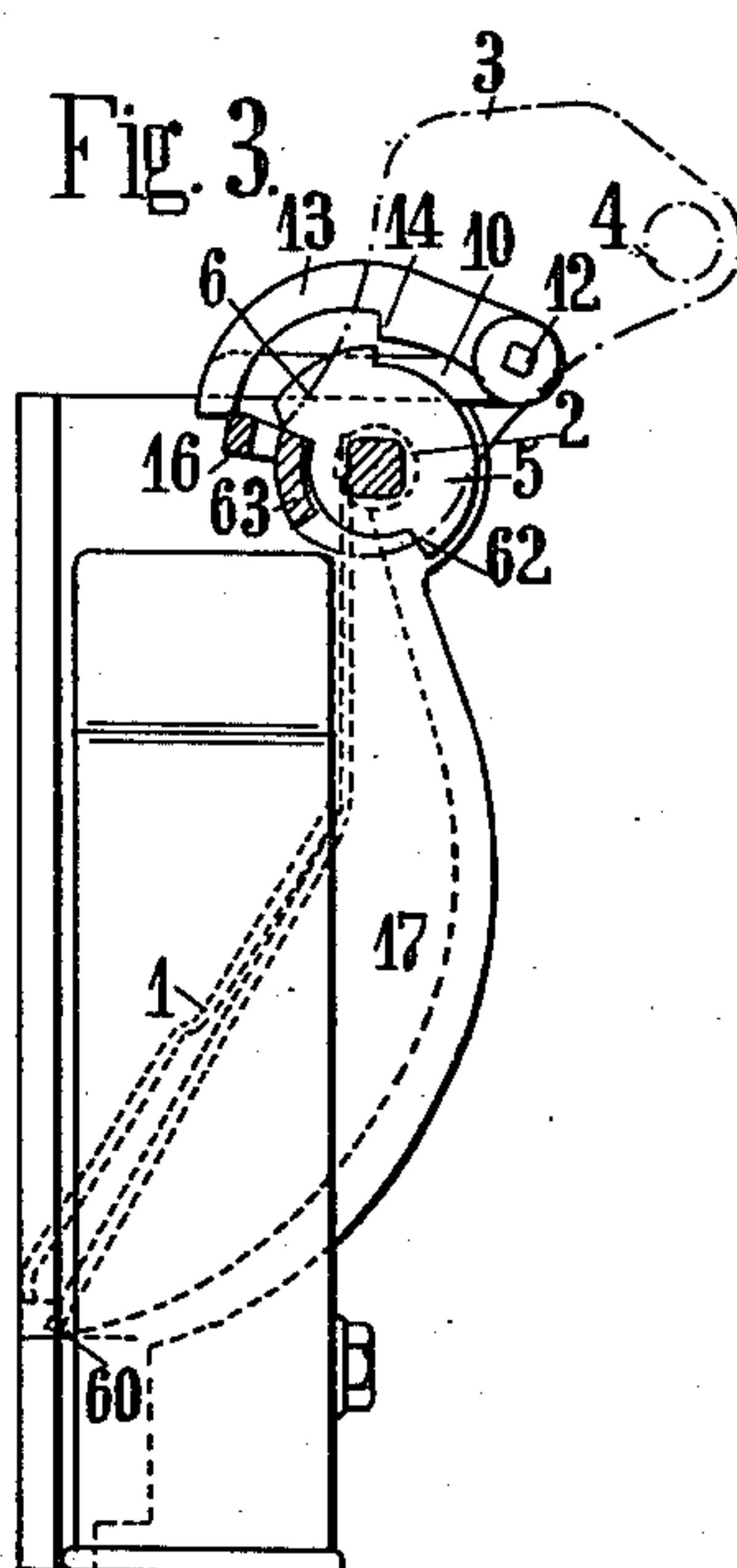
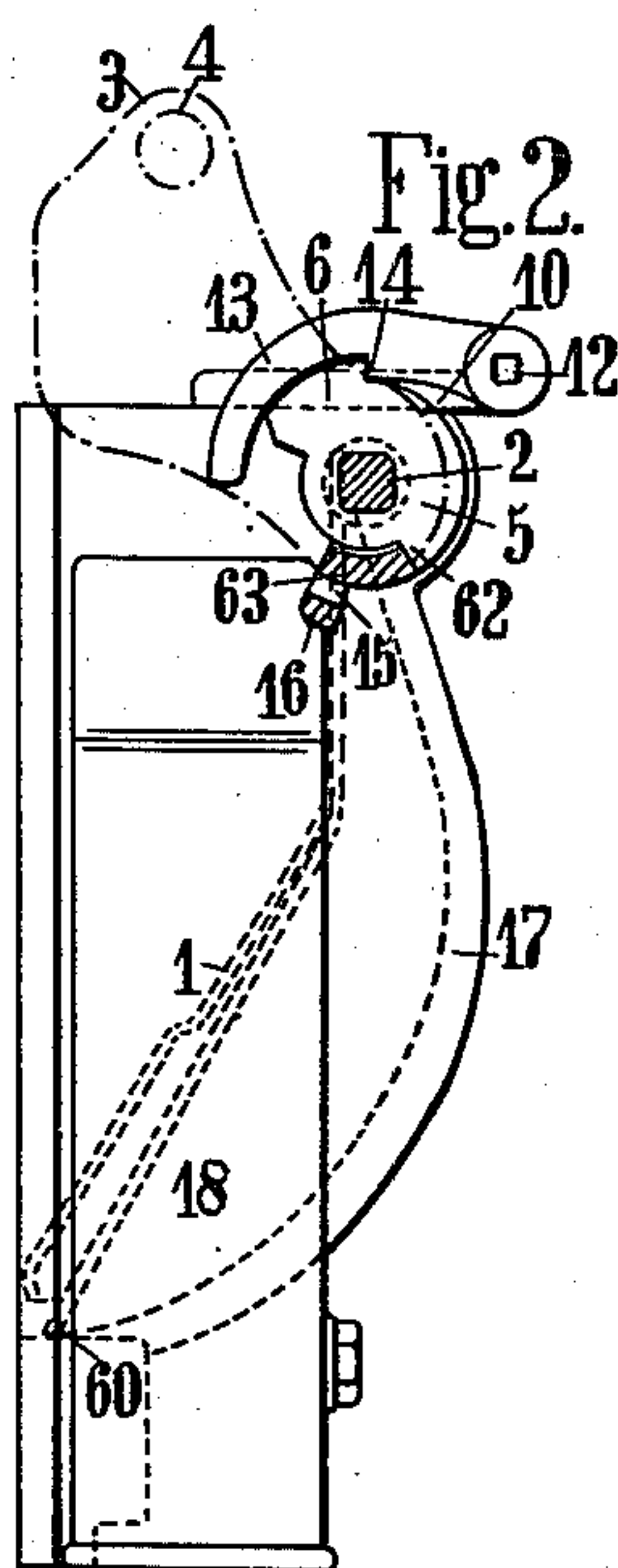
