No. 859,938. PATENTED JULY 16, 1907.

A. M. GOW.

BLOWER PUMP.

APPLICATION FILED SEPT. 2, 1903.

4 SHEETS—SHEET 1.

Fig. 1

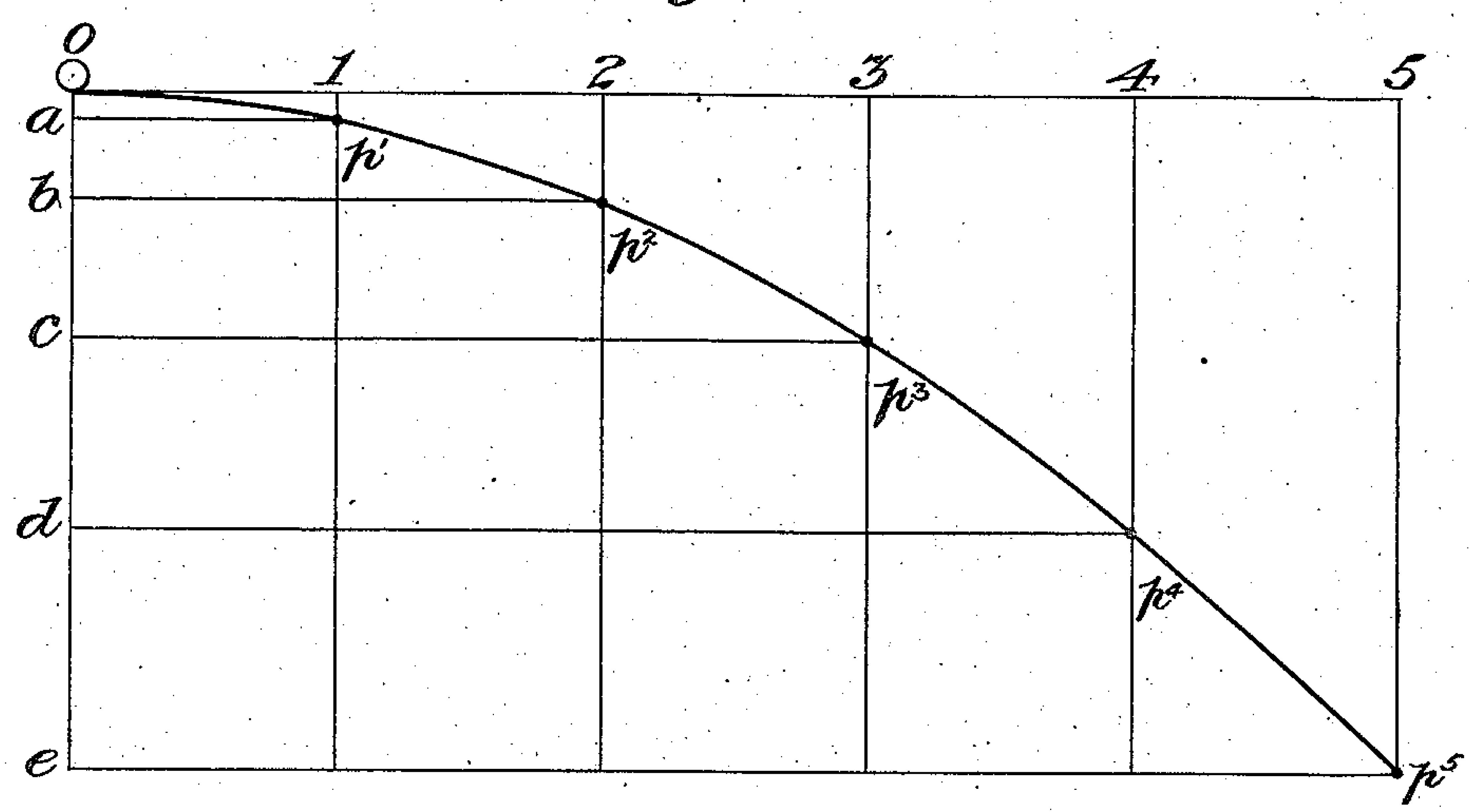

