No. 841,643. PATENTED JAN. 15, 1907.

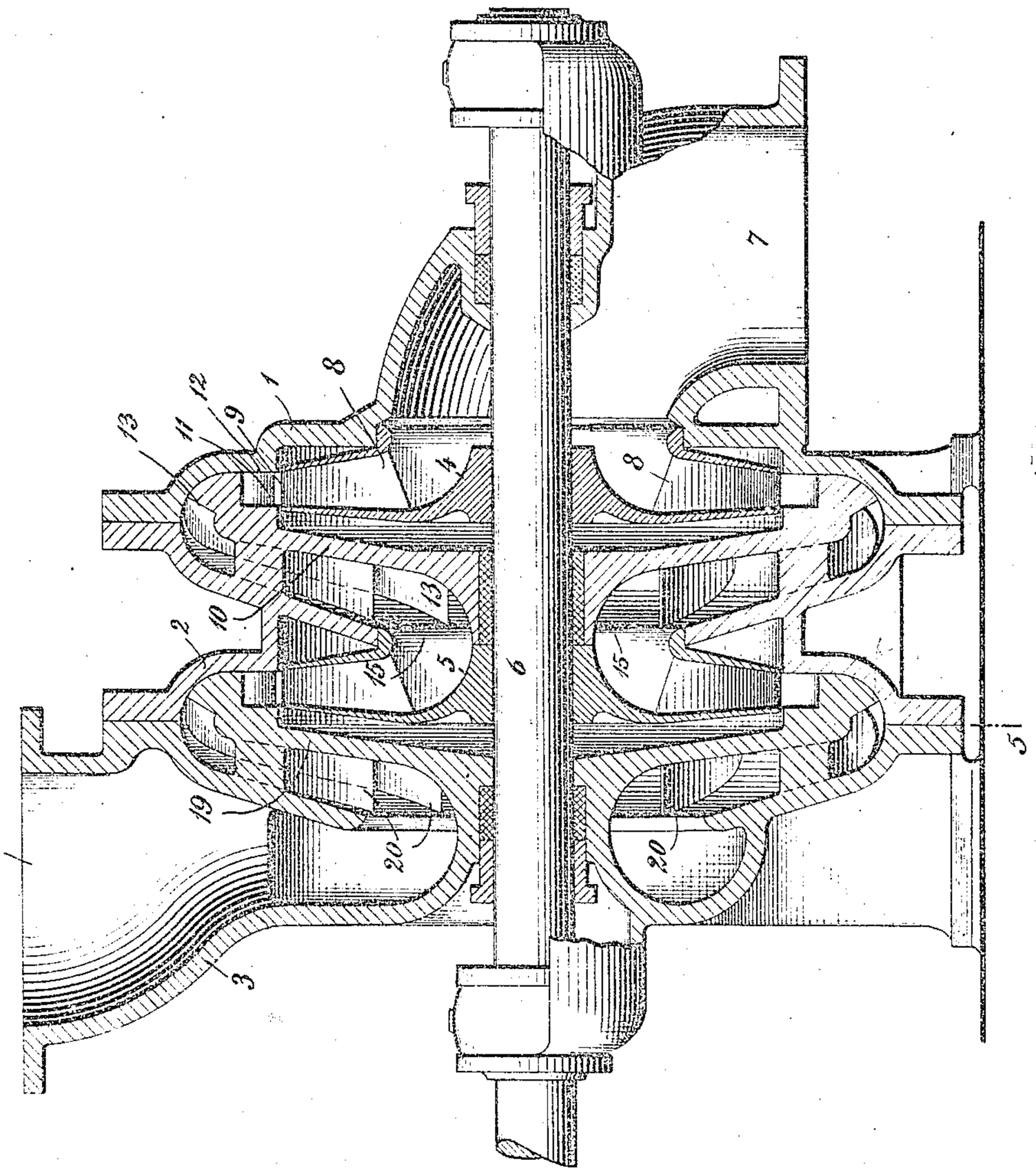
J. DEGEN.

CENTRIFUGAL PUMP.

APPLICATION FILED AUG. 4, 1906.