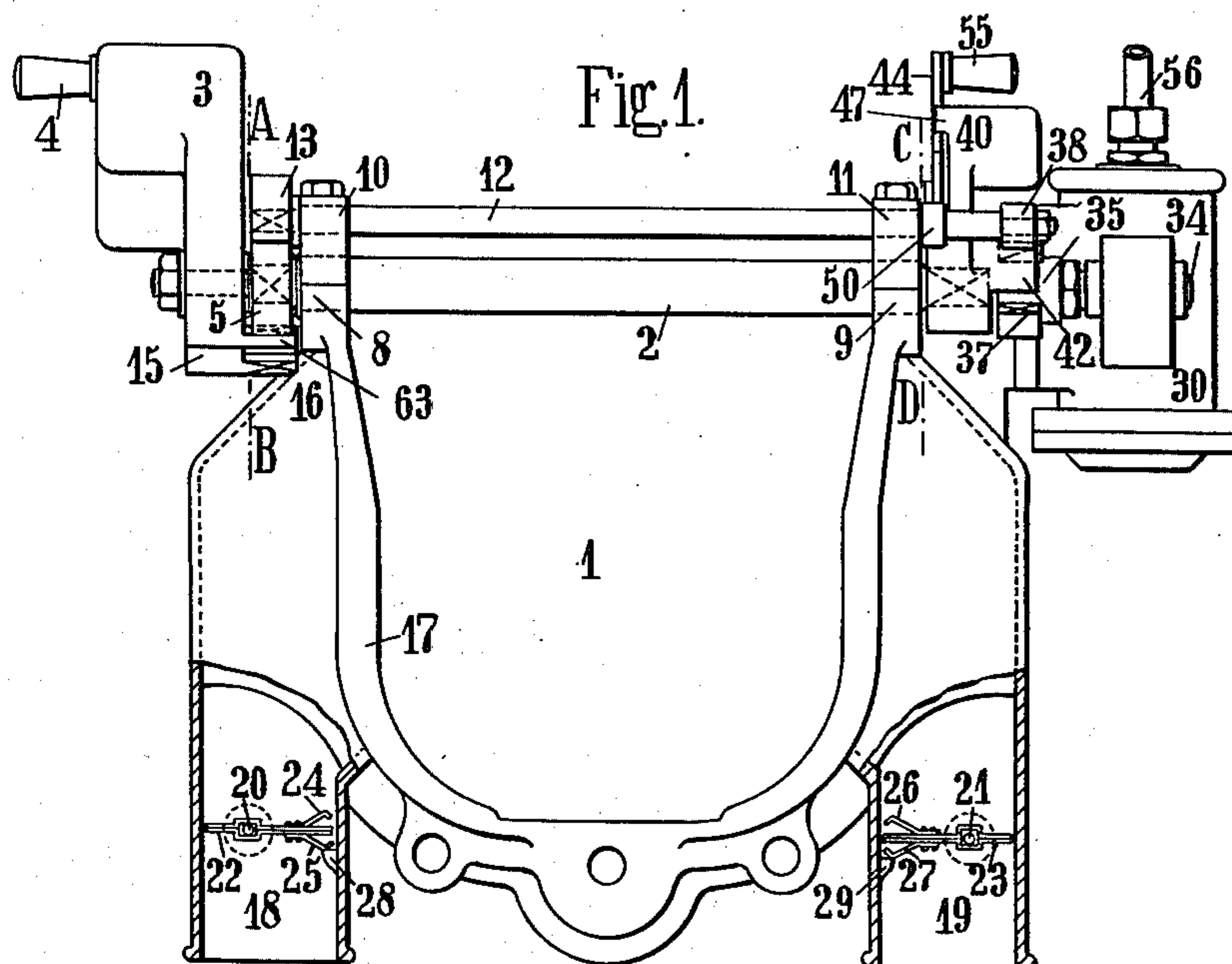


