Jan. 17, 1939. C. B. SCHNEIBLE 2,144,417

SLUDGE PUMP

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Fig. 1.

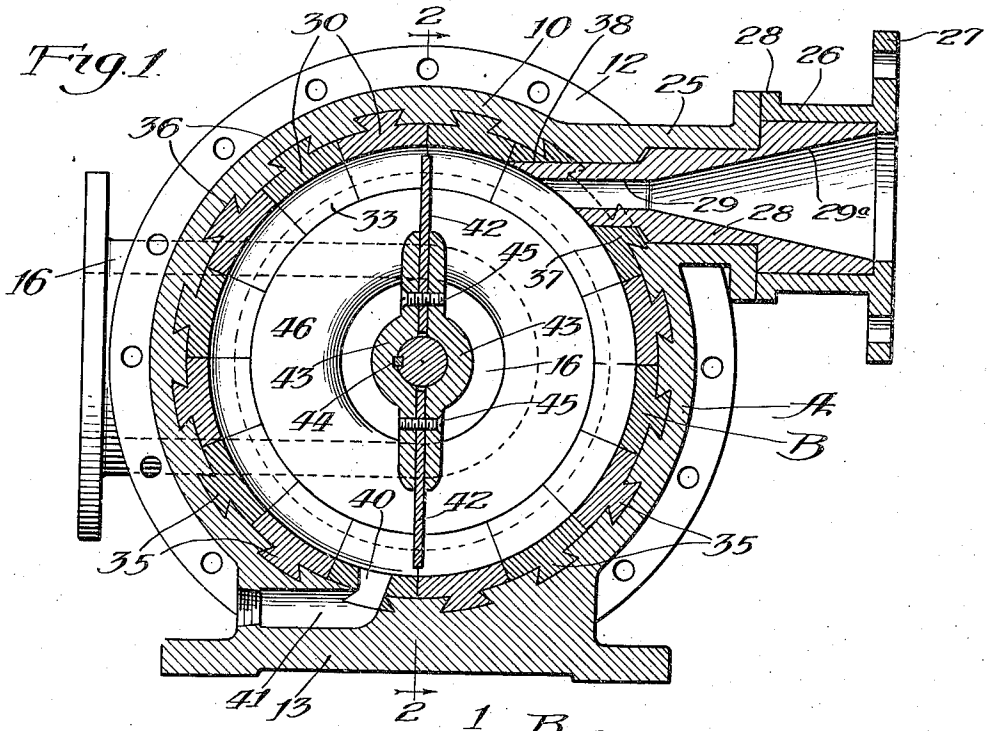
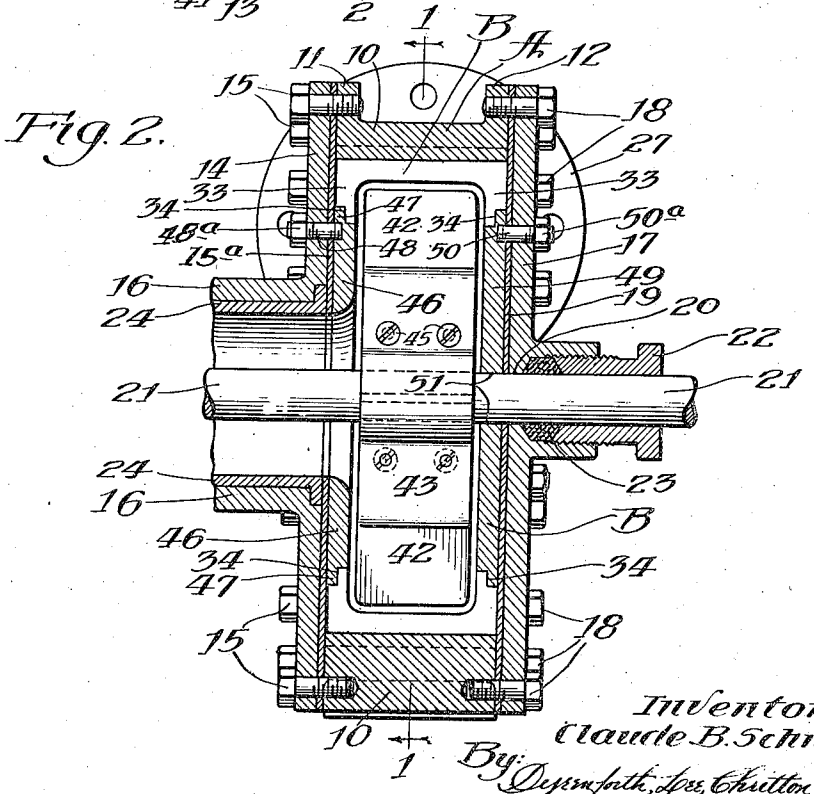


Fig. 2.



