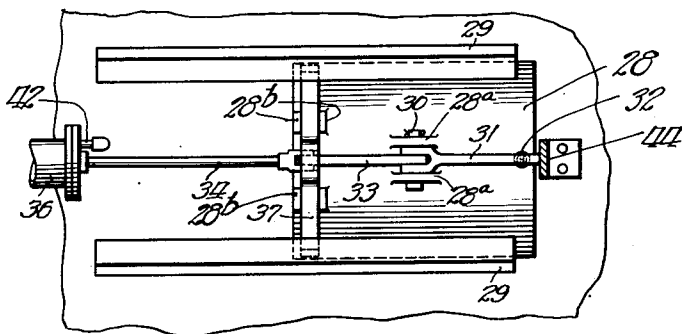
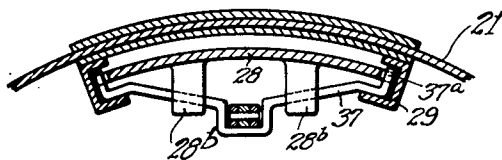


Fig. 6.



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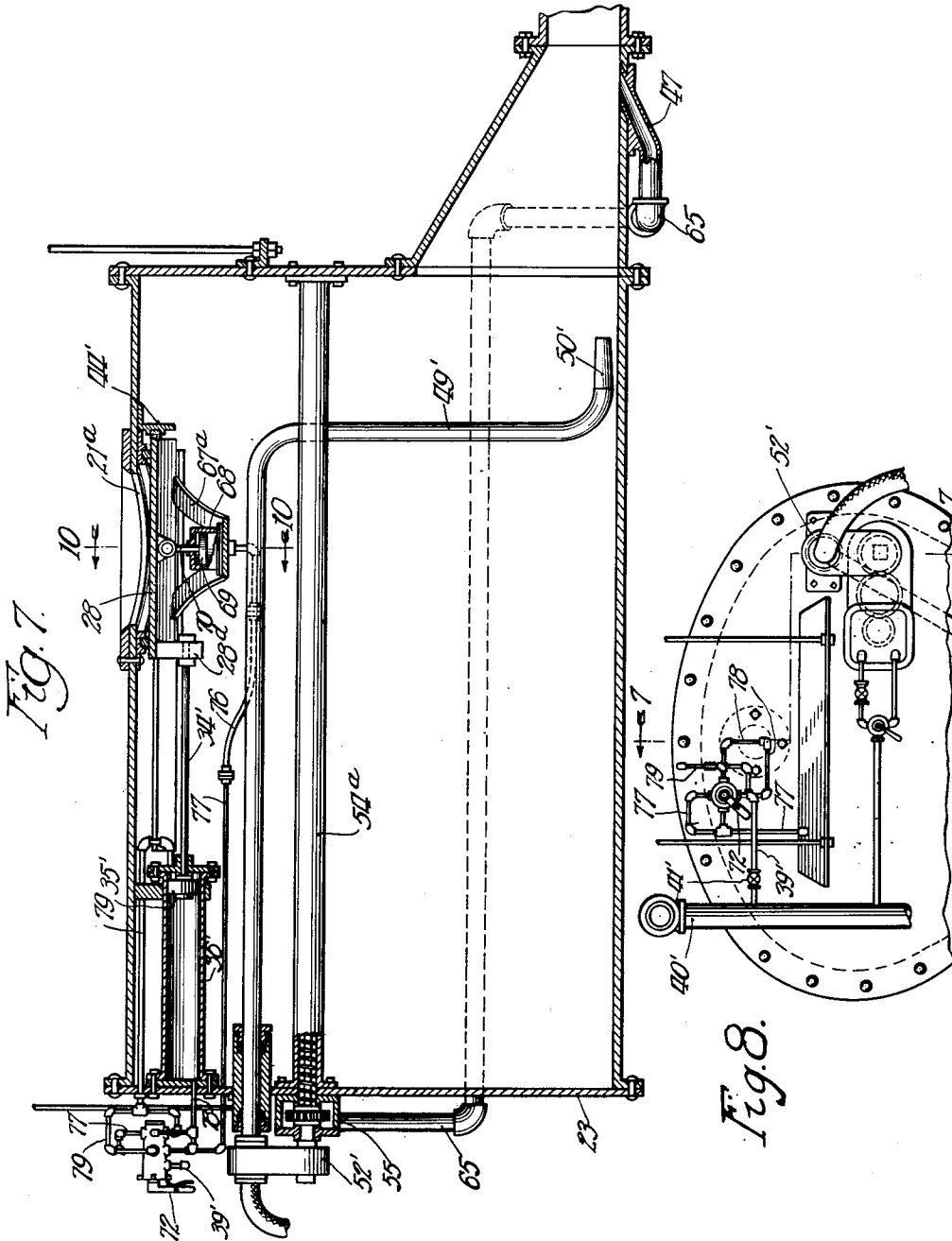
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5 Sheets-Sheet 4



