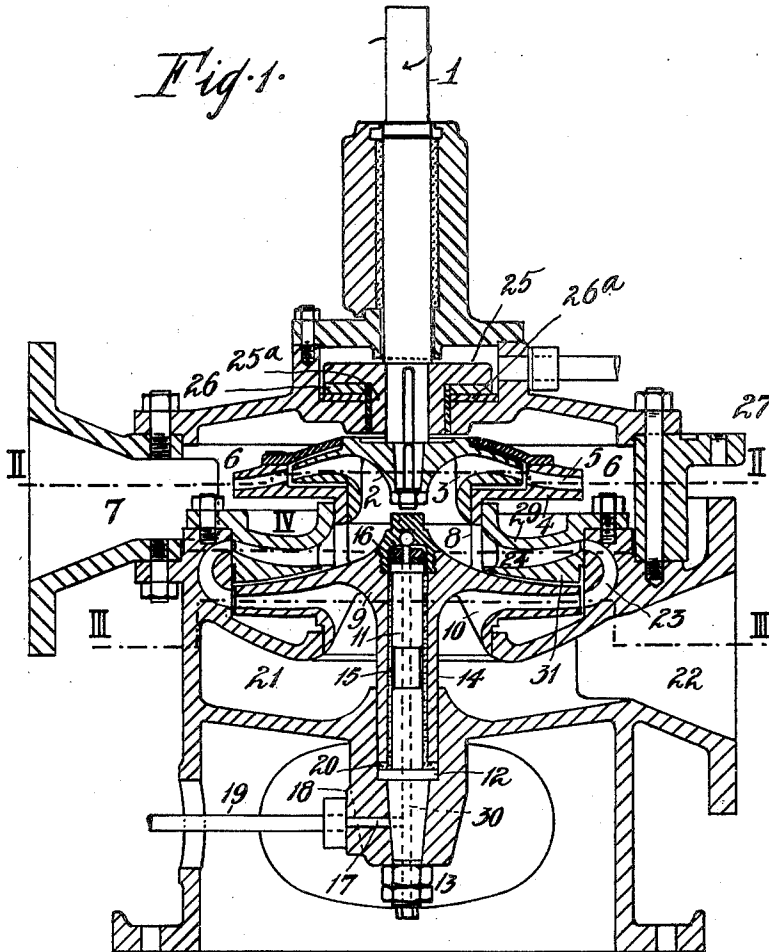


A. G. M. MICHELL.
CENTRIFUGAL PUMP.
APPLICATION FILED SEPT. 18, 1912.

1,089,248.

Patented Mar. 3, 1914.
2 SHEETS—SHEET 1.



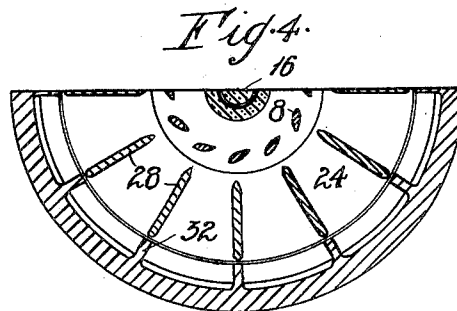
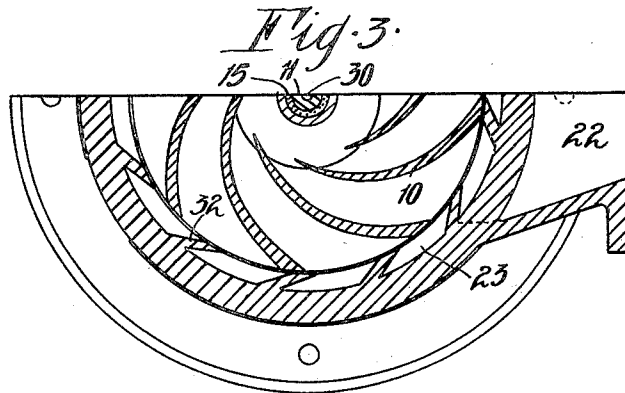
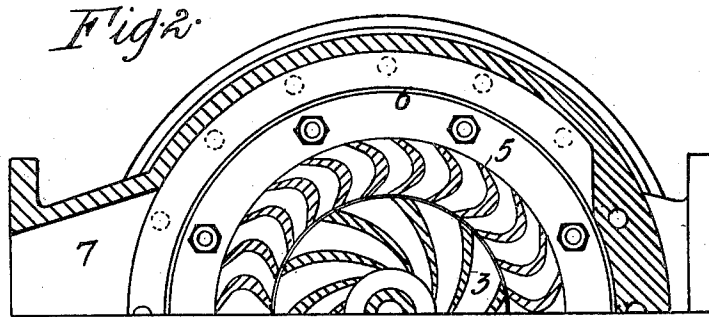
Witnesses:
M. E. McNamee,
C. J. Hester

Inventor
Anthony G. M. Michell
by *James L. Harris* / *Atty.*

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Witnesses:

M. E. Mc Nade,

C. D. Heller

Inventor
Anthony G. M. Michell
by James L. Morris,
att'y

UNITED STATES PATENT OFFICE.

