No. 721,159. PATENTED FEB. 24, 1903.

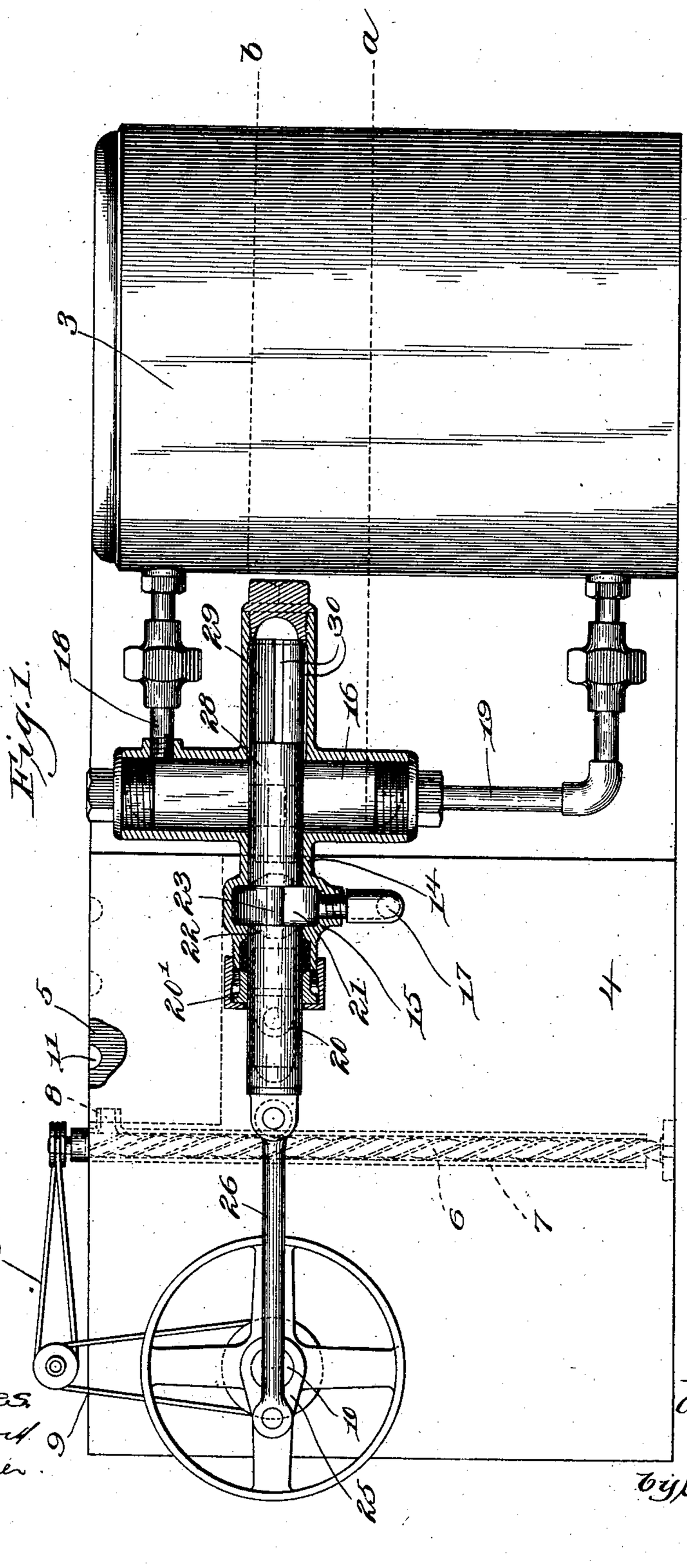
C. CROMPTON.

BOILER FEEDING APPARATUS.

APPLICATION FILED SEPT. 20, 1901.

NO MODEL. 7 SHEETS—SHEET 1.

Fig. 1.



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A. D. Kaiser.

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No. 721,159. PATENTED FEB. 24, 1903.

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BOILER FEEDING APPARATUS.

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NO MODEL. 7 SHEETS—SHEET 2.

Fig. 5.

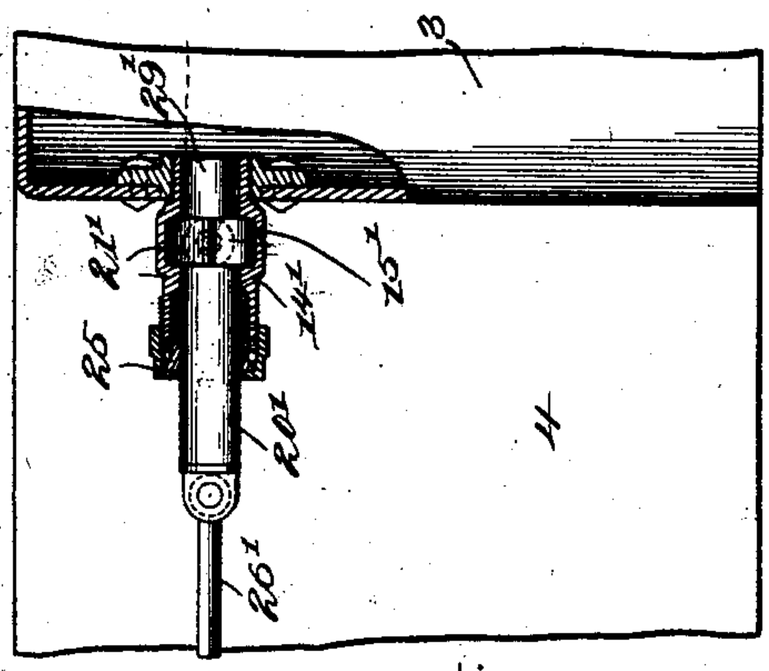

Fig. 6.

