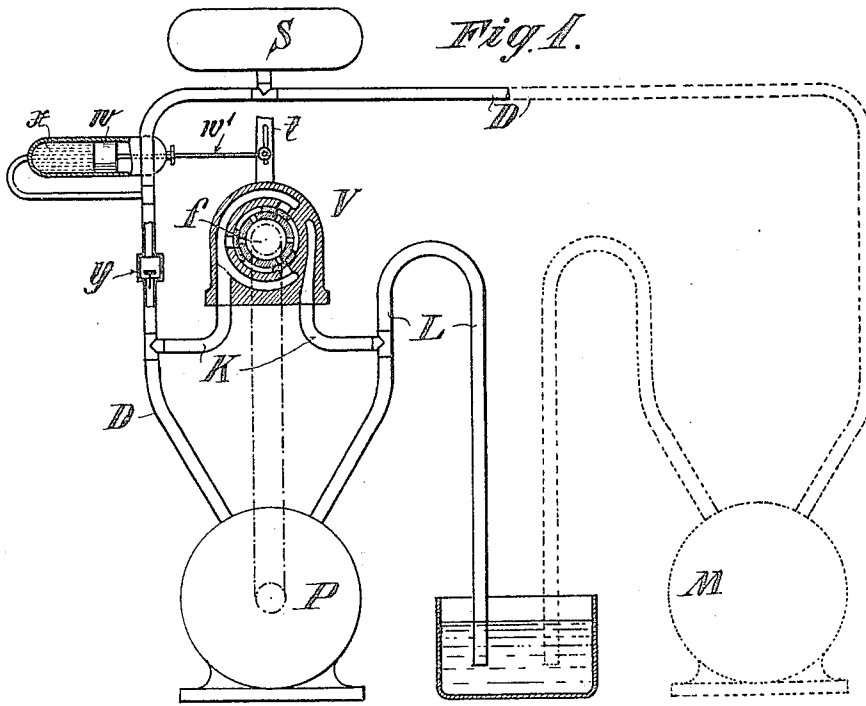
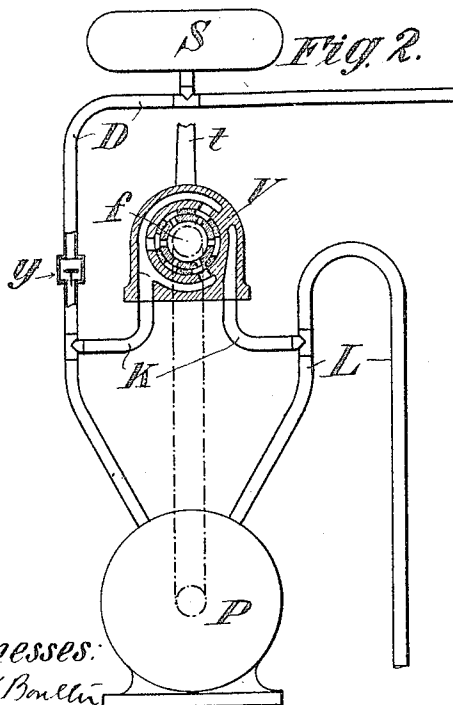


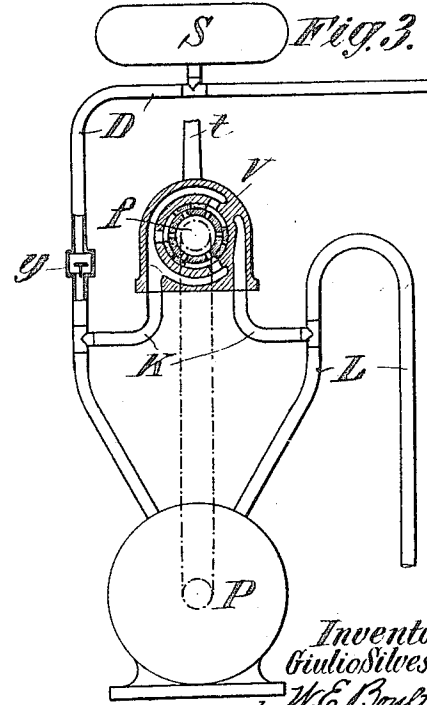
G. SILVESTRI.
 APPARATUS FOR REGULATING THE OUTPUT OF CENTRIFUGAL PUMPS.
 APPLICATION FILED JUNE 16, 1913.

