(No Model.) 3 Sheets—Sheet 1.

E. N. TRUMP & J. E. SWEET.

COMPRESSOR OR VACUUM PUMP.

No. 517,903. Patented Apr. 10, 1894.

Fig. 1.

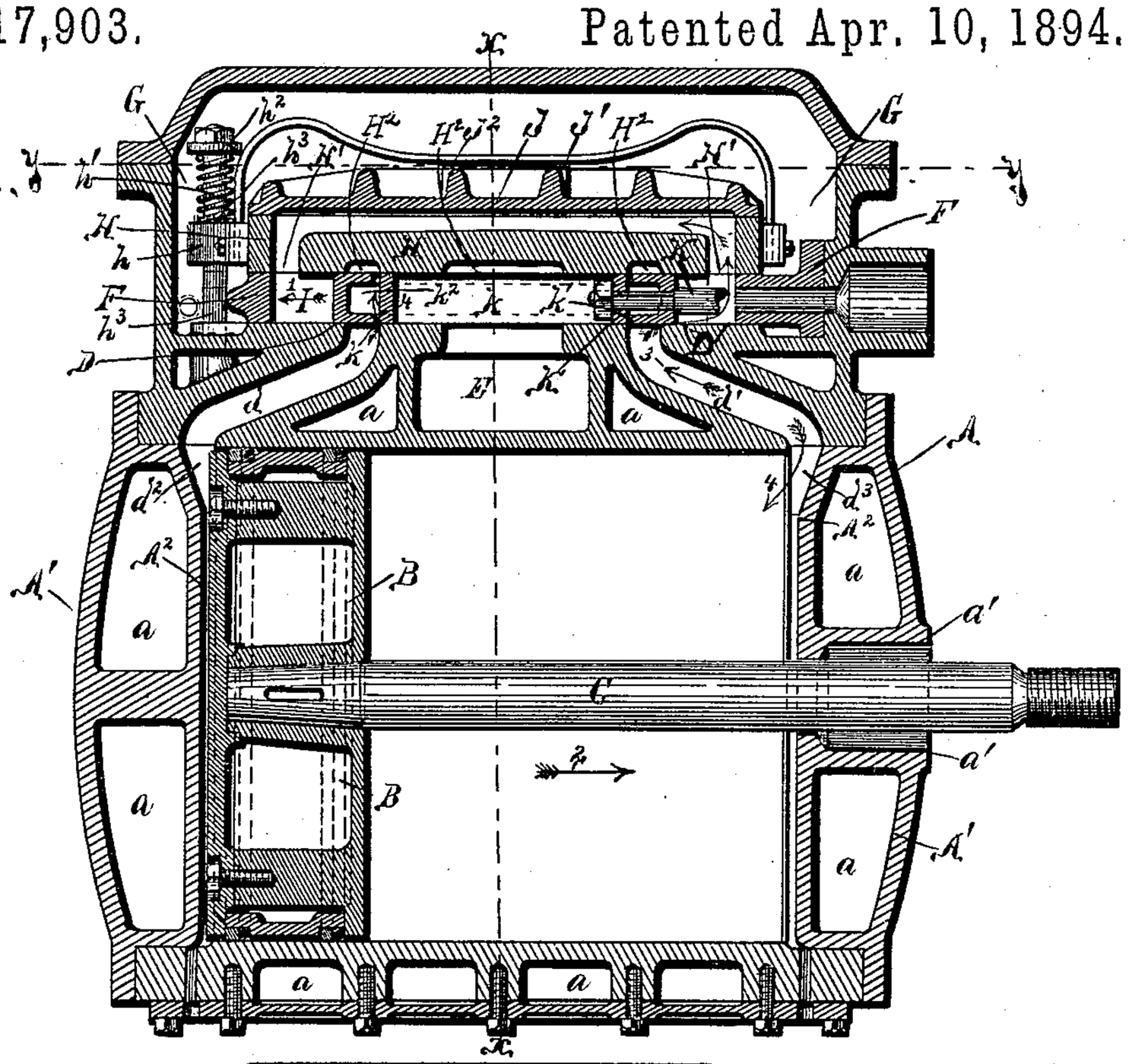
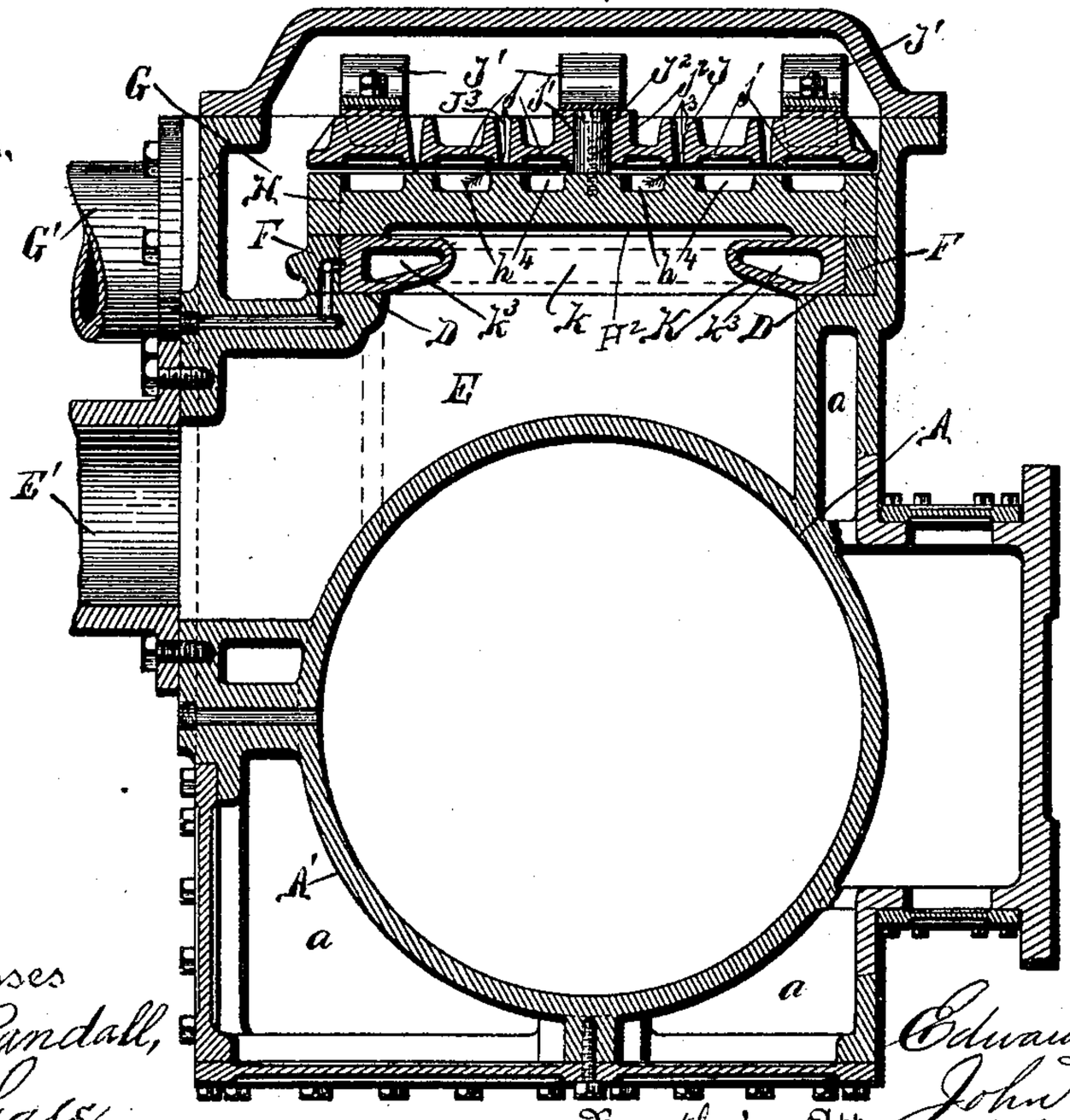


