Nov. 21, 1944. B. A. TRIPP 2,363,162

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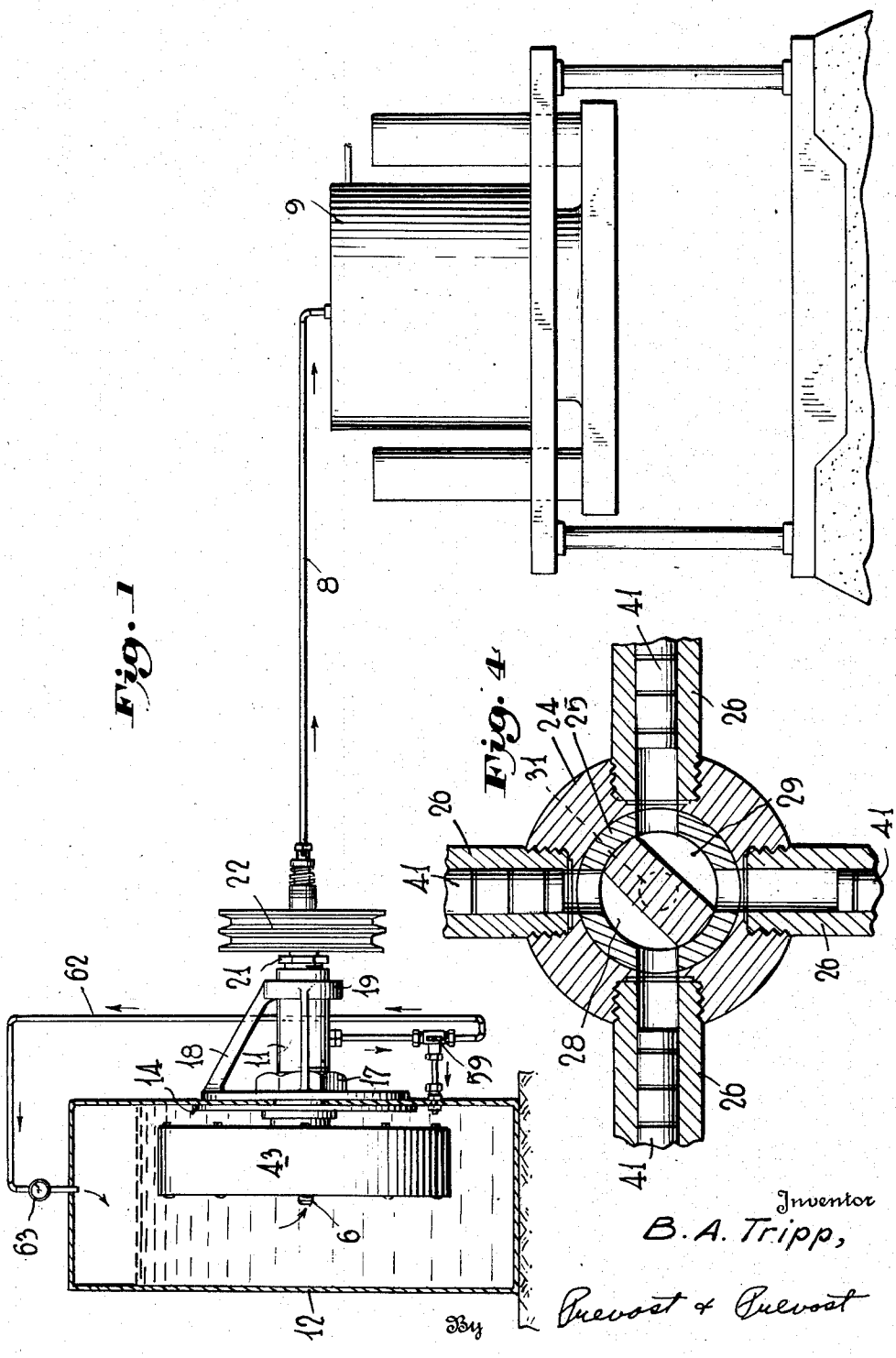


