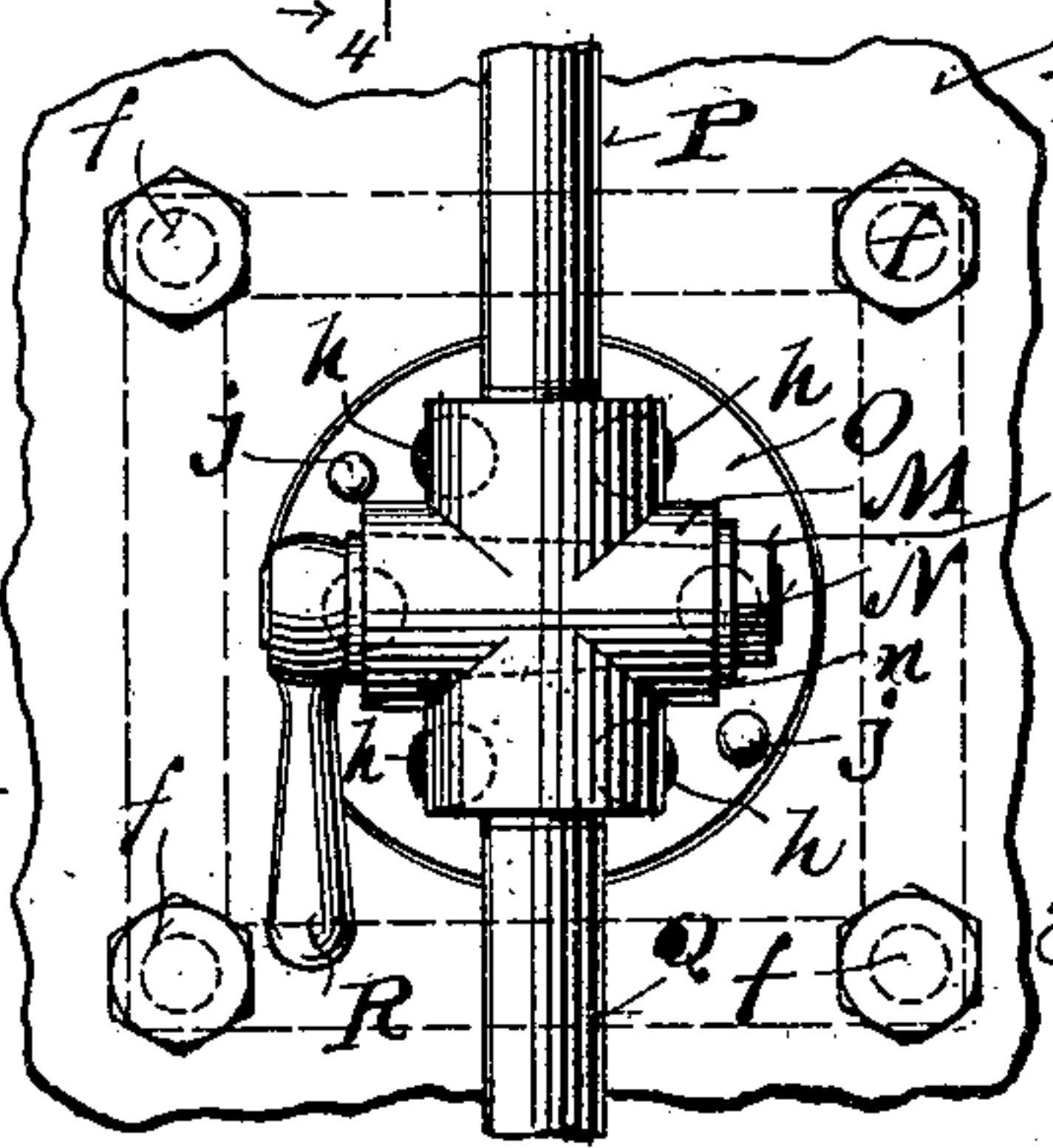
