Nov. 18, 1924.

1,515,702

E. C. REYBOLD

PUMP DIAPHRAGM

Filed May 24, 1922

Fig. 1.

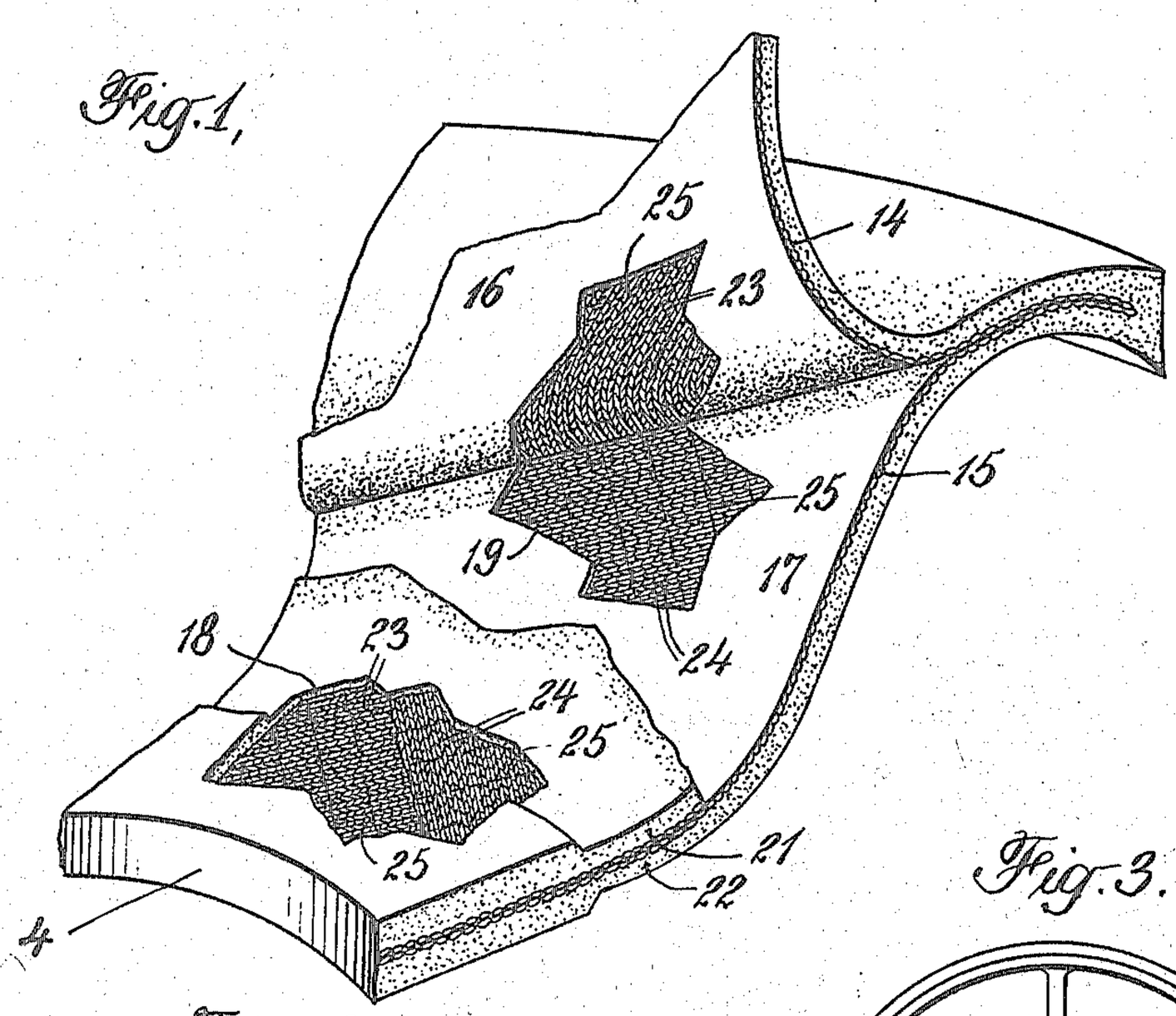


Fig. 2.

