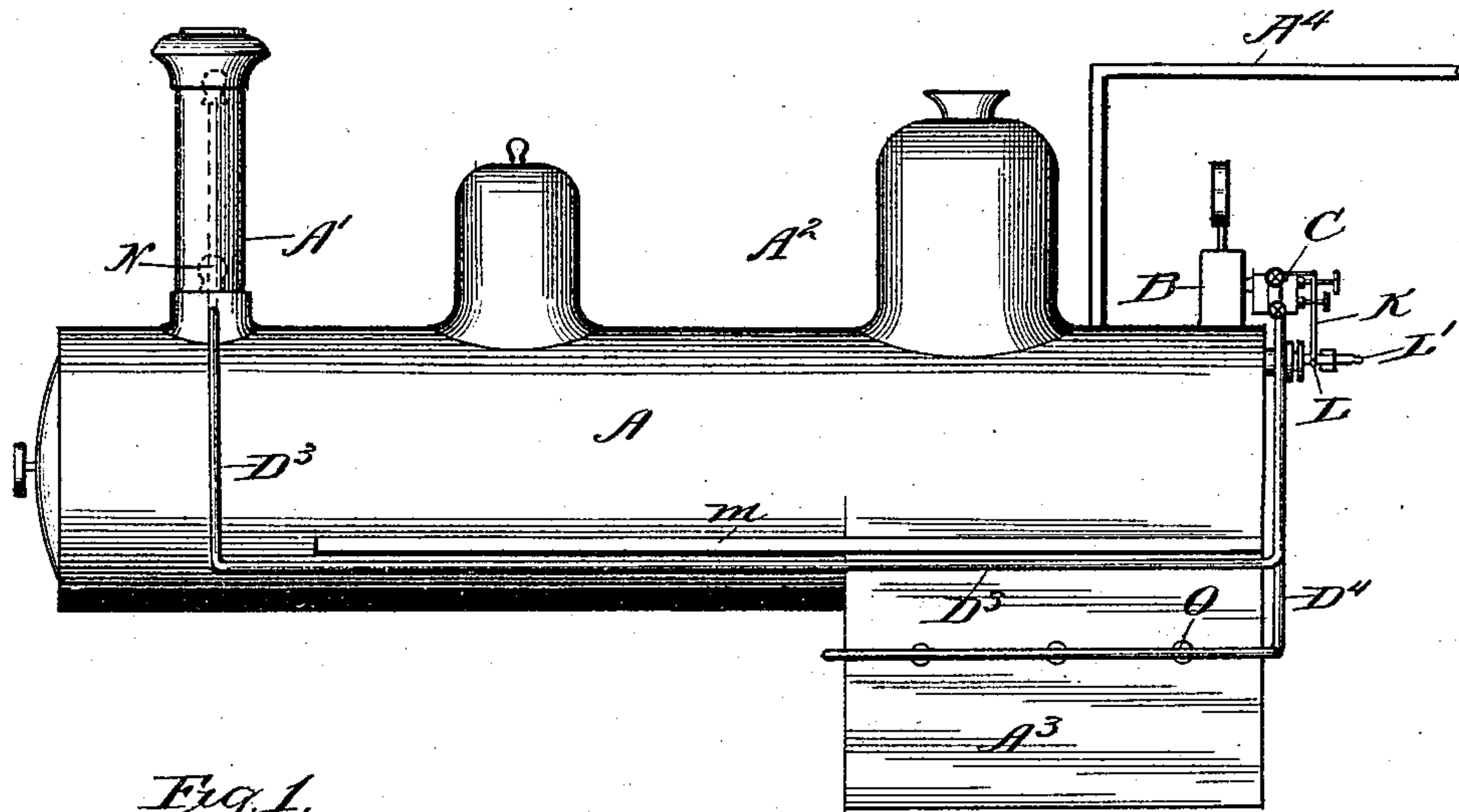


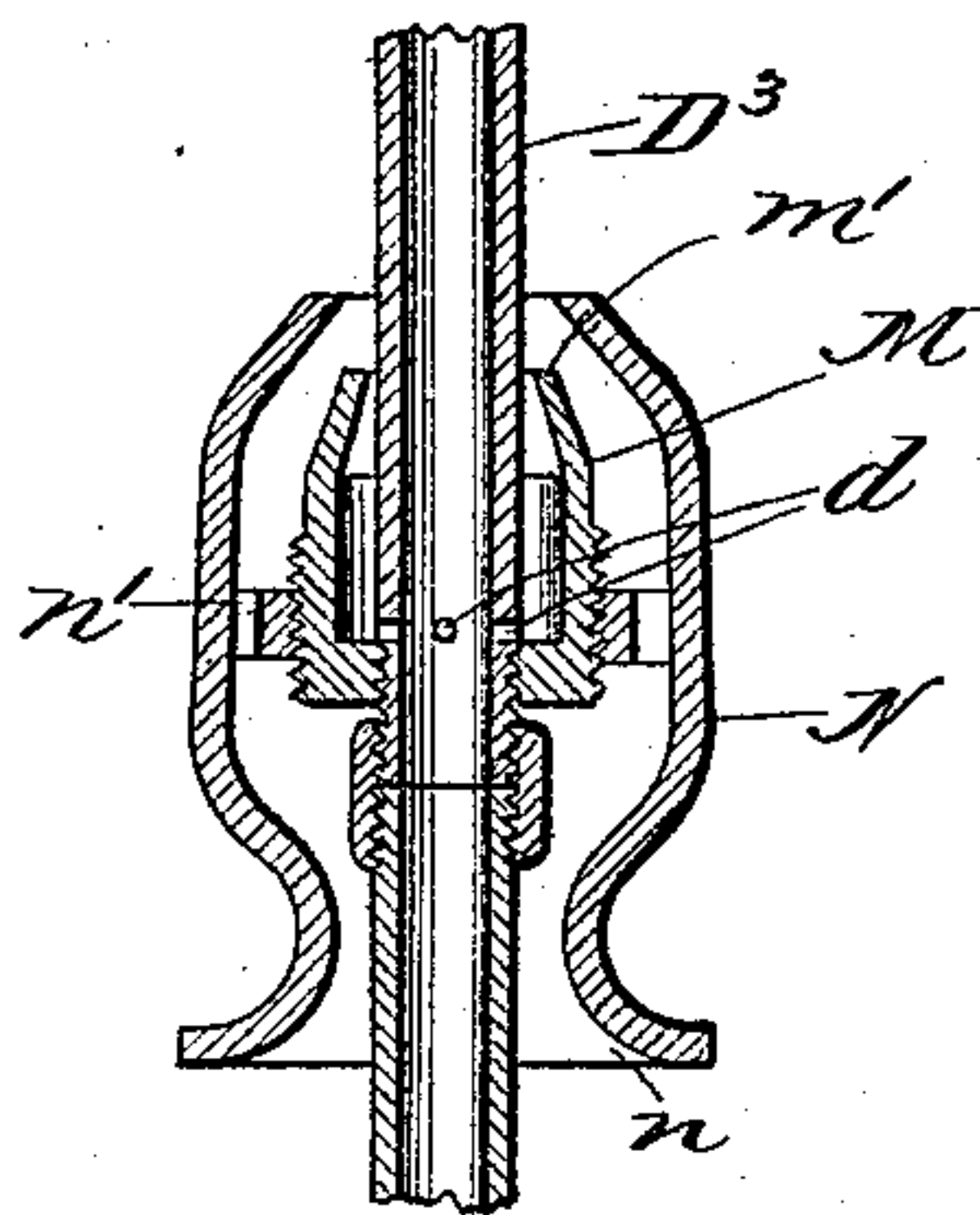
3 Sheets—Sheet 1.

No. 490,539.

Patented Jan. 24, 1893.