Fig. 2

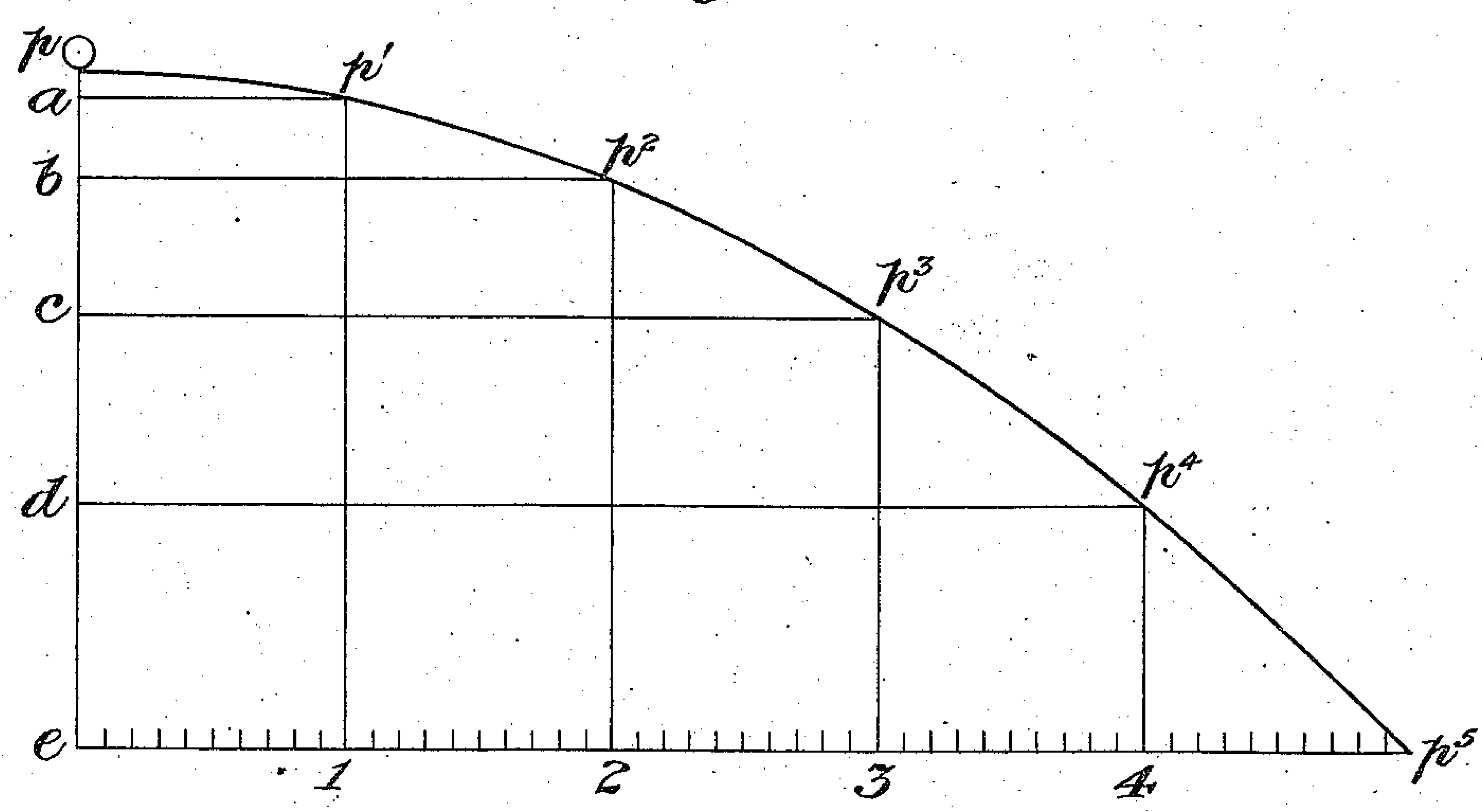

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PHOTO-LITHO by SACKETT & WILHELMS CORP. N.Y.

