3 Sheets—Sheet I.

F. D. CUMMER.

CONDENSERS AND HEATERS FOR STEAM-ENGINES.

No. 175,942. Patented April 11, 1876.

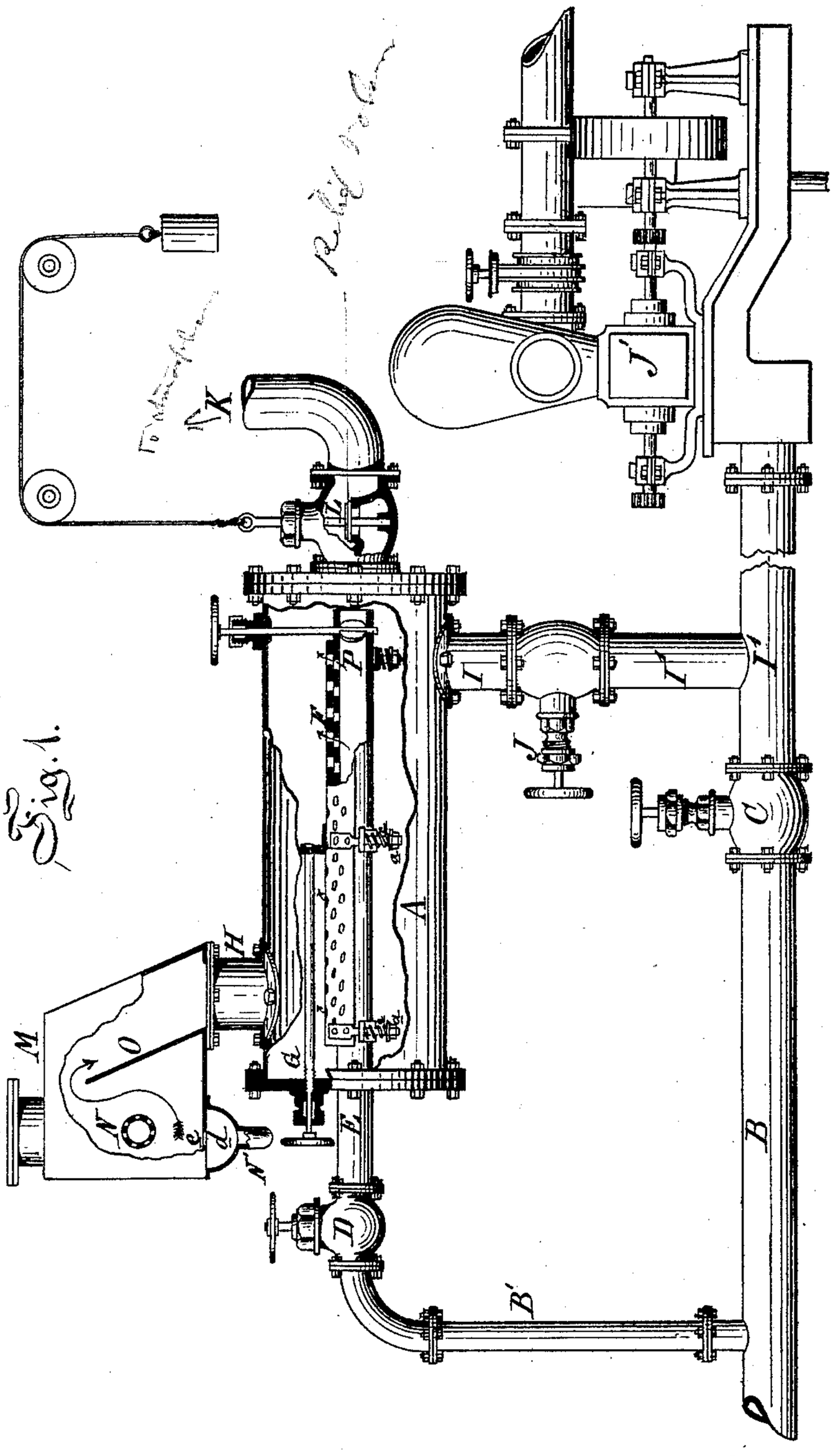

Fig. 1.

