

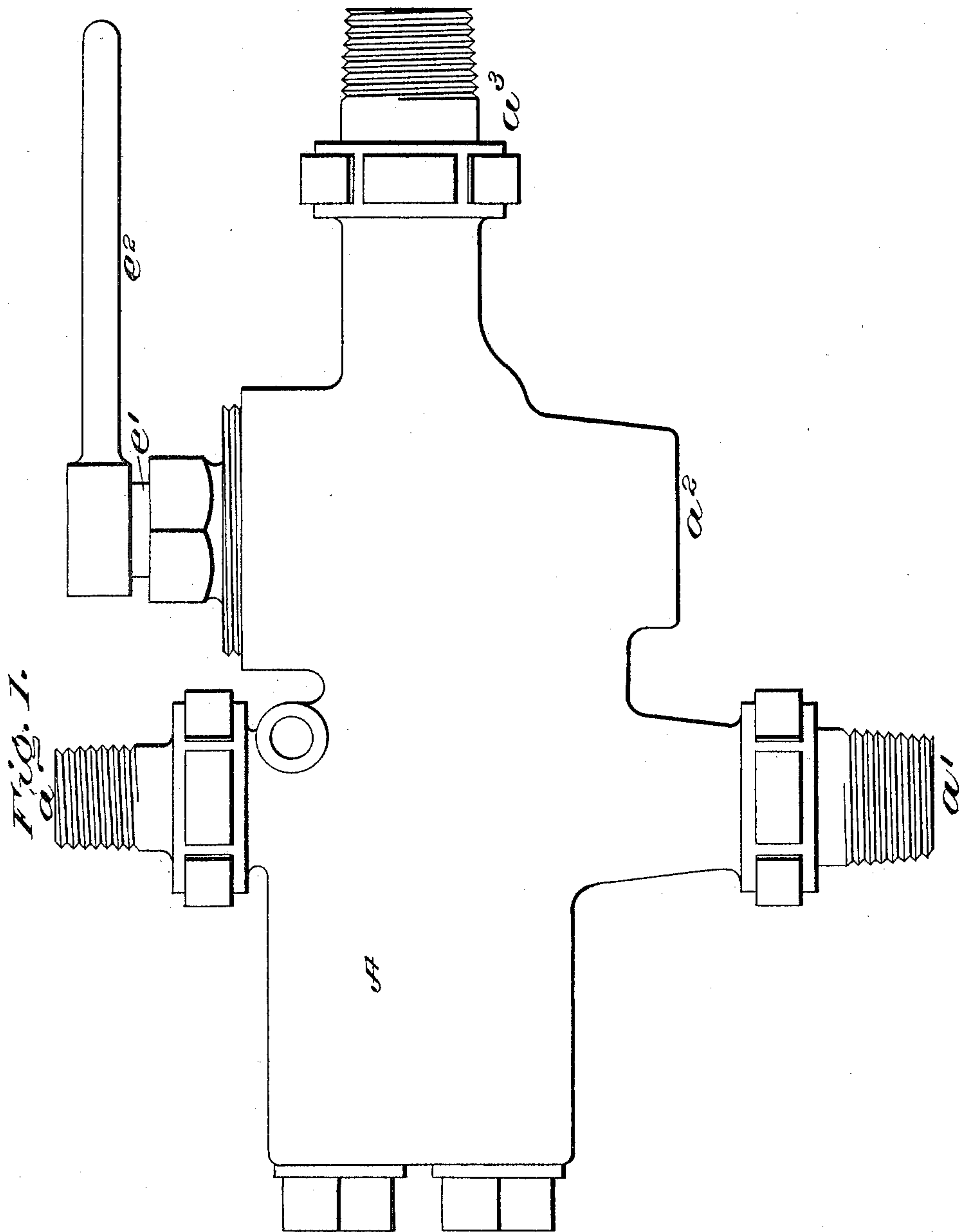
(Model.)

5 Sheets—Sheet 1.

F. STICKER.  
STEAM INJECTOR.

No. 600,456.

Patented Mar. 8, 1898.



Witnesses

*John B. Hodges*

Inventor

*Francis Sticker*

by *John W. Via*

Attorney

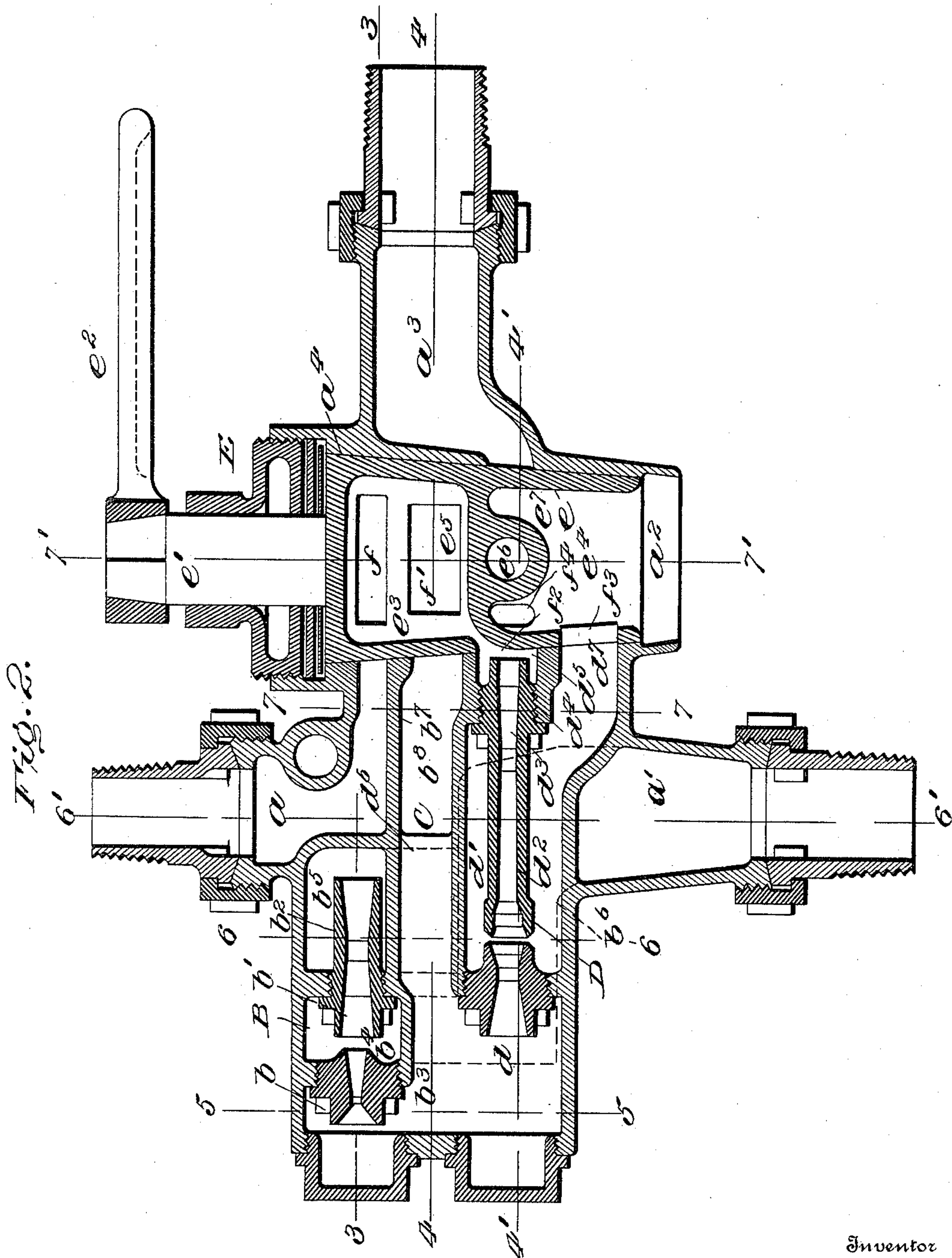
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Witnesses

