No. 877,485. PATENTED JAN. 28, 1908.

E. W. BROOKS.

COMPOUND PISTON CENTRIFUGAL PUMP.

APPLICATION FILED JULY 2, 1906.

Fig. 1.

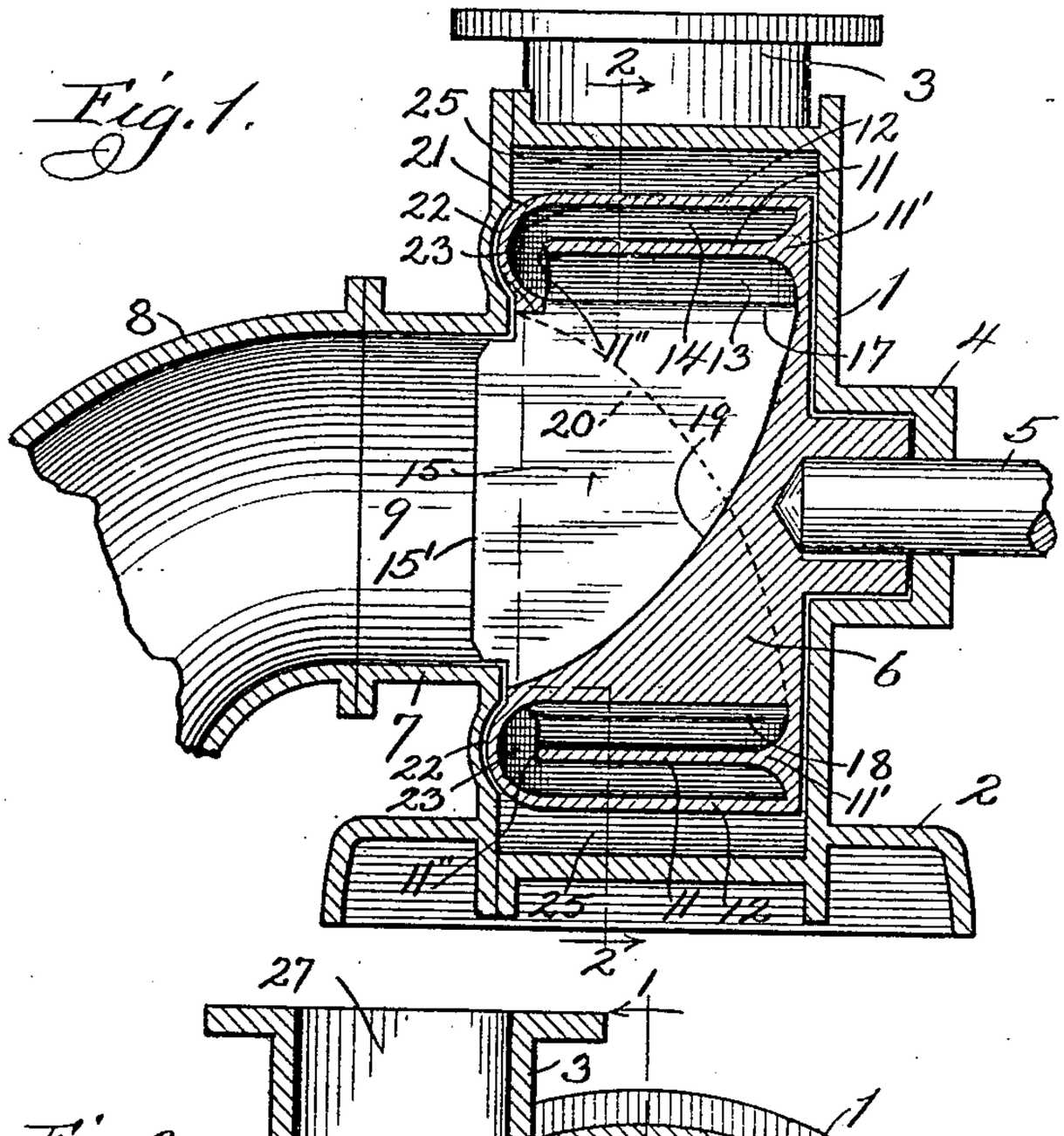

Fig. 2.

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COMPOUND-PISTON CENTRIFUGAL PUMP.

No. 877,485. Specification of Letters Patent. Patented Jan. 28, 1908.

Application filed July 2, 1906. Serial No. 324,322.

To all whom it may concern:

Be it known that I, EVERETT W. BROOKS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Compound-Piston Centrifugal Pumps, and refers more specifically to a pump in which the liquid is passed through a succession of chambers formed in a single impeller or piston and wherein it is successively subjected to the impelling action.

Among the salient objects of the present invention are to provide a pump capable of delivering liquid at a high pressure or against a high head; to provide a construction wherein centrifugal force is imparted to the liquid by passing it from chamber to chamber in a single piston, each successive chamber being radially outward from the preceding chamber and the liquid being retarded in its outflow by passing through successive chambers sufficiently to enable it to acquire the desired flow pressure; to provide a construction which is more compact than the ordinary compound pump while capable of producing the same general results; to provide a construction which is high in efficiency, and in general to provide a simple and improved pump of the character referred to.

