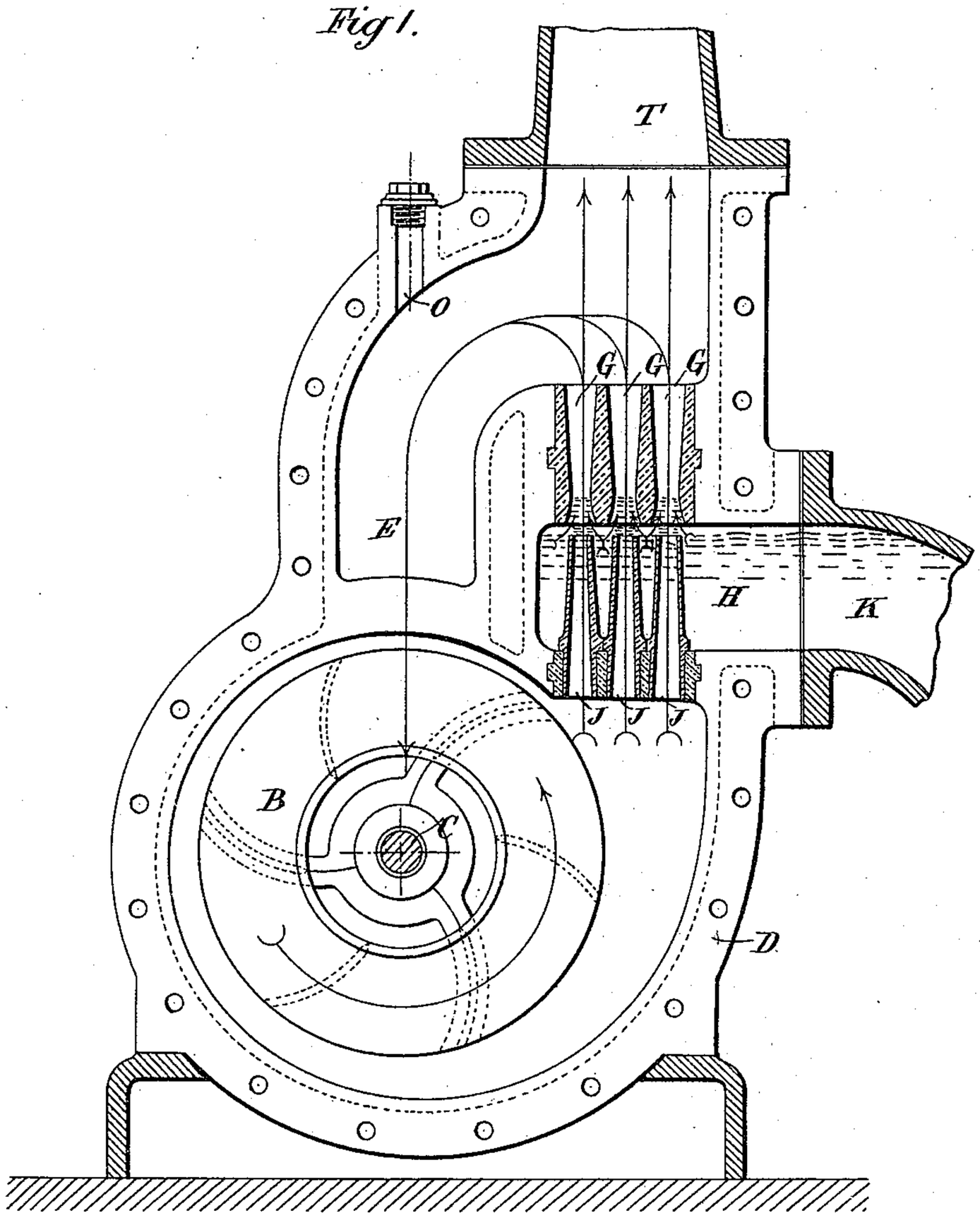
(No Model.) 6 Sheets—Sheet 1.

P. NEZÉRAUX.

CENTRIFUGAL PUMP.

No. 441,252. Patented Nov. 25, 1890.

Fig 1.



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(No Model.) 6 Sheets—Sheet 2.