*James B. Hodges*

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(Model.)

5 Sheets—Sheet 3.

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Fig. 3.

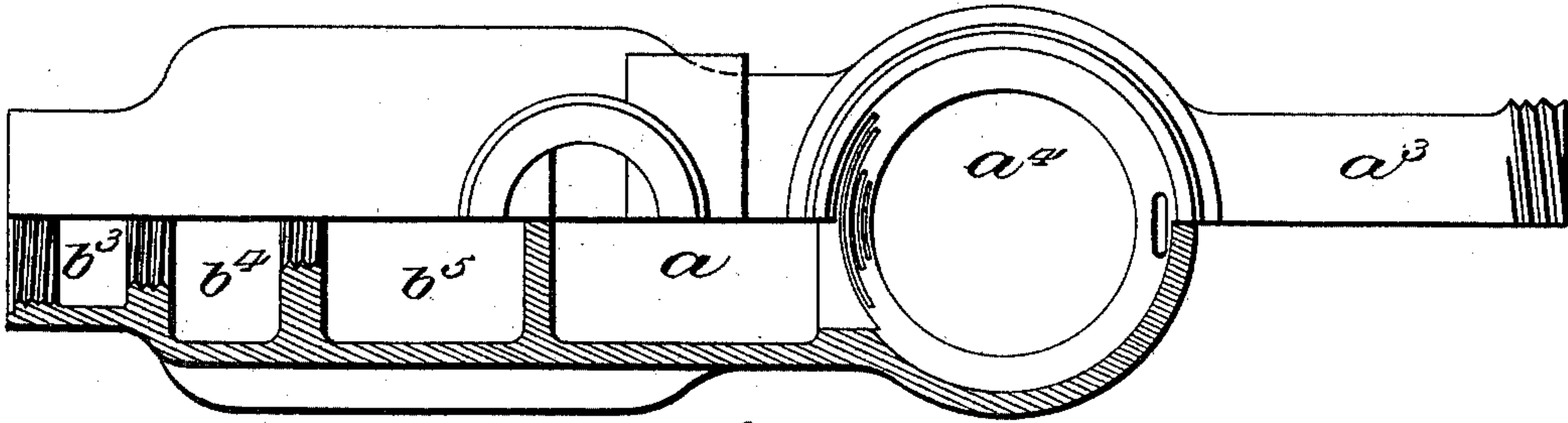


Fig. 4.

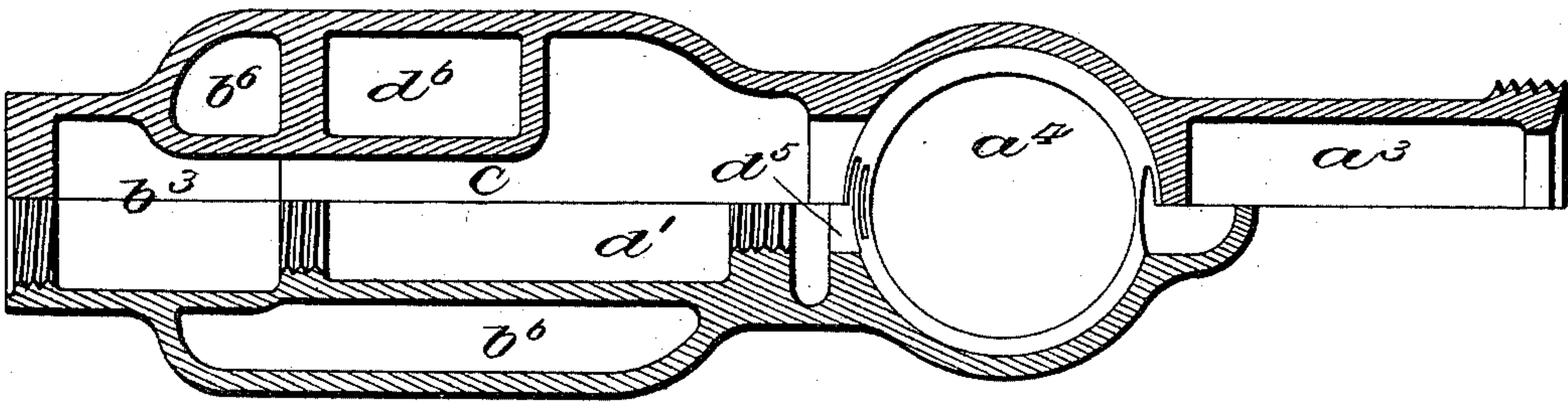


Fig. 5.

