No Model.)

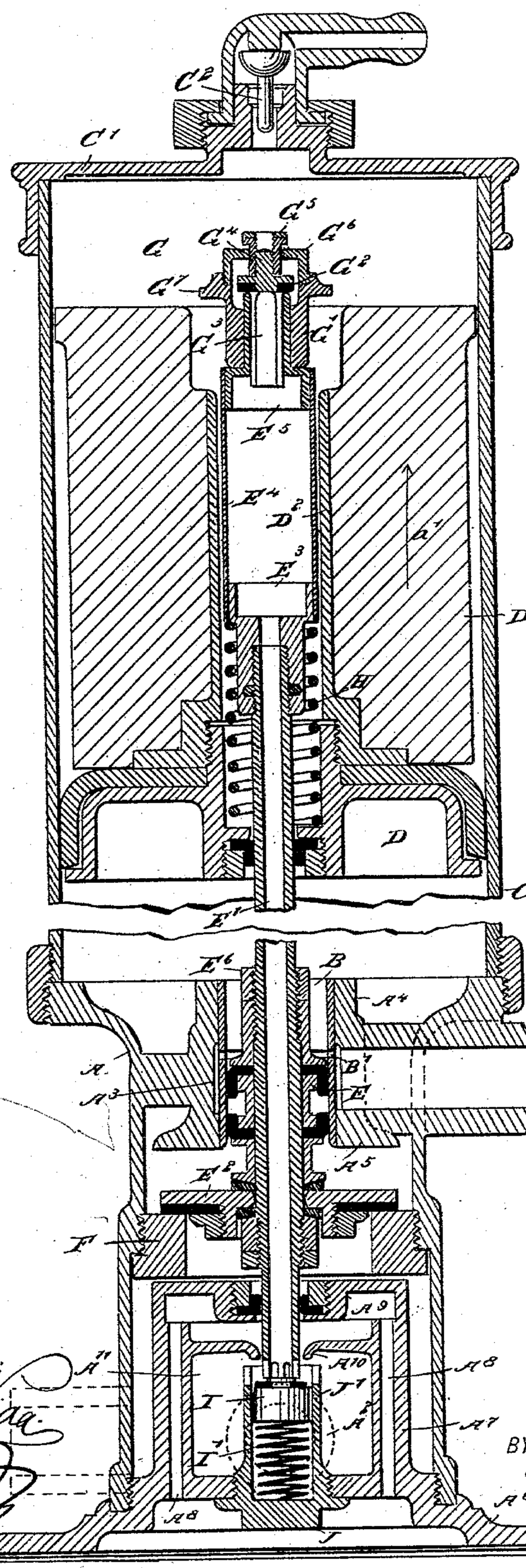
3 Sheets—Sheet 1.

A. KALTHOFF.

HYDRAULIC AIR COMPRESSOR.

No. 551,549. Patented Dec. 17, 1895.

Fig: 1.



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(No Model.) 3 Sheets—Sheet 2.