The invention consists in the matters hereinafter described and more particularly pointed out in the appended claims.

The invention will be readily understood from the following description, reference being had to the accompanying drawings, in which

Figure 1 is a vertical axial sectional view of a preferred embodiment of the invention; Fig. 2 is a sectional view on the indirect line 2—2 of Fig. 1 and looking in the direction of the arrows.

In constructing centrifugal pumps capable of pumping against high heads or high pressure it has been the usual practice to construct what amounts to a plurality of independent pumps arranged side by side concentric with a main shaft extending through the series; the delivery passage of the first pump of the series delivering from the peripheral portion of the pump casing to the axial inlet of the succeeding pump, and so on successively through the series.

It is the object of the present invention to secure the same general result, viz: the capability of delivering water at a high pressure or against a high head by the use of a single impeller arranged in a single chamber. The manner in which this is accomplished will be apparent from the following description of a construction embodying the invention.

Referring to the drawing, 1 designates as a whole a suitable stationary casing, which is desirably as usual provided with a suitable base 2 and which is internally of approximately cylindric form. At its periphery (at its upper side in the present instance) the casing is provided with a tubular extension 3 constituting the delivery pipe. At one side the casing is provided with an axial hollow hub-like extension 4, through which is arranged to extend, and within which is journaled, a main shaft 5, carrying upon its inner end the piston or impeller, designated as a whole 6; the latter being keyed upon the shaft. At the side opposite the main shaft, and in axial alinement with the latter, the casing is provided with a tubular extension 7 adapted for connection with a suitable supply pipe 8 and constituting the axial inlet of the pump.

The impeller 6 consists of a hollow cylindric shell, the main body of which is of an axial length slightly less than the internal axial length of the pump chamber, provided with an inlet opening 9 which registers with the opening of the inlet extension of the casing, and internally divided into a plurality of chambers, as will now be specifically described. The interior of the impeller is divided by two concentrically disposed, spaced apart annular partitions 10 and 11, respectively, which, together with the cylindric peripheral wall 12 of the impeller, subdivide the latter into two outer annular spaces 13 and 14, and an axial space. The axial space is subdivided by means of a diametrically disposed partition 15 extending parallel with the axis of rotation and forming in effect a pair of radial vanes into two central chambers 15′. The outermost annular space 14 is likewise subdivided by means of two radial partitions 16 arranged in diametrically opposite relation into two chambers 14′. Coincident with the points where the front faces of the impeller blades 15 (considered with reference to the direction of rotation) merge into the cylindric partition member 10, are formed narrow axially elongated ports 17 which discharge obliquely rearwardly or approximately tangentially, and these ports are over-

nung by deflecting lips 18 which extend approximately tangential to the exterior of the partition wall 10, of which they form in effect extensions.

The end walls 19 and 20 of the two central chambers 15′ of the impeller which are opposed to the inlet end thereof, are shaped to conform approximately to the shape which the two streams of liquid passing through these chambers will assume, these end walls being each curved and inclined from the corner or angle where the rear face of the impelling blade or partition 15 meets the cylindric wall 10 at the inlet end of the impeller, to the diagonally opposite angle at the end of the port opening remote from the inlet side of the impeller, as shown clearly in Fig. 1.

The end of the impeller provided with the axial inlet, is closed from the innermost annular partition 10 to the outer periphery of the piston by means of an internally concave wall 21 which is conveniently made externally convex in cross section, as indicated at 22, and arranged to run as close to the corresponding end wall of the casing as may be without undue friction. The annular partition 11 merges into the end wall of the piston remote from its inlet, as indicated at 11′, but at its opposite edge 11″ terminates a sufficient distance from the end wall 21 to provide a somewhat restricted annular passage 23 affording communication between the chamber 13 and the two concentric chambers 14′.

From the chambers 14′ axially elongated slot-like ports 24 lead outwardly into the discharge space 25 surrounding the piston within the casing; these ports 24 being arranged in the same general manner as are the ports 17 and being similarly overhung by deflecting lips 26. The outlet passage or throat 27 of the pump communicates directly with the discharge space 25 within the casing.

The operation of the pump constructed as described is obvious but may be briefly stated as follows: The cylindric stream of liquid entering through the supply pipe is divided by the projecting extension 15″ of the vane member 15, the respective halves of the stream entering the two primary chambers 15′ of the impeller. While passing through these chambers the liquid is carried around bodily with the impeller thus acquiring centrifugal force and being impelled outwardly through the ports 17 into the annular space 13. In the chamber 13 the liquid is deflected back in a direction opposite that in which it enters and passes through the annular port 23 into the chamber 14; the return deflection and the restriction of the passage 23 both serving to retard to some extent the outflow of the liquid and retaining it within this part of the impeller until it acquires a relatively high pressure. Upon arriving in the chamber 14 it is further carried around positively with the piston by reason of the presence of the vanes 16 and finally passes out through the ports 24 into the discharge space of the pump, from whence it flows out through the delivery passage 27. The retention of the liquid within the impeller in passing through the several compartments thereof, and because of its tortuous flow through these passages, enables a relatively large amount of centrifugal force or energy to be imparted to it, and the amount of this force is, of course, proportionate to the peripheral speed of the outer chamber. By reason of the retardation of flow through the impeller it is obvious that the peripheral speed may be much higher than would be practicable with a piston wherein the liquid passed through but a single chamber.

