No. 710,370. Patented Sept. 30, 1902.

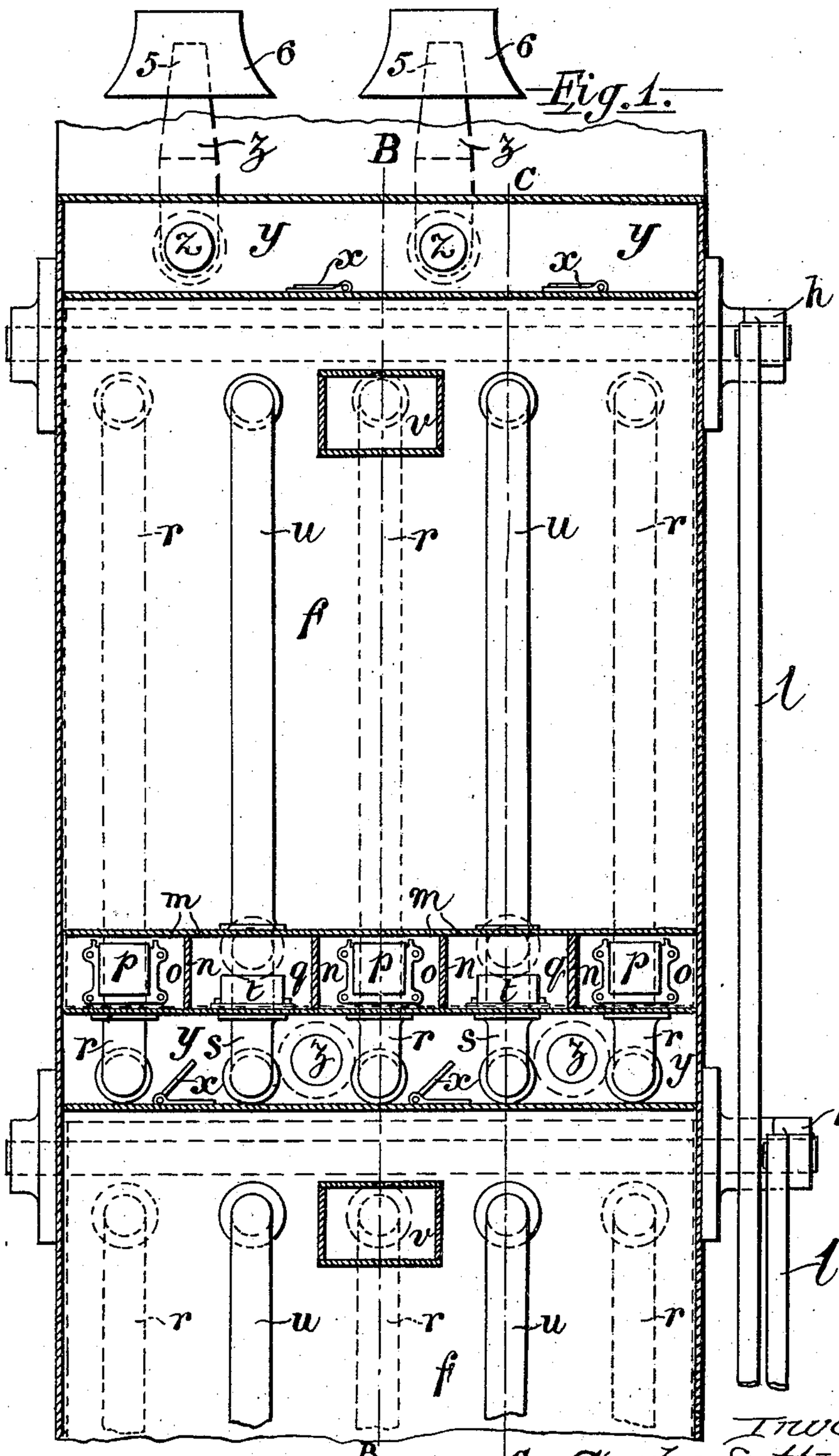
C. SCOTT-SNELL.

METHOD OF PRODUCING DRAFT.

(Application filed Oct. 28, 1901.)

(No Model.) 5 Sheets—Sheet 1.

Fig. 1.



