No. 750,846. PATENTED FEB. 2, 1904.

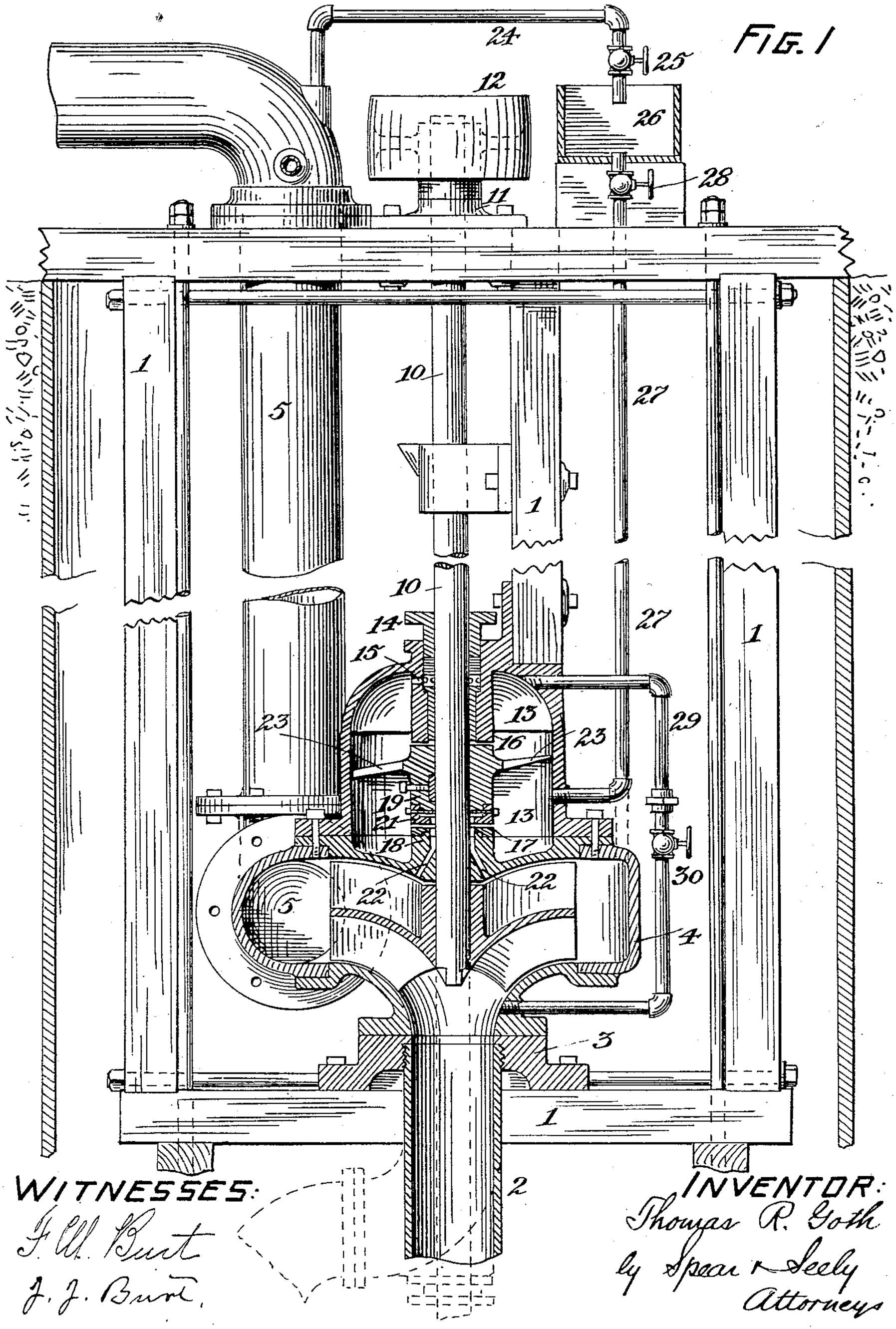
T. R. GOTH.

CENTRIFUGAL PUMP.

APPLICATION FILED FEB. 17, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

FIG. 1



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NO MODEL. 2 SHEETS—SHEET 2.