*Fig. 1.*



*Fig. 8.*

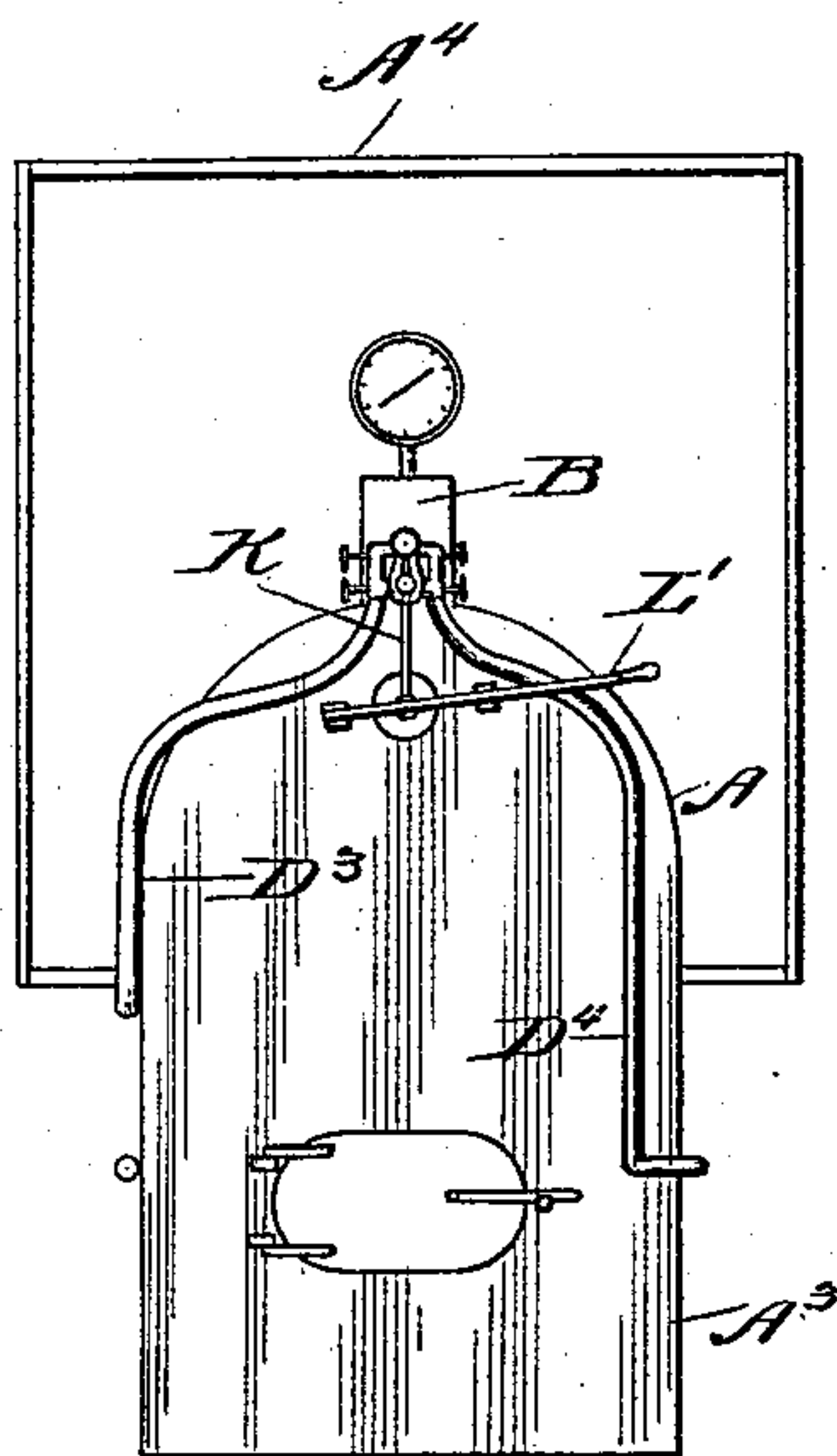


Fig. 2.

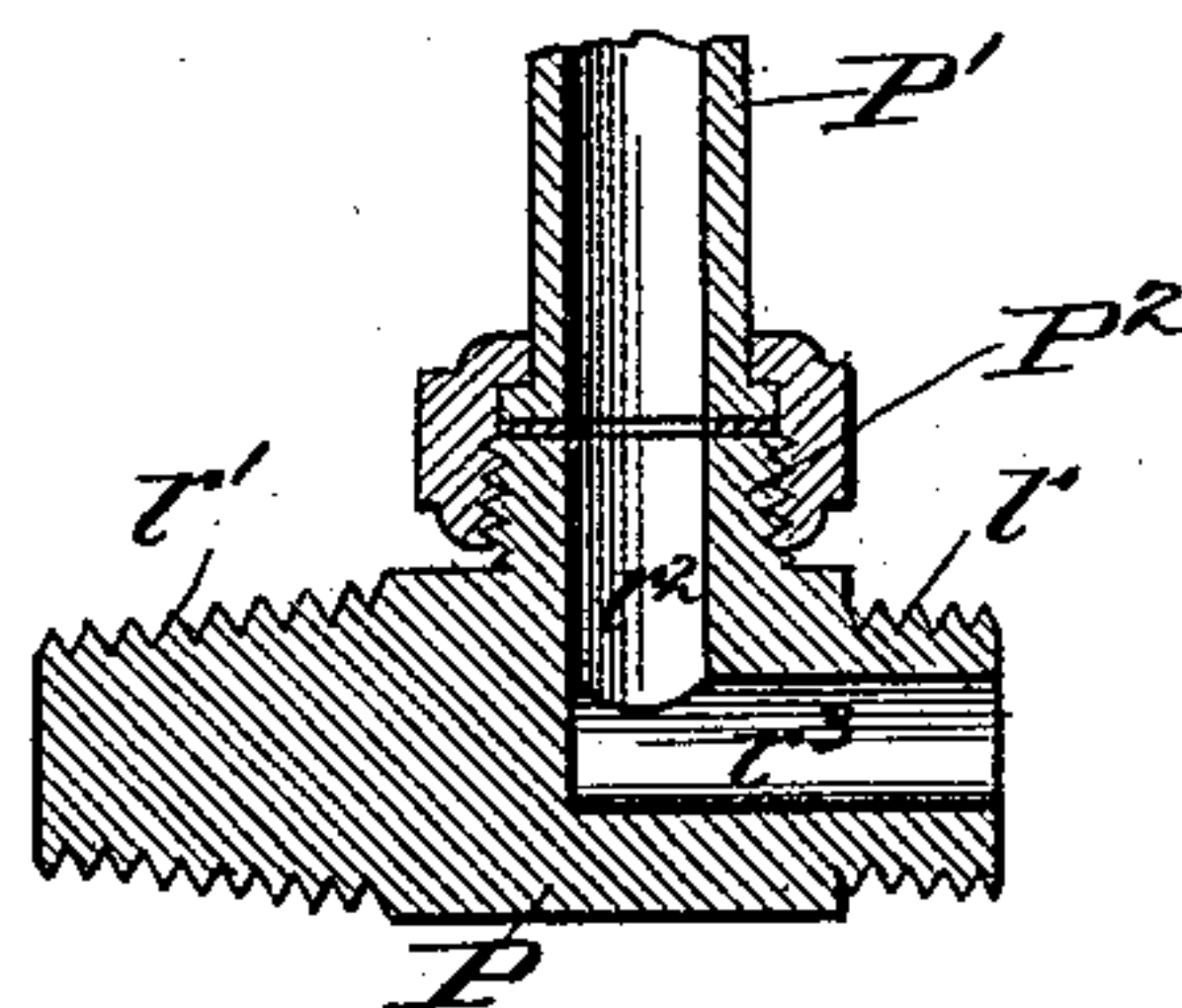
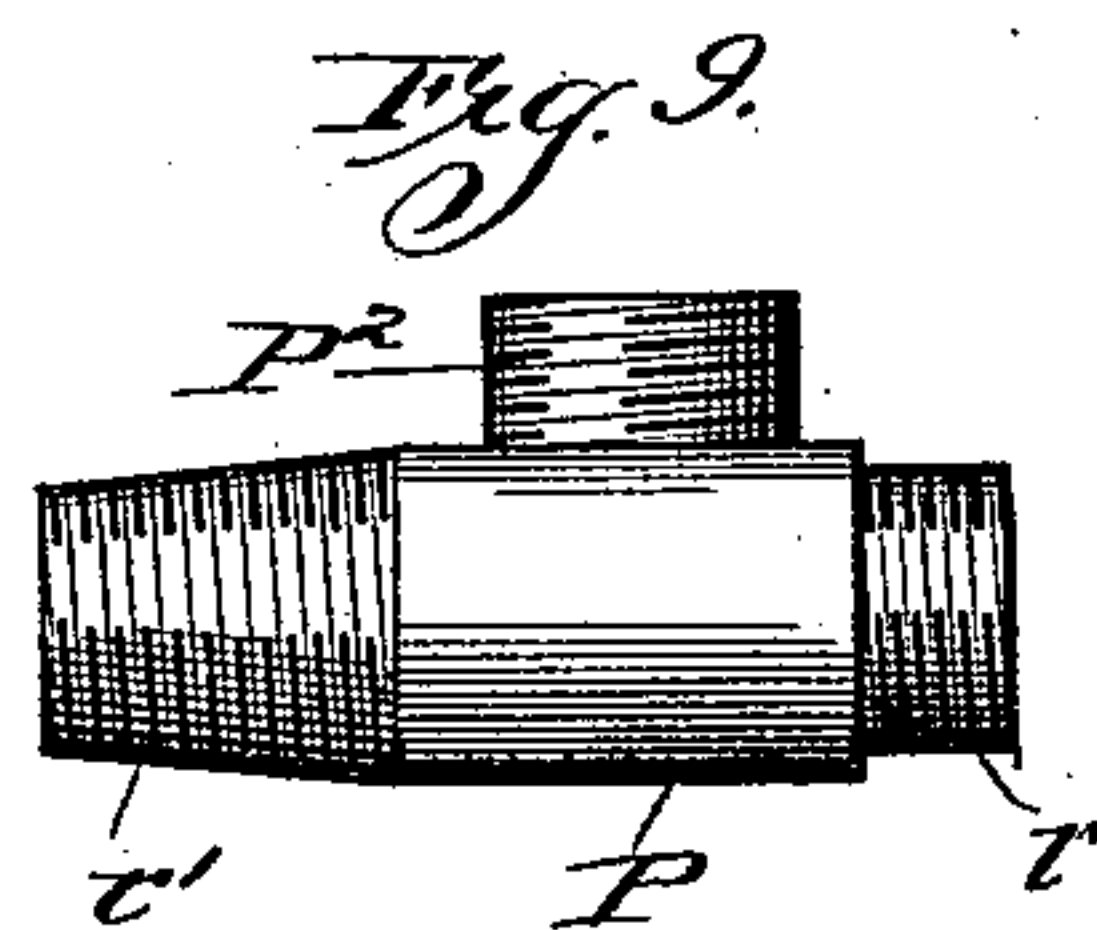


Fig. 10.

