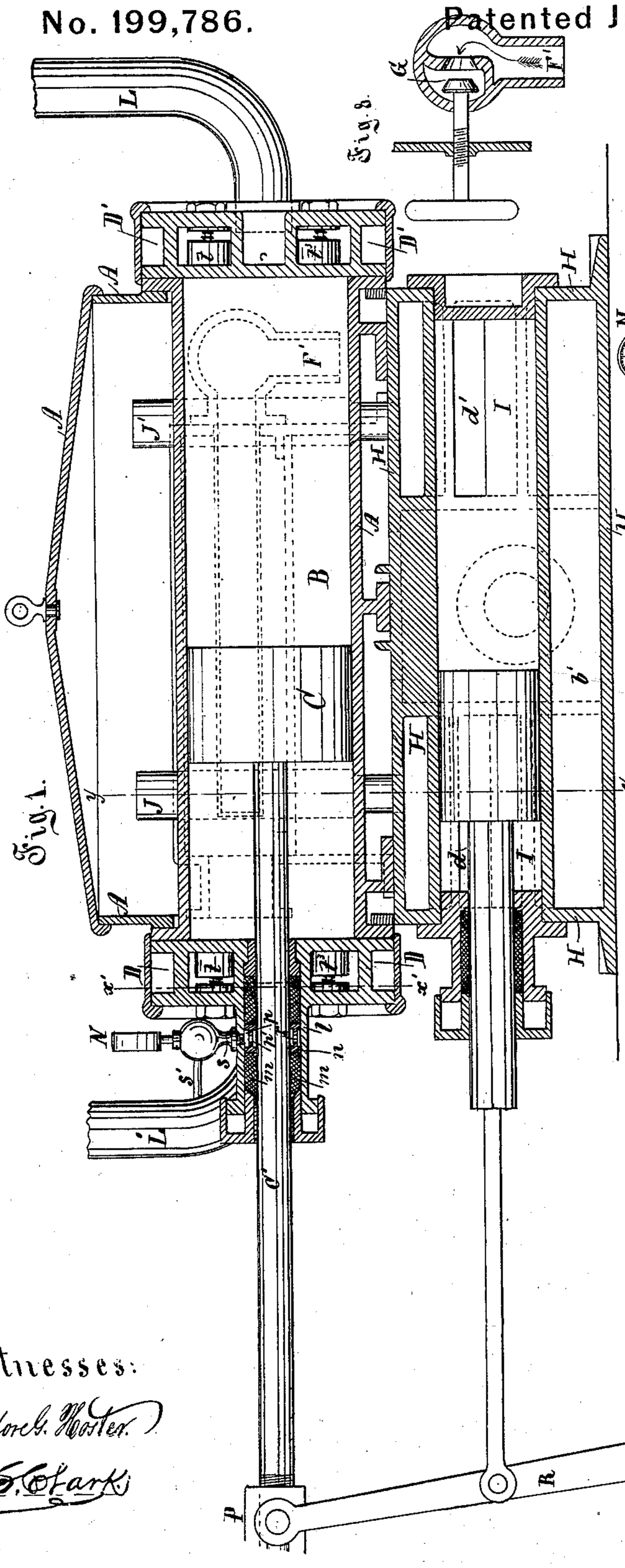
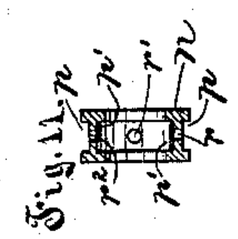
3 Sheets—Sheet 1.

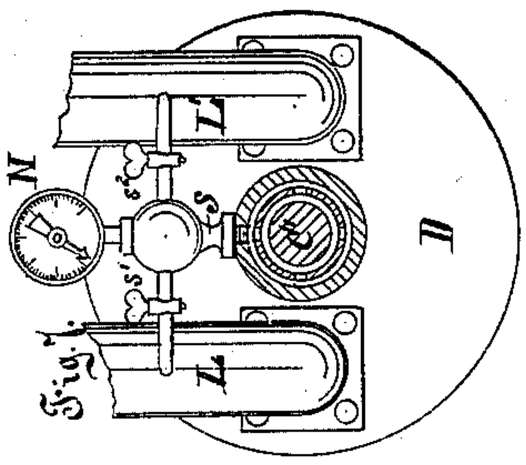
E. BÜRGIN.

