S. A. HUNTLEY.

CENTRIFUGAL PUMP.

APPLICATION FILED APR. 2, 1906.

913,140.

Patented Feb. 23, 1909.

3 SHEETS—SHEET 1.

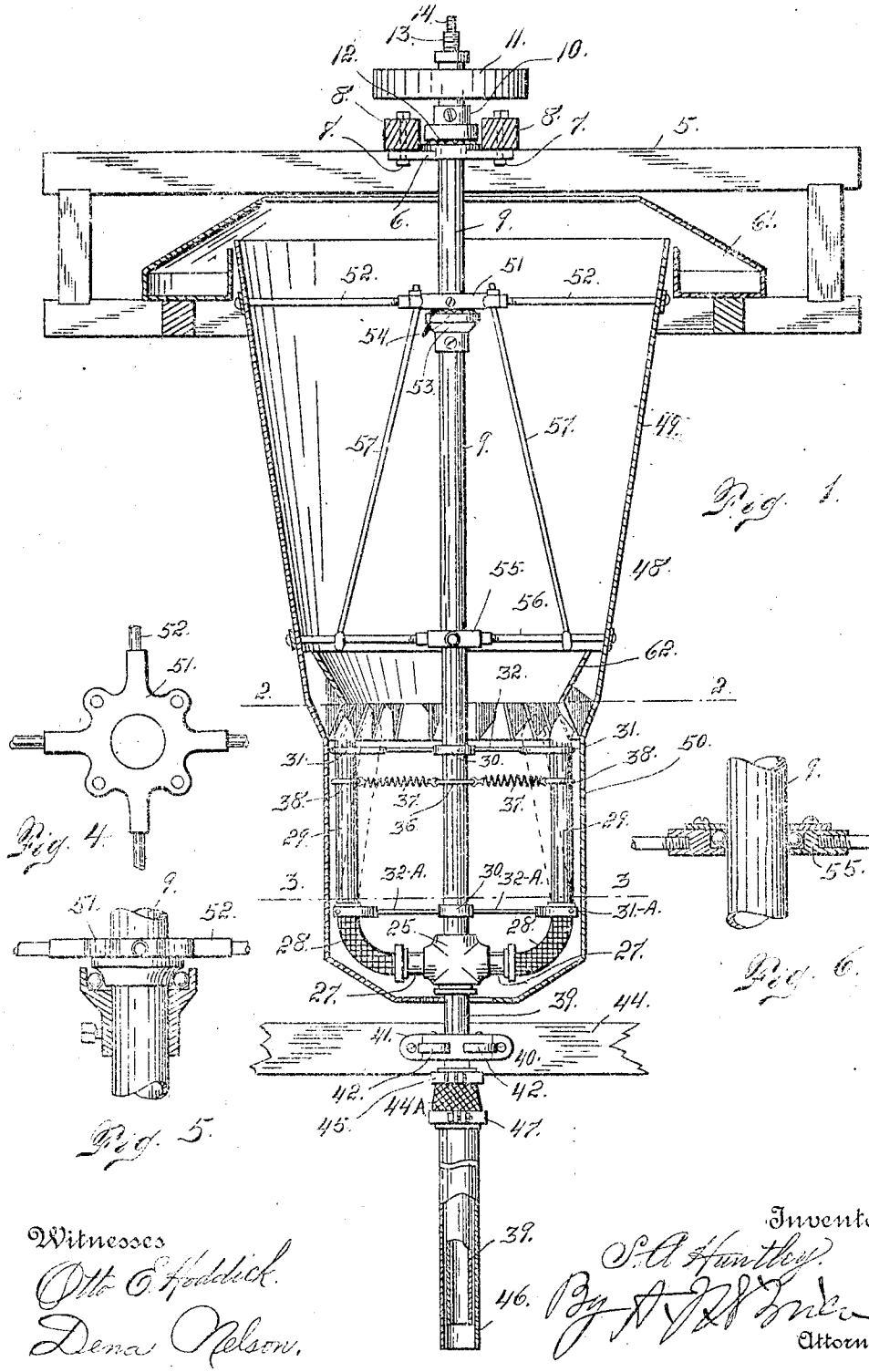


Fig. 1.

