No. 771,857. PATENTED OCT. 11, 1904.

W. BROADBENT.

PNEUMATIC GOLD SEPARATOR.

APPLICATION FILED JAN. 23, 1904.

NO MODEL. 5 SHEETS—SHEET 1.

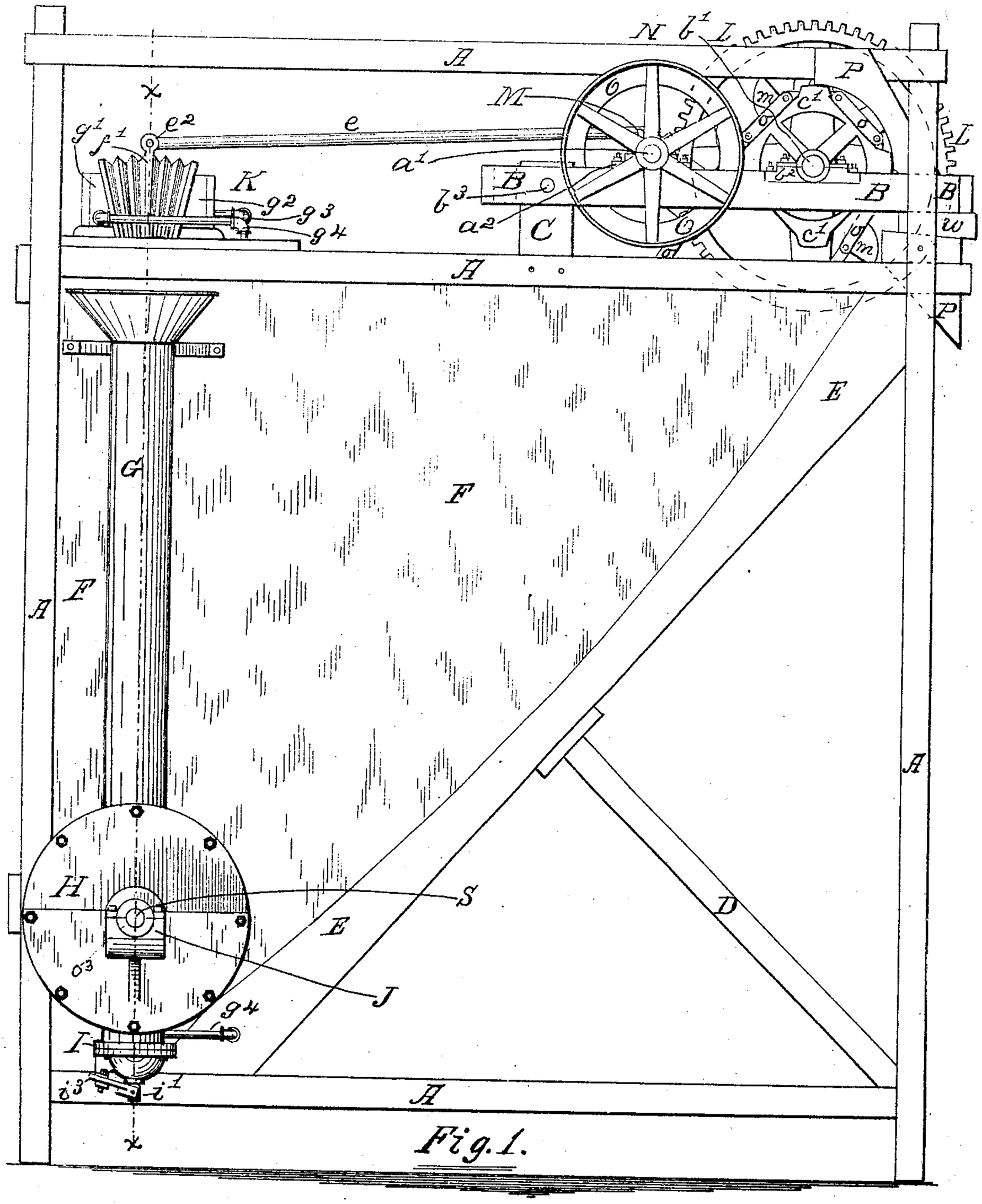

Fig. 1.

Witnesses:
H. C. Healy
Wm. R. Hall

Inventor:
William Broadbent
By J. M. Thomas
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NO MODEL. 5 SHEETS—SHEET 2.