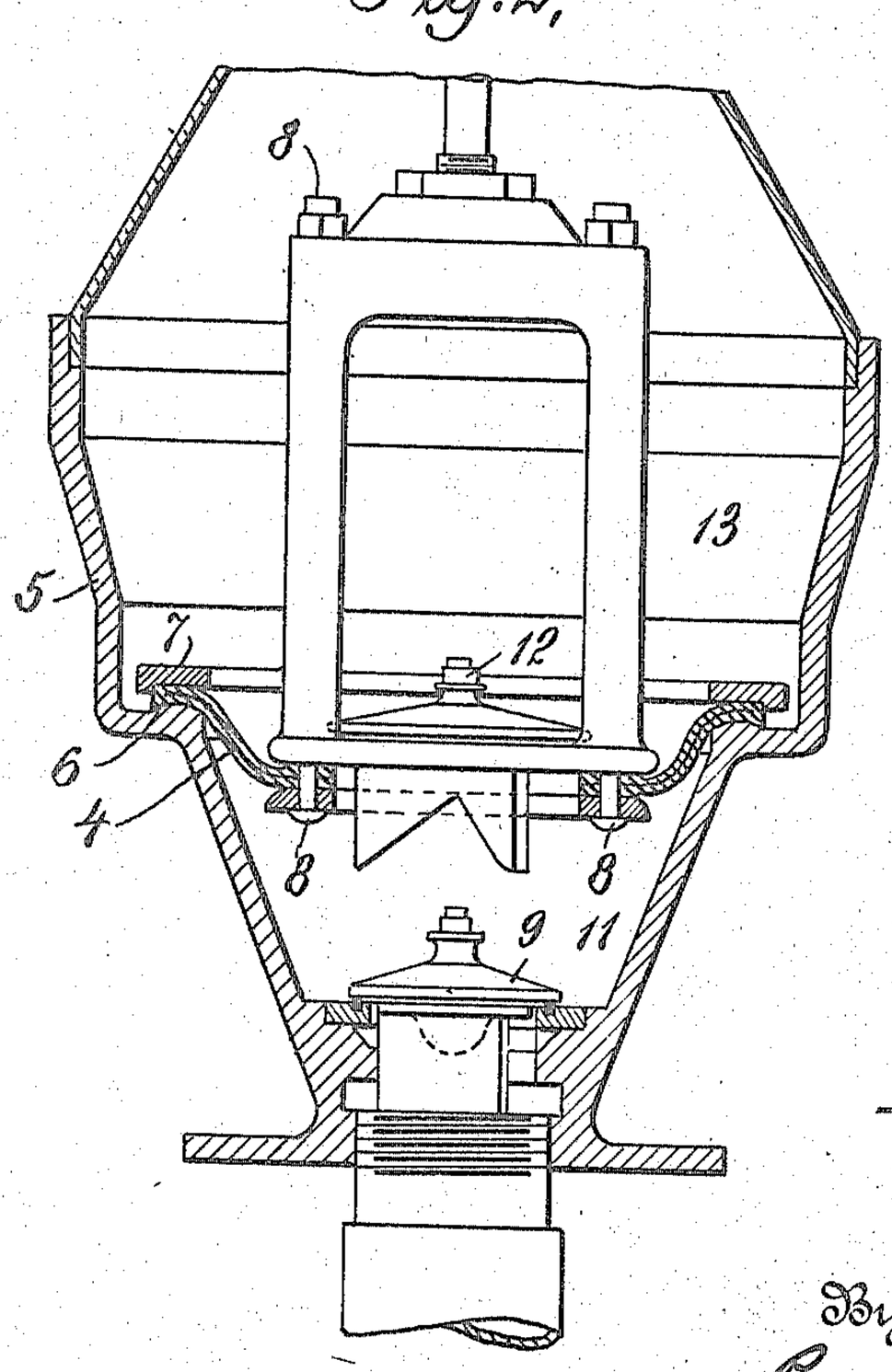