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BOILER FURNACE.  
APPLICATION FILED NOV. 7, 1908.

965,292.

Patented July 26, 1910.

2 SHEETS—SHEET 1.



Witnesses:-

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Inventor:-

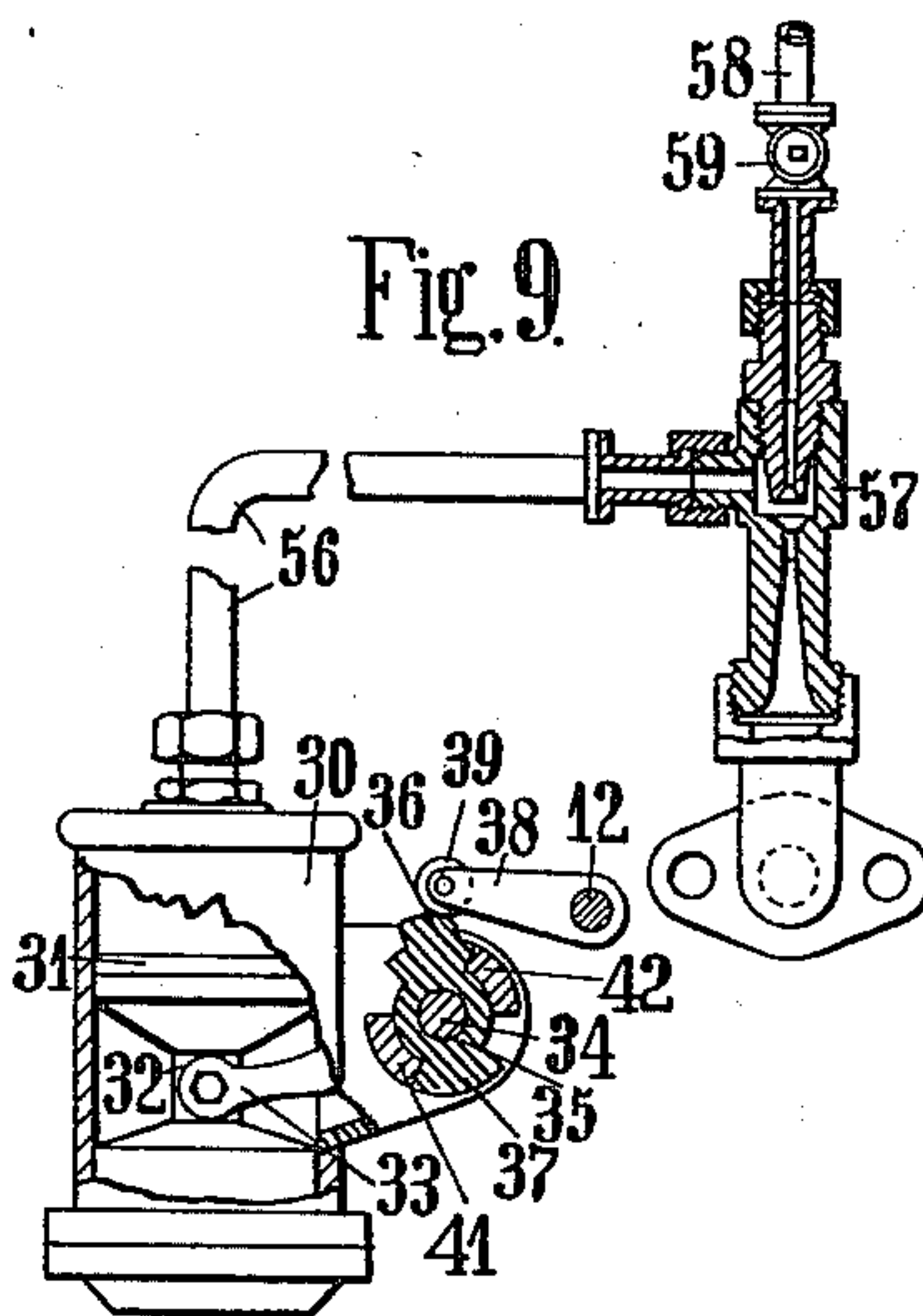