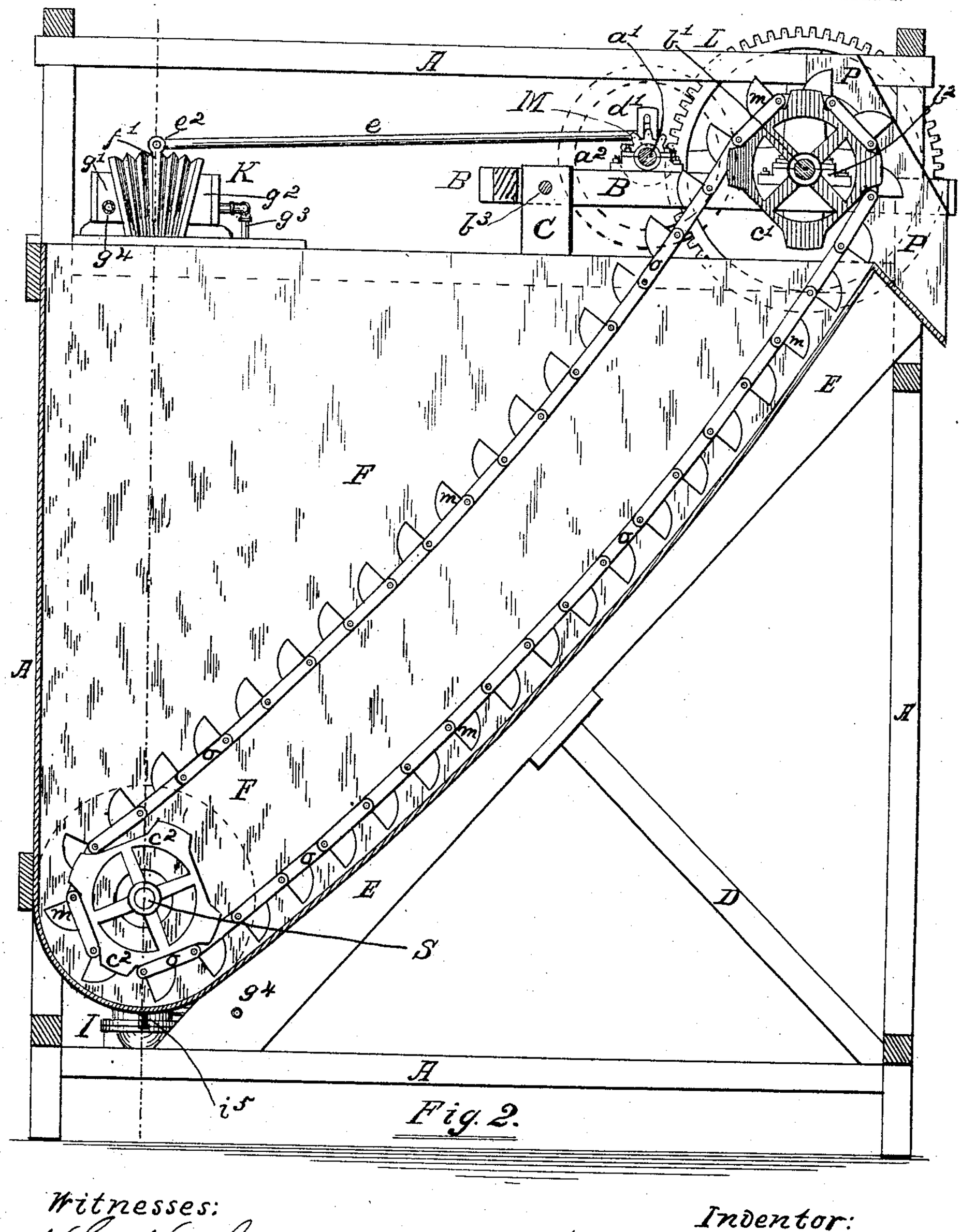

Fig. 2.

Witnesses:
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NO MODEL. 5 SHEETS—SHEET 3.