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Fig. 3

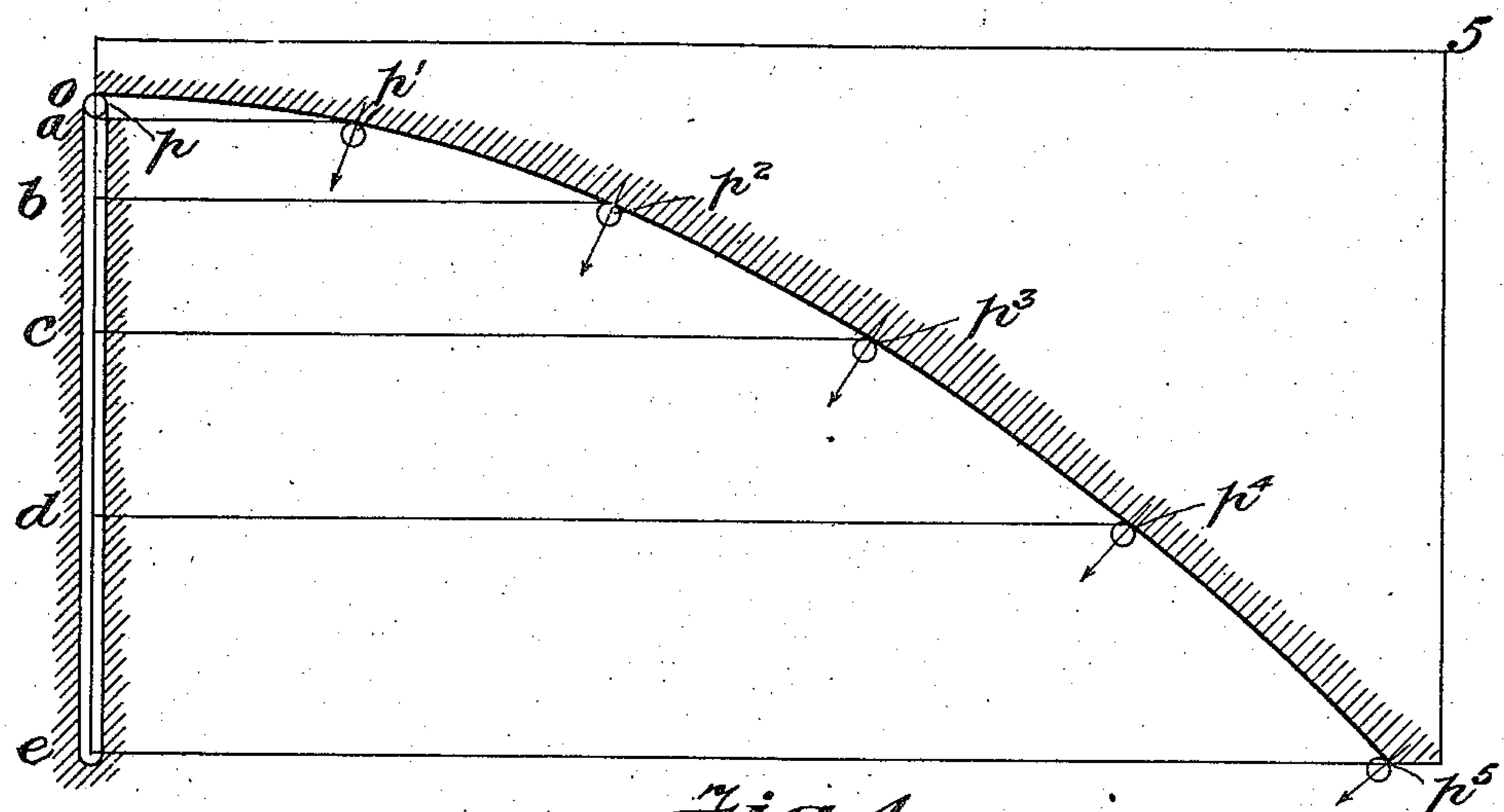
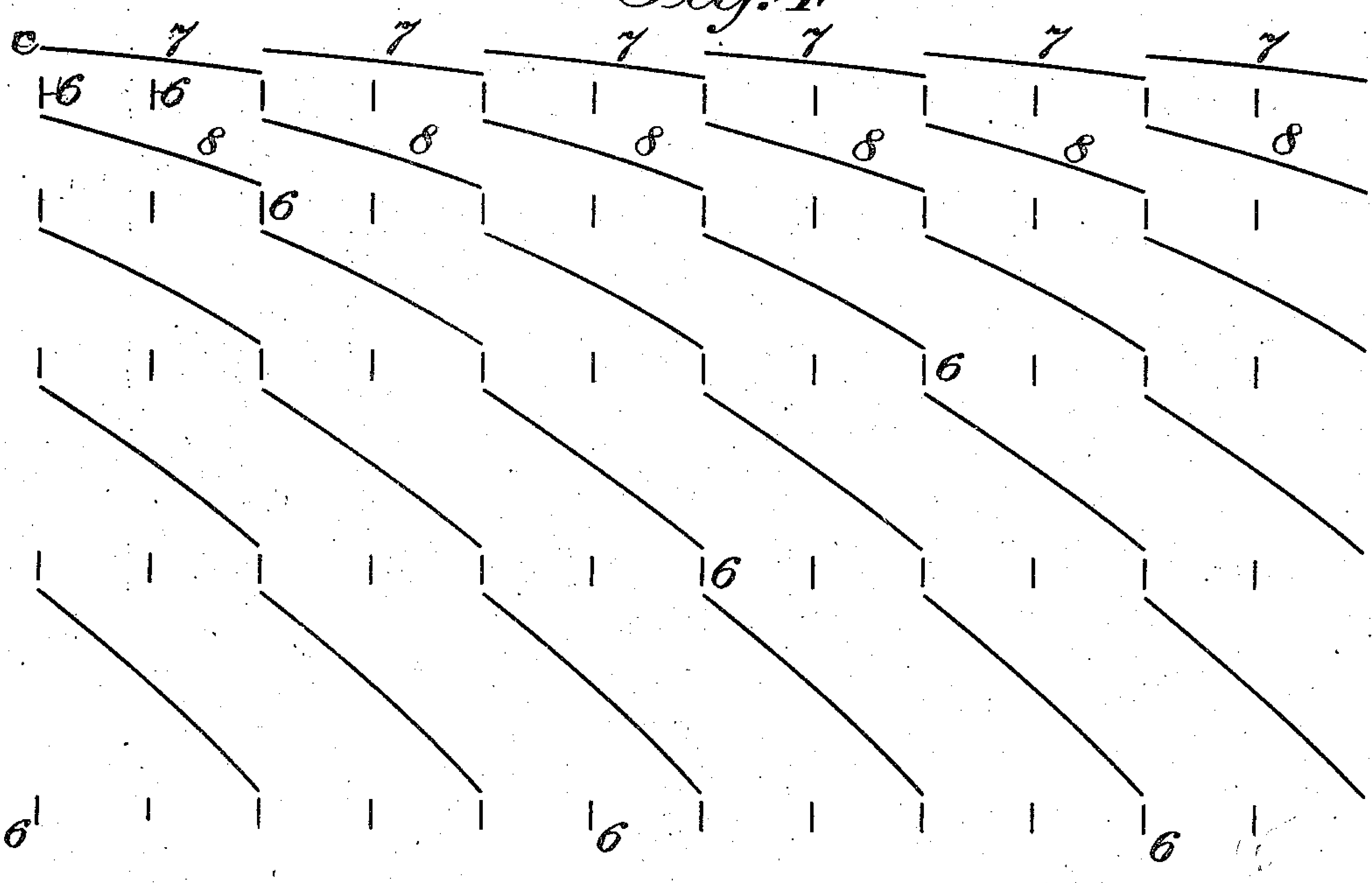