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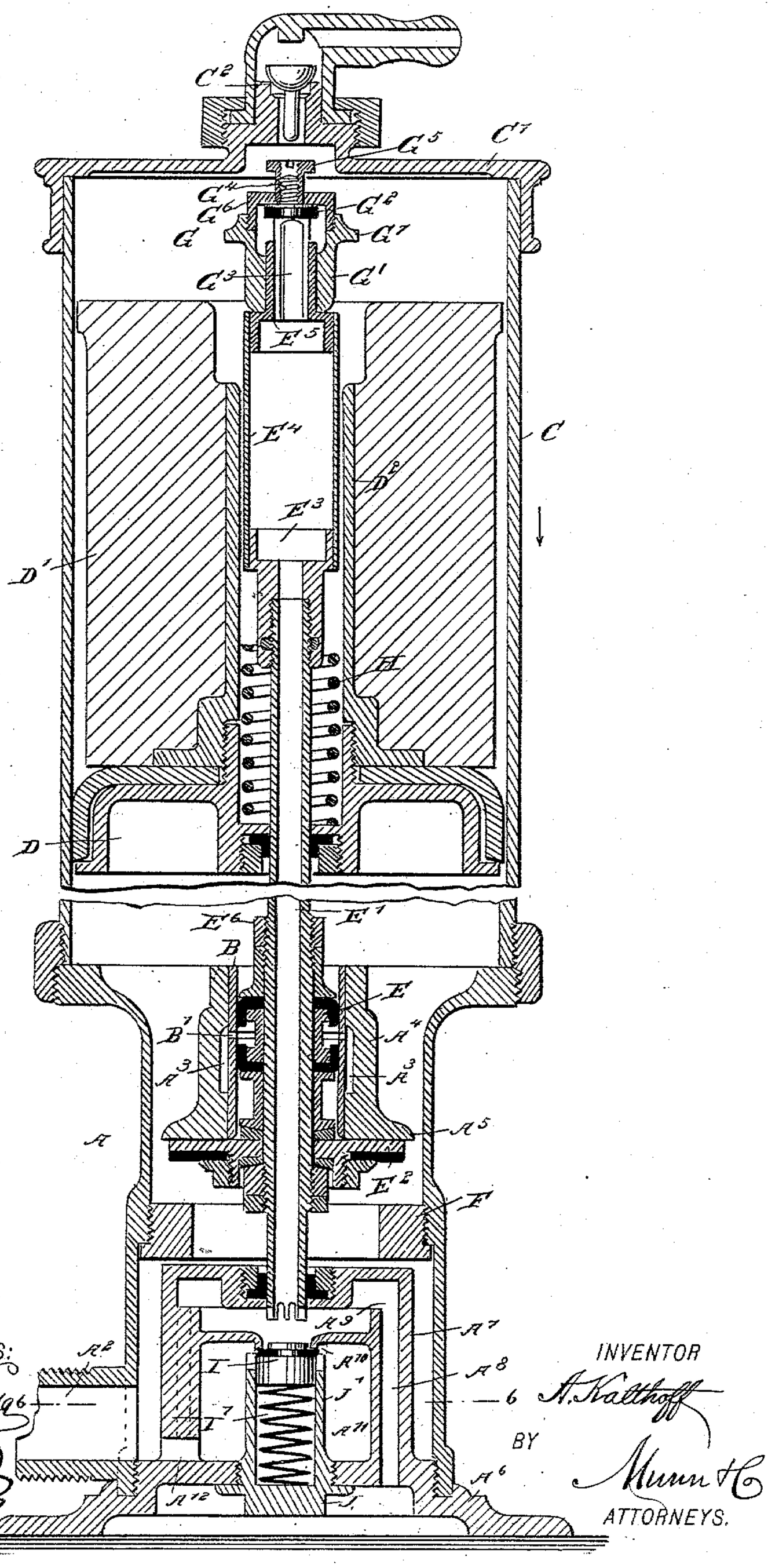
HYDRAULIC AIR COMPRESSOR.

No. 551,549. Patented Dec. 17, 1895.

Fig: 2.



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HYDRAULIC AIR COMPRESSOR.

No. 551,549. Patented Dec. 17, 1895.

Fig: 3.