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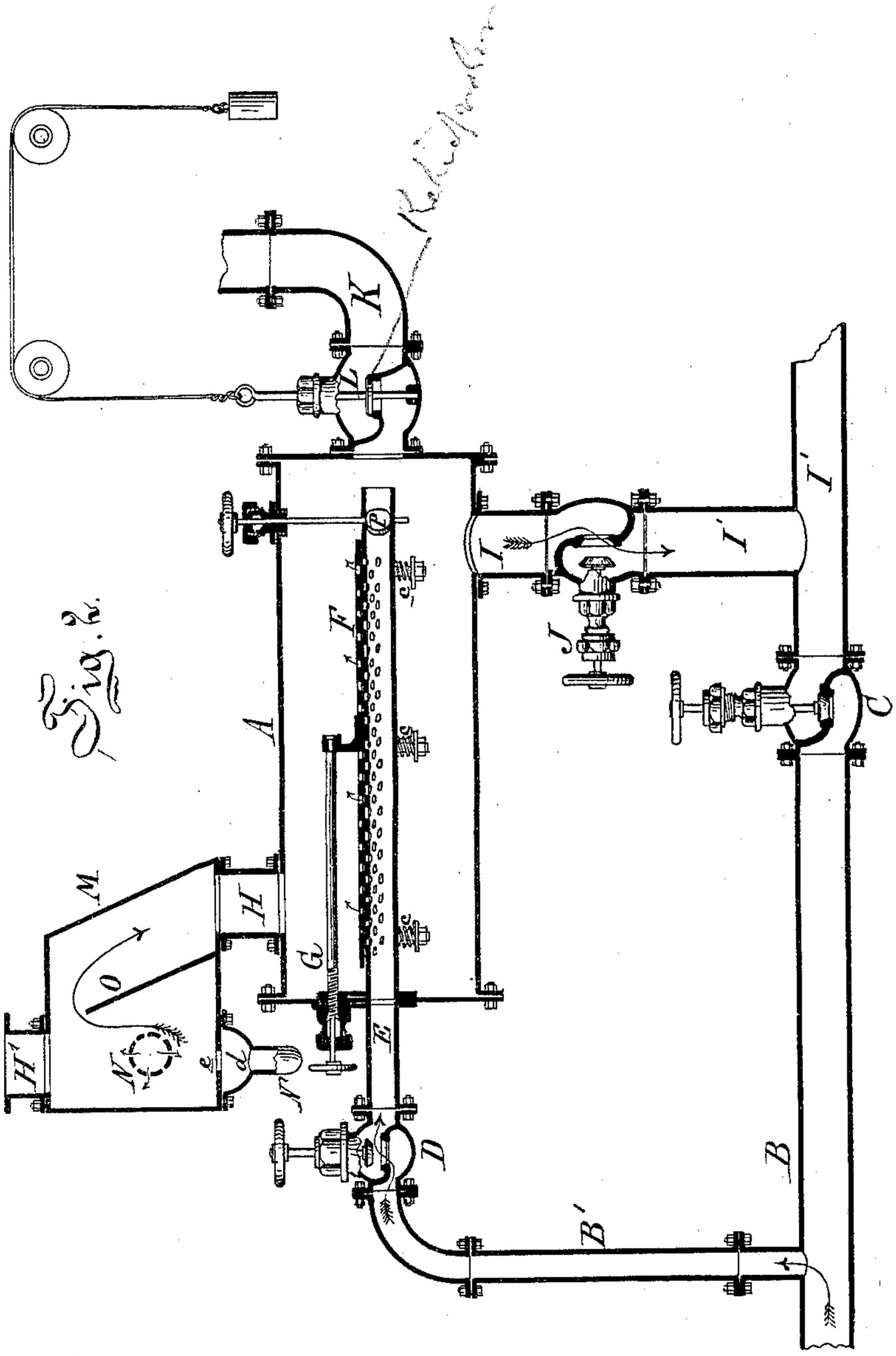

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3 Sheets—Sheet 3.

