(No Model.) 2 Sheets—Sheet 1.

L. J. & J. T. HOPE.

VENTILATING APPARATUS.

No. 411,522. Patented Sept. 24, 1889.

Fig. 1.

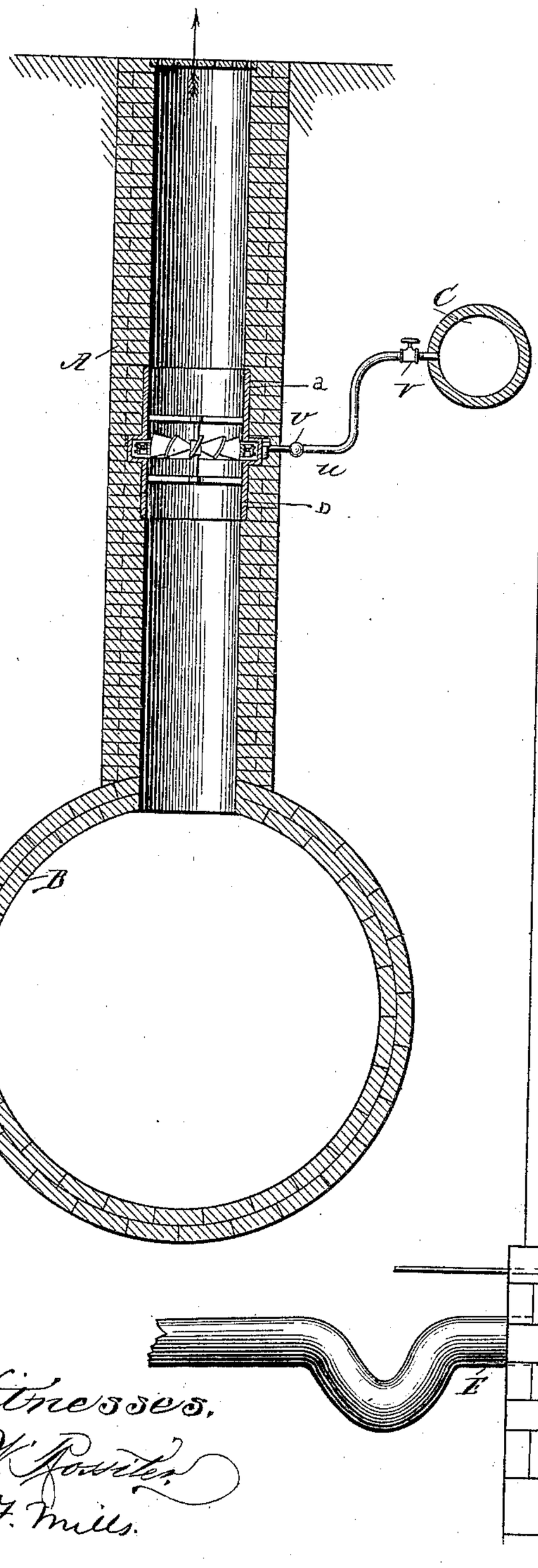
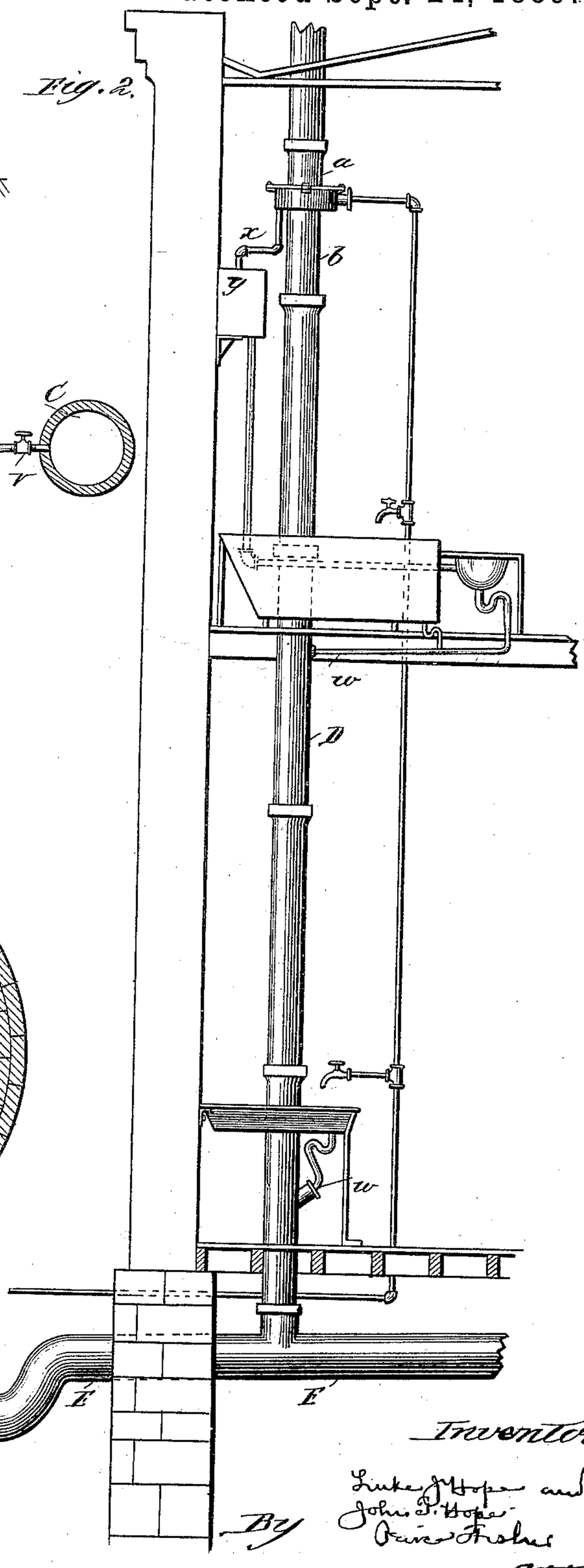