Fig. 1

Fig. 4

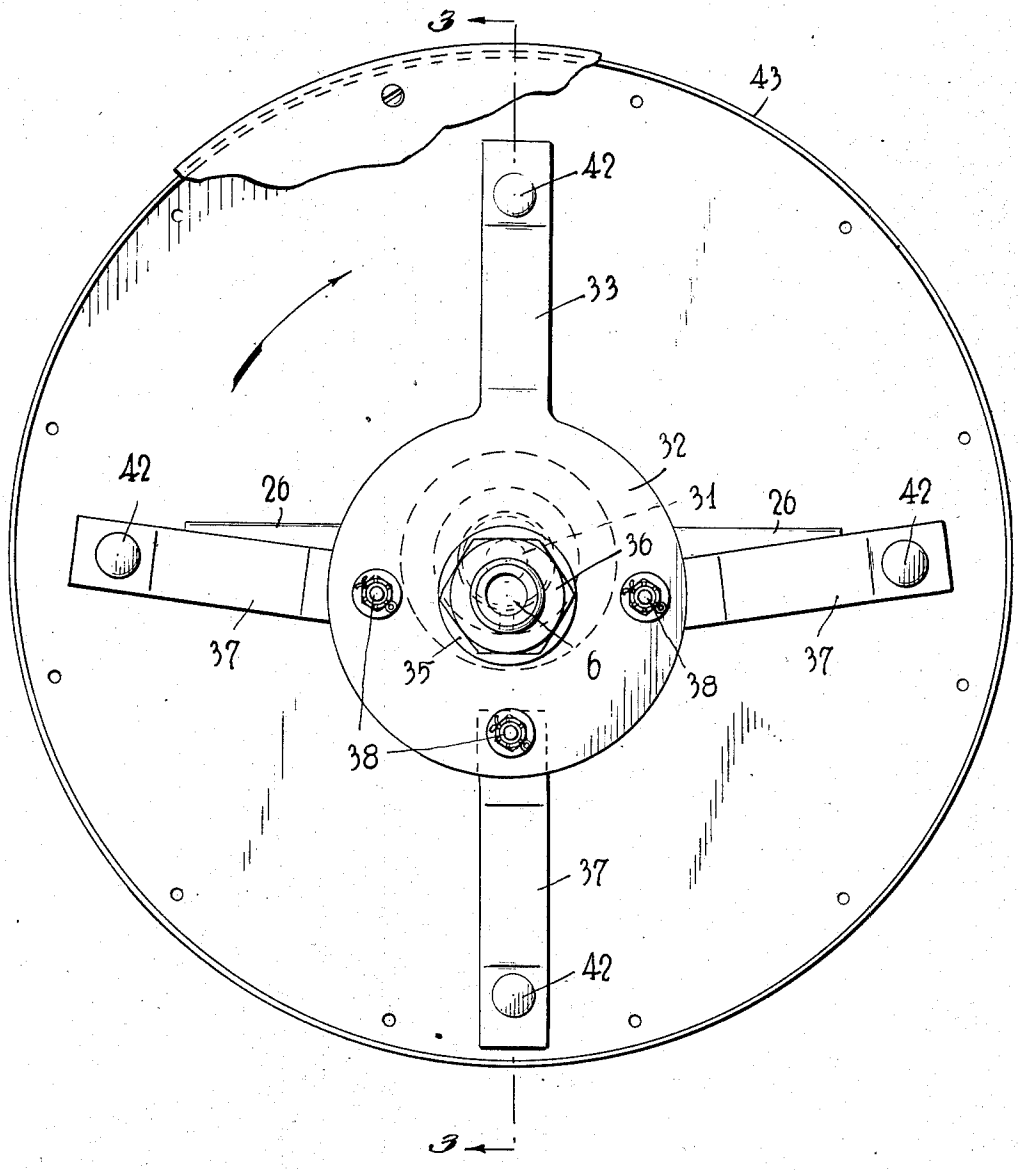
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Fig. 2