ANTHONY GEORGE MALDON MICHELL, OF MELBOURNE, VICTORIA, AUSTRALIA.

CENTRIFUGAL PUMP.

1,089,248.

Specification of Letters Patent.

Patented Mar. 3, 1914.

Application filed September 18, 1912. Serial No. 721,096.

To all whom it may concern:

Be it known that I, ANTHONY GEORGE MALDON MICHELL, a subject of the King of Great Britain, residing at No. 450 Collins street, Melbourne, in the State of Victoria, Commonwealth of Australia, have invented certain new and useful Improvements in Centrifugal Pumps, of which the following is a specification.

The present invention relates to an improved centrifugal pump of that type in which the kinetic energy of the fluid discharged from a primary pump-wheel is utilized by means of a turbine wheel to propel an auxiliary pump-wheel, which acts on the fluid in series with the primary wheel.

The invention consists in a special arrangement and construction of these elements by which they are combined in a single external casing, and thus a simplification of the apparatus is attained, together with certain other advantages which will be referred to later.

Briefly stated the invention comprises a compound centrifugal pump having contained in a common external casing a primary pump wheel actuated by motive-power from an external source, a turbine-wheel actuated by the water discharged from the primary wheel and an auxiliary pump-wheel actuated by the turbine-wheel by means of connecting bars which couple the turbine-wheel and auxiliary wheel together and which form ports through which the water enters the primary wheel after passing through the secondary wheel.

One of the features of the improvements is the arrangement in a compound centrifugal pump of a turbine wheel and an auxiliary pump wheel rigidly coupled together and rotating on a common fixed spindle.

For a better understanding of the invention the following description is given by way of illustrating the method of carrying same into effect, although I do not restrict myself to the specific details hereinafter described.

The invention is illustrated by the accompanying drawings, which comprise—

Figure 1 a central vertical section through the pump, Fig. 2 a half transverse section on line II—II Fig. 1, Fig. 3 a half transverse section on line III—III Fig. 1, Fig. 4 a half transverse section on line IV Fig. 1.

The invention may be applied to pumps

arranged with either vertical or horizontal shafts. The following description and drawings relate to a pump of the former class.

Fig. 1 shows the vertical primary spindle 1 carrying the primary wheel 2 at its lower end. This primary wheel is furnished with blades 3 and is otherwise substantially similar to the single wheel of ordinary centrifugal pumps. Surrounding the primary wheel is the turbine wheel 4 with blades 5 which receive the water discharged from the primary wheel and deliver it into the chamber 6 and thus to the outlet branch 7 of the pump. Rigidly connected to the turbine wheel 4 by the bars 8 is the auxiliary wheel 9 which like the primary wheel is furnished with blades 10 and is otherwise constructed as a centrifugal pump wheel. The turbine wheel 4 and auxiliary pump wheel 9 may be cast in one piece as shown in Fig. 1 or may be of separate parts rigidly coupled together. In either case these combined wheels are mounted upon a fixed spindle 11 secured in a vertical position to the lower part of the pump casing as by the collar 12 and nuts 13 as shown in Fig. 1 and the auxiliary wheel 9 is furnished for this purpose with a relatively long boss 14 having a liner or sleeve 15 fitting the spindle 11 and a thrust bearing 16 may also be fitted upon the upper end of the spindle 11. In order to lubricate these bearings the spindle 11 has a hole 30 drilled throughout its length adapted to receive oil from a port 17 in the base 18 of the casing to which oil is conveyed by the pipe 19. The oil thus introduced is delivered first to the thrust bearing 16 and is then discharged between the sleeve 15 and the spindle 11 and escapes between the flange 20 of the sleeve 15 and collar 12 on the spindle 11 into the chamber 21 of the pump. This chamber being directly in communication with the suction branch 22 the water in it is usually at lower than atmospheric pressure so that oil will be drawn in through the pipe 19 from a suitable reservoir placed at a convenient level.