4 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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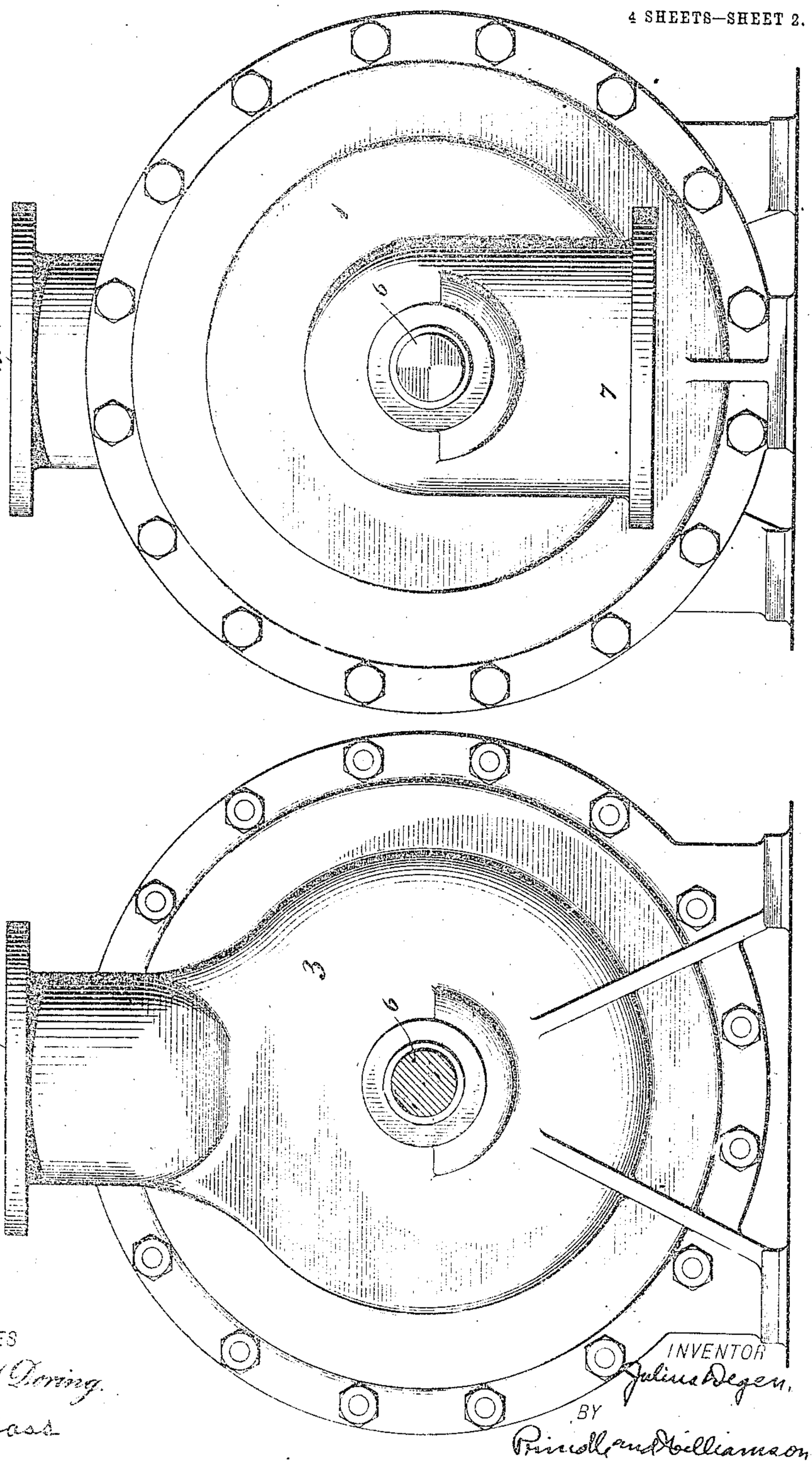
4 SHEETS—SHEET 2.



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4 SHEETS—SHEET 3.

Fig. 3.