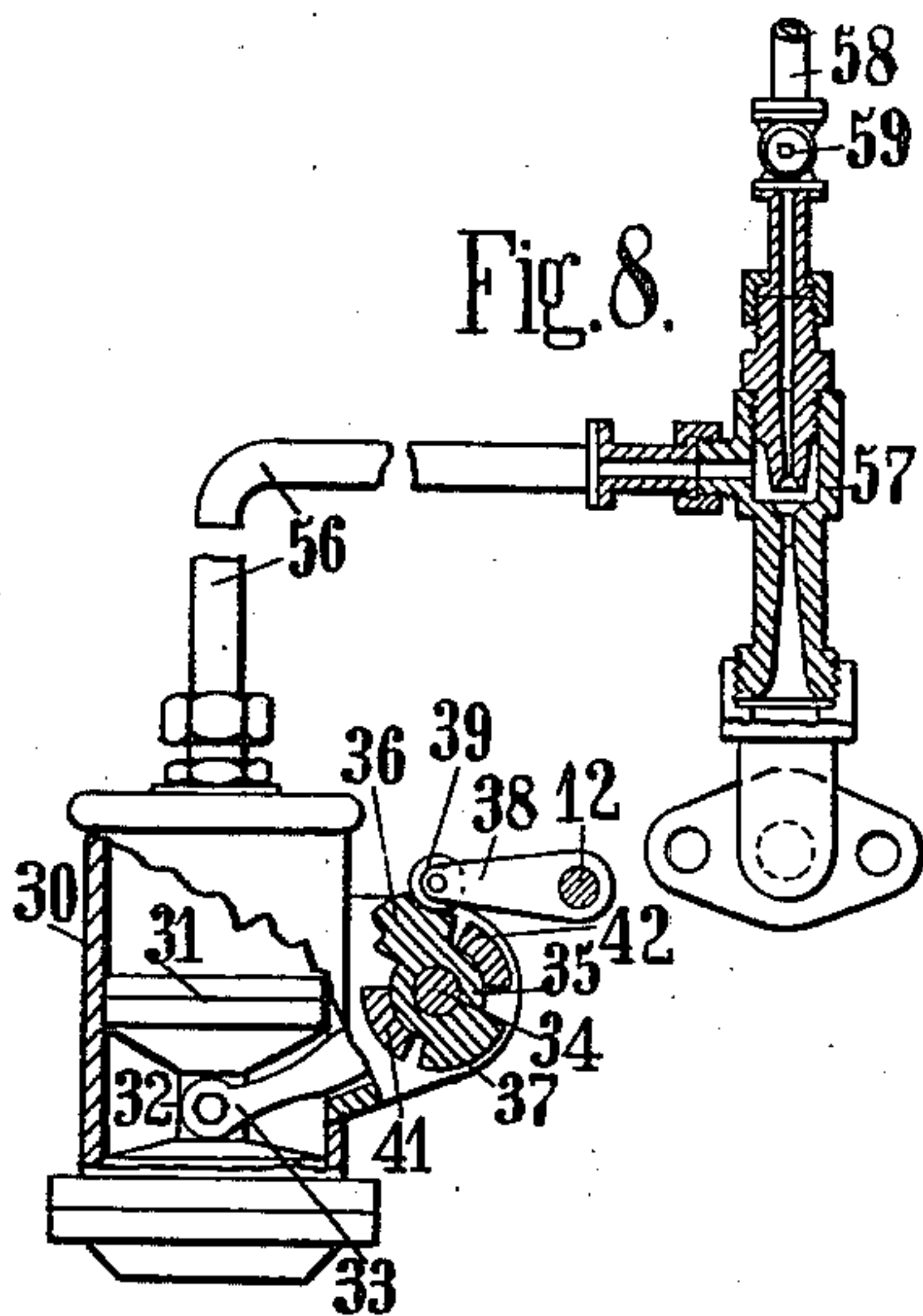
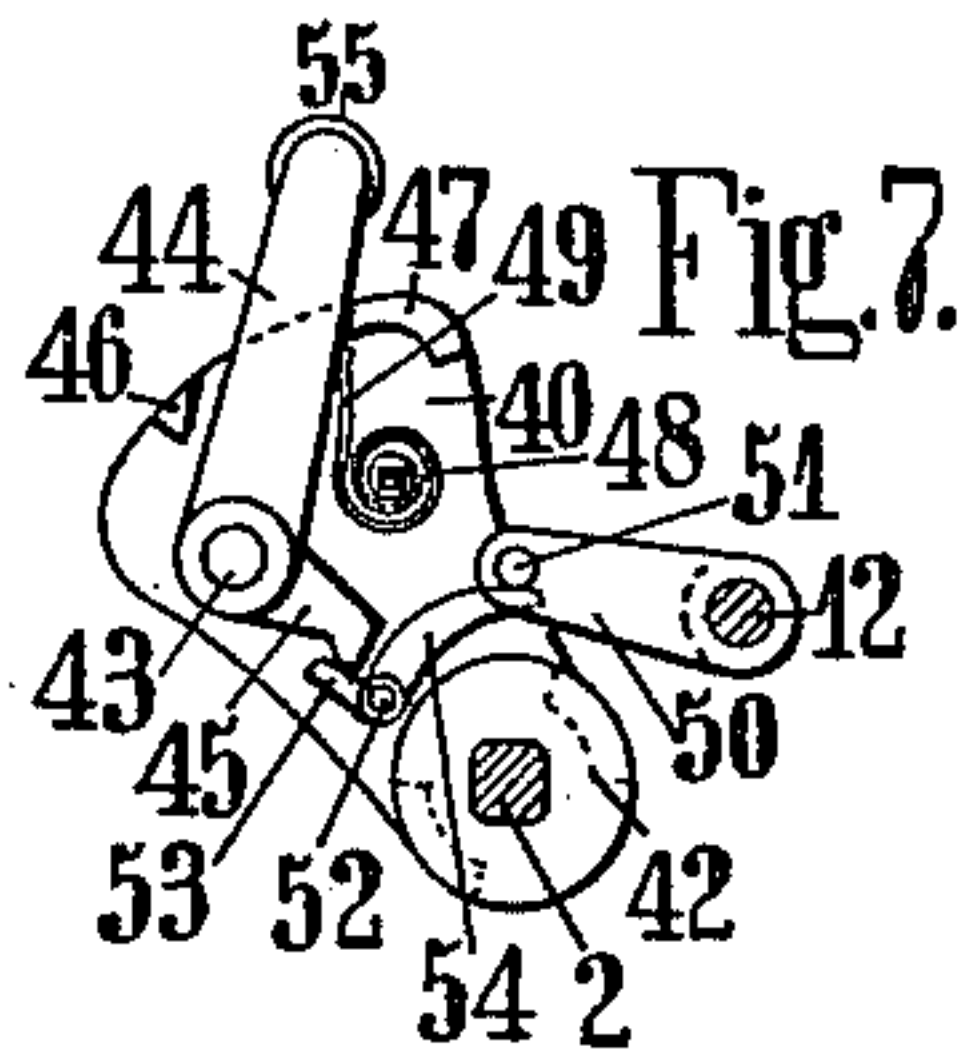
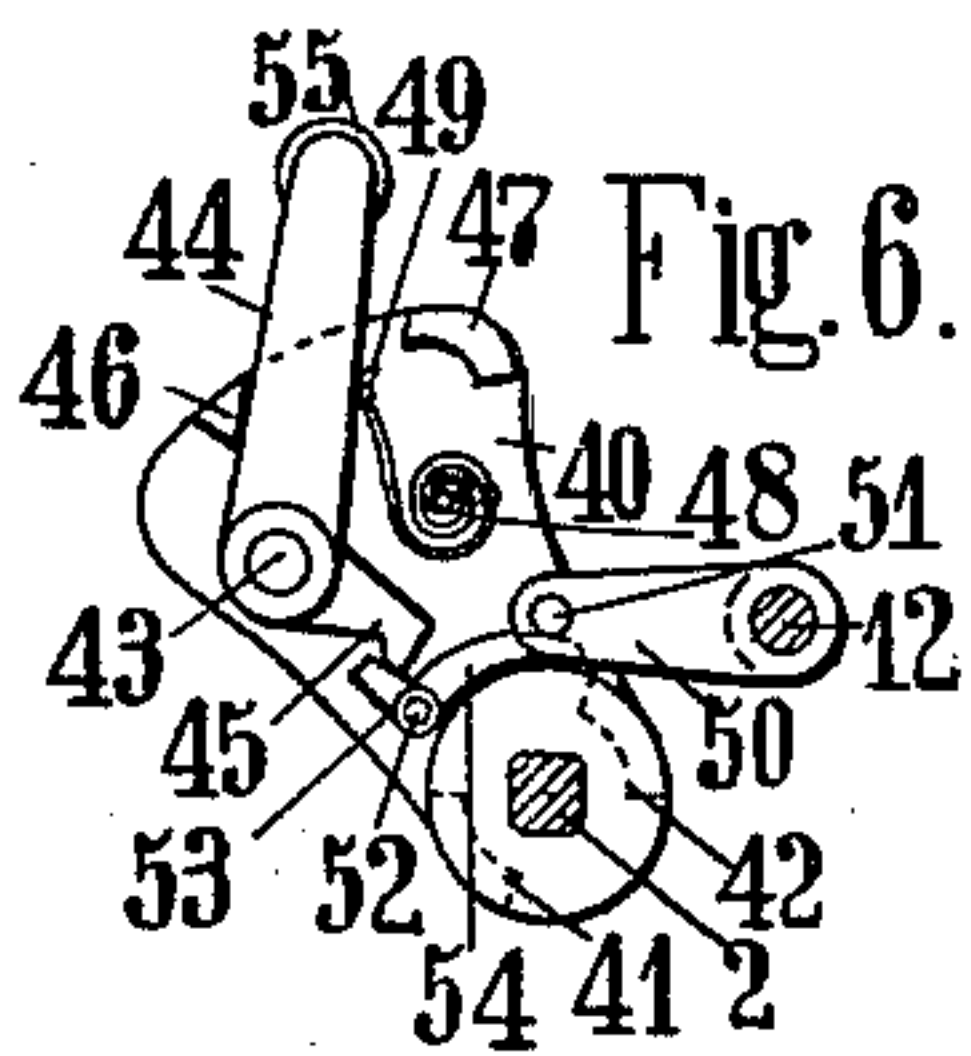