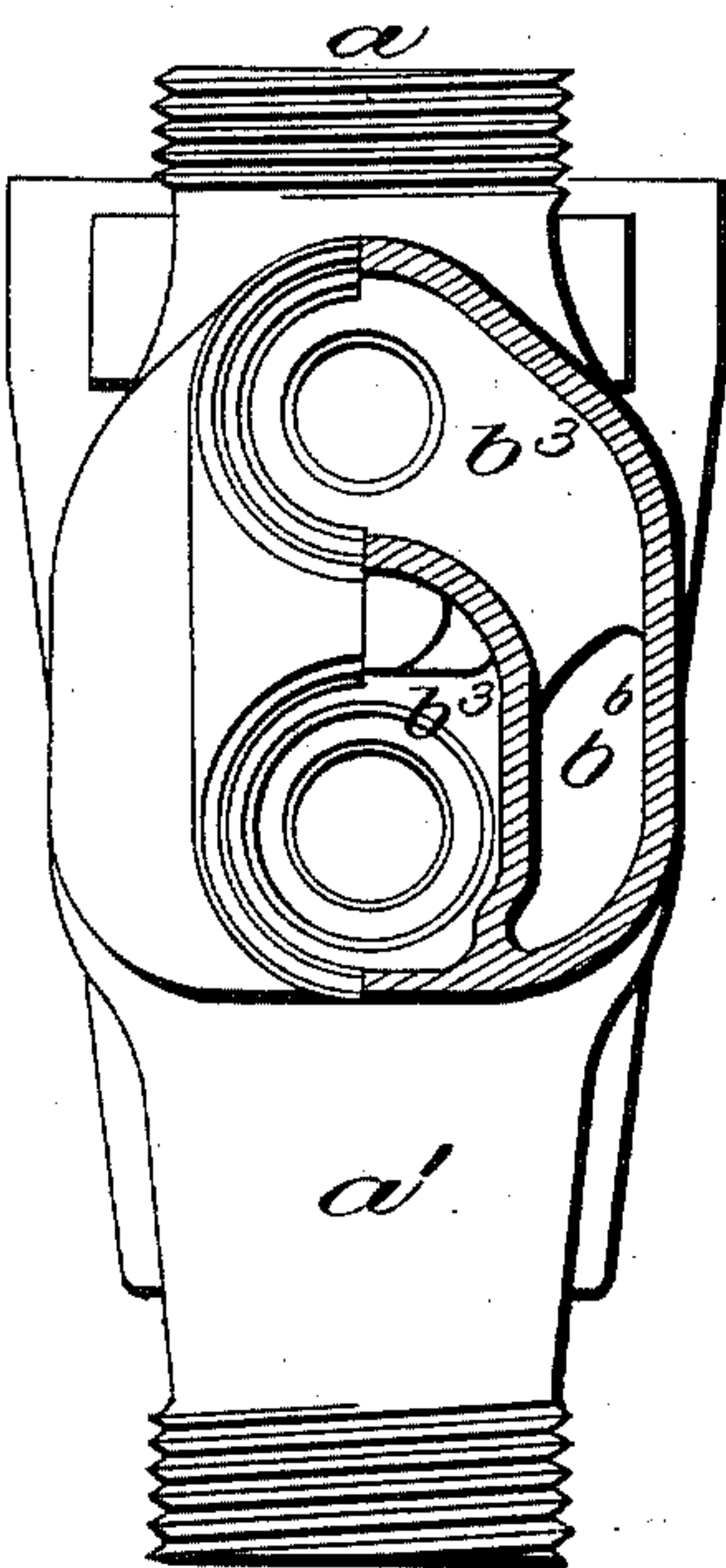


Fig. 6.

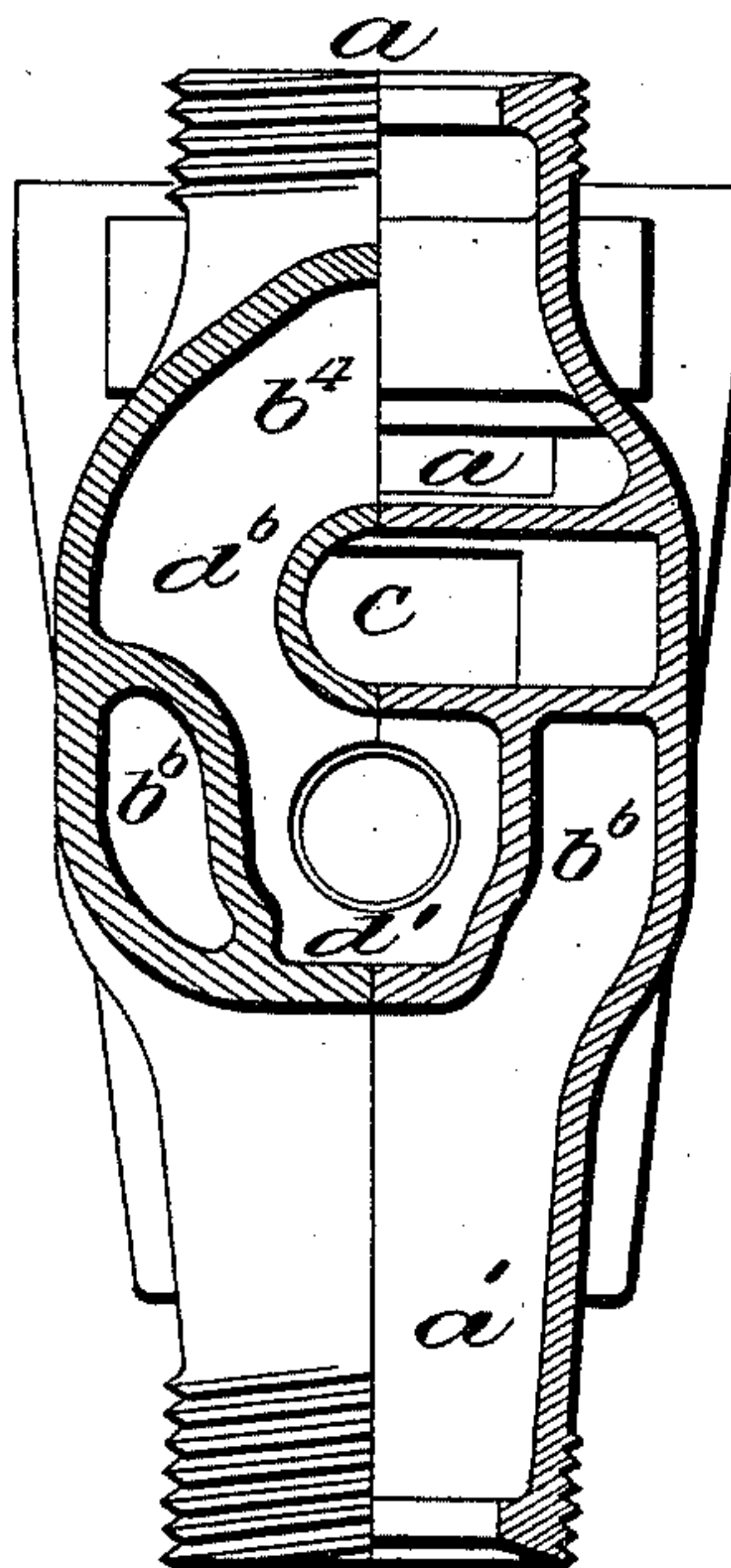
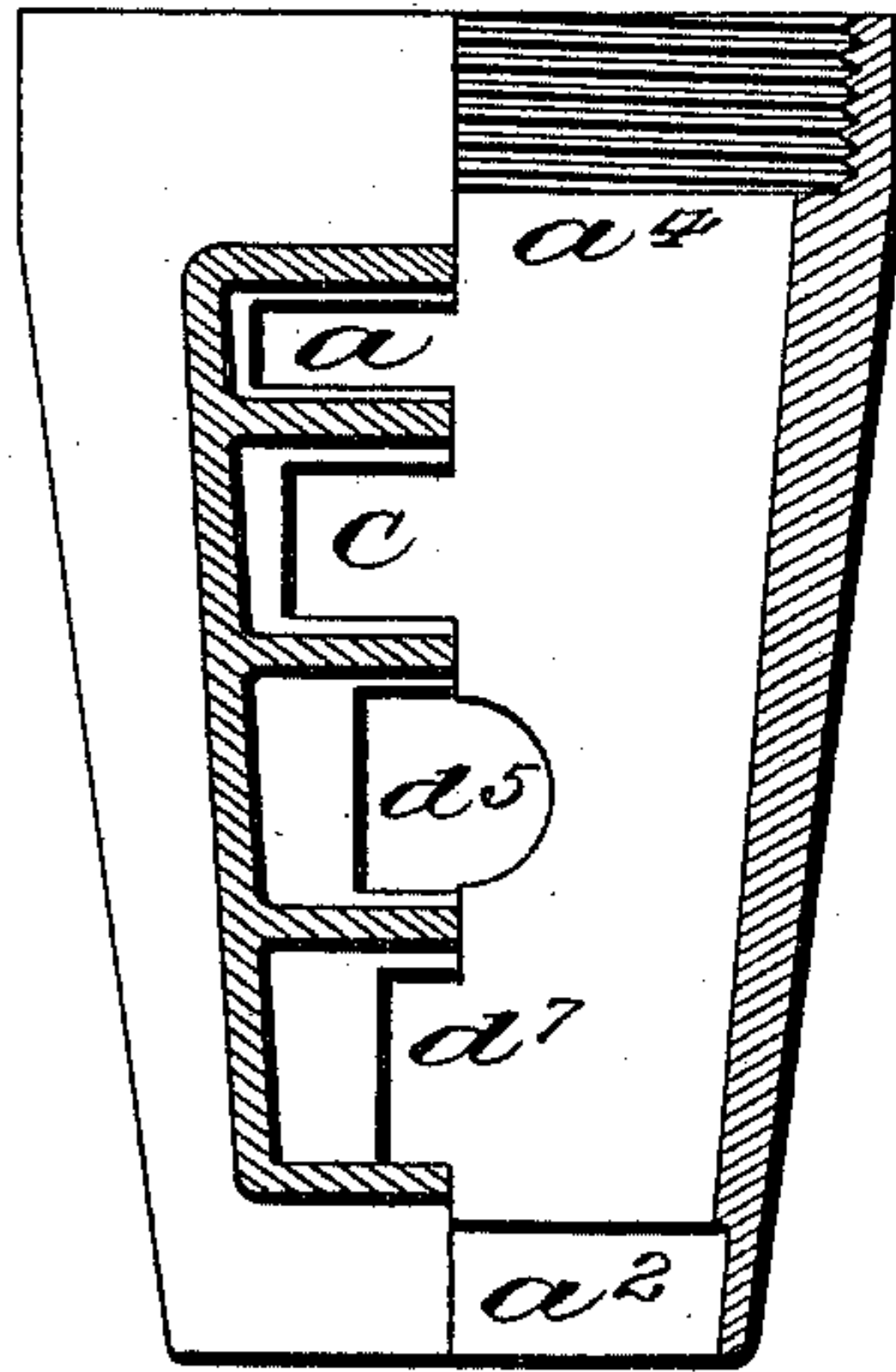