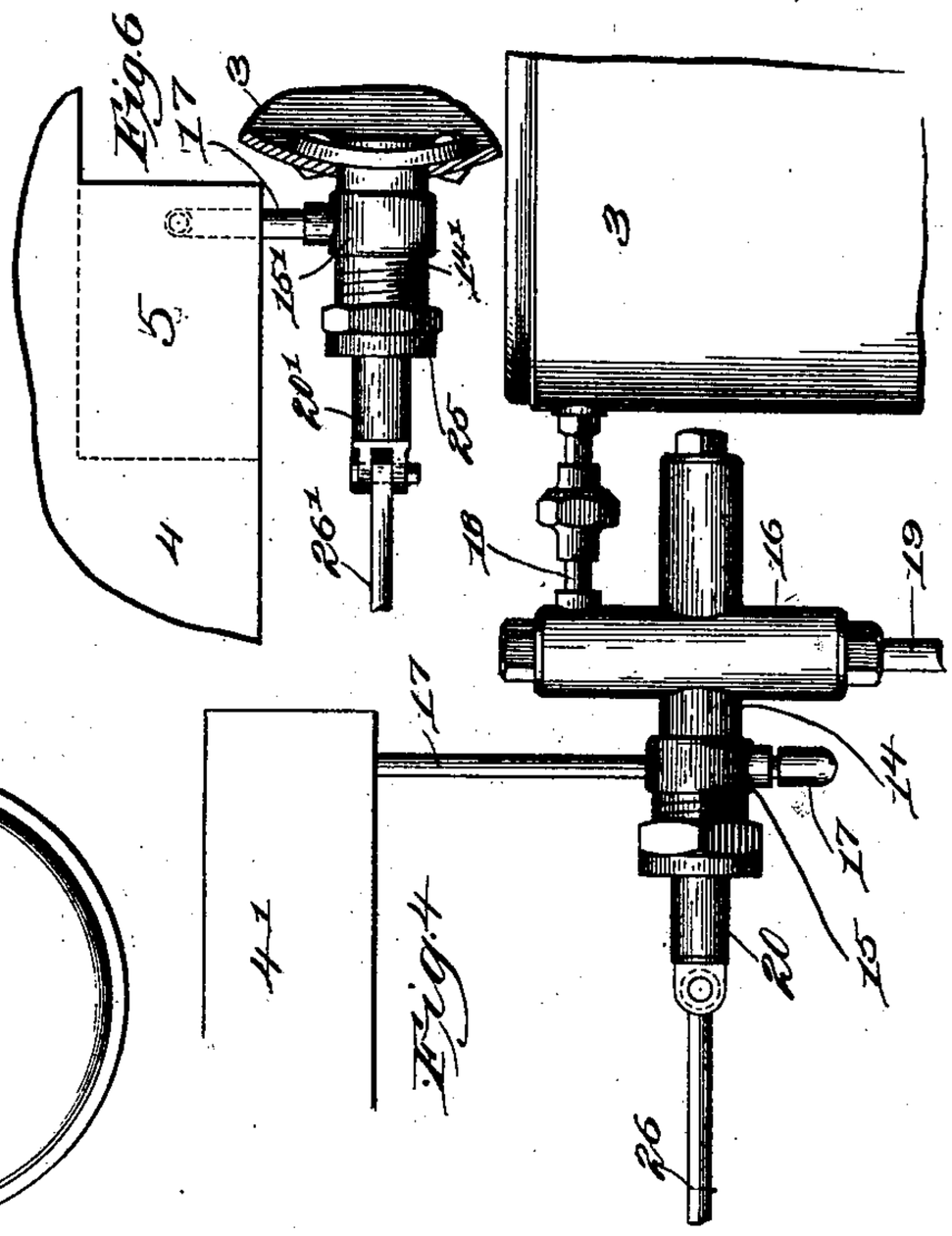

Fig. 2.

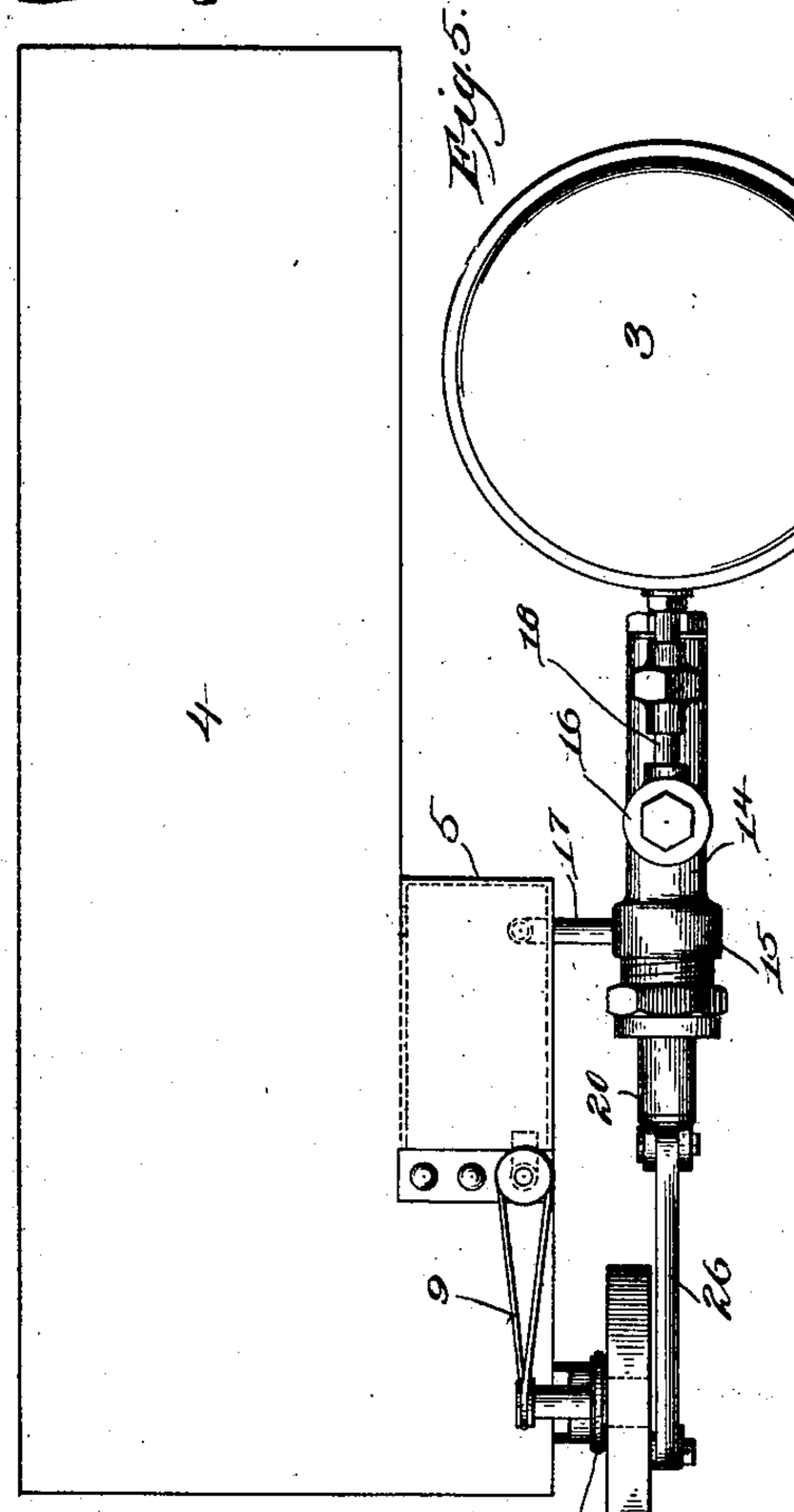

Fig. 4.

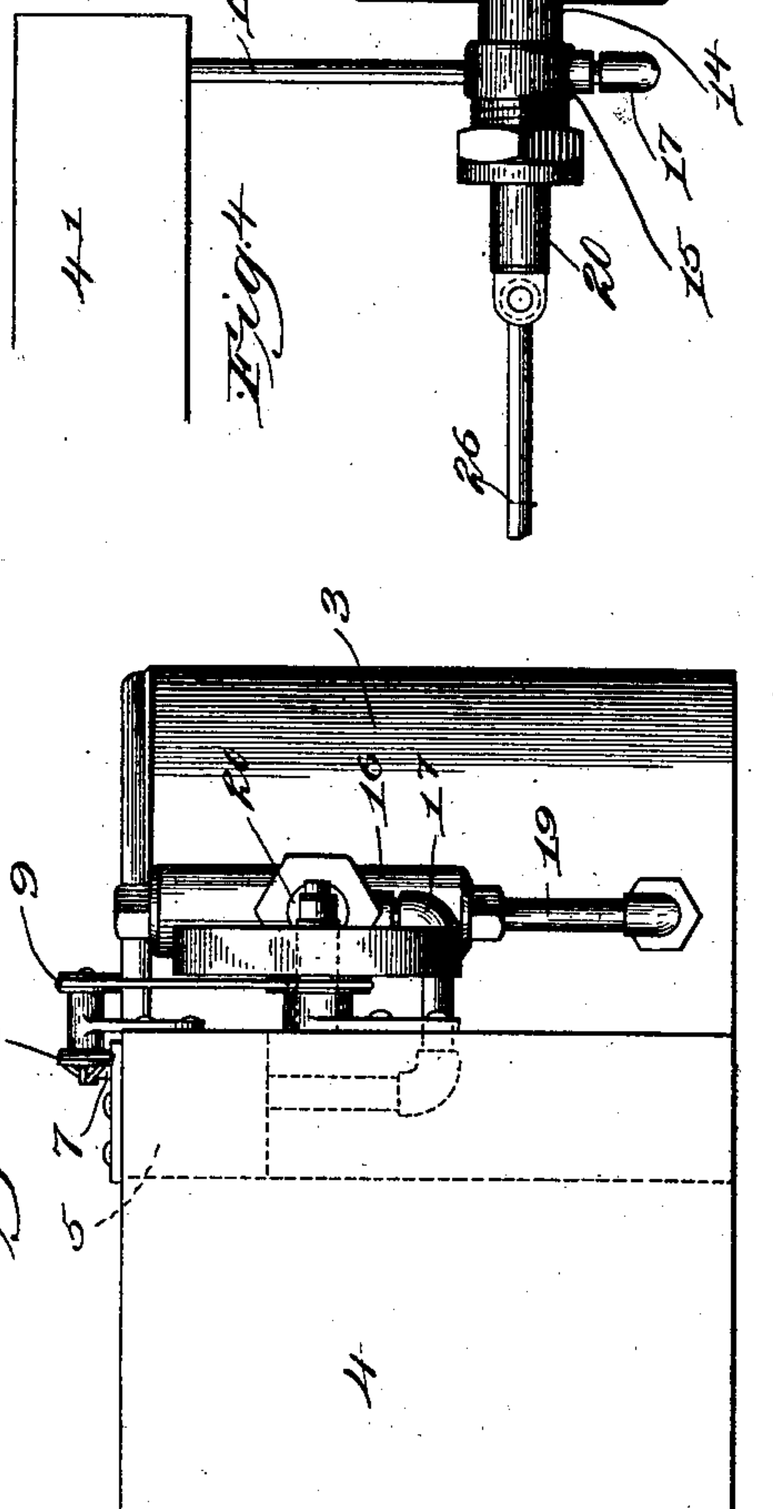

Fig. 3.