Witnesses:  
John L. Tunison.  
Martin H. Olsen.

*Inventor.*  
Charles Camp  
By Chas. Tillman, Atty

(No Model.)

3 Sheets—Sheet 2.

C. CAMP.  
SMOKE CONSUMER.

No. 490,539.

Patented Jan. 24, 1893.

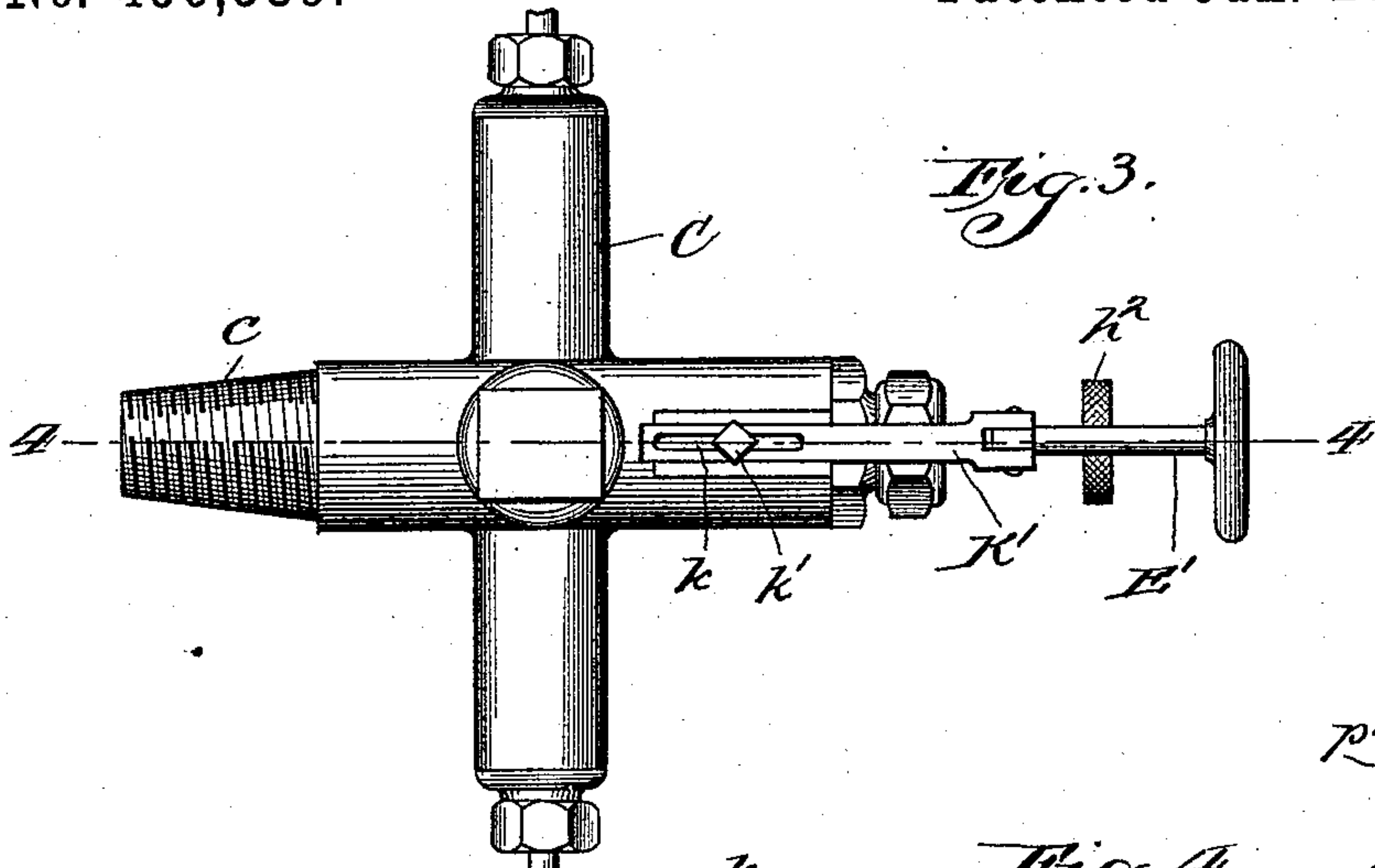


Fig. 3.

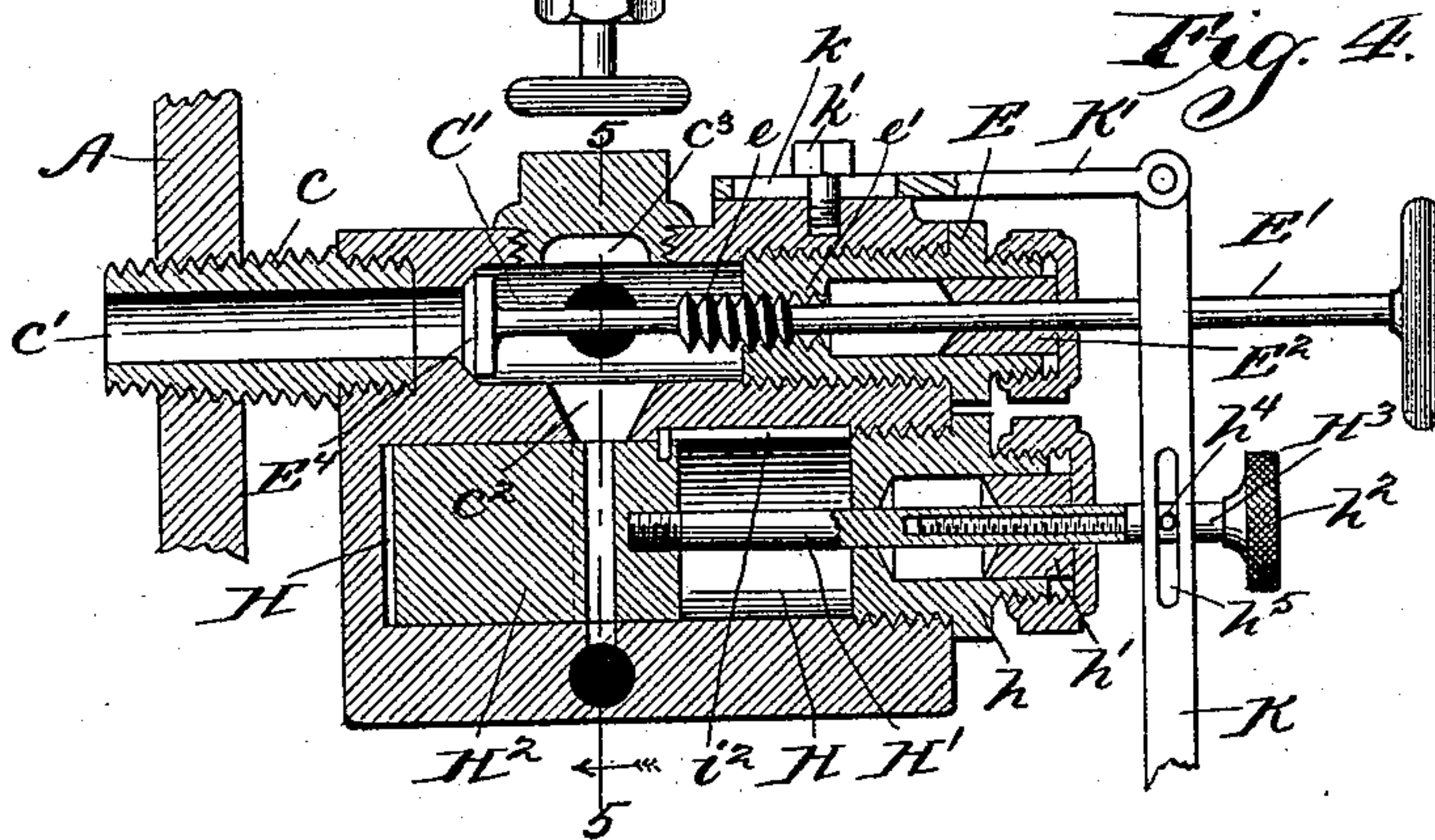


Fig. 4.