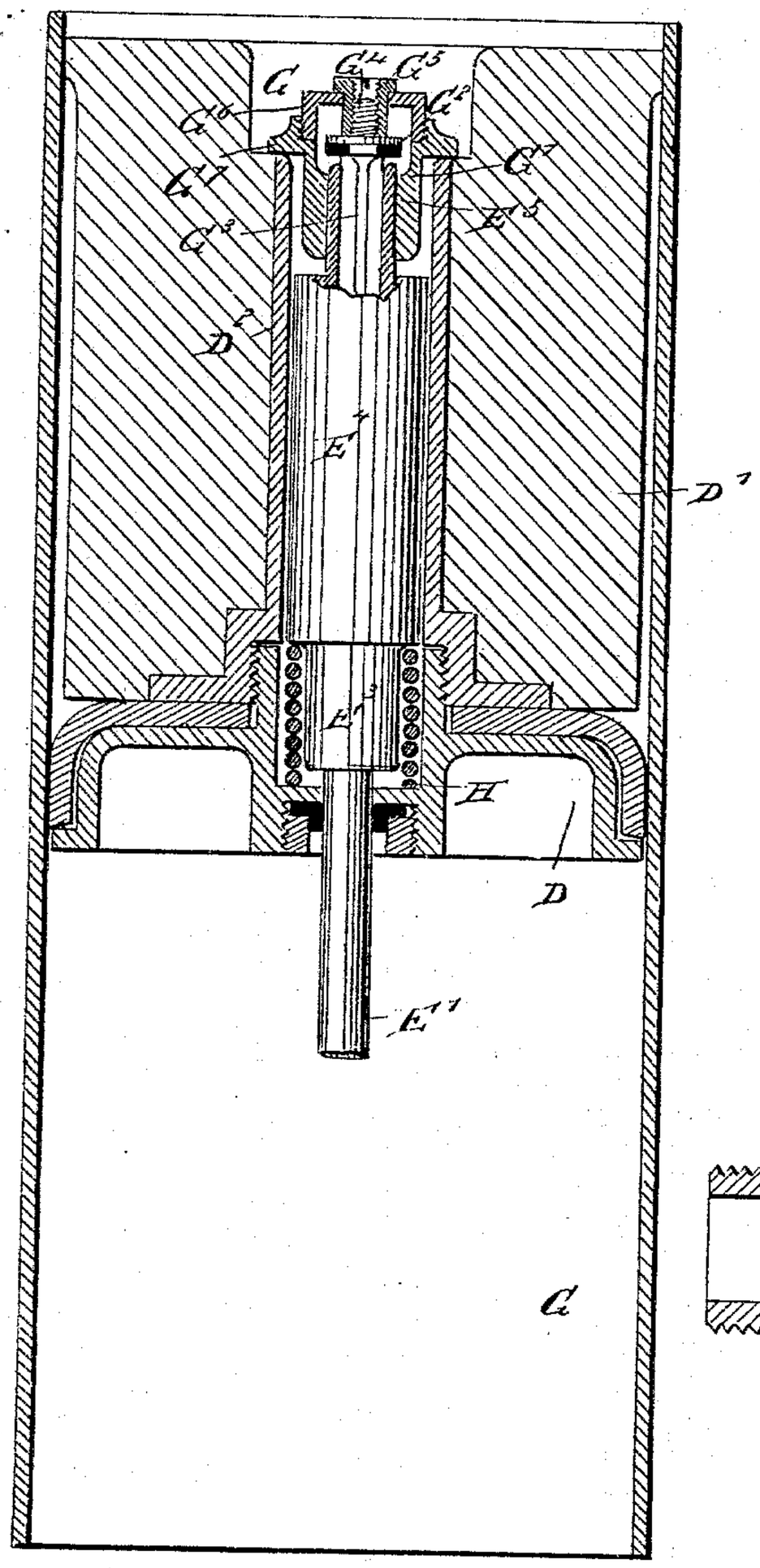


Fig: 4.

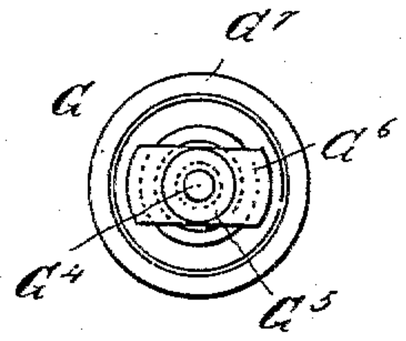


Fig: 5.