1,141,015.

Patented May 25, 1915.
 2 SHEETS—SHEET 1.



Witnesses:
 H. K. Boulter
 H. C. Smith



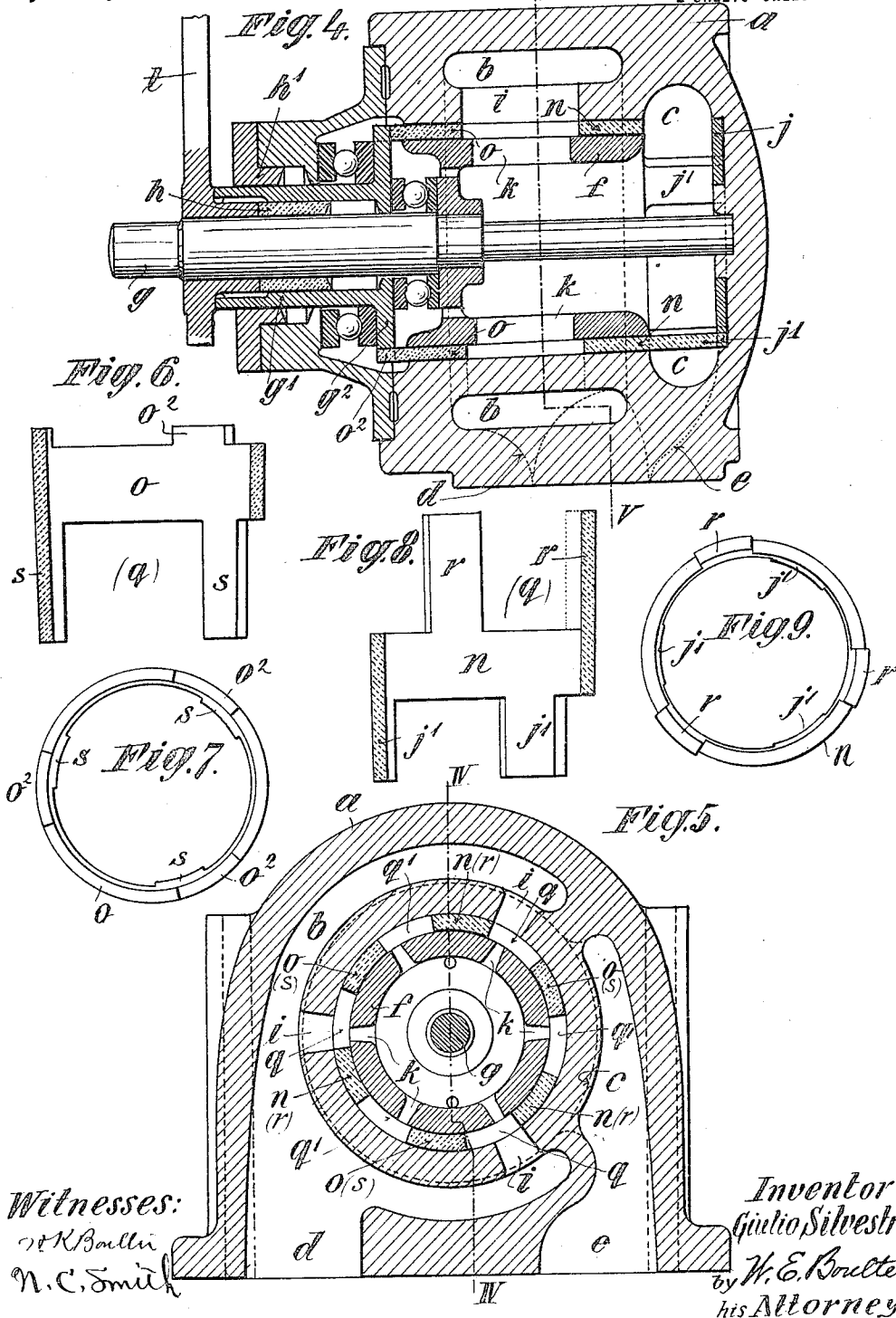
Inventor
 Giulio Silvestri
 by M. E. Boulter
 his Attorney.

