(No Model.) 2 Sheets—Sheet 1.

N. B. TRIST.

FURNACE.

No. 587,515. Patented Aug. 3, 1897.

Fig. 1.

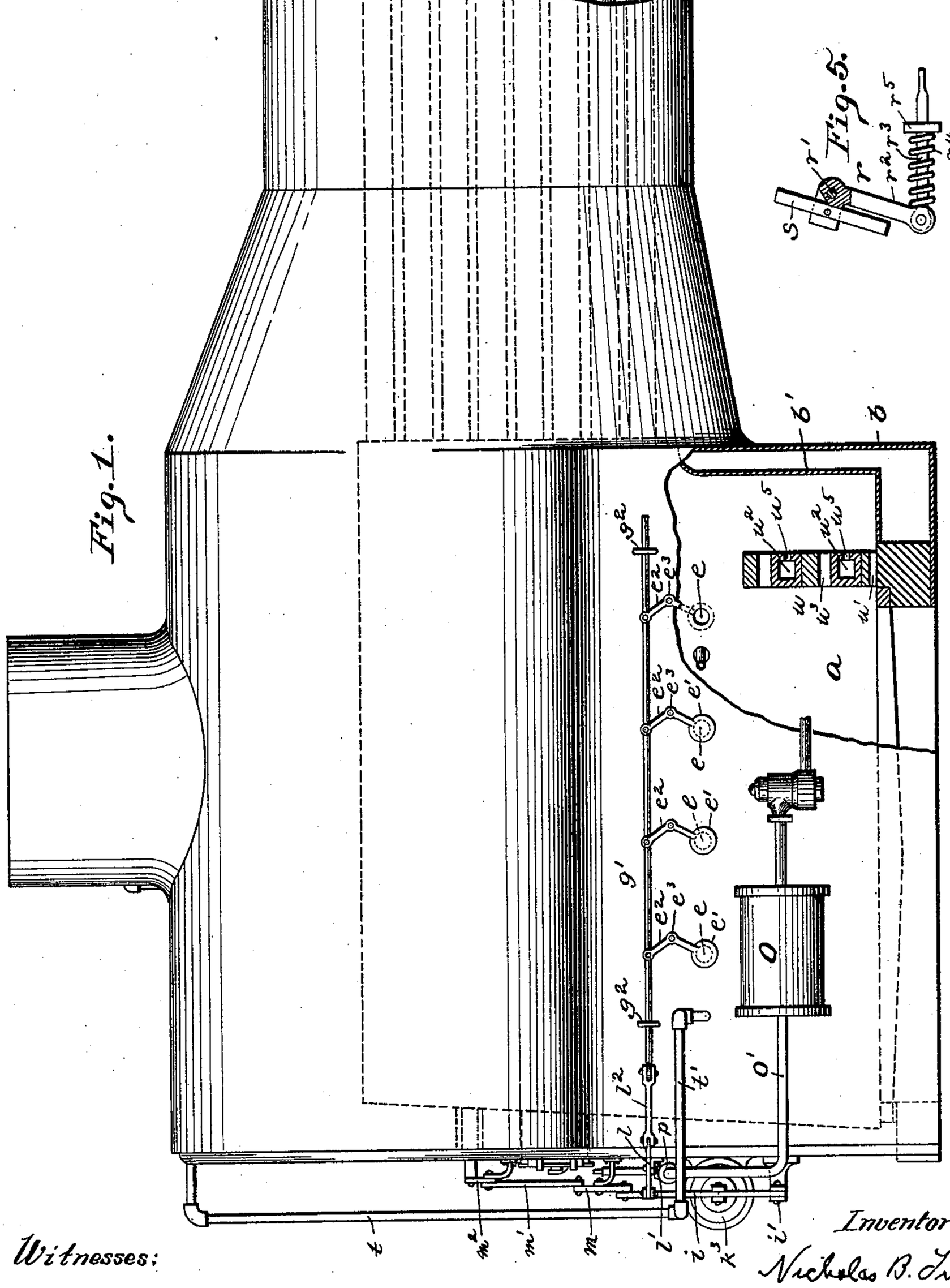

Fig. 5.