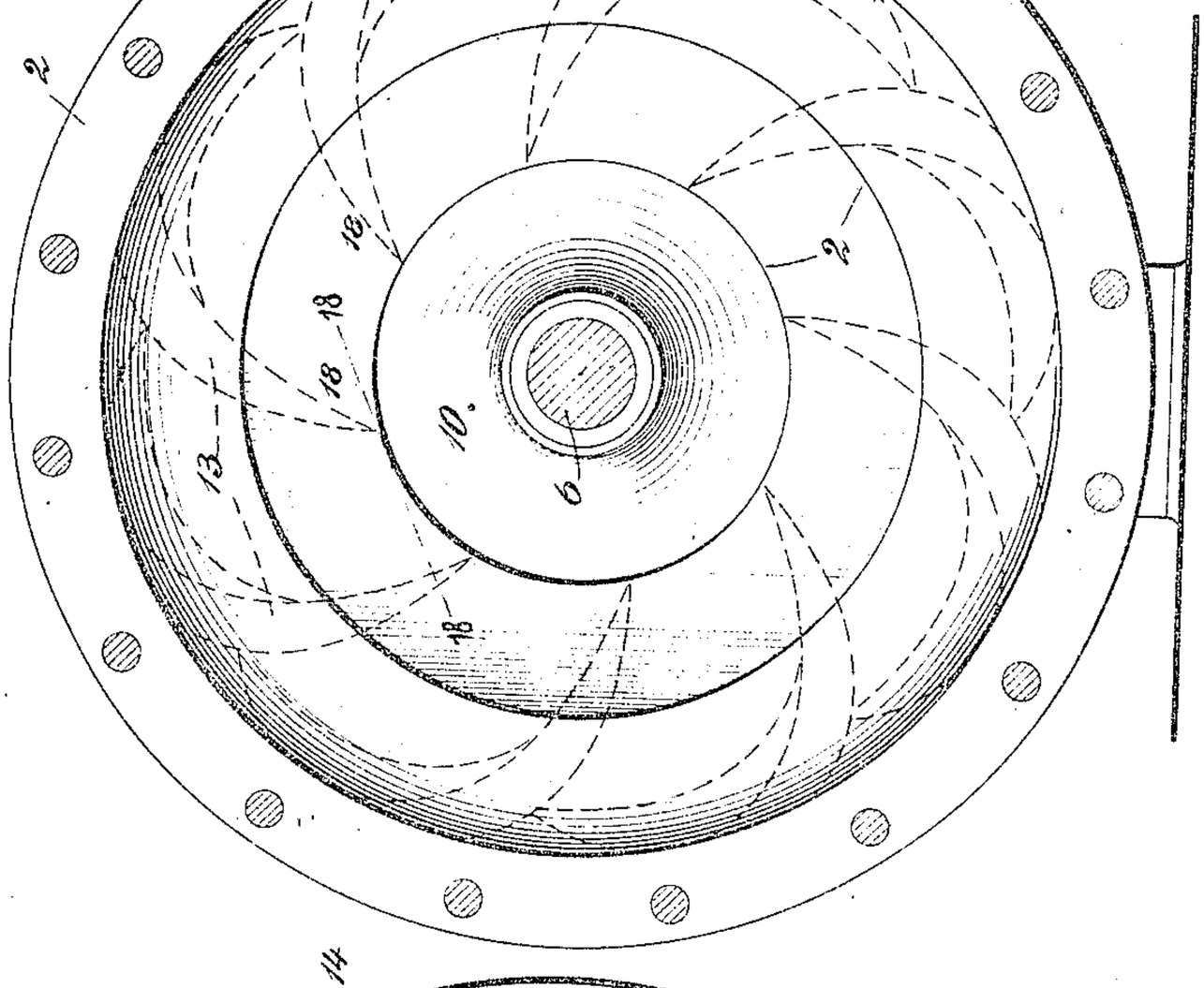
