No. 606,766. Patented July 5, 1898.

W. R. PARK.

INJECTOR.

(Application filed May 16, 1898.)

(Model.) 3 Sheets—Sheet 1.

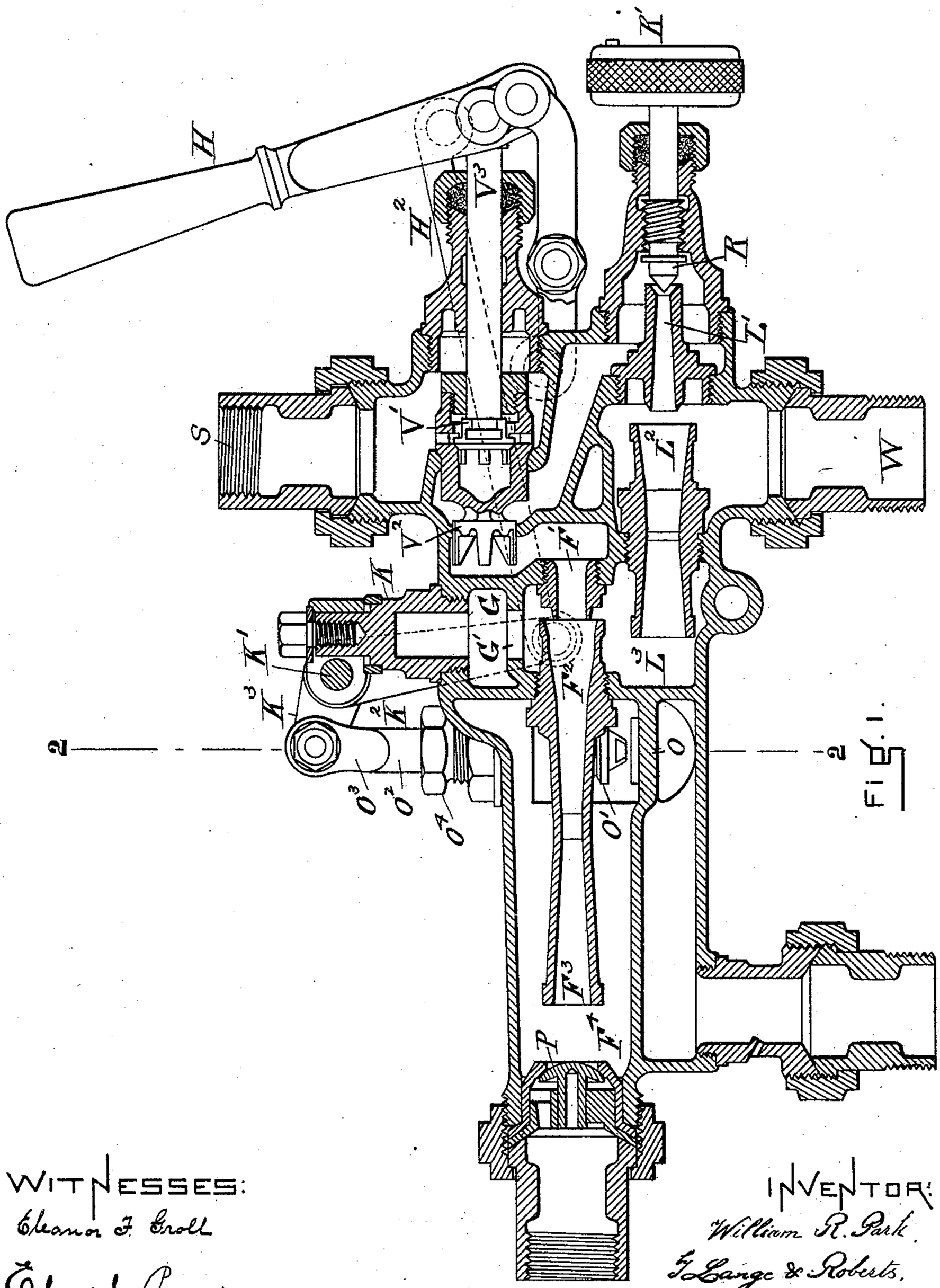

Fig. 1.