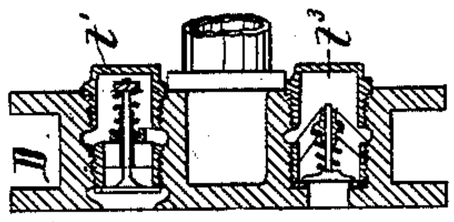
Steam-Condensing and Gas and Air Compressing Apparatus.

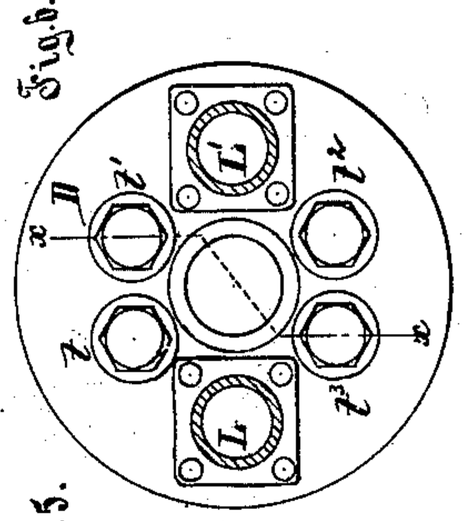
No. 199,786. Patented Jan. 29, 1878.

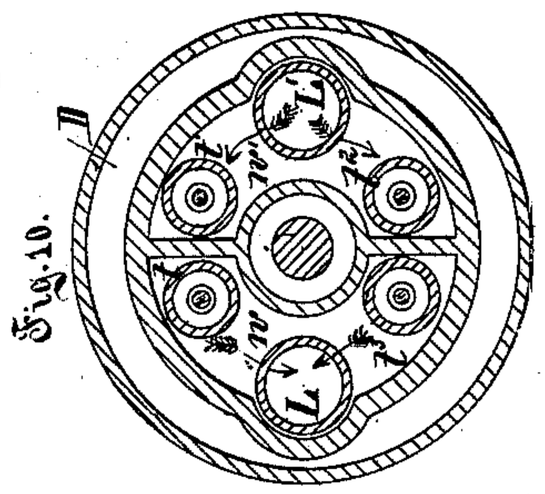












Witnesses:

Theodore G. Hoster.

B. S. Clark.

Inventor:

Emil Bürgin

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E. BÜRGIN.

Steam-Condensing and Gas and Air Compressing Apparatus.

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Fig. 3.