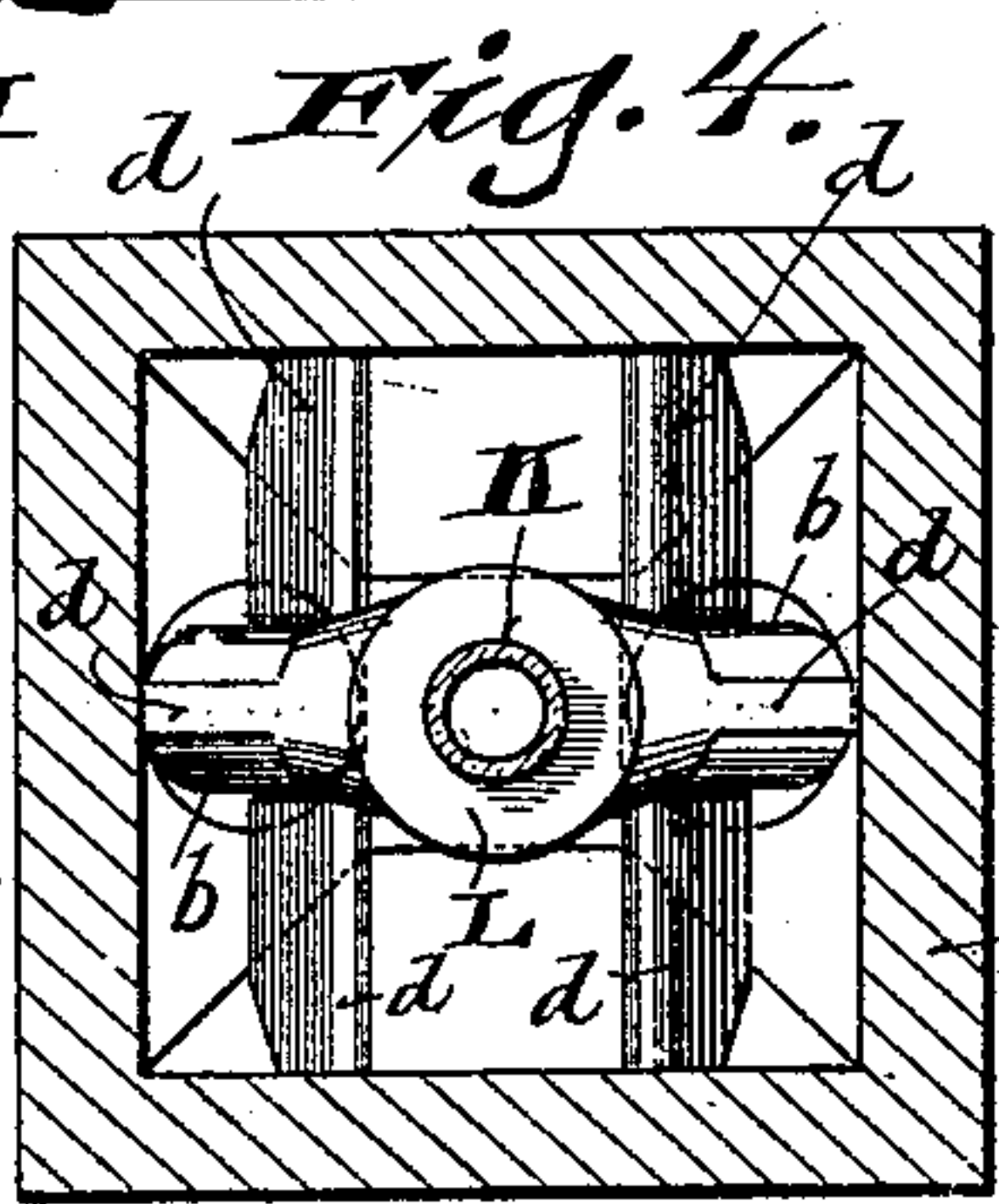