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CONDENSERS AND HEATERS FOR STEAM-ENGINES.

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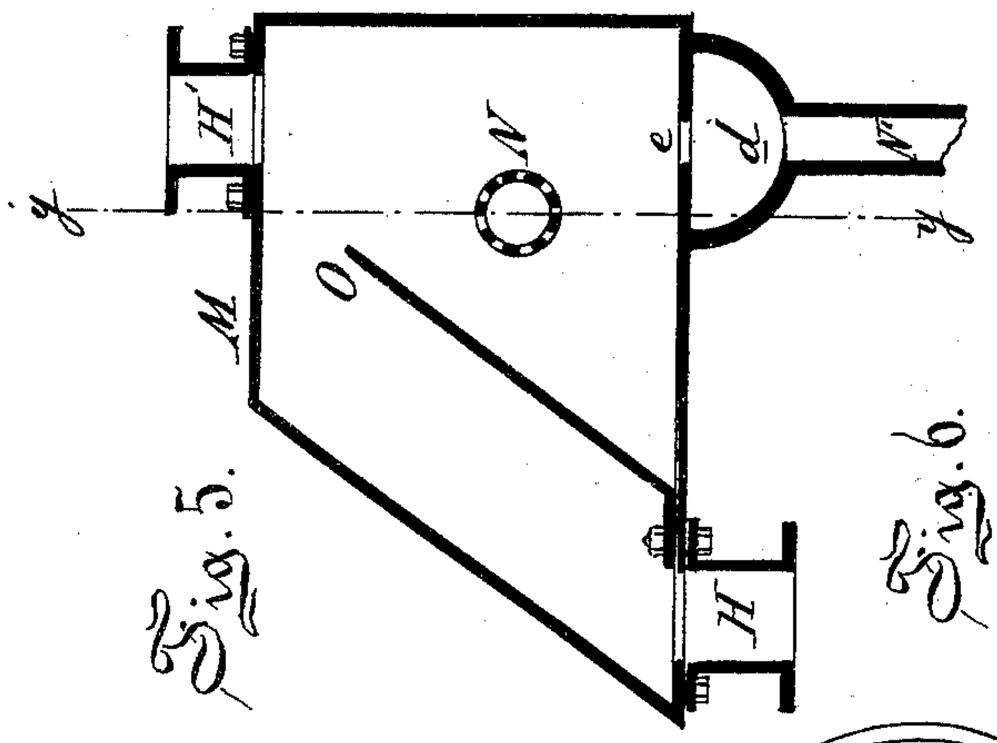

Fig. 5.

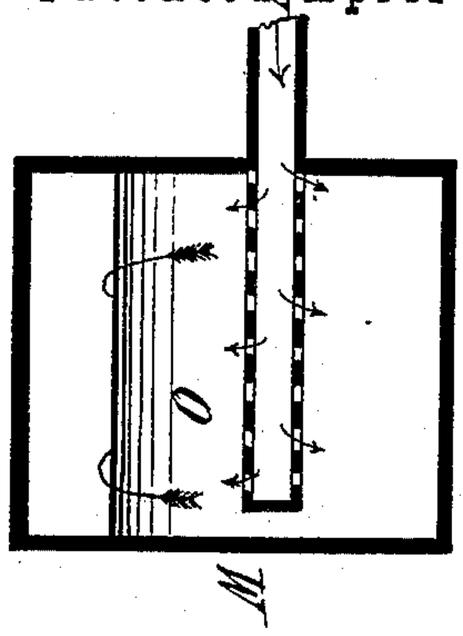

Fig. 6.