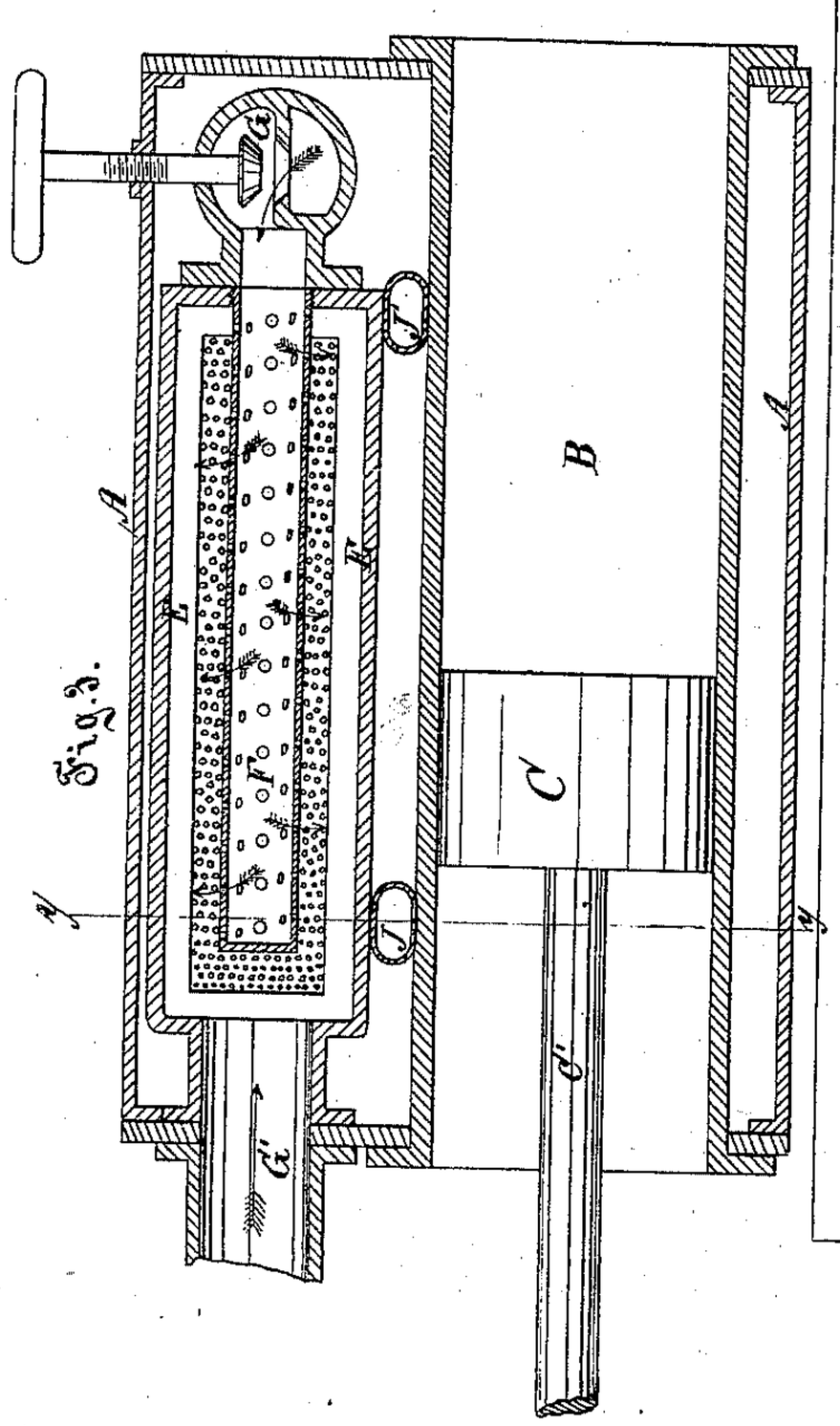


Fig. 4.