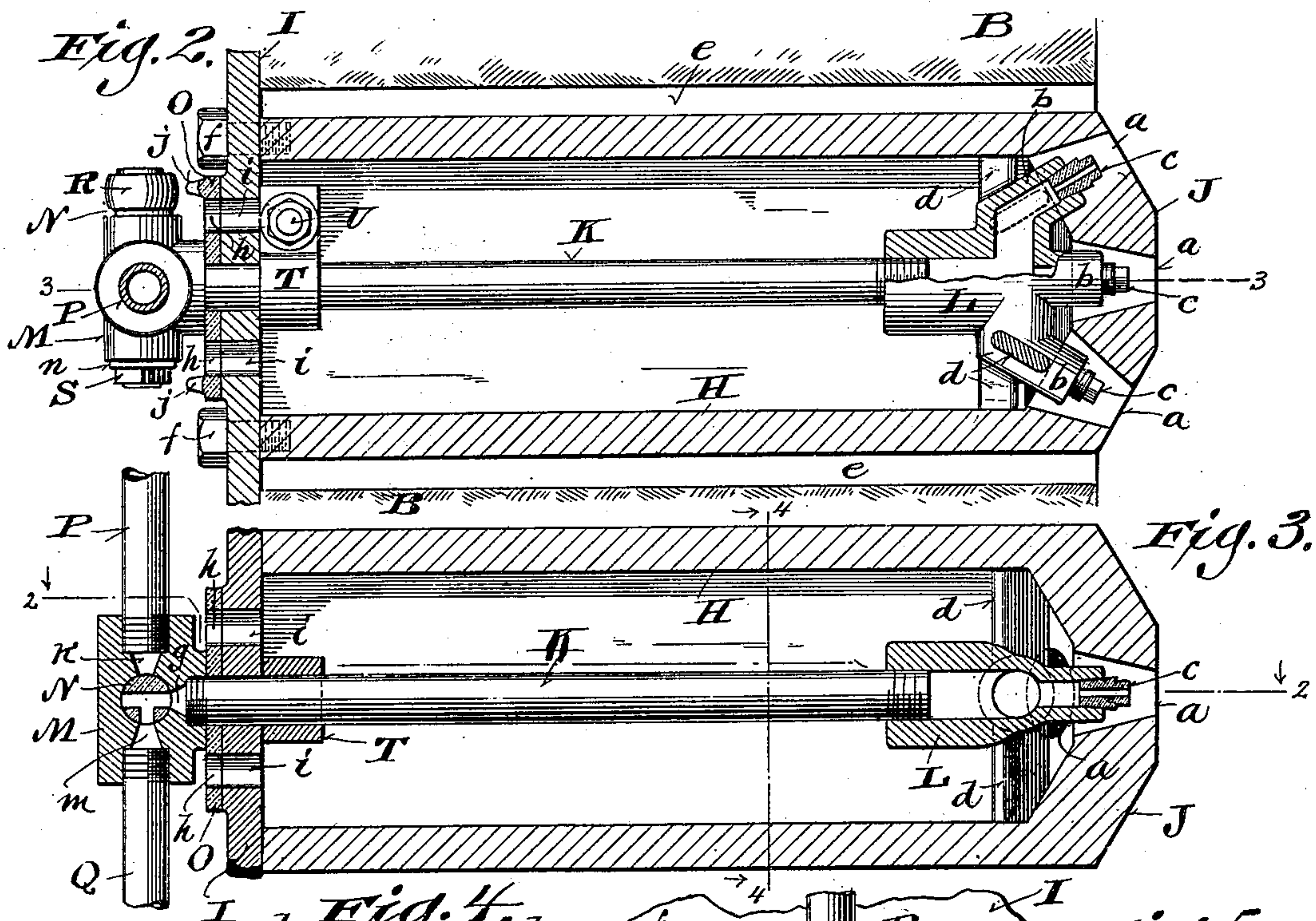