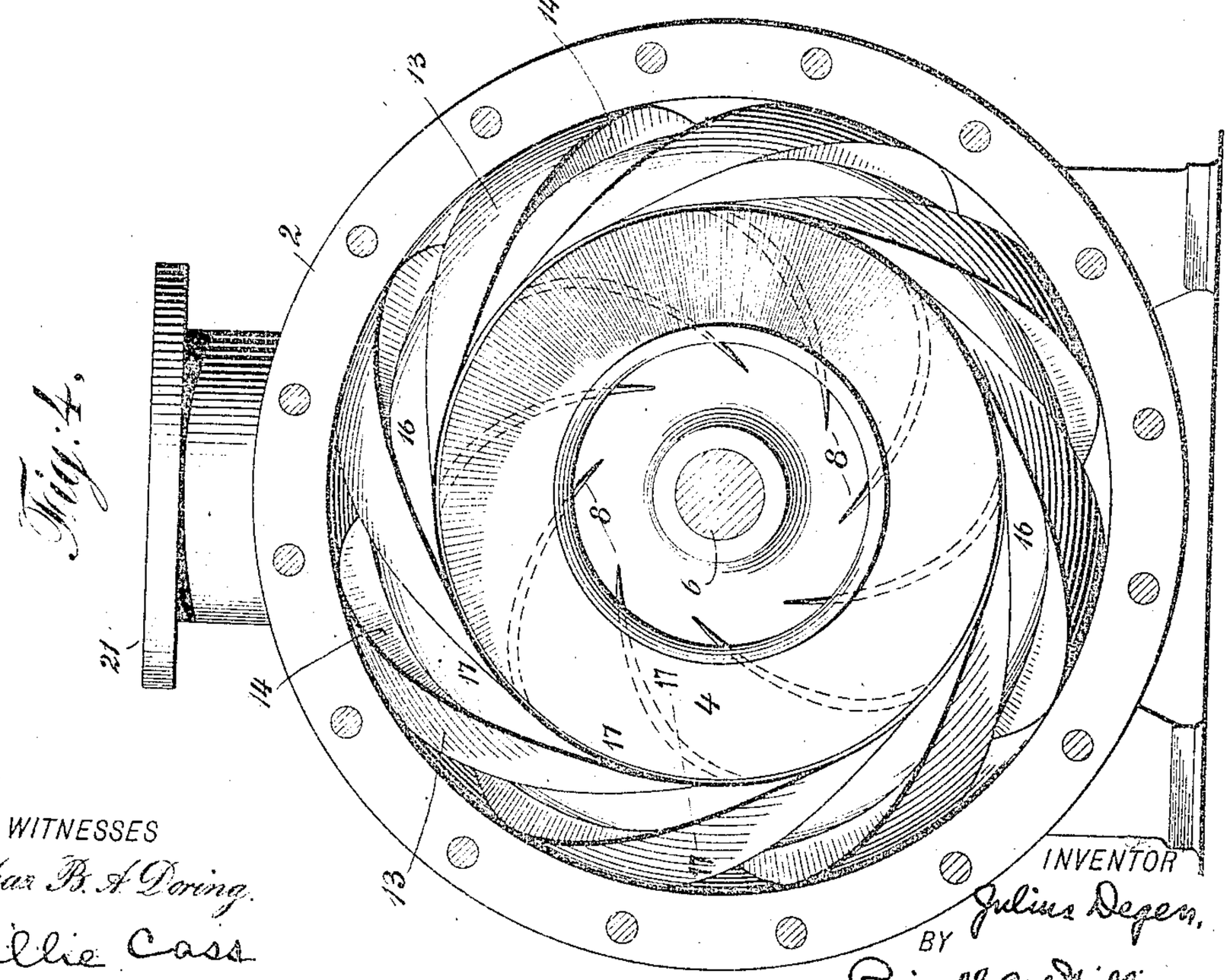