Fig. 7.



Witnesses

*John H. Smith*  
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(Model.)

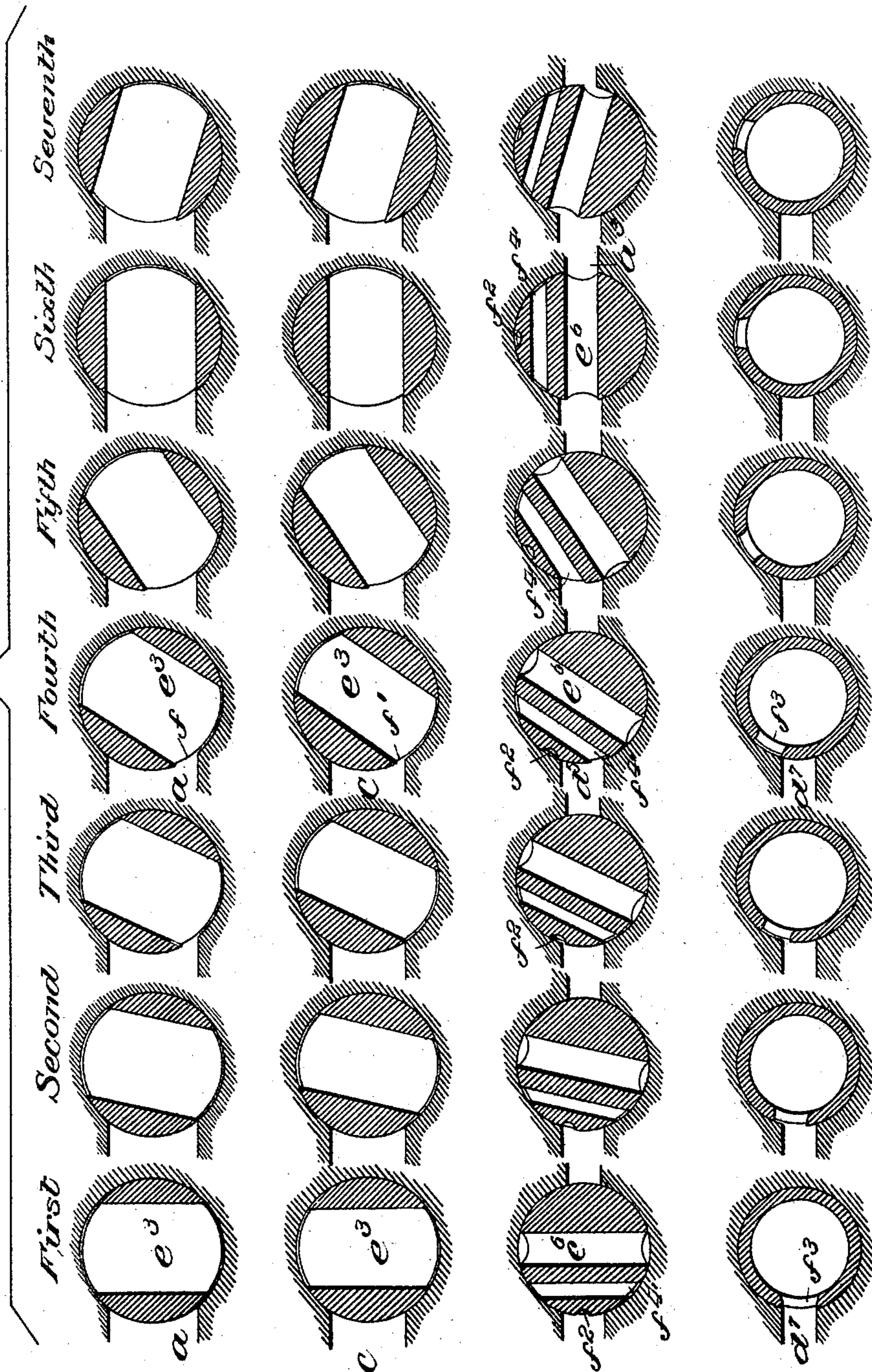
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Fig. 8.



