No. 684,806.

Patented Oct. 22, 1901.

K. ENZINGER.
PRESSURE REGULATOR FOR PUMPS.

(Application filed Mar. 8, 1900.)

(No Model.)

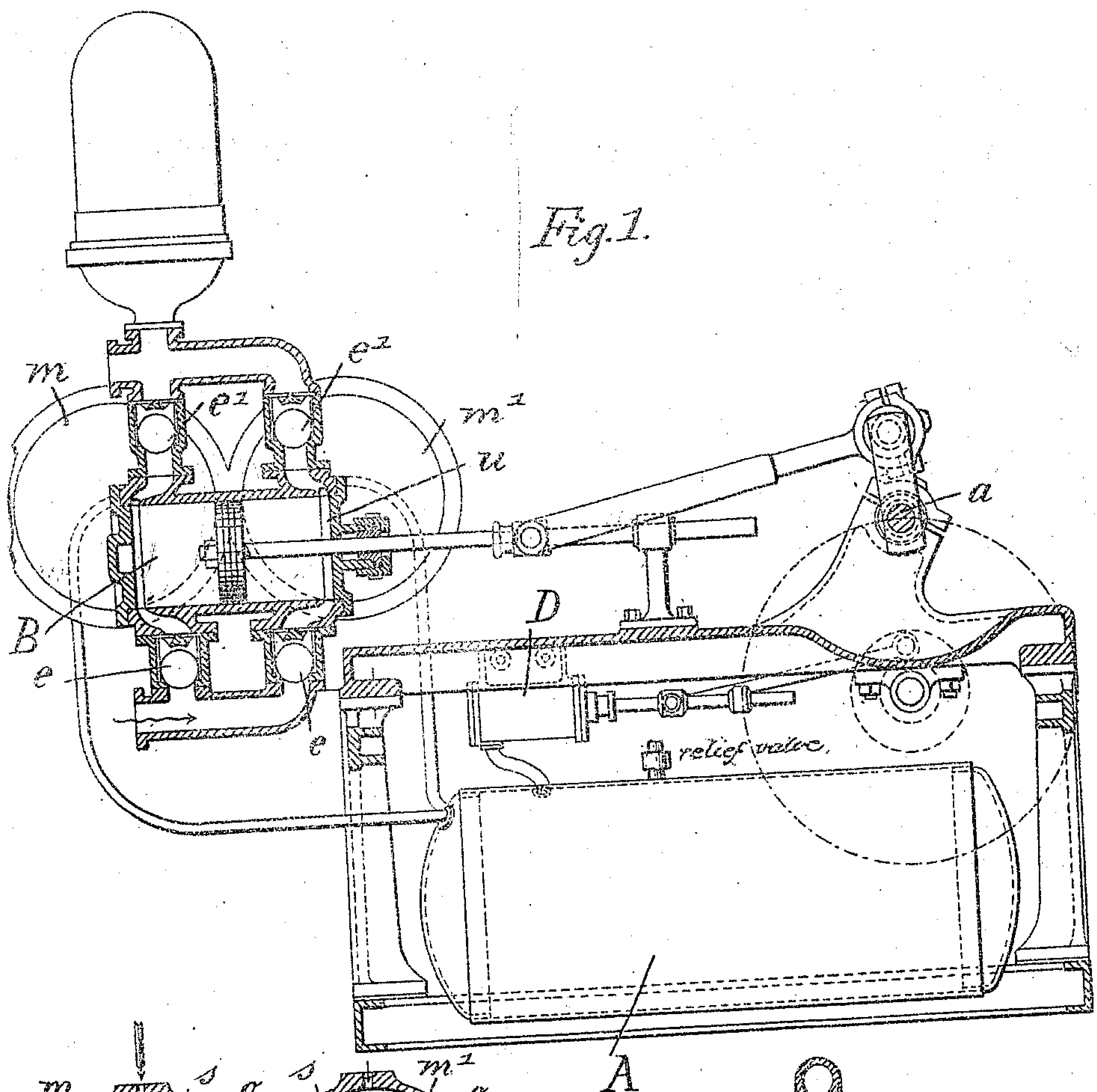

Fig. 1.