Fig. 4.

Fig. 6.

Fig. 5.

Witnesses

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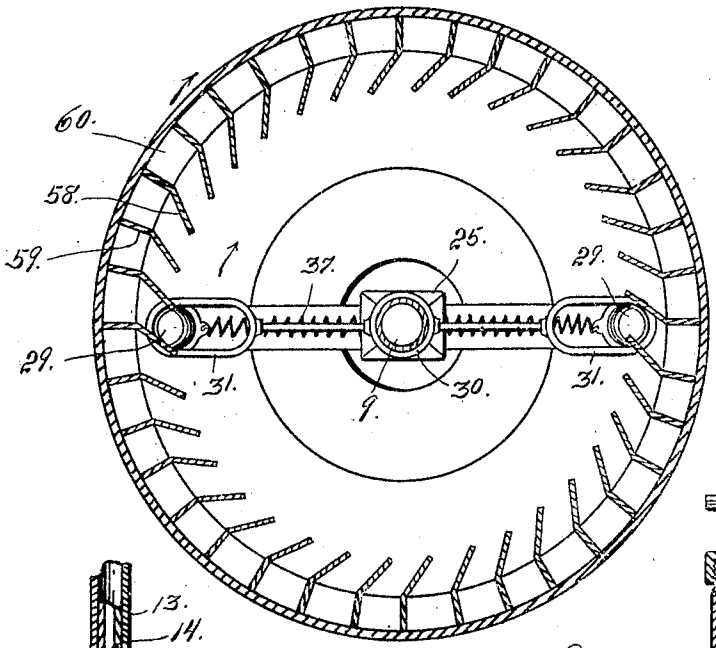


Fig. 2.

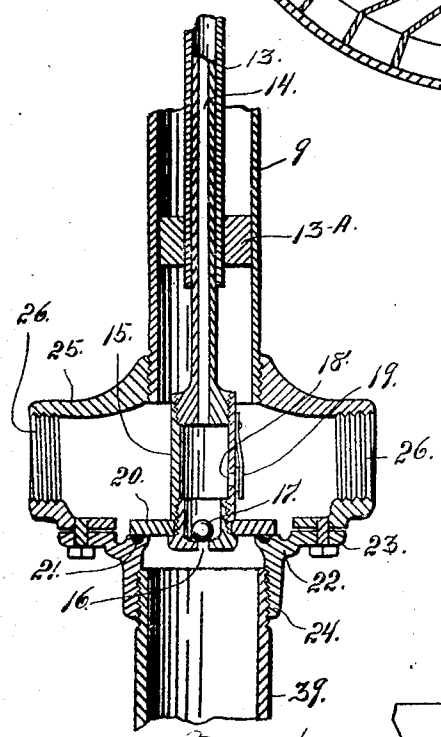
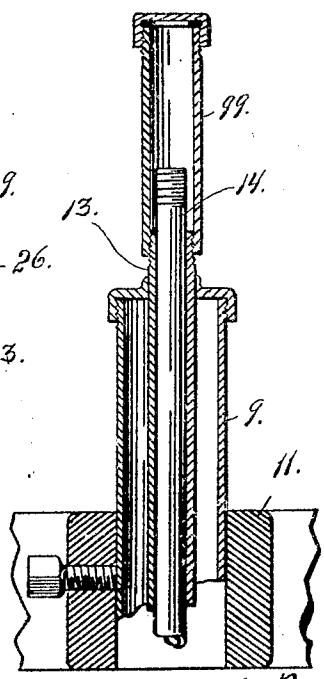


Fig. 7.



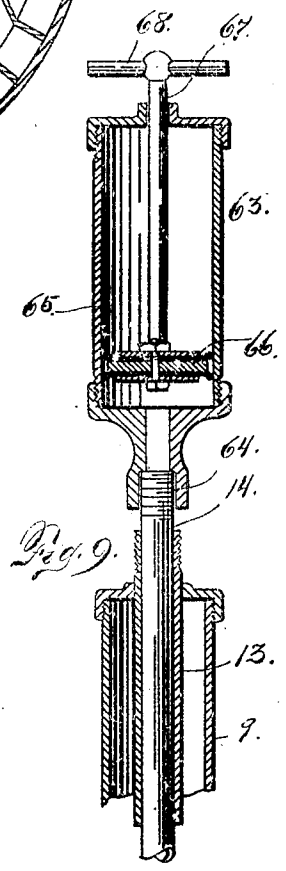


Fig. 9.

