

May 25, 1943.

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2,319,981

PUMP FOR CONCRETE AND THE LIKE

Filed Dec. 3, 1941

2 Sheets-Sheet 1

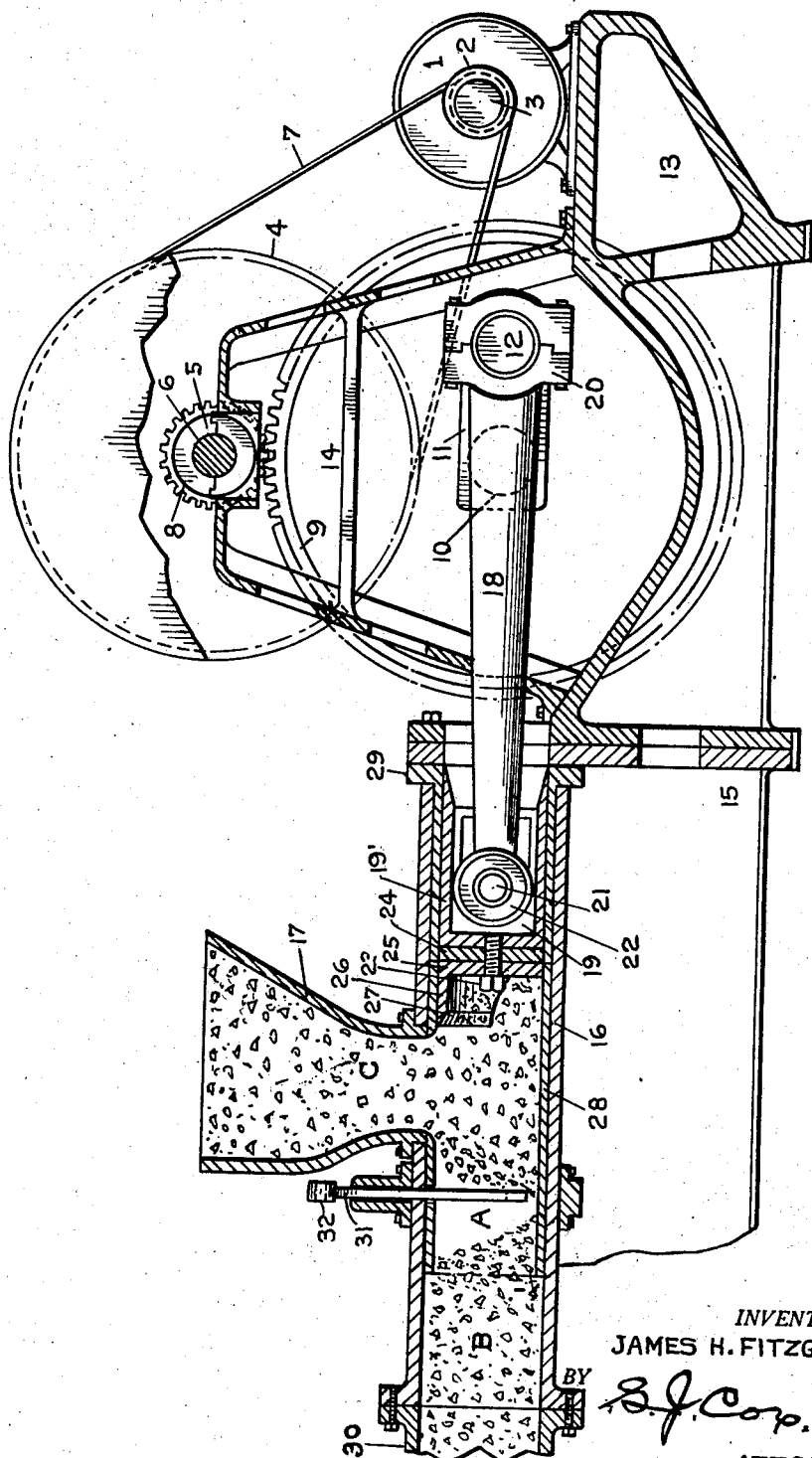


Fig. 1

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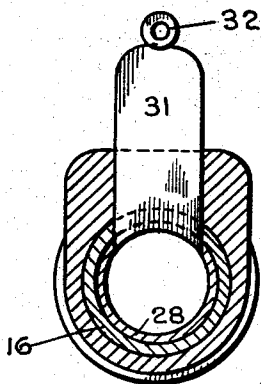
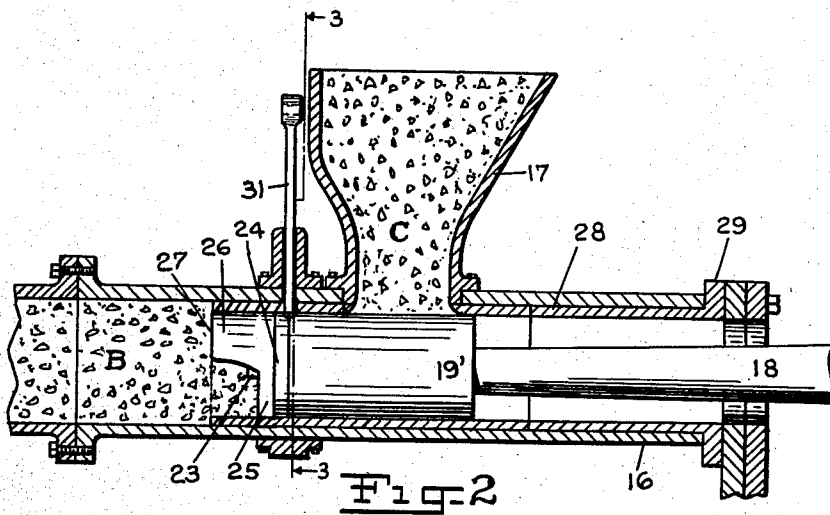


Fig-3

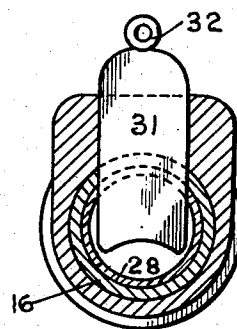


Fig-4

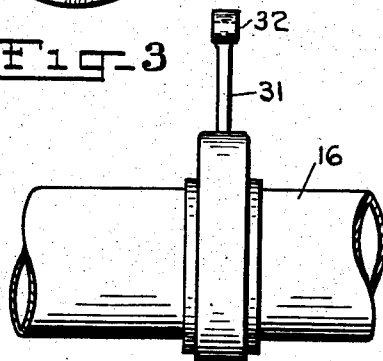


Fig-5

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UNITED STATES PATENT OFFICE

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PUMP FOR CONCRETE AND THE LIKE

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5 Claims. (Cl. 103—153)

The invention relates primarily to the conveyance of concrete and similar materials by means of a pumping device by which they are propelled through conduits to the place of delivery but may be employed for other purposes to which it is adaptable. Its object is to improve the pumping apparatus heretofore used and shown in various patents and other publications in the art and to provide a pumping and conveying apparatus which will be simpler in construction, more efficient and durable and will require a minimum of repairs, renewals, operating cost, upkeep and servicing.

Heretofore it has been the practice to employ pumps of this class in which the feeding hopper outlet and the outlet of the pressure cylinder are provided with valves synchronized with the piston or plunger, the former closing and the latter opening on the forward or power stroke and the latter closing and the former opening on the return or back stroke of said plunger, so that concrete is fed to the cylinder from the hopper and concrete in the discharge or conveying conduit is prevented from moving back into the said cylinder on the back stroke and on the forward stroke the concrete is shut off from the hopper while the discharge is opened. It has also been the practice to have the forward stroke of the plunger terminate short of the hopper outlet so that the mass of concrete in the cylinder below the hopper is never cut off and the plunger always acts directly on that mass and the mass always obstructs the hopper outlet and must be forced to flow backward toward the plunger to admit more from the hopper flowing by gravity therefrom. This construction and operation is attended with difficulties and disadvantages and requires the attention of trained operators, the careful synchronization of the valves and valve operating connections and frequent servicing and repairs. It also leads to unsatisfactory operation and requires the use of very high pressures which necessitate strong, heavy construction and cause breaks and undue wear and tear on the apparatus.