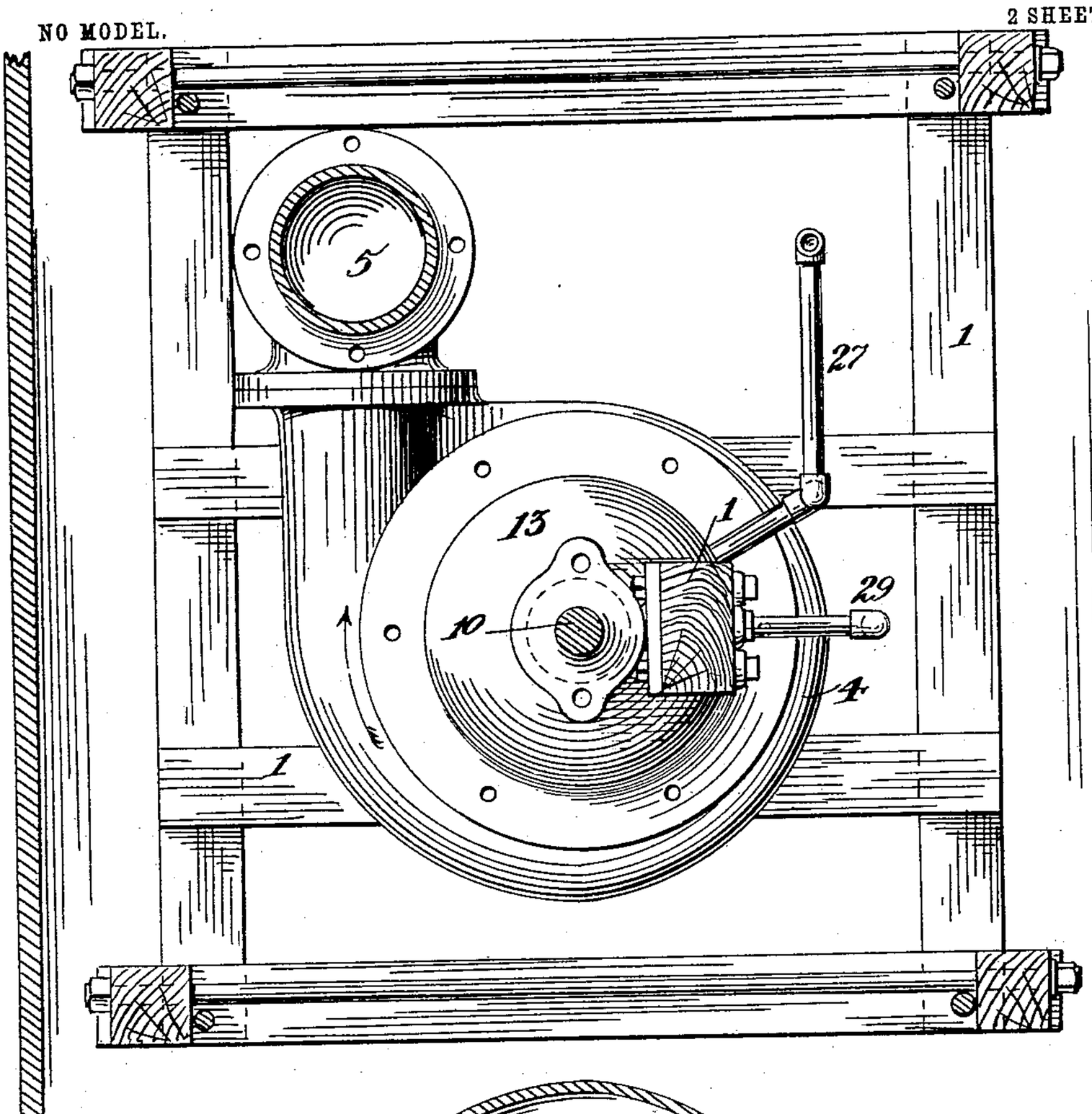


FIG. 2

FIG. 4.

