3 Sheets—Sheet 1.

B. F. STURTEVANT.

HEATING AND VENTILATING APPARATUS.

No. 100,211. Patented Feb. 22, 1870.

Fig. 1.

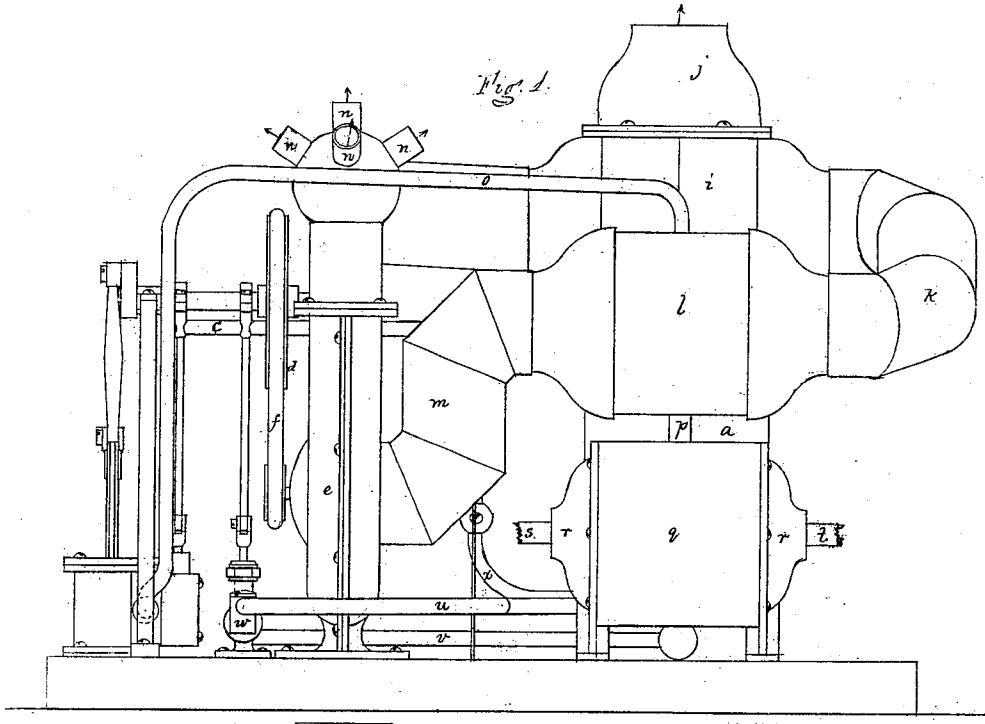
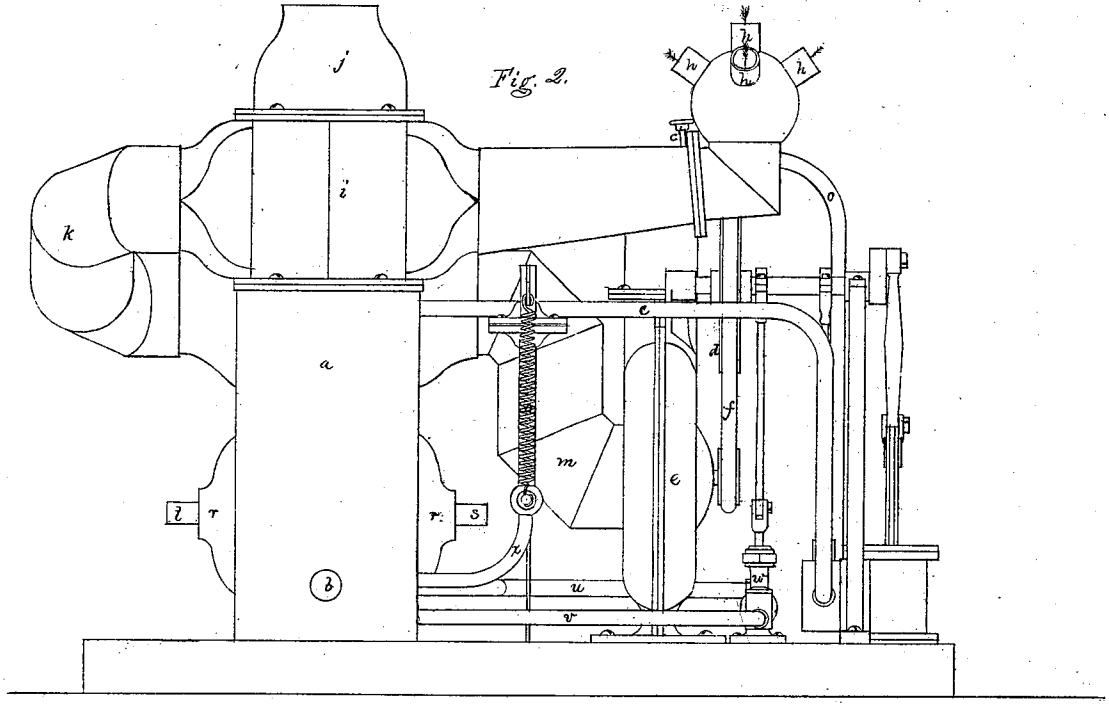