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(No Model.)

2 Sheets—Sheet 2.

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Fig. 3.

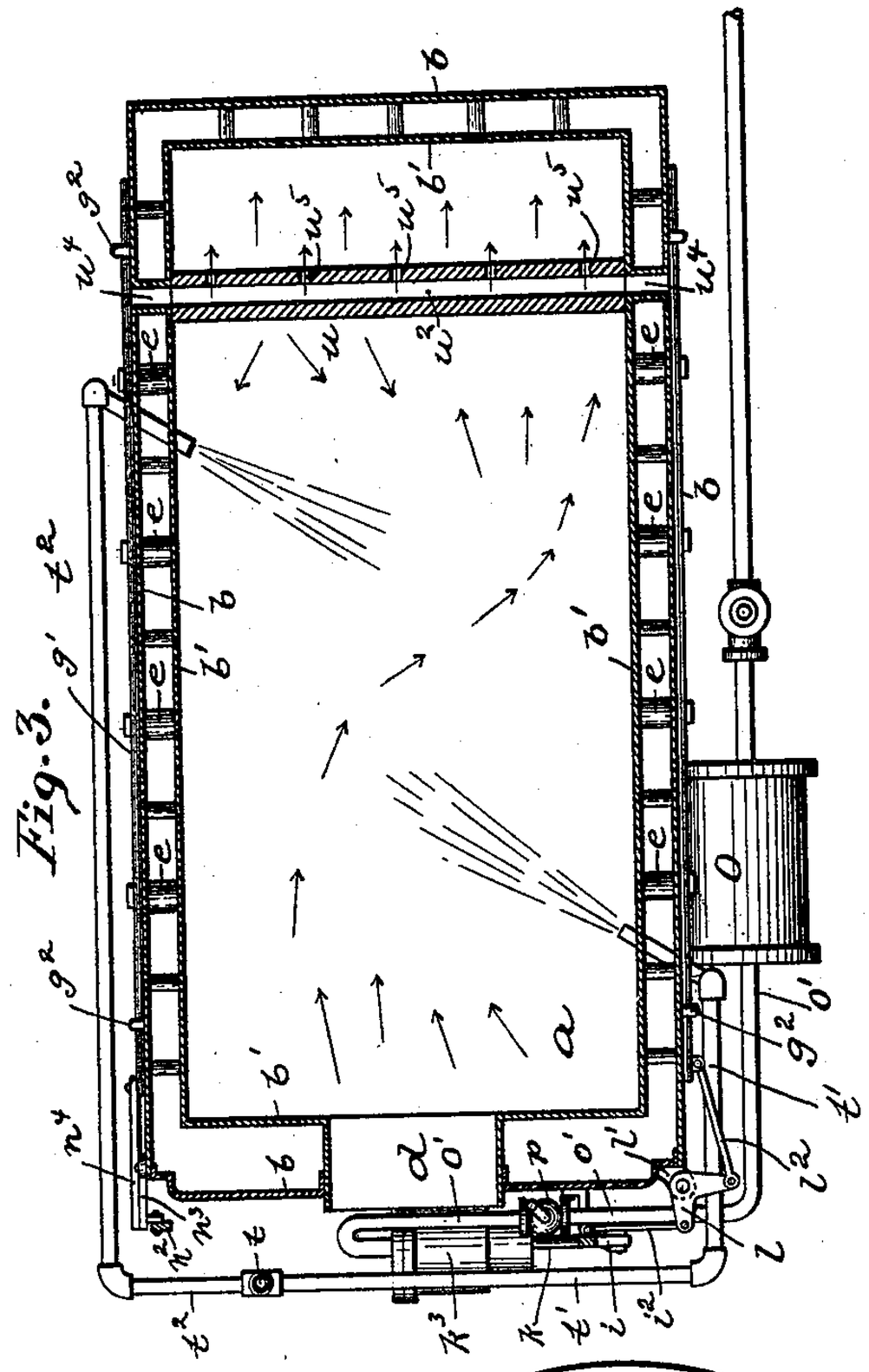


Fig. 4.