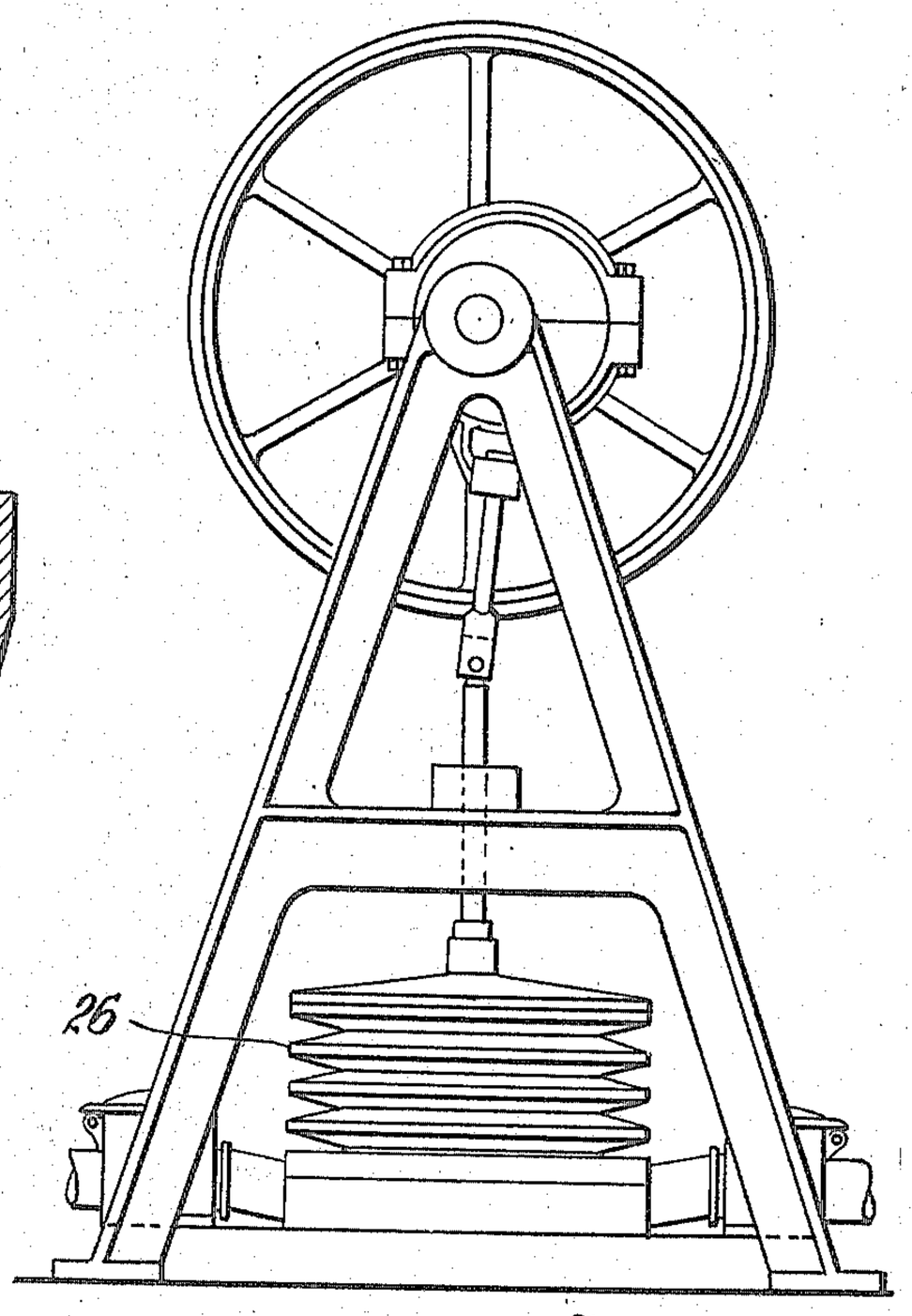