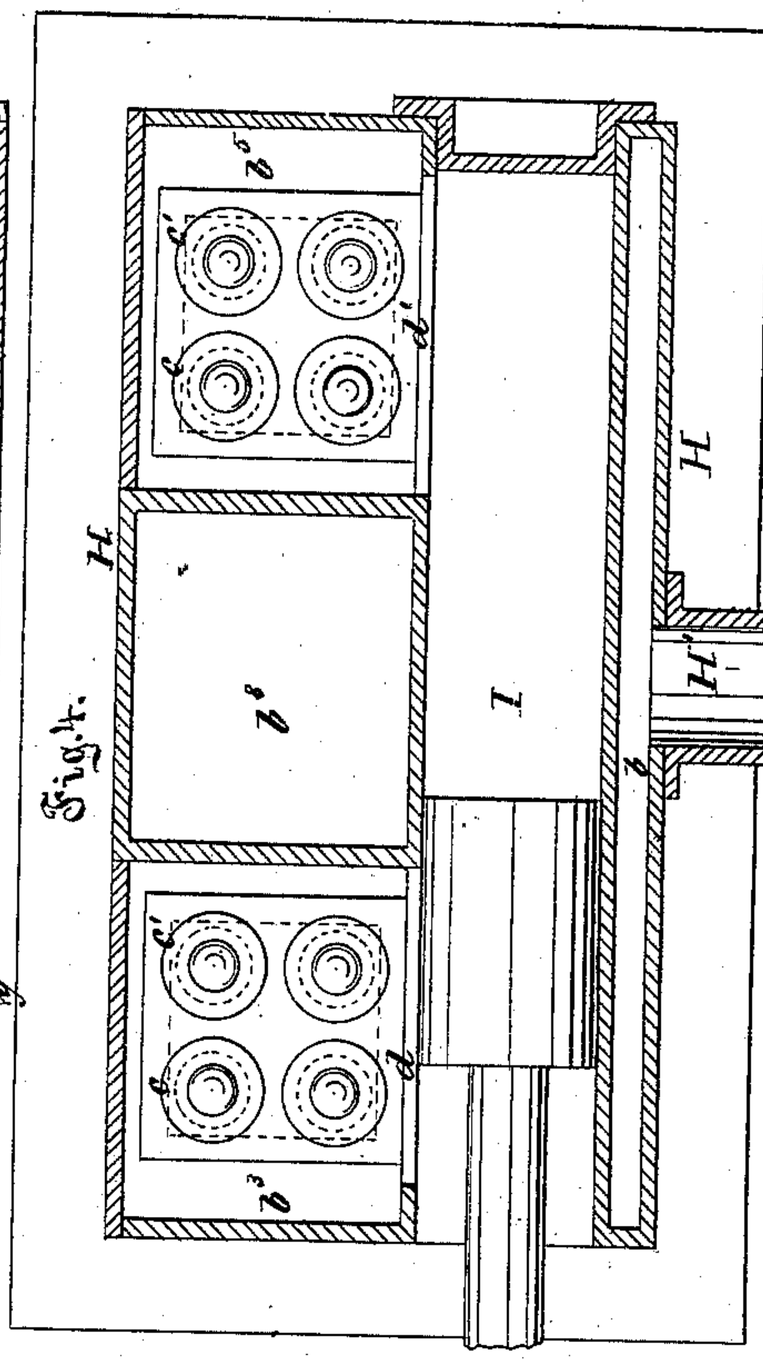