Witnesses.
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No. 721,159. PATENTED FEB. 24, 1903.

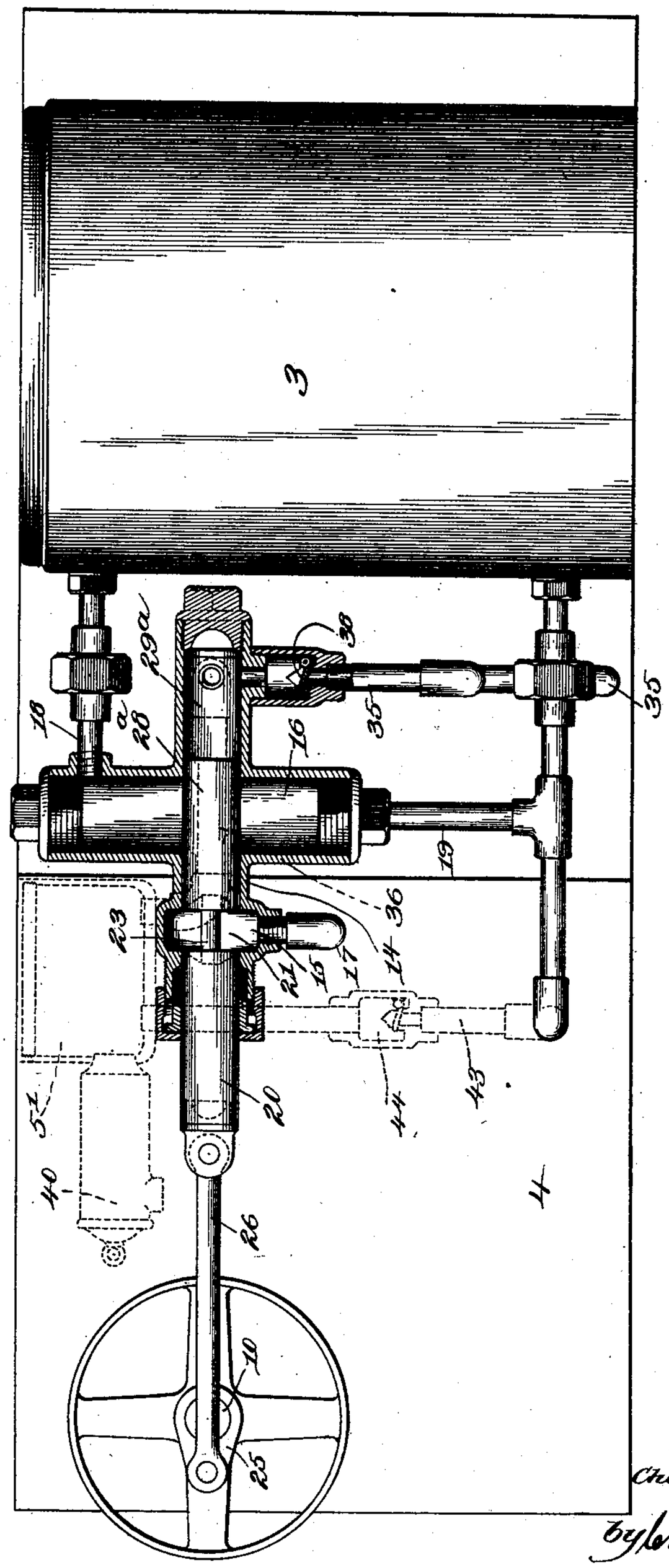
C. CROMPTON.

BOILER FEEDING APPARATUS.

APPLICATION FILED SEPT. 20, 1901.

NO MODEL. 7 SHEETS—SHEET 3.

Fig. 7.



Witnesses,
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No. 721,159. PATENTED FEB. 24, 1903.

C. CROMPTON.

BOILER FEEDING APPARATUS.

APPLICATION FILED SEPT. 20, 1901.

NO MODEL. 7 SHEETS—SHEET 4.

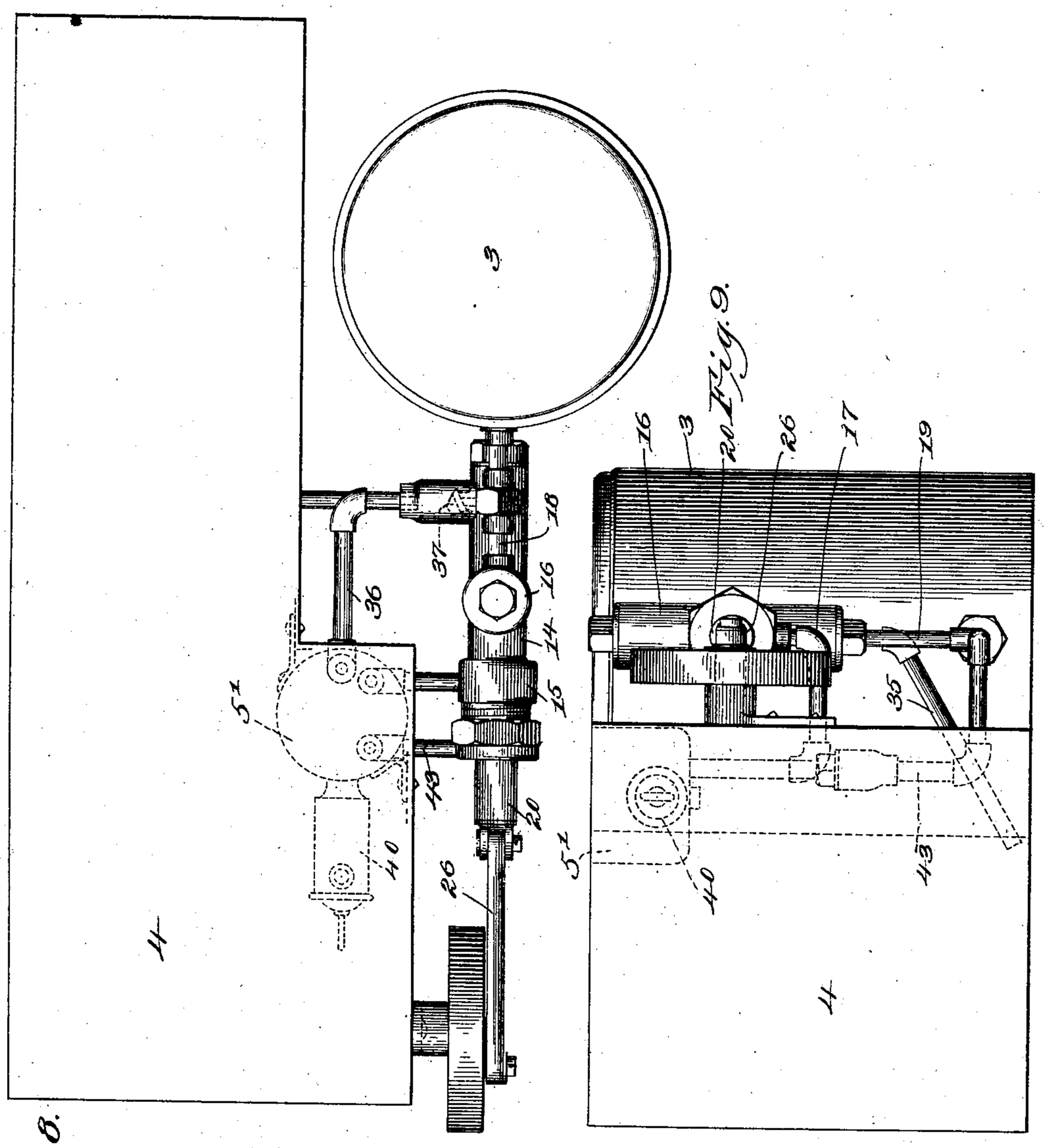

Fig. 8.