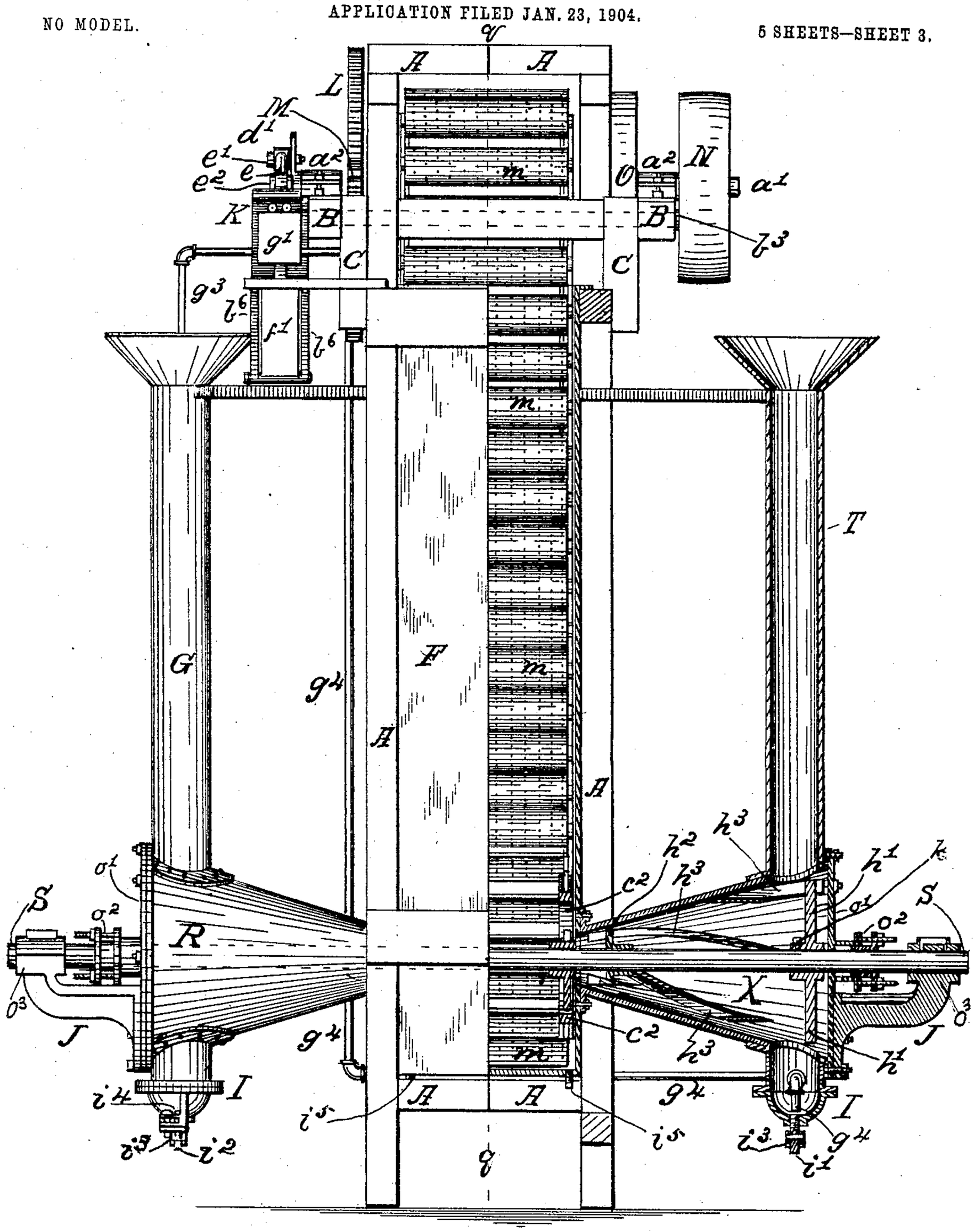

Fig. 3.

Witnesses:
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NO MODEL. 5 SHEETS—SHEET 4.