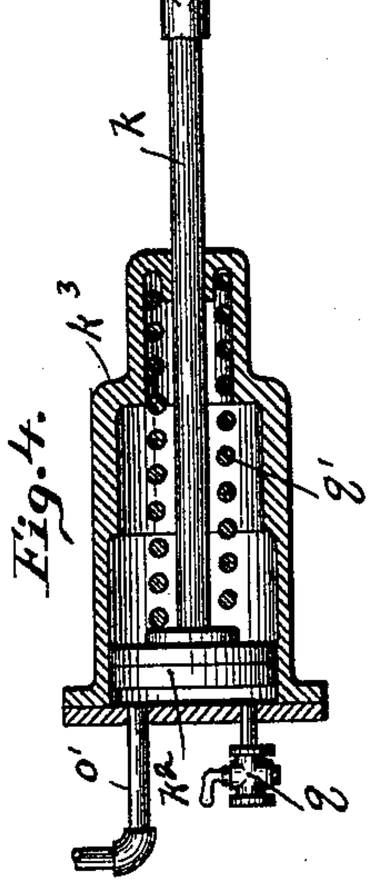
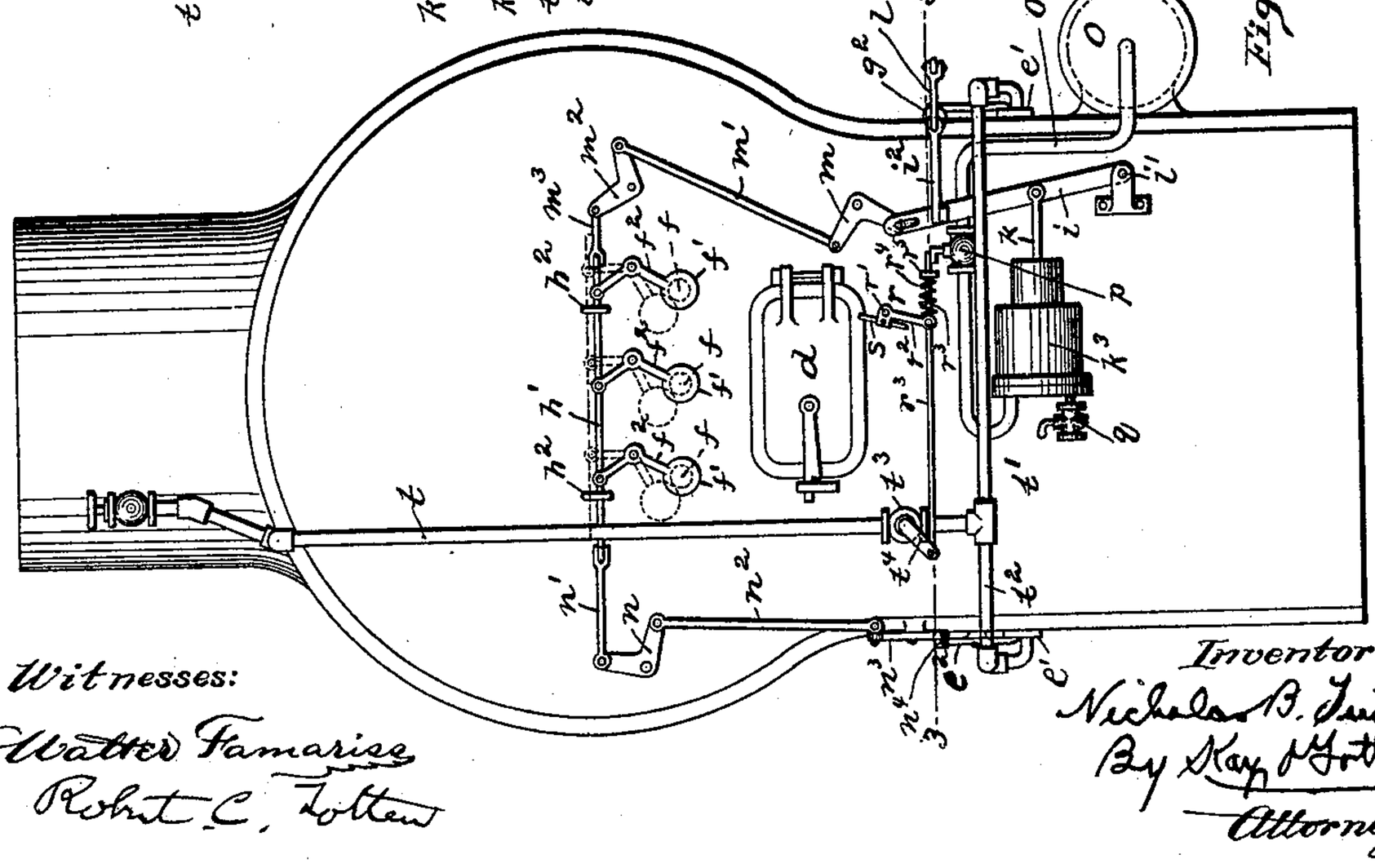