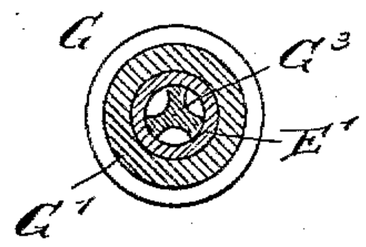
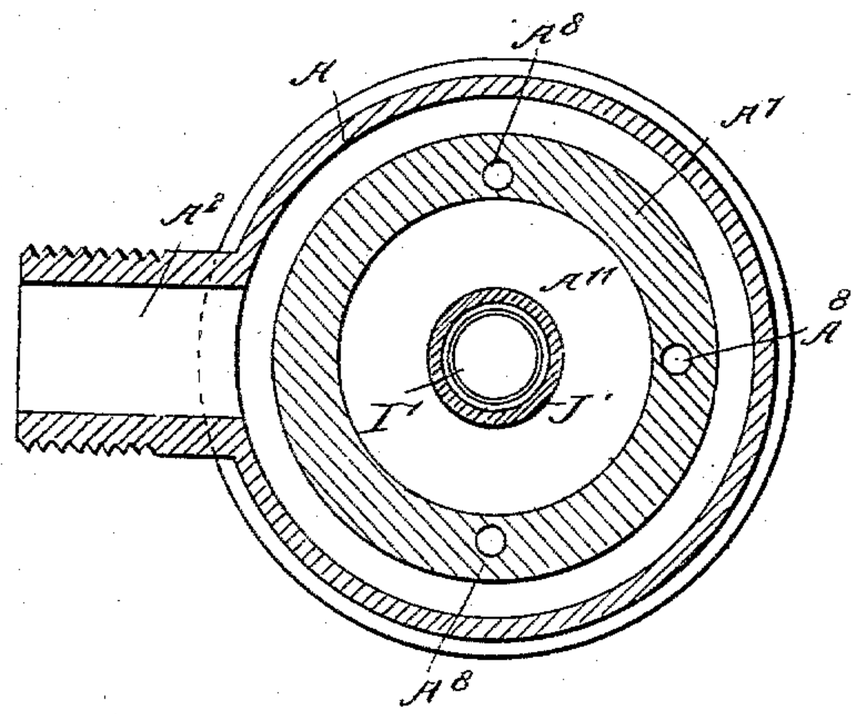


Fig: 6.



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UNITED STATES PATENT OFFICE.

ALBRECHT KALTHOFF, OF NEW YORK, N. Y.

HYDRAULIC AIR-COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 551,549, dated December 17, 1895.

Application filed April 27, 1895. Serial No. 547,328. (No model.)

To all whom it may concern:

Be it known that I, ALBRECHT KALTHOFF, of New York city, in the county and State of New York, have invented a new and Improved Hydraulic Air-Compressor, of which the following is a full, clear, and exact description.

The invention relates to hydraulic air-compressors more especially designed for use in beer-pumps and similar machines; and its object is to provide a new and improved hydraulic air-compressor which is comparatively simple and durable in construction, automatic in operation, and arranged in such a manner that the pressure of the water for operating the compressor is utilized to the fullest advantage without perceptible loss.

The invention consists of certain parts and details and combinations of the same, as will be fully described hereinafter, and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a sectional side elevation of the improvement. Fig. 2 is a transverse section of the same with the main valve in a discharge position and the piston descending. Fig. 3 is a sectional side elevation of the piston, the spring, and the release-valve. Fig. 4 is a plan view of the release-valve. Fig. 5 is a sectional plan view of the same, and Fig. 6 is a sectional plan view of the improvement on the line 6 6 of Fig. 2.

The improved hydraulic air-compressor is provided with a casing A for the water-inlet A′ connected with a suitable water-supply, usually the city main, the said casing being also provided with a water-outlet A^2, arranged at right angles to the inlet and connected with a suitable place of discharge. The inner end of the water-inlet A′ connects with an annular chamber A^3 formed in the central portion A^4 arranged within the casing A, and containing a cylindrical bushing B provided in its wall with ports B′ leading to the said annular chamber A^3. The upper end of this bushing B opens into a cylinder C containing a piston D, supporting on its top a suitable weight D′ and adapted to compress the air in the upper part of the cylinder C, the latter being provided on its top with a cap C′ containing an air-discharge valve C^2 connected with an air-reservoir in the usual manner.

The inflow of the water from the inlet A′ to the cylinder C and the outflow of the water from the latter to the outlet-pipe A^2 is controlled by a main valve, preferably constructed as shown in the drawings, and provided with a piston-valve E fitted to slide in the bushing B for opening and closing the ports B′, to permit the water to flow from the inlet A′ through the said ports B′ into the casing C, as illustrated in Fig. 1, or to cut off the said ports B′ and inlet A′ from the cylinder C, as illustrated in Fig. 2. The main valve is further provided with a valve-disk E^2 fastened, like the the piston-valve E, on a hollow valve-stem E′; and this valve-disk E^2 is normally held on the top of a valve-seat F, screwing into the middle portion of the casing A, as is plainly shown in the drawings. The upward movement of the main valve (which is composed of the valve E, disk E^2 and stem E′) is limited by the disk E^2 being seated against the under side of the central part A^4 of the casing, as indicated in Fig. 2.