With the present invention, the plunger is so arranged and is given such a stroke that it passes the hopper outlet, forces the concrete in the cylinder well beyond it and on its return stroke leave a void in the cylinder below the hopper outlet into which the concrete may freely pass therefrom. It also packs the concrete in the discharge end of the cylinder so that it will not readily flow backward thereinto and leaves a space between each section or slug of concrete

which has been forced by the plunger to said discharge end and the concrete gravitating into the cylinder from the hopper in which space a gate may operate freely and which provides a cushion on the forward stroke of the plunger which will absorb the initial pressure created thereby, until the said hopper outlet is closed off, thereby insuring against the return of air and liquid in the concrete by pressure to and through the concrete in the hopper. It also involves the use of a cutting edge projecting from the head of the plunger and passing over the outlet of the hopper in advance thereof which shears the concrete at said mouth and closes the outlet before sufficient pressure is built up to cause blowing back of said fluid elements on the power stroke of the plunger, as well as preventing such action on the backward stroke until another void has been formed between the discharge and the feed, and the pressure thus relieved.

It is believed that in the present apparatus on the forward or power stroke of the piston the air of the void in the cylinder or pressure chamber between the newly discharged slug or sub-mass of concrete therein adjacent the discharge mouth of the hopper and the column of concrete beginning at the discharge end of said pressure chamber, being many times more fluent than any of the elements of the concrete mixture, seeks to escape from the pressure and spreads in both directions, penetrating the concrete and between the concrete and the cylinder until it impinges against the cylinder head, where it accumulates, thus tending to clear the path of the piston and lubricate between it and the cylinder and greatly reducing friction and wear on these parts. It is also believed that on the return stroke of the piston this air being under compression maintains pressure on the column of concrete in the cylinder end and conveying conduit so as to prevent the said column from retreating under the influence of suction and thus cause it to pack or jam and prevent a backward flow. This second action of the trapped air of the void renders the use of a gate between the piston and the column of concrete unnecessary in most cases. With or without the gate, however, a bend in the cylinder end or nearby conduit may be employed to promote this packing or jamming of the concrete. However, whether this theory of operation is correct or not, the creation and maintenance of the void performs a useful and important function in promoting the action stated. It is believed that it

also tends to prevent arching of the concrete in the neck of the hopper above the discharge opening by momentarily agitating the concrete therein from below when the piston retreats, as it has been found in operation that this arching does not occur, at least to any serious extent. If desired, however, an agitator in the neck of the hopper may be employed to prevent packing or arching and insure a free and rapid discharge. It has also been found that friction and wear on the piston and cylinder are reduced to a degree far below that which usually occurs in pumps of this type, and that the piston works freely and with high efficiency.

It will be seen from the foregoing that the invention includes not only an apparatus but a method of operation performed by that apparatus which comprises the constant maintenance of a void filled with air which is compressed and expanded alternately and provides a free space for the movement of the gate or other valve when used which will insure against blocking thereof.

Various other functions and advantages will be apparent to those familiar with the construction and operation of apparatus of this type from the following description.

The improvements are illustrated in the accompanying drawings, referred to herein, which show an exemplary embodiment thereof and in which—

Fig. 1 is a vertical, longitudinal, medial section partly in elevation, of the pumping apparatus, with the piston or plunger retracted and the gate closed;

Fig. 2 is a similar view of the pump with the piston at the end of its forward stroke and the gate open;

Fig. 3 is a vertical cross section of the cylinder and gate housing on the line 3—3 of Fig. 2 showing the gate in open position;

Fig. 4 is a view similar to Fig. 3 showing the gate closed; and

Fig. 5 is a side elevation of the cylinder, gate and gate housing.