P. NEZÉRAUX.

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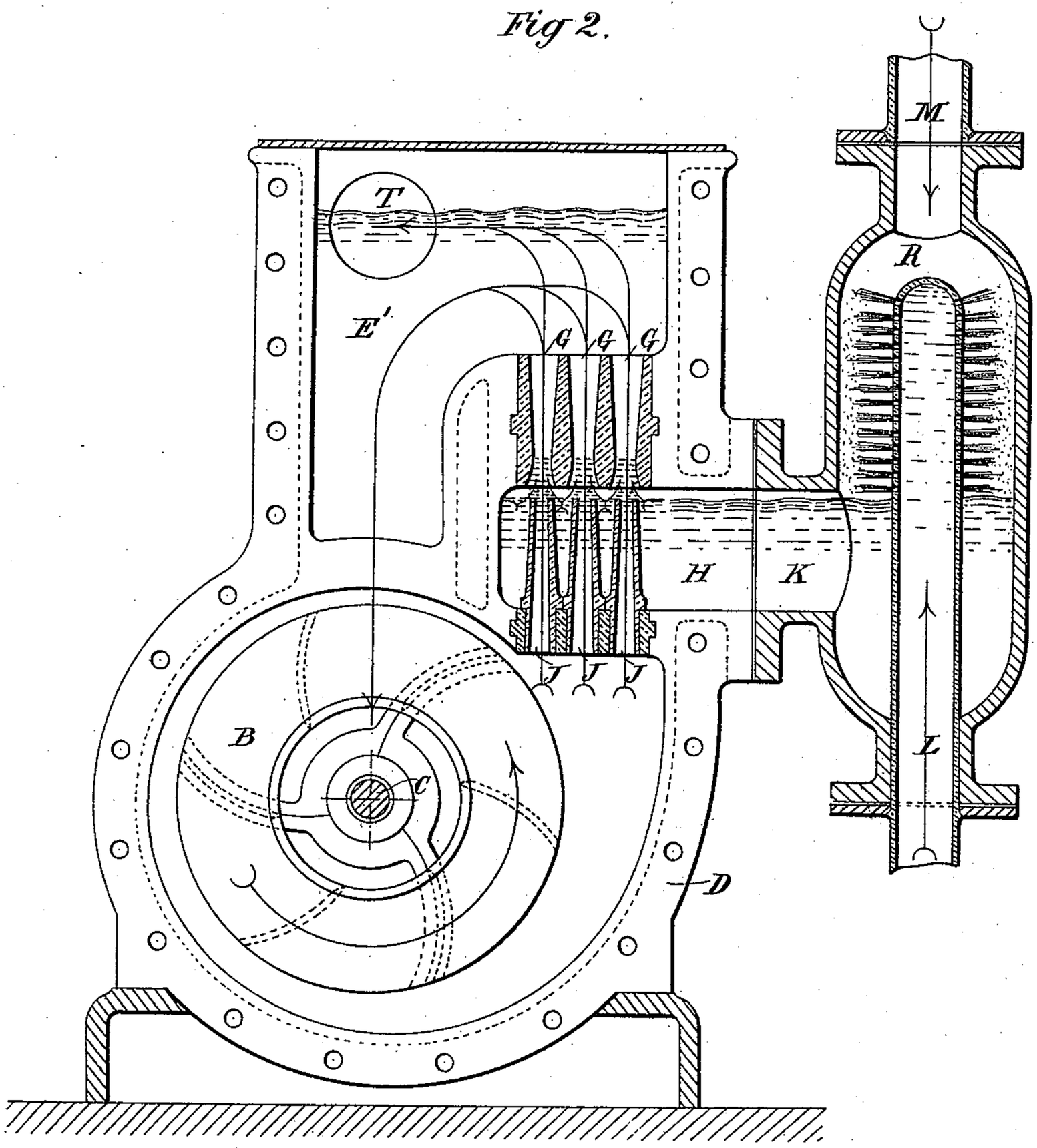
Fig 2.



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(No Model.) 6 Sheets—Sheet 3.

P. NEZÉRAUX.

CENTRIFUGAL PUMP.