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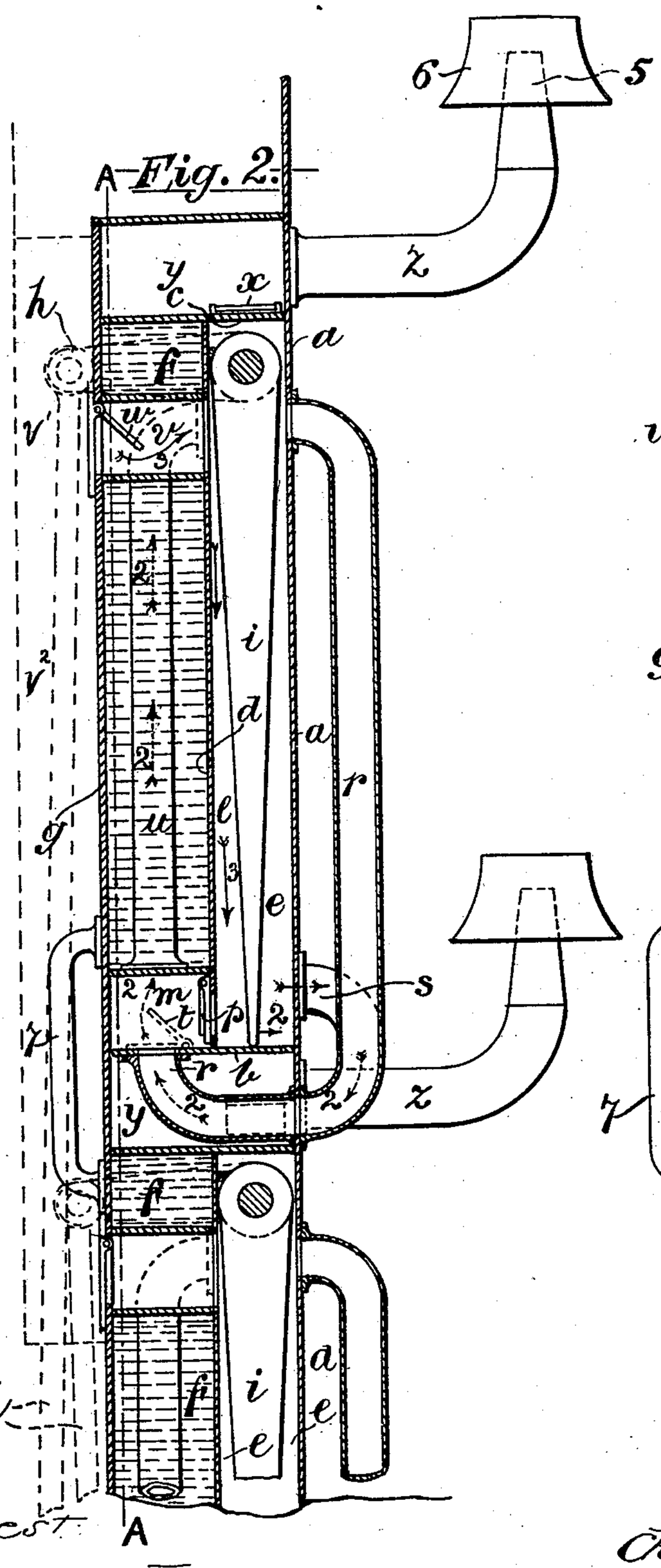

Fig. 2.

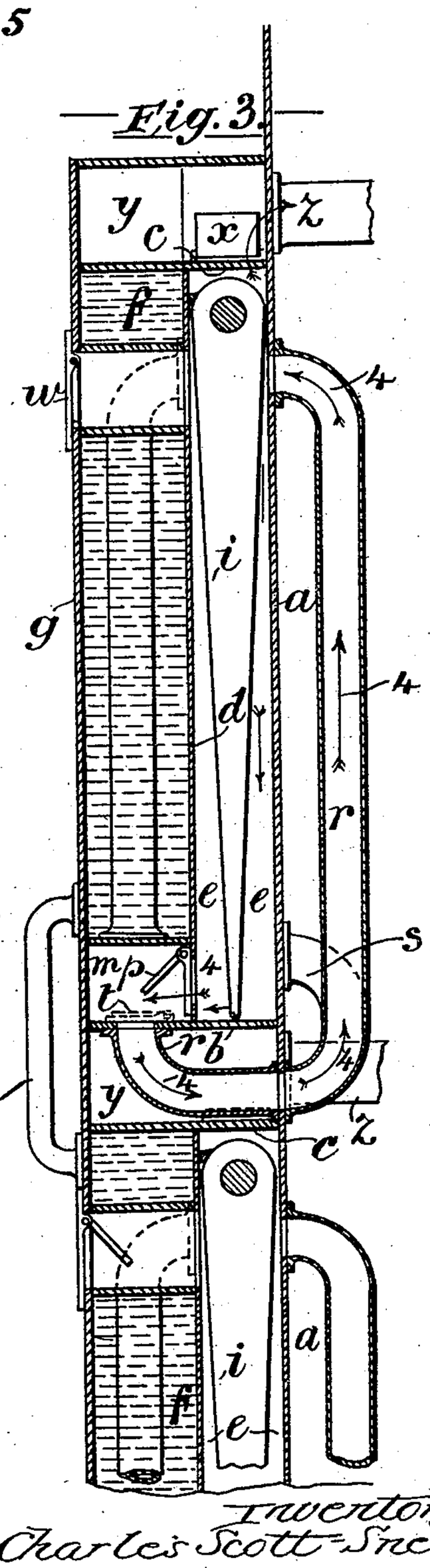

Fig. 3.