Fig. 2.



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(No Model.) 3 Sheets—Sheet 2.

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Fig. 3.

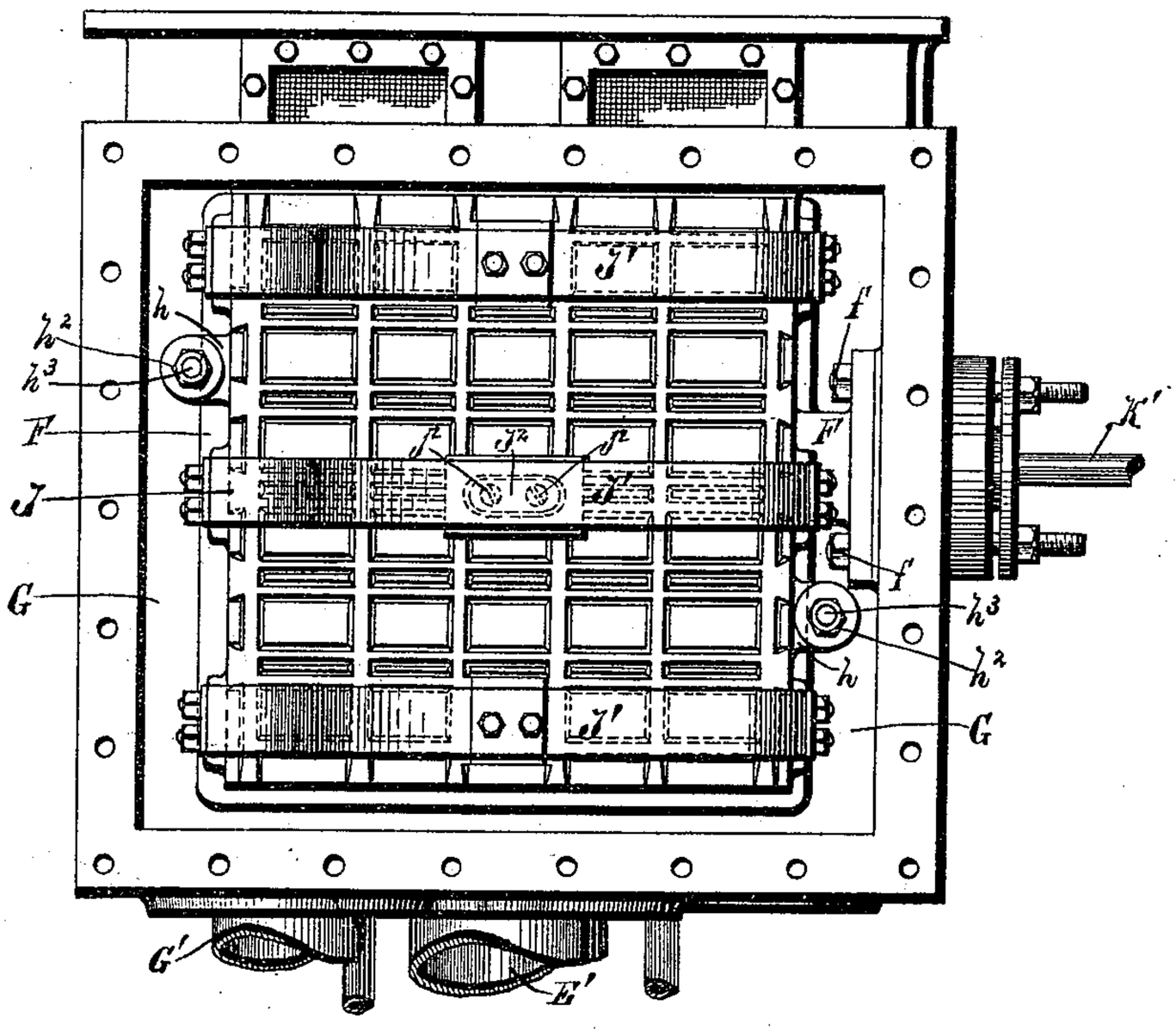

Fig. 4.