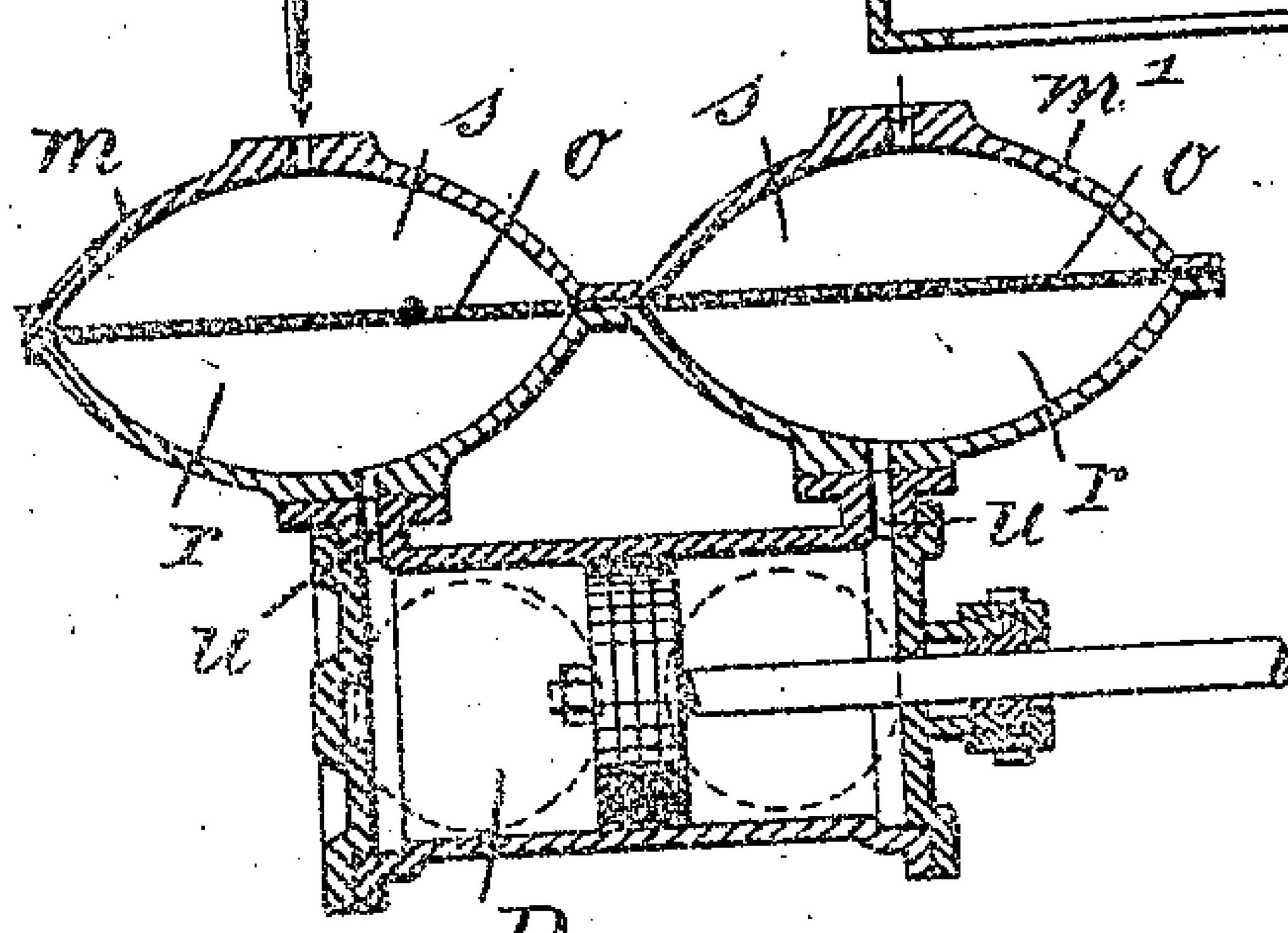

Fig. 2.