The specimen power unit for operating the pump consists essentially of a motor 1 with small pulley 2 on its shaft 3, a large pulley 4 mounted in bearings 5 by a trunnion shaft 6 and driven by a belt 7, a pinion 8 on shaft 7 meshing with a large gear wheel 9 having its axis 10, to which a crank arm 11 is keyed, fixed thereto. This power unit is suitably mounted on a frame consisting of the base frame member 13 and the upper frame member 14 bolted thereto, all as shown in Fig. 1. The frame 15 supporting the other parts of the apparatus is securely fixed to the frame 13 of the power unit and mounts the cylinder 16 on which the feed hopper 17 is in turn fixed and supported.

The connecting rod 18 of the piston 19 is operatively connected with the crank arm 11 to be driven thereby by the crank pin 12 and bearing head 20 on the rod. The opposite end of the piston rod is connected inside the skirt 19' of the piston by a wrist pin 21 engaged with the piston bearing 22.

The piston 19 has secured to its head by means of one or more screw bolts 23 passing there-through and through a packing disk 24 and threads therein, a heavy disk 25 with a semi-cylindrical member 26 projecting forwardly therefrom at its upper half and provided with a cutting edge 27. This member is preferably a separate piece which may be removed from the piston head and replaced when worn or damaged,

but it may be made integral with the piston if desired. Its primary purpose is to cut through the concrete at the mouth of the hopper, at the beginning of the forward stroke of the piston, sever the sub-mass of concrete deposited in the cylinder 16 beneath said mouth on the preceding retraction of the piston and seal off the mouth opening before the pressure built up by said stroke has reached a degree which will cause the air and liquid content of the plastic concrete mixture—commonly called “soup”—to blow up into the hopper to any undesirable extent. There will be a slight passage of air under compression, following the path of least resistance, between the forward cutting edge of this member and forward edge of the hopper mouth, which will tend to clear the concrete from these edges and prevent the larger aggregates—usually cracked stone or gravel—from being caught between them. This air will be supplied principally from the concrete void A in the forward portion of the cylinder left by the piston on its backward stroke and pushed forward by the mass of concrete dumped into the cylinder ahead of the piston before the piston starts another forward stroke. The member 26 also permits the piston to retreat to a point where the air in the void A has an opportunity to expand to a certain extent before the hopper mouth is uncovered, so that it will not at that time blow up into the concrete mass C in the hopper except to a limited extent and sufficient only to loosen the packing of said concrete in the neck. The void will then form behind the retracted piston from beyond the point where the gate is located to the opposite side of the hopper so that the concrete descending from the hopper will have an unobstructed path, to fill the cross-section of the cylinder and spread laterally.

The cylinder is provided with an internal wear lining 28 preferably in two sections joined back of the member 25 when at “home” position so that the forward part may easily be removed and replaced if necessary. At its forward edge the lining has a flange 29 which is secured between the main support member 15 and the edge of the cylinder, and at the edges of its opening 28' which surrounds the mouth of the hopper it is rounded to reduce friction and wear. Its forward edge terminates at the place where the forward or power stroke of the piston and its cutting edge ends, and at this point provides a slight ledge reducing the diameter of the cylinder and retarding the slight backward movement of the column of concrete B in the discharge end of the cylinder and the conveying conduit 30 forming a joined continuation thereof.

The gate 31 works in a housing 32 and has a ring at its top to which may be connected any suitable means for opening it before the piston advances and closing it as the piston starts to retreat so that it will act against the backward movement, if any, of the concrete column B. It has straight sides and an upwardly curved bottom so that it does not fill the cross section of the cylinder but leaves spaces at sides and bottom, insufficient to permit the concrete to flow therethrough and sufficient to cause it to pack if necessary and form a jam. These spaces or apertures will, however, permit air to pass the gate freely. Any satisfactory mechanism synchronized with the piston, as, for illustration, a spring rod connected with the piston drive and operating a cam member or lever for raising and lowering the gate, may be employed to op-

erate the gate. The gate operates in a transverse slot in the cylinder and its lining and this slot may be provided with packing to prevent leakage around the gate if necessary.