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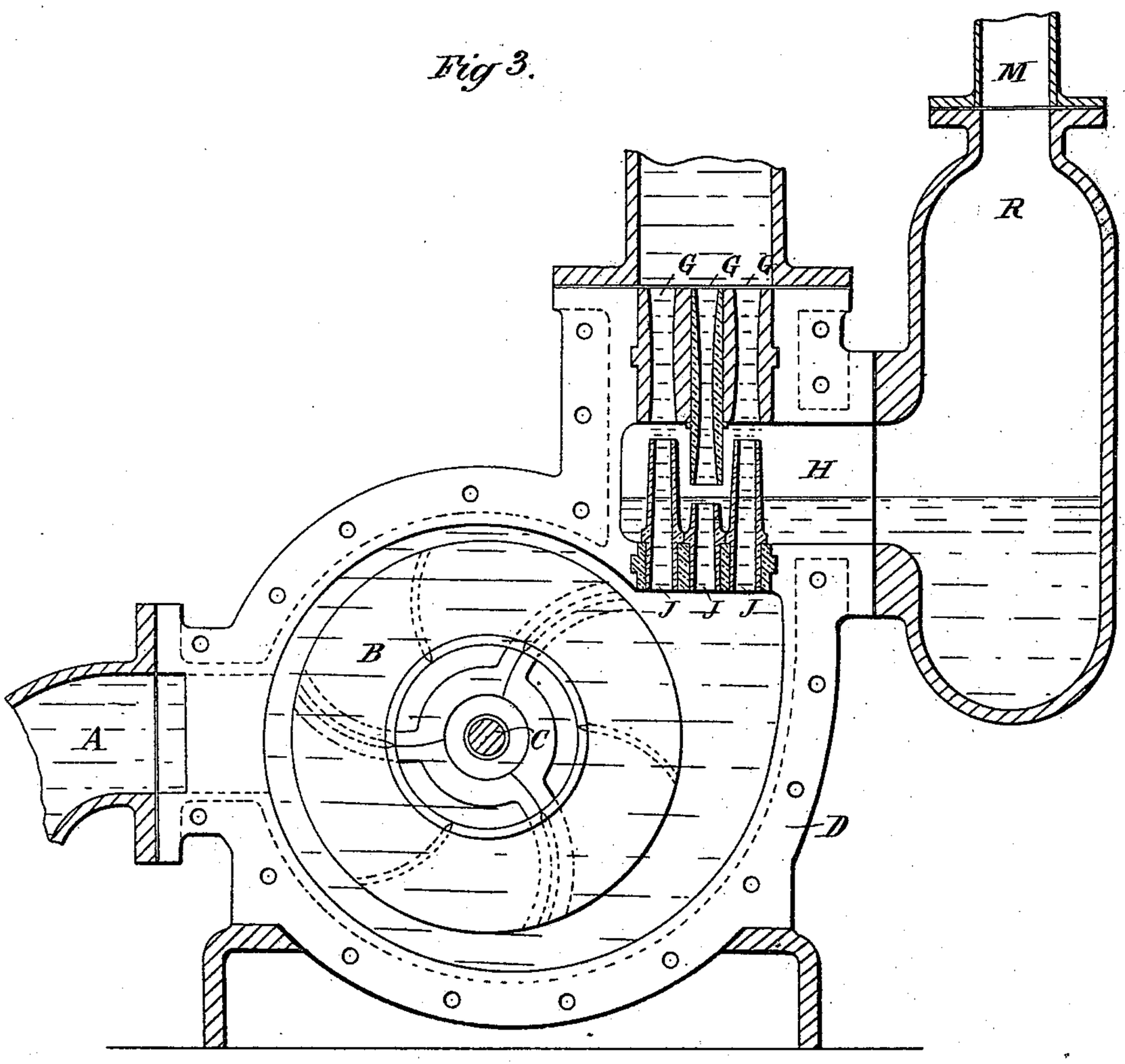
Fig 3.