Witnesses

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(Model.)

5 Sheets—Sheet 5.

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Fig. 12

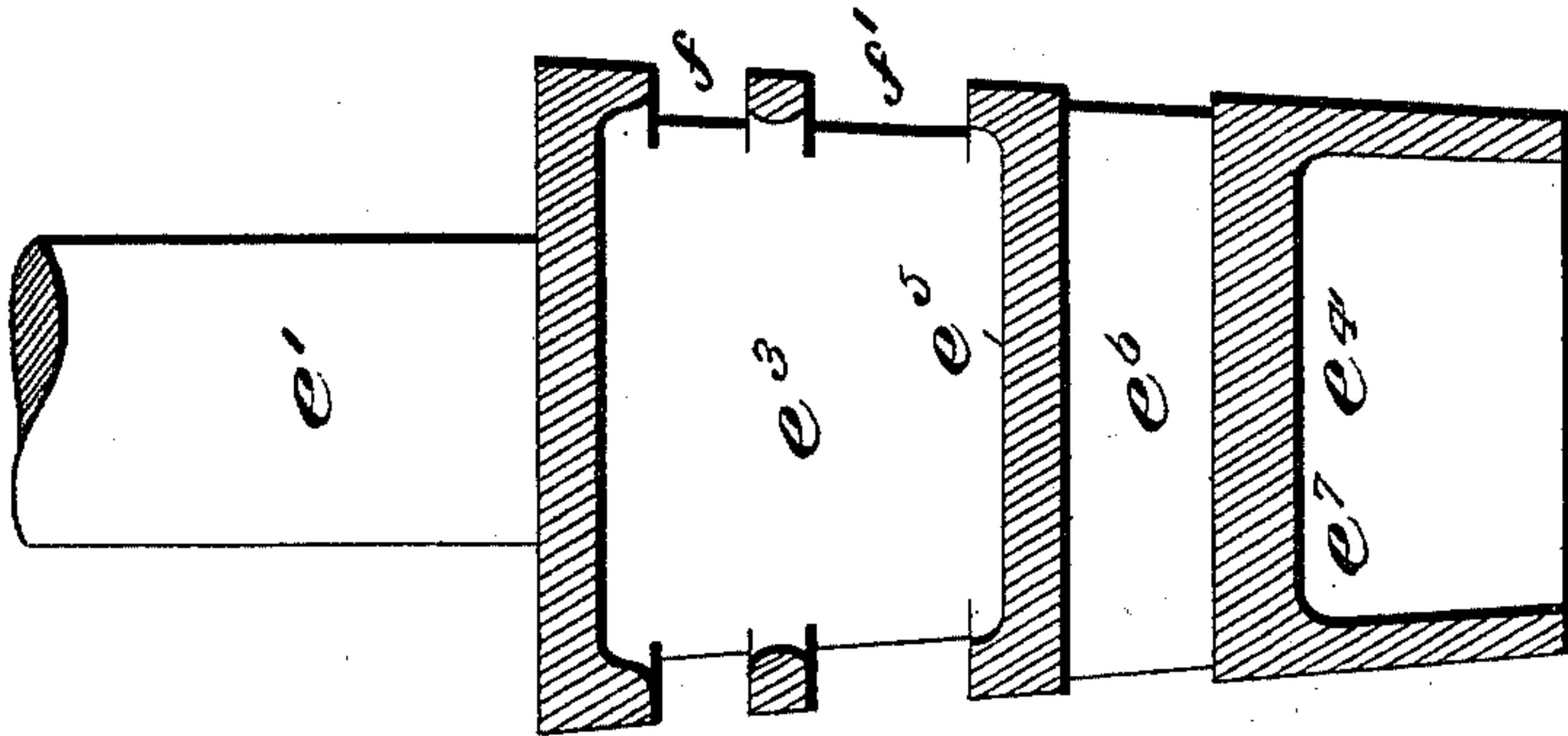


Fig. 10.

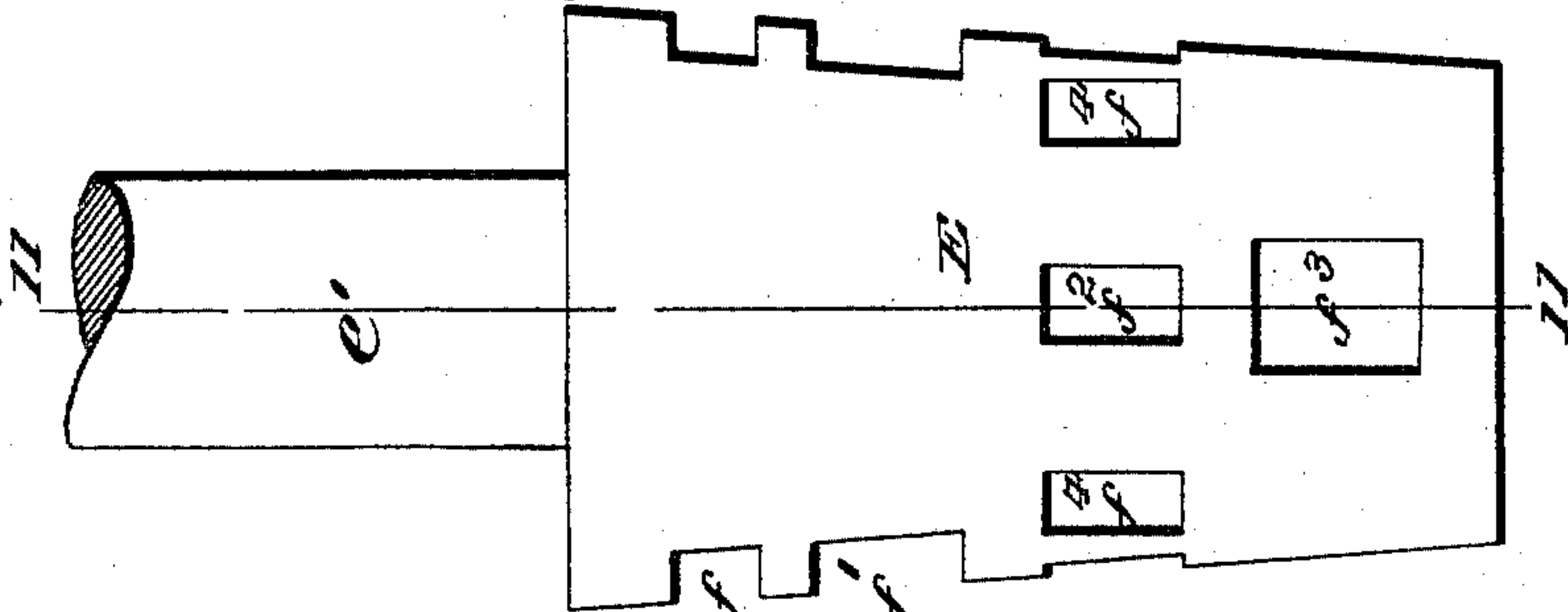


Fig. 11.