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CLOSURE FOR PNEUMATIC CONCRETE CONVEYERS

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Fig. 9.

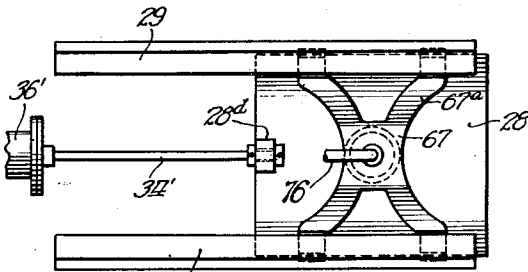


Fig. 10.

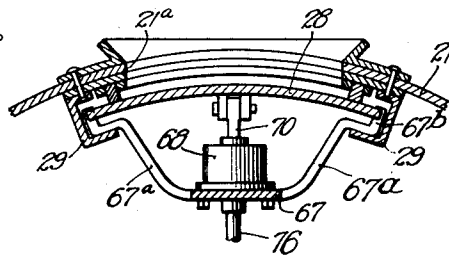


Fig. 11

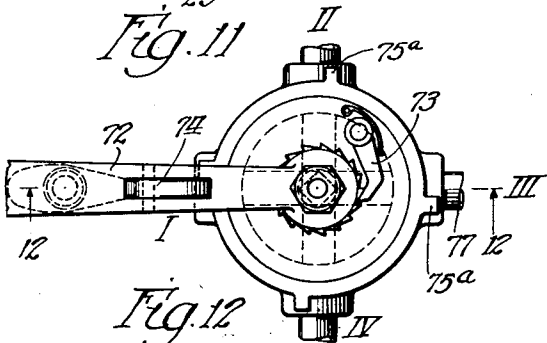


Fig. 12

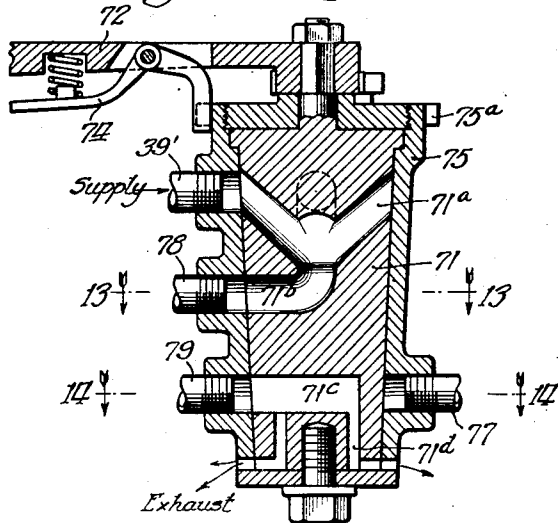


Fig. 13.

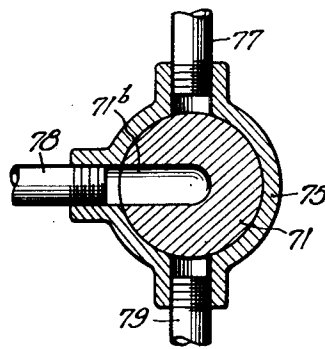
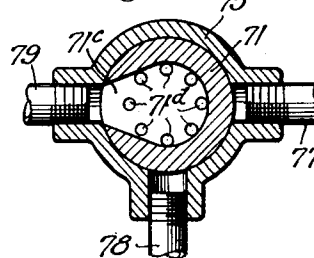


Fig. 14



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UNITED STATES PATENT OFFICE.