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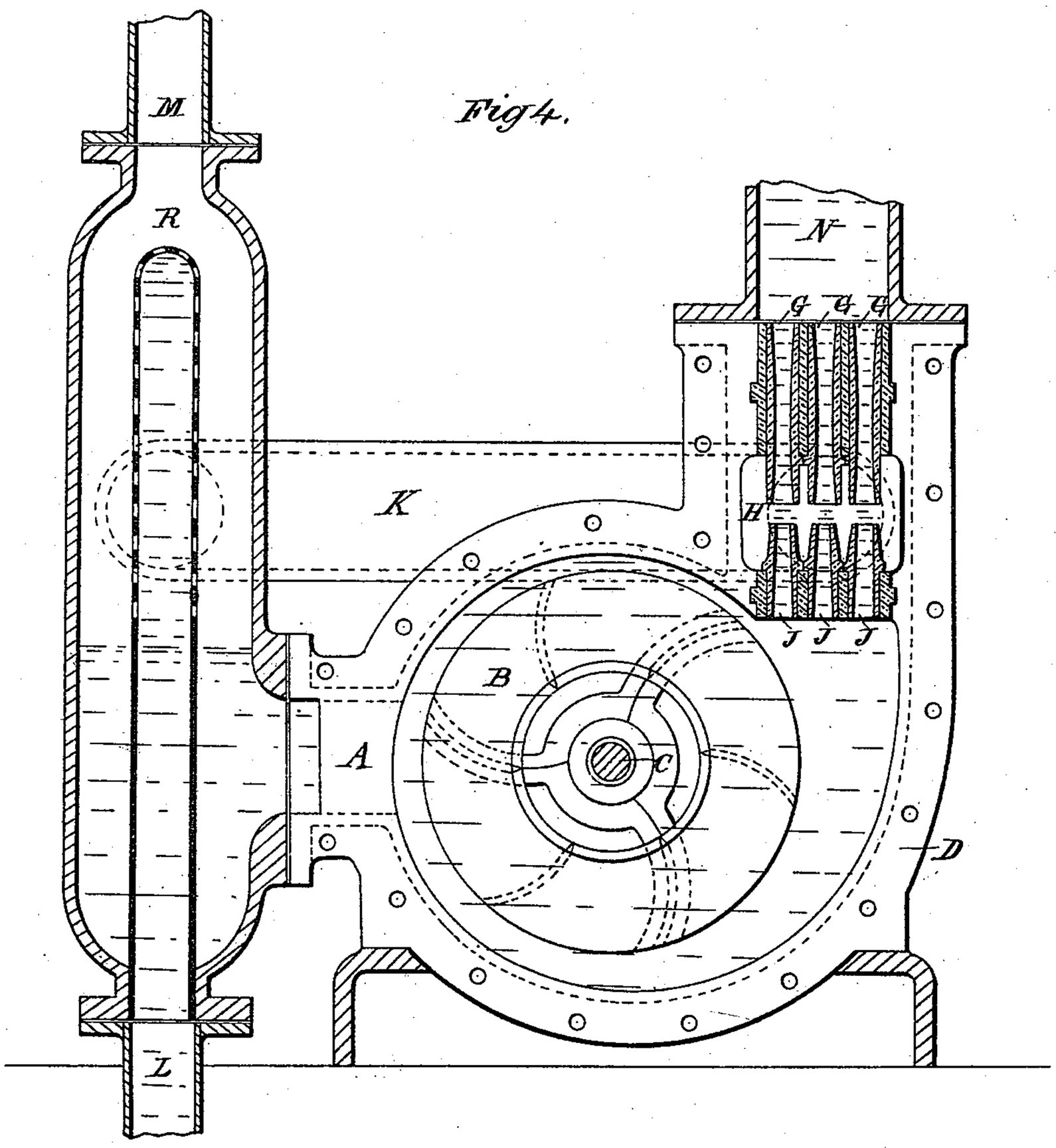
(No Model.) 6 Sheets—Sheet 4.

P. NEZÉRAUX.

CENTRIFUGAL PUMP.

No. 441,252. Patented Nov. 25, 1890.

Fig 4.