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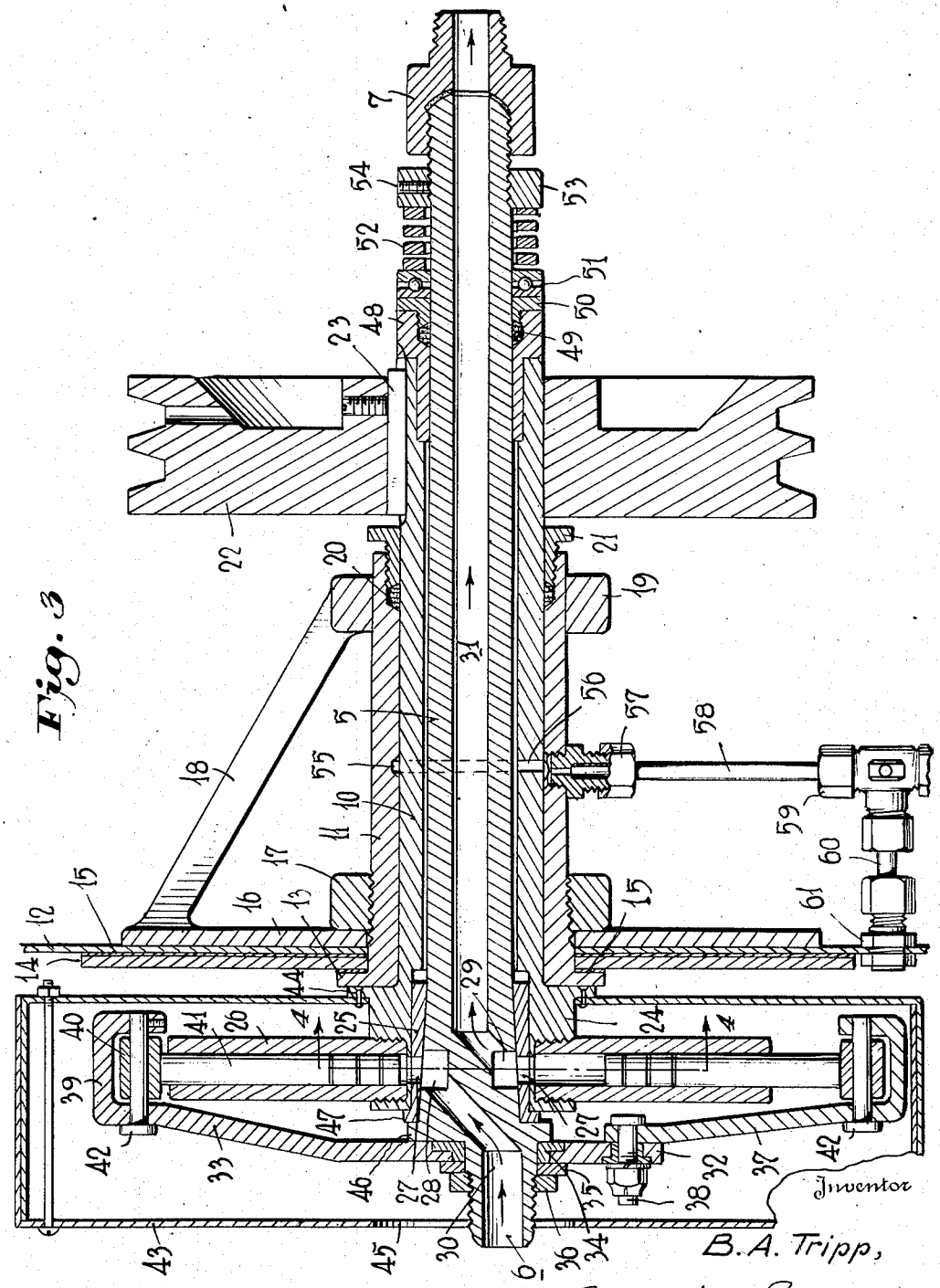


Fig. 3

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Patented Nov. 21, 1944 2,363,162

UNITED STATES PATENT OFFICE

2,363,162

PUMP

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Application December 29, 1941, Serial No. 424,827

14 Claims. (Cl. 103—161)

This invention relates to high pressure pumps, and more particularly to a rotary pump of the radial cylinder type adapted especially for operating a hydraulic press.

One of the objects of the invention is to provide a pump of such construction as to prevent vibration of the pipe line caused by strokes of the pistons which is accomplished in my construction due mainly to the fact that two cylinders are always discharging at the same time at 90 degrees intervals.

Another object is to provide a pump, the output of which has a definite maximum pressure which may be maintained, but not exceeded for each setting of a control member.

A further object is to supply a pump of balanced character which facilitates lubrication when lubricating oil is used as the pressure medium.

With the foregoing objects outlined and with other objects in view which will appear as the description proceeds, the invention consists in the novel features hereinafter described in detail, illustrated in the accompanying drawings, and more particularly pointed out in the appended claims.

In the drawings:

Fig. 1 is a side elevation, partly in vertical section, of my improved pump structure shown in use with a hydraulic press.

Fig. 2 is a transverse vertical sectional view of the pump on an enlarged scale, and shown partly in elevation.

Fig. 3 is a vertical longitudinal sectional view, taken on the line 3—3 of Fig. 2.

Fig. 4 is an enlarged transverse vertical sectional view of a detail, taken on the line 4—4 of Fig. 3.