HARRY BRISTOL KIRKLAND, OF CHICAGO, ILLINOIS, ASSIGNOR TO CONCRETE MIXING AND CONVEYING COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

CLOSURE FOR PNEUMATIC CONCRETE CONVEYERS.

Application filed January 13, 1926. Serial No. 80,870.

My invention relates generally to apparatus for pneumatically conveying concrete and in particular is concerned with the provision of improvements in apparatus embodying the broad principles of construction and operation shown and described in the patent to McMichael No. 1,127,660, issued February 9, 1915.

An object is to provide an improved construction so as to simplify its method of operation, prevent the apparatus from becoming clogged and in general, increase the speed and efficiency of its operation.

A further object is to provide improved means to eject the concrete from the apparatus.

A further object of my invention is to provide an improved door operating mechanism.

Other objects will appear from the following specification, reference being had to the accompanying drawings in which:

Figure 1 is a vertical longitudinal sectional view of the apparatus taken on the line 1—1 of Figure 2;

Figure 2 is a front end elevation;

Figure 3 is a transverse vertical sectional view of the charging door and adjacent parts taken on the line 3—3 of Figure 1;

Figure 4 is a detailed sectional view taken on the line 4—4 of Figure 2, showing the means used to withdraw and return the secondary pressure nozzle;

Figure 5 is a bottom plan view of the charging door taken on the line 5—5 of Figure 1;

Figure 6 is a vertical transverse sectional view of the charging door and associated parts taken on the line 6—6 of Figure 1;

Figure 7 is a longitudinal vertical sectional view of a receptacle using modified forms of door operating and pressure pipe withdrawing mechanisms;

Figure 8 is a front end elevation of the receptacle shown in Figure 7;

Figure 9 is a bottom plan view of the modified construction of the door operating mechanism;

Figure 10 is a transverse vertical sectional view of the modified door operating mechanism taken on the line 10—10 of Figure 7;

Figure 11 is a plan view of the multi-port door controlling valve;

Figure 12 is a vertical sectional view

thereof taken on the line 12—12 of Figure 11;

Figures 13 and 14 are transverse sectional views taken on the lines 13—13 and 14—14 respectively of Figure 12;

Figure 15 is a front end elevation of the lower part of the receptacle showing a second modification of a pressure pipe withdrawing mechanism; and

Figure 16 is a vertical sectional view thereof taken on the line 16—16 of Figure 15.

In lining the walls of long tunnels and similar structures with concrete it has been found desirable to have the receptacle, from which the concrete is pneumatically conveyed, movable into the tunnel. This is usually accomplished by providing an arched frame carriage the wheels of which run on rails at the sides of the tunnel, bridging over the track upon which the work cars are run. The receptacle is suspended from the frame of this carriage, at one side so as not to interfere with the operation of the cars with which it is supplied with mixed concrete. For this reason the receptacle must have as small over-all dimensions as is consistent with the capacity desired. Due to the necessity of having the receptacle of limited vertical and transverse dimensions, it is made in the shape of an obovate cylindroid lying on its side, the concrete being ejected from one end of the receptacle at a constricted or funnel portion. Difficulty has been experienced in advancing the concrete in the receptacle to the funnel portion, where the booster nozzle can act upon it to eject it from the receptacle. My present invention overcomes this difficulty by providing a secondary air pressure nozzle which is movable along the bottom of the receptacle so as to successively force portions of the concrete toward the booster nozzle. In this way, as the concrete which has been dumped into the receptacle is pneumatically forced toward the booster nozzle and as the pile of concrete recedes from the booster nozzle, the secondary pressure nozzle is gradually withdrawn so as to continually feed a supply of concrete to the booster nozzle.

In Figures 1 and 2 I have shown the receptacle 20 as composed of an obovate cylindroid shaped sheet 21 to which the heads 22 and 23 are securely riveted. Supporting

rods 24, suspended from a movable overhead frame (not shown), are bolted to angle clips 25 which are riveted to the heads 22 and 23. A charging aperture 21^a formed in the top of the receptacle is surrounded by suitable ring plates 26 and 27 which serve as a funnel and a reinforcement respectively for this opening.