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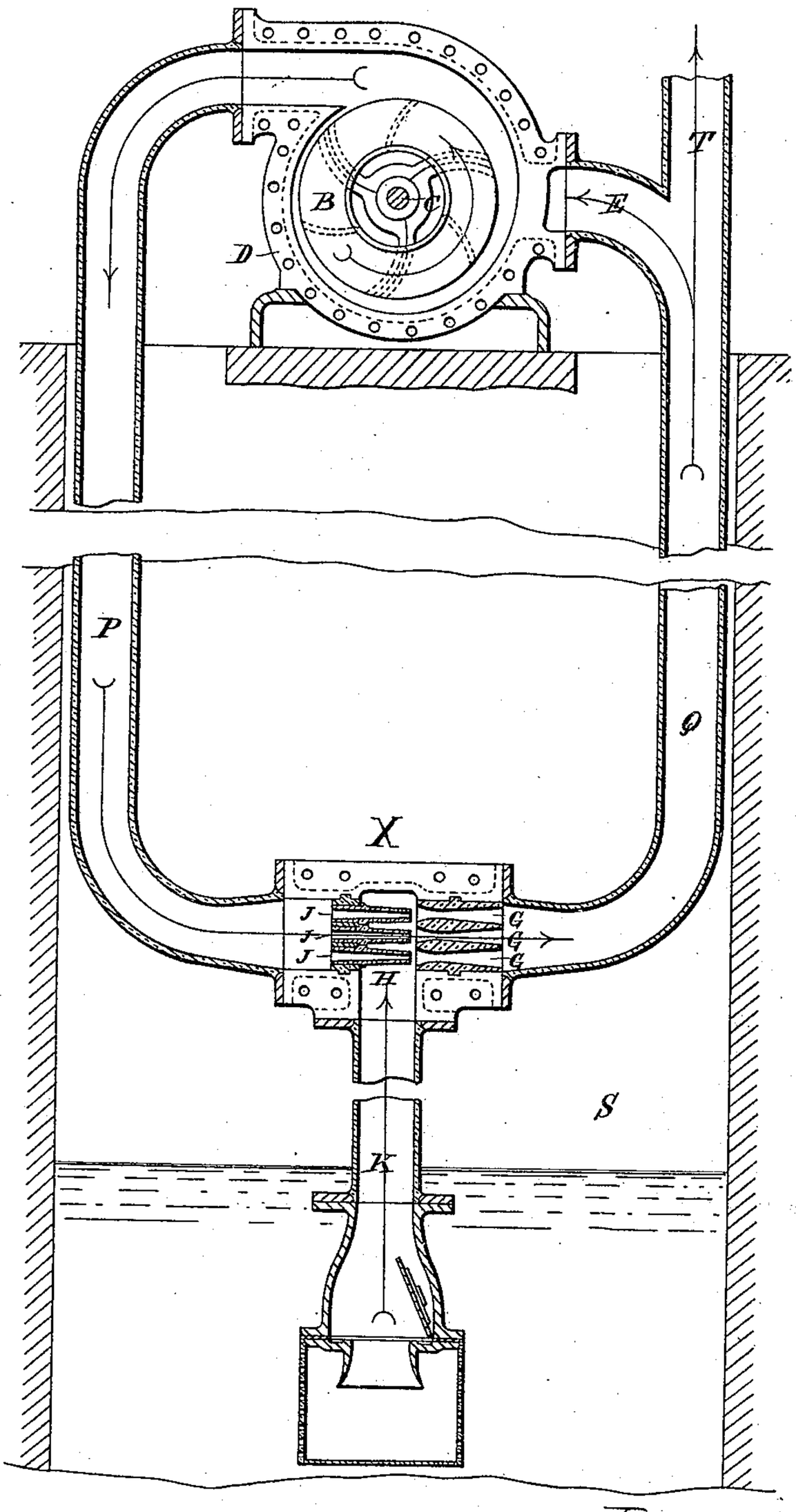
6 Sheets—Sheet 5.

P. NEZÉRAUX.

CENTRIFUGAL PUMP.

No. 441,252. Patented Nov. 25, 1890.

Fig 5.