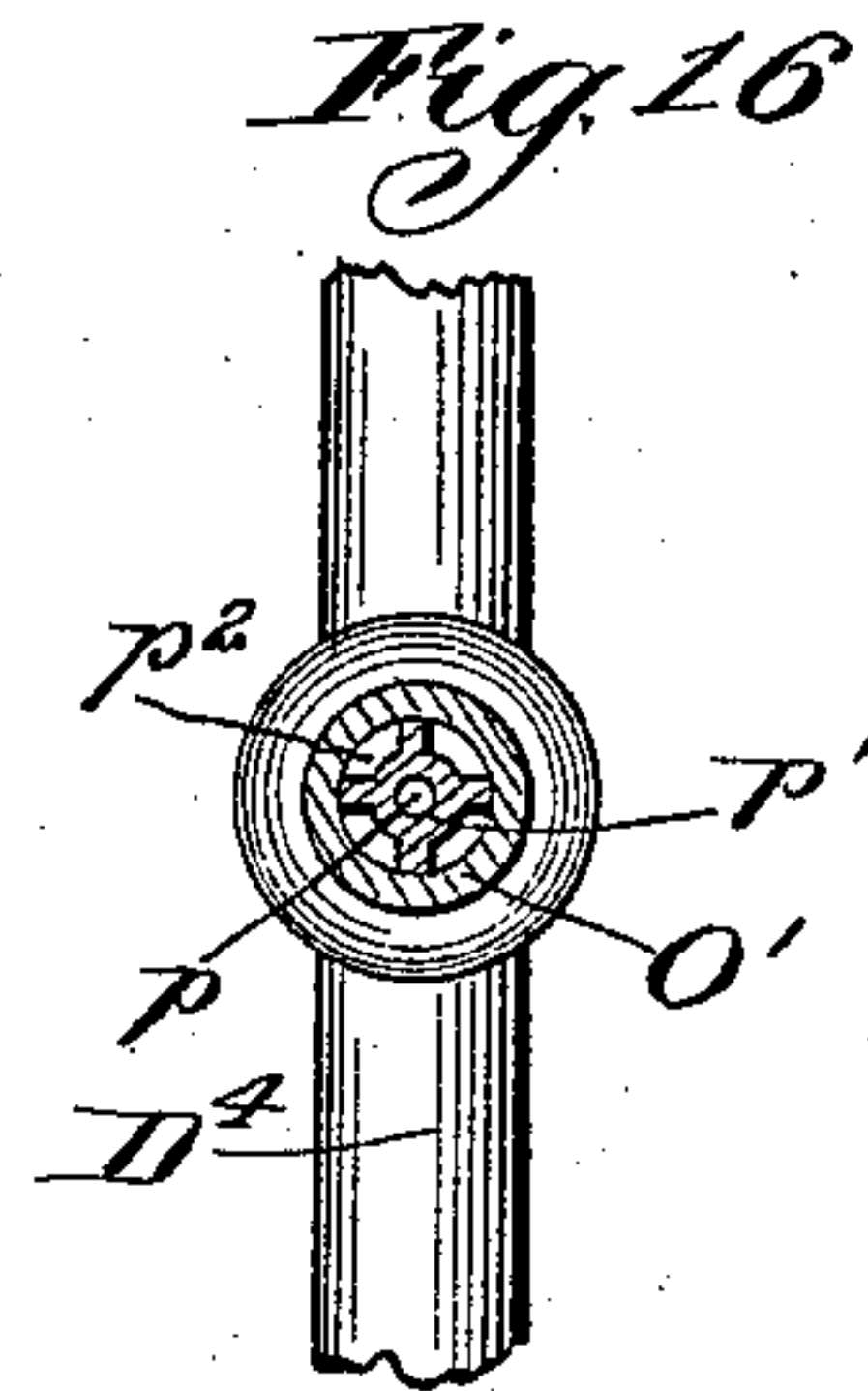


Fig. 16.

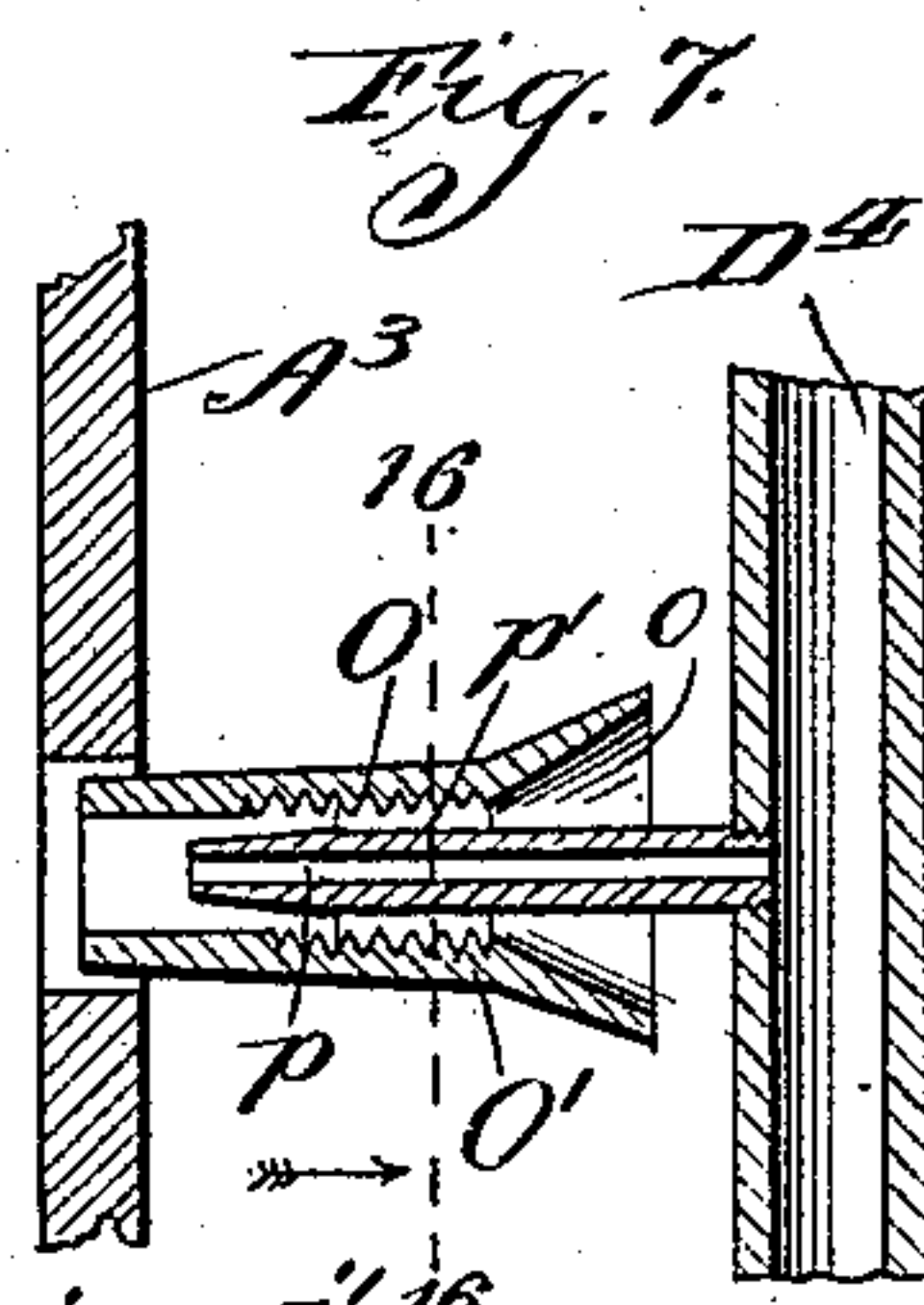


Fig. 7.

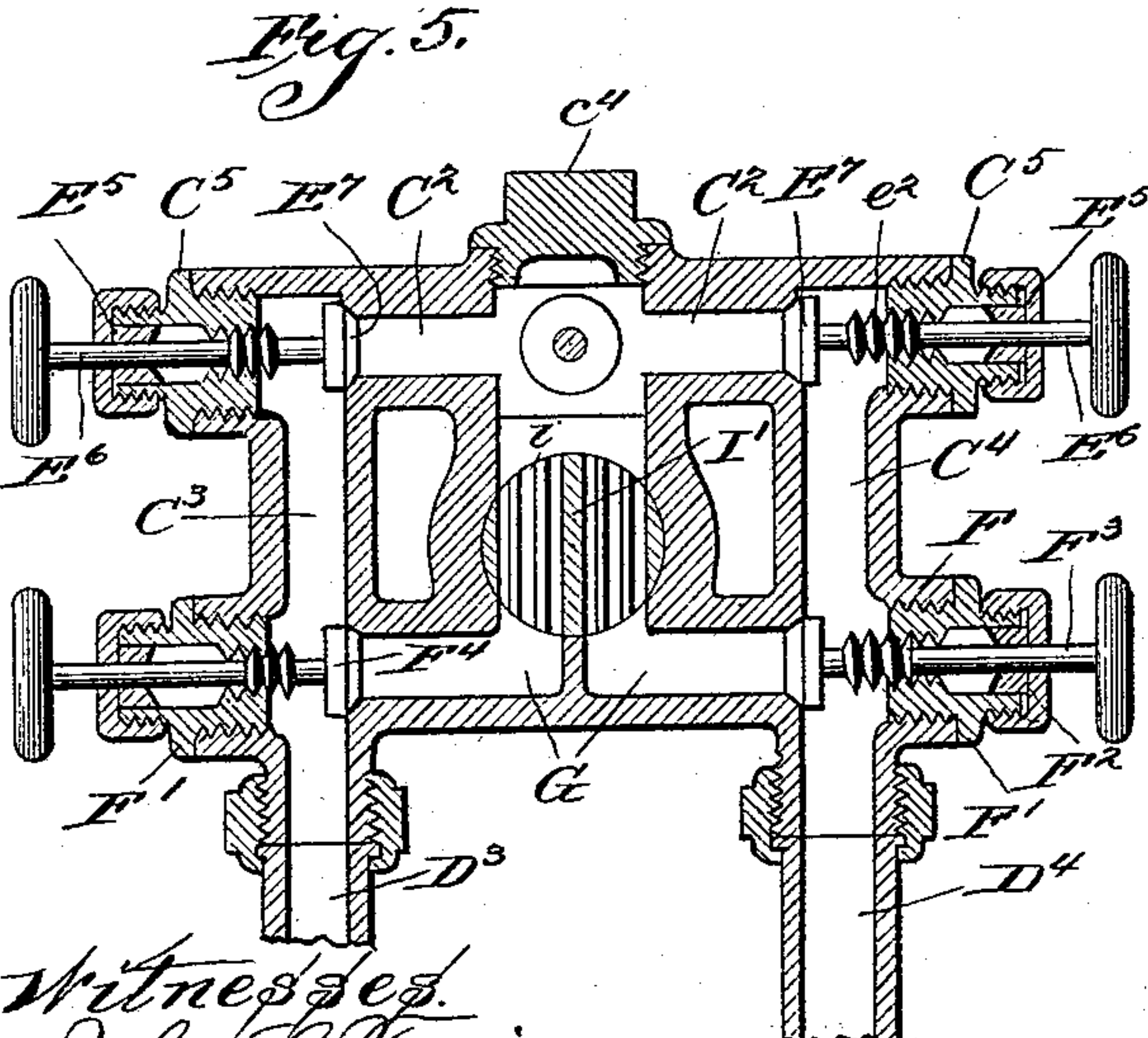


Fig. 5.