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Fig. 3.

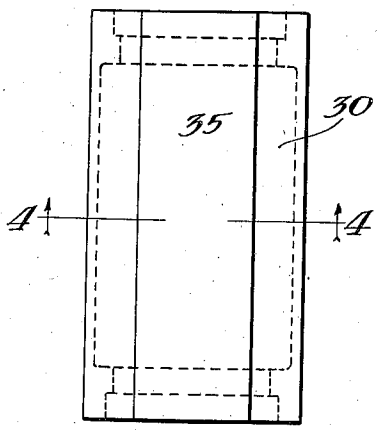


Fig. 5.

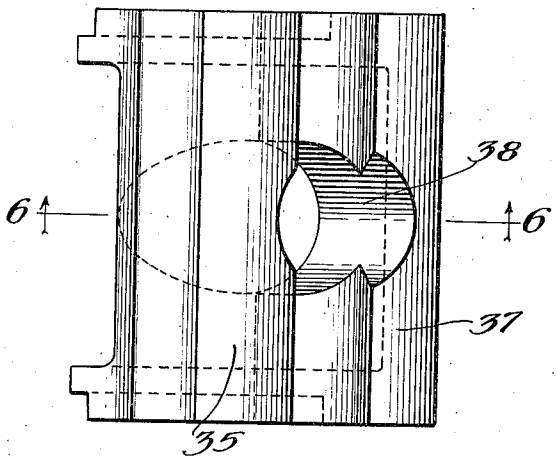


Fig. 4.

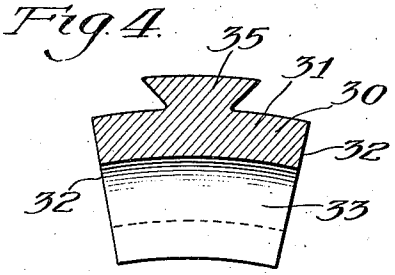


Fig. 6.

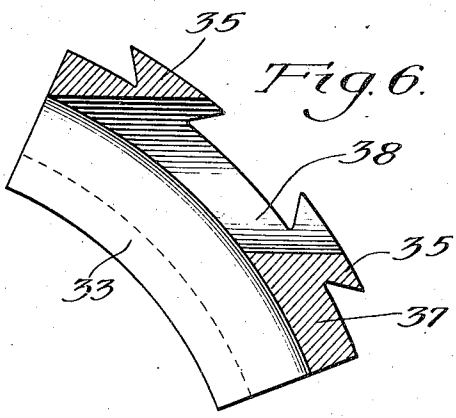
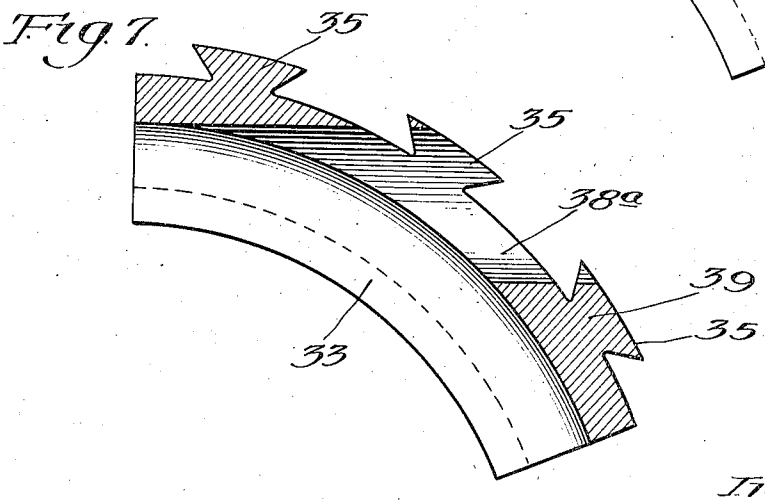


Fig. 7.