It is understood that the outlet A^2 is below the valve-seat F, so that when the disk E^2 is in the position shown in Fig. 2 then the water from the cylinder C can pass from the upper part of the casing A through the seat F into the lower part of the casing and through the outlet A^2 to a suitable place of discharge.

The valve-stem E′ of the main valve extends through a suitable stuffing-box in the piston D to carry at its upper end a head E^3, on which is secured a cylinder E^4 fitted to slide in a tubular extension D^2 formed on the piston D and passing through the weight D′. On the upper end of this cylinder E^4 is secured a valve-seat E^5, on which is held a release-valve G formed with a body portion G′ fitted to slide on the valve-seat E^5 and containing a valve G^2 adapted to be seated on the top of the said valve-seat E^5, as plainly indicated in Fig. 1.

The valve G^2 is provided with the usual web G^3 for guiding the valve G^2 in the seat E^5, and from the top of the said valve G^2 extends upwardly a threaded shank G^4, onto which screws a cylindrical sleeve G^5 fitted to slide in a bridge G^6 screwing in a flange G^7 formed

on the upper part of the body G′ and adapted to be seated on the upper end of the tubular extension D^2 of the piston D, as plainly indicated in Fig. 3. Normally the valve G^2 is held to its seat E^5 by the pressure of the air in the upper end of the cylinder C; but when the piston D moves upward, then the tubular extension D^2 of the said piston moves in engagement with the flange G^7, so as to lift the valve-body G′ and to move the valve G^2 off its seat E^5, as indicated in Fig. 3. When this takes place, the air can pass from the upper end of the cylinder C through the valve-seat E^5 into the cylinder E^4, so that the pressure on the top and bottom of the valve-stem E′ is equalized, and consequently the said valve-stem E′ can be moved suddenly upward to shift the main valve from its normal or water-inlet position to a water-outlet position, by the action of a coil-spring H contained in the piston D, and resting and pressing with its upper end on the head E^3 of the stem E′.

It is understood that when the piston D moves into an uppermost position, it compresses the spring H, as shown in Fig. 3, prior to the tubular extension D^2 lifting the flange G^7 of the valve-body G′ to unseat the valve G^2.

Now it will be seen that when the several parts are in the position illustrated in Fig. 1 water can flow through the inlet A′, annular chamber A^3 and ports B′ in the bushing B, through the latter to the lower part of the cylinder C, to exert its pressure against the under side of the piston D to cause the latter to slide upward in the direction of the arrow *a*′, as shown in the said Fig. 1. During the upward movement of the piston D the valve E of the main valve is below the ports B′, and the disk E^2 is seated on the seat F, so that the water is returned within the cylinder C. Now when the piston D nears its uppermost position, it commences to compress the spring H, and finally the piston D^2 engages the flange G^7 of the valve-body G′, to move the valve G^2 off its seat E^5, as indicated in Fig. 3. Now it is understood that as long as the piston D was moving upward and when it commenced to compress the spring H, the latter could not force the stem E′ upward as the pressure of the air on the upper side of the valve G combined with the pressure of the water on the upper side of the valve-disk E^2 prevented the spring from shifting the main valve; but as soon as the valve G^2 is lifted off its seat E^5, then the air-pressure on the valve G is sufficiently lessened to permit the compressed spring H to suddenly shift the main valve by pushing the hollow stem E′ upward, lifting valve-disk E^2 against the pressure of the water on its top to move the piston-valve E into the position shown in Fig. 2, and cut off the water-supply, and at the same time move the valve-disk E^2 off its seat F, to permit the water to pass from the lower end of the cylinder C to and through the outlet A^2. Now it will be seen that when the water recedes from the cylinder C, the piston D, owing to its weight D′, is forced downward in the cylinder C until finally the lower end of the piston D moves in contact with the nut E^6 for holding the piston-valve E in place on the stem E′, to push the latter downward so as to again shift the position of the main valve from the outlet position to its normal or inlet position, as indicated in Fig. 1. In doing so, the water can again flow into the cylinder C, to raise the piston D therein, so that the above-described operation is repeated.