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

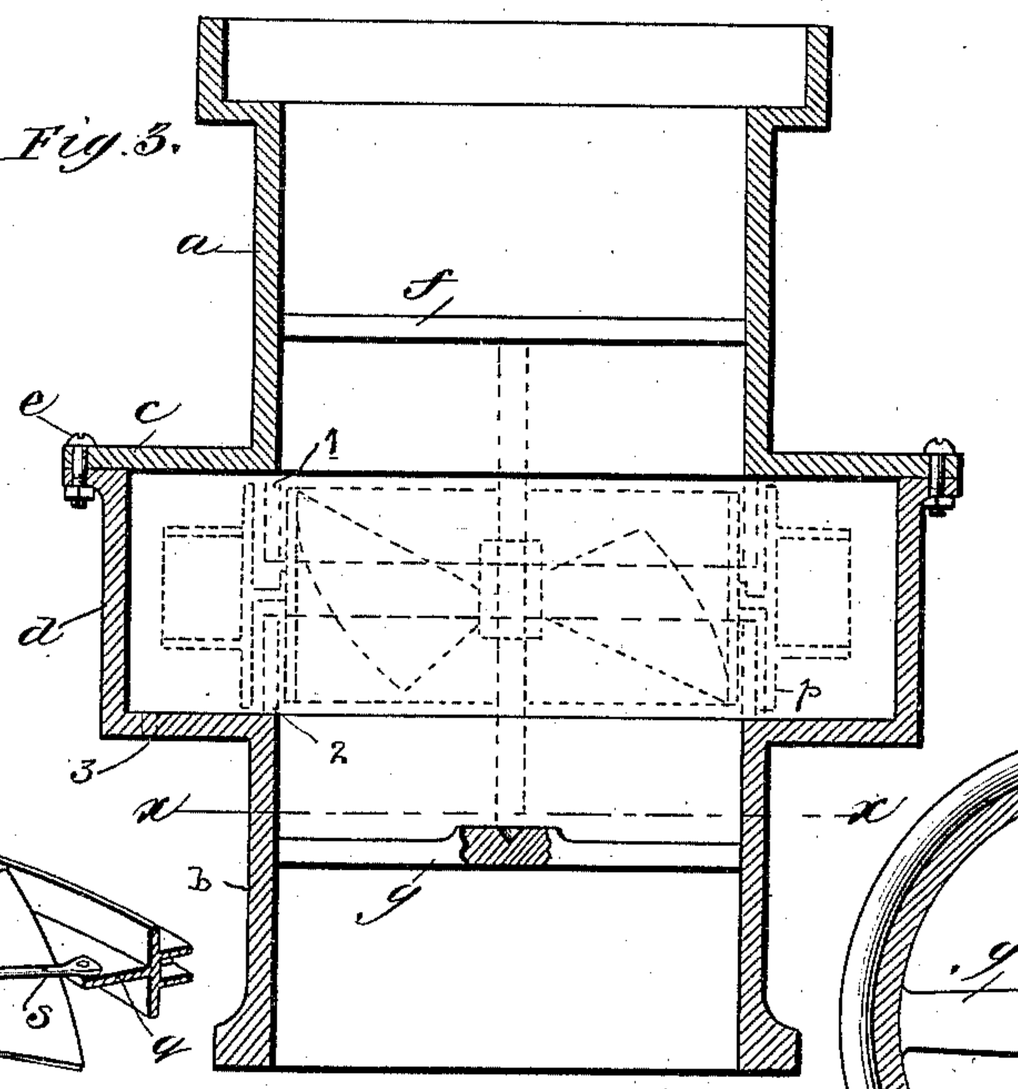

Fig. 7.

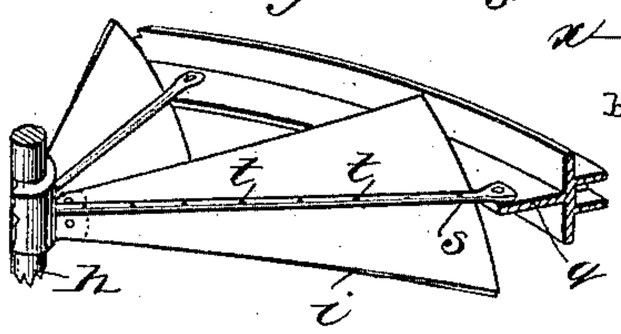

Fig. 4.

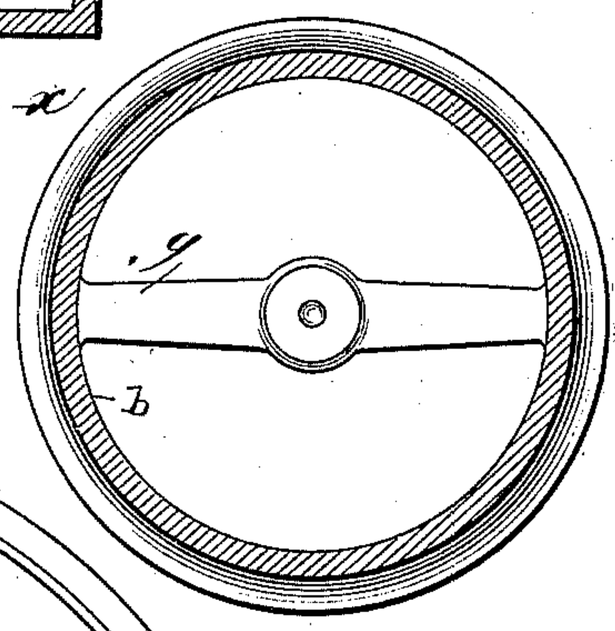

Fig. 5.

