Aug. 8, 1933. M. V. ANDERSON 1,921,720

REVOLVING CYLINDER PUMP

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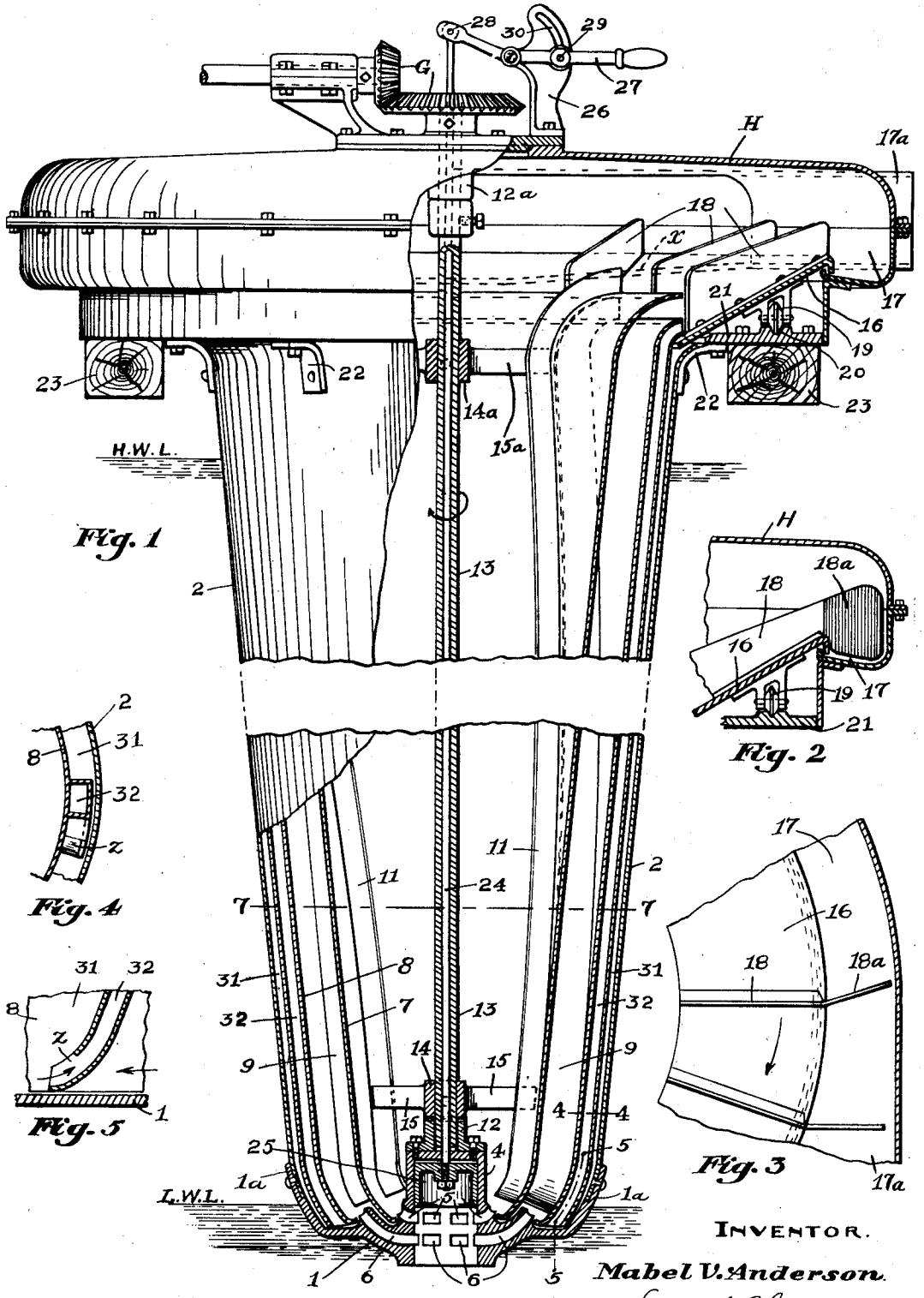