Fig. 2.



Witnesses: W. B. Keasby, C. Warren Brown

B. F. Sturtevant

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B. F. STURTEVANT.

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Fig. 3.

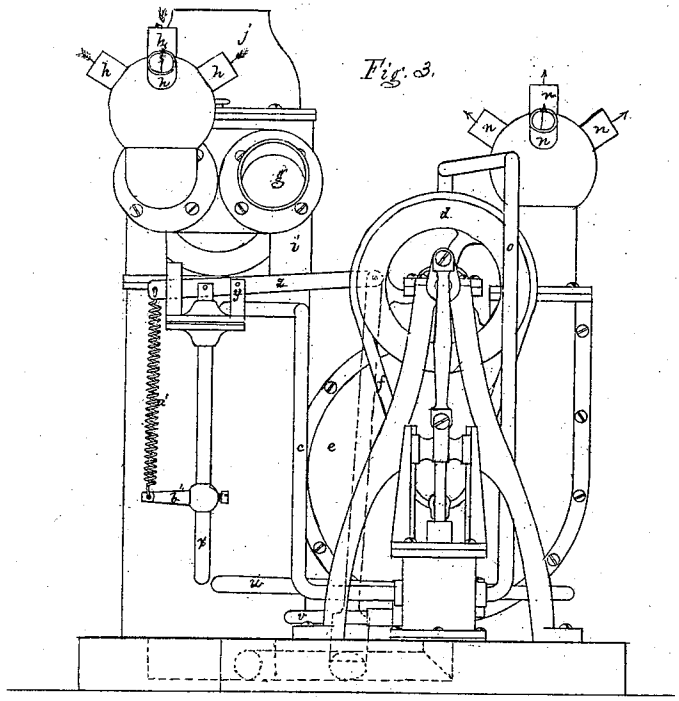
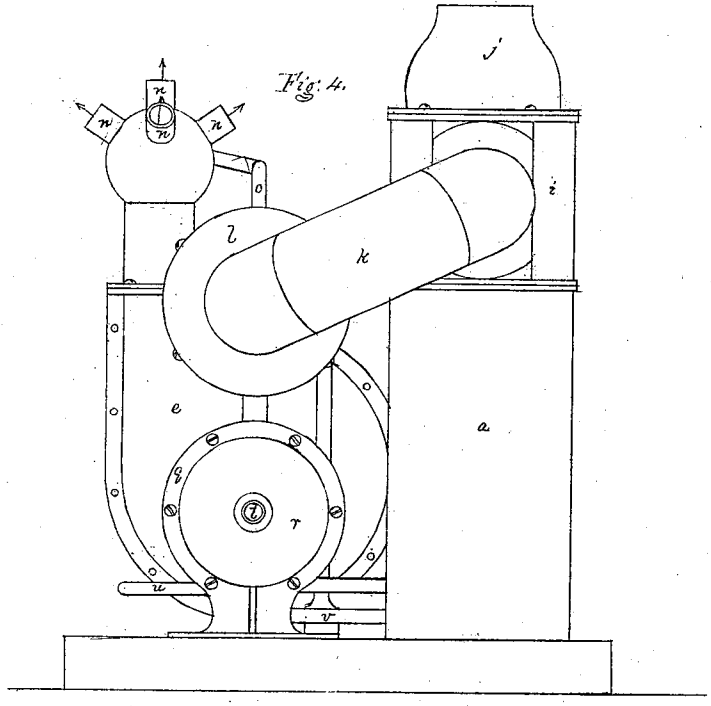