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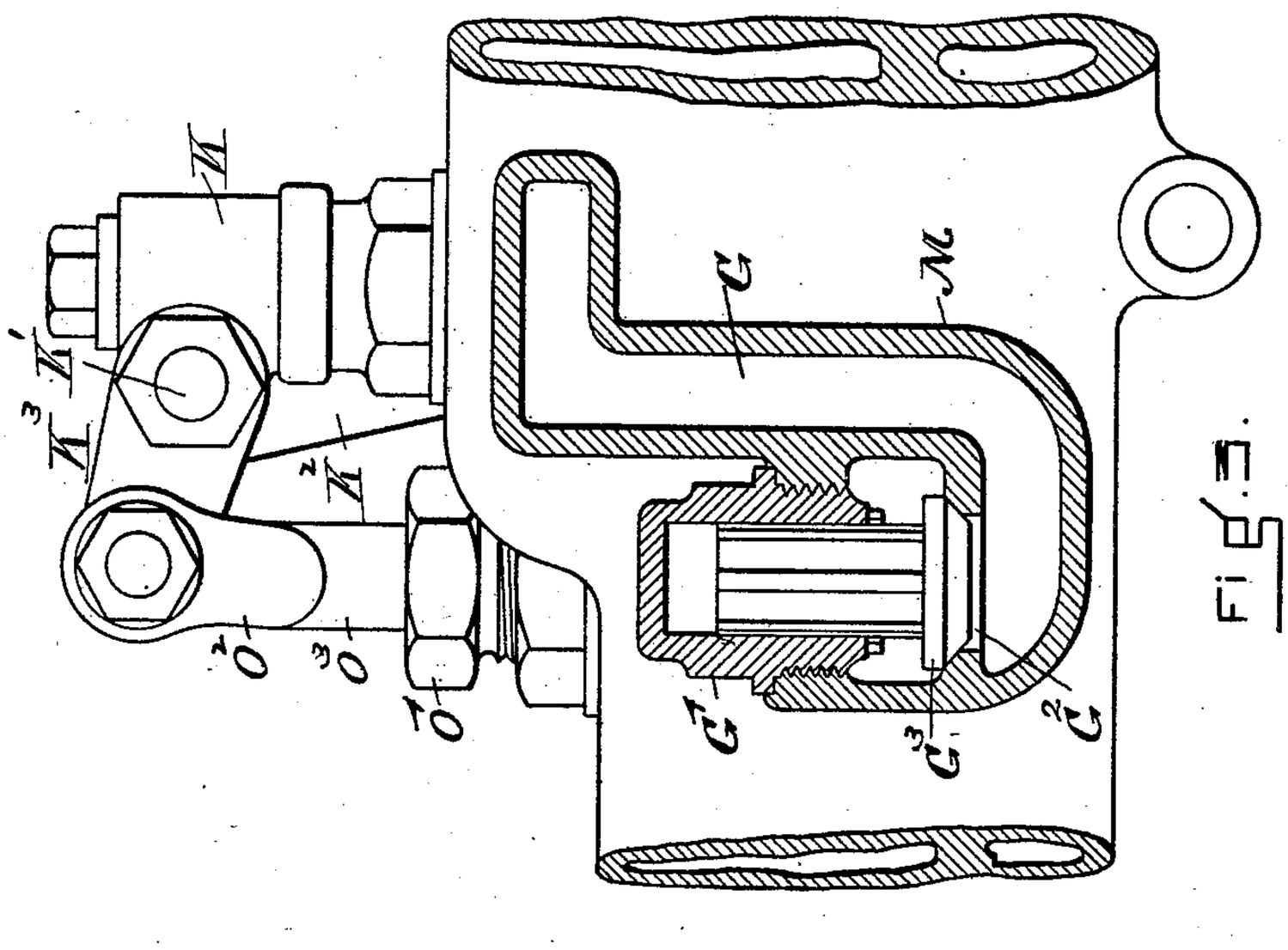

Fig. 3.