Fig. 1

Fig. 2

Fig. 4

Fig. 5

Fig. 3

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REVOLVING CYLINDER PUMP

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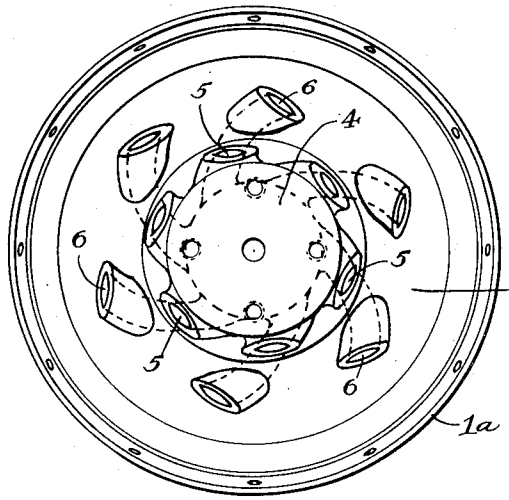
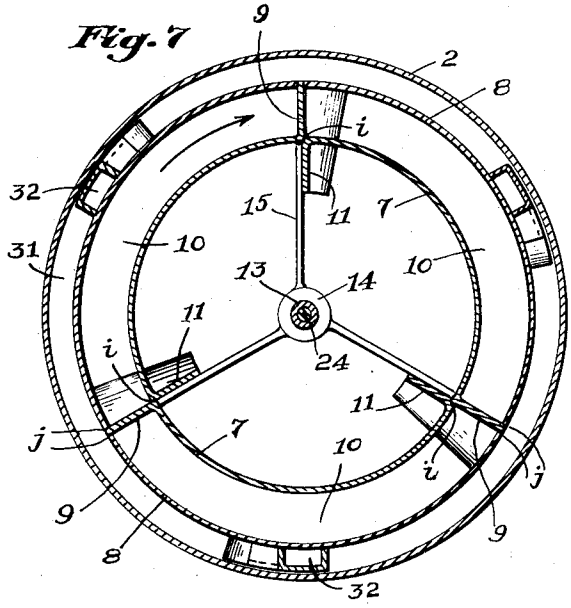


Fig. 6

Fig. 7



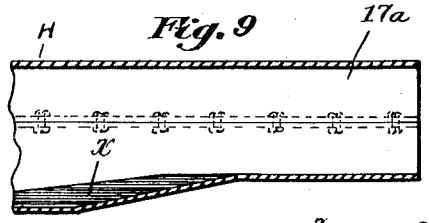


Fig. 9

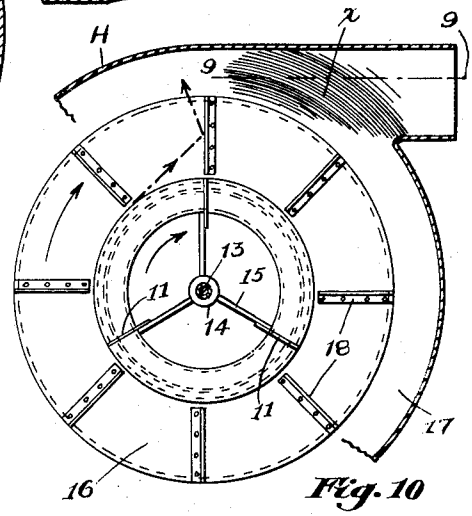


Fig. 10

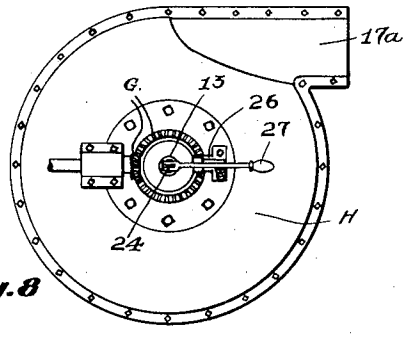


Fig. 8

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REVOLVING CYLINDER PUMP

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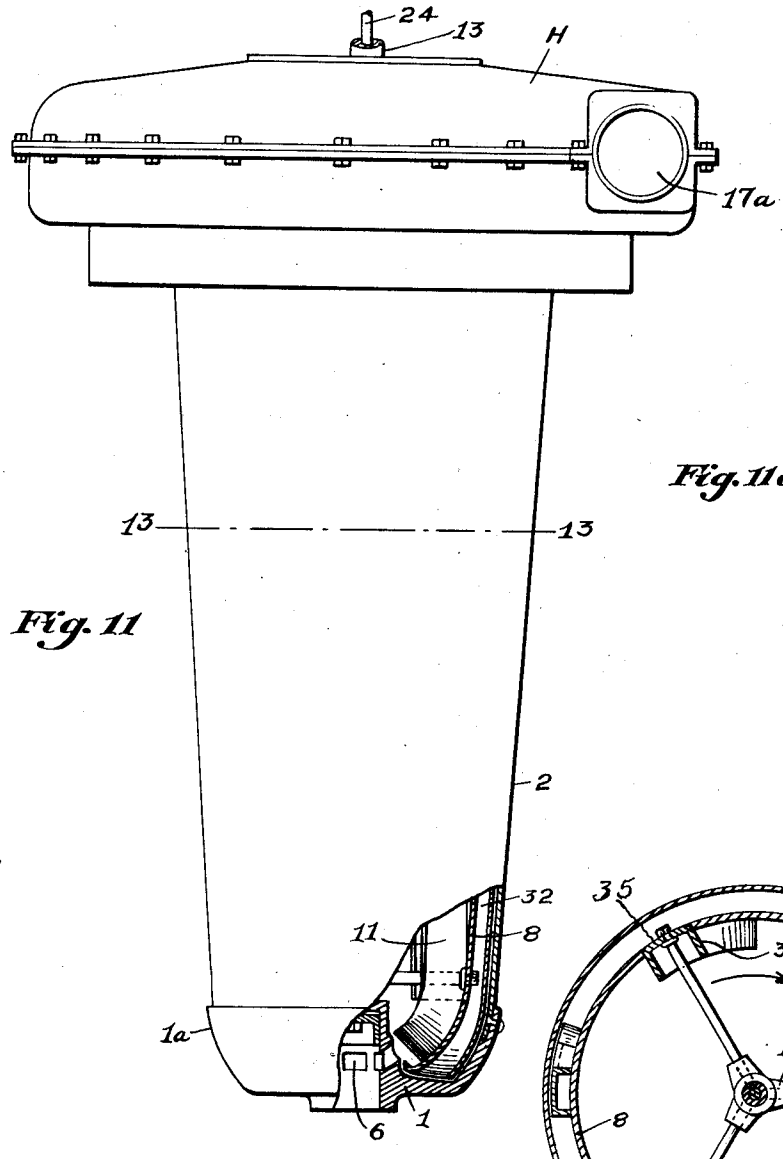