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Fig. 8.

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3 SHEETS—SHEET 3.

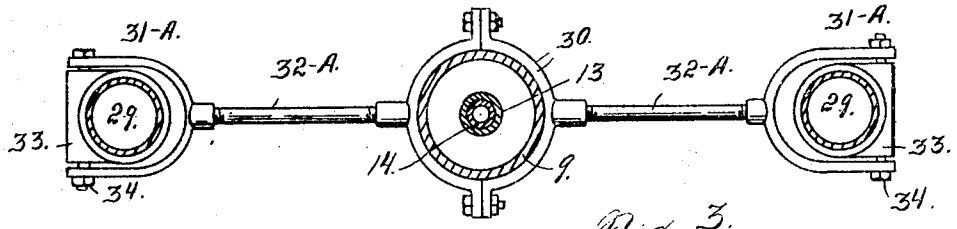


Fig. 3.

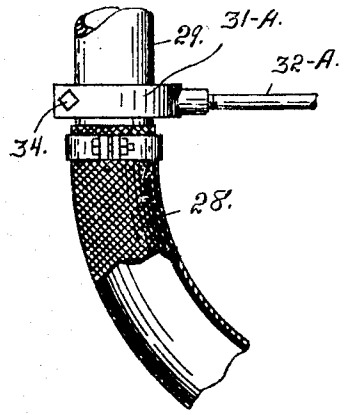


Fig. 10.

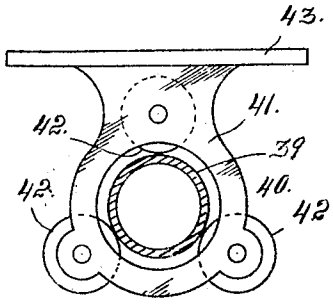


Fig. 12.

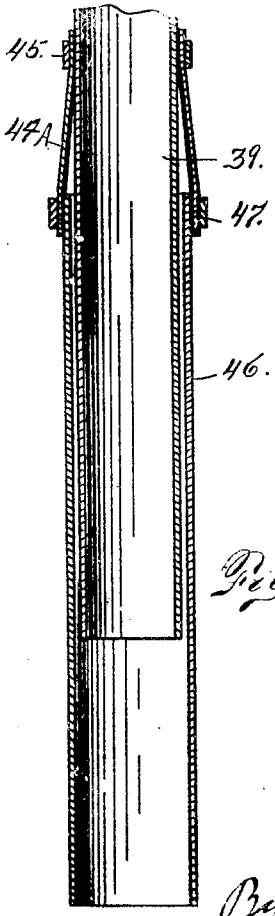


Fig. 11.

Witnesses

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UNITED STATES PATENT OFFICE.

STEPHEN A. HUNTLEY, OF DENVER, COLORADO.

CENTRIFUGAL PUMP.

No. 913,140. Specification of Letters Patent. Patented Feb. 23, 1909.

Application filed April 2, 1906. Serial No. 309,243.

To all whom it may concern.

Be it known that I, STEPHEN A. HUNTLEY, a citizen of the United States, residing in the city and county of Denver and State of Colorado, have invented certain new and useful Improvements in Centrifugal Pumps; and I do 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, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in centrifugal pumps.

My present improvement consists of certain novel features of construction, all of which will be fully understood by reference to the accompanying drawing in which is illustrated an embodiment thereof.