Referring to the drawings, 5 designates a stationary tubular shaft having a crank portion 6 at one end thereof. The opposite end of the shaft is connected by a screw threaded joint to an adapter 7 that may be connected by a pipe 8 to any means for utilizing the output of the pump, for example, a hydraulic press 9. As best shown in Fig. 3, the shaft supports a rotatable drive sleeve 10 which rotates in a reservoir bushing 11. At one end, the latter extends into a reservoir 12 and is provided with an outwardly extending flange 13 abutting a reinforcing plate 14 which in turn abuts one of the walls of the reservoir. Sealing gaskets 15 are arranged between the parts 12, 13 and 14, and a good joint is maintained by arranging a clamping plate 16 at the exterior of this wall. Such plate is adjustably secured in position by any suitable means such as a nut 17 having threaded engagement with the bushing 11. For reinforcing purposes, struts 18 are arranged between the peripheral portion of the plate 16, and a brace collar 19 which surrounds and slidably engages the bushing 11.

For sealing purposes, a packing ring 20 is arranged between the parts 10 and 11, and is engaged by a threaded gland 21.

The drive sleeve may be turned by any suitable means such as a belt driven pulley 22 keyed to the sleeve as indicated at 23.

The drive sleeve is provided at one end with a shouldered flange 24 which slidably engages the flange 13. Between the flanged end of the drive sleeve and the stationary crankshaft, there is a valve seat bushing 25 having an internal frusto-conical surface engaging a corresponding surface at the exterior of the crankshaft.

Four or more radially arranged cylinders 26 have their inner ends in threaded connection with the drive sleeve, and the inner ends of such cylinders communicate by ports 27 either with an intake groove 28 or a discharge groove 29 of the crankshaft; the groove 28 communicating with an inlet passageway 30 of the shaft, and the groove 29 communicating with an outlet passageway 31 which is within the shaft and leads to the pipe 8. As best shown in Fig. 4, the grooves are so arranged with relation to the cylinders that two cylinders are in communication with the intake groove while the other two cylinders are in communication with the discharge groove.

From Fig. 2 it may be seen that the disk 32 of a master connecting rod 33 is rotatably mounted upon the crank portion of the stationary shaft so as to travel about an axis arranged eccentrically to the axis of the main portion of the shaft, and the master connecting rod 33 is preferably provided with a central bearing 34. A thrust plate 35 is held in contact with the bearing portion of the master connecting rod 33 by means of a thrust nut 36 threaded on the crank portion of the shaft. Other connecting rods or links 37 have their inner ends pivotally connected at 38 to the disk of the master connecting rod 33 and the outer end portion of each connecting rod is preferably of U-shape, as indicated at 39 (Fig. 3), so as to receive the head portion 40 of a piston 41. Obviously, there is one piston for each cylinder, and the enlarged heads of the pistons slidably and rotatably engage pins 42 by which they are secured to the crank connecting rods.

The pistons, cylinders and crank rods all ro-

tate in unison with the drive sleeve 10, and they are preferably arranged in a two-part housing 43 that is fixedly connected at 44 to the drive sleeve so as to rotate therewith. This housing of the main parts within the reservoir prevents turbulence, as best shown in Fig. 1, while at the same time allowing the pressure medium within the reservoir to enter the housing through a central aperture 45.

From Fig. 3 it will be noted that the stationary crankshaft has a thrust flange 46 against which flange 47 of the valve seal bushing 25 presses, and this contact and also the contact between the conical part of 5 and the conical inner surface of valve seal bushing 25 is maintained by the means now to be described.

A bushing 48 which has a press fit with one end of the drive sleeve, and a sliding fit on the stationary crankshaft, provides a recess for packing 49 held in place by a packing nut 50. An anti-friction thrust assembly 51 surrounds the stationary shaft and is pressed against the nut 50 by means of a coil spring 52, the compression of which may be adjusted by a nut 53 in threaded connection with the crankshaft and which may be secured in fixed position by a set screw 54.

As the oil used as a pressure medium may also serve as a lubricant, it may travel between the bushing 11 and drive sleeve 10 for the purpose of lubricating moving parts, and to prevent such oil from leaking, I arrange an internal annular groove 55 within the bushing so that it may discharge such oil through a relief line 58 back into the reservoir. A port 56 which extends through the drive sleeve from the shaft 5 to the bushing 11, provides a passageway and prevents a high pressure from building up against packing ring 49. A union fitting or coupling 57 may be employed in returning such oil to the reservoir by means of a pipe 58 connected at one end to the union and at its other end to a three-way valve 59 which in turn is connected by a pipe 60 to another union 61 that is connected to the lower portion of the reservoir. To permit inspection of the oil, the three-way valve, as shown in Fig. 1, may be connected to a tube 62 which leads to the top portion of the reservoir and has an inspection element 63 interposed therein. Any fluid can be pumped by this invention and its use will not be restricted to pumping oil, or for operating hydraulic presses.