Fig. 4.



Witnesses: W. B. Crosby, C. Warren Brown.

B. F. Sturtevant

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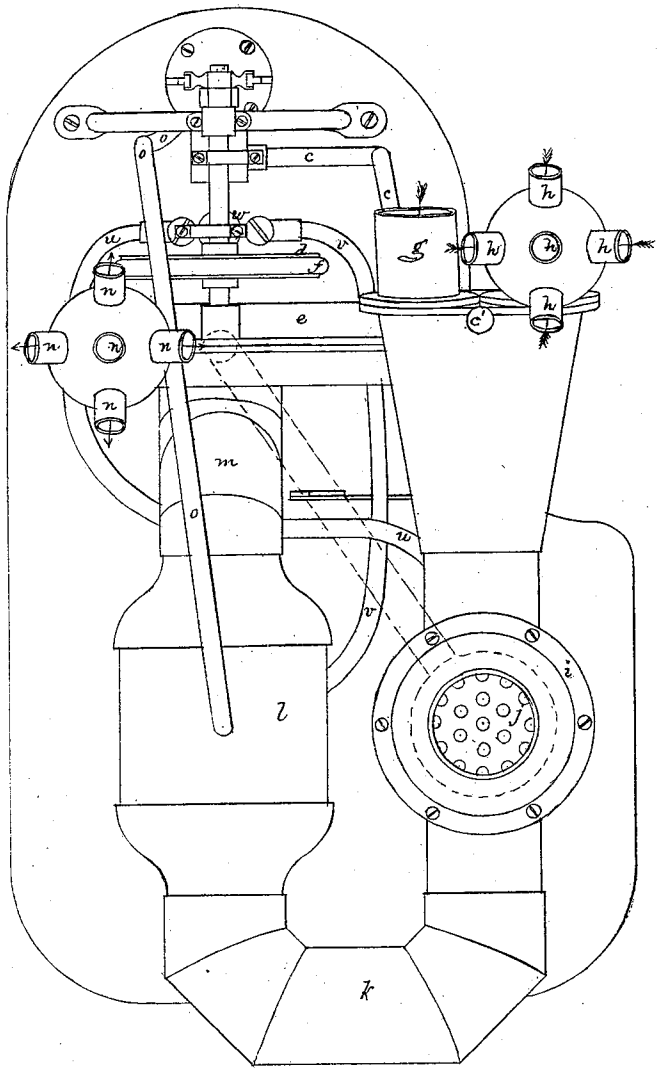
B. F. STURTEVANT.

HEATING AND VENTILATING APPARATUS.

No. 100,211. Patented Feb. 22, 1870.

Fig. 5



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Witnesses { J. B. Crosby
C. Warren Brown.

United States Patent Office.

B. F. STURTEVANT, OF JAMAICA PLAIN, MASSACHUSETTS.

Letters Patent No. 100,211, *dated February* 22, 1870.

HEATING AND VENTILATING APPARATUS.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, B. F. STURTEVANT, of Jamaica Plain, in the county of Norfolk, and State of Massachusetts, have invented an Improved Heating and Ventilating Apparatus; and I do hereby declare that the following, taken in connection with the drawings which accompany and form part of this specification, is a description of my invention sufficient to enable those skilled in the art to practice it.