Fig. 4.



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4 SHEETS—SHEET 4.

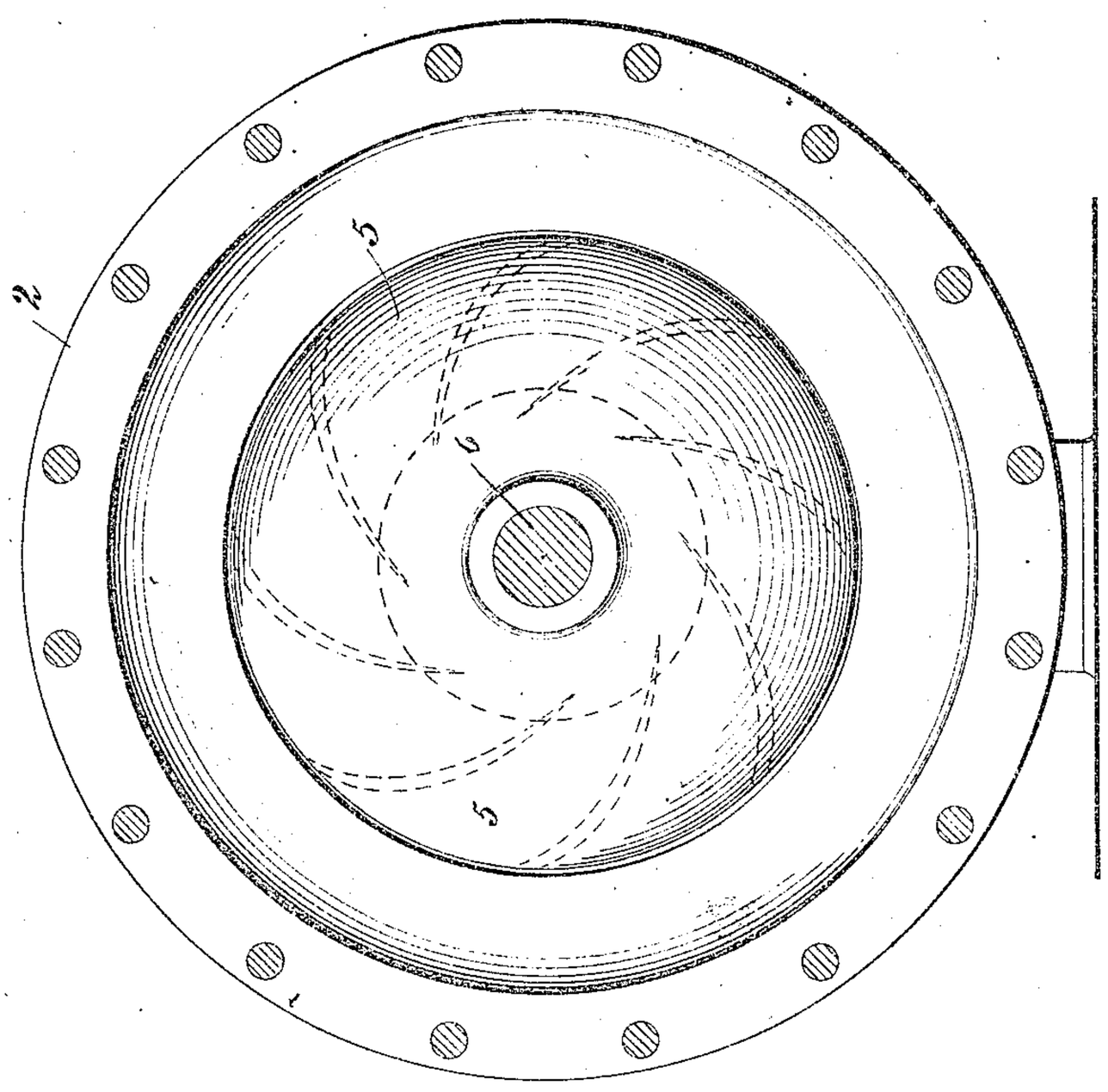

Fig. 6.

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UNITED STATES PATENT OFFICE.

JULIUS DEGEN, OF TRENTON, NEW JERSEY.

CENTRIFUGAL PUMP.

No. 841,643. Specification of Letters Patent. Patented Jan. 15, 1907.

Application filed August 4, 1906. Serial No. 329,187.

To all whom it may concern:

Be it known that I, JULIUS DEGEN, of Trenton, in the county of Mercer, and in the State of New Jersey, have invented a certain new and useful Improvement in Centrifugal Pumps; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which—

Figure 1 is a central longitudinal section of a two-stage pump embodying my invention. Figs. 2 and 3 are respectively right and left end elevations of the pump. Fig. 4 is an end view of the suction end of the pump, the suction-head being removed. Fig. 5 is a view of the delivery side of one of the partitions of the pump; and Fig. 6 is a view of the delivery end of the pump, the delivery-head being removed, this view being taken on the line 5 5 of Fig. 1.

The object of my invention has been to provide a multistage centrifugal pump of high efficiency in which the water is transferred from one impeller to the next impeller of the series in such a way that its velocity is transformed into the maximum amount of pressure; and to such ends my invention consists in the centrifugal pump hereinafter specified.

In carrying my invention into practice I provide a casing which in the illustrated embodiment of my invention consists of a suction-head 1, an intermediate section 2, and a delivery-head 3. Within the casing thus formed are two impellers 4 and 5, secured upon a shaft 6. I have illustrated the use of two impellers, although my invention is applicable to a multistage-pump having any number of impellers. The water reaches the first impeller 4 by a suction-pipe 7, which pipe leads the water, as usual, toward the central portion of the impeller. The impeller has a series of blades 8, as usual, so that the rotation of the impeller will by centrifugal action throw the water out between the blades 8 at the exit 9 of the impeller.

In order to carry the water from the first impeller to the second impeller, a partition 10 is secured within the casing alongside of and overhanging the impeller, the front wall 11 of the partition and the rear wall 12 of the suction-head being in line with the side walls of the exit 9 of the impeller.