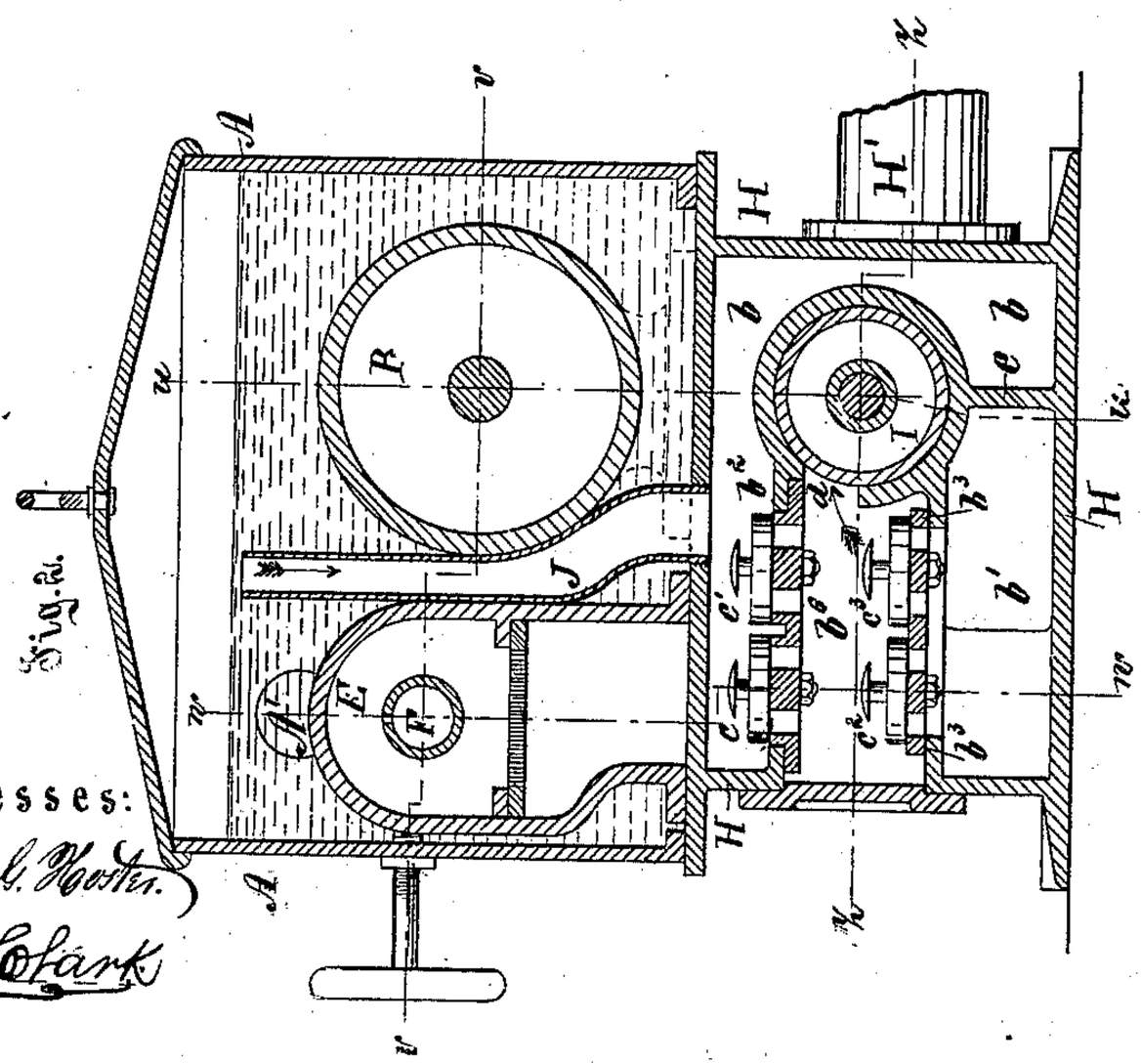