Fig. 3.



Inventor

Edwin Compton Reybold

By his Attorneys

Pennie, Davis, Marvin & Edmonds

Patented Nov. 18, 1924. 1,515,702

UNITED STATES PATENT OFFICE.

EDWIN COMPTON REYBOLD, OF DENVER, COLORADO, ASSIGNOR TO THE DORR COMPANY, A CORPORATION OF DELAWARE.

PUMP DIAPHRAGM.

Application filed May 24, 1922. Serial No. 563,232.

To all whom it may concern:

Be it known that I, EDWIN COMPTON REYBOLD, a citizen of the United States, residing at Denver, in the county of Denver, State of Colorado, have invented certain new and useful Improvements in Pump Diaphragms; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to flexible diaphragms such as are used in reciprocating pumps of the diaphragm type, and it has for its object the construction of an improved pump diaphragm.

The diaphragm pump has been found to be well adapted for lifting sludges discharged from settling tanks in metallurgical and chemical plants and especially wherever a liquid containing a substantial amount of suspended solids is to be elevated.

However, the diaphragms heretofore used in these pumps, made of rubber reinforced with convass, have been highly unsatisfactory because relatively frequent replacements have been necessary. It is extremely important to reduce the frequency of diaphragm replacement to a minimum since the expense involved in replacing a diaphragm is vastly greater than the actual cost of a new diaphragm, inasmuch as it involves not only the labor required in making the replacement, but also the loss of product caused by shutting down operation of the apparatus with which the pump is operating while the diaphragm is being changed. This loss of product is often equivalent to a very substantial sum of money.

The diaphragm constructed in accordance with the present invention is reinforced with a plurality of layers of parallel thread fabric. This parallel thread fabric may be made in the well-known way by laying side by side, parallel to each other, the number of threads necessary to produce the desired width of fabric and temporarily securing these threads together by means of relatively light threads woven at right angles to the parallel threads and spaced some distance apart, for example, one-half inch. The fabric is, therefore, extremely strong in one direction and relatively weak in the direction at right angles to the first, because the light holding threads are used merely to hold the strong parallel threads in position during the subsequent "frictioning" process. Consequently, when these fabrics are placed in the diaphragm structure the strong parallel threads of adjacent layers of fabric are arranged at an angle to each other, preferably at right angles, in order to strengthen the diaphragm in all directions.

The "frictioning" may be done by any process which completely embeds in rubber each parallel warp thread so that it is protected from wear against neighboring threads. A method of frictioning which has been found to be very successful is as follows: First the fabric is coated upon a spreader with several coatings of rubber gum upon both sides of the fabric. This spreading process expells the air from between the threads and embeds each individual parallel thread in a coating of gum, thus separating them from each other by means of the gum and at the same time preserving their alignment. After spreading, the fabric is "skin-coated" on the calender and then cut into pieces of the required dimensions. By thus expelling all of the air from the fabric, embedding the individual parallel warp threads in rubber gum and separating the layers of fabric by the thin layer of rubber applied during the "skin-coating" process, the friction caused by the flexing of the diaphragm in pumping is greatly reduced. Not only is the friction reduced, but also the wear of adjacent threads or adjacent layers against each other is prevented.

This "friction" parallel thread fabric is now used to construct the complete rubber diaphragm which is built up as follows:

First, a layer of rubber facing is placed in the mould and on top of this a layer of the frictioned fabric, then another layer of the frictioned fabric is laid with its threads at an angle, preferably at right angles, to the threads of the first layer. A second layer of rubber facing is then added and the whole vulcanized in the ordinary way. Two layers of the frictioned parallel thread fabric are usually sufficient to give the required strength but additional layers may be used if desired.

The diaphragm of the present invention is flexible to a relatively high degree, exceptionally durable and can be manufactured at a reasonable cost.

A better understanding of the invention

together with the objects which it accomplishes will be had as the description progresses in connection with the accompanying drawings in which Fig. 1 is a view in perspective of a section of the diaphragm with a portion of the upper facing of rubber broken away and another portion folded back to show the frictioned reinforcing fabrics. Fig. 2 is a view in cross section of the pumping mechanism of a sludge pump of the diaphragm type showing the diaphragm in position and Fig. 3 is a view in elevation of another form of sludge pump.