Fig. 2.



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UNITED STATES PATENT OFFICE.

NICHOLAS B. TRIST, OF PITTSBURG, PENNSYLVANIA.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 587,515, dated August 3, 1897.

Application filed October 7, 1896. Serial No. 608,190. (No model.)

To all whom it may concern:

Be it known that I, NICHOLAS B. TRIST, a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Furnaces; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to certain improvements in the construction of furnaces, its object being to provide a convenient form of mechanism for supplying the furnace with air in such quantities as to insure more perfect combustion.

The invention comprises certain novel features, all of which will be fully hereinafter set forth and claimed.

To enable others skilled in the art to make and use my invention, I will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a side view of a boiler-furnace, partly broken away, with my invention applied thereto. Fig. 2 is an end view. Fig. 3 is a cross-section on the line 3 3 of Fig. 2. Fig. 4 is a vertical longitudinal section of the cylinder controlling the valve mechanism and the connections thereto; and Fig. 5 is a detail, partly in section, showing more clearly the device for controlling one of the valves.

Like letters of reference indicate like parts in each view.

The invention may be applied to any suitable form of boiler-furnace, that shown being a simple type used in connection with a tubular boiler. The furnace shown has the usual fire-chamber *a*, which in the boiler-furnace is inclosed within the boiler itself, the outer shell of the boiler being shown at *b*, the inner shell at *b'*, the boiler-tubes at *c*, and the furnace-door at *d*. The interior arrangement of the furnace is illustrated by dotted lines in Fig. 1. Extending through the side walls of the furnace are the air-inlets *e*, which are shown as communicating with the furnace-chamber above the grate and are formed of suitable tubes passing through the inner and outer shells of the boiler, and in the back walls of the furnace above the door *d* are like air-inlets *f*. (Shown by dotted lines in Fig. 2.) These several air-inlets are controlled by the disks *e'*, said disks being mounted on the bell-cranks e^2, which are pivoted at e^3. The upper ends of the bell-cranks e^2 are connected to the sliding rod *g'*, said rod being journaled in guides g^2. The disks *e'*, when the cranks e^2 are in the position shown in full lines, Fig. 1, close the air-inlets *e*, but when the sliding rod is moved said air-inlets are opened, as shown in dotted lines, Fig. 1. A like construction is employed in connection with the end inlet-ports *f*, the disks *f'* being formed on the lower ends of the cranks f^2, the upper ends of said cranks being connected to the sliding rod *h'*, journaled in the guides h^2.

The several sliding rods *g'* and *h'* are connected to the main lever *i*, fulcrumed at *i'* and adapted to be moved by means of the piston-rod *k*, controlled by the piston k^2 in the cylinder k^3. This main lever *i* is connected directly to one of the side bars by means of the strap i^2, crank-lever *l*, mounted in the bearing *l'*, and strap l^2, so that as the lever *i* is forced forward toward such crank-lever *l* the sliding rod *g'* is moved longitudinally in its guides and the disks *e'* are withdrawn from the air-inlets *e'*, or close the same, as the case may be.