In operation, a suitable prime mover turns the pulley 22 which rotates the drive sleeve 10. As the latter carries the cylinders, and they turn as a group about the axis of the main portion of the shaft 5, the pistons 41 will be moved radially in and out relatively to said axis because of the fact that the connecting rods are operably connected to the bearing 34 which rotates eccentrically with regard to said axis. As the cylinders travel, the pressure medium in the reservoir will be drawn through 30 and 28 into the cylinders as the pistons therein move outwardly. Then, as the pistons move inwardly, the pressure medium will be forced through 29, 31 and 8 to the hydraulic press 9. Of course, the pressure medium will be returned from the press to the reservoir by any suitable means, not shown. In such operation the thrust nut 53, which can be set in any position and held there by the set screw 54, presses against the compression spring 52. As the inner surface of the valve seat bushing 25 is frusto-conical, it has a running fit on the somewhat longer tapered section of the portion of the crankshaft which it surrounds. They fit perfectly throughout their surface of contact. Under the high pressures used, there will be a slow leakage of the pressure medium between these surfaces, flowing both to the left and right (Fig. 3) from the ports 27 during discharge. This leakage pressure medium exerts a pressure substantially perpendicular to the two frusto-conical surfaces. The horizontal component of the pressure on the shaft 5 tends to force it to the left, and similarly, part 25 is forced toward the right. The compression spring 52 will establish a balance with the force moving the crankshaft to the left, and the pressure gauge (not shown) will hold steady even when the entire output of the pump is by-passing direct to intake port 28, or back into the reservoir by going to the left between flanges 46 and 47, or through relief line 58, due to the press having reached the end of its stroke. The crank shaft thus acts as a relief valve when the hydraulic press comes to the end of its stroke, by moving to the left and thus creating a passageway between the conical inner surface of the valve seat 25 and the outer surface of the cone shaped part of the crankshaft through which the pressure medium can pass.

My improved pump is particularly advantageous for use with hydraulic presses employed in the manufacture of plastics such as Bakelite, which come in powder form and have to be compressed just the right amount to become solid and almost unbreakable. Too much pressure injures the quality of the product, and as my pump automatically relieves the pressures when it reaches the desired maximum, it is manifest that the pump is especially useful with such presses.

It will be observed that oil passing to the right by leakage or otherwise from the valve ports 27 during discharge, passes between the parts 5 and 10, then through the hole or holes 56 to the exterior of the driving sleeve 10, then via the groove 55 around the inside of the bushing 11 until it reaches the union 57 from which it passes back to the reservoir. This structure prevents a high pressure from building up against the packing ring 49, which I found would not form an effective seal without this relief provision.

There is no vibration of the pipe line 8 caused by the piston strokes in my pump, because there are always two cylinders discharging at the same time at 90 degree intervals.

Rotation of the pump being to the right (Fig. 2), no special provision has to be made to prevent the rotation of the inner group of parts except the use of right hand threads on the adapter 7 and the crank shaft 5.

While I have disclosed what I now consider to be a preferred embodiment of the invention in such manner that the same may be readily understood by those skilled in the art, I am aware that changes may be made in the details disclosed, without departing from the spirit of the invention, as expressed in the claims.

What I claim and desire to secure by Letters Patent is:

1. In a structure of the character described, a crankshaft member, a sleeve member surrounding the crankshaft member, one of said members being rotatable relatively to the other, means for rotating the rotatable one of said members, a plurality of radially disposed cylinders fixedly connected to the sleeve member, a valve sleeve having ports, one for each cylinder, positioned between said members and rotatable with one

of said members, the ports of the valve sleeve communicating with the inner ends of the cylinders, an intake passageway in the crankshaft having a portion extending transversely thereof and of such length as to communicate simultaneously with a plurality of adjacent ports of the valve sleeve, a discharge passageway in the crankshaft member having a portion extending transversely thereof and of such length as to communicate simultaneously with a plurality of ports of the valve sleeve, pistons slidably fitted in the cylinders, means operatively connecting the outer ends of the pistons to the crank portion of the crankshaft member, whereby the pistons are forced to reciprocate due to rotation of one of said members, one of said members being axially movable relatively to the other one of said members, yielding means functioning to hold said members against axial movement, and means for discharging pressure medium from between said members.