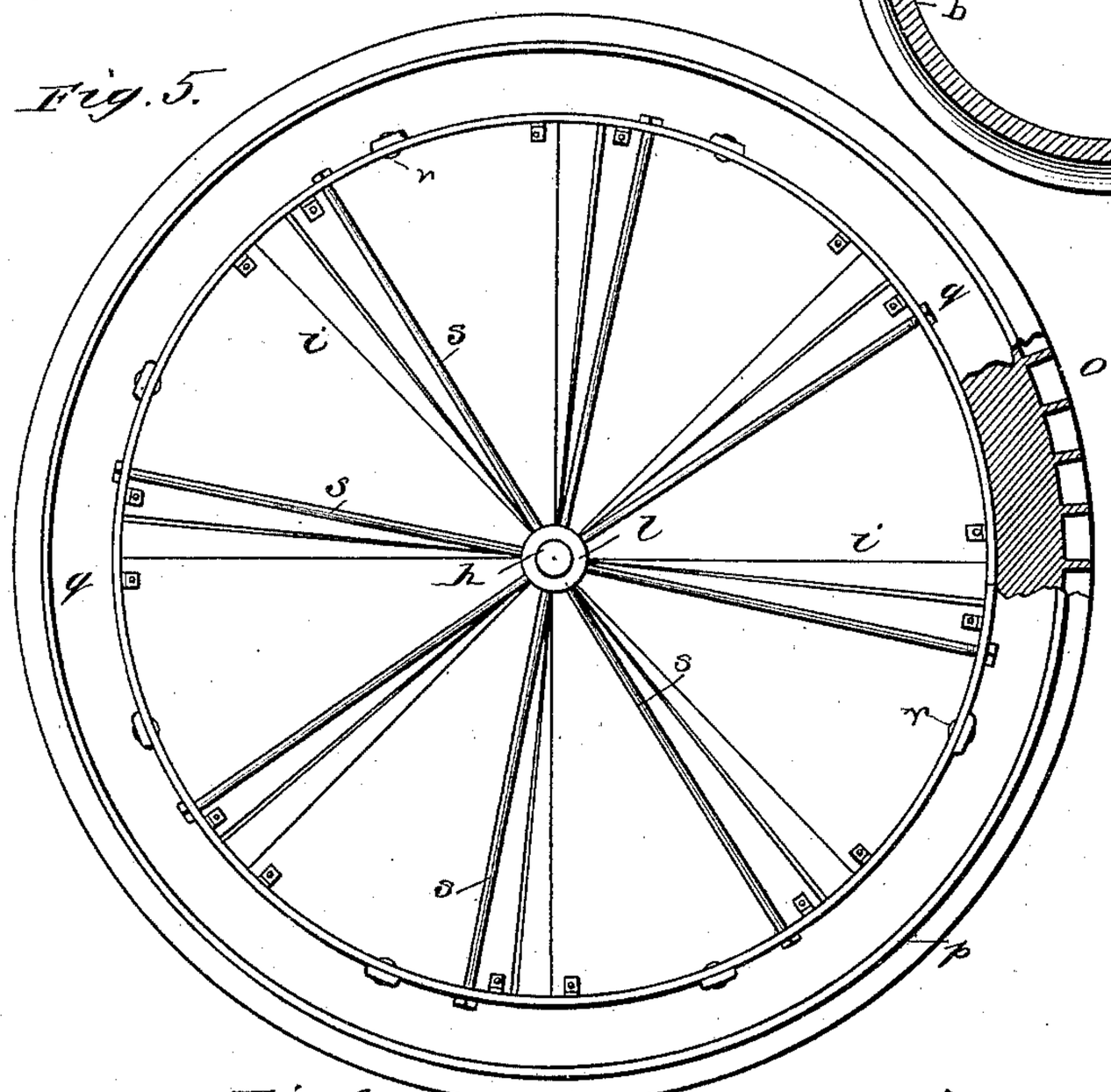

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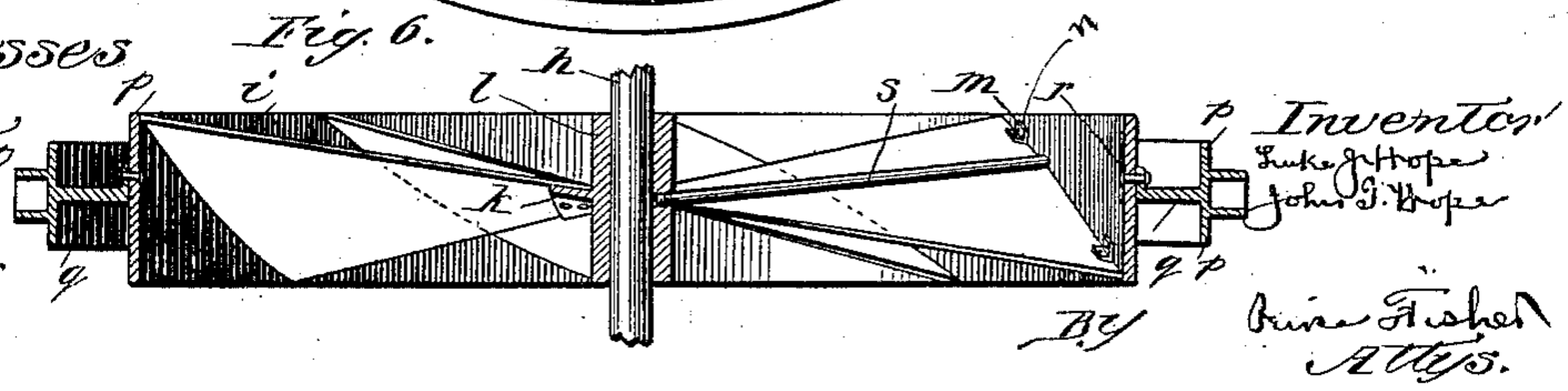
Fig. 6.



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UNITED STATES PATENT OFFICE.

LUKE J. HOPE AND JOHN T. HOPE, OF KANSAS CITY, MISSOURI.

VENTILATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 411,522, dated September 24, 1889.

Application filed August 9, 1887. Serial No. 246,486. (No model.)

To all whom it may concern:

Be it known that we, LUKE J. HOPE and JOHN T. HOPE, residents of Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Ventilating Apparatus, of which the following is hereby declared to be a full, clear, and exact description sufficient to enable others skilled in the art to make and use the same.

The invention relates to ventilating apparatus of that class wherein a rotary fan is used to establish an exhaust or forced current of air; and the improvements are more especially applicable to the street-ventilating pipes and the soil or waste pipes in buildings which lead from and are in communication with the usual subterranean drain or sewer.

The invention consists in furnishing the air-fan and the motor-wheel for propelling the same with a separable or divided inclosing-case, which not only receives and sustains the devices, but is so constructed that by reason of its tubular terminals the case may be built in or be fitted to the ventilating pipe or flue as an ordinary section or continuation thereof, and thus be either joined or removed by the workman without requiring special skill or fittings.

The invention further consists in the combination, with the ordinary soil-pipe of dwellings, &c., having the usual waste branch pipes from sinks, tubs, closets, &c., discharging therein, of a positively-driven air-fan located in the soil-pipe above or beyond the waste-outlets, so that the fan is free from fouling, and the soil-pipe, in addition to its common function, is directly utilized for the purpose of ventilating the sewer-drain and the waste-passages or branch pipe under the influence of the air-fan.

The invention also consists of certain improvements in detail and in the structure of the rotary fan and of the motor-wheel therefor employed to create and maintain the ventilating air-current, as will more fully appear from the description following, and be thereafter distinctly pointed out by claims at the conclusion thereof.