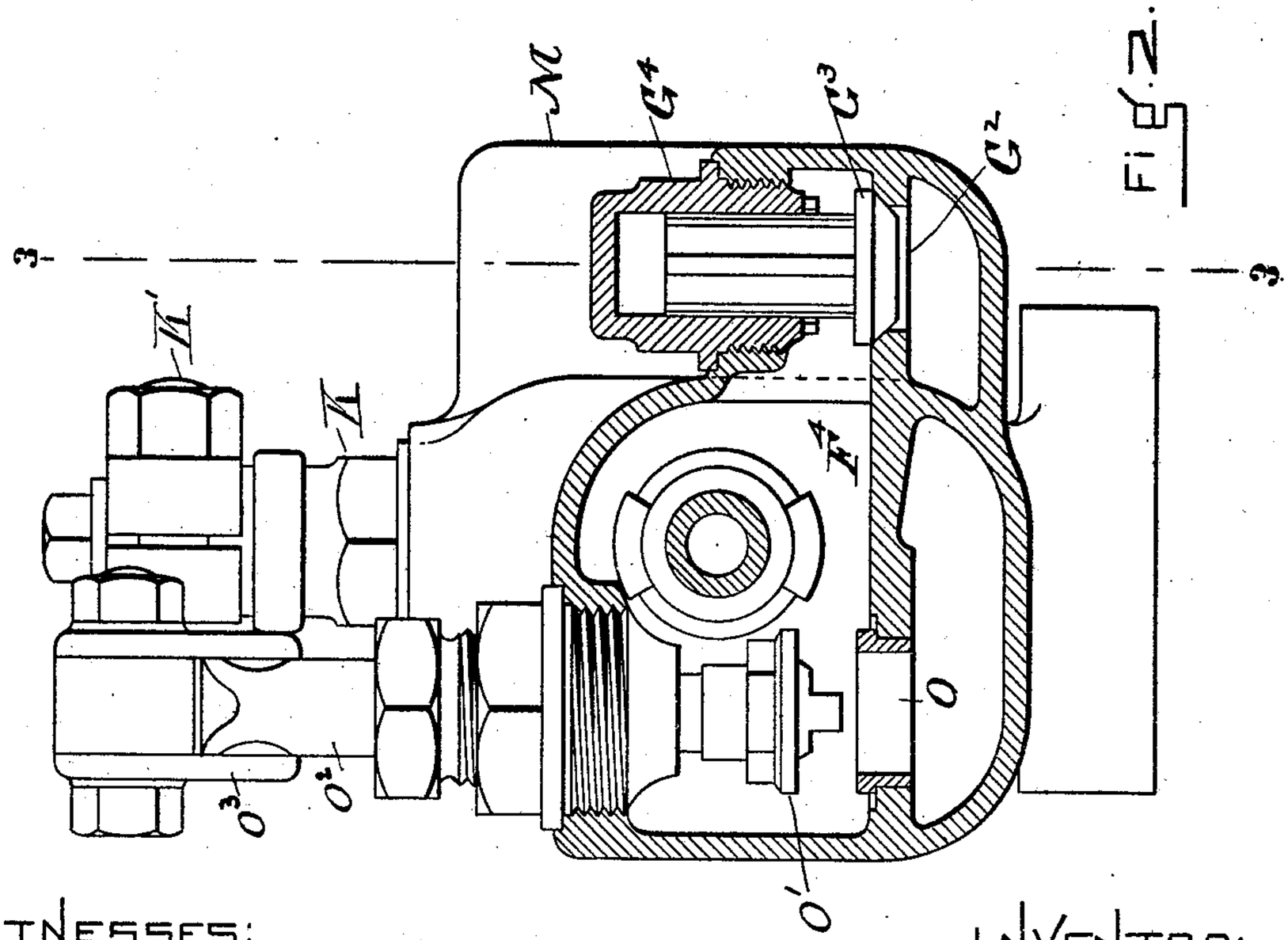

Fig. 2.

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(Model.) 3 Sheets—Sheet 3.