The connections shown to the other sliding rods are as follows: The lever *i* connects with a crank-lever *m*, which by a strap *m'* connects with the crank-lever m^2, having a strap m^3 connected to the sliding rod *h'*. The other end of the sliding rod *h'* connects by a strap *n'* with the crank-lever *n*, which by a strap n^2 connects with a like crank-lever n^3, a strap n^4 extending from such crank-lever to the sliding rod *g'* on the other side of the boiler, which has disks *e'* depending therefrom and operated thereby. It will therefore be seen that when the piston operates to force out the main lever *i* through crank-levers and straps all of the sliding rods are moved so as to withdraw the disks from the several air-inlets communicating with the fire-chamber *a* and provide for the free entrance of air into the same.

At one side of the furnace is the air-reservoir *o*, which may be supplied with air from any suitable source, and in cases where my invention is used in connection with locomotives this reservoir may be supplied from the same source as the air to operate the brakes.

The pipe o' leads from this reservoir to the cylinder k^3, communicating therewith at the end opposite to that through which the piston-rod k passes, this pipe being controlled by the valve p, and when said valve is opened air passes from the reservoir to the cylinder and forces back the piston k^2 therein and so causes the necessary movement of the lever i for operating the valve-plates. This cylinder k^3 has also the throttle-valve q, by which the air is permitted to escape gradually, and within the cylinder and confined around the piston-rod between the end through which the piston-rod passes and the piston itself is the spring q', which acts normally to force the piston k^2 to the opposite end of the cylinder, this movement being gradual, however, because the air escaping is controlled by the throttle-valve q, which, because of the slow escape, provides for a very gradual closing action. This results in a very gradual movement of the several sliding rods controlled by the lever i, so that after the piston is once operated on by the compressed air the time at which the valves close the inlet-ports to the furnace is controlled by the throttle-valve q and may be regulated so as to provide for the closing of the same during any predetermined period after they have been opened.

Mounted on the rear face of the boiler is the lever r, pivoted at r', while one arm r^2 of said lever is connected by a strap r^3 to the valve p. The spring r^4 is confined between the arm r^2 and a suitable guide-stop r^5, so that upon the swinging of the lever r for the opening of the valve as soon as the pressure is removed the valve will be closed and the air-supply cut off. Mounted in the other arm of the lever r' is a pivoted trip s, one arm of which extends up within the course of the door d, while the other extends down parallel with the arm r^2 of the lever, so that when the door is opened it will press upon one side of the upper part of the arm, and as that arm is free to swing the door passes the trip, which drops back to its normal position, and when the door is closed it presses upon the other side of the upper arm of the trip, while the lower arm thereof presses against the lever r, and as the arm is held by the lever the closing of the door causes the movement of the lever, so as to open the valve p and permit the passage of air to the cylinder. The spring r^4 brings the tripping-lever r back to its normal position and closes the valve as soon as the door itself is closed.

In addition to the supply of air I may at the same time furnish the fire-chamber with steam, the valves controlling the admission of the steam being operated by the same mechanism used to operate the sliding rods. Leading from the steam-space in the boiler is the pipe t, which is shown as extending down the end wall of the furnace and having the branch pipes t' and t^2, which are shown as communicating with the fire-chamber through the side walls. The pipe t' leads into the furnace-chamber diagonally in the direction of the natural draft, while the pipe t^2 is shown as communicating with the furnace-chamber diagonally in the direction opposite to the natural draft, these pipes communicating with such chamber above the grate h, and being so arranged in order to form a swirl within the furnace-chamber and insure the mixing of the steam with the gases arising from the fuel therein. The pipe t has the valve t^3, operated by the arm t^4. This arm t^4 is connected to the strap r^3. By this construction at the same time that the valve p is opened the valve t^3 is opened to admit steam to the fire-chamber.