In the accompanying drawings, forming part of this specification, Figure 1 is a view in section showing a sewer-drain with a ventilating-pipe leading therefrom to the surface, and an air-fan, motor-wheel, and inclosing-case secured therein in accordance with the invention. Fig. 2 is a view in elevation showing the stand or soil pipe of a dwelling leading from the sewer-drain and having the usual waste-connections from tubs, stands, &c., discharging therein, and the air-fan and motor-wheel inclosing-case secured to the stand-pipe as a part thereof. Fig. 3 is a view in longitudinal section of the inclosing-case with its tubular terminals. Fig. 4 is a transverse section thereof upon line *x x* of Fig. 3. Fig. 5 is a plan view, partly in section, of the air-fan and motor-wheel combined. Fig. 6 is a transverse section thereof. Fig. 7 is a perspective view of a modified form of air-fan and motor-wheel.

The inclosing-case to receive and sustain the air-fan and motor-wheel is composed of the two separable sections *a b*, having tubular terminals at their outer ends, and at their inner ends furnished with outwardly-projecting flanges or offsets *c d* to constitute a box or chamber for the motor-wheel. The tubular sections *a b* of the inclosing-case are secured together at their meeting flanges *c d* by the bolts *e*, or like expedient, and upon their interior are conveniently furnished with the cross-bars *f g*, which serve as pivot supports or bearings for the axle *h* of the air-fan and motor-wheel.

The air-fan may be of any convenient and usual construction having the blades thereof extending in inclined direction from a central hub or support. In the preferred form, as exhibited by Fig. 6 of the drawings, the vanes *i* are riveted at their inner ends, as at *k*, to the nibs or seats extending radially from the hub *l*, the vanes extending thence with proper incline or twist to the peripheral drum or short cylinder *m*, inclosing the vanes, and to which they are secured by the angle-irons *n* or like expedient.

The motor-wheel is preferably cast in one piece to constitute a ring or disk for the air-fan. Upon its outer face the wheel carries the circumferential series of buckets *o*, and at the base of these buckets, extending laterally upon each side, are the guard-flanges *p*. A

web or ring *q* extends inwardly from the center of the wheel-rim and bears snugly about the outer face of the drum *m*, to which it may be secured by rivets, as at *r*, or otherwise. A series of spokes *s* may extend radially from the hub *l* and be fastened at their outer ends to the drum *m*, serving thereby to stiffen the parts and relieve the vanes from strain; or, again, as in Fig. 7, the spokes *s* may be attached directly to the web or ring *q*, projecting inwardly from the motor-rim, thereby sustaining the motor-wheel from the axle *h* independently of the vanes *i* of the air-fan. To strengthen and stiffen the structure it may sometimes be desirable to rivet the vanes *i* to the spoke-rods *s*, as at *t*, and the vanes may for like reason be lightly secured to the web or ring *q* at the meeting point of their edges.

For some of the purposes of the invention the web or ring *q* of the motor-wheel may be directly secured to the vanes of the air-fan without employing the intermediate drum *m* or the radial spokes *s*. This may be accomplished, for example, in manner as set forth in our Letters Patent No 347,709, dated August 17, 1886. One difficulty, however, encountered in such plan of construction is that the air-currents developed by the rotation of the fan-blades impinge upon the surrounding case and are thrown back therefrom into the path of the blades, thus developing cross-currents and impeding the rotation of the fan. By interposing the drum *m* peripherally about the vanes or blades of the fan, as shown in Fig. 6, the escape of the air at the outer ends of the blades and against the case is prevented. The drum *m* is fixed to and moves constantly with the vanes, diverting the air-currents and preventing the rebound of any part thereof, so that the resistance encountered by the fan from the reflex or reaction currents is very materially lessened. Because of this advantage the form of air-fan shown by Fig. 6 of the drawings, having the surrounding drum *m* thereon, is to be preferred in practice, although, as stated above, the other forms of fan may be employed in the separable case and in the ventilation of the stand-pipes in manner presently to be described without departing from the spirit of the invention.