Fig. 11

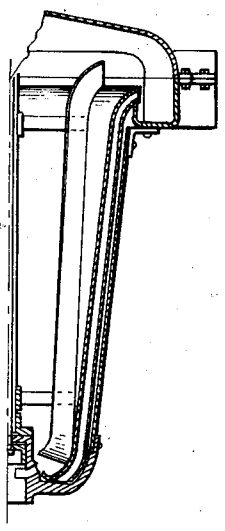


Fig. 11a

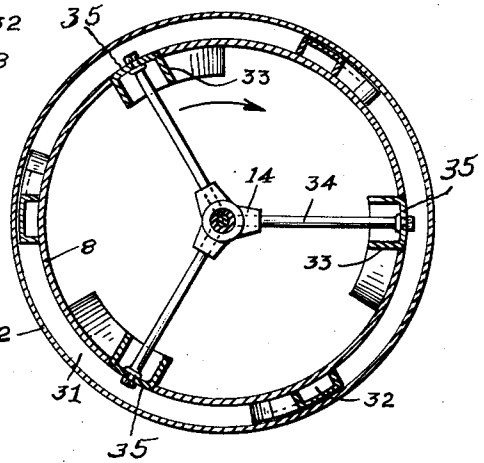


Fig. 13

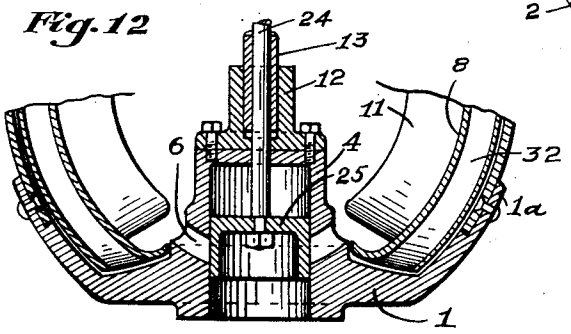


Fig. 12

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REVOLVING CYLINDER PUMP

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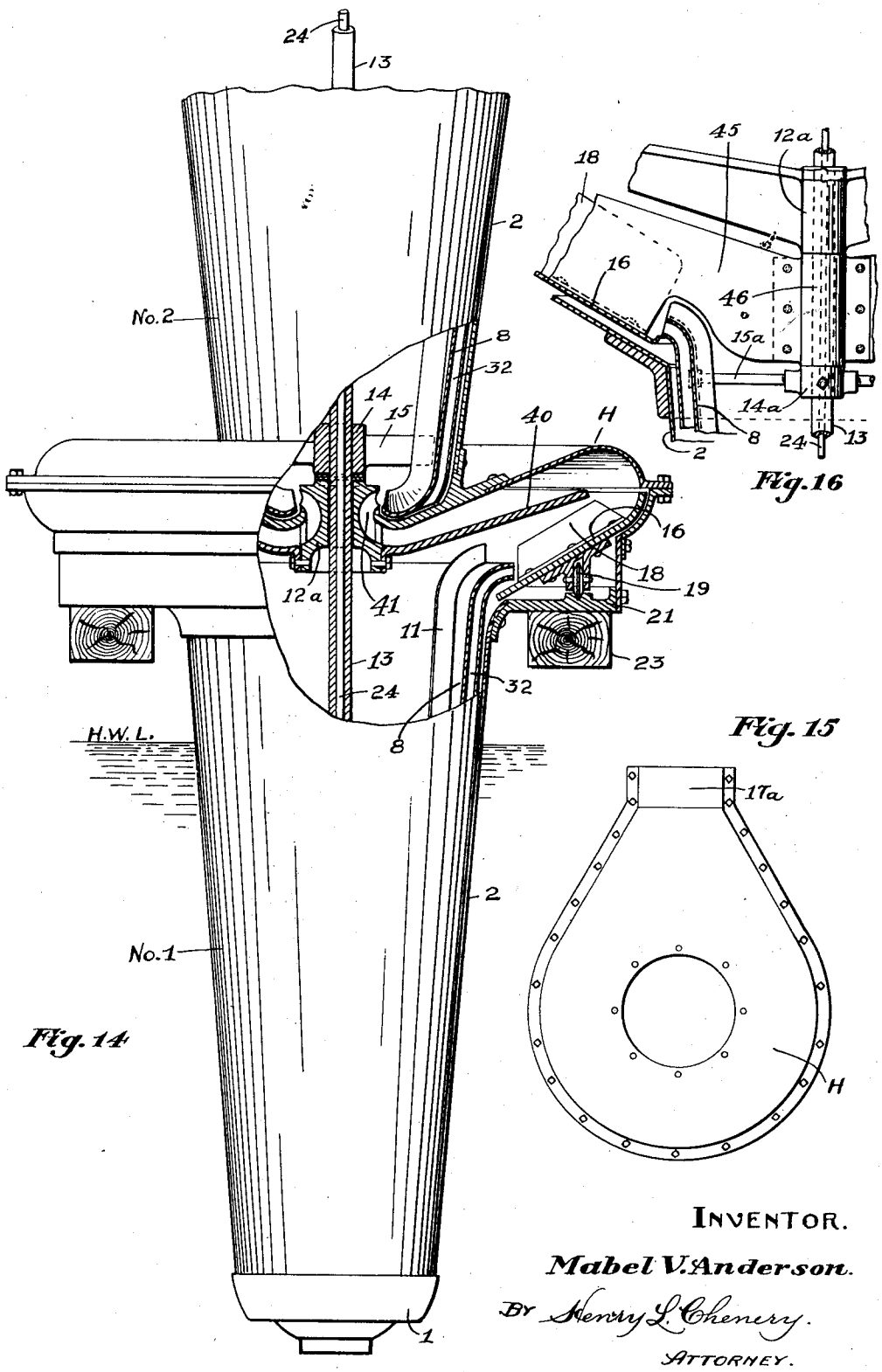


Fig. 14

Fig. 16

Fig. 15

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Patented Aug. 8, 1933 1,921,720

UNITED STATES PATENT OFFICE

1,921,720

REVOLVING CYLINDER PUMP

Mabel V. Anderson, Lewiston, Maine, assignor of one-fourth to Annie E. Heath, Crumpsall, England, and one-fourth to Elizabeth G. Canham, Auburn, Maine

Application April 4, 1932. Serial No. 602,941

5 Claims. (Cl. 103—99)

This invention relates in general terms to liquid-elevating apparatus but deals more particularly with what is commonly known as a revolving pump, the cylinder of which is frusto-conical in form and operates by being revolved rapidly in the liquid, the latter entering the lower, or smaller end, and discharging from the upper, larger portion.

In the conventional type of revolving pump the cylinder is immersed for a short distance from the bottom end in the liquid and centrifugal action in conjunction with the diverging sides of the cylinder causes the liquid to rise on its interior surface, the height to which the liquid can be elevated depending on the speed at which the cylinder is rotated and the angle of incline of its walls.