2. In a structure of the character described, a crankshaft member, a sleeve member surrounding the crankshaft member and of less length than the latter, one of said members being rotatable relatively to the other, means for rotating the rotatable one of said members, a plurality of radially disposed cylinders fixedly connected to one end portion of the sleeve member and arranged adjacent to the crank portion of the crankshaft member, a valve sleeve having ports, one for each cylinder positioned between the members and rotatable with one of said members, the ports of the valve sleeve communicating with the inner ends of the cylinders, an intake passageway in the crankshaft member having a portion extending transversely thereof and of such length as to communicate simultaneously with a plurality of adjacent ports of the valve sleeve, a discharge passageway in the crankshaft member having a portion extending transversely thereof and of such length as to communicate simultaneously with a plurality of ports of the valve sleeve, pistons slidably fitted in the cylinders, means operatively connecting the outer ends of the pistons to the crank portion of said crankshaft member, whereby the pistons are forced to reciprocate due to rotation of one of said members, one of said members being axially movable relatively to the other, yielding means for yieldingly retaining one of said members against axial movement relatively to the other, and means for discharging pressure medium from between said members.

3. In a pump, a stationary crankshaft member, a sleeve member surrounding and rotatable on the crankshaft member, means for turning the sleeve member, a plurality of radially disposed cylinders fixedly connected to the sleeve member, a valve sleeve having ports, one for each cylinder, positioned between the crankshaft and the sleeve member and rotatable with the sleeve member, the ports of the valve sleeve communicating with the inner ends of the cylinders, an intake means in the crankshaft member adapted to communicate with the ports of the valve sleeve, a discharge means in the crankshaft member adapted to communicate with the ports of the valve sleeve, pistons slidably fitted in the cylinders, means operatively connecting the outer ends of the pistons to the crank portion of said crankshaft member, whereby the pistons are forced to reciprocate due to rotation of said sleeve member, the valve sleeve and crankshaft member having contacting frusto-conical surfaces, one of said members being axially movable relatively to the other one of said members, yielding means functioning to hold said members against axial movement and to maintain the contact between said frusto-conical surfaces, and means for discharging a pressure medium from between said members.

4. In a pump, a crankshaft member, a sleeve member surrounding the crankshaft member, one of said members being rotatable relatively to the other, means for turning one of said members, a plurality of radially disposed cylinders fixedly connected to the sleeve member, a valve sleeve having ports, one for each cylinder positioned between the crankshaft and the sleeve member, and rotatable with one of said members, the ports of the valve sleeve communicating with the inner ends of the cylinders, an intake means in the crankshaft member extending transversely thereof and of such length as to communicate simultaneously with a plurality of adjacent ports of the valve sleeve, an intake passageway extending into one end of the crankshaft member and communicating with said intake means, a discharge means in the crankshaft member extending transversely thereof and of such a length as to communicate simultaneously with a plurality of ports of the valve sleeve, a discharge passageway communicating with the discharge means and extending through the crankshaft member in a direction toward the opposite end of the crankshaft member, pistons slidably fitted in the cylinders, means operatively connecting the outer ends of the pistons to the crank portion of said crankshaft member, whereby the pistons are forced to reciprocate due to rotation of one of said members, cooperating abutment surfaces on said members arranged adjacent to the crank portion of the crankshaft member, yielding means mounted at the opposite end of the crankshaft member, for yieldingly holding said members against axial movement relatively to one another, and means for discharging pressure medium from between said members.

5. In a pump, a stationary crankshaft, a drive sleeve surrounding the crankshaft, a stationary bushing in which the drive sleeve is journaled, and through which the drive sleeve extends, means for turning the drive sleeve positioned at one end of the bushing, a plurality of radially disposed cylinders fixedly connected to the drive sleeve and arranged at the opposite end of the bushing, a valve sleeve having ports, one for each cylinder positioned between the crankshaft and the drive sleeve and rotatable with the latter, the ports of the valve sleeve communicating with the inner ends of the cylinders, an intake groove in the crankshaft extending transversely thereof and of such length as to communicate simultaneously with a plurality of adjacent ports of the valve sleeve, an intake passageway extending into one end of the crankshaft and communicating with said groove, a discharge groove in the crankshaft extending transversely thereof and of such a length as to communicate simultaneously with a plurality of ports of the valve sleeve, a discharge passageway communicating with the discharge groove and extending through the crankshaft in a direction away from said cylinders, pistons slidably fitted in the cylinders, and means operatively connecting the outer ends of the pistons to the crank portion of said shaft, whereby the pistons are forced to reciprocate due to rotation of the drive sleeve.