Tubular section *a b* of the inclosing-case being taken apart, the combined air-fan and motor may be set within the flange-box *d*, the axle *h* resting within the pivot-seat of a cross-bar *g*. The section *a* of the case is then secured to the companion section *b*, the upper pivot of the fan-axle being received in the seat therefor in the cross-bar *f*. The air-fan extends across and obstructs the tubular passage-way, while the motor-wheel is sustained within the offset chamber or external box formed by the flanges *c d* of the case-section *a b*. To render the isolation of the wheel more complete, the tubular walls of the sections *a b* may be extended toward each other, (see 1 2, dotted lines, Fig. 3,) by which means the box-like chamber more fully incloses the wheel, the waste motive agent being prevented by the wall 2 from overflowing into the pipe. A hole in the base of the box may discharge the motive agent after it has spent its force in actuating the wheel and fan. In vertical relation of the air-fan the lateral flanges *p* at the base of the wheel-buckets more fully co-operate with the contiguous walls 1 2 of the tubular case to trap the water and prevent its escape from the case onto the vanes of the fan. Ordinarily, however, in sewer-ventilation the discharge of the waste agent directly into the sewer-ventilating pipe will be unobjectionable, and because of this the walls 1 and 2 of the tubular sections *a b* need not be frequently employed. By reason of the peculiar construction of the inclosing-case it is clear that it furnishes not merely a secure receptacle to seat and protect the air-fan and motor-wheel, but by reason of the tubular terminals given to the sections the case may be directly built into or joined as part of the body of the ventilating-pipe without special fittings or the need of skilled labor for such purpose.

As shown in Fig. 1, the separable inclosing-case carrying the air-fan and motor-wheel therein is set directly in masonry walls of the ventilating pipe or flue A, leading from the sewer-drain B. A water-pipe *u*, connected with the main C or other source of supply and controlled by the cock *v*, furnishes the motor-jet for driving the bucket-wheel.

In Fig. 2 the inclosing-case for the air-fan and motor-wheel is shown secured to the soil or ventilating pipe of the sewerage system, being joined thereto as if it were an ordinary section of the same, as usually constructed. The soil and ventilating pipe D is connected in usual manner with the subsoil-pipe or sewer-drain E, and is furnished, as well understood, with the waste passages or conduits discharging therein from the sinks, tubs, closets, &c., of the building.

Our invention designs that the case inclosing the air-fan shall be located in the soil-pipe above or beyond the waste-connections discharging therein, not merely to prevent the fouling or obstruction of the fan, but also in order that the fan in such relation shall efficiently act to withdraw the vitiated air and foul gases from the entire length of the soil-pipe, and also from the waste passages or conduits discharging therein. Thus arranged the traps in the waste-passages are not only relieved from the pressure of the sewer-gases, but the tendency is to establish positive currents from within the apartments and through the traps and waste-passages to the soil-pipes, and thence by the air-fan to the outside of the building. The common soil-pipe is in this manner utilized for the purpose of ventilation as well, and a positive ventilating-current is established through the waste-passages and soil-pipe to the outside of the building during all kinds of weather.

When water is employed as a motive agent

to operate the fan-wheel, the waste-water may pass from the case by the outlet-pipe, as at *x*, and serve to supply a flush-tank *y*, which may flood the lateral drains and conduits leading into the main soil-pipe, as well understood. Instead of using water as the motive agent, compressed air or live steam may also be used; or, again, the wheel-rim and inclosing-case may be modified to constitute an electro-motor for the air-fan.

It is plain that for the purposes of the sewer-ventilation distinctive of our invention the air-fan need not carry the motor-wheel at the rim thereof; but this latter may be separately sustained from the common axle; or, again, in lieu of the rim-wheel, some other means may be adopted for positively rotating the air-fan.

Heretofore the inclosing-drum of a ventilator-fan having a motor-wheel rim has been furnished at its ends with short cylindrical extensions. These light sheet-metal extensions served to direct the in and out currents of air, and by one of them the drum was sustained from the side wall of the room; but the drum was not made of separable tubular sections, as in our invention. It did not constitute a continuous part of the ventilating or drain pipe, nor could it be practically used in such combination. The fan and motor-wheel had to be set up or taken apart from within the drum, whereas by our device these could be mounted or removed entire, dismantling merely one drum-section without disturbing the set of the other as a part of the tubular drain. It has also been proposed to establish a forced circulation within the ventilating-shaft of an underground sewer by use of a fan there located and deriving power from an overshot wheel, which latter was driven by the sewage of the drain. The fan had no motor-wheel rim, and was not sustained within the tubular sections of a case constituting an integral part of the shaft.