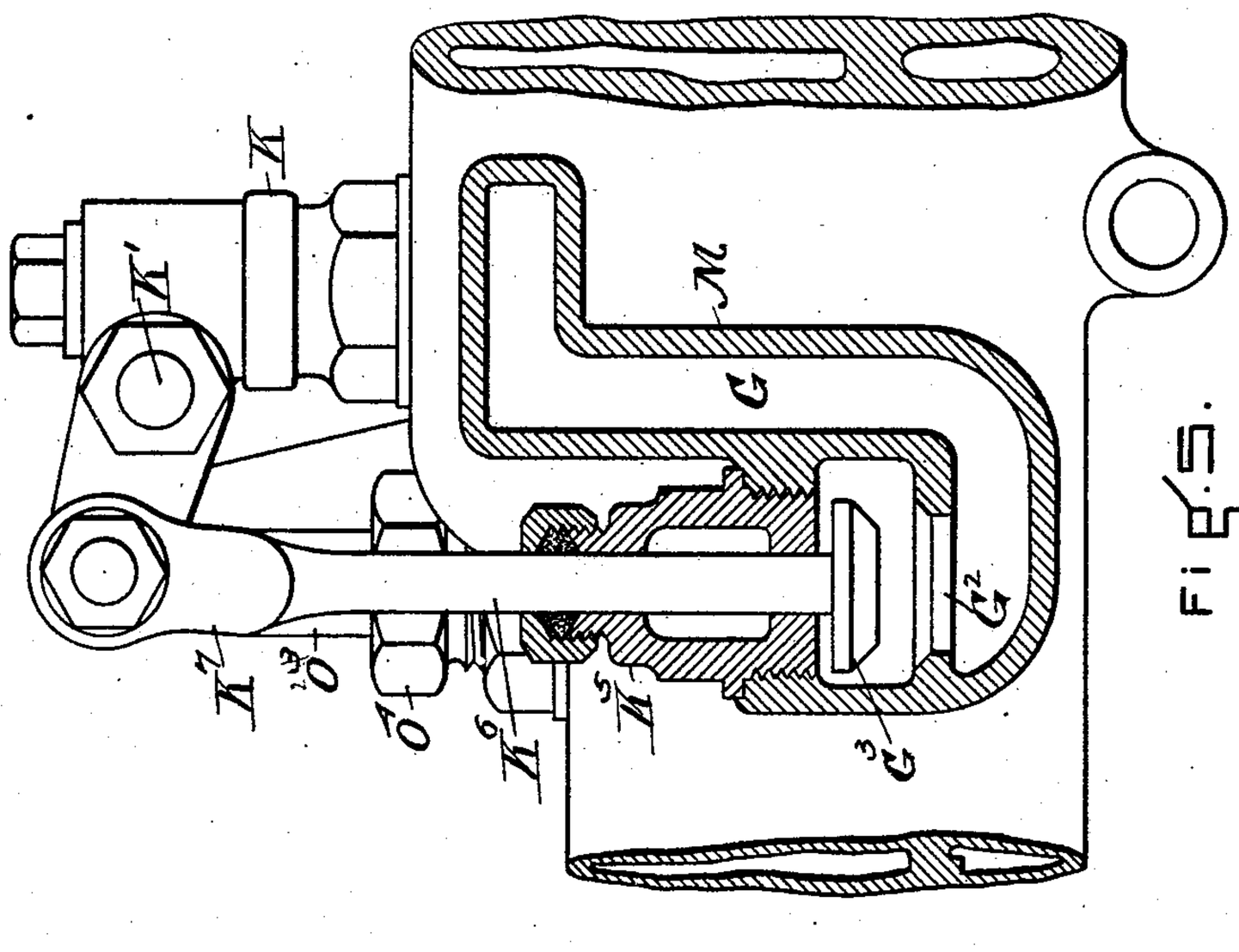

Fig. 5.

