Aug. 16, 1966 M. M. MASON 3,266,433

CONCRETE PUMP

Filed Jan. 21, 1965 4 Sheets-Sheet 1

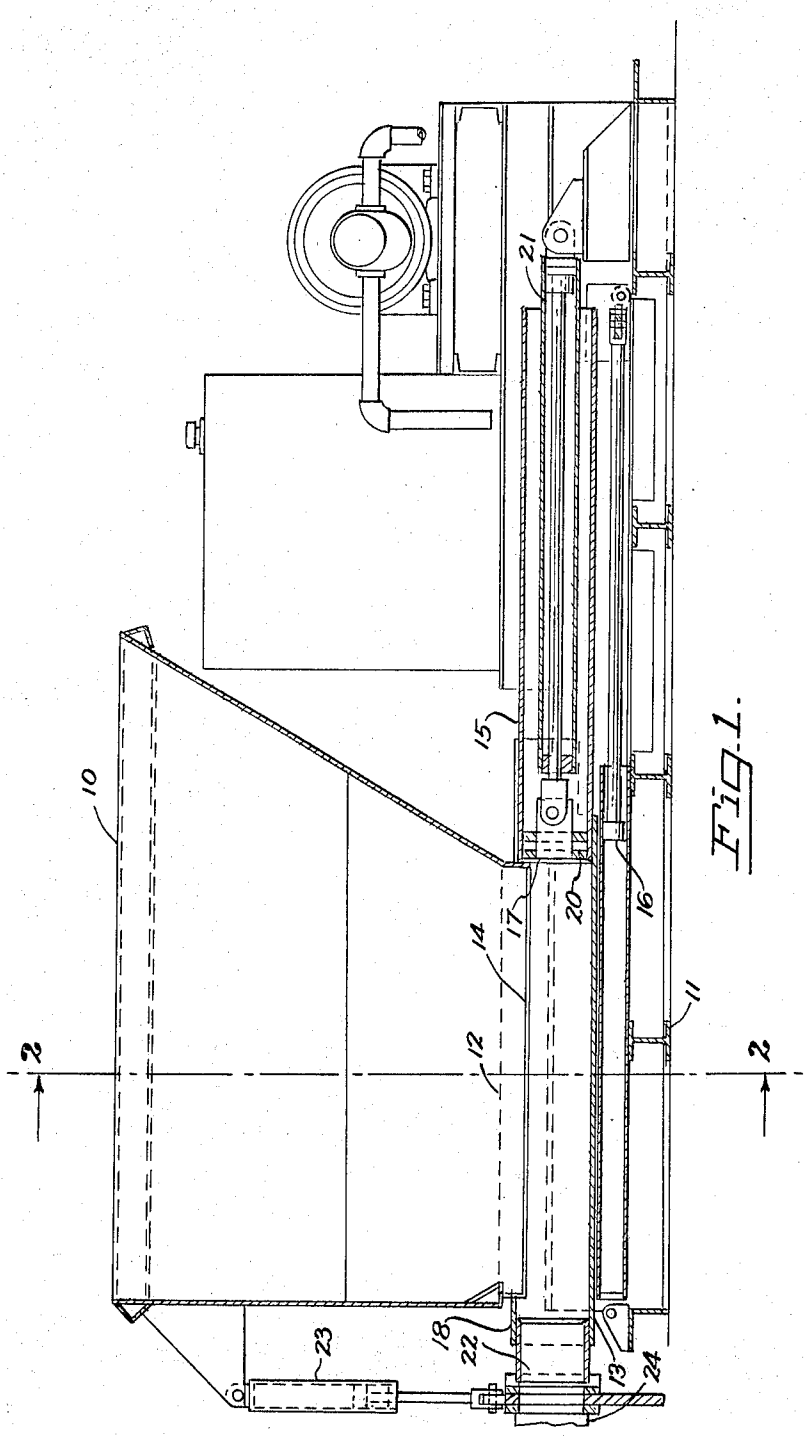


FIG. 1.

Aug. 16, 1966 M. M. MASON 3,266,433

CONCRETE PUMP

Filed Jan. 21, 1965 4 Sheets-Sheet 2

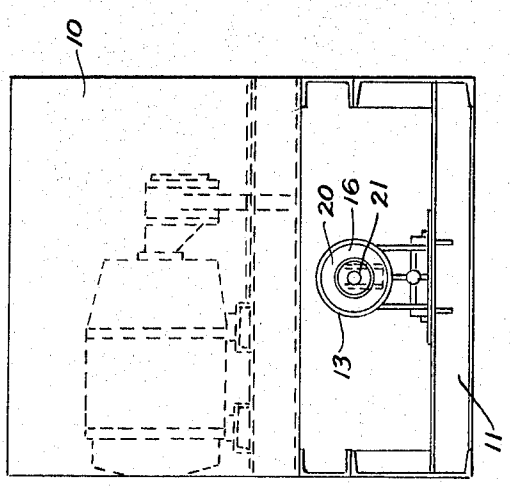


Fig. 3.