Fig. 9.

Witnesses,
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No. 721,159. PATENTED FEB. 24, 1903

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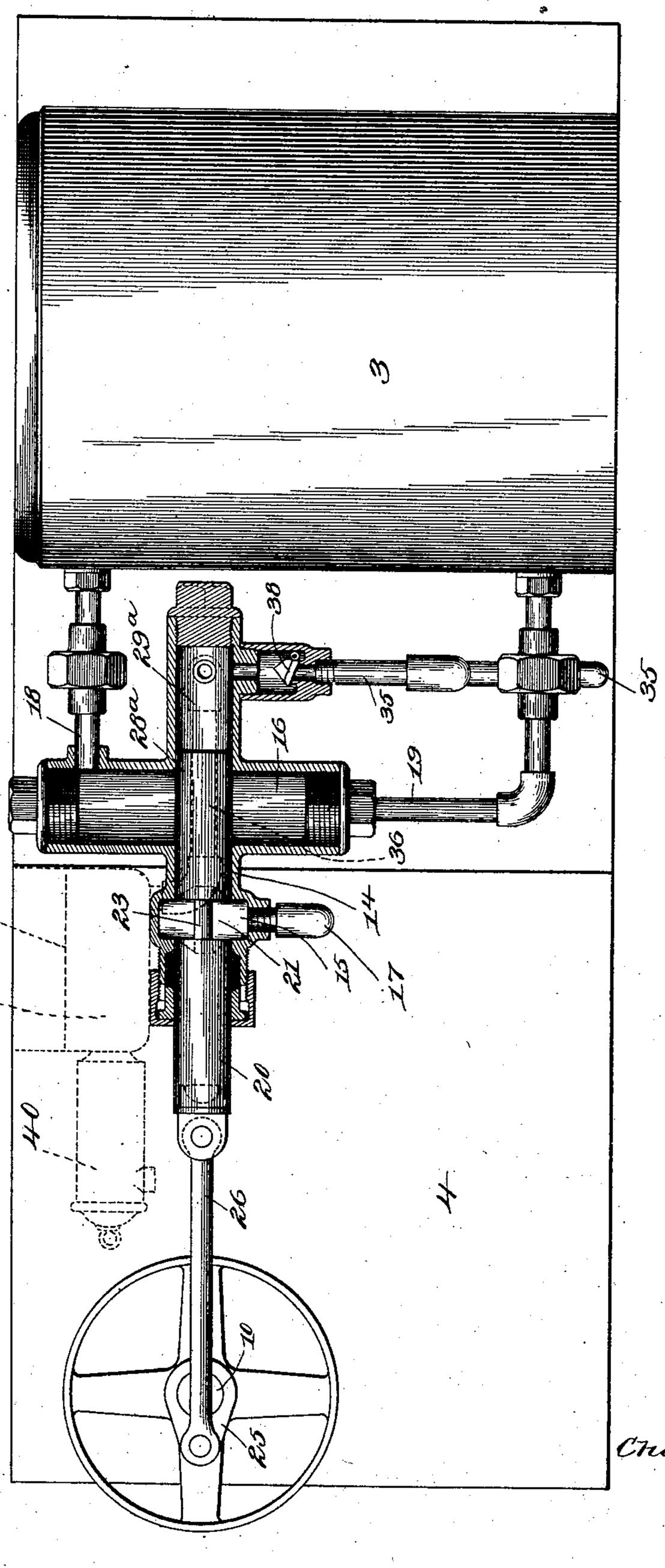
BOILER FEEDING APPARATUS.

APPLICATION FILED SEPT. 20, 1901.

NO MODEL. 7 SHEETS—SHEET 5.

Fig. 10.



Witnesses.
H. C. Sumsford.
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No. 721,159. PATENTED FEB. 24, 1903.

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BOILER FEEDING APPARATUS.

APPLICATION FILED SEPT. 20, 1901.

NO MODEL. 7 SHEETS—SHEET 6.

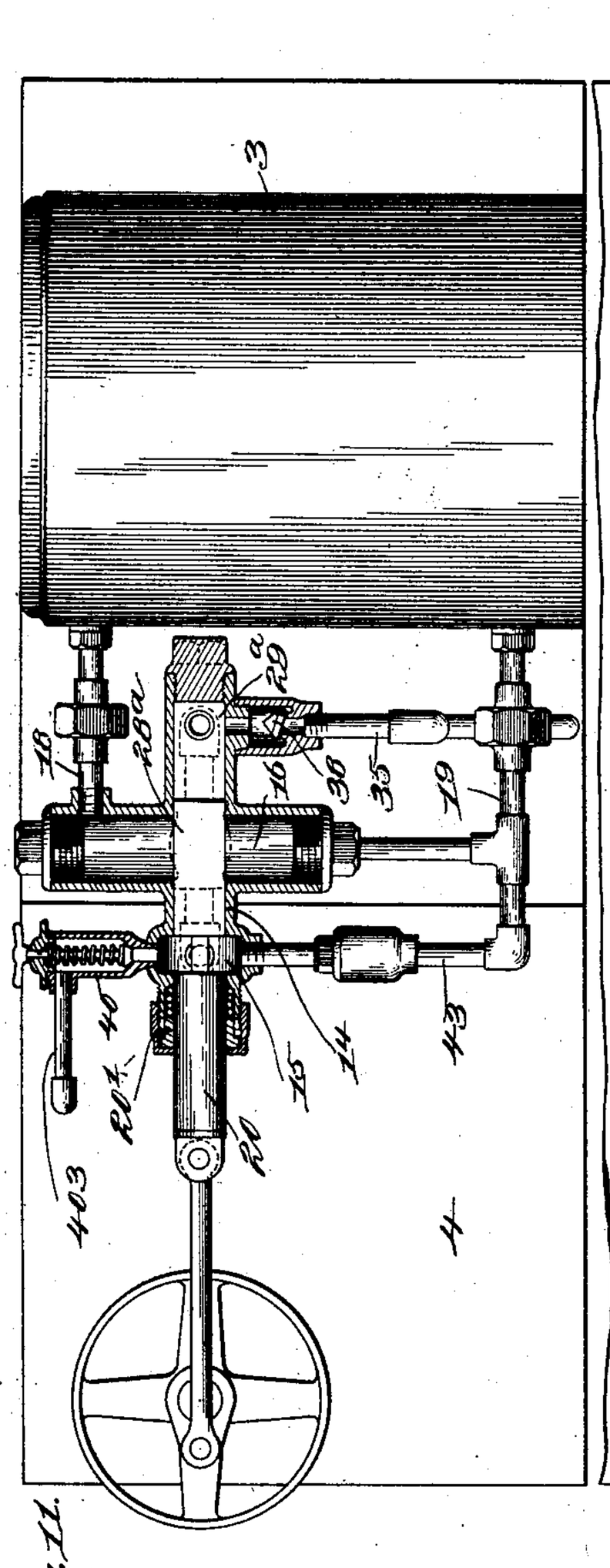

Fig. 11.