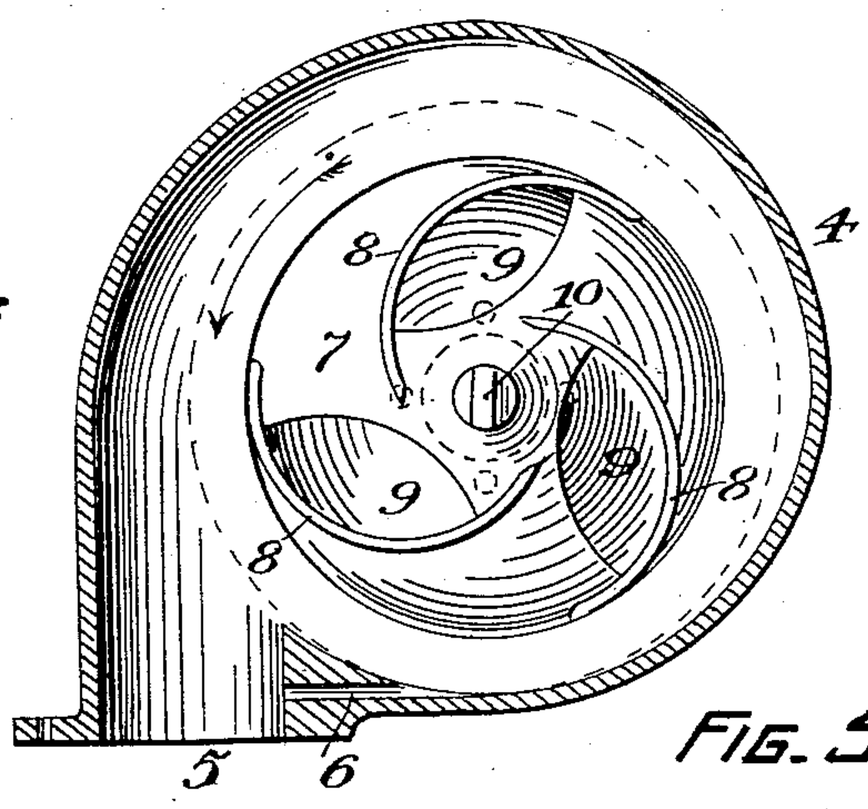


FIG. 3

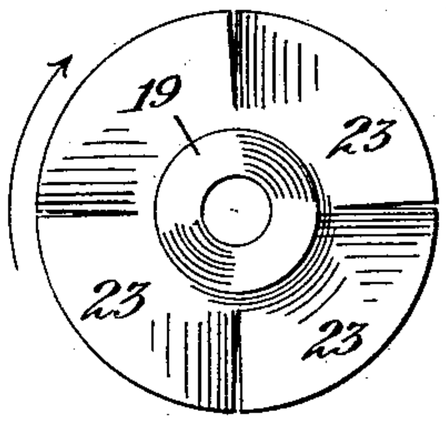


FIG. 5

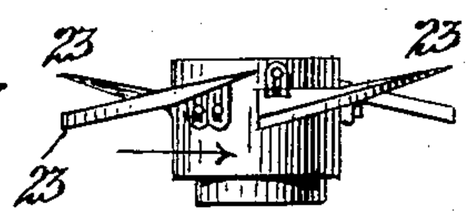
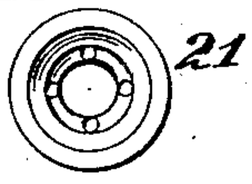


FIG. 6



WITNESSES:

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No. 750,846. Patented February 2, 1904.

UNITED STATES PATENT OFFICE.

THOMAS R. GOTH, OF SAN FRANCISCO, CALIFORNIA.

CENTRIFUGAL PUMP.

SPECIFICATION forming part of Letters Patent No. 750,846, dated February 2, 1904.

Application filed February 17, 1903. Serial No. 143,841. (No model.)

To all whom it may concern:

Be it known that I, THOMAS R. GOTH, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Centrifugal Pumps, of which the following is a specification.

My invention relates to centrifugal pumps; and its object is to afford a perfect means for maintaining the pump-shaft and pump in equilibrium and preventing injurious end thrust. Such end thrust in a vertical pump, to which my pump is more particularly applied, is caused by the weight of the pump-runner, its shaft, and any attached parts. Such weight produces excessive friction and wear of the bearings and interferes with the easy and effective running of the pump.

I have devised simple, effective, and controllable means for maintaining the equilibrium of the pump-runner and have hereinafter described and have shown in the accompanying drawings a practical embodiment of my invention.

Figure 1 is a vertical section. Fig. 2 is a top plan view. Fig. 3 is a bottom plan of the pump-runner with its casing in horizontal section. Fig. 4 is a plan view of the disk, having inclined blades, which forms a part of the balancing means. Fig. 5 is an elevation of a modification of the same supposed to be rotating in the opposite direction from Fig. 4. Fig. 6 is a plan view of one of the rings which form the lower bearing for the pump-spindle, showing also the relief-ports leading to the pump-casing.