Fig. 4



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4 SHEETS—SHEET 3.

Fig. 5

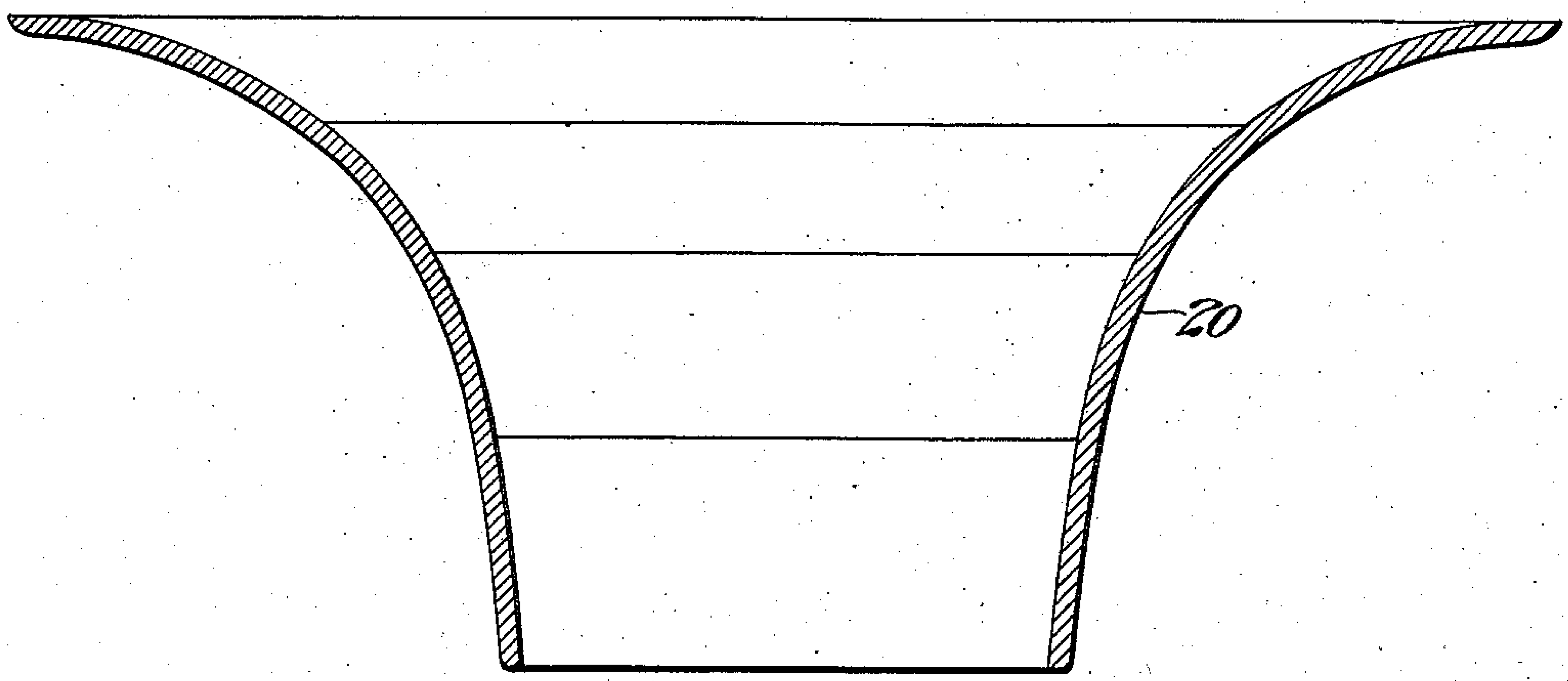
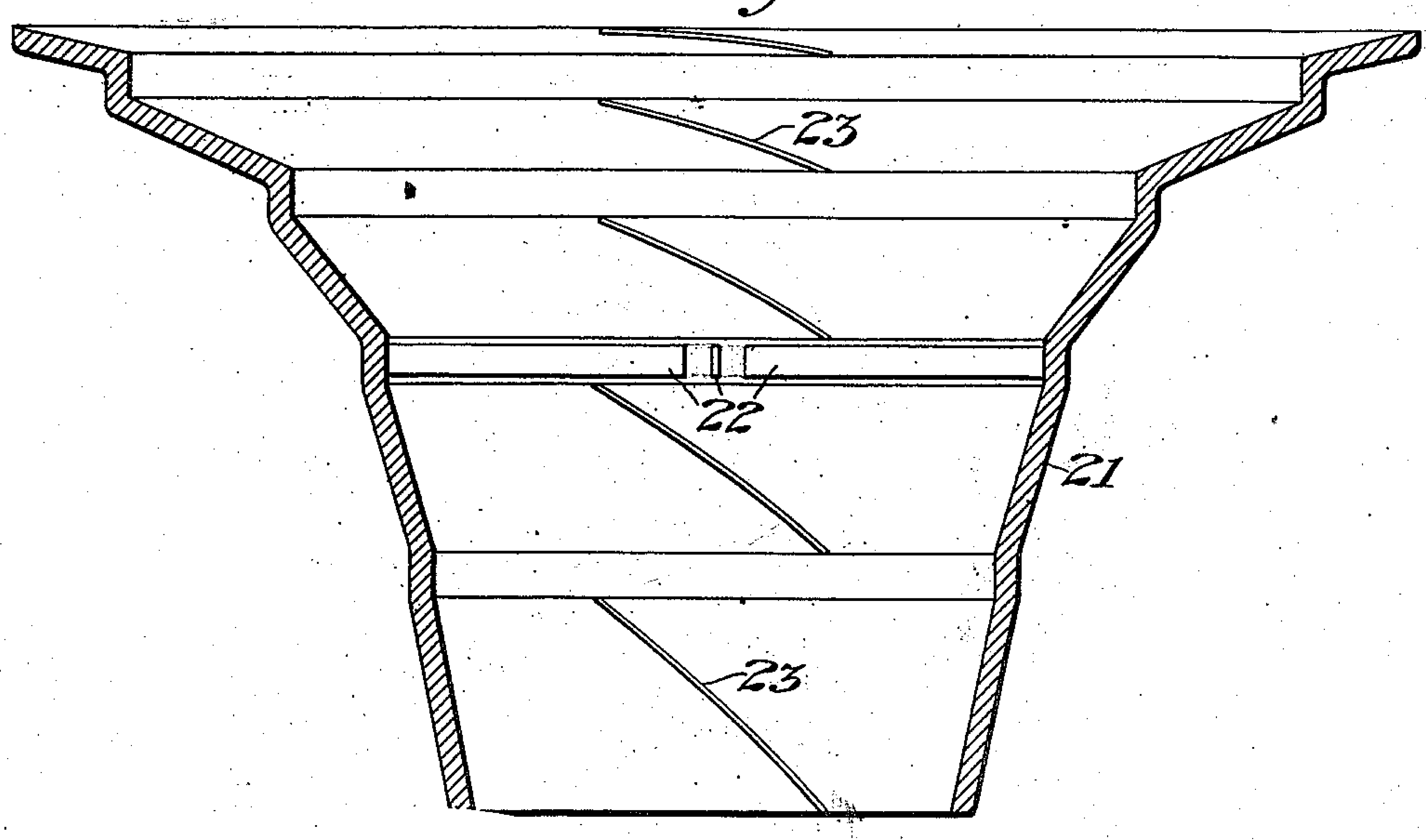