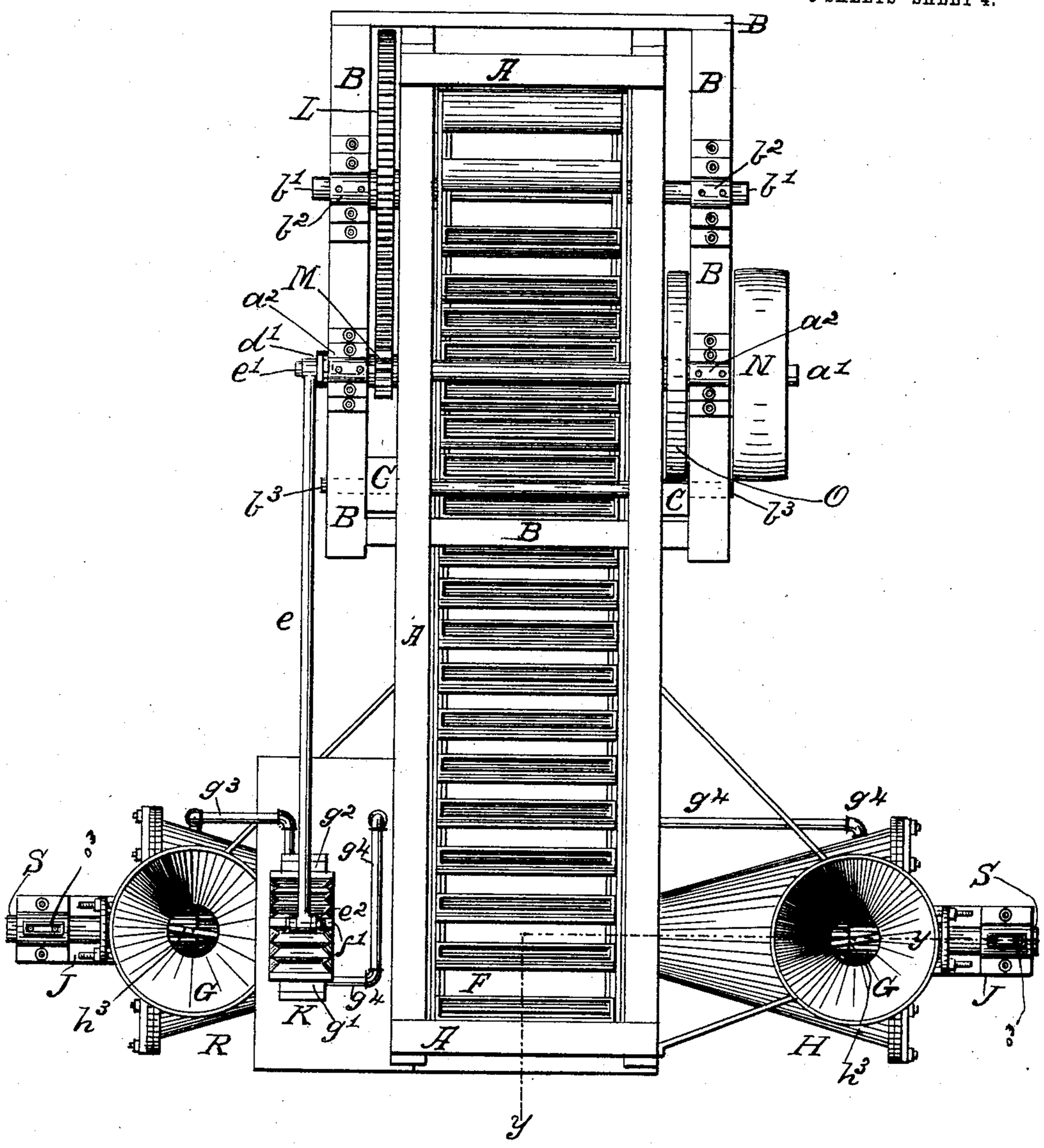

Fig. 4.

Witnesses:
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APPLICATION FILED JAN. 23, 1904.

NO MODEL. 5 SHEETS—SHEET 5.

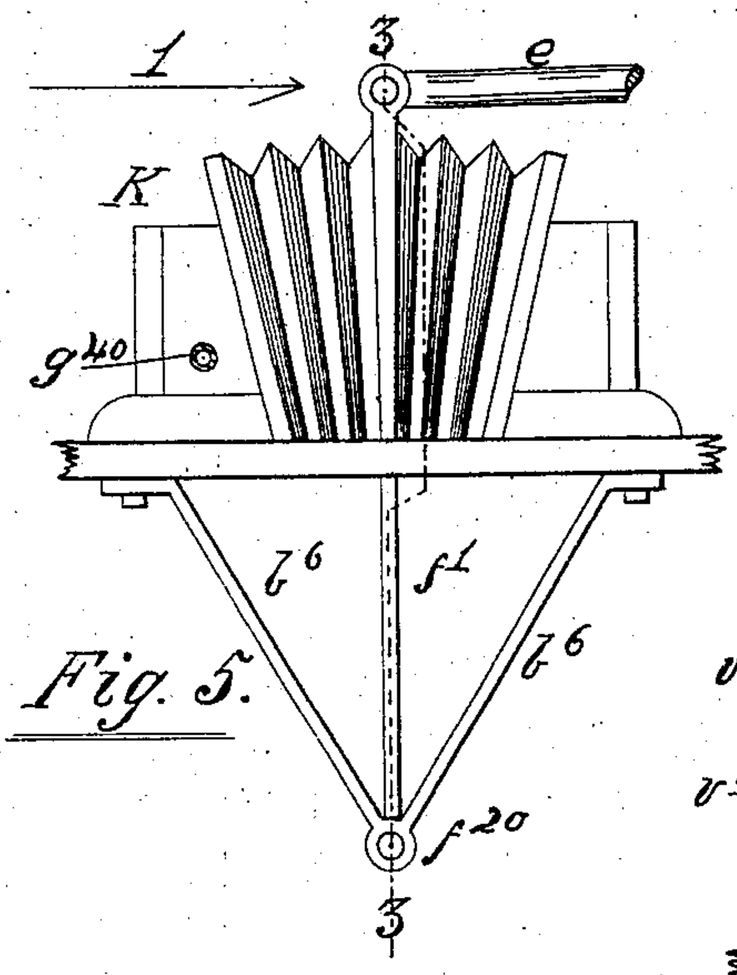

Fig. 5.