In this invention I make use of fuel to generate steam, to operate through a suitable steam engine to produce motion, which is utilized in moving air which absorbs the heat escaping in the volatile products of combustion and in the exhaust steam, and which conveys the caloric so absorbed to any desired location, the power developed by the combustion of the fuel being also employed to the extent necessary to return the water of condensation to the boiler, to be again evaporated and used as before.

In some cases I use a part of the force generated by the combustion of fuel to heat water for domestic or manufacturing purposes, and also to raise it from one level to a higher one.

The drawings show, in Figures 1 and 2, two opposite elevations of an apparatus embodying my invention.

In figures 3 and 4, two opposite end elevations; and

In Figure 5, a plan of said apparatus.

The boiler may be of any known type; that shown in the drawings at *a* is designed to be of the vertical multitubular variety, having its fire door at *b*. The steam generated in the boiler is conveyed to any suitable engine by a pipe, *c*, the engine shown in the drawings being of the direct-action vertical variety, with its fly and driving-wheel *d* above the cylinder.

The engine is made to put in motion any kind of an air motor, the kind shown in the drawings being one of my well-known centrifugal or rotary blowers *e*, the shaft of which is rotated by a belt, *f*, from the wheel *d*.

The arrangement of the blower as shown in the drawings is such, that when in operation, it draws or sucks air through the inlet *g*, or through the series of inlets *h*, through the case *i*, (which surrounds a series of flues through which the volatile products of combustion pass off through the outlet *j* to a chimney or other escape duct,) through pipe *k*, to and through a series of pipes contained in case *l*, through pipe *m*, to the blower inlet, and thence they are forced by the fan-wheel in the blower through any one or all of the distributing-pipes *n*.

The exhaust steam from the engine passes through the pipe *o* into the case *l*, around the tubes therein, through which the air passes to the fan, and is condensed by the absorption of its heat by the air, the water of condensation flowing from case *l* through pipe *p* into a similar case, *q*, and around tubes therein, the ends of which enter spaces between the tube sheets of case *q* and bonnets *r*, to each of which are connected pipes, one of which, *s*, leads to an elevated reservoir for water, and the other of which, *t*, leads from said reservoir in such a manner that a circulation of water will be established by the ascent of the water heated in the pipes contained in case *q*, by the hot water of condensation from case *l*, and by the descent of cold water from the reservoir.

From the lowest part of case *q* the condensed water and what steam may be left uncondensed are drawn off through pipe *u* by pump *w*, worked by the engine by which the water is returned through pipe *v* to the boiler, to be again converted into steam, to again act as before described.

The combustion of fuel in the boiler is urged by a current of air taken from the blower through suitable ducts, and discharged into the ash-pit below the grate, said duct being shown in dotted lines in figs. 3 and 5.

The area of the passage through the duct supplying air to promote combustion is controlled by a valve worked by an apparatus that closes the valve more or less as the pressure of steam increases, and opens the valve as the pressure of steam diminishes. Said apparatus consists of a pipe, *x*, connected with the water in the boiler, preferably where the water is coolest.

The upper part of this pipe is enlarged, and contains a diaphragm, which operates a lever, *z*, pivoted at *y*, the long arm of the lever being connected to the valve which controls the passage by which air is supplied to the fuel. The short arm of the lever is coupled to a spring, *a'*, one end of which is attached to an arm, *b'*, which is made adjustable on pipe *x*, so that the degree of tension of the spring may be regulated at will to control the amount of air to be supplied to the fuel.

It will be seen that as the pressure in the boiler increases, the short arm of the lever will be raised by the diaphragm, which will extend spring *a'*, and will lower the long arm of lever *z*, which will cause the long arm of lever *z* to lower the valve thereto attached and will shut off more or less of the supply of air which urges combustion, which, of course will result in checking the fire and the generation of steam. As the pressure of steam diminishes, the contraction of spring *a'* will cause the air-valve to open, which will result in intensifying combustion and in increasing the generation of the steam.