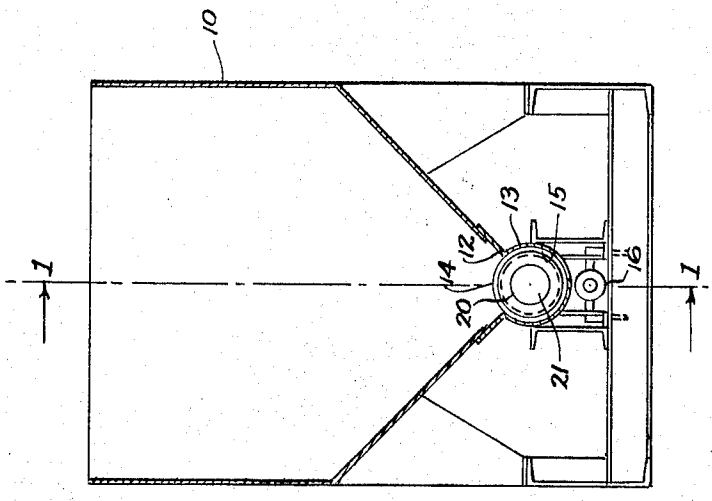


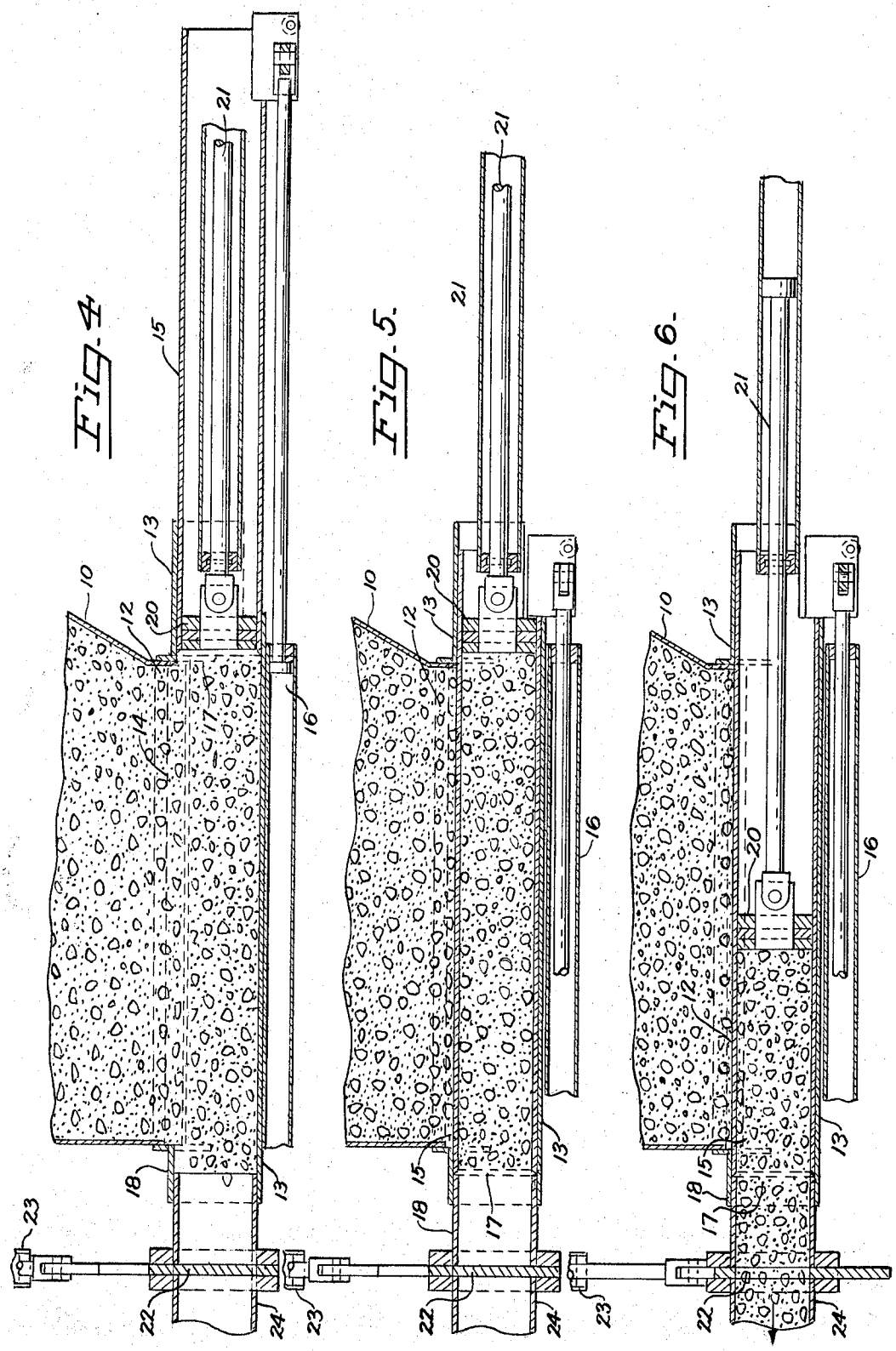
Fig. 2.