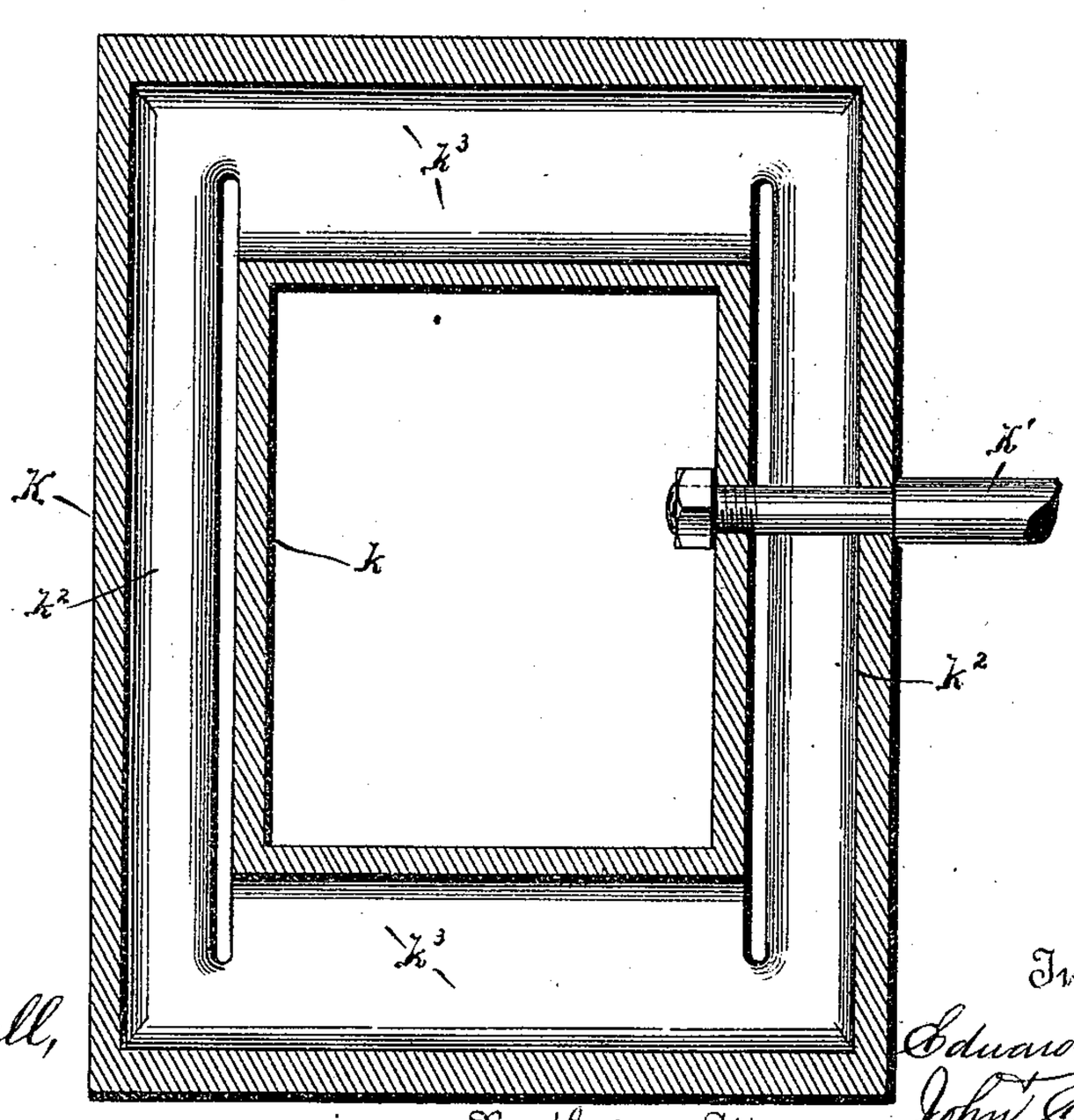

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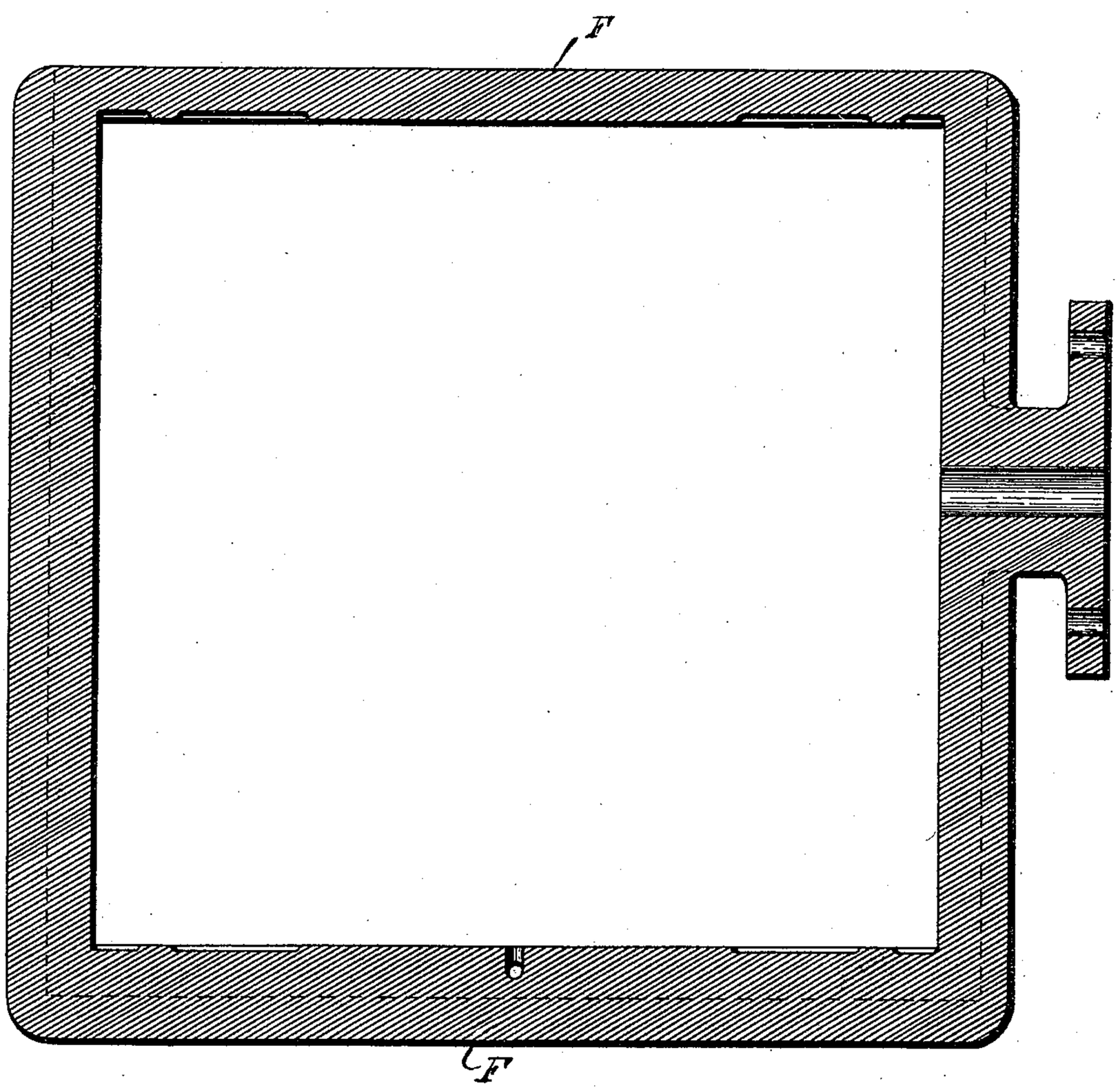
Fig. 5.



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UNITED STATES PATENT OFFICE.

EDWARD N. TRUMP AND JOHN E. SWEET, OF SYRACUSE, NEW YORK.

COMPRESSOR OR VACUUM-PUMP.

SPECIFICATION forming part of Letters Patent No. 517,903, dated April 10, 1894.

Application filed December 15, 1890. Serial No. 374,706. (No model.)

To all whom it may concern:

Be it known that we, EDWARD N. TRUMP and JOHN E. SWEET, of Syracuse, in the county of Onondaga, in the State of New York, have invented new and useful Improvements in Compressors or Vacuum-Pumps, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

Our invention relates to improvements in air or gas compressors or vacuum pumps having mechanically operating valves, and has for its object the production of a simple and effective construction, whereby the friction and wear of the valve and its driving power are reduced to a minimum; and the invention consists in the general construction and arrangement of the parts, all as hereinafter more particularly described and pointed out in the claims.

In describing this invention, reference is had to the accompanying drawings, forming a part of this specification, in which, like letters indicate corresponding parts in all the views.

Figure 1 represents a longitudinal sectional view of our invention. Fig. 2 is a transverse sectional view, taken on line —*x*—*x*—, Fig. 1. Fig. 3 is a horizontal sectional view, taken on line —*y*—*y*—, Fig. 1. Fig. 4 is a horizontal sectional view of the valve, and Fig. 5 is a similar sectional view of a plate or rectangular ring, which forms a part of the valve chamber.

As heretofore constructed compressors and pumps have been provided with valves that are subject to a great degree of wear sufficient in some cases to render them valueless and to require a great excess of driving power.