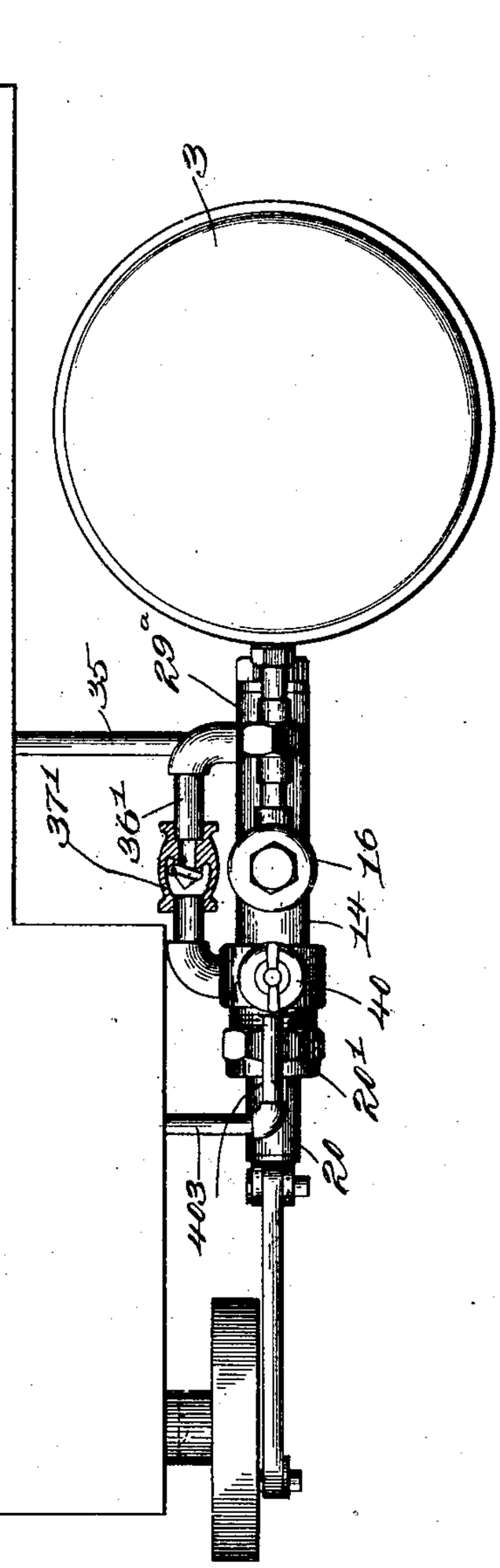

Fig. 12.

Witnesses.
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No. 721,159. PATENTED FEB. 24, 1903.

C. CROMPTON.

BOILER FEEDING APPARATUS.

APPLICATION FILED SEPT. 20, 1901.

NO MODEL. 7 SHEETS—SHEET 7.

Fig. 14.

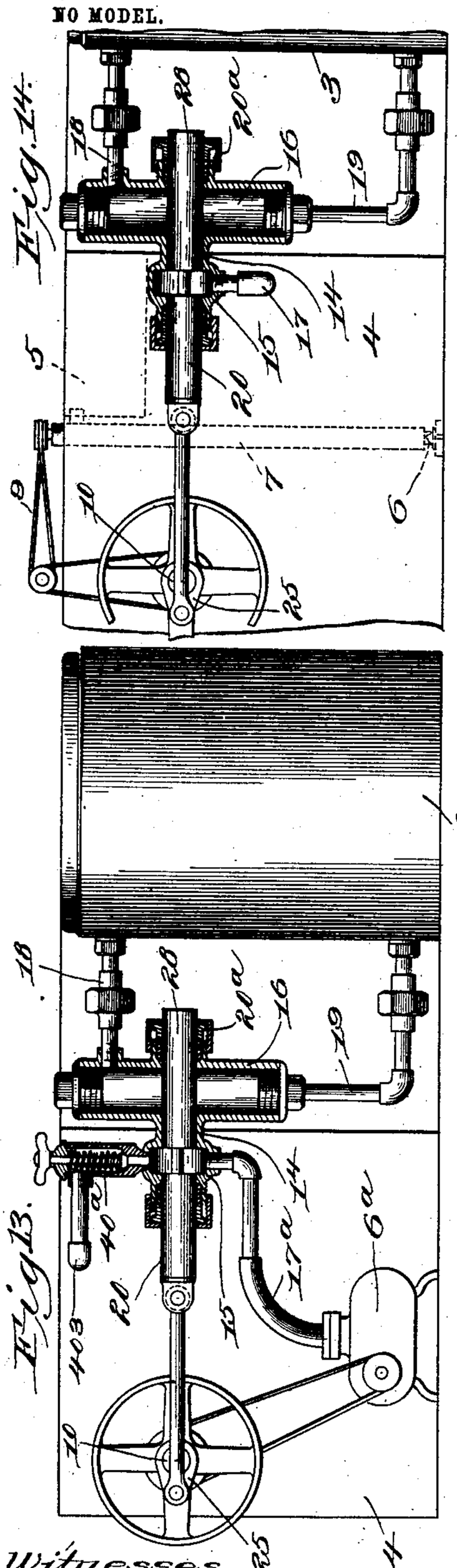
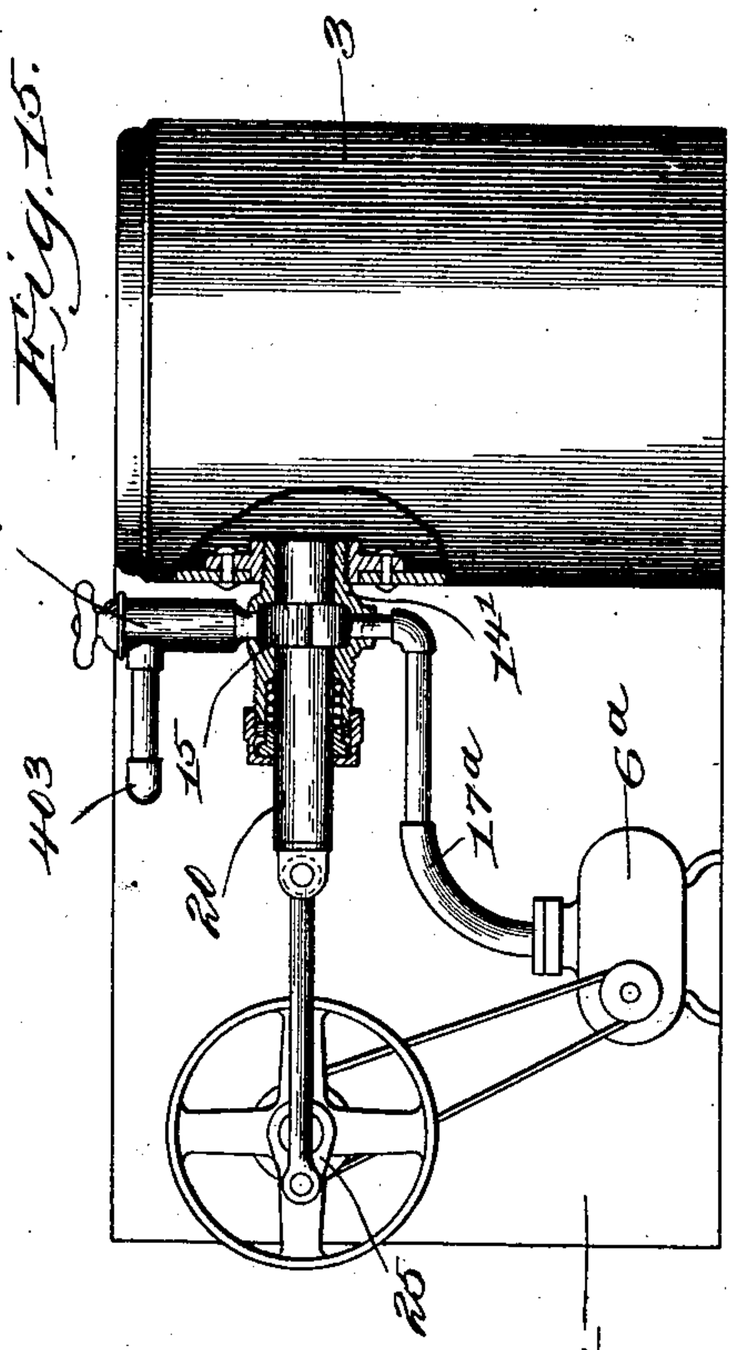


Fig. 13.