G. SILVESTRI.
 APPARATUS FOR REGULATING THE OUTPUT OF CENTRIFUGAL PUMPS.
 APPLICATION FILED JUNE 16, 1913.

1,141,015.

Patented May 25, 1915.

2 SHEETS—SHEET 2.



Witnesses:
 W. K. Baillie
 N. C. Smith

Inventor
 Giulio Silvestri
 by W. E. Baillie
 his Attorney.

UNITED STATES PATENT OFFICE.

GIULIO SILVESTRI, OF VIENNA, AUSTRIA-HUNGARY.

APPARATUS FOR REGULATING THE OUTPUT OF CENTRIFUGAL PUMPS.

1,141,015.

Specification of Letters Patent.

Patented May 25, 1915.

Application filed June 16, 1913. Serial No. 774,001.

To all whom it may concern:

Be it known that I, GIULIO SILVESTRI, a citizen of Austria, and resident of Vienna, Lower Austria, Austria-Hungary, have invented certain new and useful Improvements in Apparatus for Regulating the Output of Centrifugal Pumps, of which the following is a specification.

This invention relates to an apparatus for regulating the output of centrifugal pumps in a manner which permits of varying at will at any desired instant the quantity of fluid delivered by the pump between a maximum determined by the capacity of the pump and zero, the load on the engine driving the pump being reduced in the ratio of reduction of the quantity delivered.

In carrying out the invention there are employed, in conjunction with the pump, a rotary distributing device, an automatic check (non-return valve) and an accumulator, the distributing device being driven at a speed proportionate to that of the pump.

According to the invention, the pressure pipe connected with the pump is short-circuited at intervals with the suction pipe during each revolution of the pump rotor, or piston, so that during periods of time alternating with such intervals the pump delivers part of the fluid into the delivery part of the pressure pipe *i. e.* the part of the pressure pipe lying between the accumulator and the motor, or other device to be operated by the fluid delivered by the pump, and part into an accumulator, the part collected in the accumulator being permitted to flow away into the delivery part of the pressure pipe, when the connection of the latter with the pump is interrupted. The accumulator operates simply as an air vessel the function of which is to cause the fluid delivered in pulsations to discharge as a continuous stream. The intermittent short circuiting of the pump relieves the engine driving the pump, the engine transmitting power to the pump only in proportion to the quantity of fluid to be delivered.

The apparatus comprises in addition to an accumulator of usual construction interposed in the pressure pipe and a non-return valve interposed in said pipe between the pump and the accumulator, a distributing device which is fitted in a short-circuit pipe connecting the pressure pipe with the suction pipe.

In the accompanying drawings, the appa-

ratus is illustrated diagrammatically in three different operative positions *i. e.* for maximum output of the pump in Figure 1, half output in Fig. 2 and for no output in Fig. 3. Fig. 4 is a longitudinal section of the distributor; Fig. 5 a corresponding cross section; Fig. 6 is a section and Fig. 7 a plan of the movable part of the distributor casing and Fig. 8 a section and Fig. 9 a plan of the fixed part of the distributor casing.

As shown, in the interior of the casing *a* are formed a passage *b* and a chamber *c*; the passage *b* communicates with the connecting branch *d*, and the chamber *c* with the connecting branch *e*, the said branches *d* and *e* serving according to the direction of rotation, as inlet and outlet for the fluid being pumped. The passage *b* communicates at several points by means of ports *i* with the interior of the casing *a* while the chamber *c* is directly connected with the reduced end of the cavity formed in the casing.

In the casing is mounted the rotary distributor proper indicated at *f*, which is of hollow conical form and is continuously rotated at a speed proportional to the number of revolutions of the pump controlled thereby; the said distributor being mounted on a shaft *g* which is led through the stuffing box *h* to the exterior of the casing and carries at the outer end the actuating means. In the instance shown the distributor is driven at the same speed as the pump shaft, through the intermediary of chain and sprocket gearing or a belt and pulleys.

In the distributor are arranged ports *k*, which, on rotation of the distributor, register with or are out of register with the ports *i*. The end of the distributor adjacent the chamber *c* is open so that the interior of the distributor is continuously in communication with the chamber *c*. The distribution of the fluid is therefore always effective when the ports *k* and *i* are in register.