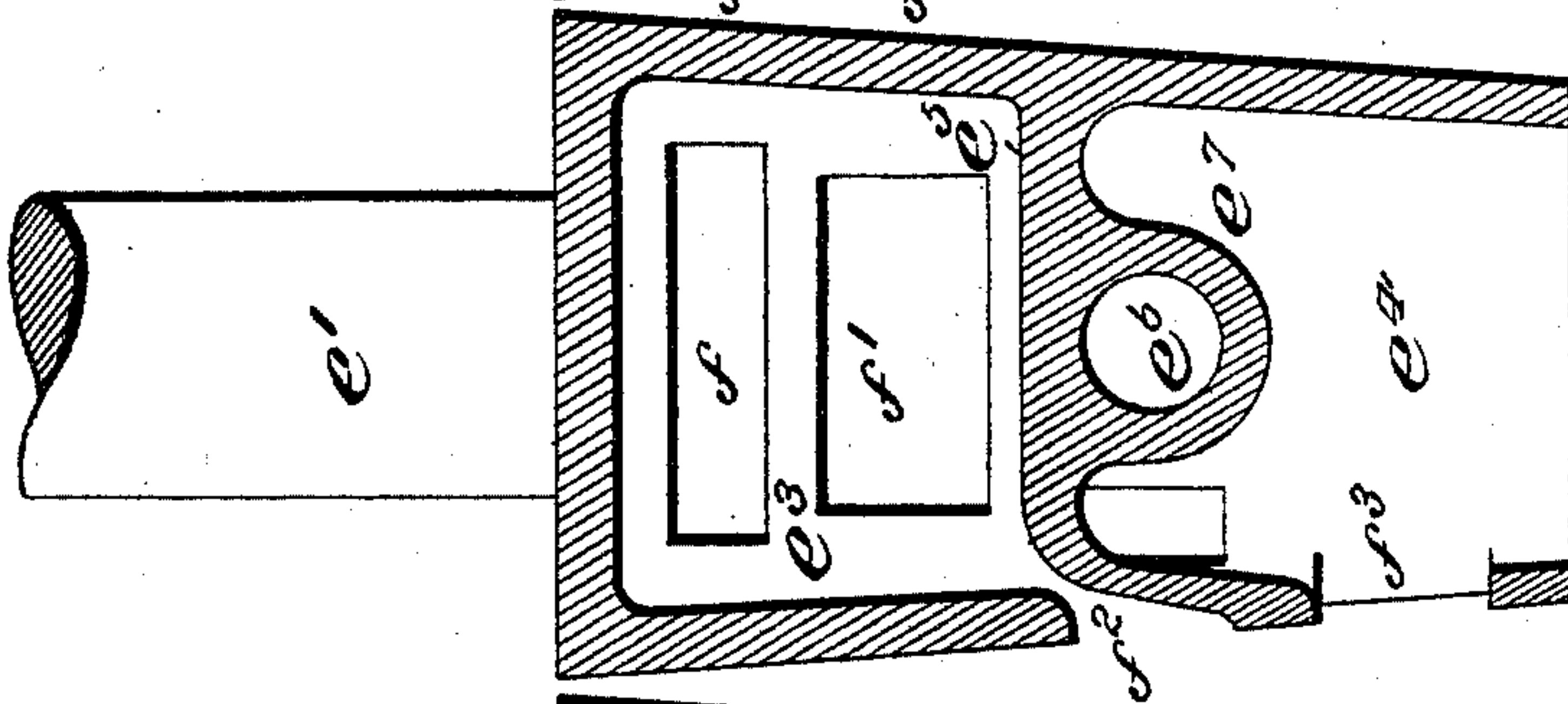
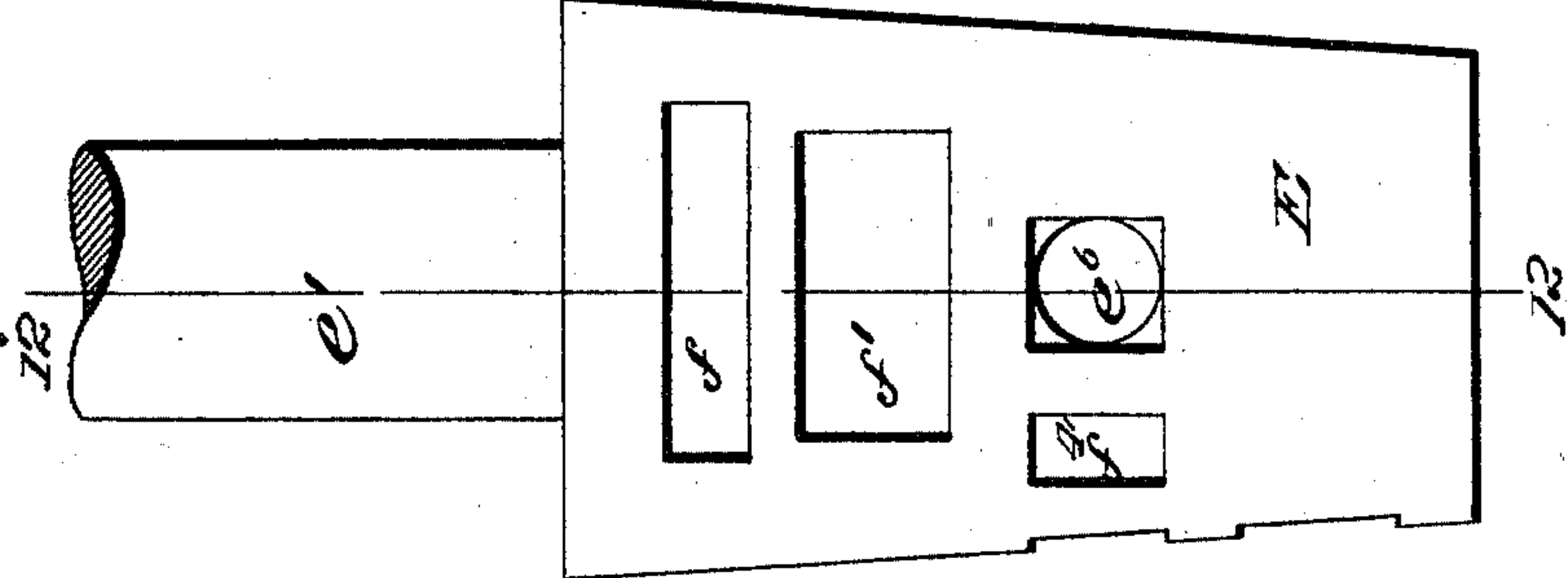


Fig. 9.