In this drawing, Figure 1 is a vertical longitudinal section taken through parts of my improved construction, the other parts being shown in elevation. Fig. 2 is a horizontal section taken on the line 2—2 Fig. 1. Fig. 3 is a section taken on the line 3—3 Fig. 1 omitting the outer casing, the parts being shown on a larger scale. Fig. 4 is a top view in detail of a centering collar which connects the outer casing with the hollow revoluble shaft. In this view the radial connecting rods are broken away and the parts shown on a larger scale than in Fig. 1. Fig. 5 is a side view of the same showing the main pipe in place and the lower ball race member in section. Fig. 6 is a sectional view of a ball bearing, centering collar which also connects the outer casing with the hollow revoluble shaft by means of radially disposed rods which are partly broken away in this view. Fig. 7 is a vertical longitudinal section taken through a portion of the hollow revoluble shaft, the valve and its casing, as well as the depending conduit extending below the valve casing. This section is taken where the hollow shaft and the depending suction conduit showing the valve casing or T-head with which the lower extremities of the lateral eduction pipes are connected, the parts being shown on a larger scale than in Fig. 1. Fig. 8 is a sectional view taken through the upper part of the hollow shaft and its connections, parts being shown on a larger scale. Fig. 9 is a similar view with the priming pump in place. Fig. 10 is a detail view of a portion of one of the lateral eduction pipes, shown partly in section and on a larger scale. Fig. 11 is a section view illustrating a longitudinally extensible suction conduit employed in connection with my improvements. Fig. 12 is a section taken through the suction conduit above its roller bearing the latter being shown in plan view and on a larger scale than in Fig. 1.

The same reference characters indicate the same parts in all the views.

Let the numeral 5 designate a stationary upper frame to which is secured a plate 6 provided with a hub in which is formed a ball race. This plate is secured to the stationary frame by bolts 7 passed through cross bars 8 mounted on the frame 5. Passing through the plate 6 is a hollow revoluble shaft 9 to which is secured a ball race collar 10 coöperating with the ball race portion of the plate 6 to form a ball bearing. The balls 12 of this bearing are interposed between the two ball race members. By means of this construction the hollow revoluble shaft is suspended upon the frame 5. To this shaft above the ball bearing is made fast a power pulley 11. Projecting above the upper extremity of the hollow shaft 9 is a pipe 13 which forms a guide for the hollow valve stem 14 also exposed above the guide 13. This valve stem extends downwardly through the hollow shaft 9 and is connected at its lower extremity with an auxiliary valve casing 15 having an orifice 16 at its lower extremity controlled by a ball valve 17; and an orifice 18 in one side controlled by a clapper valve 19. To the lower extremity of this auxiliary valve casing and above the orifice 16, is secured the main valve 20 which engages a seat 21 formed on a collar 22 having both horizontal and vertical flanges 23 and 24. To the horizontal flange is secured the main valve casing or T-head 25 having threaded lateral openings 26 into which are screwed coupling members 27 attached to the lower extremities of the flexible conduit members 28 forming a part of the lateral eduction conduits 29. The upper extremities of these conduits are open for the escape of the water.

The hollow revoluble shaft 9 is connected at its lower extremity with the T-head 25, having exterior threads which engage the interior threads formed in an opening at the top of the said head. The lateral eduction

pipes 29 are connected with the hollow shaft 9 by means of upper and lower clamping collars 30 applied to the shaft 9, the said collars being connected with upper and lower loops 31 and 31A respectively, which surround the eduction pipes. One collar 30 is connected with the loops 31 by rods 32; while the loops 31A are connected with the other collar 30 by rods 32A. Each eduction pipe 29 where it passes through the loop 31A is reinforced as shown at 33 to receive a bolt 34 which forms a pivot and allows the pipe 29 to swing inwardly to the position shown by dotted lines in Fig. 1, the opening of each loop 31 being of sufficient length to permit this movement. Between the two clamping collars 30, is located a collar 36 surrounding the pipe 9 and with which a coil spring 37 is connected on each side. The opposite extremities of the springs 37 are connected with collars 38 which fit the eduction pipes 29 closely. The tension of the springs 37 is normally such that as the machine slows down or diminishes its speed preparatory to stopping, the said tension will overcome the centrifugal force before the machine stops and thus draw the eduction pipes inwardly to the dotted line position in Fig. 1, thus reducing the centrifugal force since the two pipes are brought nearer together causing their upper open extremities to move in a smaller circle. This action diminishes the centrifugal force sufficiently to prevent the discharge of the priming before the machine stops. In other words by virtue of this arrangement it is my intention to maintain the eduction pipes full of water when the machine stops thus obviating the necessity of repriming preparatory to commencing the next operation. It is evident that the inward lateral swing of the eduction pipes 29 is permitted by virtue of the flexible elbow members 28.