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Patented Jan. 17, 1939 2,144,417

UNITED STATES PATENT OFFICE

2,144,417

SLUDGE PUMP

Claude B. Schneible, Chicago, Ill.

Application January 11, 1937, Serial No. 120,113

6 Claims. (Cl. 103—114)

This invention relates to a sludge pump, and more particularly to a centrifugal sludge pump equipped with a wear resisting lining.

An object of the invention is to provide an improved sludge pump which is especially adapted to resist the abrasive action of sand, gravel, etc., and which is well suited to heavy-duty service in pumping liquids having large quantities of sand or other highly abrasive materials.

Another object is to provide a wear resistant lining for a sludge pump which may be replaced in sections when necessary and which can be easily changed in the field without sending the pump in to the factory or shop. Other objects and advantages appear as the specification proceeds.

A preferred embodiment of the invention is illustrated in the accompanying drawings, in which—

Fig. 1 is a sectional view in elevation, the section being taken as indicated at line 1—1 of Fig. 2; Fig. 2, a broken sectional view in elevation, the section being taken as indicated at line 2—2 of Fig. 1; Fig. 3, a plan view of one block of the lining; Fig. 4, a sectional view of the block shown in Fig. 3, the section being taken as indicated at the line 4—4 of Fig. 3; Fig. 5, a plan view of the lining block adjacent the discharge opening; Fig. 6, a sectional view of the block shown in Fig. 5, the section being taken as indicated at line 6—6 of Fig. 5; and Fig. 7, a sectional view of a modified form of block for use adjacent the discharge opening.

As illustrated, A designates a pump casing; B a pump lining, and C an impeller.

The casing A may include a cylindrical wall 10 resting on base 13 and having external flanges 11 and 12 at its edges. An inlet side piece 14 coextensive with the outer edge of flange 11, is secured to wall 10 by means of bolts 15 extending into flange 11, and has a gasket 15a adjacent its inner surface. At its center, piece 14 is formed to provide the inlet pipe 16 which is turned forwardly and adapted to make connection with pipes carrying dirt-laden liquids. Pipe 16 is provided with a wear resistant liner 24 formed of any suitable wear resistant material and which can be replaced when it becomes worn. On the other side of wall 10 is the pressure side piece 17 which is coextensive with the outer edge of flange 12 and is secured to wall 10 by means of bolts 18 extending into flange 12, the gasket 19 being placed adjacent its inner surface.

Pressure piece 17 provides at its center a bearing 20 for one end of shaft 21. The hollow screw 22 is adapted to receive shaft 21 and screw into piece 17 to bind the packing material 23 against shaft 21 and in this way form a tight seal. The other end of shaft 21 is bearinged in the wall of inlet pipe 16 in a similar manner.

Extending rearwardly from the top portion of wall 10 is the outlet pipe casing 25, which may be of any suitable form. As illustrated, it includes an outer section 26 of larger diameter and provided with a flange 27 for making connection with the pipes which are to receive the liquid from the pump. The interior of outlet casing 25 is lined with the wear resisting liner 28 which is of such shape as to fit the inner surface of the casing. As shown clearly in Fig. 1, liner 28 has a cylindrical bore 29 adjacent the interior of the pump and a frusto-conical bore 29a at its other end, thus providing a Venturi discharge opening. The inner end of liner 28 extends inward beyond wall 10 and has a beveled surface parallel with wall 10.

The pump lining B is comprised of single blocks 30 of a form such as illustrated in Figs. 3 and 4, which blocks are matched up and placed side by side to form a continuous lining as illustrated in Fig. 1. The main body 31 of blocks 30 is arcuate in form, and its sides 32 are cut along radial lines so that the blocks may be placed squarely together to form a cylindrical wall. At each end of the blocks is an inwardly extended portion 33 which, when the blocks are placed together forms a rim at each side of the pump. The outer edges of portions 33 are grooved at 34 so that when the blocks are placed properly together an annular groove is formed.