Fig. 6



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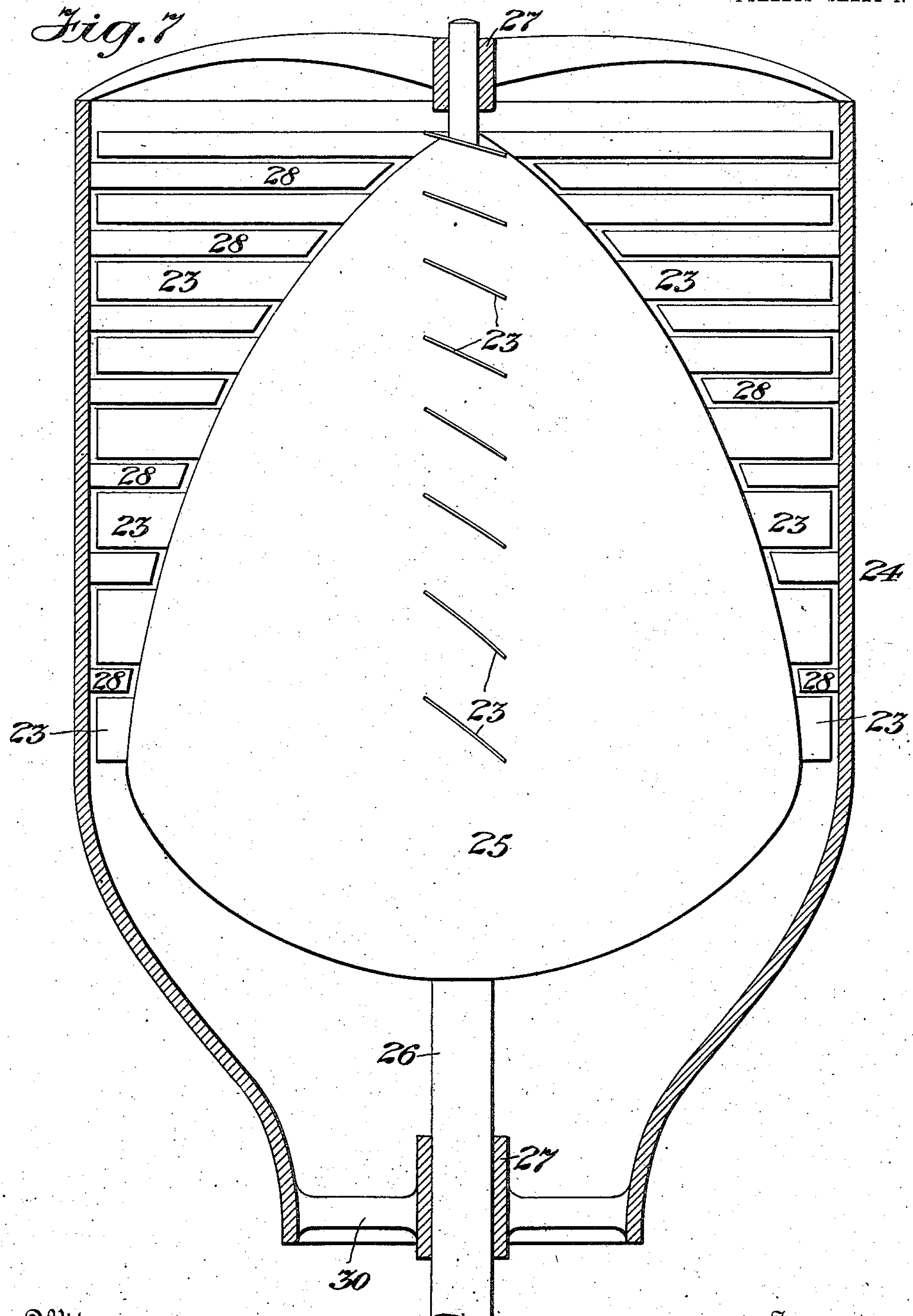
4 SHEETS—SHEET 4.

Fig. 7



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UNITED STATES PATENT OFFICE.

ALEXANDER M. GOW, OF EDGEWOOD PARK, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE WESTINGHOUSE MACHINE COMPANY, A CORPORATION OF PENNSYLVANIA.

BLOWER-PUMP.