Connected with the depending flange 24 of the collar 22, is a depending suction pipe 39 which passes through a bearing 40 consisting of a body part 41 in which is journaled a number of antifrictional rollers 42 adapted to engage the pipe during its rotary action incident to the operation of the machine. It may be stated that this suction pipe rotates with the hollow shaft 9 and the eduction pipes 29. This bearing 40 is provided with a base 43 secured to a suitable support 44. This support 44 together with the bearing 40, maintains the hollow shaft 9 together with the suction pipe and their attachments, in vertical alinement during the operation of the pump. By means of the roller and ball bearing constructions heretofore described, the friction upon the central rotary members 9 and 39 is reduced to a minimum.

Below the bearing 40, the upper extremity of a flexible sleeve 44A is secured to the pipe 39 by a clamping collar 45; while the lower extremity of the flexible sleeve is secured to an outer pipe 46 by a similar clamping collar 47. The pipe 39 telescopes in the pipe 46, and by loosening the collar 45, the outer pipe 46 may be raised or lowered whereby the suction conduit member of the apparatus composed of the two pipes 39 and 46, may be shortened or lengthened as may be desired and according to the level of the water in the source of supply. The depth or level of the water in the source may vary from time to time and it may be very important to have the suction member of the apparatus extensible. Moreover by constructing each apparatus with this extensible feature, sufficient adjustability is permitted to make the apparatus available in localities where the exact conditions can not be learned in advance. As soon as the proper adjustment of the pipe 46 either up or down has been made, the clamping collar 45 will be again tightened. The inside of this collar is lined or otherwise equipped with a suitable packing material to insure the making of water tight joints where the flexible sleeve is connected with the device.

Inclosing the apparatus above the support 46, is a casing 48 composed of upper and lower portions 49 and 50. The lower portion 50 incloses the tension pipes 29 and is provided with an opening through which the upper part of the eduction pipe 39 passes. The upper portion or member 49 of this casing is outwardly flared or has the shape of the frustum of a cone to aid in elevating the water. This outwardly flared member acts in maintaining a circular sheet of water which is much easier to elevate than a solid body, and as the water is caused to be thrown outwardly by its centrifugal action this circular sheet is easily maintained with a member the shape of the frustum of a cone. A further object of the revolving cylinder 49 is to reduce the friction which would ordinarily result from the centrifugal action of the water against a stationary cylinder. The reduction of the friction materially aids in raising water as there is practically no resistance to the centrifugal action of the water as it leaves the eduction pipes. The entire casing 48 is supported in place and centered around the shaft 9, by a collar 51 surrounding said shaft and connected with the upper portion or the member 49 of the casing by radial rods 52. This collar 51 is provided on its under surface with a ball race and coöperates with a collar 53 secured to the shaft 9 and carrying ball bearings 54. The casing is thus allowed to rotate around the shaft 9 while suspended thereon. In order to further support the casing and give it the necessary strength, a collar 55 surrounds the shaft 9 near the lower part of the casing member 49. This collar is con-

nected with the casing by rods 56. The collar 51 is connected with the rods 56 by brace rods 57. By virtue of this construction the casing 48 is interiorly strengthened and braced and centered to rotate around the shaft 9 under the influence of the action of the water discharged from the upper extremities of the eduction pipes 29 as heretofore explained.

The casing 48 is provided adjacent the discharge extremities of the eduction pipes 29, with a horizontal zone provided with a series of blades 58 whose outer edges are secured to the inner surface of the casing. These blades are angular in shape changing their direction about midway of their length as shown at 59 at which point they are bent rearwardly relatively to the direction of rotary travel of the casing under the influence of the liquid discharged from the eduction pipes 29. These plates 58 are so arranged as to form compartments or bucket spaces 60 which catch the water as it is discharged from the eduction pipes. As the water is discharged into these bucket spaces or against these blades or wings, a rotary movement is imparted to the entire casing 48, the said casing revolving around the shaft 9 as an axle, being centered thereon by virtue of the construction heretofore explained. This rotary motion imparted to the casing by the action of the water discharged from the eduction pipes by the centrifugal force of the rotating apparatus develops sufficient centrifugal force through the rotation of the casing 48, to continue the upward movement of the water to the top of the said casing where it is discharged into a trough 61.