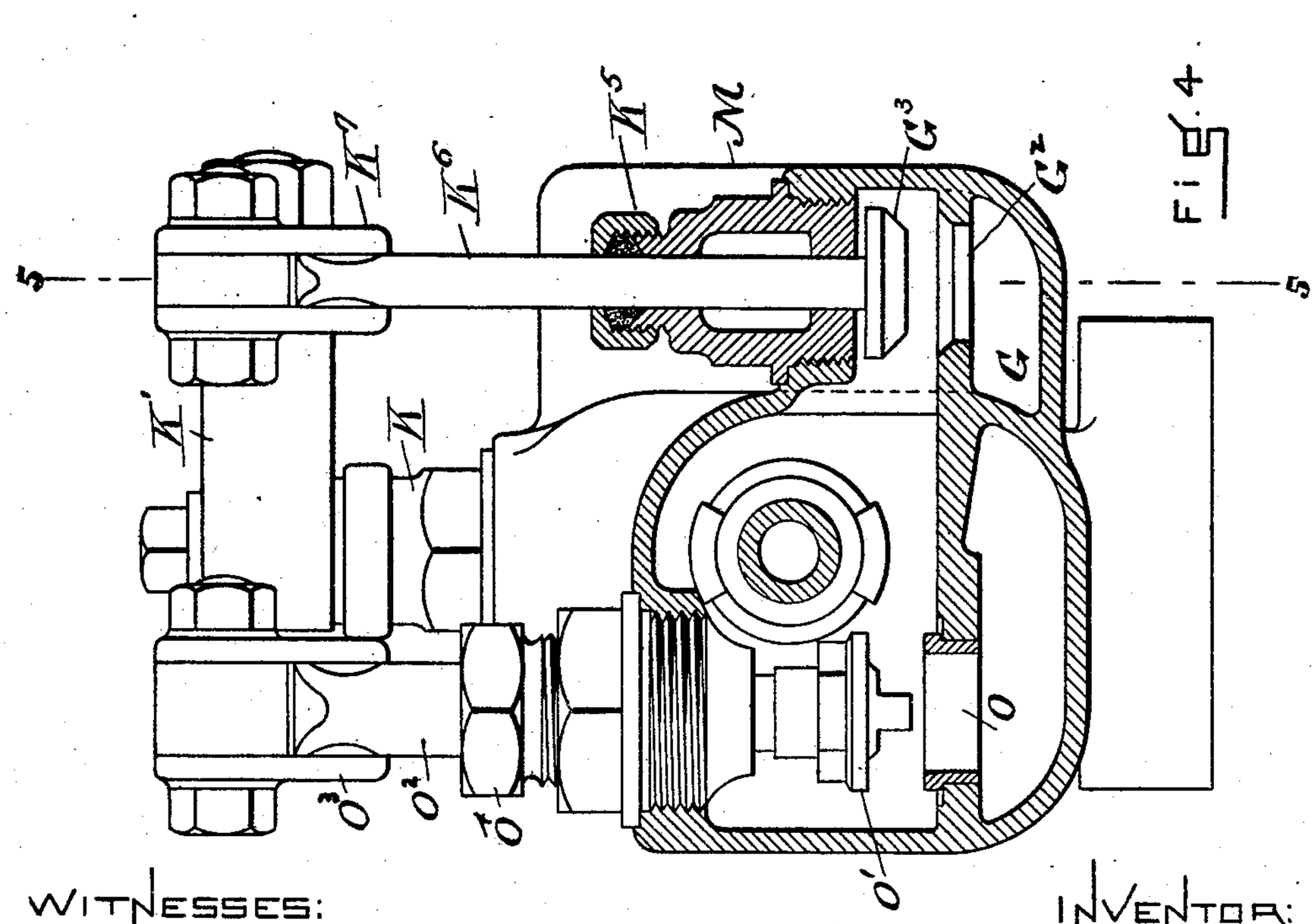

Fig. 4.

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UNITED STATES PATENT OFFICE.

WILLIAM R. PARK, OF TAUNTON, MASSACHUSETTS, ASSIGNOR TO THE HANCOCK INSPIRATOR COMPANY, OF BOSTON, MASSACHUSETTS.

INJECTOR.

SPECIFICATION forming part of Letters Patent No. 606,766, dated July 5, 1898.

Application filed May 16, 1898. Serial No. 680,794. (Model.)

To all whom it may concern:

Be it known that I, WILLIAM R. PARK, a citizen of the United States of America, and a resident of Taunton, county of Bristol, and State of Massachusetts, have invented certain new and useful Improvements in Injectors, of which the following is a specification.

This invention relates to injectors of the double-tube class, wherein a lifting-ejector is employed to supply water to a forcing-injector, which in turn operates to force and feed the water supplied to it against counter-pressure, such as that of a steam-boiler, and is shown and described as applied in particular to that form of double-tube injector wherein the several elementary parts are operated by a single lever or equivalent device.

In the drawings hereto annexed, Figure 1 is a vertical longitudinal section of an injector embodying my invention. Fig. 2 is a section of the injector shown in Fig. 1 at the line 2 2, viewed from the boiler end of the injector. Fig. 3 is a vertical longitudinal section of part of the injector at the line 3 3 of Fig. 2, viewed from the right-hand side; and Fig. 4 is a cross-sectional view corresponding in location to the section of Fig. 2 of an injector employing a positive mechanically-controlled intermediate overflow-valve. Fig. 5 is a vertical longitudinal section at the line 5 5 of Fig. 4.