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(No Model.) 5 Sheets—Sheet 3.

Fig. 2a.

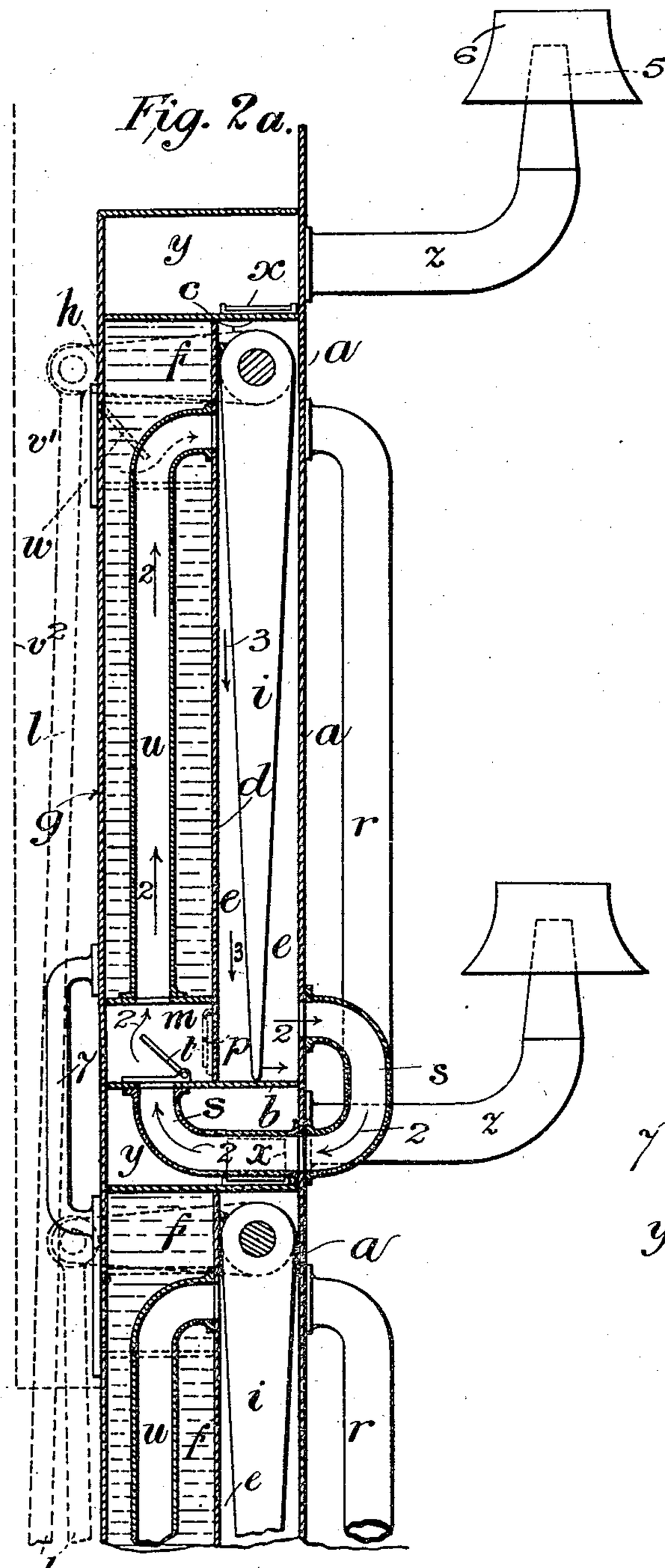
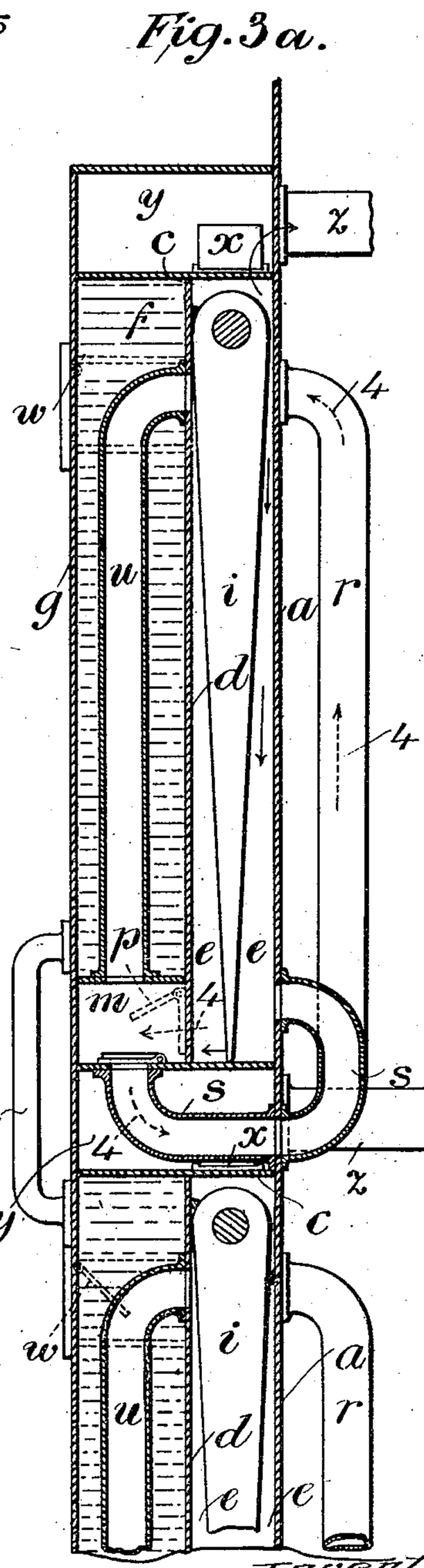