Fig. 15.



Witnesses:
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UNITED STATES PATENT OFFICE.

CHARLES CROMPTON, OF WORCESTER, MASSACHUSETTS.

BOILER-FEEDING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 721,159, dated February 24, 1903.

Application filed September 20, 1901. Serial No. 75,949. (No model.)

To all whom it may concern:

Be it known that I, CHARLES CROMPTON, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented an Improvement in Boiler-Feeding Apparatus, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to a boiler-feeding apparatus of that class wherein a confined water-space is put into communication with a source of water-supply and the boiler at a normal water-level in alternation. Heretofore in apparati of this class it has been customary to locate the supply of water at a higher level than the normal water-level in the boiler in order that when the confined water-space is brought into communication with the source of water-supply the water will descend by gravity and fill the said water-space. In the ordinary steam-driven motor-vehicle the boilers and water-tank are situated at substantially the same level, these elements being generally in the rear end of the body of the vehicle and under the seat thereof, and it is impossible therefore to support the main water-tank above the level of the boiler, so that boiler-feeding devices of the above-named class as heretofore constructed are not adapted for use in connection with motor-vehicles.

It is one of the objects of my invention to adapt this form of boiler-feeding mechanism to an automobile construction, and I accomplish this by providing mechanism whereby the water which is delivered to the confined water-space from the source of supply shall have a certain head or pressure regardless of the quantity of water in the main tank or the location of said tank.

In one form of my invention I provide in addition to my tank or reservoir containing a supply of water an auxiliary tank or reservoir situated above the normal water-level of the boiler. A confined water-space is put alternately in communication with the auxiliary tank and with the boiler at the normal water-level, and since the auxiliary tank is above the confined water-space and also above the water-level of the boiler the water will flow from said auxiliary tank and be delivered to the water-space under a head or pressure dependent upon the difference in level between the auxiliary tank and the confined water-space. A suitable form of pumping mechanism is operated continuously to pump or lift water from the main tank to the auxiliary tank, and the said auxiliary tank overflows into the main tank if the water is fed thereto faster than it is fed therefrom into the boiler. In another form of my invention the water which is delivered to the water-space is put under pressure by means of a pump or similar device and is delivered directly to the confined water-space from the pump, the pump in this case taking the place of the auxiliary tank in creating head or pressure in the water.

Figure 1 illustrates in side elevation one form of my boiler-feeding device. Fig. 2 is a top plan view thereof. Fig. 3 is an end elevation. Fig. 4 shows a slight modification. Figs. 5 and 6 show still other modifications. Fig. 7 is a side elevation of another form of my invention. Fig. 8 is a top plan view of Fig. 7. Fig. 9 is an end view thereof. Fig. 10 illustrates another modification, and Figs. 11, 12, 13, 14, and 15 illustrate various other forms in which my invention may be embodied.

While I have herein illustrated a boiler-feeding device which is especially adapted for use in connection with steam-driven automobiles, yet I desire to state at the outset that my invention is not limited to steam-driven automobiles nor to any form of boiler, but may be used generally where it is necessary to feed water to a boiler or to tanks.

I have designated the boiler by 3, said boiler being of any suitable or usual construction, and the main water-tank containing the supply of water is designated generally by 4, the said tank being of any suitable shape adapted for the position where the device is to be used.

The mechanism for feeding the water to the boiler 3 comprises a cylinder 14, suitably supported at the normal water-level of the boiler, the said cylinder having intermediate its ends the enlarged chambers 15 and 16, the chamber 15 having connected thereto a suitable supply-pipe which delivers water under

pressure to said chamber. The chamber 16 is connected to the inside of the boiler both above and below the normal water-line, the said chamber 16 being shown in this embodiment of my invention as a vertical cylindrical chamber intersecting the bore of the cylinder 14, though I desire to state that the chamber 16 may be of any desired shape or may have any appropriate position. The upper end of said chamber 16 is connected by a pipe 18 to the upper portion of the boiler, while the lower end of said chamber is connected by a pipe 19 to the lower portion of the boiler.

Reciprocating in the cylinder 14 is a plunger 20 of any suitable construction, it passing through a common stuffing-box 20′ at one end of said cylinder 14 and having the reduced portion 23 of any suitable shape, said reduced portion forming a confined water-space 21, which during the reciprocation of the plunger is adapted to be put in communication alternately with the enlarged chambers 15 and 16. As shown in the drawings, the reduced portion is made by turning down the plunger to leave the stem or core 23, the shoulders either side the stem 23 being concaved, as shown at 22, to increase the capacity of the water-space. The plunger may be reciprocated in any suitable way and is illustrated as being connected to a crank 25 on the main shaft 10 by means of a pitman 26.

Assuming that the chamber 15 is maintained full of water, it will be seen with the construction above described that when the parts are in the position shown in Fig. 1 the confined water-space 21 will be filled with water and when the plunger is reciprocated into the dotted-line position the confined water-space filled with water will be brought into the chamber 16. If now the water in the boiler is below normal water-level—for instance, at the level of the line *a*—it will be obvious that the water from the water-space will be delivered into the chamber 16, the said water-space being filled with steam from the upper portion of the boiler. As the water-space is returned to the chamber 15, the steam therein is condensed and a fresh supply of water is delivered thereto, this fresh supply being in turn delivered to the chamber 16 and to the boiler when the plunger is in the dotted-line position. As soon as the level of the water in the boiler rises to about the line *b*, which is the supposed water-level, the water which is carried in the water-space from the chamber 15 to the chamber 16 will be returned to the chamber 15 as the plunger reciprocates. This device, therefore, will automatically maintain the level of the water in the boiler at substantially a certain predetermined height.

It is desirable in boilers used for automobile purposes that the level of the water in the boiler be maintained as near to the normal water-line as possible, and it is desirable, therefore, that the amount or quantity of water which is delivered to the boiler at any given instant shall be comparatively small. In practice, therefore, I will make the capacity or cubical contents of the confined water-space comparatively small, and in order to deliver to the boiler water as fast as it is converted into steam and the steam is used when the automobile is running rapidly it is necessary to give the plunger a rapid reciprocation. Where the plunger has this rapid reciprocation, the time that the confined water-space remains in either chamber for the purpose of receiving a charge of water or delivering the same is a very short interval of time, and it becomes necessary, therefore, to provide a character of water-space which will become filled with water in the shortest possible time and which will discharge the charge of water as quickly as possible. For this purpose I employ an annular water-space, as illustrated, the said annular water-space presenting in effect the greatest extent of opening or entrance passage-way for the water to enter the said space. To allow the water to enter the confined water-space from the sides, it is necessary, of course, that the chamber 15 be an annular chamber which surrounds entirely the plunger. With this construction it will be apparent that when the plunger has moved the water-space into the position shown in Fig. 1, for instance, the water in the annular water-chamber 15 enters the annular water-space from all sides, and consequently in the shortest possible time. When the plunger has been reciprocated to bring the water-space into the chamber 16, the size of the chamber is such that the water may almost instantly be delivered from the annular water-space into the chamber. It is possible by means of an annular water-space having enlarged chambers 15 and 16, therefore, to reciprocate the plunger with extreme rapidity without any danger that the water-space will not fully receive the discharge or deliver the same. I find in practice also that it is desirable that the chamber 16 shall be considerably larger in volume than the volume of the confined water-space, for not only does this construction enable the charge of water to be almost instantly delivered from the water-space, but, owing to the relative size of the chamber 16 and the area of the confined water-space each individual charge does not materially affect the level of the water in the chamber. By using a connection between the chamber 16 and the boiler smaller in diameter than the confined water-space the charges of water as they are delivered to the chamber 16 will flow gradually into the boiler.