Compared with the ordinary plunger pump the revolving type has many advantages where it is required only to raise the liquid to comparatively moderate elevations. There is comparatively little friction to overcome in the moving parts, in contrast to those of the plunger pump—as pistons and piston-rod packings—and has, moreover, no suction or discharge valves to become clogged and inoperative. It can even raise sand, chips or other foreign matter which would be more than likely to put the average plunger pump out of commission.

The revolving pump, however, is strictly a drafting device and is not designed nor adapted for force-pump purposes.

Many attempts have heretofore been made to improve the revolving cylinder pump and perfect it to such an extent that it would compare favorably with, or even rival the plunger or the rotary type of pumping apparatus in efficiency.

One drawback in the operation of revolving cylinder pumps as they have been constructed in the past is that to obtain even mediocre success they must be immersed only a short distance in the liquid, as the efficiency and effectiveness of its pumping service increasingly diminishes as the cylinder is more deeply covered by the surrounding liquid. Thus the pump when operating in a tank, say of water, must be continuously lowered as the water is drawn therefrom, and this necessarily requires more or less hoisting and lowering paraphernalia which complicates matters and causes the pump to loose favor with those who might otherwise employ this type of liquid-elevating device for their particular use.

I have incorporated in my present invention several features which I believe make it superior in operation and efficiency to revolving cylinder pumps as at present constructed. Among these features are—

1. A cylinder mounting in which the cylinder itself is enclosed within a stationary casing substantially eliminating direct contact of the outside of the cylinder with the surrounding liquid.