Fig. 3a.



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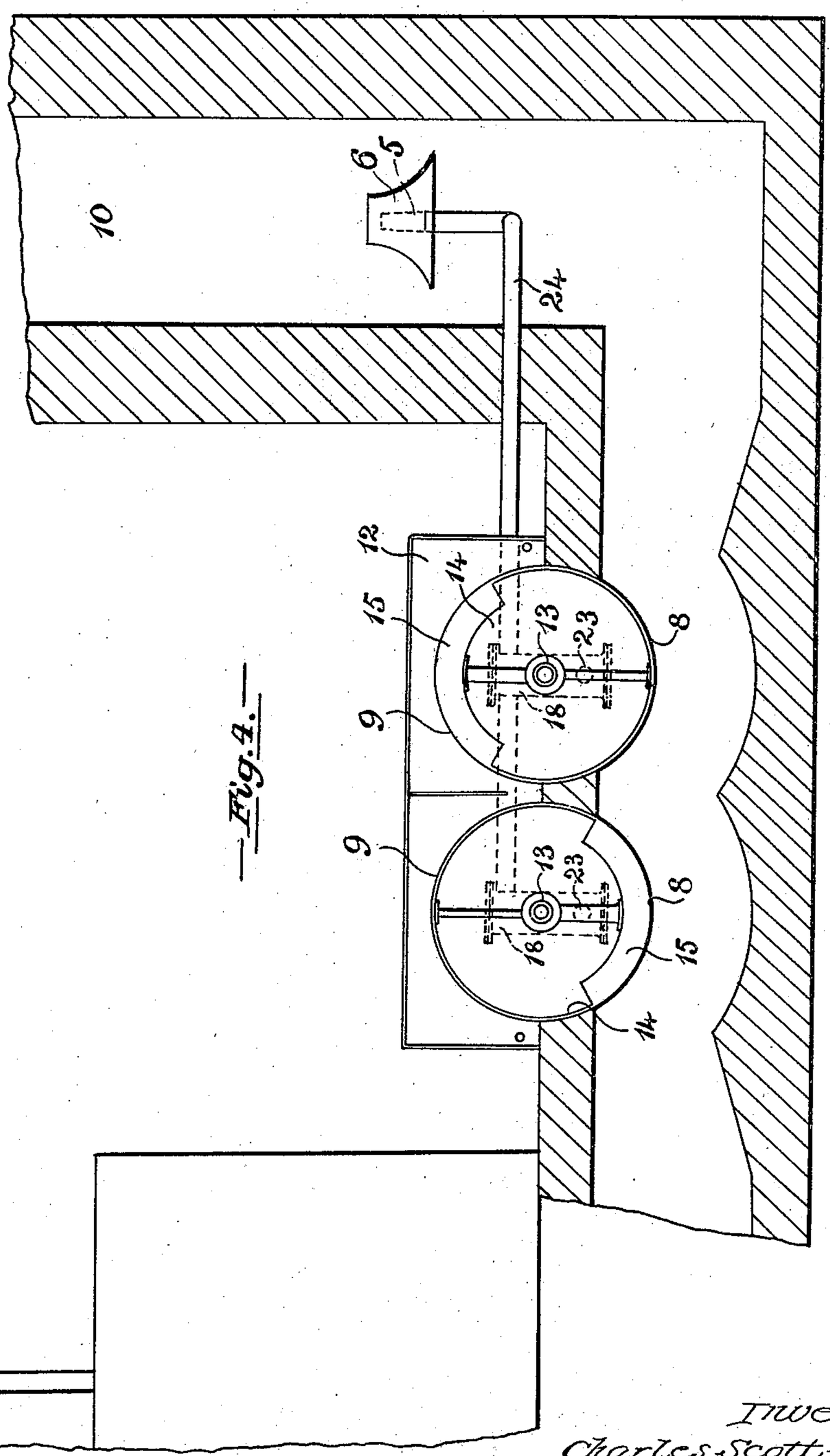
(No Model.) 5 Sheets—Sheet 4.