It is common to ventilate the drain or soil pipes of a house into which the closets, basins, &c., discharge by extending such pipe upward to the air and opening a vent therein below the discharge-connections. This plan is of value; but by our improvement the lower vent may be dispensed with and a forced circulation be established, instead of the sluggish uncertain current before prevailing. No provision was made whereby an air-fan could be arranged above all lateral connections of the pipe to control the ventilation thereof, nor was any part of the pipe proper so modified as to constitute of itself the inclosing-case for the fan and its motor-wheel, as by our invention. Where the ventilation of closet, basin, and like lateral traps or connections by forced current has been attempted, the connections were with a distinct flue and not with the drain-pipe proper, as we propose, nor, under such circumstances, was any attempt made to modify the flue construction, so that a section thereof would serve as a case for the fan.

Having thus described the invention, what we claim as new, and desire to secure by Letters Patent, is—

1. The combination, with the sewer-drain, of the soil or ventilating pipe communicating therewith, the dual separable tubular sections constituting a continuous part of said pipe and having external box-flanges thereon to form an inclosing-case, an air-fan journaled within said pipe, and a motor-wheel located within the external flange-case and sustained from the axle of said fan, substantially as described.

2. In drain or ventilating pipes, the combination, with the dual tubular separable sections having external box-flanges thereon to form an inclosing-case, of an air-fan journaled within the tube, and a motor-wheel located within the external flange-case and sustained from the axle of said fan, substantially as described.

3. In drain or ventilating pipes, the combination, with the dual tubular separable sections having external box-flanges thereon to form an inclosing-case, of an air-fan pivotally sustained within and from said sections, and a motor-wheel secured about the rim of said fan and located within the external flange-case, substantially as described.

4. The combination, with the ventilating-pipe, of an air-fan having a motor-wheel arranged about the rim thereof and an inclosing-case for the same, said case consisting of dual separable sections united at their opposite tubular terminals to the ventilating-pipe and secured apart at their contiguous ends by external box-flanges projecting from said sections and forming a hollow chamber, said fan being pivotally sustained within and from said sections, and the motor-wheel being located within said hollow chamber, substantially as described.

5. The combination, with the sewer-drain, of the soil and ventilating pipe communicating therewith and having branch or waste pipes discharging into said ventilating-pipe, an air-fan located in said ventilating-pipe above or beyond the discharge-outlets from said waste-pipes, and suitable mechanism to positively actuate said fan, whereby the vitiated air may be withdrawn from said waste-pipes and soil-pipe, substantially as described.

6. The combination, with the sewer-drain, of the soil and ventilating pipe communicating therewith and having branch or waste pipes discharging into said ventilating-pipe, an air-fan located in said ventilating-pipe above or beyond the discharge-outlets from said waste-pipes, a motor-wheel arranged about the rim of said air-fan, an inclosing-case for said wheel, and suitable inlet and outlet ports in said case for the admission and discharge of the motive agent operating said wheel, substantially as described.

7. The combination, with the sewer-drain, of the soil and ventilating pipe communicating therewith and having branch or waste pipes discharging into said ventilating-pipe, the dual tubular sections constituting a continuous part of said pipe and having external box-flanges thereon forming an inclosing-case, said sections being united with said ventilating-pipe above or beyond the discharge-outlets from the waste-pipes, an air-fan pivotally sustained within and from said sections, and a motor-wheel secured about the rim of said fan and located within the flange-case, substantially as described.

8. In ventilating apparatus, the combination, with the casing, of an air-fan sustained thereby and having inclined vanes, a peripheral drum secured to said vanes, a motor-wheel inclosed within said casing and having a projecting ring-flange attached to said drum, substantially as described.

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