It will be understood that the length of the piston stroke, the piston and the member 26 may be varied to secure the best results and that other details of the exemplary embodiment may be changed, also that any suitable power unit and power transmitting mechanism may be employed without departing from the scope of the invention.

The improvements may be used for pumping the usual wet and dry plastic mixed concrete, which usually consists of broken rock or gravel, sand, Portland cement and sufficient water to produce a wet or "dry" mix, but is not limited to the pumping of such concrete mixtures as distinguished from other more or less fluent solids in a divided state either dry or mixed with liquid.

What I claim is:

1. A piston or plunger, an elongated cylindrical pressure chamber in which the plunger reciprocates, power means for moving said plunger forward to drive the material to be pumped and backward therefrom, a feeding container for said material having a discharge opening into said chamber along the path of said plunger and between its forward and backward positions and adapted to discharge material into said chamber in advance of the said plunger's forward stroke, a projecting member rigid with the forward end of the head of said plunger entirely within the extreme radial dimensions of the plunger constructed and arranged to pass said discharge opening in advance of said plunger and to cut off discharged material from the body of material in the container and close the opening.

2. A piston or plunger, an elongated cylindrical pressure chamber in which the plunger reciprocates, power means for moving said plunger forward to drive the material to be pumped and backward therefrom, a feeding container for said material having a discharge opening into said chamber along the path of said plunger and between the forward and backward positions and adapted to discharge material into said chamber in advance of the said plunger's forward stroke, a projecting member comprising a cylindrical piece of metal conforming approximately to the inner contour of the pressure chamber rigid with the forward end of the head of said plunger and flush with the extreme radial dimensions of the plunger constructed and arranged to pass said discharge opening in advance of said plunger and to cut off discharged material from the body of material in the container and close the opening.

3. A piston or plunger, an elongated cylindrical pressure chamber in which the plunger

reciprocates, power means for moving said plunger forward to drive the material to be pumped and backward therefrom, a feeding container for said material having a discharge opening into said chamber along the path of said plunger and between the forward and backward positions and adapted to discharge material into said chamber in advance of the said plunger's forward stroke, a projecting member comprising a cylindrical piece of metal conforming approximately to the inner contour of the pressure chamber and a forward cutting edge thereon rigid with the forward end of the head of said plunger and flush with the extreme radial dimensions of the plunger constructed and arranged to pass said discharge opening in advance of said plunger and to cut off discharged material from the body of material in the container and close the opening.

4. A piston or plunger, an elongated cylindrical pressure chamber in which the plunger reciprocates, power means for moving said plunger forward to drive the material to be pumped and backward therefrom, a feeding container for said material having a discharge opening into said chamber along the path of said plunger and between the forward and backward positions and adapted to discharge material into said chamber in advance of the said plunger's forward stroke, a projecting member comprising a cylindrical piece of metal conforming approximately to the inner contour of the pressure chamber rigid with the forward end of the head of said plunger and flush with the extreme radial dimensions of the plunger constructed and arranged to pass said discharge opening in advance of said plunger and to cut off discharged material from the body of material in the container and close the opening, and means adjacent a void for checking backward movement of said compressed concrete.

5. A piston or chamber, an elongated cylindrical pressure chamber in which the plunger reciprocates, power means for moving said plunger forward to drive the material to be pumped and backward therefrom, a feeding container for said material having a discharge opening into said chamber along the path of said plunger and between its forward and backward positions and adapted to discharge material into said chamber in advance of the said plunger's forward stroke, a projecting member rigidly secured to the forward end of the head of said plunger entirely within the extreme radial dimensions of the plunger constructed and arranged to pass said discharge opening in advance of said plunger and to cut off discharged material from the body of material in the container and close the opening and to pass said discharge opening after the piston of the return stroke of the latter.

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