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(No Model.) 5 Sheets—Sheet 5.

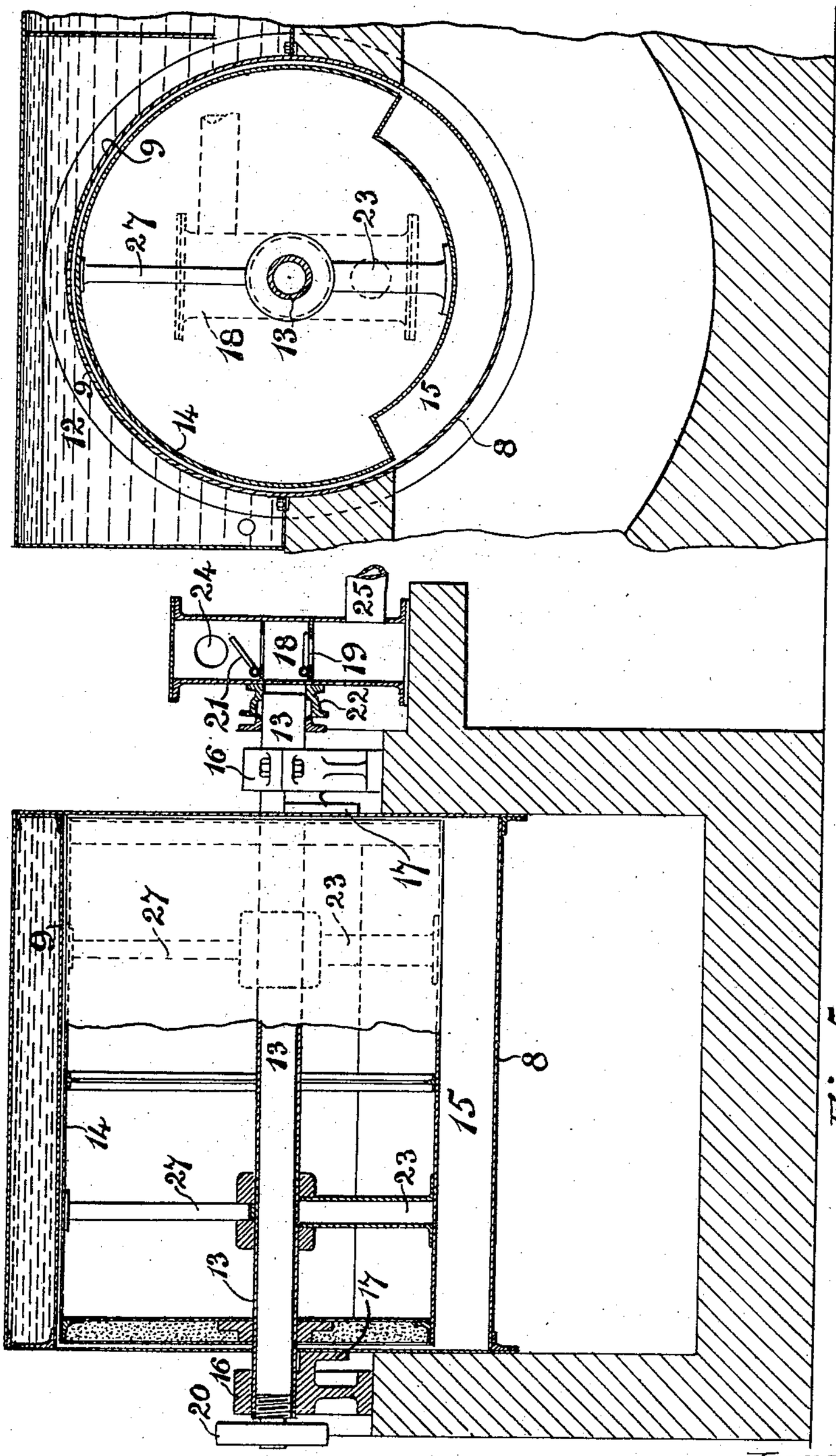

Fig. 6.

