CONTINUOUS-FEED RECIPROCATING PUMP

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Fig. 1.

Fig. 2.

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CONTINUOUS-FEED RECIPROCATING PUMP

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This invention relates to a continuous-feed reciprocating pump, and particularly to a thick-material pump, provided with two spaces or capacities on opposite sides of the plungers, and operating in opposite senses onto a common feed line, owing to the provision of check valves.

Such a continuous-feed reciprocating pump usually shows two opposed plungers, driven by a crankshaft. Both spaces or capacities are provided with at least one intake line and an outlet line. Both intake and outlet lines have a check valve. The intake lines are combined and connected with a supply line, while the output lines are connected together to form a feeding line. While one plunger exhausts, the other takes in, thus providing a continuous operation.

One disadvantage of the known continuous-feed reciprocating pump consists in a bulky construction and the necessity of having to provide four plungers. If the pump is to be used as a mortar pump, both of these disadvantages are of special importance, as the pump has to be transported quite frequently, thus the high weight constitutes a special disadvantage and on the other hand the plungers wear out quickly, which results in excessive maintenance costs for the pump.

It is therefore an object of the invention to eliminate the disadvantages of the known type of continuous-feed reciprocating pump and to construct it in such a manner that it has less weight, which makes it more suitable for transportation and to provide less plungers, to save maintenance costs.

This object according to the invention is achieved, according to one of the important inventive features, by connecting both capacities, provided on different sides of the plungers, in series, so that only the intake and outlet lines of the first capacity are provided with one check valve respectively, and the second capacity comprises half the space of the first capacity. In a reciprocating pump with two opposed plungers, the cross-section of the second plunger for instance, amounts to exactly half of the cross-section of the first plunger, with the stroke being the same. The second plunger and its cylinder thus are of considerably less weight than the first plunger, which results in a noticeable weight reduction of the pump.

Furthermore there are only two valves instead of the four valves thus far needed, because the second, smaller plunger in line operates without any valves. When the first plunger is on its intake stroke, the second plunger feeds exactly half the amount of material to the pipe line. When the second plunger is on its intake stroke, and the first plunger exhausts, the material exhausted by the first plunger would be pushed by means of the connecting line between the two capacities into the capacity of the plunger in line and the pipe line at a ratio of 50% for each one. In other words, half of the material taken in by the first plunger will be exhausted and taken in by the second plunger without a rise in pressure and exhausted. The other half is sent directly through the connecting line of the first plunger into the pipe line. This results in a completely continuous operation.

Another specially expedient form of the invention consists, according to another feature, in the pump having only one oppositely working plunger, wherein the smaller capacity lies on the piston rod side. This type of construction takes advantage of the fact that only the capacity lying on the front side needs valves, while there is no requirement of any valves for the other capacity.

Another considerable advantage lies in the fact that the second plunger, including its cylinder, is not necessary anymore. This results in a further advantage of eliminating the crankshaft, thus far needed. The drive is therefore greatly simplified. All these facts cause a considerable diminution and accordingly a large reduction in weight. Also, the operating and initial costs of the pump are much less.

Another preferred type of the invention shows a pump cylinder which is not set-off, wherein the cross-sectional area of the plunger rod equals half of the inner diameter of the cross-sectional cylinder area.

Another preferred feature according to the invention resides in the pump having two chambers, especially when used as a mortar pump, which are separated by a respective movable link or member in a hydraulic liquid chamber and an intermediate feeding chamber, both of which are connected to the respective capacities, wherein both intermediate feeding chambers are interconnected by a pipe having a check valve, while the other check valve is provided in the intake pipe of the first feeding chamber, and the feed pipe following the intermediate feed chamber in line shows no valve.

The advantage of this preferred type consists in the fact that the feed material does not engage the plunger, thus the latter will not be corroded or abraded by the feeding material. The chambers preferably show at least the volume of the respective capacities. The chamber in line comprises approximately half the volume of the first chamber. There is no need of an exact 50% to 50% ratio, as the movable members regulate the exact ratio during operation. It has been found advantageous to shape the movable members as diaphragms for the purpose of expediency and simplicity.

Another preferred type according to the invention shows the feature of an escape chamber on each of the capacities, operating at a pressure exceeding a given pressure. These escape chambers are normally closed by movable compression strain members. The preferred type consists in a piston, movable in a chamber.

The invention is not restricted to the illustrated example of a mortar pump, but applicable with all the preferred advantages to cases, where a continuous feed of material is desirable.

Further features and advantages and applications of the invention are pointed out in conjunction with the drawing wherein a preferred example of construction is illustrated. The drawing shows:
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FIG. 1 as a cross-section of part of the reciprocating pump, according to the invention; and
FIG. 2 as a view of the pump along direction II of FIG. 1, wherein the pipes are seen in a cross-sectional view.

The reciprocating pump 1 according to the invention comprises a cylinder 2, the one end wall of which is traversed by a plunger rod 3, to the front end of which is attached a plunger 4. The plunger rod is driven by planetary gears 5 of a known type which need not be further described. The planetary gearing owes its advantage to extremely low weight and small constructions.

A space or capacity 6 is situated in front of plunger 4, while a space or capacity 7 lies behind the latter. The capacity 6 communicates with an intermediate compression space or capacity 8 of a chamber 9, while capacity 7 is connected to an intermediate compression space or capacity 10 of a chamber 11. The intermediate spaces 8 and 10 of chambers 9 and 10 respectively, are separated by diaphragms 12 and 13 from respective intermediate feeding chambers 14 and 15. A suction line or pipe 16 and a connecting line 17 open into the intermediate feeding chamber 14. The connecting line or pipe 17 and a feeding line or pipe 18 open into the intermediate chamber 15.