Various ways of maintaining a supply of water under pressure in the chamber 15 may be employed, and in Figs. 1, 2, 3, and 5 to 10 I have illustrated an auxiliary tank which is situated in some convenient place above the chamber 15 and is connected thereto by means of the supply-pipe 17, said auxiliary tank being in turn supplied with water from

the main tank by any suitable means. In Figs. 1, 2, and 3 the auxiliary tank is designated by 5, and for convenience it is shown as being situated inside the main tank 4, at the upper portion thereof, and above the level of the chamber 15, said auxiliary tank being connected to the chamber 15 by means of the supply-pipe 17. Any suitable means may be employed to supply water to the auxiliary tank 5 from the main tank 4, and in Fig. 1 I have illustrated a pump in the form of a screw 6, (shown in dotted lines,) said screw being confined in a suitable casing 7, which opens at its upper end at 8 into the auxiliary tank 5. The screw may be driven in any suitable way, as by belts 9, connected to the main driving-shaft 10. The auxiliary tank (shown in Fig. 1) is provided with overflows 11, whereby if the water is delivered to said tank faster than it is taken therefrom the water will flow through the overflows 11 back into the main tank 4. Since the auxiliary tank is above the level of the chamber 15 and since the said auxiliary tank is kept filled with water by the pumping mechanism, it will be obvious that the water will be delivered to the chamber 15 under a constant head or pressure dependent on the difference in level between the chamber 15 and the auxiliary tank, regardless of the amount or level of the water in the main tank 4. This construction therefore especially adapts this form of boiler-feeder for use where it is impossible or impracticable to place the main source of water-supply above the level of the normal water-level of the boiler, as in steam-driven automobiles, &c.

In the form of my invention illustrated in Fig. 1 the end 28 of the plunger is guided in the extended end 29 of the cylinder 14, and one of said parts (the extended end 29 of the cylinder in Fig. 1) is provided with a series of grooves or passages 30 to allow the water to enter or escape from the said cylinder end as the plunger reciprocates. I may, however, if desired, provide the said end of the cylinder with a stuffing-box 20^a and allow the end 28 of the plunger to project through said stuffing-box, as shown in Figs. 13 and 14, in which case there will be no unnecessary pumping action produced.

Fig. 4 illustrates a slightly-different modification, wherein it is possible to place the main water-tank 4′ above the level of the boiler, in which case no auxiliary tank will be necessary. In other respects the device of Fig. 4 is similar to that shown in Fig. 1, above described.

It is possible to dispense with the chamber 16 by making the boiler serve the function of said chamber, and in Figs. 5 and 6 I have illustrated a modification showing this construction. In Fig. 5 the boiler is shown at 3, a portion only of the boiler being shown, and 4 designates the tank, as in Fig. 1. A cylinder 14′ has intermediate its length a chamber 15′, said chamber being connected to the auxiliary tank 5 by pipe 17, as in the modification shown in Fig. 1, but said cylinder has its end 29′ secured directly to the side of the boiler in any suitable way and opening into said boiler, as shown in Fig. 4. The plunger 20′, which passes through any usual stuffing-box 25 in the end of the cylinder, has therein the water-space 21′, which is put alternately in communication with the chamber 15′ and the interior of the boiler, the said boiler serving as a chamber 16. As the plunger is reciprocated, the water in the water-space is carried into the boiler, and if the water-level is below normal the water in said water-chamber will be deposited in the boiler, and upon a second reciprocation of the plunger a second charge of water will be delivered to the boiler. When, however, the water-level in the boiler rises to the top of the piston, the water in the water-space will merely be carried back and forth between the chamber 15′ and the boiler.

Figs. 7, 8, and 9 illustrate a slightly-different modification wherein a different form of pumping mechanism is employed to supply water from the main tank to the auxiliary tank, and in this embodiment of my invention the water is maintained in the auxiliary tank at substantially boiler-pressure. The plunger 20, operating in the cylinder 14 and having the water-space 21, which delivers water from the chamber 15 to the chamber 16, is the same as in the modification illustrated in Fig. 1. In this embodiment of my invention, however, the end 28^a of the plunger fits tightly and operates as a piston in the end 29^a of a cylinder 14, and said end of the cylinder is connected by a pipe 35 with the bottom of the main tank 4 and also by a pipe 36 with the auxiliary reservoir 5′. The pipe 36 has a check-valve 37 therein to admit water from the pump portion 29^a of the cylinder 14 to the auxiliary tank, and the pipe 35 has a similar check-valve 38 therein operating to admit water from the main tank 4 to the cylinder 29^a. These check-valves may be of any usual or ordinary construction. When now the plunger 20 is reciprocated by any suitable means, water will be delivered from the chamber 15 to the chamber 16 and from thence to the boiler, as above described, and at the same time the end 28^a of the plunger 20 working in the cylinder 29^a operates as a pump to force water from the main tank to the auxiliary tank 5′. Since the pump is working constantly, whether water is being taken from the auxiliary tank and delivered to the boiler or not, I provide the auxiliary tank with any ordinary form of safety-valve 40, which can be set to any desired pressure, said safety-valve allowing the water to escape from the auxiliary tank 5 when the same has been filled and the water therein put under a certain pressure in order to prevent said tank from bursting. Connected to the tank is a pipe 43, said pipe being preferably connected to the pipe 19, as shown, the said pipe 43 having therein any usual check-valve 44, which

will admit water from the boiler 3 to the auxiliary tank 5′, but will prevent water flowing in the opposite direction. With this construction the water in the auxiliary tank is always under boiler-pressure and may be kept at any pressure, the pressure being maintained at any higher pressure by means of the safety-valve 40. It will be understood, of course, that the safety-valve will be so set as to withstand a greater pressure than boiler-pressure and also that the tank 5′ will be constructed sufficiently strong to withstand the pressure to which it is subjected. The advantage of this modification is that the water is delivered to the chamber 15′ at a pressure equal to or greater than boiler-pressure and will therefore be delivered from the chamber 15 to the boiler at this same pressure.

It is not necessary in all instances to employ the pipe 43 for maintaining the water in the auxiliary tank under boiler-pressure, and in Fig. 10 I have illustrated a modification wherein this pipe is omitted. In other respects the construction shown in Fig. 10 is similar to that shown in Fig. 7, except that in this modification I employ an air-chamber in the auxiliary tank 5′, said air-chamber serving to maintain the water under pressure. The dotted line 60 in said Fig. 10 illustrates the normal water-level in the auxiliary tank 5′, and it will be seen that as water is pumped into said tank from the main tank 4 the air in the air-chamber at the upper portion of said auxiliary tank will be compressed, thus putting the water therein under pressure. The safety-valve 40 may be set to any desired pressure, and when this pressure has been reached in the auxiliary tank the water will escape back into the main tank.

In Figs. 11, 12, 13, and 15 I have shown a slightly-different modification wherein the water is delivered to the chamber 15 directly from a suitable pumping mechanism instead of indirectly through the auxiliary tank 5 or 5′. Referring to Figs. 11 and 12, it will be seen that the auxiliary tank is dispensed with and that the pipe 36′, which is connected to the pump end 29^a of the cylinder 14, as in Fig. 7, is connected directly to the chamber 15, said pipe having any ordinary check-valve therein. The upper part of the chamber 15 has connected thereto a safety-valve 40 of any ordinary construction, which has an overflow 403 back into the main tank 4. In other respects the mechanism shown in Figs. 11 and 12 is the same as illustrated in Fig. 7. With this construction the pressure in the chamber 15 may be regulated to any desired amount by means of the safety-valve, and the amount of piping necessary is reduced.

Fig. 13 shows a form of my invention similar to that shown in Fig. 1, except that the water is delivered to the chamber 15 through a supply-pipe 17^a directly from a suitable pump 6^a, (shown as a rotary pump,) which is driven from the main shaft 10 in any usual way, said pump being connected by a suitable pipe (not shown) to the main tank 4, whereby water is pumped from said tank 4 directly into the chamber 15. In this modification, too, a suitable safety-valve 40^a is employed to relieve the pressure in the chamber 15, said safety-valve having an outlet 403, which takes back into the main tank 4.

Fig. 15 is similar to Figs. 5 and 6 in that the chamber 16 is made part of the boiler, the cylinder 14′ being open at one end and extending into the boiler. The confined water-space operates to take a change of water from the chamber 15 and deliver it directly into the boiler. Instead of using the auxiliary tank 5, however, I connect the chamber 15 directly to a suitable pump 6^a by means of a supply-pipe 17^a, whereby water is pumped from the main tank 4 directly into the said chamber. The safety-valve 40^a will be employed to relieve the pressure in the said chamber, as in the modifications illustrated in Figs. 11, 12, and 13.