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Aug. 16, 1966 M. M. MASON 3,266,433

CONCRETE PUMP

Filed Jan. 21, 1965 4 Sheets-Sheet 3



Aug. 16, 1966 M. M. MASON 3,266,433

CONCRETE PUMP

Filed Jan. 21, 1965 4 Sheets-Sheet 4

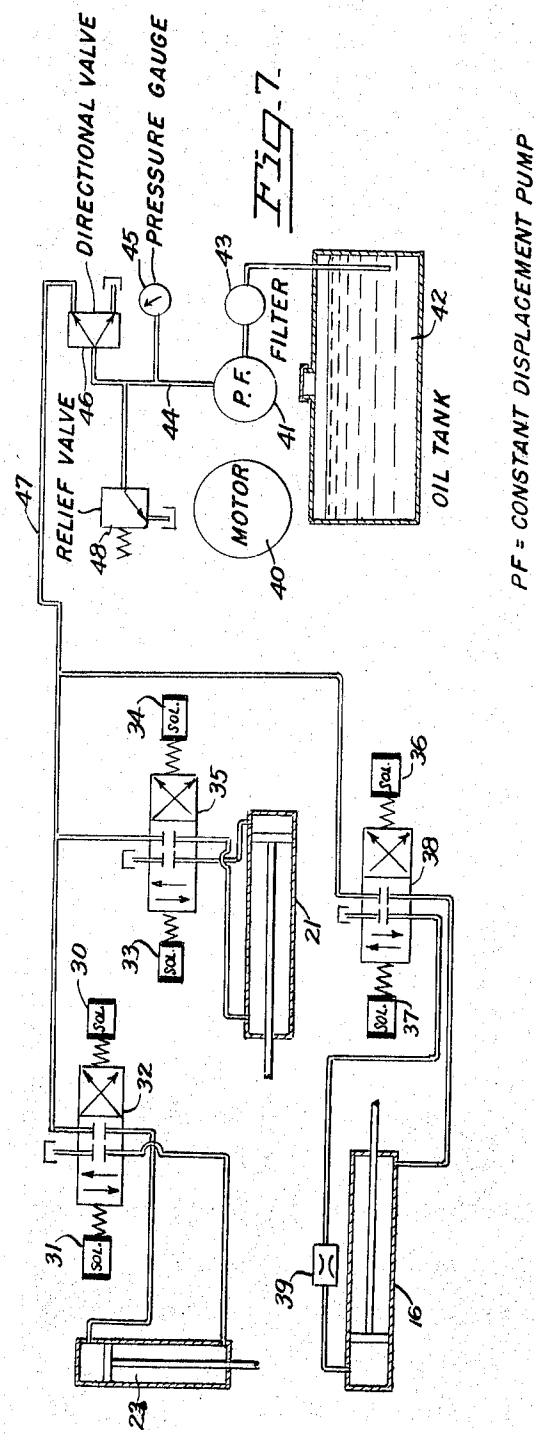


FIG. 7.

FIG. 8.

United States Patent Office 3,266,433 Patented August 16, 1966

3,266,433

CONCRETE PUMP

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Filed Jan. 21, 1965, Ser. No. 427,043
3 Claims. (Cl. 103—158)

This invention relates to a device for pumping unset concrete mixtures from a hopper to a remote location.

Many types of pumps for moving concrete mixes have been tried, but nearly all employed complex or complicated mechanisms and valving arrangements; these mechanisms and arrangements gave trouble, plugging, breaking down, or wearing excessively. As a result, pumped concrete was expensive, if at all practical.

An object of the present invention is to provide a pumping device free from springs, check valves, and other complicated mechanisms, since these were a source of trouble and expense due to their wear and breakage.