On the partition are cast or otherwise formed a series of spiral ribs 13. These ribs start in a direction so that their surfaces 14, against which the water strikes as it leaves the wheel, shall be almost if not quite parallel to the path of the water. The ribs 13 then curve gradually over the partition 10 and then toward the entrance 15 of the second impeller by a spiral path, so that the water is gradually conveyed from the exit of the impeller 4 to the entrance of the impeller 5 by such a natural spiral path that very little of the velocity of the water is lost, owing to the changes in direction.

The ribs 13 form between them passageways 16, which I term "diffusing-nozzles," and which according to my invention very gradually increase in cross-section as they pass from the impeller 4 to the impeller 5.

The inlet area of the nozzle, taken on the line 17 17 of Fig. 4, is proportioned according to the absolute outlet velocity of the liquid from the impeller 4, and the outlet area of the nozzle, taken on the line 18 18 of Fig. 5, is proportioned to the inlet velocity into the succeeding impeller 5. From the entrance 17 to the exit 18 the area of cross-section of the nozzle is gradually and continuously increasing in such proportion that the velocity of the liquid is most efficiently transformed into pressure. The impeller 5 is constructed like the impeller 4, and on the delivery side of the said impeller 5 a partition 19 is provided, which partition is in all respects like the partition 10 and which has ribs 20, which are like the ribs 13 and which form between them diffusing-nozzles like the passages 16. The ribs 20 convey the water to the outlet-pipe 21.

While the operation of my pump will be apparent from the foregoing description, the following brief summary of it may be made: The water enters the suction-pipe 7 and is given a pressure and a high velocity by the rotation of the impeller 4 and by this action is delivered into the diffusing-nozzles. These nozzles gradually transform the velocity imparted by the impeller 4 to pressure in the fluid and at the same time convey the fluid to the impeller 5 in such a way that the least possible energy is lost through eddy-currents or by changes of direction. The water does not boil around in the casing, but passes by the most direct route from one impeller to the next. The second impeller takes the fluid at the higher pressure and imparts an additional pressure and again a high velocity to it, and this second velocity is, by the second partition, with its ribs and diffusing-noz-

zles, converted into a still higher pressure, and from there the fluid is delivered to another impeller or to the delivery-pipe, as may be desired.

I have found in actual practice that by giving the water the spiral direction which I have described, in passing from one impeller to the next, and at the same time gradually decreasing its velocity, owing to the gradual increasing area of the diffusing-nozzles, I deliver the fluid at a pressure that is much higher relatively than that of any other centrifugal pump with which I am familiar. I attribute the high efficiency of my pump to the combined action on the fluid of the long spiral path from one impeller to the next and the gradually-increasing area of the passage-way or nozzle through which the fluid is transmitted.

It will be observed that I provide a long passage-way that very gradually increases in area, and thus transforms the velocity into pressure without the formation of eddy-currents, and while I provide a long spiral path for the fluid I am enabled to do this without materially increasing the diameter of the pump-casing, and therefore without greatly increasing the weight and cost of the pump. It will also be observed that the water is in the diffusing-nozzle all the time from its exit of one impeller to its entrance to the next impeller.

I claim—

1. In a centrifugal pump, the combination of a casing, an impeller and a series of diffusing-nozzles, said diffusing-nozzles extending from the exit of the impeller to a central delivery-opening in the casing, said nozzles being of a spiral form, and also of a gradually-increasing area in a direction from the impeller to the delivery-opening said increase in area being substantially continuous to said delivery-opening.

2. In a centrifugal pump, the combination of a casing, a series of impellers in said casing, said casing having a series of diffusing-nozzles formed therein, said nozzles starting from the delivery of the first impeller in a direction tangent to the direction of the fluid in leaving the impeller, said nozzles extending in a spiral direction to the entrance of the next impeller, and said nozzles gradually increasing in area from the first to the second impeller, so that the velocity of the fluid is gradually transformed into pressure.

3. In a centrifugal pump, the combination of a casing, a series of impellers therein, a partition on the delivery side of the first impeller, spiral ribs between said partition and the casing, said ribs extending from a delivery of the first impeller, in a direction tangent to the path of the fluid as it leaves the impeller, in a gradual spiral over said partition, and in toward the entrance of the second impeller, the passage-way between said ribs gradually increasing in area from the first to the second impeller, whereby the velocity of the fluid is transformed into pressure.

In testimony that I claim the foregoing I have hereunto set my hand.

JULIUS DEGEN.

Witnesses:
B. M. PHILLIPS,
ETHEL S. BLACKBURN.