In all of my above-described modifications I have provided means whereby the water may be delivered to the chamber 15 at a constant head or pressure without reference to the level of the water in the tank 4 or to the position of said tank relative to the boiler-level. The device is therefore especially adapted for use in automobiles and similar devices using steam where it is either impossible or impracticable to place the permanent source of water-supply above the water-level in the boiler.

When my boiler-feeding apparatus is used in connection with a steam-driven motor-vehicle, I will preferably operate the crank-shaft 10 from any driving part of the vehicle, so that the speed of the reciprocation of the plunger depends upon and bears a certain definite relation to the speed with which the vehicle is moving. By means of this construction the water will be fed to the boiler substantially as fast as it is converted into steam and the steam is used, for when the engine driving the vehicle is running rapidly the plunger will have a corresponding rapid reciprocation, and water will be delivered to the boiler at a rate corresponding to the steam consumption; but when the engine is moving slowly and only a little steam is being used the rate at which the water is fed into the boiler will be correspondingly diminished.

Various changes may be made in the structure of my device without departing in any way from my invention, and I reserve to myself the right to make any changes which may come within the scope of the appended claims.

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

1. In a boiler-feeding apparatus, a cylinder having two enlarged chambers, one of said chambers being connected to a source of water-supply and the other to the boiler, a reciprocating plunger in said cylinder, said

plunger having a water-space of greatest cross-sectional area at the circumference of the plunger, and said chambers each having an opening leading into the cylinder and of a size to cover the water-space when said water-space is in register therewith, whereby said water-space can be filled in a minimum time.

2. In a boiler-feeding apparatus, a cylinder, a plunger movable therein, said plunger being cut away to form a water-space of greatest cross-sectional area at the circumference of the plunger, two water-chambers opening into said cylinder, one of said chambers being connected to the boiler, means to maintain a supply of water under pressure in the other chamber, both of said chambers having a passage-way leading to the cylinder of a size to entirely cover the water-space at the point of its greatest cross-sectional area, and means to put the said water-space in communication with the two chambers alternately.

3. In a boiler-feeder, a tank containing a supply of water, a cylinder, two water-chambers communicating with the cylinder, means to connect one of the chambers to the boiler, means to supply water under pressure from the tank to the other of said chambers, a plunger movable in said cylinder and having a water-space of greatest cross-sectional area at the circumference of the plunger, and means to move said plunger to put said water-space in communication with the two chambers alternately, the opening between each of said chambers and the cylinder being of a size to entirely cover the water-space when the latter is in register with the said chamber.

4. In a boiler-feeder, a tank containing a supply of water, a cylinder having two enlarged portions or chambers, one of said chambers being connected to the boiler, a pump mechanism to supply water from the tank to the other of said chambers, a plunger in said cylinder and having a water-space, means to reciprocate said plunger to put the water-space in communication with the two chambers alternately, and means whereby the surplus water from the pumping mechanism may be delivered back into the tank.

5. In an apparatus for feeding water to boilers, a main reservoir or tank to contain water, an auxiliary tank above the normal water-level in the boiler, means to supply water to the auxiliary tank from the main tank, a movable confined water-space, and means to put said water-space into communication with the auxiliary tank and boiler at normal water-level in alternation.

6. In a boiler-feeding device, a main tank containing a supply of water, an auxiliary tank situated above the normal water-level of the boiler, a continuously-operating pump device to supply water to the auxiliary tank from the main tank, a confined water-space, and means to put the same in communication with the auxiliary tank and the boiler at normal water-level alternately.

7. In a boiler-feeding apparatus, a main tank at substantially the same level as the boiler, an auxiliary tank situated above the normal water-level of the boiler, means to supply the auxiliary tank with water from the main tank, said auxiliary tank having an overflow into the main tank, combined with a confined water-space, and means to put the same in communication alternately with the auxiliary tank and the boiler at normal water-level.

8. In a boiler-feeding device, a main tank to contain a supply of water, an auxiliary tank situated above the normal water-level in the boiler, a cylinder, a plunger movable therein and having a reduced portion constituting a water-space, said cylinder having two enlarged chambers, one of said chambers being connected with the auxiliary tank and the other with the boiler above and below the normal water-level, and means to move the plunger to put the water-space in communication with the two chambers alternately.

9. In a boiler-feeding device, a main tank containing water, an auxiliary tank situated above normal water-level, a cylinder having two enlarged chambers intermediate its end, one of said chambers being connected with the auxiliary tank and the other with the boiler both above and below the normal water-level, a plunger in said cylinder, said plunger having a water-space intermediate its ends, means to move said plunger to put the water-space in communication with the two chambers alternately, and a pump mechanism connected to the plunger-operating mechanism and operating to pump water from the main tank to the auxiliary tank.

10. In a boiler-feeder, a tank containing water, a cylinder having two enlarged chambers intermediate its ends, a plunger in said cylinder, said plunger having a water-space, means to connect one of said chambers to the tank, means to connect the other of said chambers to the boiler both above and below the normal water-level, and means to reciprocate said plunger to put the water-space in communication with the two chambers alternately, one end of said plunger and the cooperating end of the cylinder constituting a pump to force water into the tank.

11. In a boiler-feeder, a main tank, an auxiliary tank, a cylinder, a reciprocating plunger, said cylinder being connected to the main and auxiliary tanks whereby the plunger operates to pump water from the main tank to the auxiliary tank, said plunger having a water-space, the reciprocations of the plunger putting the water-space in communication with the auxiliary tank and the boiler at normal water-level alternately.

12. In a boiler-feeder, a main tank, an auxiliary tank, a cylinder, a reciprocating plunger, said cylinder being connnected to the main and auxiliary tanks whereby the plunger operates to pump water from the main tank to the auxiliary tank, said plunger hav-

ing a reduced portion constituting a water-space, the reciprocations of the plunger putting the water-space in communication with the auxiliary tank and the boiler at normal water-level alternately, and means to maintain the water in the auxiliary tank under pressure.

13. In a boiler-feeder, a main tank containing water, an auxiliary tank, a relief-valve connecting the auxiliary and main tanks, a cylinder at substantially normal water-level and having two enlarged chambers intermediate its ends, one of said chambers being connected to the auxiliary tank and the other to the boiler both above and below the normal water-level, one end of said cylinder being connected to both the main and auxiliary tanks, a reciprocating plunger in said cylinder, said plunger having a reduced portion constituting a water-space, the reciprocations of the plunger operating to pump water from the main tank to the auxiliary tank and to put the water-space in communication with the two chambers alternately.

14. In a boiler-feeding apparatus, a water-chamber, means to supply water thereto, a reciprocating plunger working through said chamber, said plunger being provided with a water-space having its greatest cross-sectional area substantially at the circumference of the plunger, and means to reciprocate the plunger, the said water-chamber, when the water-space is in register therewith, covering the entire extent of the water-space, and the plunger in its reciprocations putting the water-space into communication with the chamber and the boiler in alternation.

15. The combination, with a boiler, of a boiler-feeding apparatus comprising a water-chamber, a plunger working in said chamber, said plunger having a water-space of greatest cross-sectional area at the surface of the plunger, means to deliver water into said chamber under pressure, and means to put the water-space into communication with the water-chamber and with the boiler, in alternation, the water-chamber being of such a shape as to entirely cover the water-space when the latter is in register therewith.

16. The combination, with a boiler, of a boiler-feeding apparatus, comprising two chambers, one of which is connected to the boiler, means to deliver water under pressure to the other chamber, a plunger working through said chambers, and means to reciprocate the plunger, said plunger having a water-space shaped so that its greatest cross-sectional area is at the surface of the plunger, and each of said chambers being so constructed as to cover the entire extent of the water-space when the latter is in register therewith.

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

CHARLES CROMPTON.

Witnesses:
GEORGE H. KIMBALL,
HERMAN F. KLINGELE.