In the operation of the pump, as in previous pumps of this type, the primary spindle 1 is driven by external motive power while the turbine wheel 4 and auxiliary wheel 9, are rotated in the same direction as the primary wheel but at lower velocity by the water passing through the pump. The water passes through the two pump

wheels in series. Entering from the suction branch 22 to the chamber 21 it is delivered through the auxiliary pump wheel 9 into the annular space 23 which is provided with blades 32 (Figs. 3 and 4) by which the tangential component of its motion is destroyed so that it is delivered into the chamber 24 in a purely radial inward direction. This chamber is likewise furnished with blades 28, attached to an upper wall 29 and a lower wall 31. The water then passes between the bars 8, connecting the auxiliary pump wheel with the turbine wheel, into the inlet of the primary pump wheel 3, whence it is delivered outwardly through the primary pump wheel 2 and the turbine wheel 4 to the outlet branch 7 of the pump as already described.

One of the advantages of the present invention over previous pumps of this type arises from the fact that the water may be allowed to retain the velocity with which it is discharged from the auxiliary wheel practically unchanged in amount though altered in direction until its entry into the primary wheel. The loss of energy due to a reduction of velocity which takes place in the outer chamber of the auxiliary pump of the known type of pump referred to, as in ordinary centrifugal pumps, is thus avoided. The introduction of the water first into the comparatively large and slowly revolving auxiliary pump in many cases enables a centrifugal pump of this type to be used where a pump having a single wheel or several wheels revolving at a common high velocity would not operate satisfactorily on account of the liability of cavitation occurring in the inlets of such high speed wheels, particularly with considerable suction lifts. Under such conditions also the arrangement herein described possesses the advantage that no stuffing box involving risk of admitting air is required on the suction chamber of the pump. In cases however in which for any reason, such as the existence of a pressure in the water entering the pump, the lubrication of the internal fixed spindle shown may present difficulties the boss of the auxiliary pump may be further extended and brought out through a stuffing-box in the case of the pump, the spindle being supported at its outer end beyond the stuffing-box as by a rigid bracket. Or alternatively if desired the combined auxiliary wheel and turbine wheel herein described may be rigidly mounted on a rotating shaft brought out through a stuffing-box and carried in external bearings in the usual way.

The thrust of the primary wheel, which in the case of the construction shown is downward, may be provided for by means of a combined thrust bearing and gland consisting of a collar 25 fixed on the spindle 1 and

bearing steps 26 carried by the casing, the area of the collar 25 being such that the fluid pressure of the water in the pressure chamber is sufficient to counteract the thrust of the pump according to a well known mode of construction.

The steps 26 may consist of an annular series of flat segments each secured to the casing of the pump or may form a continuous ring similarly secured and in either case will have a practicably water-tight connection with the surface on which they rest for which purpose a packing ring 26^a may be employed. A slight clearance is allowed between the casing of the pump and the neck 25^a of the collar 25. The water under pressure in the chamber 6 has thus access to the bearing surface between the collar 25 and the steps 26 and, as already mentioned, the area of this surface is such that the collar and pump spindle will rise under this pressure against the thrust of the pump. As soon, however, as the collar 25 has risen slightly the water being throttled between the neck 25^a and casing will escape at reduced pressure between the collar 25 and the steps 26 and thus the pump spindle will cease to rise. In such an equilibrium position the collar will rotate freely on the film of water escaping below it, and thus serves as a thrust collar, while at the same time the flow of water is limited and no separate gland is required. Alternatively an ordinary stuffing box may be employed for the primary shaft, with an independent thrust bearing of any usual form. The journal bearing for the primary shaft may be mounted on the cover of the stuffing box, or combined stuffing box and thrust bearing, as shown in Fig. 1. Lugs 27 may be provided on the upper part of the pump casing to serve for the support of an electric or other motor for driving the primary pump shaft, the spindle of such motor being coupled to the primary spindle 1.

With suitable modifications of detail the apparatus herein described may be employed for pumping or compressing air or other gases, the mode of action being precisely the same as described above.

In the application of the invention to pumps with horizontal shafts, the mode of operation and arrangement of parts is precisely as above described, such differences of constructive detail being arranged as the horizontal position requires.

I claim:—

1. In a centrifugal pump and in combination with a primary pump-wheel, a rotating member comprising a turbine element receiving the fluid discharged by said primary wheel, an auxiliary pump element acting on the fluid in series with said primary pump-wheel, and a coupling element consisting of bars through which the fluid passes, cou-

pling said auxiliary pump element to said turbine element.

2. In a centrifugal pump and in combination with a primary pump-wheel, a turbine
5 element receiving the fluid from said primary pump wheel, an auxiliary centrifugal pump element coupled to said turbine element and delivering the fluid to said primary pump wheel, fixed guide-vanes con-
10 veying the fluid from said auxiliary pump

to said primary pump, and a common casing wherein said parts are arranged.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

ANTHONY GEORGE MALDON MICHELL.

Witnesses:

WALTER C. HART,

WILLIAM G. HOLDEN.