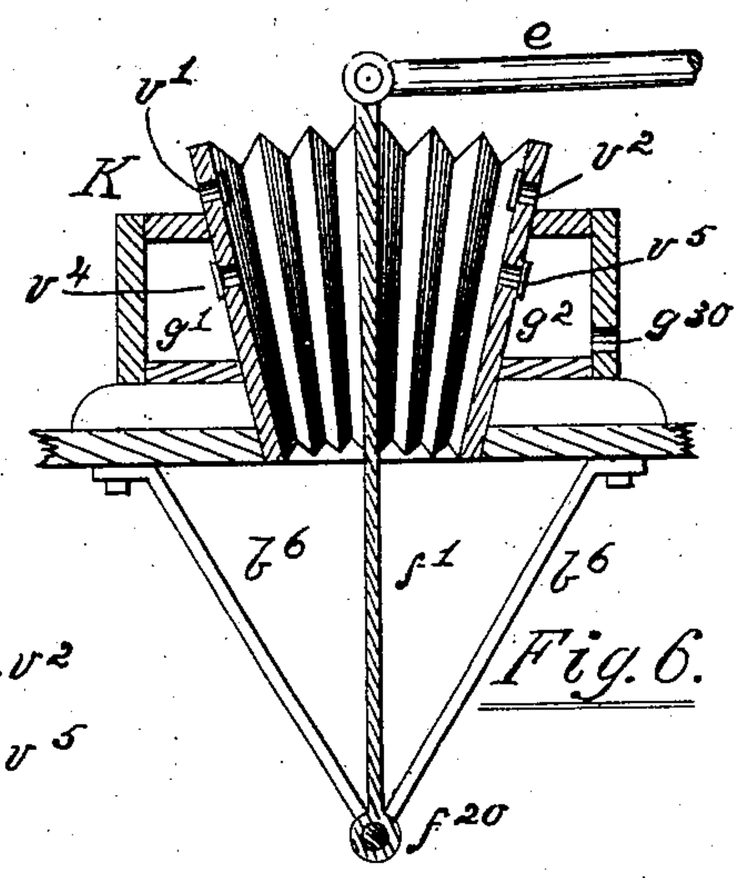

Fig. 6.

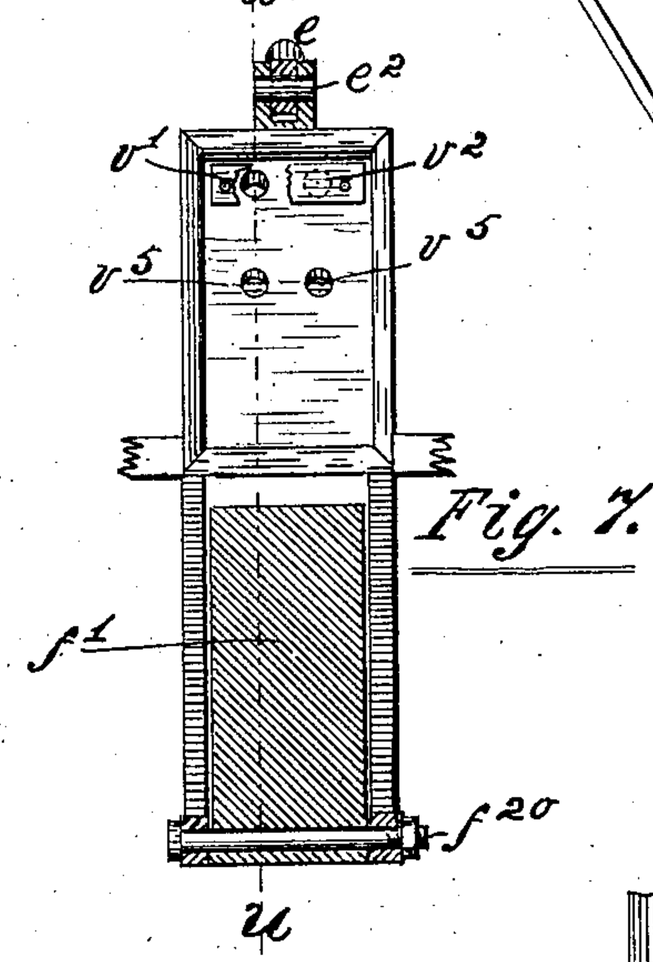

Fig. 7.