By turning the handle *c'*, fig. 5, a valve is worked to shut off from case *i* the supply of air from the inlets *g* or *h*. The inlet *g* is used when pure fresh air is needed, and the inlets *h* lead from the spaces supplied with heated air from the outlets *n*.

Suppose the boiler sufficiently filled with water, and steam generated therein by consumption of fuel in the

furnace to a pressure sufficient to work the engine and blower connected therewith, then the air will begin to flow through inlet *g* or inlets *h*, according to the position of the valve controlled by the handle *c'*, and the heat of the escaping volatile products of combustion will be transferred to the passing current of air, which on its passage will also absorb the heat of the steam exhausted from the engine, and will pass with the air forced out from the outlets *n* to be applied for warming and ventilating, or for any other useful purpose, a part of the air acted on by the blower passing to urge combustion of the fuel, and the water resulting from condensation of the steam passing back to the boiler, so that all the attention needed for the apparatus is to keep it properly supplied from time to time with fuel, and to keep the frictional surfaces lubricated and the packings from leaking.

It will be obvious that the position or arrangement of the blower may be changed so as to force the air into the case *i*, and all parts beyond, instead of drawing it through said case and the case *l*, as before described, and it will also be obvious that the case *l*, instead of being supplied with horizontal air-pipes as described, may be supplied with vertical steam pipes, and then the air will pass around said pipes and within the case. And in the water-heater the hot water and uncondensed steam may be made to pass through vertical pipes instead of around horizontal pipes.

In some heating apparatus one boiler supplies steam radiators with steam, which, as it condenses, flows back into the boiler by gravity, without the intervention of a pump, and also an engine, which works a blower to force air over the radiators to be heated and conveyed to the space to be warmed; but in such cases the exhaust from the engine escapes to waste, and the water which is carried off by the steam has to be supplied by additional water.

In my invention, on the contrary, I use no direct steam for heating, but do use all the exhaust steam, which, when it has parted with its heat, is returned to the boiler by a pump, so that I use the same water again and again, and would have to supply no additional water if it were possible to prevent all leakage at joints, stuffing-boxes, &c.

In my invention, also, I reclaim and utilize as much as possible of the heat escaping in the volatile products of combustion, and supply any deficiency of draught by a positive blast from a blower.

To obtain the minimum of heat and the maximum of ventilation, and the maximum of heat and minimum of ventilation, the valve controlled by the handle *c'* and the adjustment of spring *a'* are to be varied to suit the requirements of the case.

To vary the speed of the engine, a valve may be placed in the pipe which supplies the steam to the cylinder, or a cut-off, which may be adjusted to any desired point, may be applied to the engine.

Under some circumstances the engine of this apparatus will be worked under a heavy back pressure; for example, if it is desired to give intense heat to the air currents set in motion, then the engine and blower should be run slowly, and fuel supplied to generate steam of high pressure in the boiler. The air supplied by the condenser will then not suffice to condense the exhaust steam rapidly, and the exhaust steam will accumulate in the condensing apparatus till its pressure equals a large fraction of the pressure in the boiler, the exhaust steam under said circumstances heating the air currents about as they are usually heated by steam taken directly from the boiler.

I claim—

For producing and heating currents of air, the combination of a boiler, engine, blower, exhaust-steam-condensing apparatus, (operating to condense by the air set in motion by the blower,) and pump, or other suitable device for returning the condensed water to the boiler.

Also, in combination with the elements first claimed, an apparatus for extracting and utilizing the heat escaping in the volatile products of combustion.

Also, in combination with the elements first claimed, the series of distributing-pipes *n*, leading from the blower.

Also, in combination with the elements first claimed, the series of collecting or return pipes *h* leading to the blower.

Also, the combination of one or more return pipes *h*, and one or more delivery-pipes *n*, with a cold-air inlet-pipe, *g*, and a valve or equivalent device for regulating the proportion of fresh air to be heated and circulated.

Also, the arrangement of the water heater between the condenser and the pump, substantially as and for the purpose described.

B. F. STURTEVANT.

Witnesses:

J. B. CROSBY,

C. WARREN BROWN.