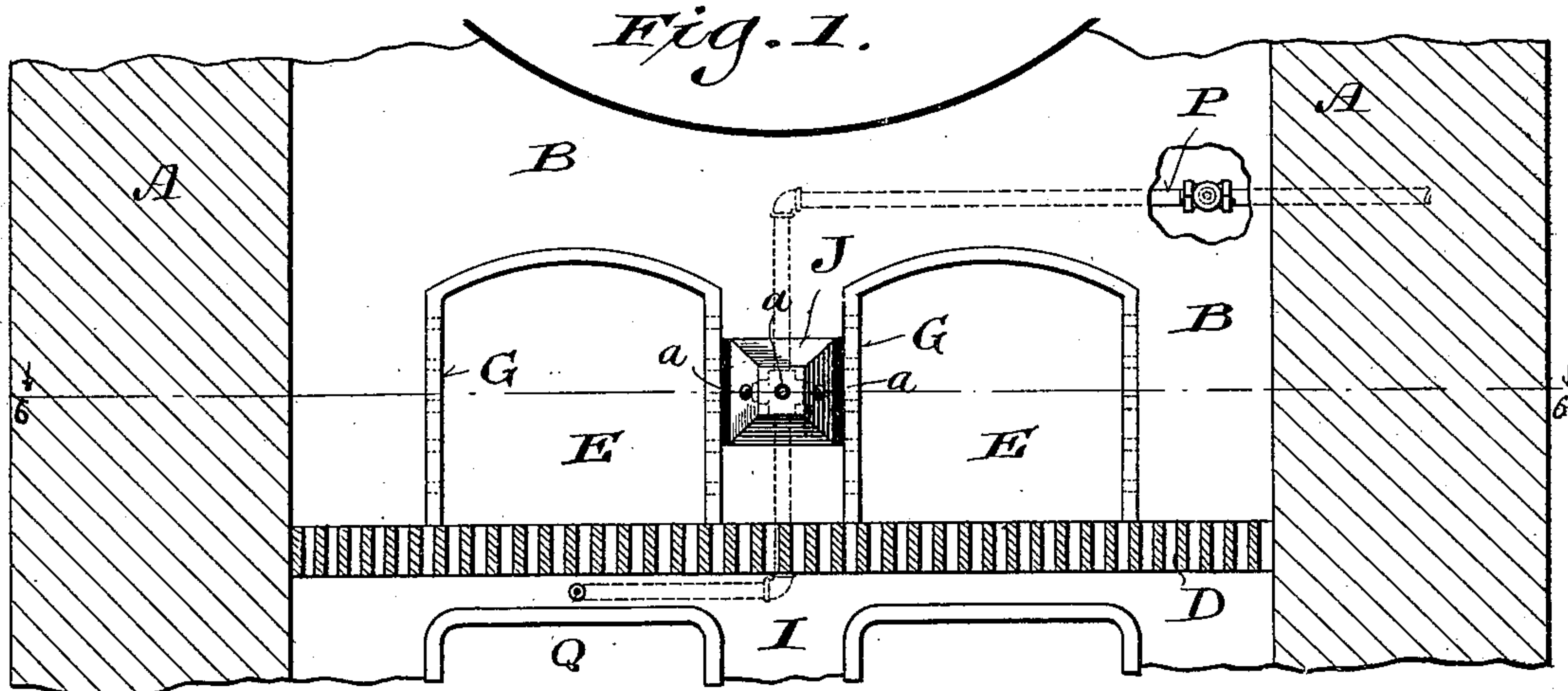