It will be obvious that the construction of the pump may be modified without departing from the principle of the invention, and accordingly I do not limit myself to the precise construction shown except in so far as it is specifically claimed.

The present application was filed contemporaneously with another companion application, Serial No. 324,321, in which the invention is more broadly claimed.

I claim as my invention:

1. In a compound-piston centrifugal pump, the combination of a suitable main casing and a piston journaled to rotate therein, said piston having an axially or approximately axially disposed inlet and sub-divided to form one or more primary chambers with suitable radially extending impelling walls pertaining thereto; and one or more internal tortuous impelling passages; consisting of passage portions deflected alternately in opposite directions parallel or approximately parallel with the axis of the piston and suitable radially extending impelling walls pertaining thereto and one or more port passage portions connecting radially contiguous parallel portions at the return-bend-points.

2. In a compound-piston centrifugal pump, the combination of a suitable main casing and a piston journaled to rotate therein, said piston having an axially or approximately axially disposed inlet and sub-divided to form one or more primary chambers with suitable radially extending impelling walls pertaining thereto and one or more internal tortuous impelling passages, consisting of passage portions deflected alternately in opposite directions parallel or approximately parallel with the axis of the piston and suitable radially extending impelling walls pertaining thereto, and one or more port passage portions connecting radially contiguous parallel portions at the return-bend-points, said port passage or passages being of restricted capacity, as compared with the parallel passage portions which they connect.

3. In a compound-piston centrifugal pump,

the combination of a suitable main casing and a compound-piston journaled to rotate therein, said piston being internally partitioned to form a central, or approximately central, receiving chamber and diametrically impeller partition therein, a series of chamber passages arranged in succession radially outside of the central passage and the flow-direction through each of which is substantially parallel with the axis of rotation of the pump, radially extending impeller walls pertaining to one or more of said radially outer chamber passages, and port passages leading from the central chamber to the radially adjoining chamber passage or passages, other port passages affording communication between the successive chamber passages and other port passages leading from the outermost chamber passages to the discharge space within the casing.

4. In a compound piston centrifugal pump, the combination of a suitable main casing, and a piston journaled to rotate therein, said piston comprising a hollow shell-like structure provided with a plurality of internal concentrically arranged cylindric partition walls dividing the interior of the piston into a central receiving space or chamber and a plurality of annular passage-chambers, restricted ports formed through the innermost of said cylindric partition walls, restricted ports formed through the periphery of the piston, and an annular restricted passage affording communication between radially contiguous ones of said passage chambers between the edge of the partition which separates said contiguous chambers and the opposed end wall of the piston.

5. In a compound piston centrifugal pump, the combination of a suitable main casing, and a piston journaled to rotate therein, said piston comprising a hollow shell-like structure provided with a plurality of internal concentrically arranged cylindric partition walls dividing the interior of the piston into a central receiving space or chamber and a plurality of annular passage chambers, restricted ports formed through the innermost of said cylindric partition walls, restricted ports formed through the periphery of the piston, and an annular restricted passage affording communication between radially contiguous ones of said passage chambers between the edge of the partition which separates said contiguous chambers and the opposed end wall of the piston, and one or more radially extending impelling vanes within said central receiving chamber.

6. In a compound piston centrifugal pump, the combination of a suitable main casing, and a piston journaled to rotate therein, said piston consisting of a generally cylindric hollow shell provided with an axial inlet, an inner generally cylindric partition wall concentric with the axis of the piston, an intermediate cylindric partition wall concentric with said inner wall and interspaced between the latter and the outer peripheral wall of the piston, an end wall closing that end of the piston opposed to the inlet side and the inlet-side end wall extending from the innermost cylindric partition to the outer periphery of the piston, the edge of the intermediate cylindric partition toward the inlet side of the piston being spaced away from the latter to form an annular port and said inner cylindric wall and the outer peripheral wall of the piston being each provided with restricted outlet ports.

7. In a compound piston centrifugal pump, the combination of a suitable main casing, and a piston journaled to rotate therein, said piston consisting of a generally cylindric hollow shell provided with an axial inlet, an inner generally cylindric partition wall concentric with the axis of the piston, an intermediate cylindric partition wall concentric with said inner wall and interspaced between the latter and the outer peripheral wall of the piston, an end wall closing that end of the piston opposed to the inlet side and an inlet-side end wall extending from the innermost cylindric partition to the outer periphery of the piston, the edge of the intermediate cylindric partition toward the inlet side of the piston being spaced away from the latter to form an annular port and said inner cylindric wall and the outer peripheral wall of the piston being each provided with restricted outlet ports, one or more impelling vanes within the receiving chamber formed inside of the inner cylindric wall, and one or more impelling vanes sub-dividing the outermost annular space.

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