Fig. 2.



Witnesses:
Theodore L. Foster.
B. S. Clark

Inventor:
Emil Bürgin

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E. BÜRGIN.

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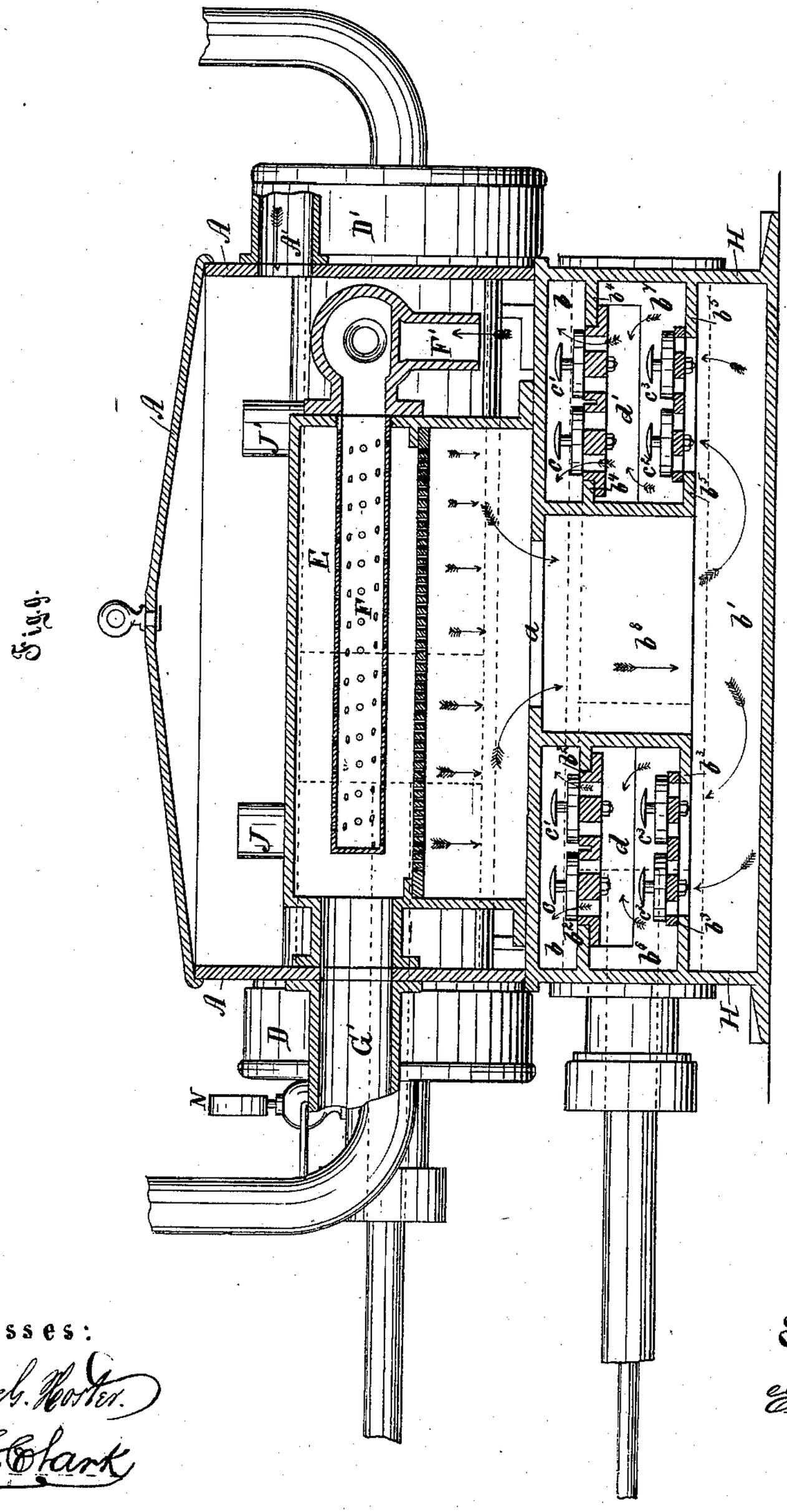

Witnesses:

Theodore L. Foster.

B. S. Clark

Inventor:

Emil Bürgin

UNITED STATES PATENT OFFICE.

EMIL BÜRGIN, OF BASEL, SWITZERLAND.

IMPROVEMENT IN STEAM-CONDENSING AND GAS AND AIR COMPRESSING APPARATUS.

Specification forming part of Letters Patent No. **199,786**, dated January 29, 1878; application filed April 28, 1877.

To all whom it may concern:

Be it known that I, EMIL BÜRGIN, of Basel, Switzerland, have invented certain new and useful Improvements in Steam-Condensing and Gas-Compressing Apparatus, of which the following is a specification, reference being had to the accompanying drawings, forming part thereof.

One part of my invention relates to the employment of a condensing steam-engine for the purpose of driving a compression-pump for compressing air, gas, or vapor; and consists in a novel, simple, and convenient construction, combination, and arrangement of the engine-condenser, its air-pump, the compression-pump, and means of cooling the cylinder of the compression-pump, and of supplying water to the condensers, whereby a very efficient, compact, and economically-working apparatus is obtained.

Another part of my invention consists in certain devices applied in connection with the stuffing-box of an air or gas compressing pump, for the purpose of providing for the return to the cylinder of said pump any air or gas that may escape therefrom around its piston-rod.

Figure 1 is a vertical longitudinal section of my apparatus on line *u u* of Fig. 2. Fig. 2 is a vertical cross-section on line *y y*, Fig. 1. Fig. 3 is a horizontal longitudinal section on line *v v*, Fig. 2. Fig. 4 is a horizontal section on line *z z*, Fig. 2. Fig. 5 is an external face view of one of the cylinder-heads of the compressing-pump. Fig. 6 is a section of the said head on line *x x* of Fig 5. Fig. 7 is an exterior face view of the said cylinder-head with the outlet and inlet pipes attached. Fig. 8 is a detailed view, in section, of the inlet-pipe to the steam-condenser, showing the valve connected therewith. Fig. 9 is a vertical longitudinal section cut on line *w w* of Fig. 2. Fig. 10 is a cross-section of one of the cylinder-heads of the compressing-pump cut on line *x' x'*, Fig. 1. Fig. 11 is a sectional view of the ring used in the stuffing-box of the compressing-pump.