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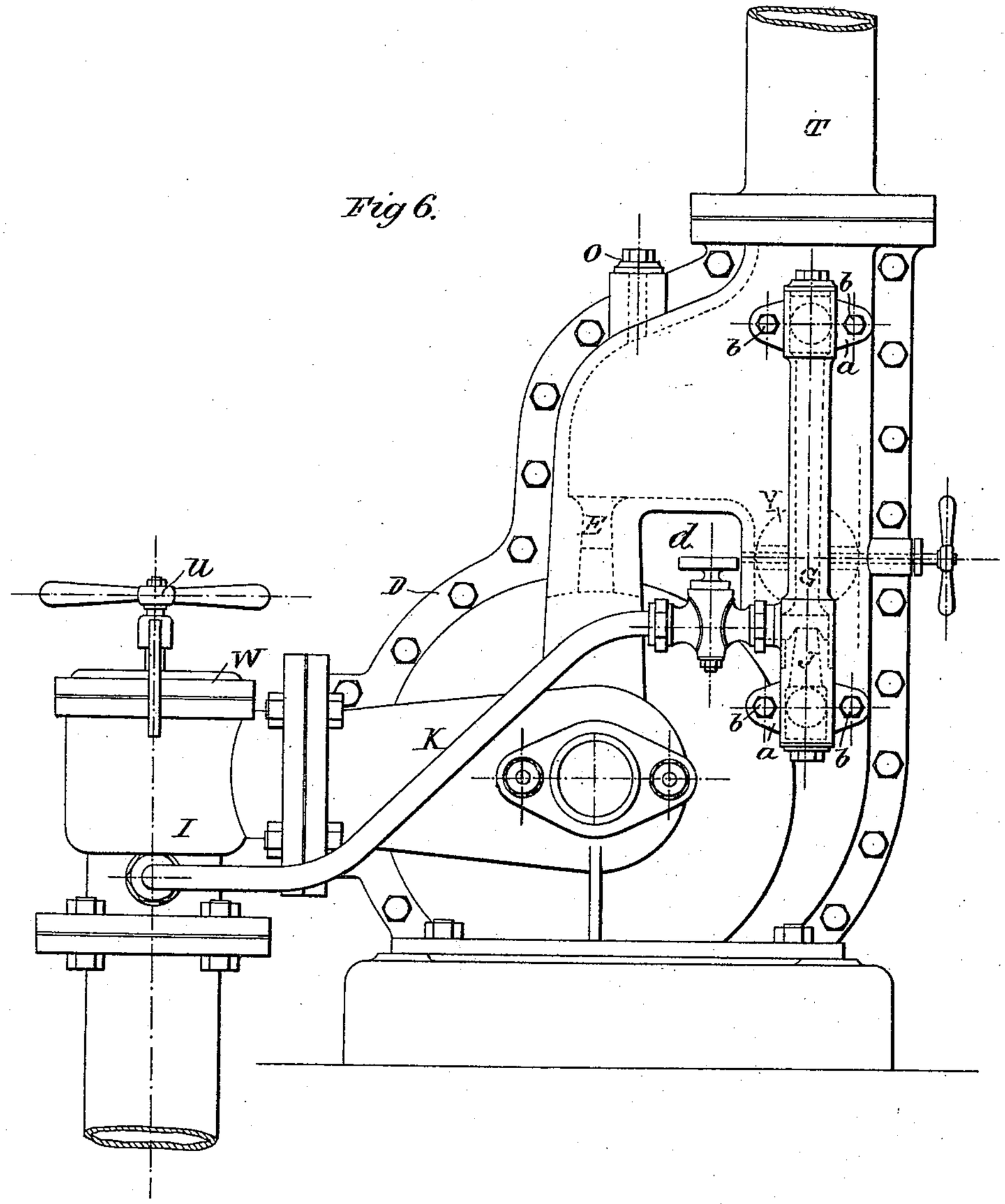
6 Sheets—Sheet 6.

P. NEZÉRAUX.

CENTRIFUGAL PUMP.

No. 441,252. Patented Nov. 25, 1890.

Fig 6.



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UNITED STATES PATENT OFFICE.

PLACIDE NEZÉRAUX, OF PARIS, FRANCE.

CENTRIFUGAL PUMP.

SPECIFICATION forming part of Letters Patent No. 441,252, dated November 25, 1890.

Application filed March 23, 1889. Serial No. 331,314. (No model.) Patented in France October 19, 1887, No. 186,397.