By virtue of this construction and arrangement, it is only necessary to employ sufficient initial power in the operation of the apparatus to discharge the water from the upper extremities of the eduction pipes 29. The force of the discharge from these pipes then becomes sufficient to rotate the casing 48 and develops sufficient secondary centrifugal force to cause the water to rise to the top of the casing 48 and discharge into the trough 61, without additional power. In this way the water may be elevated a number of feet without any additional expense, since the force of the water escaping from the eduction pipes resulting from the application of the initial power, has the necessary power to continue the upward movement of the water in the manner heretofore explained.

From the foregoing description the use and operation of my improved pump will be readily understood.

Assuming that the suction conduit composed of the depending pipe members 39 and 46, has its lower extremity immersed in the source of water supply, power is applied to the shaft 9 by connecting the pulley 13 with a belt or other instrumentality leading from any suitable source of power. As the shaft 9 is rotated, sufficient centrifugal force is developed to cause the water from the source to rise through the suction conduit and enter the valve casing or T-head 25 and follow the laterally disposed conduits 29 and escape at the upper extremities thereof. The apparatus is driven with sufficient speed say six hundred revolutions per minute to eject the water from the pipes 39 with sufficient force to impart a speed of two hundred revolutions per minute approximately to the casing 48, by the action of the water upon the bucket blades 58, which speed of the casing will be sufficient to cause the water, by the centrifugal action of the casing, to continue its upward movement and discharge at the top of the said casing into the trough 61 as heretofore explained.

In order to facilitate the action of the water upon the blades 58, a funnel-shaped casing 62 is attached to the inner edges of the upper part of the blades, whereby the water in its upward course between the bucket blades, is guided and assisted in its upward movement and prevented from falling back since the space within which it is confined is contracted thus increasing its speed and centrifugal action. By virtue of this arrangement the passage of the water through the upper portions of the bucket spaces 60 is limited to said spaces and not allowed to escape inwardly. By means of this construction the water is held within the maximum circuit of centrifugal action thus subjecting it to the greatest possible power which can be developed by a given speed or rotary action of the casing. The water enters the casing 48 at this point in a large volume and the centrifugal action is more liable to be destroyed here than at any other point and for this reason the special arrangement of the funnel-shaped casing as above described, is very important. The funnel-shaped casing 62 also prevents any re-bound which might take place when the water is thrown, by the blades 58, against the inner wall of the casing 48. This is a very important feature as it holds the water between the casing 48 and the member 62 and prevents the water from being thrown upon the blades and destroying the initial centrifugal action which takes place at this point.

Preparatory to starting the pump, a priming pump 63 is applied to the upper extremity of the hollow valve stem 14 as shown at 64 (see Fig. 9). This pump is composed of a casing 65, a valve 66, a valve stem 67 and a hand piece 68. By reciprocating the piston 66 in this priming pump, the air is pumped out of the hollow valve stem 14 its entire length thus producing sufficient suction within the valve casing 15 to raise

the ball valve 17. As the air enters this casing, it is driven out through the orifice 18 opening the clapper valve 19. In this way the air is pumped out of the suction conduit composed of the pipe members 39 and 46, with the result that the water flows upwardly taking the place of the air and shortly fills the eduction pipes 29. The centrifugal pump is then primed and the priming pump mechanism may be detached from the hollow stem 14, and a special casing 99 screwed thereon making a tight joint around the top of the hollow valve stem and leaving an opportunity for the said valve stem to have the necessary vertical movement incident to the opening and closing of the main valve 20 during the operation of the pump. The lower extremity of the guide pipe 13 is connected with a centering block 13A which is fitted into the hollow shaft 9 whereby the guide pipe maintains a uniform position and forms an accurate guide for the valve stem 14.