Another object of my invention is to provide a concrete pumping device in which mechanical failure can be held to a minimum and therefore concrete production can be increased. To promote this object, my machine is positive in its operation.

Another object is to provide a positive-displacement type of concrete pump, so that, when my pump is connected to a suitable conduit, concrete can be delivered at points quite remote from the pump itself.

Another object is to provide a pump for moving low-slump concrete (i.e., a very dry concrete mix) through a delivery pipe to forms at a final destination.

Basically, my invention calls for only three main moving parts: a cylinder, a piston, and a gate valve. Each of these is reciprocated hydraulically in a regular sequence relative to the other two. The machine is essentially linear in construction and can be placed in a relatively restricted space, such as in a small tunnel. In contrast, size is frequently a factor limiting the use of other such devices. The hydraulic pressure can be varied to suit conditions so that only the power required for a particular job need be expended, yet sufficient force can be applied to force concrete through a delivery pipe one thousand feet or more long, if on the level.

Other objects and advantages of the invention will appear from the following description of a preferred embodiment.

In the drawings:

FIG. 1 is a view in side elevation and in vertical section taken longitudinally along the line 1—1 in FIG. 2 through a machine embodying the principles of the invention.

FIG. 2 is a view in section taken along the line 2—2 in FIG. 1, through the concrete-receiving hopper and the supply tube.

FIG. 3 is a view in section taken along the line 3—3 in FIG. 1, through the oil reservoir and the pumping cylinder.

FIG. 4 is a fragmentary view in section, on an enlarged scale, of a portion of FIG. 1 showing the pump in operation at the commencement of a cycle, with both the cylinder and piston retracted.

FIG. 5 is a view similar to FIG. 4 with the cylinder moved forward to seal the area through which the piston will subsequently move.

FIG. 6 is a view similar to FIG. 5 with the piston in the middle of its forward stroke and with the gate valve open.

FIG. 7 is a diagram of an hydraulic circuit for the machine of FIGS. 1–6.

FIG. 8 is an electrical circuit diagram used for actuating the hydraulic circuit of FIG. 7.

The concrete pump of this invention includes a receiving hopper **10** mounted on a structural steel base **11**. An opening **12** at the lower end of the hopper **10** empties into (at appropriate times) a supply tube **13** which is generally cylindrical in shape with an open upper end **14** and which extends both forward of and to the rear of the hopper opening **12**. Typically the openings **12** and **14** may be about four feet long and seven inches wide.

A reciprocating cylinder **15** is adapted to slide in a close-fitting relationship to the tube **13**. It is reciprocated by a hydraulic ram **16** from a rear position shown in FIG. 4, where the forward end **17** of the cylinder **15** is to the rear of the openings **12** and **14**, to a forward position shown in FIGS. 5 and 6 and where the end **17** is beyond and ahead of the openings **12** and **14** and sealed on a front portion **18** of the supply tube **13**.

My pump also has a reciprocating piston **20** which is reciprocated by a hydraulic ram **21** to move forward and back inside the reciprocating cylinder **15**. I also provide a gate valve **22** actuated by a hydraulic device **23** to open and close a connection from the supply tube **13** to a suitable conduit **24** of a desired length.

At the start of a pumping cycle (FIG. 4) the reciprocating cylinder **15** and the piston **20** are both retracted behind the openings **12** and **14**, and the gate valve **22** is closed. Concrete falls freely from the hopper **10** into the supply tube **13**, filling that tube by gravity.

The cycle begins with the hydraulic ram **16** moving the cylinder **15** forward, as shown in FIG. 5. This fills the cylinder **15** with concrete and the overlap of the cylinder **15** beyond both ends of the openings **12** and **14**, preferably about three inches at each end, forms a seal and prevents flow from the cylinder **15** back into the hopper **10**.

The cycle continues as shown in FIG. 6 with the gate valve **22** being opened by its hydraulic device **23** and the piston **20** being moved forward by its ram **21**, forcing concrete into the delivery conduit **24** during the full length of the stroke of the ram **21** and piston **20**. If there is any concrete in the conduit **24** already, it is forced forward therein by the same amount, the length of the stroke of the ram **21** and piston **20**.

At the end of the forward stroke of the piston **20**, the gate valve **22** is closed, to prevent back flow or back suction; then both the piston **20** and the cylinder **15** are retracted, preferably simultaneously, by their rams **21** and **16**. This returns them to their FIG. 4 position, and more concrete falls from the hopper **10** into the supply tube **13**. The cycle is then repeated, resulting in actually intermittent but, in effect, substantially continuous, flow of concrete from an outlet end of the delivery conduit **24**.