No. 859,938. **Specification of Letters Patent.** **Patented July 16, 1907.**

Application filed September 2, 1903. Serial No. 171,595.

To all whom it may concern:

Be it known that I, ALEXANDER M. GOW, a citizen of the United States, and a resident of Edgewood Park, county of Allegheny, State of Pennsylvania, have invented certain new and useful Improvements in Blower-Pumps, of which the following is a specification.

The object of the present invention is to provide means whereby a volume of fluid can be moved in a straight line with an accelerated motion from minimum to maximum velocity by the action upon it of a constant force, it being well known that if a moving body be acted upon by such a force it receives a constant acceleration.

In embodying my invention, I make use of certain novel features of design, employing the well known disk fan or screw propeller to cause the motion of the fluid. When the invention is applied to the moving of air through an orifice, the apparatus embodying the invention would be called a blower; when used to cause an accelerated movement of water in a straight line the apparatus would be called a pump. By a reversal of the action best adapted to propel air or other similar fluid, the apparatus might be utilized as a steam turbine, as will appear further on.

In order to set forth clearly the principles of my invention, I have in some instances made use of a number of diagrams illustrating the action of a moving particle acted upon by a constant force. I have also shown views of an apparatus adapted to carry out the principles of my invention.

In the drawings, Figures 1, 2, 3 and 4, represent diagrams of the character above described; and Figs. 5 and 6 illustrate shapes of pipes which can be utilized in carrying out the invention; and Fig. 7 shows in section a form of apparatus adapted to do the work contemplated by the invention.

Referring to Fig. 1, the lines o—e may represent the path of a moving particle acted upon by a constant force and starting from a state of rest. The lines o—a, a—b, b—c, c—d, d—e, represent the distances passed over in successive units of time.

The lines o—1, 1—2, 2—3, 3—4, and 4—5 represent successive units of time. It is evident that if the quadrangle o—5—p^5—e were moved to the left at a constant velocity at the instant the particle p started to move, the particle p would describe in the quadrangle the curve o—p^1—p^2—p^3—p^4—p^5. This curve in reality illustrates the relative velocity between the accelerated particle and the uniformly moving quadrangle but may be designated as a "velocity curve," and will be so designated throughout the present specification. It is clear that this curve could be continued to infinity.

Referring now to Fig. 2, let us assume the particle p to be a ball acted upon by gravity, and that the distances o—a, a—b, b—c, c—d and d—e are respectively 16.08, 48.24, 80.40, 112.56 and 144.72 feet, which are the distances passed through by a falling body in successive seconds of time. Let o—1, 1—2, 2—3, 3—4 and 4—5, represent successive seconds of time. The scale is 16.08 feet to a divison. If, now, the figure o—5—p^5—e be moved to the left at any rate as for example 160.80 feet per second, the ball p will move relative to the figure o—5—p^5—e along a curve p—p^5.

Fig. 3 illustrates a different set of conditions. By the uniform movement of the figure o—p^5—5, we desire, in this instance, to transmit to the ball p a constantly accelerated motion along the path o—e. This represents the conditions in the case of a disk fan or screw propeller. If the ball p were guided in a slot so that it could not deviate from the straight line, it is evident that a constant acceleration would be transmitted to it in a line at right angles to the motion of the quadrangle if it were caused to move relative to the quadrangle along a line o—p^5, which corresponds with the velocity curve of Figs. 1 and 2. If the right line motion of the ball along the slot o—e were transmitted by a series of blades or ridges firmly mounted on the quadrilateral along the line o—p^5, it is evident that the force applied to the ball beyond the ridges would always be at right angles to a line normal to the curve of ridges at the point of contact and it follows that there would be an increased tendency to cause the ball to deviate from the straight line o e and to assume a path at an angle to it.

As has already been stated, however, it is the purpose of this invention to utilize the action of a disk fan or screw propeller to cause a fluid to receive a constant acceleration in a straight line, it is evident however that if a stream of water or air flowing along a pipe has any motion except in line with the axis of the pipe, such as a spiral motion, there is a loss of energy and efficiency proportional to the lateral or spiral motion.