Our invention is designed to reduce to a minimum the friction and wear of the valve and its driving power, and this desirable result is effected by our construction of valve chamber introduced between the compression cylinder and the compressed air or gas receiving chamber, the balanced valve movable within the valve chamber and the valve for the valve chamber.

A represents any desirable form or construction of compression cylinder, the one shown having end walls A^2 A^2 and having its outer shell A′ provided with a cavity or cavities *a*, *a*, *a*, for receiving water or other liquid.

B is a suitable compressing piston and C the piston rod guided through an opening *a*′ in the shell A′.

D represents the cylinder valve face; *d* and *d*′ ports opening therefrom, which alternately become inlets and outlets for the cylinder, d^2 d^3 recesses in the end walls of the cylinder leading to the ports *d* *d*′, and E the inlet chamber or passage opening from the pipe E′.

F represents a suitably formed plate or rectangular ring of uniform thickness accurately fitted to the valve face D for forming the outwardly extending walls of the valve chamber I interposed between the compression cylinder and its inlet chamber. The walls of this chamber may, if desired, be formed in the main casting, although, for convenience in construction, they are preferably formed as described. The plate or ring F is suitably secured by screws *f*, and the inner faces of its end walls are arranged at the outside of the ports *d* *d*′ or in other words are separated a greater distance than said ports.

H represents a pressure or cover plate imposed at the outside of the ring shaped plate F for forming the outer wall of the valve chamber I, which thus consists of a rectangular chamber enclosed by the valve face D, ring F, and pressure or cover plate H.

H′ H′ represent the valve chamber outlet ports which form the outlet for said chamber and pass through the plate H, and are connected at their upper ends with channels or recesses —h^4— in the top face of the plate H and H^2 H^2 H^2 represent channels or recesses in the under face of the plate H corresponding with and opposite to the ports *d* *d*′ and the chamber E. This cover plate H is preferably yielding, and is provided with shoulders *h* *h* movable on suitable guides or supports h^3 h^3, against each of which shoulders rests one extremity of a spring *h*′ having its opposite end bearing against a shoulder h^2 on the guide or support h^3.

J is a pressure valve of sufficient area to cover the outlet openings H′ H′ in the pressure or cover plate H, and said pressure valve is supported by springs J′, whereby, when an excess of pressure exists within the valve chamber I, a communication is established

between said valve chamber and the upper part of the chamber G at the outside of the pressure valve, which chamber G thus becomes the compressed air or gas receiving chamber, and is provided with an outlet —G'—. In its operation, the pressure valve —J— is forced outwardly against the action of the springs —J'—, and the air or gas within the valve chamber —I— passes between the pressure valve —J— and the cover plate —H—, into the chamber —G—. To facilitate the escape from the valve chamber —I—, the pressure valve —J— is formed with a series of apertures —J^3— which extend therethrough and are normally disconnected from the recesses —h^4— in the cover plate —H—, but are connected to said recesses —h^4— when the pressure valve —J— is elevated from its normal position. The pressure valve J is provided in its lower face with channels or recesses —j— registering with the corresponding channels or recesses —h^4— in the cover plate —H—, and preferably forced to operative position by springs J', which, although they may be suitably constructed, are for the purpose and ease of manufacture, arranged with their central portions bearing against said valve and their extremities secured to shoulders on the pressure or cover plate H. We usually provide an additional or central spring J' that by means of a suitable stop J^2 is held out of contact with the valve J until said valve is moved outward a slight distance, thus causing the spring pressure to increase as the valve moves outward. This stop J^2 consists of a post of greater length than the thickness of the pressure valve J guided through an opening j' in said valve and having its lower face secured upon the top face of the plate H by a screw j^2.

Movable in the chamber I is the balanced valve K, which consists of a rectangular plate of uniform thickness and width mechanically fitted to the interior of the valve chamber I, and preferably formed about three one-thousandths of an inch loose therein at ordinary temperatures. This valve K is provided with passages k' k' extending through its opposite ends for maintaining an even pressure between the compression cylinder and the recesses in the pressure or cover plate H, and thereby balancing the valve.