A is a strong closed iron case or tank. B is the cylinder, and C the piston, of a pump for compressing gas or air placed within the case or tank A. D D' indicate the cylinder-heads. In Fig. 3 these heads are removed. Within the said case A is placed also a steam-condenser, composed of the chest E and the perforated pipe F introduced into the said chest, closed at the interior end, and at the exterior opposite end communicating by pipe F' with the water in the case A. G is a valve to close and open at pleasure communication between the said water and the said condenser. G' is a steam-inlet pipe leading from the exhaust of the steam-engine employed to drive the compression-pump.

Underneath the case A, and connected to and communicating therewith, is a separate case or chest, H. Within this is placed a suction force-pump, I, which constitutes the air-pump to the condenser E F and steam-engine, and which communicates with the condensing-chamber E by means of a channel or opening, *a*, in the bottom of the case A. Within the said case H, besides the said air-pump I, are two principal compartments, b b^1, separated from each other by the division-plate *e* and plates b^2 b^3 b^4 b^5, as shown plainly in Figs. 2 and 9. The plates b^2 b^3 b^4 b^5 are provided with valves c c^1 c^2 c^3, and between the plates b^2 and b^3 and the plates b^4 and b^5 are spaces or chambers b^6 and b^7. The body of the cylinder of the air-pump I constitutes the wall of the said chambers on the side next them, and openings d d' in the said cylinder communicate with the chambers b^6 and b^7. By this arrangement water flowing from the condenser-cylinder E down through the opening *a* and the channel b^8 into the lower part b^1 of said case, will be drawn by the air-pump I up through the valves c^2 c^3 into the said pump at one movement of its piston, and then, by the reverse movement of the piston, it will be forced up through the valves c c^1 into the compartment b, whence it will flow out through the outlet-pipe H'. J J' are overflow-pipes within the case A, leading from near the top into the apartment b of the case H.

The case A is intended to be supplied with cold water introduced through an inlet-pipe, A', from some source of supply by a circulating pump, or from a tank placed above said case. This cold water will circulate about the air-compressing pump B and the condenser E for the purpose of cooling them. As it rises up to the level of the upper ends of the overflow-

pipes J J′, it will flow off through said pipes into the apartment *b* of case H, and thence out through the outlet pipe H′ with the water that comes from the condenser E and is forced up through the valves *c* c^1 by the air-pump I.

The purpose for which the pump B is intended is the compression of air, vapor, or gas. To this end each of its cylinder-heads is provided with two pipes, L L′, each pipe opening into a separate chamber, *w w′*, in the cylinder-head of the pump, as shown in Fig. 10. Each chamber is furnished with one or more valves, *t* t^1 t^2 t^3, opening into the cylinder of the pump B, of which those in chamber *w* open outward, and those in chamber *w′* inward, whereby, as is obvious, the movement of the piston in the pump B will draw air or gas in through one pipe L′ at either end of the cylinder, and force it out through pipe L.

As the gas, vapor, or air is liable to escape around the piston-rod c^1, where the rod passes through the cylinder-head of the pump B, and it is found by experience that the ordinary stuffing box and packing will not entirely prevent the escape of gas at this place, the devices which I will now describe are designed to remedy this difficulty.

In Fig. 1 the stuffing-box *l*, containing the packing *m*, is plainly represented in section. Centrally, or midway between each end of the said stuffing-box, I place a ring, *n*, which fits snugly into the said box, and through which the piston-rod c^1 slides with a close-fitting joint. This ring has two annular recesses, *p p′*, one in its exterior and the other in its interior face, as seen plainly in Fig. 11, and several apertures, *r* r^1 r^2, open communication between the two. On either side of this ring the spaces in the stuffing-box are filled with the packing. An aperture is made through the wall of the stuffing-box, opening into the recess *p*, and a pipe, *s*, leads from the said aperture. Two branch pipes, s^1 s^2, lead from the pipe *s*—one, s^1, into the pipe L, and the other, s^2, into pipe L′, whereby it is obvious the space in the recesses *p p′* in the ring *n* will feel the effect both of the pressure of the compressed air in pipe L and the vacuum in pipe L′.