2. Adaptability of the apparatus to be submerged in the liquid at various depths and maintain uniform pumping conditions at all times.

3. Facilities for procuring a variable feeding of the liquid to the interior of the pump.

4. Means to take advantage of and utilize the power and force of the water or other liquid centrifugally thrown from the top of the cylinder when rotating by directing the liquid on to a revolving platform and an upwardly sloping receiving well for the purpose of acquiring a considerable per cent greater elevation of the liquid above the top of the cylinder than could be obtained otherwise, and

5. Various other improvements in construction which will be disclosed as the description proceeds.

The character of the invention may best be understood by reference to the description found in the following specification when taken in connection with the accompanying drawings in which I have illustratively presented an embodiment which, at the present time, I consider preferable to other possible forms in which the invention might be carried out.

In the drawings,

Fig. 1 is a side elevation, partly in section, of my improved type of double, revolving cylinder pump;

Fig. 2 and Fig. 3 represent side and plan views, respectively, of a modified form of baffle plate;

Fig. 4 is a sectional plan view taken on line 4—4, Fig. 1;

Fig. 5 is a sectional elevation, the section being taken on line 5—5, Fig. 1;

Fig. 6 is a plan view of the cylinder basin, showing particularly, the intake spouts;

Fig. 7 is a sectional plan view showing the manner of fabricating the parts of the cylinder and water-elevating partitions, the section being taken on line 7—7, Fig. 1;

Fig. 8 is a plan view of the pump;

Fig. 9 is a sectional elevation of the discharge spout, the section being taken on line 9—9, Fig. 10;

Fig. 10 is a plan view of the rotary platform, showing also, the deflecting plates mounted thereon;

Fig. 11 is an elevation, partly in section, of my single cylinder pump;

Fig. 11*a* is a fragmentary representation of a conventional type of revolving pump in which my outer casing and cylinder basin are incorporated;

Fig. 12 is a fragmentary sectional elevation of the lower end of a single cylinder revolving pump;

Fig. 13 is a sectional plan view of the single cylinder pump, taken on line 13—13, Fig. 11;

Fig. 14 is a side elevation, partly in section, of a "booster" or two-stage-lift pump;

Fig. 15 illustrates a modified form of discharge spout, and

Fig. 16 shows an alternative method of suspending the rotary platform.

Similar reference characters are employed to identify like parts in all views of the drawings.

Referring to the drawings and particularly to Fig. 1, 1 represents the cylinder basin, made preferably in the form of a casting and constituting the water-induction element of the pump.

On the upstanding sides, 1*a*, of the basin is secured the outer casing 2 which surrounds the pump mechanism and excludes water from the interior as well also as serving to protect the outside of the revolving cylinder from contact with the surrounding water.

Rising from the bottom of the basin and extending for a considerable distance into the central portion of the pump is a straight-bored cylinder 4 out of the sides of which extend two sets of water intake ports 5 and 6, respectively. These ports, or passages, have both an upward and slightly tangential trend and the water, after passing therethrough has acquired a directional movement which enables the elevating cylinders 7 and 8 to more readily pick it up and force it to the discharge end of the pump. The cylinder 7 elevates water passing through the intake ports 5 and the cylinder 8 that which flows through the passages 6.

Disposed between the two members 7 and 8 and extending for substantially their full lengths are a plurality of partitions 9, forming chambers 10 between the cylinders and partitions. I have shown in Fig. 7, simply for purposes of illustration, three of these partitions, but it is obvious that more than this number might be employed if desired.

In order to reduce resistance and assist in the upward flow of the water as the cylinders rotate I slightly incline the partitions on the cylinder walls away from the direction of rotation, that is, their lower ends are set in advance of their upper ends.

I show in Fig. 7 a plan view illustrating one method of constructing cylinders and partitions integrally. Each section of the cylinder 7 has both an inwardly and outwardly projecting flange, the outer flange serving as the partition 9 and the inner flange as the water-elevating plate 11. In fabricating the parts electric welding is employed. The inner cylinder, 7, is first set up and the joints, as at *i*, made by welding; the outer cylinder segments 8 are then joined at *j*, completing the structure by a process involving outside welding only, in every instance. This greatly reduces the cost of manufacture and leaves all the inner surfaces smooth and devoid of obstructions which would retard the free movement of the water upwardly.

On the top of cylinder 4 is a pedestal bearing 12 in which is journalled the lower end of the hollow drive shaft 13. Immediately above the bearing 12 is a hub 14 with radially extending arms 15 the outer ends of which are secured, preferably by electric welding, to the members 11, respectively. In like manner the upper end of the pump is supported and held in vertical alignment with the shaft by a hub 14*a* having arms 15*a* similarly secured to the plates 11. A bearing 12*a* carries and aligns the upper end of the shaft 13.