In the operation of our invention the air or other fluid passed therethrough sometimes contains moisture, and this is extremely liable to be carried upwardly through the openings in the valve K to the top face thereof, but no injurious effect is occasioned as by the operation of the valve K within the chamber I the moisture is forced between the adjacent faces of the ring F and the yielding pressure or cover plate H, and escapes into the chamber G. Motion is communicated to the valve K by any suitable connection K' operated by an eccentric or other moving part of the machine. We preferably so construct the valve K that, after it has shut off the flow from the compression cylinder, it permits the passage of the compressed air remaining at one side of the piston to the opposite side thereof in order that, at the commencement of its stroke, the pressure on opposite sides of the piston may be equalized. To effect this action the valve K is formed with enlarged chambers k^2 k^2 opening from the openings k' k' at the front and rear extremities of said valve and with passages or ways k^3 k^3 connecting the opposite extremities of said chambers. When the valve is in the position illustrated in the drawings the compressed air in the port d, the recess d^2, and between the cylinder wall A^2 and the piston B, passes, as shown by arrow 4, through the forward opening k', the corresponding chamber k^2, and the passages k^3 to the rear opening k', and thence through the port d' and the recess d^3 into the cylinder. It will be understood, however, that the valve K is so timed in relation to the piston B as to permit almost its entire stroke before the registry of the openings k' k' with the ports d d' in order that the greater part of the compressed air may be discharged into the receiving chamber G, as previously described. From the foregoing description it is readily apparent that, owing to the peculiar construction of the valve K and the valve chamber I, said valve K is perfectly balanced, and the wear and friction of said valve and the power required to operate the same is thereby reduced to a minimum. It will also be evident upon reference to the foregoing description and the accompanying drawings that the compressed air readily escapes through the outlet ports of the valve chamber, and thence passes between the pressure valve J and the adjacent face of the pressure or cover plate H; that any moisture which passes through the openings in the valve K to its upper face is forced by the movement of the valve from the valve chamber between the pressure or cover plate and the stationary ring forming part of said chamber; that just before the limit of the piston's movement, the compressed air is automatically withdrawn from one end of the cylinder to its opposite end, and that our improved compressor or pump is simple in construction, efficient and noiseless in operation, and durable in use.

Having thus fully described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. The herein described compressor or pump, comprising a cylinder having opposite ports, a receiving chamber, a valve chamber interposed between the cylinder and the receiving chamber and formed with an outlet and with a channel or recess, as H^2, in its outer wall, a valve for closing said outlet, and a valve movable within the valve chamber and provided with an opening therethrough for communicating with said channel or recess and equalizing the pressure on opposite sides of the valve, and provided also with a passage or way between its opposite extremities for com-

municating, substantially as described, with the opposite cylinder ports, substantially as and for the purpose specified.

2. The herein described compressor or pump comprising a cylinder having opposite ports, a receiving chamber a valve chamber interposed between the cylinder and the receiving chamber and formed with an outlet, and with an outer wall, as —H— having channels or recesses, as —H^2— a valve for closing said outlet and a valve movable within the valve chamber and provided at its opposite ends with openings therethrough for communicating with said channels or recesses and equalizing the pressure on opposite sides of the valve and having a passage or way connecting said openings through the valve, whereby said passage or way and said openings communicate with the opposite cylinder ports, substantially as and for the purpose specified.

3. The herein described compressor or pump comprising a cylinder having opposite ports, a receiving chamber, an inlet chamber for communicating with said cylinder ports, a valve chamber interposed between the cylinder and the receiving chamber and formed with an outlet and with an outer wall as —H,— having a channel or recess, as —H^2,— a valve for closing said outlet, and a valve having an opening registered with said inlet chamber and extending through the valve and communicating with said channels or recesses for equalizing the pressure on opposite sides thereof and having a passage way extending from one end of the valve to its opposite end for communicating with said opposite cylinder ports, substantially as set forth.

4. The herein described compressor or pump comprising a cylinder having opposite ports, a receiving chamber, an inlet chamber for communicating with said ports, a valve chamber interposed between the cylinder and the receiving chamber and formed with an outer wall having an outlet consisting of a pair of outlet ports, as —H′—H′— a valve for closing said outlet ports, and a valve of less length than the distance between said outlet ports movable within the valve chamber and provided with a passage or way for communicating with the opposite cylinder ports, substantially as and for the purpose described.