By reference to Fig. 3, it will be seen that any water that may have leaked into the upper part of the cylinder C can pass through the now open valve-seat E^5, cylinder E^4 and head E^3 into the hollow stem E′, to flow down the same and to be discharged into the outlet A^2, as hereinafter more fully explained.

It will further be seen that when the piston D is on the downward move, the stem E′ forms the supply-pipe for the air to be compressed in the upper part of the cylinder C by the piston D as the latter ascends, as previously explained. Now for this purpose, the lower serrated end of the hollow stem E′ opens into a chamber A^9 formed in the base A^6 screwed into the lower open end of the casing A, as is plainly shown in the drawings. The base A^6 is provided with a cylindrical extension A^7, passing into the lower end of the casing, and forming with the wall thereof a sufficient space for the water coming down through the seat F to pass to the outlet A^2. This cylindrical offset A^7 is provided with a series of vertical channels A^8 leading from the outer air to the said chamber A^9, so that air can pass from the outside through the channels A^8 into the chamber A^9 and up through the hollow stem E′, to supply the upper part of the cylinder C with the air to be compressed. In the bottom of the chamber A^9 is formed a valve-seat A^{10} leading to a leakage-water discharge A^{11}, likewise formed in the cylindrical extension A^7 and connected by a port A^{12} with the water-outlet A^2, as is plainly shown in Fig. 2. The valve-seat A^{10} is normally closed from the under side by a piston-valve I fitted to slide in a cylindrical extension J′ of a cap J, screwing in the bottom of the cylindrical extension A^7, as is plainly shown in the drawings. A spring I′ holds the said piston-valve I normally on its seat, and the said piston-valve is adapted to be unseated by the lower end of the hollow valve-stem E′ as the latter descends, as previously explained and shown in Fig. 1. Now when this valve I′ is open leakage-water contained in the upper end of the cylinder is drained into the chamber A^{11} to pass to the outlet A^2, as previously explained.

It will be seen that by the arrangement described the water passing into the cylinder C presses with its full force upon the piston D to compress the air under pressure which is almost equal to the pressure of the water, so that the device utilizes the water-power to the greatest advantage. It will further be

seen that the hollow valve-stem of the main valve forms the inlet for the air to be compressed in the cylinder C by the piston D as the latter ascends, the air passing into the cylinder through said valve-stem upon the downward movement of the piston. It will also be seen that any water passing the piston D into the upper end of the cylinder C is drained therefrom by the hollow stem of the main valve.

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

1. A hydraulic air compressor, comprising a cylinder, a piston mounted therein, to draw in and compress the air, and a main valve for controlling the inflow and outflow of the water to and from the said cylinder, the said main valve being provided with a hollow stem passing through the said piston, to form an air inlet for the air to be compressed by the said piston, substantially as shown and described.

2. A hydraulic air compressor, comprising a cylinder, a piston mounted therein, to draw in and compress the air, a main valve for controlling the inflow and outflow of the water to and from the said cylinder, the said main valve being provided with a hollow stem passing through the said piston, and a release valve held on the upper end of the said hollow stem, to open or close the same, substantially as shown and described.

3. A hydraulic air compressor, comprising a cylinder, a piston mounted therein, to draw in and compress the air, a main valve for controlling the inflow and outflow of the water to and from the said cylinder, the said main valve being provided with a hollow stem passing through the said piston, a release valve held on the upper end of the said hollow stem, to open and close the same, and a spring adapted to be compressed by the said piston, and adapted to press on the said stem, to shift the position of the said valve from a water inflow to a water discharge position, substantially as shown and described.

4. A hydraulic air compressor, provided with a main valve having a hollow stem forming an inlet for the air to be compressed, and a discharge for leakage water, substantially as shown and described.

5. A hydraulic air compressor, comprising a cylinder, a piston mounted therein, a spring-pressed main valve for controlling the inflow and outflow of the water to and from the said cylinder, the said main valve being provided with a hollow stem forming an air inlet and a leakage water discharge, and a spring-pressed valve adapted to be engaged by the said stem, to connect the latter with the general water discharge, substantially as shown and described.