To all whom it may concern:

Be it known that I, PLACIDE NEZÉRAUX, a citizen of the French Republic, at present residing at Paris, in the French Republic aforesaid, have invented certain new and useful Improvements in Centrifugal Pumps, (patented to me in France under No. 186,397, dated October 19, 1887,) of which the following is a specification.

My invention consists in certain improvements in centrifugal pumps, as hereinafter fully described.

In the accompanying drawings, Figure 1 is a sectional view of a centrifugal pump embodying my invention. Fig. 2 is a similar view showing a condenser attached. Figs. 3, 4, and 5 are sectional views of modified forms, and Fig. 6 is a side elevation of a form arranged for large deliveries to slight elevations.

For many purposes centrifugal pumps are preferable to those of other constructions mainly on account of their considerable delivery compared with their small dimensions, of their easy installation and working, and because their mechanical parts are few and not likely to get out of order; but as they do not produce a vacuum like a piston and can only raise liquids to a small height with a practical speed of fan or turbine they are seldom used except for drainage or other analogous works.

Apparatus constructed according to my invention will produce an almost absolute vacuum, compress gases at four or five atmospheres, and raise liquids two or three times higher than ordinary centrifugal pumps when working at about the same speed as a turbine of similar dimensions.

In order that my invention may be fully understood, reference is made to the accompanying drawings, in which—

Fig. 1 represents my improved water-pump in sectional elevation. B is the piston, having its wings fixed on the driving-shaft C, which is supported in bearings and has a driving-pulley, as in ordinary centrifugal pumps. D is a casing formed of two adjacent shells firmly connected by bolts. Each of these shells is provided with the usual cavity to receive the piston-wheel B and a cavity which when the shells are fastened together forms the return-pipe E. Contained in the casing is an ejector device, consisting of conical nozzles or ajutages J, the total outlet area whereof is so calculated that the speed of outflow of the liquid shall be in suitable proportion with the pressure generated by the centrifugal force, and diverging receiving-tubes G, also of conical form, but arranged inversely and on the same axes as the nozzles J. The chamber H, surrounding said nozzles, communicates with the suction-pipe K, which is provided at its lower end, if desired, with a rose and flap valve. T is the outlet-pipe, through which the liquid carried in is forced, and E the return-pipe by one of the two central openings of the piston for the liquid in motion.

The operation is as follows: The body of the pump having been filled with water by the opening O and the plug then replaced, the piston is set in motion, and the liquid, being thus subjected to the action of the centrifugal force, is driven from the center to the circumference of the piston; but as it can only issue by the nozzles J it is projected in condensed jets into the diverging receiving-tubes G to return anew and indefinitely by means of the return-pipe E. In this rapid motion of the jets the liquid carries in the first place the air contained in the suction-conduit, and, a vacuum being thus produced, water begins to rush from the pipe K into the chamber H, whence it is carried in its turn by the jets through the tubes G and then raised into the outlet-pipe T. In this mode of operation the height to which the liquid will rise does not depend solely on the speed of the piston—that is to say, for a given speed of said piston the height can be greater or less, for experience has demonstrated that this height greatly depends on the relation existing between the volume of water which is drawing and over and over again returns or circulates and the volume of water which is drawn. Thus, for example, if the return volume were twice as large as that drawn, the height of the column drawn would be sixty feet for a speed the centrifugal force of which only corresponds to thirty feet. This, as will be understood, is the proportion of the masses

which act in the same way as the hydraulic ram, with the difference that the action is continuous and that there is no loss of water. It is therefore sufficient, in order to raise a liquid to a predetermined height, to establish a suitable proportion between the area cross-sectional of the nozzles J and that of the receiving-pipes G, the speed of the piston being known.

Fig. 2 shows a condensing-pump of the same construction as that shown in Fig. 1, with the exception of the return water-pipe, which in this case consists of a reservoir E′ in communication at the bottom with the suction of the pump and at the top with the outlet-pipe T. Connected to the chamber H is a receiver or condenser R, in which a vacuum is produced by the condensation of steam. The receiver contains a pipe L, which forms the inlet for the condensing water, which issues from the perforations of same and condenses the steam coming in by the pipe M. This apparatus is especially valuable for drawing off the vapors from vacuum-pans and the like and at the same time condensing them, thus taking the place of both the air-pump and the condenser usually required. In like manner it may be used as a condenser for the exhaust-steam from steam-engines. This pump, with a few special features, can be used for the compression of gases.