G. M. CONWAY.  
SMOKE PREVENTING DEVICE.

(Application filed Mar. 4, 1898.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses:  
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B. C. R. R.

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No. 693,112.

Patented Feb. 11, 1902.

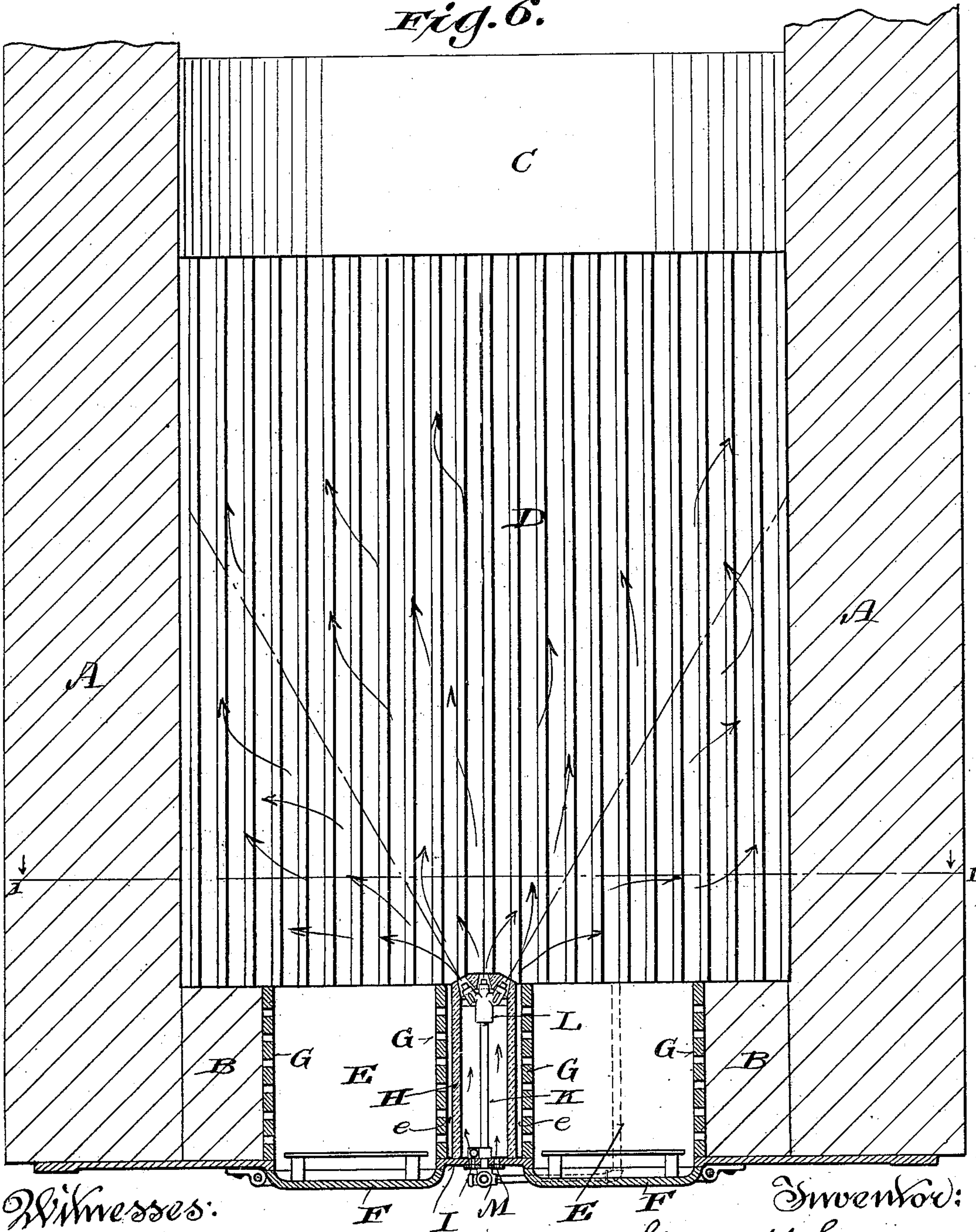
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(Application filed Mar. 4, 1898.)

(No. Model.)

2 Sheets—Sheet 2.

*Fig. 6.*



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# UNITED STATES PATENT OFFICE.