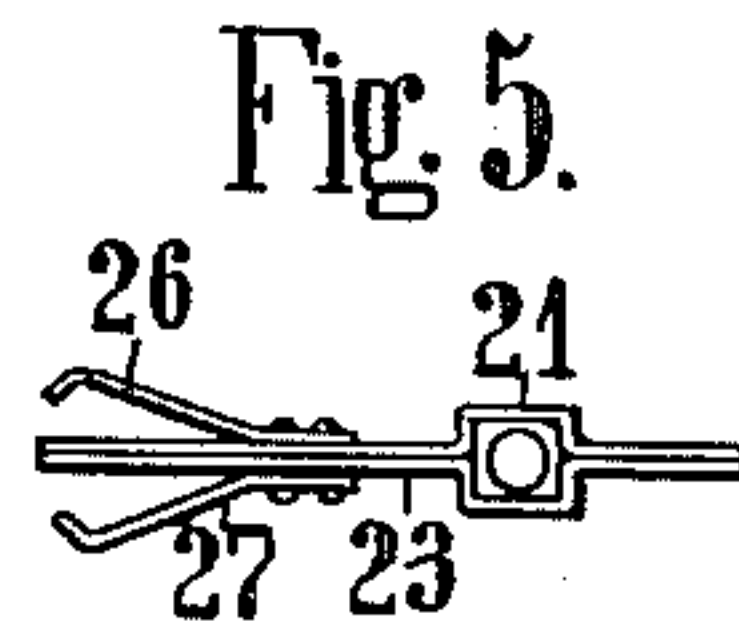
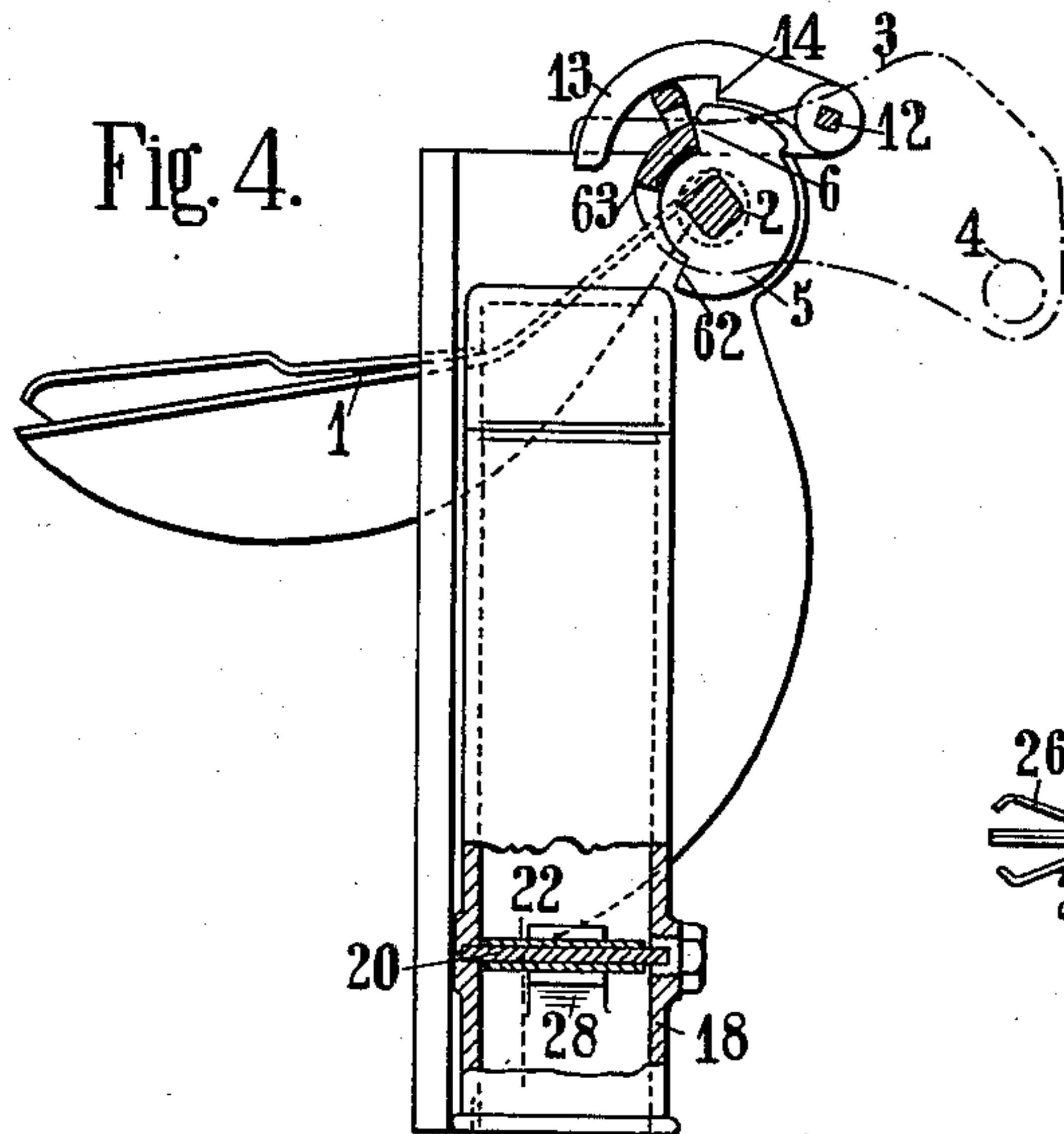
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Patented July 26, 1910.