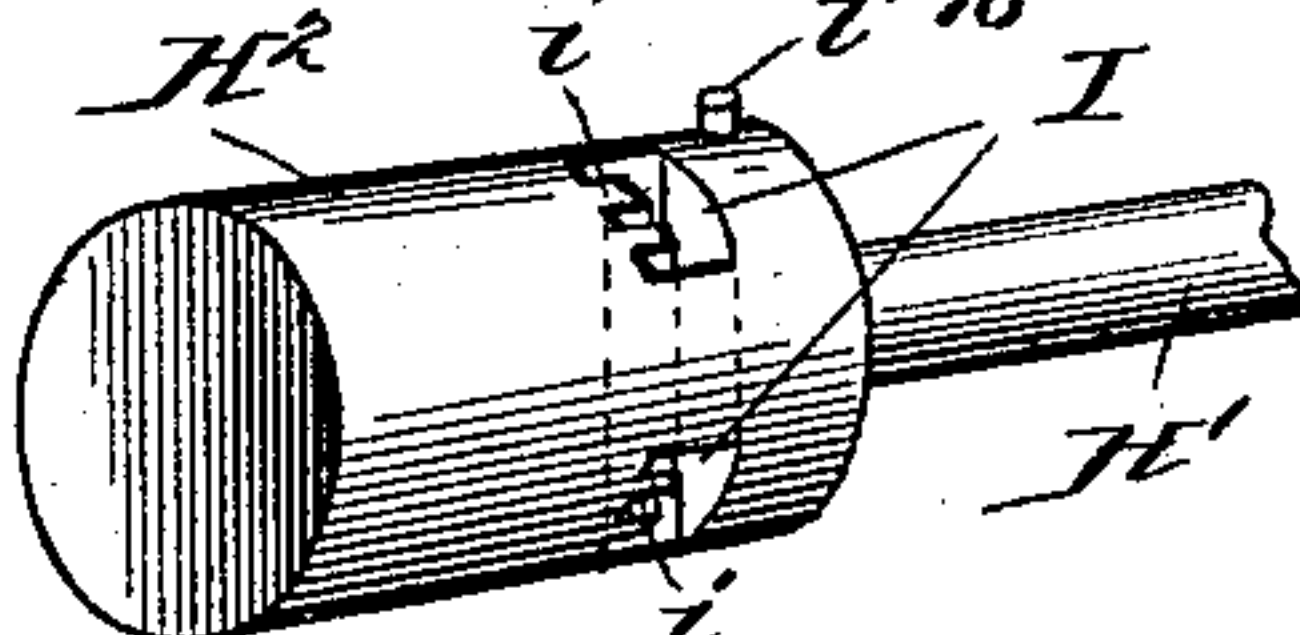


Fig. 6.

Witnesses:  
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Martin H. Olsen

Inventor:  
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By Chas. C. Tillman, Atty



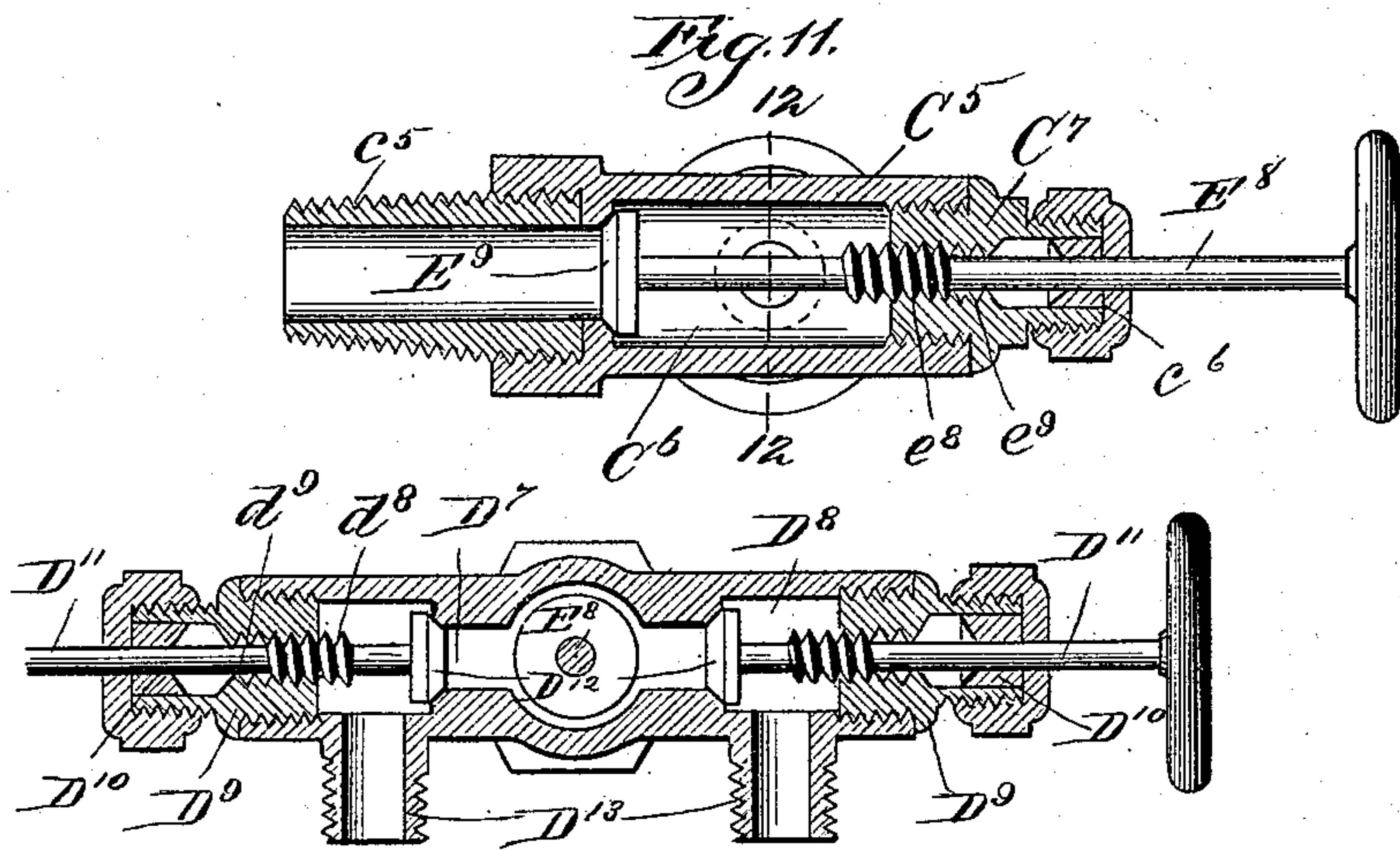
(No Model.)