Referring to these drawings the diaphragm is indicated generally by reference numeral 4 and is shown in Fig. 2 in position in the pump. This type of pump comprises a one piece casing 5 provided with an offset 6 upon which is seated the diaphragm 4. The diaphragm is clamped between a rounded surface on the offset and the clamping ring 7 by means of bolts which are not shown. The diaphragm is reciprocated by means of a circular yoke which is clamped to the diaphragm by means of the bolts 8 and which in turn is actuated by a suitable mechanism such as the eccentric shown in the upper portion of Fig. 3. In the lower part of the casing 5 there is provided an inlet valve 9 through which the liquid enters the pump. The liquid is discharged from the pumping chamber 11 through a central discharge opening in the diaphragm, this opening being closed by the discharge valve 12 which is carried on the yoke. The liquid passes from the pumping chamber 11 through the discharge valve 12 into the space 13 above the diaphragm from which it is discharged through a suitable opening not shown. A diaphragm which will operate successfully in a pump of this type must be constructed to withstand the continuous flexing which takes place during the operation of the pump, in addition to the pressure to which it is subjected.

Referring to Fig. 1 an upper layer of frictioned parallel thread fabric is shown at 14, and a lower layer at 15 with their skin coated surfaces 16 and 17 in contact. At 18 the outer facing 21 of rubber and a portion of the skin coating of rubber applied to the fabrics 14 and 15 during the frictioning process, are shown removed so as to expose the threads of the fabric. A portion of the upper fabric 14 is also shown broken away so that the threads of the lower fabric 15 may be seen. At 19 the bare threads of the fabrics 14 and 15 are again shown by folding back a portion of the upper half of the diaphragm and removing a portion of the skin coated surfaces 16 and 17.

Numeral 23 indicates the relatively strong parallel warp threads of fabric 14 and numeral 24 those of fabric 15, and, as shown, the fabrics are placed in the diaphragm structure so that the threads 23 are at right angles to the threads 24. The relatively light holding threads of both fabrics are indicated at 25 and, as above described, they are spaced a relatively large distance apart. These threads constitute the only weft or filler threads in the fabric and as they are not intended to furnish any strength to the diaphragm but merely to hold the parallel warp threads in place during the frictioning process it may be said that the fabric, after frictioning, really has no filler threads.

In Fig. 3 is shown a modification of the pump of Fig. 2 in which instead of the single diaphragm 4 being used the whole pumping chamber is expansible and is constructed in the form of a rubber bellows 26 which is reinforced in the same manner as the diphragm 4.

In comparative tests between the diaphragm constructed in accordance with this invention and the ordinary diaphragms reinforced with canvas the former diaphragms have shown a remarkable increase in life over the canvas-reinforced diaphragms.

I claim:

1. A pump diaphragm comprising a rubber body of appropriate configuration having a plurality of layers of parallel thread fabric embedded therein, the parallel threads of adjacent layers of fabric being angularly disposed with respect to each other.

2. A pump diaphragm comprising a rubber body of appropriate configuration having a pluralty of layers of frictioned parallel thread fabric embedded therein, the parallel threads of adjacent layers of fabric being angularly disposed with respect to each other.

3. A pump diaphragm comprising a rubber body of appropriate configuration having a plurality of layers of frictioned parallel thread fabric embedded therein, the parallel threads of adjacent layers of fabric being disposed at substantially right angles to each other.

4. A pump diaphragm comprising a body of vulcanized rubber having a plurality of layers of frictioned parallel thread fabric embedded therein the parallel threads of adjacent layers of fabric being disposed at substantially right angles to each other.

5. A pump diaphragm comprising a rubber body of appropriate configuration having a plurality of layers of parallel thread fabric embedded therein, the parallel threads of at least one layer being angularly disposed with respect to the parallel threads of at least one other layer.

In testimony whereof I affix my signature.

EDWIN COMPTON REYBOLD.