Between the distributor *f* and the casing *a* is fitted a sleeve (Figs. 6 to 9) formed with corresponding ports the size of which determines the duration of the period during which there is a free passage through the ports *k* and *i*. As this duration is to be variable, and accordingly, the length of the ports (considered in the direction of the circumference) must be adjustable, the sleeve is formed of two parts *n* and *o* formed with projections *r* and *s* directed toward one another and engaging each other after the

manner of teeth in such manner that in the two extreme positions of the parts in which the pairs of adjacent edges of the projections are close together, the sleeve has as many parts q as there are ports i in the outer casing of the pump, while in every intermediate position of the two parts double the number of ports q and q^1 is formed in the sleeve, one half of the number (q^1) being covered by solid portions of the wall of the outer casing of the pump and being therefore ineffective.

One part (n) of the sleeve is adjusted and secured within the casing a for example by means of a ring j formed with peripheral teeth the spaces between which engage tooth-like extensions j^1 on the part of the sleeve to be fixed, the said ring j being secured to the adjacent cover of the casing. The location of one edge of each of the projections r of the part n determines the time of opening of the outlet for the fluid. The other part o of the sleeve is adapted to be turned and can be manually adjusted by a lever t mounted on the hollow shaft g^1 surrounding the shaft g and the stuffing box h of the same and led out of the casing through a second stuffing box h^1 . The hollow shaft g^1 is coupled with the part o of the sleeve by the engagement of a toothed flange g^2 with teeth o^2 on the rim of the sleeve.

The width of the projections r and s on the two parts of the sleeve is such that when the projections are close together, openings q are formed which are of such length (considered in the direction of rotation) relatively to the ports k in the distributor, that on rotation of the distributor there is no interruption of the flow of the fluid. This result can only be obtained, however, if the number of the ports k on the distributor body, as illustrated is correspondingly greater than the number of ports in the casing, so that one port k comes into register with a port q in the sleeve before the preceding port k leaves the same port q in the sleeve. In this position (shown in Fig. 3) of the part o of the sleeve the pump delivers no fluid into the delivery part of the pressure pipe and into the accumulator, as is hereinafter explained.

While the rotary distributor, as it forms a single piece, is completely balanced as regards the forces (pressures) acting in the direction of rotation, the movable part o of the sleeve is not so balanced; being subject to a pressure acting in the direction of the circumference which tends to bring the part o of the sleeve back into the extreme position corresponding to the smallest opening of the inlet port q . Since these pressures may be of considerable amount the said movable part of the sleeve must be balanced with regard to these moments of rotation in order to permit of adjustment of the same by

hand. To this end there is caused to act on the lever t (Fig. 1) through the intermediary of a rod w^1 a piston w which is adapted to be moved within a cylinder x . The face of the piston remote from the piston rod is under the action of the pressure of the delivery part of the pressure pipe of the pump. The area of the surface of the piston and the distance between the point of connection of the piston rod to the arm t of the lever and the pivot of the same are so chosen that the product of these two factors is equal to the sum of the pressure surface of the movable part of the sleeve multiplied by their mean distance from the axis of rotation of the latter. In this manner two equal moments of rotation are obtained which increase or decrease with increase or reduction of the pressure in the piping and which balance one another since they operate against one another and permit easy adjustment of the sleeve o even with maximum pressures. This apparatus V is arranged as shown in Figs. 1 to 3 in the short circuit pipe K connecting the pressure pipe D of the pump P with the suction pipe L; the accumulator S is connected with the part of the pressure pipe lying beyond the (branch) junction of the pipe D with the pipe K, and operates as an ordinary air vessel. The non-return valve y arranged between the connection of the pipes D and K and the connection of the accumulator with the pipe D closes only when the distributor f of the distributing apparatus permits the passage of the fluid into the pipe K but opens when the pump delivers normally into the pressure pipe D. When the ports k in the rotating distributor f are covered by solid wall portions of the casing the entire volume of fluid supplied by the pump must flow through the non-return valve y in the pressure pipe and this volume of fluid is equally distributed to the delivery part of the pressure pipe and the accumulator S on account of the equal resistance in these parts.