The door 28 is slidably mounted in a pair of opposed channels 29 which are riveted to the top of the receptacle. In the construction shown in Figures 1, 3, 5, and 6 the rectangular shaped door 28, which is curved to conform to the shape of the top of the receptacle, has a pair of depending lugs 28^a which form a bearing for a pivot pin 30. A bifurcated toggle link 31 is pivoted to the door at pin 30 and its free end is resiliently held in an upward position by a spring 32 which is secured to the door. A similar link 33 is pivoted to the door at pin 30 at one end, and to the piston rod 34 at the other. The piston rod 34 carries a piston 35 which is operable in a cylinder 36 which is suitably secured to the top and to the front head of the receptacle. A saddle 37 normally slides horizontally with the door 28 and forms a support for the end of the piston rod 34. The upturned ends 37^a of the saddle 37 are guided in suitable slots in the edges of the door 28. Depending lugs 28^b also serve as guides so as to permit relative vertical movement between the door 28 and saddle 37.

A valve 38 is connected by pipe 39 to the compressed air supply line 40. A valve 41 in the pipe 39 serves as a means for regulating the air pressure at the valve 38. The valve 38 is of the four-way type, which when in one position will permit the air to flow from pipe 39 through pipe 42 to the crank end of the cylinder 36, at the same time permitting the air to escape from the head end of the cylinder 36 and pipe 43. Upon reversal of the valve 38 the air will be permitted to flow from the supply pipe 39 through the pipe 43 to the head end of the cylinder and at the same time permit the air to escape from the crank end of the cylinder 36 through the pipe 42. It will thus be seen that door 28 may be opened by the air under pressure being admitted to the crank end of the cylinder 36 and similarly the door may be closed by admitting air under pressure to the head end of the cylinder 36. Near the end of the closing operation of the door the free end of the toggle link 31 abuts against the fixed stop 44. Links 33 and 31 then act as a toggle and the continued rearward movement of the piston rod 34 causes the door 28 to be raised into firm engagement with a rubber packing ring 45 which is secured to the plate 27 and extends around the periphery of the opening 21^a. When the air pressure in the receptacle is

raised, as will be later described, the door is pressed against the packing still more firmly. At the beginning of the opening operation of the door the toggle links will again straighten out with respect to each other and permit the door 28 to move downwardly and continued application of air under pressure to the crank end of the cylinder will cause the door to be withdrawn from its position beneath the opening 21^a.

A discharge funnel 46 is secured at an opening in the lower portion of the rear head 22 and serves as a means to mass the concrete together so that it may be readily acted upon by the air stream from the booster nozzle 47, which is directed toward the discharge opening of the funnel portion 46. The pipe 48, through which the concrete is ejected, is bolted or otherwise suitably secured to the small end of the funnel 46.

The concrete having been dumped into the receptacle, some means is necessary to force the concrete toward the booster nozzle. For this purpose I provide a long pipe 49 at the end of which there is a nozzle 50. I also provide means for moving this nozzle away from the booster nozzle as the concrete between it and the booster nozzle is discharged from the receptacle. For this purpose the pipe 49 passes through a packing box 51 secured in the head 23. A cross piece 52 is fixed near the end of the pipe and a flexible hose 53, coupled to the supply line at the valve 54, supplies air to the pipe 49. The cross piece 52 is also fixed over the square end of a screw 54 which is supported in a housing casting 55 and extends backwardly in a protecting pipe 54^a which is secured to the outside of the receptacle 20. Gear 56 has a threaded bore engaging the threads of the screw 54 and meshes with intermediate gear 57 which in turn is driven by the pinion 58 of a reversible air motor 59. Upon operation of the motor 59 the gear 56 will be rotated and since it is prevented from axial movement by housing casting 55, it will force the screw 54 outwardly and hence retract the pipe 49 from the receptacle. A three-way valve 60 is arranged to connect the supply line 60^a with either of the pipes 62 or 61 which supply air for the operation of the motor to respectively withdraw and return the pipe 59.

It is usually desirable to have the pipe 49 returned to its normal position (as in Figure 1) as quickly as possible, while it may frequently be desirable to adjust the speed at which it is withdrawn depending upon the amount of the charge in the receptacle and various other conditions of operation. The pipe 62 has an adjusting valve 63 by which adjustment of the speed of the motor, while it is operating to withdraw the pipe 49 from the receptacle, may be made. This adjustment does not affect the speed of op-

eration of the motor upon the returning of the pipe. Of course, I do not wish to limit myself to the use of an air motor since any other suitable power means for withdrawing and returning the pipe 49 may be used.