Each of blocks 30 is provided with a V-ridge 35 on its exterior surface adjacent wall 10. Ridge 35 extends centrally and lengthwise of the block and has an arcuate top surface. It is wider at the top than at the bottom and somewhat resembles the letter V.

Corresponding with ridges 35 of blocks 30 are the V-grooves 36 on the interior of wall 10. Grooves 36 are parallel and equally spaced about the circumference of wall 10. They are of the same shape as ridges 35 and are adapted to receive and hold the blocks 30 by means of ridges 35.

At points adjacent the outlet opening it is necessary to make an opening through the liner blocks also, and in order not to have very small block pieces I prefer to insert here a block 37 of double width, as illustrated in Figs. 5 and 6 of the drawings. The opening 38 in block 37 is diagonal of the block and is of sufficient size to

receive the inner end of liner 28. When assembled it is seen by Fig. 1 that the inner end of liner 28 is flush with the cylindrical inner surface of blocks 37 and 30. It will be seen that block 37 has two of the V-ridges 35 and takes up a greater space along wall 10. In Fig. 7 is shown a second form of block which might be used adjacent the discharge opening. This form of block designated by character 39 is yet larger than block 37 and has three ridges 35. It takes up a space along wall 10 which is equal in size to that occupied by three of blocks 30 and contains the opening 38a. With the exception of the block adjacent the discharge opening, all of the liner blocks are of the form illustrated in Figs. 3 and 4, and this exception is made in order to provide additional support at this point. The length and radial dimensions of blocks 30, 37, and 39 are identical and either block 37 or block 39 may be placed beside blocks 30 to form an even interior lining surface.

Lining blocks 39, also blocks 37 and 39, may be formed of any suitable material such as rubber, lead, white iron, or special alloys. If desired the blocks which are placed at positions where there is most wear may be made of different material. However, since the blocks are easily replaced it has been satisfactory to form all the blocks of the same material.

One of blocks 30 which is at the bottom of wall 10 is provided with an opening 40 which connects with drain pipe 41 leading to the exterior of the pump. Pipe 41 is used only to drain the liquid from the pump and is normally closed to the passage of liquid therethrough.

An annular disk line 46 is placed on the inside of the pump casing and adjacent the inlet side. Its peripheral rim engages the inwardly extended portions 33 of the lining blocks, and its outer edge 47 is extended to engage the arcuate grooves 34 on each of the blocks. The central opening through disk liner 46 corresponds in size with the interior of inlet pipe 16. Bolts 48 secured in liner 46 extend through piece 14 and are secured by nuts 48a. Another disk liner 49 is disposed adjacent gasket 19 and has its peripheral rim engaging the extended portions 33 at the other ends of the lining blocks. It also has an extended outer edge portion for engaging the arcuate grooves on this end of the blocks, and has bolts 50 which extend through openings in pressure piece 17 and are secured by nuts 50a. The central opening 51 in disk liner 49 is of sufficient size to admit shaft 21.

The impeller C comprises the shaft 21, already mentioned and impeller blades 42 radially secured on opposite sides of shaft 21 by means of clamping irons 43. Irons 43 are secured to shaft 21 by key 44, and blades 42 are secured within clamping irons 43 by screws 45.

In the operation of my improved pump, some kind of motive power (not shown) is used to drive the impeller shaft 21 by which the impeller blades 42 are caused to rotate. The centrifugal force of the liquid within the pump causes liquid to be thrown out tangentially through the Venturi discharge passage in liner 28 and causes liquid to be drawn in through inlet pipe 16.

As the dirt-laden liquid passes into the pump through inlet 16 the sand and dirt particles are largely in suspension and pass quietly into the pump without exerting much force against the sides of the pipes. But as the liquid comes into contact with the rapidly rotating impeller, centrifugal force causes the sand and other foreign particles to be driven with force against the pump lining. Though the sides of the pump are subject to some abrasion, the greater share of the abrasive action is against the lining blocks on the interior of the cylindrical wall.