Outwardly of and abreast of the tops of the cylinders 7 and 8 is a revoluble, annular-shape platform 16 its top surface having an upward and outward flare. The top edge of the platform is at a considerably higher elevation than the tops of the cylinders and a short, vertical flange depends into the water-receiving well, or spillway 17. On the top of the platform are a plurality of deflector blades 18 against which the water is projected as it is forcibly thrown off the upper ends of the cylinders when revolving. The force of the impact of the water against the blades causes the platform to revolve, and when it has acquired sufficient speed the water which falls on to the platform is in turn thrown therefrom by centrifugal force into the spillway, which, as will be observed by reference to Fig. 9, has an upwardly sloping floor, as at *x*, extending to the tangential discharge spout 17*a*.

It is thus evident that by taking advantage of the active energy stored in the forcibly projected water, as it is discharged from the ends of the cylinders, and utilizing this force by properly directing the flow of water, a considerably higher elevating of the latter is possible than would be the case was the water discharged directly into the spillway. In other words, working under similar conditions with respect to the amount of power applied, length of cylinder and amount of water elevated in a given time, my construction contemplates greater efficiency of the pump by being able to raise the water to a higher elevation.

The platform revolves on rolls 19 running in a track 20 made in the annular table 21, the latter being supported on brackets 22 secured to the top of the outer casing 2. Beneath the table 22 are cross stringers 23 from which the whole pump structure may be suspended.

In Figs. 2 and 3, I show a modified form of deflector blade embodying an auxiliary sweeper paddle 18*a* made integral with the regular blade 18 but extended outwardly into the spillway 17. The object of the paddle element is to more rapidly and forcibly move the water toward the discharge spout and thus prevent overflowing of the spillway. It will be observed, by reference to Fig. 3, that the portion 18*a* is bent backwardly in order that its working surface may be presented in a more normal manner to the water as the paddle approaches the discharge opening 17*a*.

Through the bore of the shaft 13 operates a rod 24 the lower end of which is secured to the piston 25. On the top of the pump hood H is mounted the usual driving mechanism, as the gears G, and at one side of the main gear is an upstanding bracket 26. Pivotally mounted on this bracket is a lever 27 making connection, at 28, with the upper end of the rod 24, the hole in the lever being slotted to permit the lever to swing without binding the rod. A clamp screw 29 operating in the slot 30 of the bracket provides facilities for locking the lever in various positions. As shown in Fig. 1 the lever in its connection with the rod 24 holds the piston 25 in its uppermost position. By raising the lever the piston may be lowered

to either cover one or both sets of the intake ports 5 and 6.

The revolving pump operates best at a uniform speed sufficient to easily carry the water by centrifugal action to and over the tops of the cylinders, from which it discharges in all instances at considerable pressure. But it often is desirable to vary the amount of water discharged from the pump, and with the conventional type of revolving pump this can be accomplished only by varying the speed of rotation.

In my improved pump the quantity may easily be regulated by the actuation of the lever 27; the ports 5 may be closed by lowering the piston 25, and the ports 6 may even be partially closed if only a small amount of water is desired to be pumped. When the piston is at its lowermost position, as shown in Fig. 12, all water is excluded from the interior of the pump.

The lower ends of the cylinders 7 and 8 are "belled" or curved inwardly, inducing accelerated pick-up of the water as it passes out of the intake passages 5 and 6. Slight leakages of the water past the bottom end of the cylinder 8 into the space 31 are easily taken care of by the introduction of one or more auxiliary elevating tubes 32, the lower ends of which are open, as at *z*; and in the rotating movement of the cylinders, these tubes rapidly scoop up the comparatively small quantity of water which may have escaped into the outlying space around the cylinder 8 and pass it on to the platform 16 with the rest of the discharging water.

It is one of the characteristic features of my improved revolving pump that it may be submerged up to very nearly the top of the casing 2 without the cylinder or cylinders, if of the duplex order, coming into direct contact with the surrounding liquid. It makes no material difference whether the pump is submerged for one-tenth or nine-tenths of its length in the liquid as the casing 2 in conjunction with the regulatory control of admission of the liquid to the interior of the pump makes working conditions at all times uniform and constant.

Thus, when compared with the conventional type of revolving cylinder pump, there is eliminated the quite considerable friction and loss of power incident, in the old order of pumps, to the elevating cylinder being in direct contact with the liquid in which the pump is immersed.

In my improved construction the liquid may be admitted to the elevating cylinders only so fast as it can conveniently and efficiently be disposed of through its various movements through the pump. It is thus possible to conserve power ordinarily wasted and, furthermore, to operate the pump under conditions which would bar the revolving pump as ordinarily constructed from active service.

While the description thus far has contemplated a duplex, or two-cylinder pump, the novel features embodied in my invention are equally applicable in the main to a single-cylinder liquid elevator.