A valve 64 is used to regulate the amount of air discharged from the booster nozzle 47 to which it is directly connected by the pipe line 65. A relief valve 66 is suitably positioned at the front head of the receptacle so as to permit a quick release of the air pressure in the receptacle after the concrete has been ejected.

In Figure 7 I have shown a modified door operating mechanism and also a modified construction of the secondary air pressure pipe. For convenience of reference I have numbered the parts which are common to both constructions with the same reference characters. The door 28 in this modification is also slid on its channels by an air piston, the piston rod 34' of which is slidably secured to a bifurcated lug 28^a, depending from the door 28. A suitable cushioning stop 44' limits the rearward movement of the door. A saddle 67, the form of which is best shown in Figure 9, has four arms 67^a having upwardly turned ends 67^b which are suitably guided in notches in the side edges of the door 28. The saddle 67 supports a cylinder 68 having a piston 69 secured to the piston rod 70 which is pivotally connected to the door 28. By admitting air under pressure to the lower end of the cylinder 68, the door will be raised to securely seal the opening 21^a. Upon release of the pressure in the lower part of the cylinder 68 gravity will restore the door 28 to the position in which it rests upon the channel rails 29.

In order to prevent the operator of the apparatus from attempting to move the door 28 by admitting air into the cylinder 36 before he has released the pressure in the cylinder 68, I have provided a semi-automatic control valve consisting of a body 75 and a rotatable valve member 71, operatively secured therein. This valve has four operative positions. In position I, it admits air to the head end of cylinder 36 and permits the air from the crank end of cylinder 36 to escape. In position II, air is admitted under pressure to the lower end of cylinder 68. In position III, the air is permitted to escape from the lower end of the cylinder 68. In position IV, air under pressure is admitted to the rear end of cylinder 36 and the air permitted to escape from the front end of the cylinder. A ratchet wheel 72^a integral with the handle 72, with co-operating spring pressed pawl 73 prevents the valve from being turned in the wrong direction. A release lever 74 is pivotally secured to the handle 72 and spring pressed into engagement with the upper peripheral

edge of the valve body 75 and adapted to normally abut against one of the four lugs 75^a. The lugs 75^a thus define the four positions of the valve as previously enumerated.

Referring now to Figures 7 to 14 inclusive, the lower end of cylinder 68 is connected through a flexible air hose 76 to a pipe line 77 which is suitably connected to the valve body 75 at two ports as shown in Figures 13 and 14. The pipe line 78 connects the head end of the cylinder 36 which a second pair of ports of the valve, while another pipe line 79 suitably connects the crank or rear end of the cylinder 36 with a third pair of ports in the valve body 75. A pipe 39', connected through the regulating valve 41' with the main air supply line 40, supplies the air to the control valve. In each of the four positions of the valve 71, one of the four centrally and downwardly (Figure 12) extending ducts 71^a connects the supply line 39' with the distributing duct 71^b. The receiving duct 71^c is connected to the free air through exhaust passages 71^d.

In the modification which is shown in Figure 7, the secondary air pressure pipe 49' has its nozzle 50' adjacent the bottom of the receptacle but the pipe extends upwardly so that its major portion normally lies above the concrete when the receptacle is charged and lies to the side of the opening 21^a so that in charging the receptacle the concrete does not fall upon the pipe. In this construction the pipe is not subjected to the abrasive action of the concrete to such a great extent as in the first described construction. In other respects the construction of the modification shown in Figures 7 and 8 is similar to that shown in Figures 1 and 2 with the possible exception that the screw protecting pipe 54^a lies inside the receptacle.

In Figures 15 and 16 I have shown a modified construction for withdrawing the air pressure pipe 49. In this construction a cross bar 52'' is secured to the end of the pipe 49 and to the ends of a pair of piston rods 80. The pistons 81 connected to these rods operate in cylinders 82 which are rigidly secured to the receptacle.