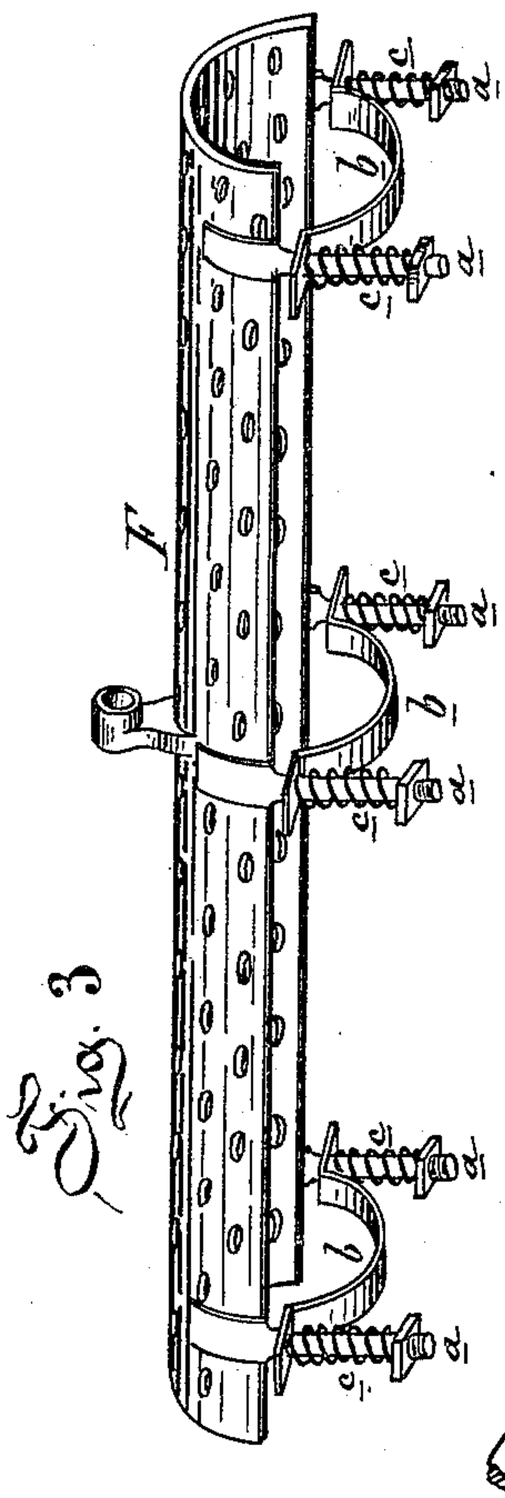

Fig. 3

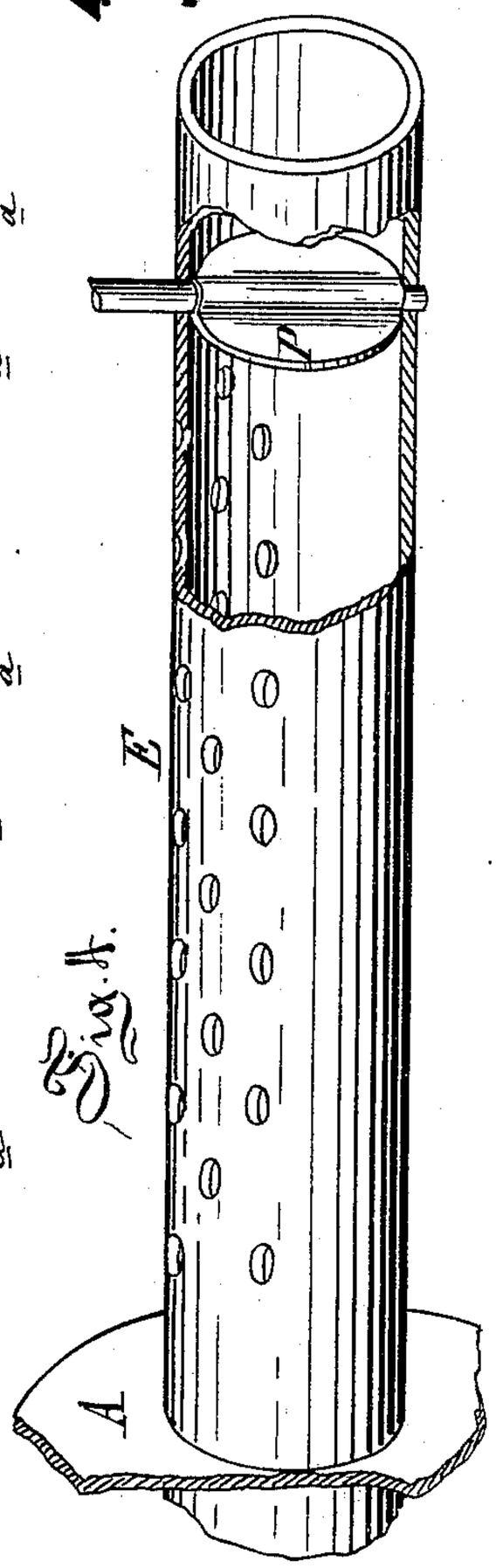

Fig. 4.