I have illustrated in Figs. 11, 12 and 13 such a pump, there being, of course, but one set of intake ports opened or closed by the same mechanism as applied to the pump previously described.

In Fig. 13 there is, however, a somewhat different construction effecting simply mechanical design of the parts having to do with the cylinder and supporting structure.

The water-elevating blades, in this instance, are constructed in the form of channels to the outer faces of which the different sections of the wall of the cylinder are attached by electric welding. The legs 33 of the channels stiffen the structure and the forward ones act as the water-elevating elements.

As was the case with the two-cylinder pump, the water-elevating members are inclined on the cylinder walls to expedite the upward movement of the water. The radial arms 34 are secured to the webs 35 of the channels and this prevents any obstruction being interposed to resist the passage of the liquid upwardly along the smooth surface of the legs 33.

The operation of the pump is so simple that no lengthy description is required. The piston 25 should first be set to exclude all water from the interior of the pump. After proper running speed of rotation of the cylinders has been attained, the piston is raised to a point, uncovering the ports to admit the desired amount of water.

In many instances the requirements call for the elevating of the water to more than moderate heights. It is possible, of course, to construct a revolving cylinder pump of more than ordinary length—say twenty or more feet—but for certain reasons it would seem to be, for commercial service, a mechanical impracticability, due to its necessary bulkiness and further to the fact that it is somewhat difficult to sustain a column of water above a certain height.

It would be, however, a very desirable acquisition if the accomplishment of this object could be brought about by apparatus employing the revolving cylinder pump principle as much of the trouble experienced by valve-equipped pumps, when handling certain material, could be eliminated.

In Fig. 14, I illustrate a construction which I have evolved to effect the above object sought, embodying a plurality of cylinders vertically arranged, the lower, or No. 1 cylinder being the main pumping element and its casing the only one immersed in the body of liquid.

The intake end of this No. 1 pumping unit is identical to that of the revolving pumps hereinbefore described, and its upper end is also similar except that a somewhat different spillway is employed.

As the liquid passes off the platform 16 it impacts on the wall of the hood H and from there is deflected on to the annular shelf 40 which is stationary and fixed on the cylinder basin of the pumping unit immediately above—which unit I designate as pumping unit No. 2.

Entering through the open passages 41 the water or other liquid passes upwardly through the pump No. 2 and is discharged therefrom in exactly the same manner as it is in the previously described revolving pump.

It will be observed that there is no regulatory means in the pump No. 2 cylinder basin, and none is necessary, as the admission of the liquid is governed by the intake elements employed for this purpose in the bottom of pump No. 1, which latter is controlled by a similar arrangement to that employed in the single lift, or one-stage pump, including the rod 24 and lever 27.

This principle of raising the liquid by "boosting" it in successive stages from one pumping unit to another can be enlarged on to an extent limited only by the laws of good mechanical practice.

It constitutes an arrangement of moderate size pumping units actuated by a shaft common to all. The individual elements are more easily

manufactured, will handle the water more effectively and the height to which it may be elevated greatly in excess of what would be possible with a single cylinder pump.

In Fig. 11*a* is shown a fragmentary sectional elevation of a revolving pump constructed, insofar as concerns the cylinder and hood, on somewhat similar lines to that of the old, conventional type of revolving pump. The rotary platform is eliminated and the water passes directly from the cylinder to the spillway in the hood. My casing 2, however, is incorporated in the arrangement, as well also as the feed-water-control mechanism, a description of which has hereinbefore been made.

While the description previously given of the platform 16 designates the water discharging from off the tops of the cylinders as being the sole power medium through which rotation is given it, I may elect to employ a modified construction for this element, in which case somewhat different conditions exist as to its actuation.

If reference be had to Fig. 16 it will be observed that the platform is attached to and supported from thin radial ribs 45, the inner ends of which are secured on the hub member 46 which latter is loosely mounted and revoluble on the shaft 13. This hub member, 46, bears on the top face of the cylinder-carrying hub 14*a*, the latter being fixed on the shaft 13.

In my former structure hereinbefore described, the actuation of the platform was wholly distinct from the positive power actuation of the cylinder, but in the present instance, as depicted in Fig. 16, there is a frictional interconnection between the platform elements and the positively driven hub 14*a*. Thus the platform may start to rotate, at first very slowly, immediately after the shaft 13 begins to revolve, for the reason that the whole weight of the platform and connecting parts is borne by the hub 14*a*.

It is not expected, nor is it required, that the platform be brought to the full operative speed of the cylinder through this frictional contact between the two hubs, but it will have acquired a moderately high rate of rotatable movement previous to the time the water is admitted to the cylinder and this will prevent excess accumulation of the liquid on the platform surface.