Fig. 5.

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UNITED STATES PATENT OFFICE.

CHARLES SCOTT-SNELL, OF SALTASH, ENGLAND.

METHOD OF PRODUCING DRAFT.

SPECIFICATION forming part of Letters Patent No. 710,370, dated September 30, 1902.

Application filed October 28, 1901. Serial No. 80,355. (No model.)

To all whom it may concern:

Be it known that I, CHARLES SCOTT-SNELL, engineer, a subject of the King of Great Britain and Ireland, residing at Culver Park, Saltash, in the county of Cornwall, England, have invented certain new and useful Improvements in Methods of Producing Draft, (for which I have made application for Letters Patent in Great Britain, No. 7,154, dated the 4th of April, 1901,) of which the following is a specification.

My invention relates to a new method or process for producing forced or induced draft in steam-boilers and other apparatus in which solid, liquid, or gaseous fuel is burned under forced or induced draft, and has for its object to effect such increased draft in a more economical manner than hitherto.

My invention consists generally in effecting forced or induced draft by means of waste heat from combustion of fuel in the boiler or other furnace, the waste heat operating upon elastic fluid to produce alternate expansion and contraction in such a manner that a quantity of the elastic fluid is delivered either into the waste-gas flue in such a way as to effect induced draft or into the air-inlet of the furnace in such a way as to effect forced draft.

In carrying my invention into effect generally as applied to a steam-boiler I utilize the heat in the products of combustion after they have effected their primary purpose, such as raising steam in a boiler, and are on their way to be discharged into the atmosphere. The waste heat when brought into contact with cold air tends to produce expansion of the air, and if the air be within a closed vessel, so that the expansion is wholly or partially prevented, a rise of pressure ensues. The air under pressure so produced may be discharged into the uptake leading into the funnel to induce a draft or into the ash-pit or other suitable place, so that it will by its pressure increase the rate of combustion in the furnace by effecting what is known as "forced draft." In the forced-draft arrangement the air may be heated before entering the furnace by passing it into contact with surfaces heated by the waste gases. In order to maintain the continuity of supply of air under pressure, I cause the remaining volume of heated air within the inclosed vessel to fall in temperature. The fall in temperature may be effected by bringing this volume into contact with a surface sufficiently lower in temperature than the source of heat, or it may be effected by cutting off the supply of heat acting upon the inclosed air. In either case the fall must be enough to produce a partial vacuum within the vessel and cause an influx of more air. The supply of fresh air is drawn in through a check-valve to prevent escape, when under the influence of heat the air expands, and in order to prevent the heated air already delivered from being drawn back a second check-valve is fitted to the eduction-outlet.

The alternate heating and cooling of the air (in order to maintain continuity of supply) may be produced by accumulating such air in contact with a surface heated by the products of combustion, such as the surface of the uptake or other portion of the system traversed by the heated products, and afterward against a surface cooled by a water-jacket, or the same result may be produced by shielding the said heated surface and uncovering the previously-shielded cool surface to produce condensation and then afterward shielding the cooled surface and uncovering the heated surface to produce pressure.

It will be obvious that in applying my invention to gas-producers the wall of the producer may form the hot side of my apparatus.

In the accompanying drawings, Figure 1 is a sectional elevation of one form of my invention as applied to a marine boiler, the section being taken on the line A A of Fig. 2. Figs. 2 and 2ª are sectional end views of the same on the lines B B, C C, respectively, of Fig. 1, showing by arrows the course of the air during the air-suction stroke. Figs. 3 and 3ª are similar views of the same, but showing by arrows the course of the air during the discharge movement of the displacer. Fig. 4 is a diagrammatic view of another form of my invention as applied to a Cornish or land boiler. Fig. 5 is a longitudinal section, and Fig. 6 is a cross-section, of this blower on an enlarged scale.