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UNITED STATES PATENT OFFICE.

FRANKLIN D. CUMMER, OF DETROIT, MICHIGAN.

IMPROVEMENT IN CONDENSERS AND HEATERS FOR STEAM-ENGINES.

Specification forming part of Letters Patent No. **175,942**, dated April 11, 1876; application filed February 9, 1876.

To all whom it may concern:

Be it known that I, FRANKLIN D. CUMMER, of Detroit, in the county of Wayne and State of Michigan, have invented certain Improvements in Condensers and Heaters for Steam-Engines, of which the following is a specification:

The first part of my invention relates to an improvement on the condenser for which Letters Patent of the United States were issued to Gordon W. Hall on May 14, 1872; and it consists in a perforated saddle or sleeve, upon or within the perforated injection-pipe, and longitudinally adjustable with relation thereto, so as to regulate the volume of the injection-water without diminishing the force of the jets.

The second part of my invention relates to the combination of a stop-valve in the exhaust-water pipe and another in an extension of the water-main connected therewith, whereby the powerful rotary pump used in connection with the condenser may immediately, in case of fire, be made available as a fire-pump.

The third part of my invention relates to the combination with a condenser of this class of a peculiar feed-water heater so arranged that the exhaust steam will pass through it into the condenser, and in which a portion of the exhaust steam is condensed and made available as feed-water.

Figure 1, Sheet 1, is a sectional elevation with parts of the condenser and heater broken away to show the internal arrangement. Fig. 2, Sheet 2, is a longitudinal vertical section through the center of the condenser and heater. Fig. 3, Sheet 3, is an enlarged perspective view of the saddle. Fig. 4 is a similar view of the perforated injection-pipe, broken away at one end to show the valve. Fig. 5 is a longitudinal vertical section through the heater. Fig. 6 is a cross-section of the same at *y y*.

In the drawing, A represents the body of the condenser in the form of a horizontal cylinder, having sufficient capacity to condense all the exhaust steam of the engine with whose exhaust-pipe it is connected. B is a suction-main, having a stop-valve, C, which, when the condenser is in use, is kept closed, as seen in Fig. 2; back of the valve C, or nearer the source of supply, the main is intersected by a branch-pipe, B′, with an elbow at the top, fitted with a stop-valve, D, with which is connected the cold-water-injection pipe E, which enters one head of the condenser and extends nearly to the other, to its inner end being fitted a butterfly or other valve, P, which is turned by a stem passing through a stuffing-box to the outside of the condenser. The injection-pipe has the upper half of its surface perforated with a large number of fine apertures, and on it lies a semi-cylindrical saddle, F, pierced with a corresponding number and series of apertures, which may be brought to coincide with those in the injection-pipe, or to partially or entirely close them, by means of a screw-stem, G, extending through a stuffing-box in the head of the condenser, with a hand-wheel on the outer end by means of which said screw may be turned to slide the saddle on the injection-pipe.

To keep the saddle in contact with the injection-pipe against the pressure of the issuing jets, the former is provided with several pairs of pendant lugs, *a*, each threaded at the lower end and provided with a nut; a yoke, *b*, is placed on each pair of said lugs, and is forced up against the injection-pipe by a spiral spring, *c*, interposed between the end of the yoke and the nut on the lug, as represented in Fig. 3. In lieu of the saddle, a similarly-perforated pipe may be sleeved upon or within the injection-pipe, and, in some respects, it is preferable to the saddle.