Witnesses

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Inventor

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*by J. H. M. Hill,*

Attorney



# UNITED STATES PATENT OFFICE.

FRANCIS STICKER, OF NEW YORK, N. Y., ASSIGNOR TO JULIUS C. DRUCKLIEB AND CHARLES A. DRUCKLIEB, OF SAME PLACE.

## STEAM-INJECTOR.

SPECIFICATION forming part of Letters Patent No. 600,456, dated March 8, 1898.

Application filed August 17, 1897. Serial No. 648,579. (Model.)

*To all whom it may concern:*

Be it known that I, FRANCIS STICKER, of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Steam-Injectors; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention contemplates certain new and useful improvements in steam-injectors, having special reference to "locomotive" or "double-jet" injectors.

In a concurrent application for patent, filed August 13, 1897, Serial No. 648,165, I have shown and described an injector of this class in which the starting, working, and regulation of the apparatus were under the control of a single positively-operated cock, which controlled both the admission of steam and the overflow. In said application I also pointed out the advantages resulting from positioning the lifter above the forcer, enabling the water to be lifted without interference from any back pressure from the forcer and also allowing the steam and water to have a natural flow from the lifter to the forcer. I also provided in said injector means for effecting a thorough draining of the overflow. In the present invention I likewise control the starting, working, and regulation of the apparatus by a single cock located in the casing between the steam inlet and outlet to the boiler.

The primary object of this invention is to obtain increased facilities for lifting the water in starting the injector. This I accomplish in a novel manner—namely, by first admitting steam to the forcer in a reverse direction—that is, through the delivery-tube and thence through the remaining tubes of the forcer, the discharge from what is, in working, the steam-tube passing to and through the lifter in the usual manner.

A further object of this invention is to minimize the area of the several chambers of the casing. This is accomplished by locating the several tubes closer together than ordinarily. This results in a great saving of space, since the space usually left between the opposed

ends of the tubes causes loss in the velocity of the column.

In the present invention I also avoid the use of check-valves, sliding nozzles, and the like, all the parts being stationary save the single cock, which controls the operation of the machine.

The invention will be hereinafter fully set forth, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a view in side elevation. Fig. 2 is a vertical longitudinal sectional view. Fig. 3 is in part a top plan view and in part a horizontal sectional view on line 3 3, Fig. 2. Fig. 4 is in part a horizontal sectional view on line 4 4 and in part on line 4' 4', Fig. 2. Fig. 5 is in part an end view and in part a vertical sectional view on line 5 5, Fig. 2. Fig. 6 is a vertical sectional view in part on line 6 6 and in part on line 6' 6', Fig. 2. Fig. 7 is a vertical sectional view in part on line 7 7 and in part on line 7' 7', Fig. 2. Fig. 8 is a diagrammatical view showing in seven different series the several positions occupied by the different portions of the cock. Figs. 9 and 10 are outside views of the cock. Figs. 11 and 12 are respectively cross-sectional views on lines 11 11 and 12 12, Figs. 9 and 10.

Referring to the drawings, A designates the casing or casting;  $a$ , the steam-inlet;  $a'$ , the water-inlet;  $a^2$ , the overflow;  $a^3$ , the boiler-outlet, and  $a^4$  a tapered vertical opening extending through the casing in line with the overflow  $a^2$ . The inner branch of the steam-inlet is extended rearward horizontally and opens at its end into opening  $a^4$ .

B is the lifter proper, comprising a steam-tube  $b$ , combining-tube  $b'$ , and delivery-tube  $b^2$ , the two latter tubes being integral. The steam-tube  $b$  extends from steam-chamber  $b^3$  into water-chamber  $b^4$ , into which projects the combining-tube. The delivery-tube opens into discharge-chamber  $b^5$ . The water-chamber  $b^4$  is connected with water-inlet  $a'$  by a cored passage-way  $b^6$ , one on each side of the casing. Upper and lower horizontal partitions  $b^7$  and  $b^8$  conjunctively form a steam-channel C, which extends from opening  $a^4$  to chamber  $b^3$ .

D is the forcer proper, although in the pres-



ent invention it operates in starting as a lifter. It comprises a steam-tube  $d$ , opening into steam-chamber  $b^3$  and water-chamber  $d'$ , a combining-tube  $d^2$ , and delivery-tube  $d^3$ , the latter being mounted in a partition  $d^4$ , forming a discharge-chamber  $d^5$ . The combining-tube  $d^2$  also opens into the water-chamber  $d'$ . The normal discharge end of steam-tube  $d$  is flared, and the minimum cross-sectional area of the bore of said steam-tube  $d$  is greater than the maximum cross-sectional area of the bore of the delivery and combining tubes, and the adjacent ends of said steam and combining tubes are placed in close juxtaposition. The water-chamber  $d'$  is connected with the discharge-chamber  $b^5$  of the lifter by cored passage-ways  $d^6$ . The water-chamber  $d'$  has an overflow-channel  $d^7$  leading therefrom at its lower end and opening into the opening  $a^4$ .

In starting the injector steam is first admitted through the delivery-tube of the forcer, and passing through the combining and steam tubes of the latter into chamber  $b^3$  will enter the tubes of the lifter and pass down into the water-chamber of the forcer and out through the channel  $d^7$  to the overflow, creating a vacuum in the water-chamber of the lifter and effecting the lifting of water. Thereupon steam is cut off from the forcer, which has up to this point been acting as a lifter, and is admitted through channel C equally to both the lifter and forcer, the steam-tubes thereof being extended into a common chamber.

E is the cock for controlling the operation of the machine. It consists of a tapered rounded body  $e$ , fitting snug within vertical opening  $a^4$ , in which it is held by a stuffing-box. To a projecting rod  $e'$  a handle  $e^2$  is removably secured. This cock is formed with upper and lower chambers  $e^3$   $e^4$ , separated by a partition  $e^5$ . It is also provided with a delivery-port  $e^6$ , formed in a web  $e^7$ , depending from partition  $e^5$  and extending transversely through the cock-body. This port is designed to coincide with the forcer delivery-tube and boiler-outlet when the column of steam and water is fully established. The chamber  $e^3$  is for steam, while the lower chamber  $e^4$  is for the overflow, and being open at its lower end a direct outlet to the atmosphere is obtained. In the chamber  $e^3$  are formed upper and lower ports  $f$   $f'$ , the former being designed to register with steam-inlet  $a$  and the latter with steam-channel C, and being the outlet is larger than the inlet-port. Steam is admitted to the chamber  $e^3$  before the port  $f'$  can be brought into line with channel C. In one side of this cock is formed a port  $f^2$ , which leads from steam-chamber  $e^3$  to a point below the partition  $e^5$ . Through this port an initial flow of steam in starting the injector passes from chamber  $e^3$  to the delivery-tube of the forcer and through the several tubes of the latter in the reverse direction of the passage after the column of steam and water is established. At this time only a small portion of

inlet-port  $f$  is open to steam-inlet  $a$ . Beneath this primary port  $f^2$  is an overflow-opening  $f^3$ , through which the overflow from channel  $d^7$  passes to the atmosphere, while in one side of the cock openings  $f^4$  are provided on either side of port  $f^2$  to accommodate the overflow from the forcer and chamber  $d^5$  occurring after the lower overflow has been closed. These two ports  $f^4$  are formed so that the cock can be turned to the right or left. For the same reason I form two sets of upper ports  $f'$   $f^2$  at diametrically opposite points.