In Fig. 1 is illustrated the upper end of a well near the surface of the ground, and 1 represents a supporting-frame of timbers and tie-rods, which sustains the pump and pipes. The suction-pipe 2 extends into the well from the base 3, upon which is supported the pump-casing 4. From the casing leads the discharge-pipe 5, having the air vent or communication 6 with the casing, Fig. 3. The general constructions of the pump-casing and pump or runner form no part of the present invention and may be of any preferred construction; but I prefer to make them according to my application for patent, Serial No. 127,384, filed October 15, 1902. The runner has a central disk 7, curved vanes 8, extending on both sides of said disk, and openings 9 adjacent to the concavity of the vanes, Fig. 3, to allow water to pass through the central disk and be acted upon by the vanes on both sides of it. The hub of the runner is fixed on the lower end of the shaft 10, whose upper end runs in bearings 11 and carries a pulley 12. This shaft may be of any suitable length. I prefer, however, to provide my pump with only a short shaft and to couple it to a longer extension, which carries the power-pulley at about the point where the shaft is broken off in Fig. 1. This is for convenience in transportation, as will be readily understood.

The lower bearing for the spindle is a double thrust-bearing between which the equilibrium of the spindle and pump-runner are automatically maintained. The construction is shown in Fig. 1. An extension 13 of the pump-casing is bolted to the latter and forms a chamber through which the main shaft passes. A gland 14 closes its upper end, and in said gland and its seat are perforations 15 to allow water to enter from chamber 13 and lubricate the shaft. The lower end of said seat is the upper thrust-bearing 16. The lower thrust-bearing is a ring 17, which may be and preferably is seated loosely on an upward annular boss 18 of the pump-casing, the said boss and ring being of such angular or other cross-section as to hold the ring in place. Of course the boss 18 might in itself form the bearing; but I prefer to use a separate ring, because it can be easily hardened and conveniently removed and replaced.

Secured to the shaft within the chamber 13 is a hub 19, carrying at its lower end, and preferably secured thereto, a hardened ring 21, similar to the ring 17 and shown in detail top plan in Fig. 6. The length of the hub is less than the distance between the two bearings, giving a slight but sufficient clearance for relieving the lower bearing from the weight of the pump and shaft. There is a clear space between the bearing-rings and the shaft, and with this space communicate ports 22, which lead into the pump-casing. The hub 19 is provided with inclined blades 23, which may

be formed with or attached to it, Fig. 4, or adjustably secured to it. One means of adjustment is illustrated in the slots and pins shown in Fig. 5, by which the angle or pitch of the blades can be changed. The angle or pitch of the blades in Fig. 5 assumes a direction of rotation for the runner opposite to that of Fig. 4, as shown by arrows in the several figures. The pitch is such in all cases that with a given direction of rotation the blades press downwardly and tend to lift the shaft and runner. The blades 23 do not form a piston, because water can pass freely between them, and, further, they are not passive—that is, acted upon by water-pressure; but as they rotate with the shaft and are inclined to any horizontal plane of the same they exert a positive downward pressure against water in chamber 13, with a consequent lifting effect upon the runner and shaft.

The chamber 13 is supplied with water from the main discharge-pipe. I prefer to lead a pipe 24, having a cock 25, to a reservoir 26, above ground, so as to divert a small part of the main discharge to said reservoir. Then from said reservoir a pipe 27, having cock 28, enters the chamber 13. From chamber 13 a pipe 29, with cock 30, leads to the main suction-pipe.

The pump can be conveniently primed at starting by filling the reservoir 26 and opening cock 28. Water fills chamber 13, escapes through pipe 29, and goes to the main suction. When the pump first starts, its whole weight rests upon the lower thrust-bearing; but as soon as it is in operation the inclined blades act like propeller-blades against the water beneath them and tend to raise the shaft from the lower bearing. If the upward thrust produced by this operation raises the hub too far from the lower thrust-bearing, communication is established through ports 22 with the pump-casing, permitting water to escape from chamber 13 downwardly and reducing the propeller action of the blades until the equilibrium has been restored. The action of the pump can be observed at the upper shaft-bearing, where it can be determined by an inspection of the action of the shaft at that point where the preponderance of pressure is and what kind of regulation is required to secure equilibrium. If the action of the propeller-wheels produces an upward thrust in excess of the weight of the pump, the supply of water from reservoir 26 is reduced by cock 28 until the equilibrium has been restored. Conversely, the supply of water can be increased up to the maximum capacity of the reservoir and pipe 27 to supply it until it enables the propeller to effectively counteract the gravity. Further, the lifting effect can be changed by substituting blades of different pitch for those shown in Figs. 1 and 4 or by adjusting the blades shown in Fig. 5.