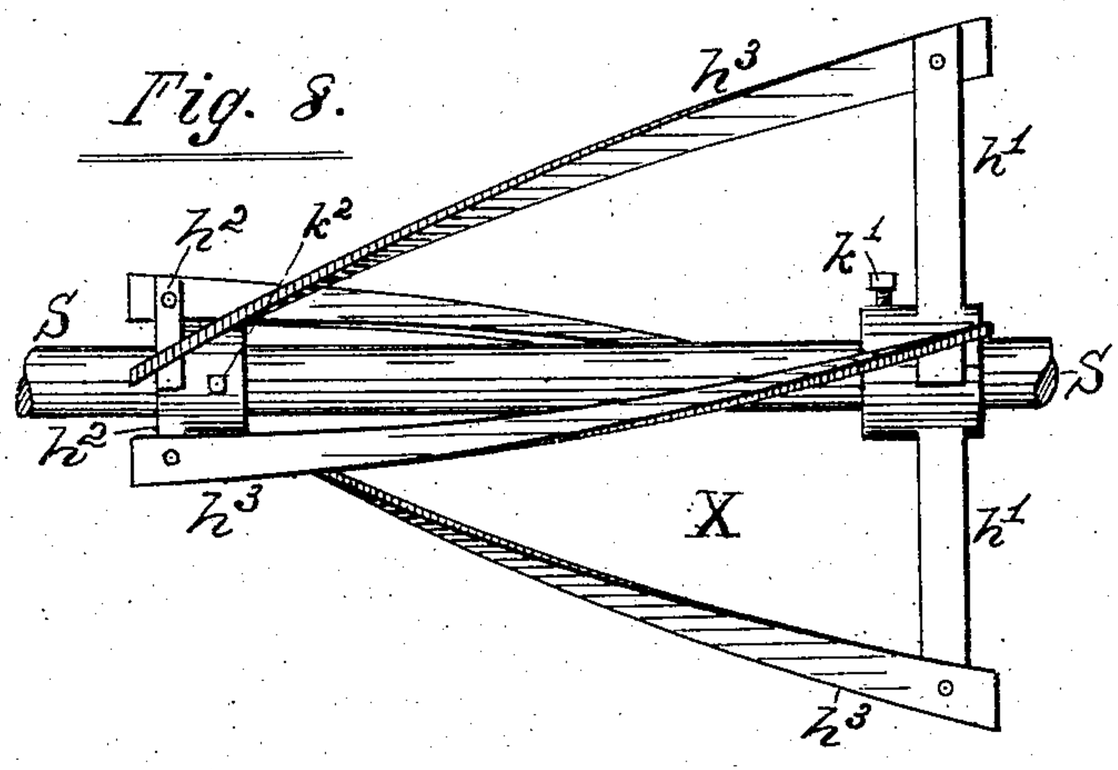

Fig. 8.

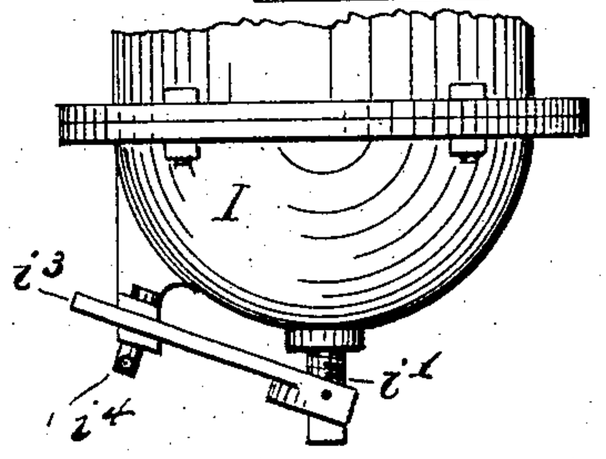

Fig. 9.

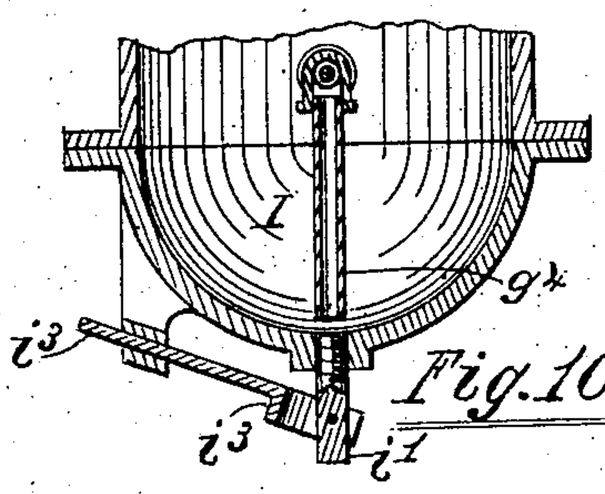

Fig. 10.

Witnesses:
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Inventor:
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No. 771,857. Patented October 11, 1904.

UNITED STATES PATENT OFFICE.

WILLIAM BROADBENT, OF SALT LAKE CITY, UTAH.

PNEUMATIC GOLD-SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 771,857, dated October 11, 1904.

Application filed January 23, 1904. Serial No. 190,412. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM BROADBENT, a citizen of the United States, residing at Salt Lake City, Salt Lake county, State of Utah, have invented a new and useful Machine for Separating Gold from Sand or other Material by Mechanical Means and with the Use of but Little Water, of which the following is a specification.

The method of saving gold by bringing it in contact with mercury is well known. The saving of gold by agitation in water by sluicing, by rockers, by jigs, and in pans are all old; but the combination of all those old methods in one light, cheap, and easily-moved machine using but little water, together with the novel method of agitation by air impulses as applied to placer-gold, is the purpose of this invention; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

Similar letters of reference refer to like parts through the several views.

I have fully and clearly illustrated my invention in the accompanying drawings, wherein—

Figure 1 represents exterior side view elevation. Fig. 2 represents a vertical longitudinal section on plane of line *q q* of Fig. 3. Fig. 3 represents a front view, partly in section, on line *x x* in Fig. 1 and line *y y* in Fig. 4. Fig. 4 represents a plan view looking down. Fig. 5 represents enlarged detail of air-pump, side view. Fig. 6 represents a detail vertical view of air-pump, in section, on line *u u* of Fig. 7. Fig. 7 represents an enlarged detail vertical view of transverse section on line *z z* of Fig. 5. Fig. 8 represents detail view of spiral agitator and conveyer X. Fig. 9 represents an enlarged detail view of gold-pocket I. Fig. 10 represents an enlarged detail vertical section of gold-pocket I on line *x x*, Fig. 1, and line *y y*, Fig. 4, showing locked nut i''.