2 SHEETS—SHEET 2.



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# UNITED STATES PATENT OFFICE.

GUSTAV DE GRAHL, OF WILMERSDORF, NEAR BERLIN, GERMANY.

## BOILER-FURNACE.

965,292.

Specification of Letters Patent.

Patented July 26, 1910.

Application filed November 7, 1908. Serial No. 461,515.

*To all whom it may concern:*

Be it known that I, GUSTAV DE GRAHL, a subject of the German Emperor, and residing at Wilmersdorf, near Berlin, Germany, have invented certain new and useful Improvements in Boiler-Furnaces, of which the following is a specification.

The subject-matter of the present invention is a device for obtaining smokeless combustion in boiler furnaces. The same enables secondary air for combustion to be introduced automatically into the combustion chamber in proportion as the vacuum in the combustion chamber increases, so that the vacuum cannot exceed a definite limit.

The subject-matter of the invention is represented by way of example in the accompanying drawings, namely:

Figure 1 shows the same partly in side elevation and partly in vertical section. Figs. 2 and 3 are each a vertical section in the plane A—B in Fig. 1, namely Fig. 2 when the door is bolted and Fig. 3 after the bolts are released. Fig. 4 shows the device partly in sectional elevation and partly in vertical section when the door is open. Fig. 5 shows the valves in flues arranged laterally of the furnace-door on an enlarged scale. Figs. 6 and 7 are vertical sections in the plane C—D in Fig. 1, and Figs. 8 and 9 show, partly in side elevation, and partly in vertical section, the cataract in combination with an ejector and the door-shaft.

The shaft 2, with which the furnace-door 1 is rigidly connected is journaled in the bearings 8, 9 attached to the door-frame 17. A lever 3 formed as a counterweight and provided with a handle 4 is mounted able to rock on the shaft 2. The sector 5 which has projections 6 and 62 is attached on the shaft 2 close to the lever 3. The shaft 12 is journaled in the extension 10 of the bearing 8 and in the extension 11 of the bearing 9. The bow-shaped lever 13 which has the pawl-like shoulder 14 is attached on the shaft 12. The lever 3 is rigidly connected by the part 15 with the nose 16 and is provided with the projection 63.

The door-frame 17 is provided with the lateral air-flues 18, 19 which open laterally into the chamber inclosed by the door-frame. The bolts 20, 21 are journaled in the flues 18, 19. Flap-valves 22, 23 which are each firmly connected with two springs 24, 25 and 26, 27 are attached on said bolts. The stop 28 for the flap-valve 22 is arranged on

the interior wall of the flue 18, and the stop 29 for the flap-valve 23 is arranged on the interior wall of the conduit 19.

The cataract-cylinder 30, in which the piston 31 is movable, is attached laterally of the door-frame 17. The part 32 of the piston is clasped by a fork 33 which is attached on the shaft 34. The bushing 35 which has the two projections 36, 37 is attached on the shaft 34. The lever 38 which carries the roller 39 is attached on the shaft 12. The weighted lever 40 with which the two projections 41, 42 are rigidly connected is attached on the shaft 2. The pivot 43, around which the double lever 44, 45 can rock, is attached to the weighted lever 40. The arm 44 is provided with the handle 55 (Fig. 1). The two abutments 46, 47 (Figs. 6 and 7) are provided on the lever 40, and to the latter is attached the spring 48 which tends to press the lever 44 against the abutment 46 with its end 49. Further, the double lever 53, 54 is pivoted to the lever 40 at 52. Further, there is rigidly connected with the shaft 12 the lever 50, to which the pivot 51 is attached. The arm 54 is of such a length that it rocks against the pivot 51. The cataract-cylinder 30 is connected above through a pipe 56 with an ejector 57. There opens into the ejector 57 the steam pipe 58, and in the latter there is arranged a stopcock 59 in order to shut off steam from the ejector. The cataract-piston 31 can be sucked up, *i. e.* raised, by the ejector without the lever 3 having to be operated by hand.

The device operates as follows: When the furnace-door is shut, as shown in Figs. 1 and 2, in proportion as the vacuum in the fire-box exceeds a definite limit the valves 22, 23 are opened so that air can pass through the flues 18, 19 into the fire-box. In the closed position the furnace-door 1 lies at 60 on the door-frame and is prevented from opening by the shoulder 14 of the lever 13 which lies against the nose 6 of the sector 5. The door is consequently locked and in this position is immovable. When the door is to be opened for stoking, the weighted lever 3 is moved out of the position according to Fig. 2 into the position according to Fig. 3. The door is not yet opened, but the rounded nose 16 of the lever 3 acts against the lever 13 and rotates the same upward so that the shoulder 14 is removed from the projection 6, as clearly