3 Sheets—Sheet 3.

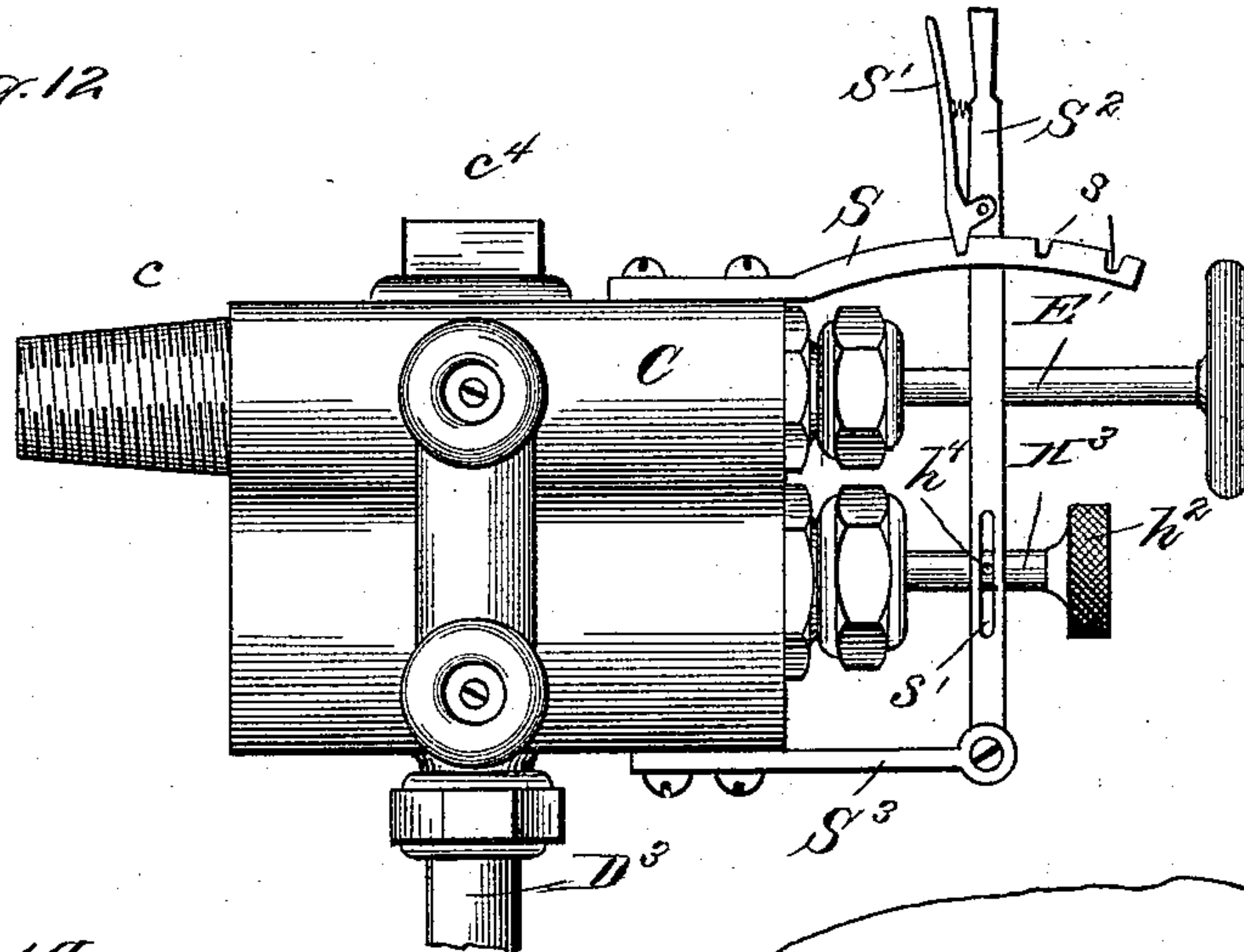
C. CAMP.  
SMOKE CONSUMER.

No. 490,539.

Patented Jan. 24, 1893.

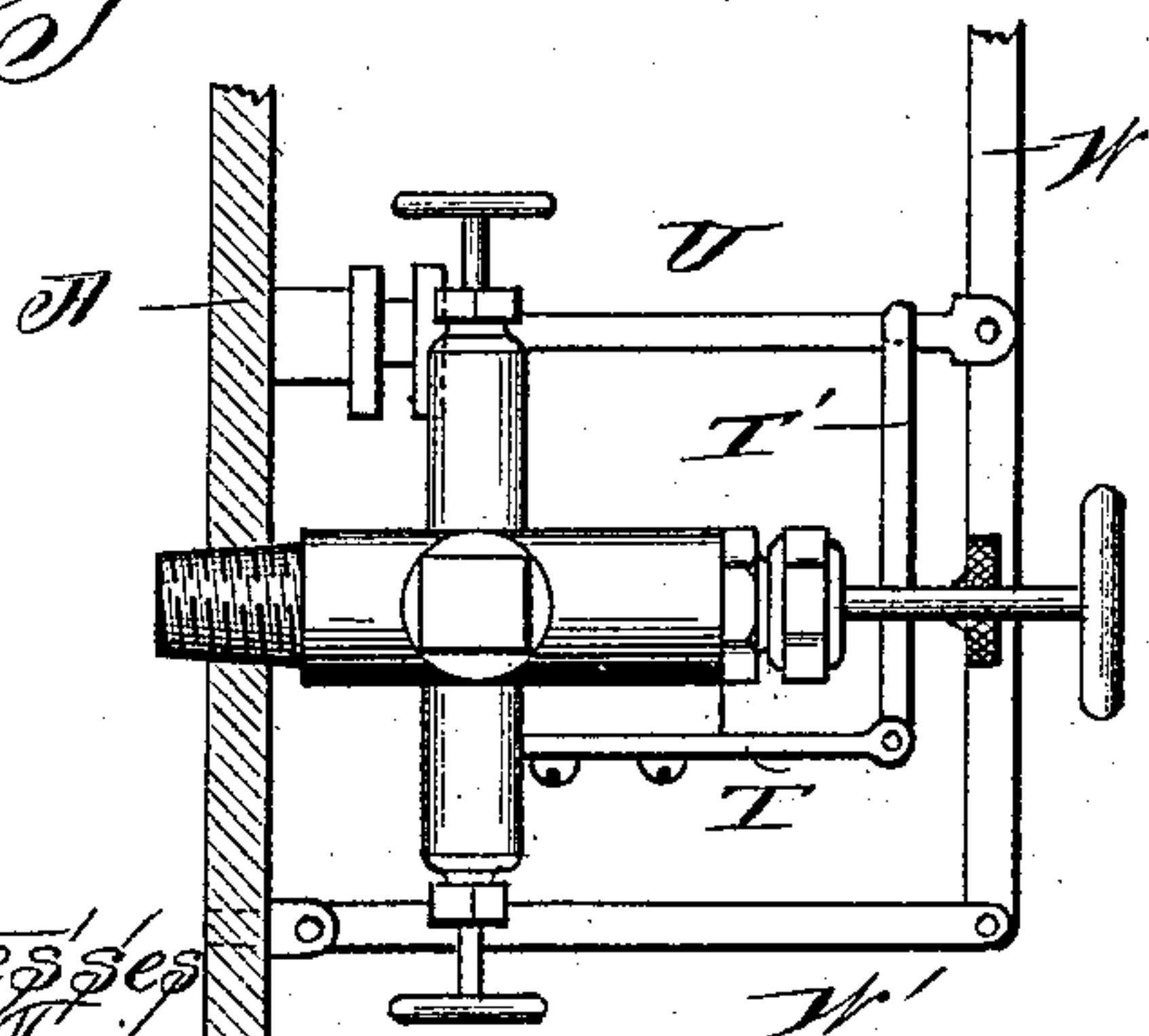


*Fig. 12.*

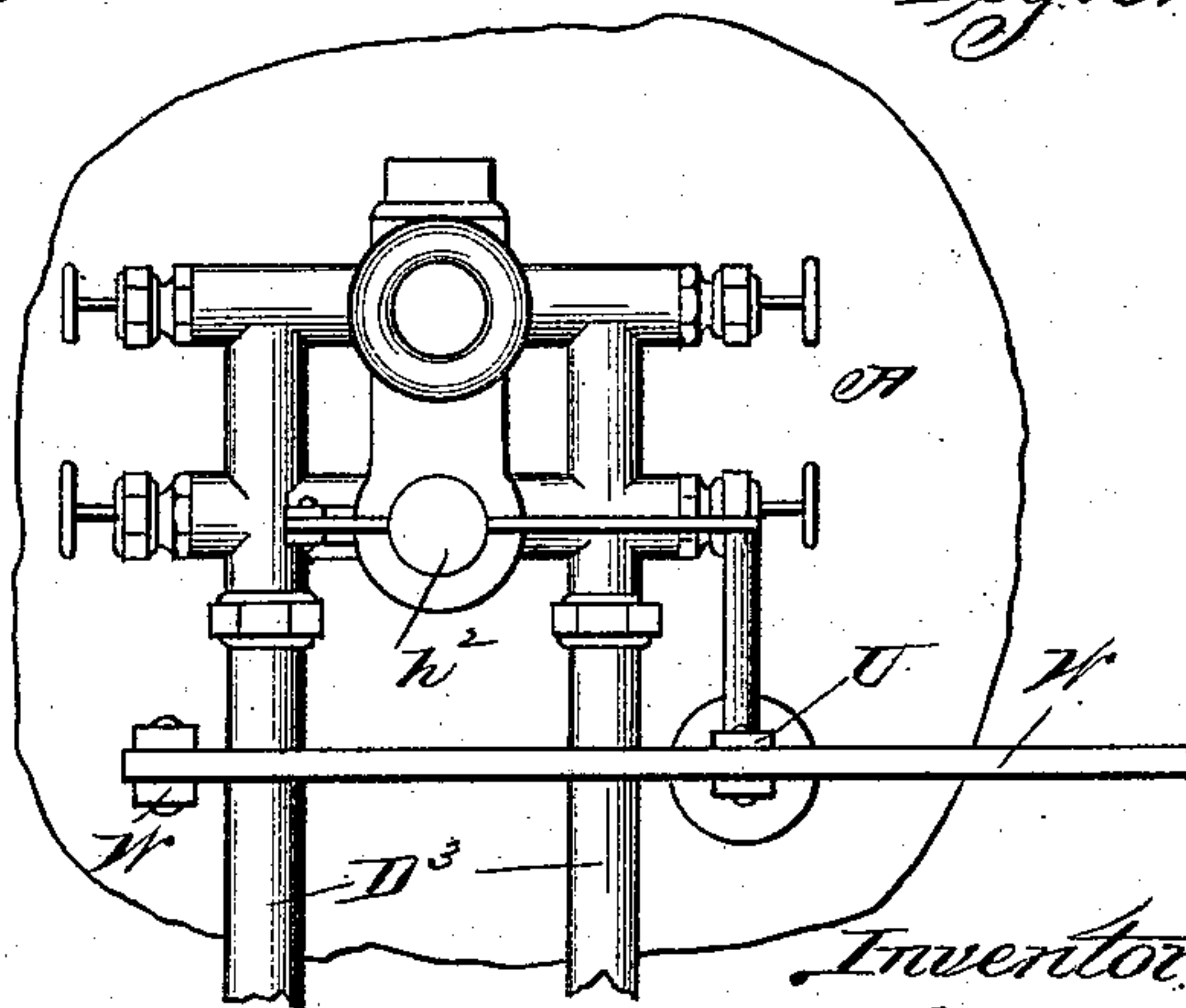


*Fig. 13.*

*Fig. 14.*



Witnesses  
John L. Tinsley  
Martin A. Olson



Inventor  
Charles Camp  
By Chas. C. Tinsley, Atty



# UNITED STATES PATENT OFFICE.

CHARLES CAMP, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO  
BENJAMIN F. BUSHNELL, OF SAME PLACE.