The structure of the body of the injector and the operation of the steam-inlet valves, the lifter and forcer tubes, and the final overflow-valve are shown and described in detail in United States Letters Patent No. 492,944, issued to me and Belvin T. Williston on March 7, 1898. Therefore for the most part matters of detailed description will be omitted herefrom, except such as relate in particular to the improvements and inventions which differentiate the structure here shown from preëxisting forms of double-tube injectors.

The steam-valve which admits steam from pipe S to the lifter and forcer successively is a double valve, the portion V′ opening first in response to the movement of the common valve-stem V^3 and admitting steam to the lifter steam-tube L′, which is provided with a reducing-valve R, operated by an external valve-wheel R′. The lifter-steam from steam-tube L′ entrains water from the water-supply pipe W into the lifter combining and delivery tube L^2, which delivers the lifter-water to the lifter delivery-chamber L^3. In the lifter delivery-chamber L^3 are located the contiguously-associated ends of the forcer steam-tube F′ and the forcer combining-tube F^2. The forcer delivery-tube F^3 emerges into the forcer delivery-chamber F^4. The final overflow-aperture O delivers the overflow in the usual manner. The final overflow-valve O′ is operated by the movement of the lever H through link H^2, bell-crank lever K^2 K^3, which is pivoted to the standard K at K′, connecting-rod O^3, and valve-stem O^2, which passes through a valve-chest O^4.

The forcer steam-valve V^2 opens to admit steam to the forcer after the lifter steam-valve V′ has admitted steam to the lifter and started the water-supply, and by the continuous movement of lever H the final overflow-valve O′ is gradually closed, so that the counter-pressure valve P is forced open when the feed-jet from the forcer delivery-tube F^3 is fully established.

The prompt and certain establishment of an unbroken feed-jet in and from the forcer depends on the thorough immersion of the water-entraining aperture of the forcer combining-tube. To the end that the forcer combining-tube should be supplied with water, the invention shown and described in Letters Patent No. 492,944 aforesaid was directed. The herein-described improvement still further insures the prompt and certain action of the injector and removes wholly the possibility of failure in operation through inexperience, lack of skill, or carelessness on the part of the operator.

A passage G, formed in the wing-casting M, Fig. 2, forms a path of communication between the lifter delivery-chamber L^3 and forcer delivery-chamber F^4. This passage in the structure shown begins with an aperture G′, which is situated in the inclosing wall of the lifter delivery-chamber L^3 at a point above the entraining end of the forcer combining-tube, so that water passing through the said aperture G′ thoroughly floods the forcer-tube. The passage G continues from aperture G′

down to an aperture G^2, Fig. 3, wherethrough it communicates with the forcer delivery-chamber F^4, Fig. 2. An automatic check-valve adapted to close in response to pressure from the forcer delivery-chamber is placed in this passage. As shown, this valve G^3 seats itself over aperture G^2 and is held in operative position by a plug G^4, Figs. 2 and 3. From aperture G^2 the water from the lifter delivery-chamber flows to the final overflow-outlet O.

The operation of the injector controlled by a single steady movement of the lever H is as follows: The lifter-water first fills the lifter delivery-chamber L^3, floods the entrance of the forcer combining-tube F^2, passes through the aperture G′, and then, instead of taking a short cut to the final overflow-valve, fills the passage G and emerges in a stream from the aperture G^2, from which it finds its way to the final overflow-outlet O. Then when the forcer-steam is admitted and goes to work the pressure in the forcer delivery-chamber tends to reverse the current of water flowing through the passage G. With an injector constructed so that the passage G constitutes only a direct short cut from the lifter delivery-chamber to the final overflow-aperture the reversal of pressures and current tends to disturb the immersion of the forcer combining-tube, except so far as checked by an intermediate valve, and the jet may break or fail to be established; but with a tortuous passage, such as the passage G, there is a reserve supply of forcer-combining-tube-immersion water, and before the forcer combining-tube can by any accident be deprived of its surrounding water valve O′ closes the final overflow and the established jet performs its appointed work.