Fig. 3 shows another condensation-pump, in which the steam entering by the pipe M is directly condensed by the water issuing from the nozzles J J. The condensation-water in this case can only be reused in the piston after having been cooled by any suitable apparatus. Otherwise it must run to waste, in part at least, and a supply of cool water be provided to replace it.

Fig. 4 shows a third arrangement of condensation-pump, in which the receiver R where the vacuum is produced is placed at the suction end A of the pump instead of being placed at the forcing end. In this apparatus L is the inlet for the condensation-water, M the steam-inlet, and N the outlet of the product of condensation. K is a pipe communicating on one side with the receiver R and on the other with the nozzles J J. It is by means of this pipe that the vacuum is produced in the receiver R. In this pump, as in that shown in Fig. 3, the condensation-water can only be reused in the piston after having been cooled, or otherwise must run to waste, in part at least.

Fig. 5 shows an arrangement of my invention in which the nozzles J and tubes G, forming the injector portion of the apparatus X, instead of being placed in the body of the pump, are suspended on the pipes P and Q (the latter having a return branch E) in a well S, the arrangement allowing of an endless circulation of water in equilibrium through the pump and the delivery through the pipe T of the portion of the liquid sucked in by the inlet-pipe K, which communicates with said nozzles and tubes. The end of the pipe K may be provided with an ordinary flap-valve and strainer-box or rose, as shown. This arrangement offers the valuable advantage of allowing water to be drawn from a depth of sixty-five feet and more without mounting the pump in the well.

Fig. 6 is an end elevation of another arrangement of a pump constructed on my system especially arranged for a large delivery at a small height. This pump differs from the ordinary centrifugal pump by the vacuum which it produces at the suction by not requiring stoppage for priming and by the facility with which the delivery can be regulated without changing the speed of the piston. The apparatus which produces the vacuum in this pump, and which consequently serves to prime the suction-conduit, is in this case attached to the outside of the pump, and consists of a nozzle J and receiving-tube G, which are fixed on the forcing-conduit of the pump by means of the bosses *a a* and screws *b b*. The injector-nozzle J receives water from the inside of the pump, and the tube G, which forms the diverging cone, reintroduces this water into the pump. Y is a butterfly-valve provided with a handle, (and with a sector, if necessary, to maintain its position,) which is closed for priming and opened immediately after for working. K is the inlet-pipe communicating with the injector at one end and at the other with the pump immediately below the seat of flap-valve I.

The operation of the apparatus is as follows: If the pump has emptied itself during a stoppage and become consequently unprimed, the flap-valve I must be inspected and cleaned—an easy thing, as it is only necessary to loosen the screw *u* and remove the cover W. This cover is then replaced, and the body of the pump is filled with water by the opening O, which is then closed. The butterfly-valve Y being closed and the piston set in motion, the cock *d* is opened, when the liquid contained in the pump, being compressed by the centrifugal force, enters the injector apparatus to return indefinitely by the return water-pipe E. The rapid passage of the water in the cones J and G produces in this case an energetic drawing of air, which soon fills the suction-conduit. If at this moment the butterfly-valve Y is opened, the delivery will immediately commence and the pump will supply the full body of water permitted by its outlet-pipe. The butterfly-valve Y by adjustment may be employed to regulate the delivery of the pump.

As will be easily understood, when it is desired to obtain a more perfect vacuum, the water in the body of the pump can be replaced by mercury or slightly volatile alkaline solutions, such as calcic chlorides.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, with a centrifugal pump, of one or more ejectors, a condensing-

chamber in communication with said ejectors, a steam-inlet port for said chamber, and a water-pipe extending within the chamber and perforated at its inner end, substantially as described.

2. In combination, a centrifugal pump having supply and discharge channels, valves in said channels, an ejector and channels leading therefrom to the pump, the supply-channel, and the discharge-channel, and a return-channel from the discharge-channel to the pump, substantially as described.

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