The former will, in practice, usually exceed the latter, but the said pressure may be equalized by means of the stop-cocks in the pipes s^1 s^2—that is to say, by so far closing the former and opening the latter as to equalize said pressure. N is a pressure-gage connected with the pipe *s*, which, when the said two pressures are equalized, will stand at zero, thereby indicating when the said stop-cocks are properly adjusted.

Now it is evident, that with the arrangement above described, whatever vapor or gas may pass from the cylinder of the pump B through the packing in the stuffing-box *l* to the recesses *p p′* in ring *n* will be there diverted through the said recesses, and through the pipe *s* s^2 and L′, back into the cylinder of the pump B.

The steam-engine for driving the compression-pump B may have its cylinder arranged directly in line with the cylinder of said pump, and the piston-rod P connected directly with the piston-rod of said pump, as shown in Fig. 1, and the piston-rod of the air-pump may be connected with and operated by a swinging arm or lever, R, actuated from the head of the piston-rod P through suitable connections.

The operation of this apparatus is as follows: The pipes L and L′ being connected—the former with a receptacle for holding compressed air, gas, or vapor, and the latter being open to the atmosphere or connected with a chamber or reservoir containing the air, gas, or vapor to be compressed—a supply of cool water being provided to flow into the chest A, and connection being established between the steam-condenser E and the exhaust of the steam-engine, (not shown,) if now the pumps B and I are put in motion, at each stroke of the piston of B air, gas, or vapor, as the case may be, will be drawn in at one end of the cylinder of B, through the pipe L′, and forced out at the opposite end through the pipe L into the receptacle for holding the compressed air, gas, or vapor. The water flowing into the case A will circulate around the said pump B and the condenser-cylinder E, and flow out through the pipes J J′ into the apartment *b* of the case H, and thence out through the outlet-pipe H′. The pump I will act to draw the water to itself from the case A into and through the condenser E, and channel b^8, apartment b^1, and valves c^2 and c^3, and then to force it out through the valves *c* and c^1 into the apartment *b*, whence it will flow out through the outlet-pipe H′, together with the water coming from the case A through the overflow-pipes J J′, the operations of compressing air, gas, or vapor, condensing the exhaust-steam of the steam-engine employed to drive the compressing-pump, and circulating the cold water employed for cooling the compressing-pump and for condensing the steam, being thus all carried on within substantially a single compact case or chest. The devices described, connected with the stuffing-box of the gas-compressing pump, operate to return to the cylinder of said pump all gas that may escape from the said cylinder in the act of compressing the same, and at the same time prevent the air from being drawn in through the stuffing-box.

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

1. The combination, with one water tank or case, A, of the cylinder of an air or gas compression pump, and the condenser of a steam-engine for driving the said pump, both arranged within the said tank or case, to be both cooled by the water circulating through the said tank or case, substantially as herein described.

2. The combination with the water tank or case A, containing the cylinder of an air or gas compressing pump, and the condenser of

the condensing steam-engine which works said pump, of the case or chest H, placed below said tank or case A, and the air-pump of said steam-engine, placed within said case or chest H, and connected with said condenser, substantially as herein described.

3. The combination, with the stuffing-box of the compressing-pump B, of the ring *n*, escape-pipe *s*, and branch pipes s^1 s^2, provided with stop-cocks, the said branch pipes being connected, the one with the suction or inlet pipe, and the other with the force or outlet pipe of said pump, as described.

Witness my hand this 27th day of April, 1877.

EMIL BÜRGIN.

Witnesses:
THEODORE G. HOSTER,
B. S. CLARK.