GEORGE M. CONWAY, OF MILWAUKEE, WISCONSIN.

## SMOKE-PREVENTING DEVICE.

SPECIFICATION forming part of Letters Patent No. 693,112, dated February 11, 1902.

Application filed March 4, 1898. Serial No. 672,533. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE M. CONWAY, a citizen of the United States, and a resident of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Smoke-Preventing Devices; and I do hereby declare that the following is a full, clear, and exact description thereof.

My invention relates to devices especially designed for the prevention of smoke from furnaces and the improved combustion of the fuel and hydrocarbons therein contained, whereby the efficiency of said fuel is greatly increased, involving greater economy in its use and the doing away of the nuisance of floating free carbon particles in the gases and other products of combustion escaping therefrom; and to that end it consists in certain peculiarities of construction and combination of parts, all as will be fully set forth hereinafter and subsequently claimed.

In the drawings, Figure 1 is a transverse vertical sectional view through the lower part of a horizontal-tubular-boiler furnace embodying my said improvements, taken on the line 1 1 of Fig. 6 and looking from the interior outward toward the front of the furnace. Fig. 2 is a longitudinal sectional view through the casing containing my said improvements, taken on the line 2 2 of Fig. 3. Fig. 3 is a like sectional view through the same parts, taken on the line 3 3 of Fig. 2. Fig. 4 is a transverse sectional view taken on the line 4 4 of Fig. 3. Fig. 5 is a detail view showing a portion of the furnace-front in front of the described casing with the steam and air controlling devices in elevation. Fig. 6 is a horizontal sectional view of a furnace having my invention applied thereto, taken on the line 6 6 of Fig. 1.

Referring to the drawings, A A represent the side walls, B B the front wall, C the bridge-wall, and D the grate, of a horizontal-tubular-boiler furnace of any ordinary construction, the said walls being formed of fire-brick and clay, as is usual.

E E represent the feed-openings through which fuel is delivered to the grate D, F F the doors thereto, and G G the side walls or linings of said feed-openings shown with perforations therethrough to prevent said

walls, which are usually of cast-iron, from warping.

In the form of furnace illustrated in the present drawings between the side walls of the two adjacent fuel-openings E E, I arrange the casing H, which contains my said improvements; but it will be understood that I do not in any way limit my invention to the location named nor to the style of furnace shown, my said invention being applicable to any style of fire-box, boiler, or furnace desired. This casing is preferably made of cast-iron (though it may be made of fire-clay, brick, or any other suitable material capable of withstanding heat) and, as shown, is in effect an oblong box with straight parallel top and bottom and side walls, though this again is not material, the shape, arrangement, and location of said casing H being such as is applicable to the particular furnace to which it is to be applied.

I represents the cast-iron front of the furnace, and this front forms the closure of the outer end of said casing, while the inner end of said casing is shown at J and is preferably cast integrally with the four parallel walls of said casing already described. The said inner end J is preferably formed in the shape of the frustum of a four-sided pyramid; as best shown in Fig. 1, there being openings *a a* through the square end of said frustum and two of the oblique sides, as shown in Figs. 1 and 2, said openings being preferably conical bores with their base or greatest diameter inside and contracting outwardly, as shown.

K is a steam-pipe projecting through the front casing I of the furnace into the casing H, said pipe being preferably screw-threaded at each end, and at the inner end said pipe screws into an injector-head L, having three hollow branches *b b b*, each branch projecting into one of the hereinbefore-named openings *a a a* in the said pyramid frustum-shaped end J of the casing H. Further, the outer projecting end of each branch *b* is provided with internal screw-threads to receive the nozzles *c c c*, which have corresponding exterior screw-threads at their inner ends, and these nozzles may be made in series with bores of different diameters, so that one set may be substituted for another in order that



at any time nozzles having large or small bores may be used, according to the need in any case, as some furnaces will require a greater discharge of steam over the fire-bed than others. The said injector-head L is fitted with centering-lugs *d d*, projecting up and down vertically and also laterally (six being shown in the present drawings) to insure that the said injector is properly centered in the adjacent end of the casing H. The said casing is built into the masonry of the furnace at top and bottom, but with air-spaces *e e* at the sides between the outer sides of said casing H and the inner surfaces of the adjacent perforated side walls or linings G G of the fuel-feed openings E E, and the front ends of the walls of said casing (which latter is an open box at the front end) are secured to the furnace-front I by the screws *f f*, as shown.