If the rotating distributor f opens the passage in the short circuit pipe K, the fluid delivered by the pump is brought back through the pipe K into the suction main, since a back pressure operates from the pressure pipe D on the valve y . The system is thus short-circuited, and since, under these conditions, the pump meets no resistance, it has no reaction on the engine driving the same and the engine therefore runs with no load during these intervals. During the same intervals of time however, the quantity of fluid collected within the accumulator S flows away into the delivery part of the pressure pipe which therefore delivers the liquid in a continuous stream. The pump develops its maximum output when the sleeve o of the distributor is in closed position *i. e.* when the ports i in

the outer casing are covered by solid portions of the wall of the sleeve *o* (Fig. 1) in this case the apparatus *V* runs idle and may be stopped. Adjustment of the sleeve *o* to increase the size of the ports *q-i* causes a periodical return flow of a part of the fluid into the suction pipe and only that amount passes into the pressure pipe which is necessary to supplement the returning portion in order to complete the quantity to be delivered.

In Fig. 2 the apparatus is shown in the mid-position in which the pump discharges into the pressure pipe *D i. e.* into the delivery part thereof and into the accumulator only one half of the total amount of fluid delivered. The farther the ports in the sleeve *o* are opened the less is the volume of fluid passing into the pressure pipe *i. e.* into the delivery part thereof and into the accumulator and the volume of fluid so passing becomes *nil* when the sleeve *o* is adjusted to the largest opening of the ports *q* (Fig. 3). If the fluid delivered by the pump be used as the actuating medium for a rotary motor such as indicated by *M* in dotted lines in Fig. 1 the speed of rotation of this motor can be varied between a maximum determined by the ratio of the volumes of pump and engine and zero.

Having described my invention I declare that what I claim and desire to secure by Letters Patent of the United States is:—

1. In an apparatus of the character described, the combination of a pump, pipes connected to said pump constituting a suction pipe and a pressure pipe, a short-circuit pipe connecting the suction pipe with the pressure pipe, a flow interrupter arranged within said short-circuit pipe, said interrupter adapted to be moved at a speed proportionate to that of the pump piston, an accumulator connected to the pressure pipe, and a non-return valve fitted in the pressure pipe between said accumulator and the point of connection of the short-circuit pipe with the pressure pipe.

2. In an apparatus of the character described, the combination of a rotary pump for supplying fluid under pressure, a suction pipe and pressure pipe connected to said pump, a short-circuit pipe connecting the suction pipe with the pressure pipe, a flow interrupter arranged in said pipe and

adapted to rotate at a speed proportionate to that of the pump, an accumulator connected to the pressure pipe and operating as an air vessel, and a non-return valve arranged in the pressure pipe between the point of connection of the accumulator with the pressure pipe and the point of connection of the short-circuit pipe with the pressure pipe.

3. The herein described flow interrupter consisting of a casing having two passages, one of which serves as the driving medium inlet and the other as the driving medium outlet, a rotary hollow distributor having a ported wall adapted during its rotation to establish communication at intervals between the driving medium inlet and the outlet, and a sleeve disposed between the casing and the rotary distributor, said sleeve consisting of a stationary part and an adjustable part, said parts having interengaging tooth shaped projections and recesses and serving to determine by the length of some of these recesses the duration of communication between the driving medium inlet passage and the inner space of the distributor.

4. The herein described flow interrupter consisting of a casing having two passages, one of which serves as driving medium inlet and the other as driving medium outlet, a rotary hollow distributor having a ported wall adapted during its rotation to establish communication at intervals between the driving medium inlet and the driving medium outlet, a sleeve disposed between the casing and the rotary distributor, said sleeve consisting of a stationary part and an adjustable part, said parts having interengaging tooth shaped projections and recesses, a hollow shaft on said adjustable part, said hollow shaft extending through the casing, a lever mounted on said hollow shaft, a cylinder and a piston movable within said cylinder, said piston being coupled with the lever and being connected with the pressure pipe of the driving medium.

Signed at Vienna, Lower Austria, Austria-Hungary, this third day of June, A. D. 1913.

GIULIO SILVESTRI.

Witnesses:

WILHELM BERGER,
AUGUST FUGGER.