In the operation of the furnace, whether for boiler purposes or other heating purposes, it is desirable that there shall be a secondary supply of air to the gases passing over from the fuel on the grate, and for that purpose I employ the bridge-wall u. As shown in Fig. 1, where the side of boiler is broken away, this bridge-wall is formed of courses of checker-brick and hollow tile placed the one upon the other, the two lower courses shown being open checker-brick, as at u', and resting upon the same is the hollow tile u^2, which is surmounted by two courses of open checker-work u^3, with another line of hollow tile u^2. Each course of hollow tile u^2 has air-entrances u^4 at one or both ends thereof and has the ports opening through the side thereof opposite to the grate, as at u^5, so that the air entering through the same will intermingle with any of the unconsumed gases passing through the openings in the checker-work u' or u^3, and will so provide for a supply of air to such gases and lead to the combustion of the same.

In the employment of the invention with the apparatus above described it will be seen that in the normal positions of the parts the valves or disks feeding the air to the fire-chamber are closed, the fire-chamber then having its ordinary air-supply through the grate. When it is intended to feed coal to the furnace, the fireman opens the door and swings it out, as usual, and it strikes the upper arm of the trip s, passing the trip without operating the apparatus, and the fireman proceeds to feed the coal to the furnace. When he closes the door, it strikes against the upper arm of the trip s and the lower arm strikes against the lever r and is held thereby, so that the door, in order to pass the trip, must move the lever r and through the same open the valves p and t^3. The opening of the valve p permits the air to pass through the reservoir o, through the pipe o', and the cylinder k^3, forcing back the piston k^2, and through its piston-rod k moving the main lever i, and through the crank-lever connections therefrom operating the sliding rods g' and h', and so acting to open the air-inlets to the fire-chamber above the grate. This will provide for the entrance of a sufficient portion of air to burn the gases which are first driven off from the coal as it is heated and therefore provide for the more

perfect combustion of the same, overcoming much of the loss of fuel in smoke. The opening of the valve t^3 permits a supply of steam under pressure to the fire-chamber, the same entering from the pipes t' t^2 into the fire-chamber and providing an extra supply of such fluid to the same at the same time that the hydrocarbons or other combustible gases are being distilled from said freshly-fed fuel in larger quantities than in the normal operation of the furnace, so supplying fluid for supporting combustion of these gases and to a great extent preventing the emission of smoke from the furnace and utilizing these gases so generated in more than normal quantity from the fresh fuel in the heating of the boiler. All of such gases passing through the checker-work are mingled with the air entering from the courses of tile and burned therewith, the air entering in this way being heated by the heat of the tile, which is of course exposed to the heat generated within the furnace and is maintained at a sufficiently high heat to heat the incoming air. The movement of the piston k^2 compresses the spring q' in the cylinder k^3, and by the shutting of the door the spring r^4 moves the lever r to its normal position, closing the valves p and t^3. The spring q' then operates on the opposite side of the piston k^2 and will gradually force the air through the throttle-valve q and move the sliding rods as the air is permitted to escape from the cylinder. The only escape of the air is through the throttle-valve q, having but a small opening therein and that small opening governed by the valve, so that a very gradual escape of the air may be provided from the cylinder. In so doing the spring draws upon the main lever i and therefore draws the sliding rods out in such a way as to bring the disks e' f' again over the air-inlets e f.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination of a furnace having one or more inlet-ports, a sliding rod above said ports journaled in bearings on the furnace-walls, bell-cranks on said rods and pivoted to the furnace-walls, uninclosed flat disks formed on the lower ends of said bell-cranks covering said ports, automatic apparatus for moving said sliding rod and a trip operated by the door controlling the same, substantially as set forth.

2. The combination with a furnace-door, the lever r pivoted to the furnace-body and carrying the trip s pivoted thereon, having its upper arm extending within the course of the furnace-door, a valve, the lower arm of said trip engaging with said lever to move the same and operate said valve for admission of air or steam to the fire-chamber, substantially as set forth.

3. The combination with a furnace-chamber, of a bridge-wall therein and a space beyond the bridge-wall, said bridge-wall being formed of checker-work and of hollow tile having openings therein on the side opposite to the grate, substantially as set forth.

In testimony whereof I, the said NICHOLAS B. TRIST, have hereunto set my hand.

NICHOLAS B. TRIST.

Witnesses:
WILLIAM PHILLIPS,
ROBERT C. TOTTEN.