I have shown in Fig. 1 in dotted lines a curved extension of the main suction-pipe downwardly into the well. This is only for the purpose of enabling two pumps to be set tandem in a deep well. The suction-pipe represented by the dotted lines is then substituted for the main suction-pipe of Fig. 1 and becomes the discharge-pipe for a second pump below, remaining as the inlet-pipe for the pump shown. The shaft is extended through a packing-gland to the lower pump.

It should be noted that the manner of connecting the pipes 27 and 29 to the chamber 13 is not arbitrary and may be changed to suit special circumstances. The purpose is to have an ample supply of water in chamber 13, and that effect can be produced by causing the pipe 27 to enter said chamber near its top instead of near the bottom, as shown. The pipe 29 might also be connected to chamber 13 near the bottom of the latter, and as a matter of fact the pipe 29 might be entirely omitted and a communication made by the continuation of pipe 27 to the discharge, as indicated by dotted lines in Fig. 1. In the latter case there would of course be an elbow for leading pipe 27 into the chamber 13 at the desired point.

While I have shown in the drawings and have herein described a series of blades mounted upon the pump-shaft and so arranged as by their pressure to produce a lifting action upon the pump-shaft, it must be understood that if the inclination of such blades were reversed they could be caused to produce an upward pressure against the water in the chamber which incloses them, and thereby to aid the effect of gravity instead of opposing it. If the pump were so constructed and the water-inlet were so arranged that the rotary action of the runner tended to lift the pump and shaft in opposition to their gravity, then positively-acting blades like those shown, but reversed as to their inclination, could be used to aid the gravity of the pump and shaft in maintaining the proper equilibrium.

I do not limit myself to the precise details of construction and arrangement herein described, and shown in the drawings, as I desire to avail myself of such modifications and equivalents as fall properly within the spirit of my invention.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a centrifugal pump, a pump-casing, a rotary runner inclosed thereby, suction and discharge pipes connecting with said casing, a water-chamber communicating with said casing, and an inclined rotary pressure device within said water-chamber, adapted to act positively against the water therein, substantially as and for the purpose set forth.

2. In a centrifugal pump, a pump-casing, a rotary runner therein, suction and discharge pipes, a water-chamber connected to said cas-

ing, and rotating blades carried by the runner-shaft within said chamber, and adapted to act positively upon the water therein.

3. In a centrifugal pump, a pump-casing, suction and discharge pipes communicating therewith, a runner in the casing, a chamber in communication with the casing and having a water-inlet, a runner-shaft passing through said chamber, and blades on said shaft within said chamber, adapted to exert a downward pressure upon the water in said chamber, and thereby tending to raise said runner and shaft.

4. In a centrifugal pump, a pump-casing having suction and discharge pipes connected thereto, an extension of the casing forming a water-chamber and having a water-inlet, a runner-shaft extending through said extension, and adjustable blades on said shaft and rotating therewith, adapted to press downwardly upon water in said extension, and thereby tending to raise said runner and its shaft.

5. In a centrifugal pump, a pump-casing, having suction and discharge pipes for water, an extension of said casing in communication therewith, means for admitting water from the main discharge-pipe to the interior of said extension, a runner-shaft passing through said extension, a disk carrying inclined blades and mounted upon said shaft within said extension, and means for regulating the supply of water to said extension.

6. In a centrifugal pump, means for counteracting the gravity of the pump and its shaft, the same comprising a chamber connected to the pump-casing, means for admitting water to the said chamber, a rotary disk having inclined blades for acting downwardly upon the water in said chamber, and means for regulating the supply of water to said chamber.

7. In a centrifugal pump, the pump-casing and the rotary pump-runner therein, an extension of said casing forming a water-chamber, rotary blades carried by the runner-shaft within said chamber, ports or passages connecting said chamber to the pump-casing, suction and discharge pipes communicating with the pump-casing, an independent reservoir, a pipe from the main discharge-pipe to said reservoir, a pipe from said reservoir to said extension adapted to supply water thereto, and a regulating-valve in said last-named pipe.

8. In a vertical centrifugal pump, a pump-casing, a rotary runner therein, a suction-pipe entering said casing from below, an extension of said casing above the same, and inclined blades mounted upon the shaft in said extension, and adapted to act downwardly upon water in said extension.

In testimony whereof I have affixed my signature, in presence of two witnesses, this 2d day of February, 1903.

THOMAS R. GOTH.

Witnesses:
L. W. SEELY,
F. M. BURT.