Supported by a framework A and braces E and D is a tank F, built of suitable material, rectangular in form in horizontal section and triangular in vertical longitudinal section, with threaded tap-off plugs i^5 i^5 in the cylinder-formed bottom, as shown in Figs. 1, 2, and 4, to which is detachably secured near the bottom and one on either side two conically-shaped casings H and R, containing the conveyer-agitators X X. (See Fig. 3.) The conically-shaped casings H and R are each provided with removable heads o' o' and stuffing-box o^2 o^2 and also carrying journal-brackets J J, which carry shaft S, to which casings H and R at the top and near the larger diameter of said casings are secured feed-tubes G T. Opposite and on the lower side of said casings are secured gold-pockets I I, with tap-off plugs i'' i^2, with pivoted levers i^3 i^3, with lock-pins i^4 i^4, as shown in Figs. 3, 9, and 10.

Surmounting the tank and framework hereinbefore mentioned and pivoted to said framework by pivot b^3 is a yoke B, supported upon frame A by uprights C C and wedges *w w*, as shown in Fig. 1, which yoke B supports and carries driving-shaft a', working in bearings a^2 a^2, and upper elevator-shaft b', working in bearings b^2 b^2, as shown in Fig. 4.

Motion is imparted to the machine by power applied to driving-shaft a' through drive-wheel N and regulated by balance-wheel O. (See Fig. 4.) On driving-shaft a' is a pinion M, which engages spur-gear L, which is firmly secured to upper elevator-shaft b', which also carries secured thereto sprocket-wheels c' c', (see Fig. 2,) said sprocket-wheels carrying bucket-chains *o o* and imparting motion thereto. The bucket-chains *o o* are tightened or loosened by moving yoke B up or down upon pivot b^3 by inserting or removing wedges *w w*, to the links of which chains *o o* are secured perforated buckets *m m m*, &c. Within the lower extremity of bucket-chains *o o* are inclosed similar sprocket-wheels c^2 c^2, firmly secured to shaft S, to which shaft S motion is imparted by chains *o o*, which shaft S, supported by bearings o^3 o^3 upon brackets J J, also carries adjustably secured thereon two conveyer-agitators X X. Conveyer-agitator U works within casing R and X within casing H. They are constructed alike except that on

U the blades are disposed spirally to the right, while the blades on X are disposed spirally to the left of a plane $x\,x$, as shown in Fig. 1. A collar provided with spurs or spokes $h'\ h'\ h'$, &c., and one with shorter spokes $h^2\ h^2\ h^2$, &c., are adjustably secured to shaft S by set-screws $k'\ k^2$, which construction permits adjustment of conveyer-agitators X and X laterally on said shaft S as well as the angle of the spiral contour of feed-blades h^3, &c. At the end opposite drive-wheel N upon the shaft a' is firmly secured slotted crank d', (see Fig. 4,) within the slot of which is adjustably secured a stud-pin e', which stud-pin e' is inclosed by one end of rod e. The other end of rod e by pivot e^2 is connected to the upper end of diaphragm f' of air-pump K, working on pivot f^3. (See Figs. 5 and 6.) Secured to opposite sides of diaphragm f' is the bellows of air-pump K. The fixed walls of air-pump K are provided on one side with ingress-ports $v'\ v'$ and on the other with ingress-ports $v^2\ v^2$ and each provided with valves to prevent egress of air. Similar ports $v^4\ v^4\ v^5\ v^5$ are provided in the fixed walls of the said bellows of air-pump K, but located within air-chambers $g'\ g^2$ at either end of said air-pump K, serving as egress-ports, provided with valves to prevent the return of air expelled by movement of diaphragm f'. Secured to air-pump K at opening g^{40} is air-pipe g^4, as shown in Figs. 5 and 4. The other end of air-pipe g^4 is connected to and enters into gold-pocket I near the bottom of casing H (see Figs. 4, 3, 1, and 10) and terminates near the bottom of gold-pocket I directly over threaded tap-off plug i', which threaded tap-off plug i' is fitted with lever i^3. Secured to air-pump K at opening g^{30} (see Fig. 6) is air-pipe g^3, as shown in Fig. 4. The other end of air-pipe g^3 is connected to and enters into gold-pocket I near the bottom of casing R and terminates near the bottom of said gold-pocket I in the same manner as shown in Fig. 10.