## SMOKE-CONSUMER.

SPECIFICATION forming part of Letters Patent No. 490,539, dated January 24, 1893.

Application filed August 29, 1892. Serial No. 444,376. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES CAMP, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have  
5 invented certain new and useful Improvements in Smoke-Consumers, of which the following is a specification.

This invention relates to attachments to be applied to locomotive and other boilers to prevent the emission of smoke, and consists in certain peculiarities of the construction, novel arrangement, and operation of the various parts thereof, as will be hereinafter more fully set forth and specifically claimed.

15 The objects of my invention are first, to provide a device for the prevention of smoke, which may be applied to any kind of a boiler, and which shall be inexpensive in construction, simple and effective in operation; and  
20 second, such a device which will produce an artificial draft, and by reason of the same, will facilitate the generation of steam.

In order to enable others skilled in the art to which my invention pertains to make and  
25 use the same, I will now proceed to describe it, referring to the accompanying drawings, in which—

Figure 1, is a view in side elevation of the boiler, fire-box, and a portion of the cab of a  
30 locomotive, with my attachments in place ready for operation. Fig. 2, is a view in front elevation thereof. Fig. 3, is a detached plan view of the controlling valve of my invention. Fig. 4, is a central sectional view thereof,  
35 taken on line 4, 4, of Fig. 3. Fig. 5, is a central cross sectional view, taken on line 5, 5, of Fig. 4. Fig. 6, is a perspective view of a comb-valve or piston, employed in the lower portion of the controlling valve. Fig. 7, is a horizontal  
40 sectional view of a portion of the fire-box, steam pipe, and one of the injectors connected thereto. Fig. 8, is a vertical sectional view of a portion of the steam pipe, which is located within the smoke stack, with its thimble and  
45 smoke conductor or sleeve, employed to produce an artificial draft. Fig. 9, is a view in side elevation of a plug to be used in connection with the controlling valve, when the same is to be operated indirectly. Fig. 10, is a sectional  
50 view thereof, showing a portion of the conducting pipe secured thereto. Fig. 11, is

a longitudinal sectional view, of a modification of the controlling valve. Fig. 12, is a cross section, taken on line 12, 12, of Fig. 11. Fig. 13, is a view in side elevation of the controlling valve, showing a modification in the  
55 manner of operating the same. Fig. 14, is a plan view of the valve, connected with the boiler, showing a modification in the manner of operating the same, in connection with the  
60 throttle lever of a locomotive. Fig. 15, is a view in front elevation thereof. And Fig. 16, is a sectional view, taken on line 16, 16, of Fig. 7.

Similar letters refer to like parts throughout the different views of the drawings.

A, represents the boiler of a locomotive of the ordinary construction, having the smoke stack A', steam dome A<sup>2</sup>, fire-box A<sup>3</sup>, cab A<sup>4</sup>, and the other usual appurtenances, to the  
70 head of which, and preferably to the valve-gage or what is termed by engineers "the pumpkin" B, is connected and receives steam therefrom, the controlling valve C, which  
75 valve is made of any suitable size, form and material, but preferably of the form shown in Figs. 3, 4, and 5. The upper portion of said valve is formed or provided with a hollow screw threaded projection c, which is  
80 adapted to be inserted into or connected with the front portion of the boiler A, or the "pumpkin" B, the hollow c', thereof, opening into a slightly enlarged and longitudinal cavity C', which is located about the central upper  
85 portion of the valve C, and has leading laterally and transversely therefrom two ports C<sup>2</sup>, which unite with vertical channels C<sup>3</sup>, C<sup>4</sup>, which channels are open at their lower ends, and the former one C<sup>3</sup>, has connected to it a  
90 conducting pipe D<sup>3</sup>, which conveys steam from the valve to the smoke stack, and for the purpose presently to be explained.

To the lower end of the channel C<sup>4</sup>, is connected in any suitable manner a conducting pipe D<sup>4</sup>, which passes around the fire-box A<sup>3</sup>,  
95 and is provided with a number of steam jets or injectors for the distribution and discharge of air and steam, into said box, to facilitate the draft therein. As is clearly shown in Fig. 4, of the drawings, the front end of the cavity  
100 C, is formed with a screw threaded plug E, the open end of which is provided with suit-



able packing  $E^2$ , through which is passed a valve-stem  $E'$ , having on its inner portion suitable male screw threads  $e$ , to engage with the female threads  $e'$ , to regulate the valve-head  $E^4$ , which is secured on the inner end of the stem  $E'$ , and opens or closes the hollow  $c'$ , leading to the cavity  $C'$ . The outer ends of the ports  $C^2$ , are likewise provided with screw threaded plugs  $C^5$ , having suitable packing  $E^5$ , in their outer ends, through which are passed the valve stems  $E^6$ , provided with male screw threads  $e^2$ , on their inner portions, and with valve heads  $E^7$ , on their inner ends, which heads open and close the channels or ports  $C^2$ , as is apparent by reference to Fig. 5, of the drawings. Near the lower ends the ports or channels  $C^3$ , and  $C^4$ , are formed with hollow bosses  $F$ , which are threaded on their inner surfaces and are provided with threaded plugs  $F'$ , having suitable packing  $F^2$ , through which is passed valve stems  $F^3$ , having on their inner ends the valve heads  $F^4$ , to open and close the channels  $G$ , which are united vertically with the cavity  $C'$ , and laterally with the ports  $C^3$ , and  $C^4$ .

As shown in Fig. 4, the lower middle portion of the cavity  $C'$ , may be formed with a funnel-shaped opening as at  $c^2$ , while its upper central portion is provided with an opening  $c^3$ , having a removable plug  $c^4$ , which construction permits of access to the interior of the valve, so that its parts may be lubricated, as well as affording a channel or guide-way for the steam from the cavity  $C'$ , to the cavity  $H$ , which is located longitudinally and directly beneath the cavity  $C'$ , and is provided at its front end with a screw-threaded hollow plug  $h$ , having at its outer end suitable packing  $h'$ , through which packing and plug is passed and operates a rod or stem  $H'$ , having secured to its inner end a comb-toothed piston or valve  $H^2$ , which operates in the cavity  $H$ , and is provided at a suitable point with two vertical orifices or openings  $I$ , which are separated by an upright partition  $I'$ , and are provided with vertical ribs, or comb-teeth  $i$ , and receives steam from the cavity  $C'$ , and discharges it into the channels  $G$ . The front portion of the stem  $H'$ , is formed hollow and provided with internal screw-threads to engage with the rod  $H^3$ , which has at its outer end a milled hand-piece  $h^2$ , for turning the same, and is screw-threaded on its inner portion to engage with the hollow of the stem  $H'$ , thus forming a turn-buckle to adjust the length of the stem or rod to levers having different distances to travel. The top and front portions of the piston or valve  $H^2$ , is provided with a pin or projection  $i'$ , which fits into a longitudinal groove  $i^2$ , in the upper surface of the cavity  $H$ , and prevents the valve turning as is obvious.

From the above, it will be seen and readily understood that when the steam is admitted to the cavity  $C'$ , through the hollow  $c'$ , and the ports  $C^2$ , are closed it will pass down through the funnel-shaped opening  $c^2$ , of the

cavity  $C'$ , into and through the openings  $I$ , of the piston or comb-valve  $H^2$ , out into the channels  $G$ , and from thence into the ports or channels  $C^3$ ,  $C^4$ , which are connected with the conducting pipes  $D^3$ , and  $D^4$ , respectively, and that the volume of steam will be divided by the partition  $I'$ , of the comb-valve as well as regulated by the comb-teeth  $i$ , which are placed in the openings  $I$ , for this purpose. For it is apparent, that when a full supply of steam is desired to pass through the openings  $I$ , they may be placed directly under the opening  $c^2$  of the cavity  $C'$ , and when a smaller quantity is desired, the piston or valve may be moved forward by means of the lever, when the port will be partially closed and the steam will pass between the comb-teeth  $i$ , or by moving it farther forward the entire supply may be shut off. The front portion of the rod  $H^3$ , is provided with a laterally extending pin or projection  $h^4$ , which fits into a vertical slot  $h^5$ , of the bar  $K$ , which is pivotally secured at its upper end to a horizontal brace rod  $K'$ , which is provided with a longitudinal slot  $k$ , through which is passed a screw  $k'$ , and adjustably secures it to the top of the controlling valve. The lower end of the bar  $K$ , is pivotally secured to the throttle-stem  $L$ , which is operated by means of the throttle-lever  $L'$ , of the locomotive.