6. In a pump, a stationary crankshaft, a drive

sleeve surrounding the crankshaft, a stationary bushing in which the drive sleeve is journaled and through which the drive sleeve extends, means for turning the drive sleeve positioned at one end of the bushing, a plurality of radially disposed cylinders fixedly connected to the drive sleeve and arranged at the opposite end of the bushing, a valve sleeve having ports, one for each cylinder, positioned between the crankshaft and the drive sleeve and rotatable with the latter, the ports of the valve sleeve communicating with the inner ends of the cylinders, an intake groove in the crankshaft extending transversely thereof and of such length as to communicate simultaneously with a plurality of adjacent ports of the valve sleeve, an intake passageway extending into one end of the crankshaft and communicating with said groove, a discharge groove in the crankshaft extending transversely thereof and of such a length as to communicate simultaneously with a plurality of ports of the valve sleeve, a discharge passageway communicating with the discharge groove and extending through the crankshaft in a direction away from said cylinders, pistons slidably fitted in the cylinders, means operatively connecting the outer ends of the pistons to the crank portion of said shaft, whereby the pistons are forced to reciprocate due to rotation of the drive sleeve, said crankshaft being axially movable relatively to the drive sleeve, means for yieldingly holding the crankshaft against axial movement in one direction, and means for discharging pressure medium from between the crankshaft and drive sleeve.

7. A structure of the kind claimed in claim 1, in which the valve sleeve and crank shaft member have contacting frusto-conical surfaces.

8. In a structure of the character described, a reservoir to contain a pressure medium, a stationary bushing connected to the reservoir and having a bore communicating with the interior of the reservoir, a drive sleeve journaled in and extending through the bushing, radial cylinders fixedly secured to one end portion of the sleeve and arranged in the reservoir, means secured to the opposite end portion of the sleeve for turning the latter, a stationary crankshaft extending through the sleeve and having a crank end portion positioned within the reservoir, a valve sleeve having ports, one for each cylinder, positioned between the crankshaft and the drive sleeve and rotatable with the latter, the ports of the valve sleeve communicating with the inner ends of the cylinders, an intake passageway communicating with the reservoir and arranged to simultaneously supply the pressure medium from the reservoir to a plurality of said cylinders, a discharge passageway extending through the main portion of the crankshaft and arranged to simultaneously discharge the pressure medium from a plurality of said cylinders, pistons slidably fitted in the cylinders, and means operatively connecting the outer ends of the pistons to the crank portion of said shaft, whereby the pistons are forced to reciprocate due to rotation of the drive sleeve.

9. In a structure of the character described, a reservoir to contain a pressure medium a stationary bushing connected to the reservoir and having a bore communicating with the interior of the reservoir, a drive sleeve journaled in and extending through the bushing, radial cylinders fixedly secured to one end portion of the sleeve and arranged in the reservoir, means secured to the opposite end portion of the sleeve for turning the latter, a stationary crankshaft extending through the sleeve and having a crank end portion positioned within the reservoir, a valve sleeve having ports, one for each cylinder, positioned between the crankshaft and the drive sleeve and rotatable with the latter, the ports of the valve sleeve communicating with the inner ends of the cylinders, an intake passageway communicating with the reservoir and arranged to simultaneously supply the pressure medium from the reservoir to a plurality of said cylinders, a discharge passageway extending through the main portion of the crankshaft and arranged to simultaneously discharge the pressure medium from a plurality of said cylinders, pistons slidably fitted in the cylinders, means operatively connecting the outer ends of the pistons to the crank portion of said shaft, whereby the pistons are forced to reciprocate due to rotation of the drive sleeve, and a circular housing rotatable with the drive sleeve and enclosing said cylinders and said connecting means.

10. In a structure of the character described, a reservoir to contain a pressure medium a stationary bushing connected to the reservoir and having a bore communicating with the interior of the reservoir, a drive sleeve journaled in and extending through the bushing, radial cylinders fixedly secured to one end portion of the sleeve and arranged in the reservoir, means secured to the opposite end portion of the sleeve for turning the latter, a stationary crankshaft extending through the sleeve and having a crank end portion positioned within the reservoir, a valve sleeve having ports, one for each cylinder, positioned between the crankshaft and the drive sleeve and rotatable with the latter, the ports of the valve sleeve communicating with the inner ends of the cylinders, an intake passageway communicating with the reservoir and arranged to simultaneously supply the pressure medium from the reservoir to a plurality of said cylinders, a discharge passageway extending through the main portion of the crankshaft and arranged to simultaneously discharge the pressure medium from a plurality of said cylinders, pistons slidably fitted in the cylinders, means operatively connecting the outer ends of the pistons to the crank portion of said shaft, whereby the pistons are forced to reciprocate due to rotation of the drive sleeve, said crankshaft being axially movable relatively to the drive sleeve, means for yieldingly holding the crankshaft against axial movement in one direction, and means for leading the pressure medium from between the crankshaft and drive sleeve to the reservoir.