To correct the constant and increasing tendency of a moving particle, driven by the ridge corresponding in position to the "velocity curve," to deviate from a straight line, it is proposed to cut the ridge into segments, and to introduce between the segments stationary pieces corresponding to the slot of Fig. 3 of such shape that particles, as they leave each segment of the ridge, shall be delivered to the next series of segments in straight lines at right angles to the motion of the impelling blades or ridges. This arrangement is illustrated in Fig. 4 where a number of such blades or ridges appear, cut into segments, and having interposed between the members of each series of segments stationary blades, 6, 6, as shown, these blades being at right angles to the line of motion of the segments. It is proposed to mount these segments radially upon a rotating shaft inclosed in a casing, which casing shall hold the stationary blades. Under such circumstances, particles of matter acted upon by the segments or moving blades, 7, 7, 7, 7, 7, 7, receive a certain velocity and leave the blades not in a line at right angles to the plane of rotation, but in a line normal to each of the blades. The stationary blades 6, 6, 6, 6, serve to change their direction and deliver them to the second series of moving blades, 8, 8, 8, 8, 8, 8, in a line at right angles to the plane of rotation. The blades 8, 8, accelerate the velocity of the moving particles and the next succeeding series of stationary blades 6, 6, correct their angularity of motion until finally the particles are discharged between the blades 6, 6, shown at the bottom of Fig. 4, at the desired velocity and in a line parallel to the axis of rotation. While this arrangement provides for the delivery of the moving particles in the manner indicated, yet it is evident that if the casing inclosing the revolving parts were of uniform cross section, the stream of particles would have to enter the casing at the same velocity at which they were discharged in order to keep the casing full. To insure that each series of blades shall add to the moving stream its increment of velocity, the area of the cross section through which the stream is flowing must decrease as the velocity increases.

Fig. 5 illustrates at 20 the shape of the pipe whose cross sectional area decreases in proportion to the increase in velocity due to a constant force.

Fig. 6 shows at 21 a similar illustration of a casing having mounted in it the stationary blades, 22, 22, and movable blades, 23, 23. The casing decreases in cross sectional area as the velocity increases and the successive series of blades increase in pitch in proportion to the acceleration; and between the members of each series of movable blades are arranged the stationary blades for the purpose described. It is evident, however, that in the arrangement illustrated in Fig. 6, the centrifugal force would cause the fluid to press against the casing and the contraction of the walls would accentuate this and cause a loss of efficiency. This is corrected by the organization illustrated in Fig. 7 where is illustrated an efficient apparatus for accomplishing the purposes of my invention. The casing, 24, in this instance is made straight, and the number of movable blades 23 is increased by dividing the ridges or blades corresponding in position to the "velocity curve" into smaller segments. The blades are mounted upon a conical shaped piece, 25, which in turn is secured upon a shaft, 26, mounted in bearings, 27, 27, in the casing 24. The conical shaped piece, 25, is of such curvature that the volume between it and the casing decreases in proportion as the velocity of the stream increases. The blades 23, 23, are mounted in series upon the cone, 25, and are of such a curvature that together they would form the proper "velocity curve."

Between the members of each successive series of movable blades are mounted stationary blades, 28, 28, the same being rigidly attached to the casing 24. Any desired number of movable and stationary blades may form a series. To avoid complication in the drawing, the cone 25 has been shown as carrying only a small number of movable blades and the casing a small number of stationary blades. The operation is similar to that previously described in connection with Fig. 4.

If the apparatus were immersed in water far enough to cover the first series of movable blades, it is evident that the water would be forced through the apparatus at a constantly accelerated velocity until discharged at the outlet, 30. Similarly, when operating as a fan, air would be forced through at a constantly increasing rate of speed. Used either as a blower or a pump, the principles remain the same, although the number and shape of the blades may be altered to suit different conditions.

By a reversal of the action under conditions which would force steam in a direction reverse to that indicated in the foregoing, the apparatus might serve the purposes of a steam turbine, as will be readily understood.

I claim as my invention:—

1. A rotary fluid compressor comprising a stationary casing, a rotor mounted within said casing, a fluid passage between said casing and said rotor, decreasing in cross-sectional area in the direction of the fluid flow and in direct proportion to the desired increase in fluid velocity, alternate annular rows of propeller blades and guide vanes located in said passage and mounted on said rotor and casing respectively, the propeller blades increasing in pitch in the direction of the fluid flow so that the working faces of the blades conform in position to the velocity curve of the fluid.

2. A rotary fluid motor comprising a stationary casing, a rotor mounted within said casing, a fluid passage between said casing and said rotor decreasing in cross-sectional area in the direction of the fluid flow and in direct proportion to the desired increase in fluid velocity, alternate annular rows of propeller blades and guide vanes located in said passage and mounted on said rotor and said casing respectively, the propeller blades increasing in pitch in the direction of the fluid flow so that the working faces of the blades conform in position to the velocity curve of the fluid and the guide vanes arranged so that their working faces are parallel to the axis of the rotor.

Signed at New York, in the county of New York, and State of New York, this 25th, day of August, A. D. 1903.

ALEXANDER M. GOW.

Witnesses:
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GEORGE H. STOCKBRIDGE.