In actual pumping operations it is not designed to positively, or even frictionally, rotate the platform for in that instance there would be a draft on the power which is designed wholly to drive the cylinder of the pump. The reason for incorporating the platform in the pump structure is to enable the water to rise or be elevated to a point higher than could be accomplished by the cylinder alone; the object in rotating it is so that it may more readily shed the liquid once it has been deposited on the platform surface.

The features, in general, characterizing my improved revolving cylinder pump will, it is believed, add materially to the efficiency and dependability of pumping apparatus of this class and create thereby a demand for them which at the present time does not exist.

What I claim is:

1. A revolving cylinder pump comprising in combination a water-receiving hood having a tangential discharge opening, an inverted frusto-conical shape casing secured at its larger end to the bottom portion of said hood, a ported basin on the bottom end of said casing, a central, axially disposed bore in said basin, a piston in said bore, a tubular, revoluble shaft axially disposed within said casing, the lower end of said shaft being journalled in said basin, a bearing on said hood in which the upper end of said shaft operates, a frusto-conical cylinder secured on said shaft, within and disposed in spaced relation to said casing, a rod operable within said tubular shaft with its lower end fixed in said piston, and means to actuate said rod.

2. A revolving cylinder pump comprising in combination a vertically disposed cylinder of inverted frusto-conical shape, its top end being belled outwardly and its lower end belled inwardly, a non-rotating casing surrounding said frusto-conical cylinder and laterally spaced therefrom, said casing extending vertically substantially the full length of said cylinder, a basin secured to the lower end of said casing, a central, vertically disposed bore in said basin, intake ports of upward trend providing communication between the outside and the interior of said casing, a piston in said bore arranged to slide over said ports, either to open them in various amounts or close them entirely, a tubular, revoluble shaft axially disposed within and secured to said frusto-conical cylinder, a non-rotating rod operable within said tubular shaft and having its lower end fixed in said piston, means on the upper end of said rod to raise and lower it for the purpose of causing said piston to open and close, respectively, the said ports, and means to rotate said shaft.

3. In apparatus of the class described comprising in combination a revoluble, frusto-conical shape cylinder having an inturned lower end, a stationary casing surrounding and disposed in spaced relation to said cylinder, a basin secured to the lower end of said casing, a straight bore cylinder in and extending upwardly from the bottom of said basin, the lower end of said straight bore cylinder being open to the outside, intake ports in said basin extending from said straight bore cylinder to the interior of said casing, a piston operable in said straight bore cylinder and adapted to either open or close said intake ports whereby liquid, in which said casing is adapted to be immersed, may be admitted to or excluded from the interior of said casing, an annular platform, having an outwardly and upwardly flaring top surface, surrounding the upper end of said frusto-conical cylinder, a track beneath said platform, rolls on said platform adapted to traverse said track whereby rotation may be given said platform, a shaft axially mounted in and secured to said frusto-conical cylinder, means to rotate said shaft, and a hood, having a discharge outlet therefrom, surmounting said casing.

4. In apparatus of the class described comprising a stationary casing adapted to be immersed in a body of liquid, a basin secured to the lower end of said casing, a frusto-conical shape cylinder revoluble in said casing, a shaft axially mounted in and secured to said cylinder, a hood surmounting said casing and secured thereto, a spillway in said hood, a discharge spout opening out of said spillway, ports through said basin providing for the admission of the liquid, in which said casing is immersed, into the interior of said casing, means to control the passage of the liquid through said ports, either to vary the quantity admitted or to exclude it entirely, an annular platform revolubly mounted outwardly of the upper end of said frusto-conical cylinder and disposed in axial alignment therewith, the top sur-

face of said platform being inwardly inclined, a plurality of baffle plates secured to and rising from the top surface of said platform, a paddle on the end of each of said baffle plates extending outwardly and downwardly into said spillway, and means to rotate said shaft whereby rotation may be given said frusto-conical cylinder and by the force of the liquid centrifugally thrown from said cylinder and impacted on said baffle plates rotation may also be had of said annular platform.

5. A revolving cylinder pump comprising in combination a stationary casing adapted to be immersed in the liquid to be elevated, a revoluble, frusto-conical cylinder operable in said casing, a basin on the lower end of said casing, means to provide, through said basin, a regulated admission of the liquid to the interior of said casing, an annular, inwardly inclined platform disposed outwardly of said frusto-conical cylinder and extending upwardly above the top thereof, a hood superimposed on said casing, a basin secured in said hood, an annular, inwardly inclined shelf extending from said last mentioned basin upwardly within said hood and to within a short spaced distance from the outer wall thereof, intake passages in said last mentioned basin merging into the space located immediately above said inclined shelf, a second casing surmounting said hood, a revoluble, frusto-conical cylinder operable in said secondly mentioned casing, a shaft axially mounted in and secured to both of said frusto-conical cylinders, a second hood mounted on and above the said second casing, a spillway in said last mentioned hood, a discharge outlet therefrom, and means to rotate said shaft.

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