6. A hydraulic air compressor comprising a cylinder having an air outlet and an air inlet at one end and a water outlet and inlet at the other end, a piston in said cylinder between the respective air and water inlets and outlets, valves for controlling the admission and discharge of air from the cylinder, a valve for controlling the admission and discharge of water to and from said cylinder, said valve being held in one position during the forward stroke of the piston, means for exhausting the remaining air from said cylinder at the end of the forward stroke of the piston, whereby the air pressure is reduced, and means for automatically moving said valve to its opposite position when the air pressure in the cylinder is reduced, as set forth.

7. A hydraulic air compressor comprising a cylinder having an air outlet and an air inlet at one end, and a water outlet and inlet at the other end, a piston in said cylinder between the respective air and water inlets and outlets, valves for controlling the admission and discharge of air to and from the cylinder, a valve for controlling the admission and discharge of water to and from the cylinder, said valve being held in one position by the pressure of the water in the cylinder during the forward stroke of the piston, means actuated by the piston at the end of its forward stroke for exhausting the remaining air from said cylinder whereby the air pressure therein is reduced, and means for automatically moving said valve to its opposite position when the air pressure in the cylinder is reduced, as set forth.

8. A hydraulic air compressor comprising a cylinder having air and water inlets and outlets at the opposite ends, a piston in said cylinder, valves for controlling the admission and discharge of air to and from the cylinder, a valve for controlling the admission and discharge of water to and from the cylinder, a stem for said valve extending into the air space in said cylinder and adapted to be held in one position by the air pressure in said space during the compressing stroke of the piston, means for exhausting the remaining air from the cylinder at the end of the compressing stroke, and means for automatically moving said valve stem to its other position on the fall of the air pressure in the cylinder, as set forth.

9. A hydraulic air compressor comprising a cylinder having air and water inlets and outlets at its opposite ends a piston in said cylinder, valves for controlling the admission and discharge of air to and from the cylinder, a valve for controlling the admission and discharge of water to and from said cylinder, a stem for said valve extending into the air space in the cylinder and adapted to be held in one position by the air pressure in the cylinder on the compressing stroke of the piston, a spring connected to said stem and adapted to move the same to its other position when the air pressure in the cylinder falls, and means for exhausting the remaining air from said cylinder at the end of the compressing stroke of the piston, as set forth.

10. A hydraulic air compressor comprising

a cylinder, a piston therein, a water inlet and outlet at one end of the cylinder, a valve controlled air outlet at the other end of the cylinder, a valve for controlling the admission and discharge of water to and from the cylinder, a hollow stem for said valve extending into the air space in the cylinder and adapted to be held in one position by the air pressure in the cylinder on the compressing stroke of the piston, said stem having its hollow arranged to form an air inlet for the cylinder and provided with a valve, means for opening said valve at the end of the compressing stroke of the piston to exhaust the remaining air from the cylinder and means for automatically moving said stem to its other position when the air pressure in said cylinder is lowered, as set forth.

11. A hydraulic air compressor comprising a cylinder, a piston therein, a valved air outlet at one end of the cylinder, a water inlet and outlet at the other end of same, a valve for controlling the water inlet and outlet, a hollow stem for said valve extending into the air space in the cylinder and adapted to be pressed in one direction by the air pressure in the cylinder during the compressing stroke of the piston, said stem having its hollow arranged to form an air inlet for the cylinder and provided with a valve arranged to be operated by the piston at the end of its compressing stroke to open the air inlet and exhaust the remaining air from the cylinder, and means for automatically moving said stem in the other direction when the air pressure in the cylinder is lowered, as set forth.

12. A hydraulic air compressor comprising a cylinder, a piston therein, a valved outlet for the air at one end of the cylinder, a water inlet and outlet at the other end thereof, a valve for controlling the water inlet and outlet, a hollow stem for said valve extending through the piston to the opposite end of the cylinder and adapted to be pressed in one direction by the air pressure in the cylinder during the compressing stroke of the piston, said stem having its hollow arranged to form an air inlet to the cylinder, a valve controlling the air inlet, and arranged to be opened at the end of the compressing stroke of the piston whereby the remaining air is exhausted from the cylinder, and a spring connected to the stem and adapted to be placed under tension during the compressing stroke of the piston to move the stem in the other direction when the air pressure in the cylinder falls, as set forth.

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Witnesses:
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