shown in Fig. 3. The consequence is that the door is unlocked. Now if the lever 3 is rotated into the position shown in Fig. 4, the lever 3 which lies with its projection 63 against the projection 6 of the sector 5 drives the sector 5 so that the latter and with it the shaft 2 is rotated, and consequently the door 1 is opened. With the shaft 2 the weighted lever 40 attached on the same also executes a rocking movement. The consequence of this is that the projection 42 of the lever 40 abuts against the projection 37 of the bushing 35 and rotates the latter with the shaft 34. The fork 33 attached on the latter is rocked upward, which motion is imparted to the cataract-piston 31, so that the cataract is placed under pressure. When the furnace-door is closed the lever 3 is rotated upward. The door falls back freely the first part of the way into the closed position, the projection 6 of the sector 5 following the projection 63 of the lever 3. As soon as the projections 41, 42 of the lever 40 hit against the projection 36, 37 of the bushing 35 (Figs. 8 and 9) attached on the shaft 34, the door continues on its way into the closed position in proportion as the gradually descending cataract-piston allows of this. The lever 13 is released from the nose 16 of the lever 3, so that the former can descend into its lower position, in which its shoulder 14 lies in front of the projection 6 of the sector 5 and the door is locked again, as Fig. 2 clearly shows. The door can also be opened by the driver by moving the lever 40. For this purpose the lever 44 is first moved around the pivot 43 against the spring 48 until it lies against the abutment 47. During this time the lever 40 cannot be rotated because the door is still locked. While the lever 44 is on its way to the abutment 47, the lever 53, 54 is rotated around the pivot 52, so that the lever 54 acts against the pivot 51 of the lever 50. In this manner the shaft 12 (Fig. 6) is rotated so far that the shoulder 14 of the lever 13 is removed from the projection 6 of the sector 5 and the door is unbolted. If the lever 44 is rotated further downward, the lever 40 is driven. Since the latter is rigidly connected with the door-shaft, the latter is rotated a like distance, and the door is opened. The projections 41, 42 of the lever 40 hit against the projections 36, 37 of the bushing 35 attached on the shaft 34, the consequence of which is that the cataract-piston 31 is driven upward into the tensioned position.

The furnace-door can also be partially opened by the piston 31 of the cataract being sucked up by means of the above mentioned ejector. The movement of the piston 31 is then transmitted through the lever 33 which rocks upward and imparts its motion to the shaft 34 and the bushing 35. The latter

acts with its projection 36 against the roller 39 of the lever 38. In this manner the shaft 12 is rotated and the lever 13 (Figs. 2 and 3) which is attached to it and which participates in this rotation is raised, so that its shoulder 14 releases the projection 6 of the sector 5. Consequently the door is unlocked, as was previously pointed out. As soon as the cataract-piston descends the roller 39 of the lever 38 is released.

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

1. In means for obtaining smokeless combustion in boiler furnaces, the combination with a door, a shaft carrying said door, a weighted lever having a nose and a projection revoluble loosely on the door-shaft, a sector having two projections fixed on the door-shaft, a shaft revoluble on the furnace, and a locking lever having a shoulder fixed on the latter shaft, said shoulder abutting against one projection of the sector when the door is shut, and said nose being adapted to raise the latter lever and release its shoulder from the sector when the weighted lever is rotated to open the door, the other projection of said sector being then driven by the projection of the weighted lever.

2. In means for obtaining smokeless combustion in boiler furnaces, the combination with a door, a shaft carrying said door, a weighted lever having a nose and a projection revoluble loosely on the door-shaft, a sector having two projections fixed on the door-shaft, a shaft revoluble on the furnace, a locking lever having a shoulder fixed on the latter shaft, said shoulder abutting against one projection of the sector when the door is shut, and said nose being adapted to raise the latter lever and release its shoulder from the sector when the weighted lever is rotated to open the door, the other projection of said sector being then driven by the projection of the weighted lever, a second weighted lever fixed on the door-shaft, a lever arm attached to said shaft, and levers, substantially as shown, on the latter weighted lever for actuating said lever arm and thereby rotating its shaft and releasing said sector from the locking lever.

3. In means for obtaining smokeless combustion in boiler furnaces, the combination with a door, a shaft carrying said door, a weighted lever having a nose and a projection revoluble loosely on the door-shaft, a sector having two projections fixed on the door-shaft, a shaft revoluble on the furnace, a locking lever having a shoulder fixed on the latter shaft, said shoulder abutting against one projection of the sector when the door is shut, a cataract-cylinder containing a piston, a lever arm attached to said shaft, and means for imparting the upward motion of said piston to said lever arm, as set forth.



4. In means for obtaining smokeless combustion in boiler furnaces, the combination, with the door, a shaft carrying the door, locking means for locking the door in its  
5 closed position, of a shaft carrying a lever arm adapted to operate said locking means, a weighted lever on said door-shaft, and levers pivoted on said weighted lever for actuating said lever arm.
- 10 5. In means for obtaining smokeless combustion in boiler furnaces, the combination, with the door, a shaft carrying the door, locking means for locking the door in its closed position, of a shaft carrying a lever arm adapted to operate said locking means, 15 a cataract-cylinder containing a piston, a shaft carrying a bushing having projections revoluble on said cylinder, and a lever connected with the piston and with the latter shaft, said lever arm being rotated by 20 said bushing when said piston is raised.

In testimony whereof, I affix my signature in the presence of two witnesses.

GUSTAV DE GRAHL.

Witnesses:

FRIEDRICH ROKAHR,  
WOLDEMAR HAUPT.