A pipe line 83, connects the rear end (right hand end, Fig. 16) of the cylinders 82 with one port of a three-way valve 84 while a pipe line 85 connects the front end of the cylinders 82 with a second port of the three-way valve 84, the third port of which is connected to the supply line by means of pipe line 86. A regulating valve 87 in the pipe line 83 makes it possible to regulate the speed at which the secondary air pressure pipe 49 is withdrawn from the receptacle without affecting the speed at which it is returned, while the valve 88 in pipe line 86 may be used to regulate both the speed

at which the pipe 49 is withdrawn and the speed at which it is returned. The valve 84 may be turned so as to close the passageway from the pipe line 86.

5 While I have shown my invention and described it in detail, it will be apparent that other modifications may be employed without departure from my invention and I do not wish to be limited to the particular
10 construction disclosed, but what I claim and desire to secure by Letters Patent is:

1. In a concrete conveying device, a receptacle having an opening therein, a door slidable into position to close said opening, a
15 pair of toggle links each having one end pivoted to said door, and an actuating rod pivotally connected to one of said links, said rod being adapted to move said door in register with said opening and subsequently
20 through the toggle action of said toggle links force said door against said receptacle to seal said opening.

2. In a concrete conveying device, a receptacle having an opening therein, a door slidable into position to close said opening, and
25 means for sliding said door over said opening and forcing said door perpendicularly against said receptacle to seal said opening, comprising a rod and a pair of toggle links.

3. In a concrete conveying device, a receptacle having an opening therein, a door slidable into position to close said opening, a pair of links pivotally connected to the central portion of said door, a stop, resilient
35 means holding one of said links in position to engage said stop, an actuating rod pivotally connected to the other of said links, said rod being arranged to slide said door into position in register with said opening and
40 subsequently actuate said toggle links to force said door against said receptacle to seal said opening.

4. In an apparatus of the class described, a receiver provided with an opening for the introduction of concrete to be conveyed, a
45 door slidable upon a pair of rails beneath said opening, a pneumatically actuated rod, a saddle slidable with said door, said saddle forming a support for the end of said rod, and a toggle linkage operable by said rod for
50 raising said door relative to said rails and saddle.

5. In an apparatus of the class described, a receiver provided with an opening for the introduction of concrete to be conveyed, a
55 door slidable upon a pair of rails beneath said opening, a rod movable with said door for sliding said door on said rails, and a toggle linkage operable upon movement of said

rod relative to said door, for raising said door from said rails.

6. In an apparatus of the class described, a receptacle provided with an opening for the introduction of concrete, a door slidably
60 mounted beneath said opening, pneumatically operated means for sliding said door relative to said opening and for pressing said door against said receptacle to seal said opening.

7. In an apparatus of the class described, a receiver provided with an opening for the introduction of concrete, and means to seal
70 said opening, comprising, a cylinder, a piston and rod operative therein, a toggle linkage, having one link pivotally connected to said piston rod, a door horizontally and vertically
75 slidable and operatively secured to the central pivot of said toggle linkage, means to admit a fluid under pressure to one end of said cylinder and simultaneously permit the
80 escape of fluid from the other end of said cylinder so as to move said door horizontally into register with said opening, and a fixed stop arranged to engage the free end of said
85 toggle linkage and thereby arrest the horizontal movement of said door and cause said toggle links to force said door vertically.

8. In an apparatus of the class described, a receiver provided with an opening for the introduction of concrete, and means to seal
90 said opening comprising, a door, a saddle slidable relative to said door, means for sliding said door and saddle in one direction as a unit, and means to move said door relative to said saddle at right angles to the first
95 mentioned motion.

9. In an apparatus of the class described, a receiver provided with an opening for the introduction of concrete to be conveyed, a door slidable into registry with said opening,
100 means for applying power to slide the door into registry with the opening and means for utilizing power thus applied to force said door into tight engagement with the margins of the door opening when the registry of
105 door and opening has been effected.

10. In an apparatus of the class described, a receiver provided with an opening for the introduction of concrete to be conveyed, a door slidable into registry with said opening,
110 and means for sliding the door into registry with the opening comprising means for moving the door into engagement with the margins of the door opening when such registry has been effected.

In witness whereof, I hereunto subscribe my name this 5th day of January, 1926.

HARRY BRISTOL KIRKLAND