The employment of an intermediate overflow-reservoir passage serves to correct the errors of operation to which inspirators having a positive mechanically-controlled intermediate overflow-valve have been found liable. Valve connections such as shown in Figs. 4 and 5 have heretofore been employed in injectors of this general type, but with indifferent success. The employment of positive connections which force the intermediate overflow-valve to its seat at a rigidly-predetermined instant in the succession of operations controlled by the hand-lever limits the performance of the injector to a relatively narrow range of conditions, an intermediate valve properly set for operation under one condition of steam-pressure being ill adapted to operation under another condition; but if the auxiliary reservoir of lifter-water is provided the positively-controlled intermediate overflow-valve may be employed successfully with greater variation in conditions than it can sustain without such reservoir, for the presence of an emergency supply of water for immersing the forcer combining-tube removes the danger otherwise to be apprehended from ill-timed closure of the intermediate overflow-valve. Thus if the valve G^3, Figs. 4 and 5, is positively controlled by connections K^7 K^6 K^5, corresponding to connections O^2 O^3 of the final overflow-valve, the valve G^3 may be set in proper adjustment for a low, even the lowest probable, operating pressure and yet not be unduly out of adjustment for higher pressures, for between the time when the valve G^3 ought to close if in perfect adjustment and the time of its actual closure a short interval only elapses, which is insufficient to permit the auxiliary reservoir of water to be wholly emptied. The forcer-tubes thus can establish the jet under favorable conditions. The passage G thus constitutes an emergency reservoir of water between the forcer combining-tube and the forcer delivery-chamber. This reservoir requires an appreciable time to be emptied by back pressure. During that time the forcer combining-tube is fully supplied with water and an insured opportunity is afforded for establishing the jet. If this condition is fulfilled, the shape and course of the passage G may be varied without materially interfering with its function.

What I claim, and desire to obtain by Letters Patent, is as follows:

1. In a lifting and forcing double-tube injector, the combination of a lifter, a lifter delivery-chamber, a forcer, a forcer delivery-chamber, a final overflow from the forcer delivery-chamber, an intermediate overflow-passage from the lifter delivery-chamber to the forcer delivery-chamber, the said passage provided with a reservoir-chamber intermediate between the lifter delivery-chamber and the forcer delivery-chamber, an intermediate overflow-valve controlling the said passage, the lifter delivery-chamber and intermediate overflow-passage constituting a conduit from the lifter delivery-tube to and past the entraining end of the forcer combining-tube, through the passage and reservoir to the forcer delivery-chamber, substantially as described.

2. In a lifting and forcing double-tube injector, the combination of a lifter, a lifter delivery-chamber, a forcer, a forcer delivery-chamber, a final overflow from the forcer delivery-chamber, an intermediate overflow-passage from the lifter delivery-chamber to the forcer delivery-chamber, a valve controlling said passage, a reservoir in said passage between the said valve and the lifter delivery-chamber, the forcer combining-tube being located in the lifter delivery-chamber between the lifter delivery-tube and the entrance to the intermediate overflow-passage, substantially as described.

3. In a lifting and forcing double-tube injector, the combination of a lifter, a lifter delivery-chamber, a forcer, a forcer delivery-chamber, a final overflow from the forcer delivery-chamber, an intermediate overflow-passage having a reservoir therein, leading from a part of the lifter delivery-chamber

above the forcer combining-tube into the forcer delivery-chamber, and an intermediate overflow-valve controlling the said passage, substantially as described.

4. In a lifting and forcing double-tube injector the combination of a lifter, a lifter delivery-chamber, a forcer, a forcer delivery-chamber, a final overflow from the forcer delivery-chamber, an intermediate overflow-passage, having a reservoir therein, leading from a part of the lifter delivery-chamber above the forcer combining-tube into the forcer delivery-chamber, and an intermediate automatic check-valve controlling said passage, adapted to close in response to pressure from the forcer delivery-chamber, substantially as described.

5. In a lifting and forcing double-tube injector, the combination of a lifter, a lifter delivery-chamber, a forcer delivery-chamber, a final overflow from the forcer delivery-chamber, an intermediate overflow-passage, having a reservoir therein, leading from a part of the lifter delivery-chamber above the forcer combining-tube to a point in the forcer delivery-chamber below the forcer delivery-tube, and an intermediate overflow-valve controlling the said passage, substantially as described.

Signed by me at Boston this 29th day of April, 1898.

WILLIAM R. PARK.

Witnesses:
ODIN B. ROBERTS,
JOSEPH WARREN.