An important feature of my improved pump is that the lining may be easily replaced either wholly or partially as is necessary when it becomes worn. The pump need not be disconnected and carried to a shop or factor, but the blocks may be easily replaced wherever the pump is located and without disconnecting it. A workman may loosen bolts 18 and remove the pressure plate 17 together with liner disk 49 which is attached to the plate. This leaves the blocks loose at one end and they may be simply pulled axially from wall 10, the ridges 35 sliding in grooves 36, and removed from the pump. New lining blocks may then be inserted in place of the worn ones removed and the pressure plate 17 replaced as it was before. If only half or only a few of the blocks are worn only those that are worn need to be replaced, and maintenance costs are thereby reduced.

The V-shaped ridges 35 in the corresponding grooves 36 hold the blocks in place and make such replacement of worn blocks possible. It will be seen that the only way that the blocks may be loosened is by endwise movement, and when the side plates are in place this movement is prevented. With the side plates in position it may also be seen that the liner disks 46 and 49 engage the end portions of the liner blocks to support these in their correct radial positions.

To remove the discharge liner 28 it is necessary only to remove the discharge casing section 26 and pull the liner from the pump. This liner must be removed whenever it is desired to replace block 37 or 39, whichever may be used, or whenever liner 28 is itself worn and needs to be replaced. The Venturi bore of this liner serves to decrease the pressure of the liquid soon after it enters the discharge opening, and in this way reduces the abrasive action of the sand, etc., as it leaves the pump.

While I have described a specific form of casing, it is understood that my invention may be used in connection with casings of other forms and which differ greatly from the structure described. It will be obvious that many changes may be made in the form of the parts and the details of construction without departing from the spirit of my invention.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, but the appended claims should be construed as broadly as permissible in view of the prior art.

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

1. A pump of the character set forth comprising: a casing having inlet and discharge openings and including a cylindrical wall equipped on its inside with spaced axially extending grooves; a pump lining comprising blocks equipped with dovetail ridges, said ridges being fitted into said grooves, one of said blocks having an opening therethrough adjacent said casing discharge opening; and a discharge liner extending through said casing discharge opening and through said opening in said one of said blocks.

2. A pump of the character set forth comprising: a casing having inlet and discharge openings

and including a cylindrical wall equipped on its inside with spaced axially extending grooves which taper toward their tops; a pump lining comprising blocks equipped with dovetail ridges, said ridges being fitted into said grooves, one of said blocks having an opening therethrough adjacent said casing discharge opening; and a discharge liner having an interior surface in the form of a venturi, said discharge liner extending through said casing discharge opening and through said opening in said one of said blocks.

3. A pump of the character set forth comprising: a casing having inlet and discharge openings and including a cylindrical wall equipped on its inside with spaced axially extending grooves; a pump lining comprising blocks equipped with dovetail ridges, said ridges being fitted into said grooves, said blocks having inwardly extending end portions containing exterior grooves, and a pair of disk liners adjacent opposite sides of the pump and having their edges engaging said inwardly extending end portions of said blocks, said edges extending into said exterior grooves.

4. A pump of the character set forth comprising: a casing having inlet and discharge openings and including a cylindrical wall equipped on its inside with spaced axially extending grooves; a pump lining comprising a number of blocks, each equipped with one dovetail ridge and a larger block equipped with at least two dovetail ridges spaced apart, and being provided with an opening therethrough, said dovetail ridges being disposed in said spaced grooves, and a discharge liner extending through said casing discharge opening and through said opening in said larger block, the inner end of said discharge liner being flush with the inside surface of said larger block.

5. A pump of the character set forth comprising: a casing having inlet and discharge openings and including a cylindrical wall equipped on its inside with spaced, axially extending grooves, a pump lining comprising blocks equipped with dovetail ridges, said ridges being fitted into said grooves, said blocks having inwardly extending end portions, and a pair of disk liners adjacent opposite sides of the pump and having their edges engaging said inwardly extending end portions of said blocks, said edges and said inwardly extending end portions of said blocks having cooperating interlocking portions.

6. A pump of the class set forth comprising: a casing having inlet and discharge openings and including a cylindrical wall equipped on its inside with spaced axially extending recesses, a pump lining comprising a number of blocks, each of said blocks being provided with at least one projection adapted to engage one of said recesses, at least one of said blocks being provided with a discharge opening extending therethrough, a discharge liner extending through said discharge opening, and a pair of disk liners adjacent opposite sides of the pump and engaging the end portions of said blocks.

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