In practice the several parts of the cock occupy the first position shown in Fig. 8 when the injector is not in operation. Steam coming from the boiler is confined in the steam-inlet until the cock is turned to the third position, whereupon it will rush through port  $f$  into chamber  $e^3$  and out through primary port  $f^2$  into the delivery-tube of the forcer, and traveling through the several tubes of the latter into chamber  $b^3$  will pass through the tubes of the lifter into discharge-chamber  $d^5$ , thence down into water-chamber  $d'$ , and through channel  $d^7$  and port  $f^3$  to the atmosphere. The escaping steam, entraining with it the air in the casing, will create a vacuum in the water-chamber  $b^4$  of the lifter and cause water to be lifted thereinto. The steam being condensed and taking up the water in the combining and delivery tubes of the lifter, the cock is turned to the fourth position, cutting off the primary steam-supply to the forcer and also the primary overflow and opening up port  $f'$ , allowing steam to pass into the channel C, so as to equally supply the steam-tubes of the lifter and forcer. As this occurs one of the ports  $f^4$  is in line to relieve any auxiliary overflow from the forcer and so continues while the cock is being turned first to the fifth and then sixth positions. (See Fig. 8.) By the time the full head of steam is supplied from cock E (see seventh position) both overflows are closed and the delivery-port is coincident with the forcer and boiler-outlet. By giving the cock a still further turn (see seventh position) the capacity of the injector may be curtailed.

From what has been said it will be seen that in starting the injector the forcing device serves as a lifter or ejector. This is possible because its steam-tube is of larger area than the delivery-tube and is set close up to the mouth of the combining-tube. The forcer having completed its duty as a lifter, steam is cut off therefrom and then resupplied thereto, but in the usual way, so that it will then act as a forcer for the discharge flowing therefrom the lifter proper. It will be seen that the course of the steam is practically on straight lines and there is no loss of power, such as is incident to a tortuous course. Back pressure from the forcer against the lifter in starting is avoided, since the forcer acts as a supplemental lifting device. As pointed out in my before-noted application, by positioning the lifter proper above the forcer the wa-



ter and steam have a free fall from the former to the latter, avoiding all loss of power and shortening the way of the overflow as well as the way of the steam and water.

5 I claim as my invention—

1. A lifting and forcing injector having its forcer supplied with steam at its delivery end, whereby, in starting, the forcer will act as a lifter, as set forth.

10 2. A lifting and forcing injector having its forcer supplied with steam at its delivery end, in starting, and means for changing the direction of the steam-inlet to said forcer after the water has been lifted, as set forth.

15 3. An injector having a lifter and a forcer, and a steam-inlet leading to the normal delivery end of said forcer, whereby the primary steam will pass through the latter in a reverse direction, and thence to the lifter, as set forth.

20 4. An injector having a lifter and a forcer, a steam-inlet leading to the normal delivery end of said forcer, whereby the primary steam will pass through the latter in a reverse direction and thence to the lifter, and means for cutting off the steam and then supplying the same to both the lifter and forcer in the same direction, substantially as set forth.

25 5. A lifting and forcing injector having a steam-inlet, and a cock having a chamber for opening up connection between said inlet and forcer in starting the injector, as set forth.

30 6. A lifting and forcing injector having a steam-inlet, and a cock having a chamber for opening up connection between said inlet and the normal delivery end of said forcer, in starting the injector, substantially as set forth.

35 7. A lifting and forcing injector having a steam-inlet and a cock having a steam-chamber into which said steam-inlet opens, and a port leading from said chamber and designed to coincide with the normal delivery end of said forcer, substantially as set forth.

40 8. A lifting and forcing injector having an upper steam-inlet, a lower overflow, and a steam-chamber common to both the lifter and forcer, and a single cock for controlling steam to said chamber and also controlling said overflow, substantially as set forth.

45 9. A lifting and forcing injector having an upper steam-inlet, a lower overflow, a steam-chamber common to both the lifter and forcer, a single channel leading into said steam-chamber, and a single cock for controlling steam to said channel and also controlling said overflow, substantially as set forth.

50 10. A lifting and forcing injector having a steam-inlet, a single steam-chamber common to both the lifter and forcer, and a cock having a steam-chamber designed to control the passage of steam from said inlet to said steam-chamber, substantially as set forth.

55 11. A lifting and forcing injector having a

steam-inlet, a single steam-chamber common to both the lifter and forcer, a channel leading therefrom, a cock having a chamber and 65 upper and lower ports, one designed to register with said steam-inlet and the other with said channel, substantially as set forth.

12. The herein-described injector comprising the casing having a vertical opening, a 70 steam-inlet extending into said opening, the lifter and forcer, a steam-chamber common to both the lifter and forcer, a channel leading from said chamber to said opening, and a cock fitted in said opening and having ports 75 for controlling the passage of steam from said inlet to said chamber, substantially as set forth.

13. A lifting and forcing injector having the lifter located above the forcer, the discharge-chamber of the former opening into 80 the water-chamber of the latter, and the water-chamber of the lifter in direct communication with the water-inlet, a steam-chamber common to both the lifter and forcer, and a 85 single cock for controlling the overflow and admission of steam to said steam-chamber, substantially as set forth.

14. A lifting and forcing injector having a steam-chamber common to both the lifter and 90 forcer, a channel leading thereto, a steam-inlet, and a cock having a chamber, upper ports designed to register with said steam inlet and channel, and a lower port designed to admit steam to pass from said chamber to 95 said forcer when said channel is closed, substantially as set forth.

15. A lifting and forcing injector having its casing provided with a vertical opening, a steam-inlet leading to said opening, a steam- 100 channel leading from said opening to a steam-chamber common to both said lifter and forcer, a lower overflow-channel, and a cock having upper ports for controlling the passage of steam from said inlet to said channels, and 105 lower ports in said cock for the overflow from said channel and from the forcer, substantially as set forth.

16. In a lifting and forcing injector, the forcer having its steam-tube flared at its 110 normal discharge end, the bore of said tube being equally as large as the bore in the combining-tube of said forcer, whereby, in starting the injector, the discharge from the normal receiving end of said combining-tube 115 will freely enter and pass through said steam-tube, substantially as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

FRANCIS STICKER.

Witnesses:

LEBRECHT HERZIG,  
A. H. CURROR.