As shown in Figs. 1, 2, and 4, of the drawings the conducting-pipe  $D^3$ , is secured to and is united with the lower end of the channel  $C^3$ , and passes down and under the running board  $m$ , and then vertically into the smoke-stack  $A'$ , to near the top thereof. At suitable points within the smoke-stack the pipe  $D^3$ , is provided with a number of perforations or holes  $d$ , through which the steam may escape into a truncated-cone  $M$ , which surrounds the pipe  $D^3$ , and is tightly fitted at its bottom to said pipe just below the openings  $d$ , therein, and has its walls a slight distance from the pipe and in alignment therewith to near its top, when the same are inclined inwardly, as at  $m'$ . Around this cone is placed and secured a sleeve  $N$ , which has a flaring opening or mouth  $n$ , at its bottom, and an enlargement or chamber  $n'$ , which is contracted at its top just above the upper part of the cone  $M$ . It is apparent that when the steam passes through the pipe  $D^3$ , and escapes into the cone  $M$ , it will pass therefrom through its contracted opening  $m'$ , with great force and will create a vacuum in the sleeve  $N$ , into which the smoke will rush and be commingled with the steam in its passage through the smoke-stack, thus causing additional draft throughout the boiler.

To the lower end of the channel  $C^4$ , is secured the conducting pipe  $D^4$ , which passes around the fire-box  $A^3$ , and is provided at proper intervals with a number of injectors or jets  $O$ , through which steam and air is forced into the fire-box. These jets or injectors are constructed of a hollow screw-threaded thimble  $O'$ , having a flaring mouth



o, to receive air, and a small pipe  $p$ , which is connected at one end with the pipe  $D^4$ , and has its other end inserted into the hollow of the thimble as is clearly shown in Fig. 7. The inner portions of the pipe  $p$ , is provided with a screw-threaded enlargement  $p'$ , which is provided with longitudinal grooves  $p^2$ , through which the air may pass and mingle with the steam.

In Figs. 9, and 10, I have shown a plug  $P$ , which is designed to be used in connection with the controlling valve  $C$ , when it, the valve, is so located that it must receive steam indirectly from the boiler. When such is the case, the end  $c$ , of the valve  $C$ , is formed with screw-threads to receive the threaded end  $r$ , of the plug  $P$ , which plug is formed, as shown, with a dead end  $r'$ , which may be screwed into the boiler at any suitable point, and a pipe  $P'$ , connected at one of its ends to the steam-dome or other suitable point to receive steam from the boiler, may be attached at its other end to a boss  $P^2$ , on the plug  $P$ , having a channel  $r^2$ , connecting with the hollow  $r^3$ , of the plug which when in position opens into the cavity  $C'$ , of the controlling valve.

In Figs. 11, and 12, I have shown a modification of my controlling valve, which is somewhat simpler in construction than the valve  $C$ , which has just been described, and consists of a cylinder  $C^5$ , having a cavity  $C^6$ , about its central portion, and one of its ends formed or provided with a hollow screw-threaded projection  $c^5$ , which is adapted to be inserted into the boiler and to convey steam therefrom to the cavity  $C^6$ , and its other end provided with a hollow screw-threaded plug  $C^7$ , having suitable packing  $c^6$ , through which packing and plug is passed a stem or rod  $E^8$ , having on its inner portion screw-threads  $e^8$ , to engage the threads  $e^9$ , and on its inner end a valve-head  $E^9$ , to open and close the hollow of the projection  $c^5$ , and to admit or shut off the steam from the cavity  $C^6$ , into which opens the channels or ports  $D^7$ ,  $D^8$ , and which extend laterally from said cavity. The outer ends of these ports or channels are provided with hollow screw-threaded plugs  $D^9$ , having suitable packing  $D^{10}$ , through which is passed valve stems  $D^{11}$ , having on their inner portions screw-threads  $d^8$ , to engage threads  $d^9$ , and on their inner ends valve-heads  $D^{12}$ , to open and close the ports which open into suitable bosses  $D^{13}$ , on their under sides, which connect with the conducting pipes  $D^3$ , and  $D^4$ , in a similar manner and for a like purpose above described. It will therefore be understood that this modification is designed to be operated without a lever, while the first described valve is adapted to be operated with a lever, or automatically in the movement of the same.

In Fig. 13, is shown a modification in the manner of operating the valve  $C$ , which consists in placing on the top of the valve a quadrant-brace  $S$ , having a number of depressions  $s$ , to engage with the grip-lever  $S'$ , of the op-

erating lever  $S^2$ , which is slotted longitudinally as at  $s'$ , to receive the pin  $h^4$ , on the rod  $H^3$ , and which lever is fulcrumed at its lower end to a brace-rod  $S^3$ , which is secured to the bottom of the controlling valve.

Figs. 14, and 15, illustrate another modification in the manner of operating the valve, when attached to a locomotive, in which a brace-rod  $T$ , is secured to the valve, and has pivotally secured to its free end a rod  $T'$ , which engages with the stem  $H^3$ , and is pivotally secured at its other end to the throttle-stem  $U$ , which is secured to the throttle-lever  $W$ , which may be fulcrumed to the free end of a brace-rod  $W'$ , attached to the boiler.

The operation of my device is simple and as follows: The valve is attached to the boiler at any suitable point, to receive steam therefrom, but preferably directly with the "pumpkin." The steam is then admitted to the cavity  $C'$ , by opening the hollow  $c'$ , by means of the valve-head  $E^4$ , when, if it is desired, either one or both of the channels  $C^2$ , may be opened, and the steam discharged into the pipes  $D^3$ ,  $D^4$ , respectively, and from thence into the fire-box or smoke-stack or both. Or both the ports  $C^2$ , may be closed, when the steam will pass through the opening  $c^2$ , into the orifices  $I$ , of the piston or comb-valve  $H^2$ , and thereby be divided and regulated, into the channels  $G$ , from one or both of which it may be discharged into the pipes  $D^3$ , and  $D^4$ , by opening the channels  $G$ , by means of their valve-heads.

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

1. In a smoke-consumer, the combination with a boiler, of a controlling valve constructed as described with two conducting pipes connected thereto, one of which conveys and discharges steam and air into the fire-box through the medium of jets or injectors constructed as set forth, and the other conveys and discharges steam into the smoke-stack through one or more truncated-cones and sleeves constructed as described substantially as and for the purpose set forth.

2. In a smoke-consumer, the combination with a boiler, of a controlling valve having a cavity to receive steam from the boiler, with a valve-head to open and close the same, and lateral channels or ports leading from said cavity and having valve-heads to open and close them, and the conducting pipes, one of which discharges steam and air into the fire-box, through jets or injectors  $O$ , and the other steam into the smoke-stack through one or more truncated-cones and sleeves, substantially as and for the purpose set forth.

3. In a smoke-consumer, the combination with a boiler, of the controlling valve  $C$ , having the hollow projection  $c$ , the cavity  $C'$ , having the opening  $c^2$ , and the valve-stem  $E'$ , provided with the head  $E^4$ , to admit and shut off steam to said cavity, the channels or ports  $C^2$ , having the stems  $E^6$ , provided with the



heads  $E^7$ , the channels  $C^3$ ,  $C^4$ , connected at their lower ends with the conducting pipes  $D^3$ ,  $D^4$ , respectively, the cavity  $H$ , having therein the piston or comb-valve  $H^2$ , provided  
 5 with the openings  $I$ , partition  $I'$ , and teeth or ribs  $i$ , the stem  $H^3$ , secured to said valve and having near its outer end a turn-buckle and pin to regulate the length and motion of the stem, the channels  $G$ , having the valve-heads  
 10  $F^4$ , and stems  $F^3$ , to open and close the same, the pipes  $D^3$ , and  $D^4$ , connected with the channels  $C^3$ , and  $C^4$ , and adapted to convey and discharge steam into the smoke-stack and fire-box, respectively, all constructed, arranged  
 15 and operating substantially as and for the purpose set forth.

4. In a smoke-consumer, the combination with a boiler, of the controlling valve  $C$ , having the hollow projection  $c$ , the cavity  $C'$ , having the opening  $c^2$ , and the valve-stem  $E'$ , provided with the head  $E^4$ , to admit and shut off steam to said cavity, the channels or ports  $C^2$ , having the stems  $E^6$ , provided with the heads  
 20  $E^7$ , the channels  $C^3$ ,  $C^4$ , connected at their lower ends with the conducting pipes  $D^3$ ,  $D^4$ , respectively, the cavity  $H$ , having therein the piston or comb-valve  $H^2$ , provided with the

openings  $I$ , partition  $I'$ , and teeth or ribs  $i$ , the stem  $H^3$ , secured to said valve and having near its outer end a turn-buckle and pin to  
 30 regulate the length and motion of the stem, the channels  $G$ , having the valve-heads  $F^4$ , and stems  $F^3$ , to open and close the same, the pipe  $D^3$ , connected with the channel  $C^3$ , and extending into the smoke-stack and having  
 35 the openings  $d$ , the truncated-cone  $M$ , placed around the pipe  $D^3$ , and said openings, the sleeve  $N$ , having the flaring mouth  $n$ , and enlarged chamber  $n'$ , secured around the cone  
 40  $M$ , within the smoke-stack, the pipe  $D^4$ , connected with the channel  $C^4$ , and extending around the fire-box, and having the pipes  $p$ , provided with the screw-threaded enlargements  $p'$ , having the grooves  $p^2$ , the thimble  
 45  $O'$ , having the flaring mouth  $o$ , and placed around the pipe  $p$ , all constructed, arranged and operating, substantially as and for the purpose set forth.

Witness my hand this 24th day of August,  
 A. D. 1892.

CHARLES CAMP.

In presence of—

CHAS. C. TILLMAN,  
 E. A. DUGGAN.