11. In a structure of the character described, a reservoir to contain a pressure medium, a stationary bushing connected to the reservoir and having a bore communicating with the interior of the reservoir, a drive sleeve journaled in and extending through the bushing, radial cylinders fixedly secured to one end portion of the sleeve and arranged in the reservoir, means secured to the opposite end portion of the sleeve for turning the latter, a stationary crankshaft extending through the sleeve and having a crank end portion positioned within the reservoir, a valve sleeve having ports, one for each cylinder positioned between the crankshaft and the drive sleeve and rotatable with the latter, the ports of the valve sleeve communicating with the inner ends of the cylinders, an intake passageway communicating with the reservoir and arranged to simulta-

neously supply the pressure medium from the reservoir to a plurality of said cylinders, a discharge passageway extending through the main portion of the crankshaft and arranged to simultaneously discharge the pressure medium from a plurality of said cylinders, pistons slidably fitted in the cylinders, and means operatively connecting the outer ends of the pistons to the crank portion of said shaft, whereby the pistons are forced to reciprocate due to rotation of the drive sleeve, the last mentioned means comprising a master crank rod rotatably mounted on the crankshaft and connected to one of said pistons, and other rods pivotally connected to the master crank rod and to the other pistons.

12. In a structure of the character described, a reservoir to contain a pressure medium, a stationary bushing connected to the reservoir and having a bore communicating with the interior of the reservoir, a drive sleeve journaled in and extending through the bushing, radial cylinders fixedly secured to one end portion of the sleeve and arranged in the reservoir, means secured to the opposite end portion of the sleeve for turning the latter, a stationary crankshaft extending through the sleeve and having a crank end portion positioned within the reservoir, a valve sleeve having ports, one for each cylinder, positioned between the crankshaft and the drive sleeve and rotatable with the latter, the ports of the valve sleeve communicating with the inner ends of the cylinders, an intake passageway communicating with the reservoir and arranged to simultaneously supply the pressure medium from the reservoir to a plurality of said cylinders, a discharge passageway extending through the main portion of the crankshaft and arranged to simultaneously discharge the pressure medium from a plurality of said cylinders, pistons slidably fitted in the cylinders, means operatively connecting the outer ends of the pistons to the crank portion of said shaft, whereby the pistons are forced to reciprocate due to rotation of the drive sleeve, said crankshaft being axially movable relatively to the drive sleeve, means mounted on the crank shaft and engageable with the drive sleeve for yieldingly holding the crankshaft against axial movement in one direction, and means for leading the pressure medium from between the crankshaft and drive sleeve to the reservoir, the means connecting the outer ends of the pistons to the crankshaft being movable with the crankshaft relatively to the pistons when the crankshaft moves axially.

13. In a structure of the character described, a crankshaft member, a sleeve member surrounding the crankshaft member, one of said members being rotatable relatively to the other, means for rotating the rotatable one of said members, a plurality of radially disposed cylinders fixedly connected to the sleeve member, a valve sleeve having ports, one for each cylinder positioned between said members and rotatable with one of said members, the ports of the valve sleeve communicating with the inner ends of the cylinders, an intake passageway in the crankshaft having a portion extending transversely thereof and of such length as to communicate simultaneously with a pluarltiy of adjacent ports of the valve sleeve, a discharge passageway in the crankshaft member having a portion extending transversely thereof and of such length as to communicate simultaneously with a plurality of ports of the valve sleeve, pistons slidably fitted in the cylinders, means operatively connecting the outer ends of the pistons to the crank portion of the crankshaft member, whereby the pistons are forced to reciprocate due to rotation of one of said members, one of said members being axially movable relatively to the other one of said members, yielding means functioning to hold said members against axial movement, means for discharging the pressure medium from between said members, and packing means arranged at one end of the sleeve member for sealing the space between said members at that end of the sleeve member.

14. In a pump, a stationary shaft, a rotatable shaft surrounding and mounted on the stationary shaft, said stationary shaft having a frusto-conical portion, intake and discharge passageways in said frusto-conical portion, valve means rotatable with the rotatable shaft and having a frusto-conical surface rotatable on the frusto-conical portion of the stationary shaft, one of said shafts being axially movable relatively to the other to provide a slight space between the frusto-conical surfaces, ports extending through said valve means and arranged to communicate with said intake and discharge passageways, cylinders rotatable with the rotatable shaft, pistons arranged to reciprocate in the cylinders, means for causing reciprocation of the pistons when the rotatable shaft is turning, yielding means functioning to normally hold the shafts against relative axial movement, and means for discharging a pressure medium from between said shafts.

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