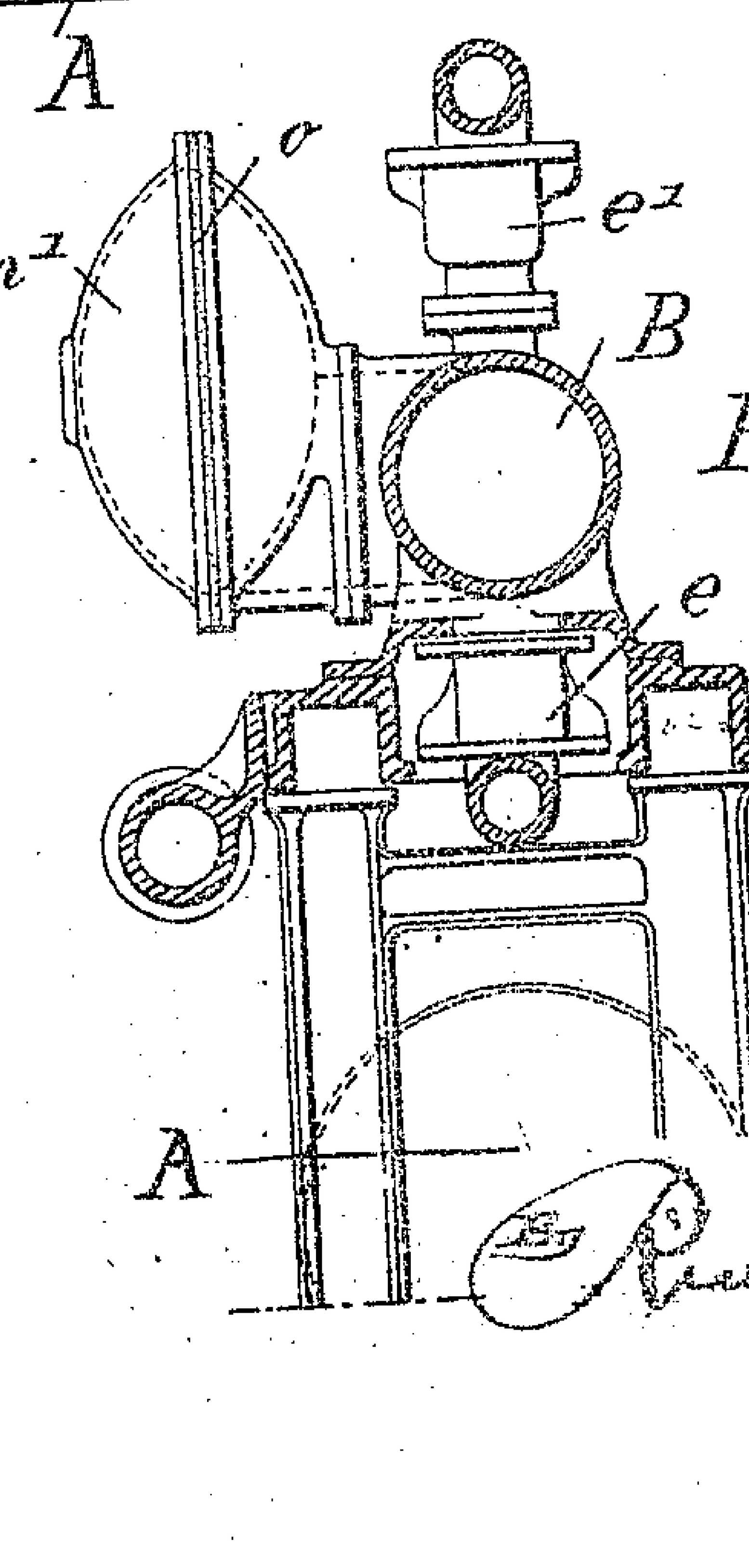

Fig. 3.

Witnesses:

[illegible]

[illegible]

Inventor:

Karl Enzinger

[illegible]

his Attorneys

UNITED STATES PATENT OFFICE.

KARL ENZINGER, OF WORMS, GERMANY, ASSIGNOR TO THE FILTER- & BRAUTECHNISCHE MASCHINEN-FABRIK AKT. GES., VORM. L. A. ENZINGER, OF WORMS, GERMANY.

PRESSURE-REGULATOR FOR PUMPS.

SPECIFICATION forming part of Letters Patent No. 684,806, dated October 22, 1901.

Application filed March 8, 1900. Serial No. 7,907. (No model.)

To all whom it may concern:

Be it known that I, KARL ENZINGER, a subject of the Emperor of Germany, and a resident of Worms, Germany, have invented certain new and useful Improvements in Pressure-Regulators for Pumps, of which the following is a full, clear, and exact specification.

The subject of the present invention is a new pressure-regulating device for pumps of all kinds. Regulators for this purpose hitherto in use are usually so constructed that when the pressure in the delivery-pipe is too high either the suction and delivery pipes are connected or the engine is stopped or the speed regulated. With the present regulator, on the contrary, the delivery-passages between the cylinder and delivery-valves communicate with chambers each having a flexible wall. On the other side of this wall a pressure acts, which during working exactly equalizes the desired pressure of the liquid being delivered. Immediately the liquid-pressure exceeds that desired, however, the wall yields, and the liquid, instead of entering the delivery-pipe, flows into the extra space set at its disposal by the yielding of the wall. The area of this space which is thus set at disposal is such that there is sufficient room for the whole liquid pumped at one stroke of the piston to be taken up. The yielding walls may most advantageously be constructed as diaphragms acted upon by compressed air, and this is the form of construction selected for illustration on the accompanying drawings.