M is a valve-casing containing a three-way tapered plug-valve N. The inner face of this casing is provided with a channel *g*, communicating with the central valve-seat and screw-threaded adjacent to its outer end to receive the adjacent end of the steam-pipe K.

O is a damper-plate having holes *h h h h* therethrough, said damper-plate having a central perforation by means of which it is loosely mounted on the outer end of the steam-pipe K between the outer surface of the furnace-front I and the inner face of the said valve-casing M, and the said holes *h h h h* are adapted to register with like holes *i i i i* through the furnace-front I, leading into the interior of the casing H, so that the supply of air into said casing may be controlled by turning said damper-plate. This damper is turned, as desired, by means of the lugs *j j*. The said valve-casing M is further provided with an upper vertical channel *k* and a lower vertical channel *m*, each communicating with the described central valve-seat and each channel being further screw-threaded for the reception, respectively, of the steam-inlet pipe P and the discharge-pipe Q, which latter is for carrying off the water of condensation which accumulates in the pipes, the said pipe Q leading into the ash-pit below the grate D.

The described plug-valve N has the usual three-way channels transversely therethrough, as best shown in Fig. 3, and one outer projecting end of said plug-valve is fitted with a lever or handle R for turning said valve as required, the other end being fitted with a washer *n* and nut S. The steam-inlet pipe P connects with the main steam-pipe, (not shown,) which connects two or more boilers and takes live steam therefrom at boiler-pressure, so that steam of the proper temperature may always be obtained when any of the connected boilers are in use.

The operation of my invention will be readily understood from the foregoing description of its construction, taken in connection with the accompanying drawings. When the boiler is fired, the lever R of the three-way valve N is thrown into a horizontal position, which

shuts off the steam from the pipe K and opens the communication through said valve N between pipes P and Q, and the pressure of the steam from the main steam-pipe thus forces the water of condensation down and out through the pipe Q into the ash-pit of the furnace. When this has been accomplished, the lever R is moved from its just-described horizontal position upward into a vertical position, which shuts off the steam from the pipe Q and opens communication between pipes P and K, and the result is that the steam is forced through the pipe K into the injector-head L and branches *b b b* thereof and discharged through the injector-nozzles *c c c* into the tapered openings *a a a* in the end J of the casing H. The steam under pressure discharged from the small bores of the nozzles *c c c* into the larger openings *a a a* expands, and its velocity produces a partial vacuum in the casing H, and the air from outside rushes in through the described openings *i i* into said casing and mingles with the steam in the said openings *a a a*, and this mixed steam and air passes through said openings over the surface of the freshly-fired fuel, as shown by the dotted lines and arrows in Fig. 6. This air that is drawn into the casing H in the manner just described becomes heated in its passage therethrough, for the reason that the side walls of the said casing absorb heat from the furnace and radiate said heat on the inside, in addition to which the steam passing through the pipe K heats the said pipe, which radiates heat to the surrounding body of air. As the jets of steam mixed with the heated air pass through the conical openings in the end J of the casing H under a high velocity over the surface of the freshly-fired fuel they produce a partial vacuum in the fire-box of the furnace, and the air from the ash-pit rushes up through the grate-openings and fixed carbon of the burning fuel, supplying heat and oxygen in connection with that forced over the surface of the freshly-fired fuel, and this serves to ignite the hydrocarbons liberated therefrom, thus increasing the value of the fuel as a heat producer and preventing the formation of smoke and the deposit of free carbon particles on the heating-surfaces of the boiler. The pipe K can be readily removed when required; but to prevent accidental longitudinal displacement I preferably employ a split collar T, clamped tightly to said pipe by means of screw-bolt U, just inside of the furnace-front I, and this, in connection with the valve-casing M, tightly screwed upon the projecting end of the pipe K, will serve to keep said pipe and the damper O in place. These streams of mingled steam and hot air are only injected over the fuel each time the furnace is freshly fired, and the operation of my device usually occupies, say, from one to three minutes, according to circumstances, after which the lever or handle R is turned down, as shown in Fig. 5, which shuts off the