The operation of the machine is as follows: The tank F, casings H and R, and feed-tubes G and T are partially filled with water, (motion having been imparted to the machine.) Suitably-sized gold-bearing material is then fed at a proper rate into feed-tubes G and T, which material is thoroughly agitated by blades $h^3\ h^3\ h^3$, &c., and the gold by its superior gravity tends to settle into the lowest point of gold-pockets I I. The size of the gold particles in a given character of ore will determine the rate of feed, as well as the spiral angle of the blades $h^3\ h^3$, &c. By reason of the incline position of the casings H and R gold particles tend to gravitate toward gold-pockets I I. Now to prevent stratification in said gold-pockets and to permit gold to find the lowest point possible is the office of the air-bubbles, displacing the pulp in their rise, thus affording a secure hiding-place for any gold that may enter the said pockets, which tendency is greatly augmented by the series of air impulses accompanied by air-bubbles from the action of the air-pump used in connection therewith and the manner in which said air-bubbles are injected. With a given rate of feed to the gold-bearing material the greater the angle given to the spiral blades h^3 h^3, &c., the more rapid the tendency of conveyance to the pulp through casings H and R and the less time given to agitation. The amount of agitation in gold-pockets I I is determined by the air impulses given through air-pipes g^3 and g^4. The contents of gold-pockets I I are alternately at rest and in upward and downward motion, thus preventing the stratification of the material in said pockets and lower parts of casings H and R and permitting the settling of the gold in pockets I I and below the discharge of air-pipe $g^3\ g^4$. Any suitable means for forcing air by puffs into gold-pockets I I will answer, so that each side is independent of the other. The bellows-pump shown is one form that may be used. The amount of air required to cause the agitation desired in gold-pockets I I is regulated by the length of stroke of rod e, which is determined by the adjustable stud-pin d'. The manner in which air-pipes $g^3\ g^4$ are placed in gold-pockets I I, giving a downward impulse to air-bubbles when forced out of air-pipes g^3 and g^4, prevents particles of material from clogging said air-pipes, and the air in each pipe being actuated independently of the other allows the proper amount of air impulses to either side should one get out of fix. Should either side in any way become stopped, the air, actuated independently as it is, from the other side would be compressed until the stoppage was removed and not effect in any way the other side. The air discharging downwardly and near the bottom of gold-pockets I I does not agitate the separated gold, but does agitate all pulp above that point as it escapes to the surface of the water in feed-tubes G and T. Should any particles of gold escape from the gold-pockets I and I and be carried up the incline bottoms of casings H and R and fall into tank F with the tailings, it is again agitated by the movement of perforated buckets $m\ m$, &c., and caught in a bath of mercury that may be used when desired in the cylindrical part of tank F and removed when desired with the mercury through threaded tap-off plugs i^5 and i^5.

I claim as new and desire to secure by Letters Patent of the United States—

1. The combination with the tank of two side casings with feed-openings therein, a depression provided with an opening and closure therefor in the bottom of each side casing, a shaft extending through the side casings and tank carrying adjustable conveyer-blades within the side casings, sprocket-wheels on said shaft for driving it from a second shaft, and carrying perforated buckets, and

means for delivering short puffs of air within the side openings near the bottom of the depressions.

2. The combination of a tank of two frusto-conical casings with feed-openings therein, a depression provided with an opening and closure therefor in the bottom of each side casing, a shaft extending through the side casings and tank, carrying adjustable conveyer-agitators within the frusto-conical casings, sprocket-wheels on said shaft for driving it from a second shaft, and means for delivering short puffs of air within the depressions in said frusto-conical casings and near the bottom of the depressions.

3. The combination with a tank of two side casings with feed-openings therein, a depression provided with an opening and a closure therefor in the bottom of each side casing, a shaft extending through the side casings and tank carrying conveyer-blades within the side casings, sprocket-wheels on said shaft for driving it from a second shaft, and means for delivering short puffs of air within the side openings near the bottom of the depressions.

4. The combination of frusto-conical casings secured to a tank, of a shaft carrying adjustable conveyer-agitators within the casings, also carrying sprocket-wheels, chains, and perforated buckets within the tank, with means for forcing short puffs of air into the casings near the bottom thereof.

5. The combination with a tank with cylindrically-formed bottom, of two side casings with feed-openings therein, a gold pocket provided with an opening and closure therefor in the bottom of each side casing, a shaft extending through the side casings and tank, carrying adjustable conveyer-blades within the side casings, sprocket-wheels on said shaft for driving it from a second shaft, and carrying perforated buckets, and means for delivering short puffs of air within said openings near the bottom of the depressions to each of said casings, each side acting independently of the other.

6. The combination of a tank of two frusto-conical casings with feed-openings therein, a depression provided with an opening and closure therefor in the bottom of each side casing, and stuffing-boxes attached to or integral therewith, a shaft extending through the side casings and tank carrying adjustable conveyer-agitators within the frusto-conical casings, sprocket-wheels on said shaft for driving it from a second shaft and means for delivering short puffs of air within the depressions in said frusto-conical casings and near the bottom of the depressions.

7. The combination with two frusto-conical casings, of a shaft carrying conveyer-agitators within the casings, and means for forcing short puffs of air into the casings near the bottom thereof.

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Witnesses:
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H. C. HEALY.