H is the pipe through which the exhaust steam from the engine enters the condenser, and I is the exhaust-water pipe, fitted with a stop-valve, J, and which communicates by a T-pipe, I′, with the stop-valve on the suction-main on the one side, and with a rotary pump, J′, on the other side, placed lower than the condenser, so that the water may flow freely to it of its own gravity.

K is a relief-pipe at the exhaust end of the condenser, and is fitted with a down-closing valve, L, that is balanced, or nearly balanced,

by a weight and cord running over pulleys above. This valve is kept closed by the pressure of the atmosphere when the condenser is in operation, but otherwise lifts, and allows the exhaust steam to pass out of the condenser.

The volume of injection-water necessary to condense the exhaust steam is regulated by shifting the perforated saddle to increase or diminish the volume of the jets to produce the required vacuum without diminishing their velocity, the cold-water-injection valve being opened far enough to have the jets, as they issue from the perforations, if necessary, impinge upon the walls of the condenser.

By this arrangement no more water need be pumped than is actually necessary to effect the condensation of the steam.

It is found, in operating jet-condensers of this variety, that the perforations are liable to become clogged from time to time with stringy matters floating in the injection-water. To remove these obstructions the saddle may be moved so as to entirely close the holes in the injection pipe, which operation will sheer off the obstructions, at the same time opening the valve P, to allow the water to flow through the injection-pipe and carry off the obstructions.

The pump, which carries off the water of condensation and the non-condensible vapors, is, as will be seen, of the rotary variety; and, to make it available as a means for extinguishing fire upon the premises or in the vicinity, all that is necessary to do is to close the valves D and J, and open the stop-valve C in the suction-main B and the hose-gates on the delivery-pipe of the pump.

In order to utilize the waste heat of the exhaust steam for heating the feed-water, and at the same time to condense a portion of the exhaust steam, I surmount the induction-pipe H with a heater, M, through which the exhaust steam must pass, entering it at the opposite upper side through a pipe, H′.

N is the feed-water suction-pipe, which enters the side of the heater below the steam-inlet, and passes transversely across nearly to the other side. Its inner end is closed, and that portion which is inside the heater is finely perforated, as shown, to discharge the feed-water in jets, it being forced by atmospheric pressure into the heater, and the volume is regulated by a valve in the pipe outside the heater.

O is an inclined diaphragm in the heater, to prevent the feed-water from passing into the condenser.

N′ is the feed-water eduction-pipe, which conveys the feed-water to the feed-pump. *d* is a pocket at the top of the eduction-pipe N′, which the feed-water enters through one or more orifices, *e*, in the bottom of the heater, from which pocket the feed-water may flow quietly to the pump, as the exhaust steam blown into the heater will not disturb it after it has passed down through the orifices *e*. The small volume of feed-water, as spray, mingling with the larger volume of exhaust steam, is speedily raised thereby in temperature to a high degree—nearly to the temperature of the steam—and at the same time it condenses a portion of such steam, which is also available as feed-water, lessening in that degree the duty required of the condenser.

In nearly every instance there is a fall of more or less head from the pump to the surface of the water into which it discharges, which I utilize by relieving the pump of atmospheric pressure to the extent of the fall by submerging the lower end of the discharge-pipe. If the discharge-pipe had a perpendicular fall of twenty-four feet, the pump would be relieved of twelve pounds per square inch of the atmospheric resistance, thus saving a large proportion of the power that would otherwise be required to operate it, amounting in this case to nearly three-quarters of the whole.

What I claim as my invention is—

1. In a jet-condenser, substantially as described, the combination, with the perforated injection-pipe, of the perforated saddle sliding thereon, substantially as and for the purposes set forth.

2. The combination, with a jet-condenser, of the perforated injection-pipe, the sliding saddle, and valve in the said injection-pipe, substantially as described.

3. In a jet-condenser and pump, substantially as described, the suction-main B, extended to form a junction with the exhaust-water pipe I′, and the combination therewith of the stop-valves C and J, substantially as and for the purpose set forth.

4. The combination, with a jet-condenser, substantially as described, of the feed-water heater M, provided with the inclined diaphragm O, perforated injection-pipe N, and eduction-pipe N′, as shown and set forth.

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