In carrying my invention into effect according to one modification as applied to a marine steam-boiler I form an air-chamber *e* against

the outer surface of the boiler-uptake *a* by means of plates *b c d* and the necessary side plates. (Not shown.) Against the wall *d* of the air-chamber I construct a water-tank *f*, extending from the top of the air-chamber to within a short distance from its bottom. In this way one side of the air-chamber is maintained at a high temperature by the gases passing up the uptake, and the other side is kept cool by the water-jacket. Within the air-chamber *e* I suspend or pivot on a horizontal axis a vertical displacer *i*, preferably wedge-shaped in cross-section. The displacer is capable of swinging on its axis like a punka when operated by a lever in any suitable manner. In order to prevent the transmission of heat from the hot side of the displacer to the cool side thereof, the displacer may be formed hollow, or it may be constructed of any suitable heat-insulating material. The plate *b*, forming the bottom of the air-chamber *e*, is carried along to meet a continuation of the front wall *g* of the water-tank *f*, so as to form an air-tight compartment *m* under the water-tank. I divide this compartment into a number of smaller compartments or boxes *o* and *q* by means of partitions *n*, as seen in Fig. 1. Openings controlled by valves *p* in the wall *d* permit direct communication between every box *o* and the bottom of the cool side of the air-chamber, and permanent communication between each of these boxes *o* and the top of the hot side of the air-chamber is effected by means of tubes *r*, which lead from the bottom of the plate *b* through the uptake-wall *a* and into the upper part of the air-chamber. The boxes *q* communicate with the bottom of the hot side of the air-chamber through the tubes *s*, which are provided with valves *t*, opening into the boxes *q*. The cooled upper portion of the air-chamber and the boxes *q* are also connected together by tubes *u*, passing from the top of the latter through the water-tank to the top of the air-chamber.

The supply of fresh air to the air-chamber is obtained by means of a duct *v*, which passes through the water-tank and is provided with a non-return valve *w*. The air-duct *v* is fed through a pipe *v'*, a side v^2 of which is shown dotted in Fig. 2, from a suitable open space. A lift-valve *x* on the top of the air-chamber permits air to be discharged into a reservoir or compartment *y*, whence it passes by a pipe *z* (see Figs. 2 and 3) into the uptake to cause a draft.

The blower operates in this manner: When the displacer *i* is moved from its extreme left-hand position to its extreme right-hand position, the hot air in the diminishing space between the hot wall *a* and the displacer is delivered through the pipes *s*, valves *t*, and pipes *u* into the cool space of the air-chamber. In passing through the pipes *u*, however, the displaced air is cooled and reduced in volume, so that a supply of fresh air is needed to fill the cool space of the chamber with air at atmospheric pressure. This air is automatically supplied by suction through the valve *w* and air-duct *v*.

In Figs. 2 and 2^a the course of the air expelled from the hot side of the chamber to the cooled side is shown by the arrows 2 2, and the course of the fresh air drawn into the cool side is shown by the arrows 3 3, the arrows being shown full or dotted, according as the pipes are in section or not. When the displacer moves from its extreme right-hand position to its extreme left-hand position, the air which filled the cool space of the air-chamber *e* is displaced through the valves *p* and pipes *r* into the heated side of the chamber *e*, as indicated by the arrows 4 4 in Figs. 3 and 3^a. By passing through the hot pipes *r* and by coming in contact with the hot wall *a* of the chamber *e* the air becomes highly heated, thus causing a rise in pressure and producing a considerable volume of air in excess of that required to fill the space between the displacer *i* and the hot wall *a* at atmospheric pressure. This surplus air lifts the valve *x* and then escapes into the compartment *y*, whence it passes through the pipe *z* and blows through an upwardly-directed nozzle 5, situated in the uptake of the boiler. In this manner an air-blast is produced which induces strong draft in the funnel or smoke-stack of the boiler. The nozzles 5 are fitted with conical mantles or rings 6 to increase the effective work of the blast upon the furnace-gases. The heat passing away in the products of combustion is thus caused to increase the draft in the boiler-furnace.

I may arrange a number of air-chambers and water-tanks one above another, as shown in Figs. 1 to 3^a, the latter being connected together by suitable pipes 7, as shown in Figs. 2 and 3^a, and I may so operate the displacers that one shall be delivering air to the nozzle while the other is drawing in a fresh supply of air. In this manner a continuous blast of air is maintained in the uptake.

It is obvious that my blowers may be arranged in many different ways without departing from my invention. I may, for instance, place two air-chambers side by side or one on each side of the boiler-uptake, where the latter is suitable for such an arrangement, and I may in each case operate the displacers alternately, so as to produce a continuous blast in the uptake. The swinging of the displacers may be positively or automatically effected by any suitable means; but I prefer to use positively-acting levers *h* and connecting-rods *l*, (shown by full lines in Fig. 1 and by dotted lines in Fig. 2,) operated by a small steam-engine for this purpose.