The schematic view in FIG. 2 shows a check valve 19 provided at the outlet of suction pipe 16, that is at the location where suction pipe 16 opens into the intermediate feeding chamber 14, while at the intake into the connecting pipe 17, that is at the outlet from the intermediate feeding chamber 14, a check valve 20 is being provided.

To maintain a continuous stream in the feeding pipe 18, the cross-sectional area of plunger rod 3 must be exactly half the inner section of cylinder 2. While during the back stroke of plunger 4 pressurized liquid in the capacity 7 will be displaced into the intermediate compression space 10 of chamber 11, during which time the feeding material within the intermediate feeding chamber 15 of this chamber will be pushed out of feeding pipe 18, as the valve 20 simultaneously closes, feeding material will be taken in through the opening valve 19 from suction line 16. On the forward stroke check valve 19 will be closed and valve 20 opens (FIG. 2). An amount of feeding material equal to capacity 6 will then be pushed through connecting pipe 17. As the ratio of capacities 6 and 7 is like 2:1, half of the amount of feeding material pushed through connecting pipe 17, during the forward stroke, is taken up by the enlarging intermediate feeding chamber 15 of chamber 11, while the other half is directly pushed into feeding line 18.

Though the intermediate feeding chambers 14 and 15 of chambers 9 and 1 respectively are connected in series, and only the intermediate feeding chamber 15 is hooked up to the sole feeding pipe 18, there will be created a feed in capacity 7 on the suction stroke. This results, in spite of the simple construction of pump 1 according to the invention, in a continuous feed.

To avoid any overpressure in pump 1, there are provided two by-pass plungers 21 and 22, which are movable within corresponding by-pass chambers 23 and 24. The chambers 23 and 24 are under pressure, so that the plungers 21 and 22 engage spacing stops 21a, 22a, respectively, during normal operation and block off the by-pass chambers 23 and 24. If the pressure within the pump rises over a designated pressure, the corresponding plunger 21 or 22 will be moved, so that the pressure medium may escape from either capacity 6 or 7. Thus damage by overpressure to the pump will be avoided.

The foregoing disclosure relates only to a preferred, exemplary embodiment of the inventive continuous-feed pump, which is intended to include all changes and modifications of the example described within the scope of the invention as set forth in the objects and the appended claims.

1. A continuous-feed reciprocating pump, particularly for thick materials like mortar, comprising wall means defining a pumping space including first and second oppositely disposed, serially interconnected space portions, a suction line for the materials connected to said first space portion, a feeding line for the materials connected to said second space portion and supplied with the materials from both space portions, a connecting line for the materials between said space portions, check valve means for said first space portion in at least one of said suction line and said connecting line, said second space portion having approximately half the volume of said first space portion, and first and second chamber means for the respective first and second space portions, and resilient separator means in said chamber means for forming therein respective first and second intermediate spaces and first and second feeding spaces of variable volumes, wherein said check valve means is constituted by two check valves, one of said check valves being between said suction line and said first feeding space, the other of said check valves being between said first feeding space and said connecting line which leads to said second feeding space, while said feeding line is directly linked to said second feeding space.

2. The continuous-feed pump as defined in claim 1, wherein said chamber means have at least the volume of the respective space portions.

3. The continuous-feed pump as defined in claim 1, wherein said second chamber means has substantially half the volume of said first chamber means.

4. The continuous-feed pump as defined in claim 1, wherein said separator means includes respective diaphragms between said intermediate spaces and said feeding spaces of each chamber means.

5. A continuous-feed reciprocating pump, particularly for thick materials like mortar, comprising wall means defining a pumping space including first and second oppositely disposed, serially interconnected space portions, a suction line for the materials connected to said first space portion, a feeding line for the materials connected to said second space portion and supplied with the materials from both space portions, a connecting line for the materials between said space portions, a connecting line for the materials between said space portions, check valve means for said first space portion in at least one of said suction line and said connecting line, said second space portion having approximately half the volume of said first space portion, first and second escape chambers for the respective first and second space portions, and means for providing a pressure in said escape chambers greater than a predetermined pressure prevailing in said pumping space.

6. The continuous-feed pump as defined in claim 5, further comprising movable pressure strain members in said escape chambers, and means for urging said strain members toward said space portions so as normally to seal off said escape chambers.

7. The continuous-feed pump as defined in claim 6, wherein said strain members are constituted by plunger means, and wherein said wall means define means for said plunger means substantially adjacent said space portions and in spaced-apart regions of said pumping space.

8. A continuous-feed reciprocating pump, particularly for thick materials, comprising a pumping cylinder having a reciprocable plunger therein with a plunger rod attached thereto, a pumping space in said cylinder and including first and second serially interconnected space portions on opposite sides of said plunger, a suction line for the materials connected to said first space portion, a discharge line for the materials connected to both space portions, said plunger feeding the materials alternately to said discharge line by way of the respective space portions, and check valve means disposed in the inlet and outlet lines of said first space portion, said second space portion having approximately half the volume of said first space portion and being devoid of check valve means.
9. The continuous-feed pump as defined in claim 8, wherein said first space portion is disposed in front of said plunger while said second space portion surrounds said plunger rod, further comprising movable strain means limiting said first space portion substantially opposite said plunger, the latter having substantially the same cross-sectional area as said strain means.

10. The continuous-feed pump as defined in claim 9, wherein the cross-sectional area of said plunger rod is substantially half of the inner section of said cylinder.

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