Having thus described my invention, what I claim is:

1. A centrifugal pump comprising a vertically disposed, hollow rotary shaft, a valve casing connected with the lower extremity of the shaft and having pivoted lateral eduction pipes leading outwardly and upwardly therefrom, a depending suction pipe communicating with the said valve casing at its upper extremity by a valve-controlled opening, and with a source of liquid supply at its lower extremity, a rotary casing constructed to be acted on by the liquid as it escapes from the eduction pipes, whereby sufficient rotary speed is imparted to continue the upward movement of the liquid by centrifugal force without the employment of additional initial power.

2. In a centrifugal pump, the combination of a central shaft suspended to rotate, a pivoted lateral eduction pipe connected with the shaft, a valve casing also connected with the shaft and communicating with the lower extremity of the eduction pipe, a suction conduit communicating with the valve casing by a valve-controlled opening, and rotary means connected with the shaft to revolve independently thereof, the said means being constructed to be rotated by the force of the liquid escaping from the eduction pipe, the said rotary means including a casing constructed to carry the water upwardly a predetermined distance under the influence of the centrifugal force developed by its rotary action.

3. In a centrifugal pump, the combination of a vertically disposed hollow shaft mounted to rotate, pivoted laterally disposed eduction pipes connected with the hollow shaft to rotate therewith, a depending suction pipe extending below the eduction pipes, the suction pipe communicating with the eduction pipes, a valve for controlling the communication between the suction pipe and the eduction pipes, a hollow valve stem passed through the hollow rotary shaft and connected with the valve, the said valve stem having a valve-controlled orifice at its lower extremity communicating with the suction pipe and having a second valve-controlled orifice communicating with the eduction pipes, the valves of the two orifices being oppositely disposed, and a priming pump connected with the upper extremity of the hollow valve stem for the purpose set forth.

4. In a centrifugal pump, the combination of a vertically disposed shaft mounted to rotate, pivoted laterally disposed eduction pipes connected to rotate with the shaft, a suction conduit communicating with the eduction pipes by a valve-controlled opening, the upper portions of the eduction pipes being constructed to have a limited swinging movement in radial planes whereby their upper extremities are allowed the maximum movement, and a tension connection between the eduction pipes and the shaft whereby the upper extremities of the said pipes are drawn inwardly when the rotary action has diminished to a predetermined speed.

5. In a centrifugal pump, the combination of a vertically disposed shaft mounted to rotate, laterally disposed eduction pipes connected to rotate with the shaft, the lower portions of the eduction pipes being pivoted with flexible elbows permitting the pipes to have a lateral swing, a connection between the vertical shaft and the eduction pipes whereby the latter are supported in operative relation with the shaft and at the same time allow a lateral swinging movement, and tension springs connecting the eduction pipes with the shaft, the tension of the said springs being regulated to draw the eduction pipes inwardly when the speed of rotation has diminished to a predetermined limit.

6. A centrifugal pump comprising a vertically disposed shaft mounted to rotate, a suction pipe connected to rotate with the shaft, pivoted laterally disposed eduction pipes connected to rotate with the shaft and communicating with the suction pipe by a valve-controlled opening, a casing surrounding the eduction pipes, extending above the same and connected with the rotary shaft to rotate around the same but independently thereof, its upper portion having the shape of the frustum of a cone, the said casing being provided with a zone of blades surrounding its interior in the zone of the discharge from the upper extremities of the eduction pipes, the blades being arranged to impart rotary movement to the casing by virtue of the force of the discharge from the eduction pipes for the purpose set forth.

7. In a centrifugal pump, the combination of a vertically disposed hollow shaft mount-

ed to rotate, laterally disposed eduction pipes connected to rotate with the shaft, a depending suction conduit communicating with the eduction pipes by a suitable opening, a valve controlling said opening, a hollow valve stem passing through the hollow shaft, its lower extremity being connected with the said valve while its upper extremity is exposed at the top of the shaft, a hollow guide pipe extending downwardly from the top of the rotary shaft, its lower extremity being centered within the shaft, the said pipe forming a centering guide for the valve stem, and a priming pump adapted to be connected with the upper extremity of the valve stem for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

STEPHEN A. HUNTLEY.

Witnesses:

A. J. O'BRIEN,

DENA NELSON.