Mixed concrete may be supplied to the hopper **10** direct from a concrete mixer or by a belt conveyor or by buckets or by any other suitable means. The concrete may have fine aggregate or coarse aggregate or mixtures thereof, as well as the cement.

As shown in FIGS. 7 and 8, the hydraulic rams **16**, **21** and **23** may be controlled by a series of solenoid valves, which may themselves be manually or automatically controlled.

Solenoids **30** and **31** may control a four-way valve **32** that, in turn, determines whether the ram **23** will open or close the gate valve **22**. When the solenoid **31** is energized, it actuates the valve **32** to the position that opens the gate valve **22**, while energization of the solenoid **26** actuates the valve **32** to the position that closes the gate valve **22**.

Solenoids **33** and **34** may control a four-way valve **35** that, in turn, determines whether the ram **21** will move the piston **20** outwardly or retract it. Energization of the solenoid **33** causes the piston **20** to move out and

pump concrete, while energization of the solenoid **34** causes retraction of the piston **20**.

Solenoids **36** and **37** may control a four-way valve **38**, which, in turn, determines whether the ram **16** will advance or retract the cylinder **15**. Energization of the solenoid **36** causes the cylinder **15** to advance to its cut-off position, while energization of the solenoid **37** causes the retraction of the cylinder **15** to open the opening **14**. An adjustable restrictor valve **39** may be used to synchronize the movements of the rams **16** and **21**, since the cylinder **15** and piston **20** are to move together during retraction.

A motor **40** may operate a pump **41** to draw oil from a tank **42** through a filter **43** and supply it to a conduit **44** at a pressure measured by a gauge **45**. During operation, a directional valve **46** connects the conduit **44** to a conduit **47** that leads to the three valves **32**, **35**, and **38**. A relief valve **48** may be provided to avoid excessive pressure.

Four switches **50**, **51**, **52** and **52** may be used to control the solenoids **30**, **31**, **33**, **34**, **36**, and **37**, either manually, by buttons **54**, **55**, **56**, and **57**, or automatically by use of a clock switch **58**. Thus, when the switch **50** is closed, the solenoids **30** and **36** are actuated, thereby simultaneously actuating the valves **32** and **38** so as to cause the ram **23** to open the gate valve **22** and also to cause the ram **16** to advance the cylinder **15**, filling the cylinder and closing the opening **14**. Then, after a delay, the switch **51** is closed to energize the solenoid **33** that actuates the valve **35** to the position where the ram **21** advances the piston **20**, sending a charge of concrete through the gate **22** into the conduit **24**. Next, after delay for completion of the pumping operation, the switch **52** is closed, energizing the solenoid **31**, which moves the valve **32** and thereby causes the ram **23** to close the gate valve **22**. Finally, the switch **53** is closed to energize simultaneously the solenoids **34** and **37** to move the valves **35** and **38** to the position where the rams **21** and **16** retract simultaneously the piston **20** and the cylinder **15**. With the clock switch **58**, the completed cycle may immediately lead to the beginning of the next cycle.

To those skilled in the art to which this invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the spirit and scope of the invention. The disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

I claim:

1. A concrete pumping device, including in combination:

a hopper for concrete having an opening in its lower end,

a supply tube having an inlet opening in its upper end aligned with said hopper opening and having a cylindrical rear end and a cylindrical forward end,

a cylinder mounted for reciprocation in said supply tube and longer than said inlet opening, for movement between a rear position where said cylinder is withdrawn from said inlet opening and a forward position where it fully closes said inlet opening and confines within itself concrete which dropped by gravity from said hopper into said supply tube,

a piston reciprocatable in said cylinder from said rear end toward said forward end,

a gate valve normally closing the forward end of said supply tube,

first hydraulic means for moving said cylinder between its rear position and its forward position,

second hydraulic means for opening and closing said gate valve, and

third hydraulic means for moving said piston between its rear position and its forward position.

2. The device of claim **1** including

first actuation means for simultaneously actuating said first and second hydraulic means for opening said gate valve and moving said cylinder to its forward position,

second actuation means for actuating said third hydraulic means for moving said piston to its forward position,

third actuation means for actuating said second hydraulic means to close said gate valve, and

fourth actuation means for simultaneously actuating said first and third hydraulic means to move said cylinder and said piston to their rear positions.

3. The device of claim **2** having means for automatically and cyclically and successively actuating said first, second, third, and fourth actuation means with a suitable timed interval between each actuation thereof.

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MARK NEWMAN, *Primary Examiner.*

HENRY F. RADUAZO, *Examiner.*