supply of steam, the channels in the valve N being then in the position shown in the sectional view Fig. 3, and the parts thus remain until a fresh firing of the furnace becomes  
5 necessary.

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

1. In a device for preventing smoke and in-  
10 creasing the combustion of fuel in furnaces, the combination of a casing arranged exterior to said furnace but having one end projecting therein above the fire-bed, said inner end having openings therethrough, and the  
15 other end of said casing being closed but provided with a series of draft-openings therethrough; a steam-pipe extending longitudinally within said casing, toward the inner end thereof; and adapted to discharge steam  
20 through said openings in the inner end of said casing; a valve-casing exterior to the closed outer end of said casing, a three-way valve within said valve-casing; a valve-controlled pipe leading from a source of steam-  
25 supply to said valve-casing; a steam-outlet pipe leading therefrom; a damper-plate loosely mounted on the exterior projecting end of the first-named steam-pipe between the closed outer end of the casing and the  
30 adjacent face of the valve-casing, and having holes therethrough adapted to register with the draft-openings through said closed outer end of the said casing; substantially as described.

35 2. The combination with a furnace having a hole in one wall thereof, of a perforated front plate closing said hole in the wall, a casing located in said hole and having an open outer end secured to said front plate and supported by said front plate which constitutes  
40 a closure therefor, and having an opening in its inner end, a steam-pipe extending longitudinally into said casing through an opening in said front plate, and adapted to discharge steam through said openings in the inner end  
45 of the casing, a damper-plate mounted to turn on said steam-pipe adjacent said front plate and having perforations adapted to register

with the perforations in the front plate, substantially as described. 50

3. The combination with a furnace having a hole in one wall thereof, of a perforated front plate closing said hole, an open-ended casing located in said hole in the furnace-wall, said open end being secured to said front  
55 plate which constitutes a closure therefor, a steam-pipe extending through a hole in said front plate into said casing and supported by front plate, and adapted to discharge steam through an opening or openings in the inner  
60 end of said casing, a valve-casing on said pipe outside said front plate, a damper-plate loosely mounted on said pipe between said valve-casing and said front plate which valve-casing and plate hold the damper in proper po-  
65 sition, and having perforations therethrough adapted to register with the perforations in the front plate, substantially as described.

4. The combination with a furnace having a hole in one wall thereof, of a perforated  
70 front plate secured to the outside face of the wall and closing said hole in the wall, an elongated casing located in said hole and having an open outer end detachably secured to said front plate which constitutes a closure there-  
75 for, and having air-openings in its inner end, a steam-pipe extending longitudinally into said casing through an opening in said front plate, an injector-head on said pipe having nozzles adapted to direct steam through said  
80 openings in the casing, means for supporting said head in the casing with the nozzles opposite said openings in the casing end, a damper-plate mounted to turn on said steam-pipe adjacent said front plate and having perfo-  
85 rations adapted to register with the perforations in the front plate, substantially as described.

In testimony that I claim the foregoing I have hereunto set my hand, at Milwaukee, in  
90 the county of Milwaukee and State of Wisconsin, in the presence of two witnesses.

GEORGE M. CONWAY.

Witnesses:

H. G. UNDERWOOD,  
N. E. OLIPHANT.