In applying my invention to land-boilers, as shown in Figs. 4 to 6, I provide a circular metal casing formed in two portions 8 and 9, bolted or otherwise secured together. This casing is sunk into the flue between the boiler and the smoke-stack 10, so that most of the outside surface of the portion 8 is in direct

contact with the hot gases in the flue, and is consequently maintained at a high temperature. The upper portion 9 forms part of a tank 12, containing water, which covers the top of the casing and keeps it cool. Concentrically within this casing I arrange a hollow rotatable drum 14, preferably constructed of thin sheet metal and secured to a hollow shaft 13. The drum is of such a length as to leave only a small clearance between its ends and the ends of the casing, while its diameter is only slightly smaller than the inside of the casing. The drum is constructed with a recess along its surface parallel to its axis, the width of the recess being about equal to that part of the circumference of the casing which is in contact with the flue-gases. The air-space 15, formed between the recessed part of the drum and the inside of the casing, is by the rotation of the drum alternately brought opposite to the hot part of the casing and opposite the water-cooled part.

The hollow shaft 13 is supported at each end by bearings 16, and the ends of the casing are attached to projections 17, formed on these bearing-blocks. One end of the shaft 13 is closed and carries a belt-pulley 20, operated by a suitable motor, whereby the shaft and drum are rotated within the casing. The other end of the hollow shaft is led into a valve-chest 18, having a suction-valve 19 and a delivery-valve 21. The valve-chest is provided with a stuffing-box 22 to prevent the escape of air, and it may be secured to a firm base in any suitable manner.

The air-space 15 is in direct communication with the hollow shaft by means of one or more pipes 23, fixed to the drum and the shaft, and the drums may be stiffened by stays 27, placed diametrically opposite the pipes 23.

The operation of this blower is as follows: When the drum is in the position shown in Figs. 5 and 6, with the air-space adjacent to the hot surface of the casing, the air expands and blows through the pipes 23 and hollow shaft 13 into the valve-chest 18, whence it passes by the delivery-valve 21 and a service-pipe 24 to the smoke-stack in the manner hereinbefore described with reference to Figs. 2 and 3 and as shown in Fig. 4. As the drum rotates the air-space 15 is brought around into contact with the cooled plate of the water-tank, thereby diminishing the pressure of air in the space 15 and causing a suction of air through the air-supply pipe 25, suction-valve 19, hollow shaft 13, and pipes 23 into the air-space 15. Further rotation of the drum again brings the air-space into contact with the hot surface of the casing, thereby causing the air to expand, when the operations described above recur.

The water-tank may be provided with inlet and outlet pipes for effecting circulation of the cooling-water.

Any desired number of blowers may be employed, and by arranging their air-spaces to be in the heating positions at different times in relation to one another a continuous blast of air may be produced.

Continuity of the blast may be effected when only one blower is employed by discharging the air into a reservoir of suitable capacity and withdrawing the air therefrom at a constant pressure.

It is obvious that instead of delivering the air-blast into the smoke stack or flue to induce a draft it may be blown in a highly-heated condition into a closed ash-pit or fire-grate to produce what is known as "forced draft."

It will be obvious that my invention may equally well be applied in or in connection with gas-producers and other analogous apparatus.

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

1. Process for producing draft in boilers and the like, consisting in heating an inclosed volume of elastic fluid, thereby raising its pressure so that a quantity of the elastic fluid is expelled, thus producing a blast, then cooling the remaining hot elastic fluid, so that a reduction in its pressure takes place whereby a fresh supply of elastic fluid is drawn in to make up the original volume, substantially as set forth.

2. Process for producing draft in boilers and the like consisting in displacing an inclosed volume of air from contact with a cooled surface into contact with a heated surface thereby raising its pressure and discharging a quantity of this compressed air as an air-blast, the residue of heated air being then brought into contact with the cooled surface whereby its pressure is diminished causing fresh air to be drawn in to make up the original volume of air, substantially as set forth.

3. Process for producing draft in boilers and the like, consisting in displacing an inclosed volume of air from contact with a water-cooled surface into contact with a surface heated by the waste gases from the boiler-furnace whereby the pressure of the air is raised and the quantity of air discharged into the boiler-uptake thus producing a draft, then displacing the residue of heated air into contact again with the water-cooled surface to diminish its volume and form a partial vacuum, whereby a suction of fresh air occurs to make up the original volume of air, substantially as set forth.

In witness whereof I have hereunto set my hand in presence of two witnesses.

CHARLES SCOTT-SNELL.

Witnesses:
WALTER E. ROCHE,
BERTRAM H. T. MATTHEWS.