Figure 1 shows a vertical longitudinal section of a pump to which the new regulator is applied. Fig. 2 is a horizontal section of the regulator, showing the two diaphragm casings and cylinders. Fig. 3 is a part vertical sectional view taken through the center of the regulator, Fig. 1.

a is the crank-shaft of a double-acting pump, driven from any suitable source of power, by means of belting, by an electromotor, or the like. The pump-cylinder B is of the ordinary construction for pumps for raising liquids. It is provided with two suction-valves *e* and two delivery-valves *e'*, each pair being connected with the suction and delivery pipes, respectively. The essential feature of the new regulator is that two casings or vessels *m m'* are secured laterally of the pump-cylinder B, each of which vessels is divided by a diaphragm *o* into two chambers *r s*. The chambers *r* are connected with the piston-cylinder by passage *u*, while the chambers *s* are connected by passages to the pipe from an air vessel A, the air in which is compressed by a small air-pump D. This air-pressure is maintained constant by means of a reducing and safety valve, whereby the tension may be regulated as desired. If, for instance, in working the liquid being pumped is to be forced through the delivery-pipe at a pressure of, say, thirty pounds per square inch, then this is the pressure which must be maintained in the air vessel A.

The manner of operation of the new pressure-regulator is as follows: The apparatus is first set in action without any liquid being pumped until the air-pump D has produced the desired pressure in the air vessel A. The liquid to be pumped is then admitted to the suction-pipe of the pump. By reason of the pressure in the air vessel A the diaphragms *o o* are pressed toward that side of the vessels *m m'* which is adjacent to the pump-cylinder B, so that the area of the chambers *r* is diminished to zero, while the chambers *s* are correspondingly increased in area. The number of revolutions of the crank-shaft *a* must be so regulated that the output of the pump is greater than the quantity of liquid required to be delivered. The result is that if more liquid enters the delivery-pipe than can be discharged there will be an increase in the pressure if no other outlet is provided. If, however, the pressure in the air vessel A is exceeded by the pressure in the delivery-pipe, the piston in the cylinder B will no longer force the liquid through the delivery-valves *e' e'*, but will force it into the diaphragm vessels. The amount so forced will be precisely that which is necessary to equalize the pressure in the delivery-pipe and the air-pressure in the vessel A. By reason of the liquid which has entered the diaphragm vessels the diaphragms will be forced against the opposite side of their casings and the chambers *r* will

be filled with liquid. It will thus be clear that the air-pressure on the diaphragm acting from the one side *s* and the pressure from the delivery-pipe acting from the other side *r* will exactly equalize each other during the delivery period, so that there will not be any increase of pressure in the delivery-pipe. If now the suction period commences in the cylinder B first, the whole of the liquid in the chamber *r* of the diaphragm vessel will be forced by the pressure of the air vessel A into the cylinder B, and the area of the chamber *r* will again be diminished to zero, and only then will the remaining suction effect of the pump-piston open the suction-valves *e*, letting so much fluid enter the cylinder from the suction-pipe as is necessary to make up the normal quantity of liquid sucked up at each stroke. If now the delivery period again commences, the liquid will only enter the delivery-pipe until the desired pressure is reached, any further liquid flowing into the chambers *r* of the diaphragm vessel ready to be forced into the cylinder B at the next suction period in the manner described.

From the above it is clear that the new pressure-regulator admits of both the speed of the piston and the quantity of liquid delivered being altered at any time, as desired, without any change occurring in the pressure in the delivery-pipe.

The chief advantages of this new pressure-regulator are as follows:

First. In working it is not necessary that the speed of the motor or transmission of power be uniform.

Second. The liquid to be pumped is always maintained at exactly the same pressure without there being any shock, so that there is no inducement for carbonic-acid gas or the like to escape from the liquid.

Third. The compressed air and the liquid pumped are always separated by the diaphragms, so that they never come in contact with each other.

Fourth. The apparatus may be adjusted for any desired delivery-pressure and this pressure maintained constant.

It will be clear that, although I have described only one particular form of construction, the new regulator may be arranged in various ways without departing from the essential feature of the invention. Thus, for instance, the yielding walls need not necessarily be diaphragm-partitions, as shown, nor need they be contained in casings of the particular design illustrated. The position of such casings and the character of the passages may likewise be varied. The arrangement of a compressed-air vessel A and pump D will be found generally practical; but here also it is obvious other means might be applied to the same end.

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

The combination with the pump-cylinder and valved suction and delivery pipes, of a chamber in open communication therewith having an interior capacity equal to the interior effective capacity of the pump-cylinder, a diaphragm in said chamber, means for applying pressure on the side of said diaphragm, opposite the communication with the cylinder whereby said diaphragm may yield when the liquid-discharge rises above a predetermined pressure and means whereby said pressure in rear of the diaphragm is kept from increasing as the diaphragm recedes whereby upon the increase in pressure of the liquid-discharge said pump is at once rendered inoperative, substantially as described.

In witness whereof I have hereunto signed my name, this 17th day of February, 1900, in the presence of two subscribing witnesses.

KARL ENZINGER.

Witnesses:
HEATON W. HARRIS,
JACOB ADRIAN.