5. The herein described compressor or pump comprising a cylinder having opposite ports, a receiving chamber, an inlet chamber, for communicating with said ports, a valve chamber interposed between the cylinder and the receiving chamber and formed with an outlet and with an outer wall as —H— having channels or recesses as —H^2—, a valve for closing said outlet, and a valve movable within the valve chamber and formed at its opposite ends with openings therethrough and with an additional opening therethrough arranged between the former openings and registered with the inlet chamber and with one of said channels or recesses, said openings in the valve operating in connection with said recesses to equalize the pressure on opposite sides thereof, and said valve having passage ways between the opposite ends of the former openings therethrough, whereby said former openings and the passages or ways communicate with the opposite cylinder ports, substantially as set forth.

6. The herein described compressor or pump, the same comprising a cylinder having opposite ports, a receiving chamber, a valve chamber between the cylinder and the receiving chamber and provided with a movable wall or plate as —H— and an outlet, a valve for closing said outlet, and a valve movable within the valve chamber and provided with a passage or way extending from one end of the valve to its opposite end for communicating with the opposite cylinder ports and a spring for forcing said wall or plate to its normal position, substantially as and for the purpose described.

7. The herein described compressor or pump, the same comprising a cylinder having a valve face, a stationary plate or ring imposed above the valve face, a yielding wall or plate as —H— at one side of said ring, a balanced valve between the yielding plate and the valve face, and a receiving chamber at one side of said pressure or cover plate, substantially as and for the purpose described.

8. The herein described compressor or pump, the same comprising a cylinder having opposite ports and a valve face, a stationary plate or ring imposed above the valve face, a yielding wall or plate as —H— imposed at one side of the stationary plate or ring and provided with an outlet and with channels or recesses, as —H^2—, whereby a valve chamber is inclosed by said valve face, the stationary ring, and the wall or plate, a valve for closing said outlet, and a valve movable within said valve chamber and provided with openings therethrough registered with said channels or recesses for equalizing the pressure on opposite sides of the valve and with a passage or way for communicating with the opposite cylinder ports, substantially as and for the purpose specified.

9. The herein described compressor or pump, the same comprising a cylinder having opposite ports, a valve chamber connected to the cylinder and formed with an outlet, a pressure valve for closing said outlet, a spring for forcing the pressure valve to normal position, a second spring for the pressure valve, a stop for preventing the action of the latter spring until after the commencement of the movement of the pressure valve, and a valve movable within the valve chamber and provided with a passage or way extending from one end of the valve to its opposite end and communicating with the opposite cylinder ports, substantially as and for the purpose set forth.

10. The herein described compressor or pump, the same comprising a cylinder having opposite ports, a valve chamber connect-

ed to the cylinder and provided with a yielding wall or plate as —H— and an outlet, a valve for closing said outlet, a guide or support for the yielding wall or plate, and a valve movable within the valve chamber and provided with a passage or way extending from one end of the valve to its opposite end and communicating with the opposite cylinder ports, substantially as and for the purpose specified.

11. The herein described compressor or pump, the same comprising a cylinder, a receiving chamber connected to the cylinder, a valve chamber between said cylinder and receiving chamber provided with an outlet, a valve movable within the valve chamber, a pressure valve for closing said outlet provided with an opening therethrough, a spring for forcing the pressure valve to operative position, a second spring connected to said pressure valve, a stop for the latter spring guided through the opening in the pressure valve and supported upon the valve face for the same, said stop being of greater length than the thickness of the pressure valve, substantially as described.

12. The herein described compressor or pump, the same comprising a compression cylinder having a valve face and opposite ports leading from said valve face to the opposite ends of the cylinder and provided with recesses at their inner ends, a valve chamber of rectangular section connected to the cylinder and provided with a yielding wall or plate as —H— having an outlet consisting of separated outlet ports, as —H'—H'— guides for said wall or plate, springs for forcing said wall or cover plate to operative position, a valve of angular section movable in the valve chamber and provided at its opposite ends with openings extending therethrough, and passages or ways connecting the opposite ends of said openings, a pressure valve at one side of said wall or cover plate, and springs for supporting said pressure valve, substantially as and for the purpose specified.

In testimony whereof we have hereunto signed our names, in the presence of two attesting witnesses, at Syracuse, in the county of Onondaga, in the State of New York, this 30th day of July, 1890.

EDWARD N. TRUMP.
JOHN E. SWEET.

Witnesses:
CLARK H. NORTON,
L. M. BAXTER.