C. H. SCOTT.

COMPRESSOR OR EXHAUSTER FOR AIR OR OTHER FLUIDS.

APPLICATION FILED MAR. 23, 1905.

**924,942.** **Patented June 15, 1909.**

FIG. 1.

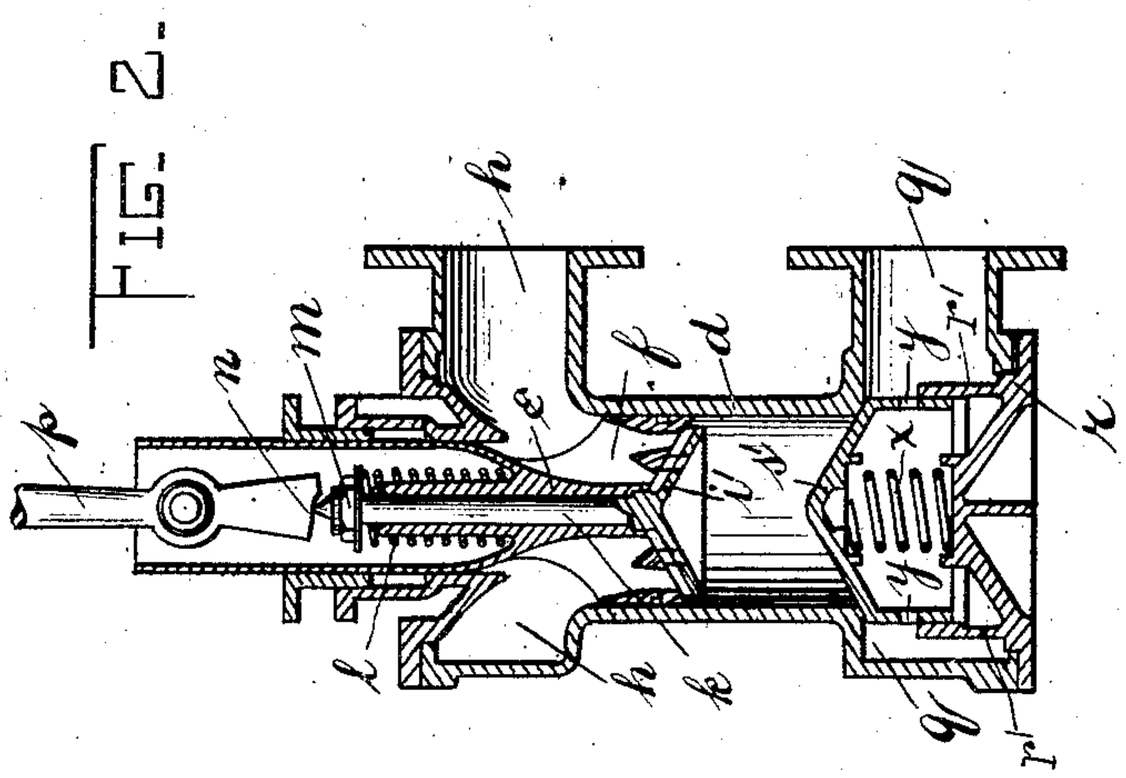



FIG. 3.

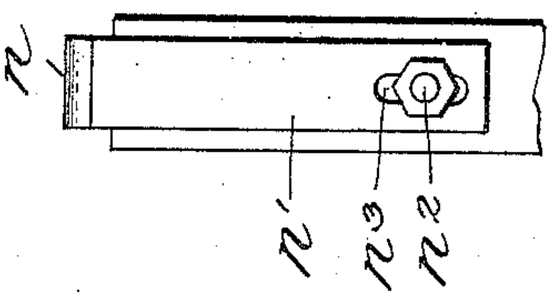



FIG. 4.

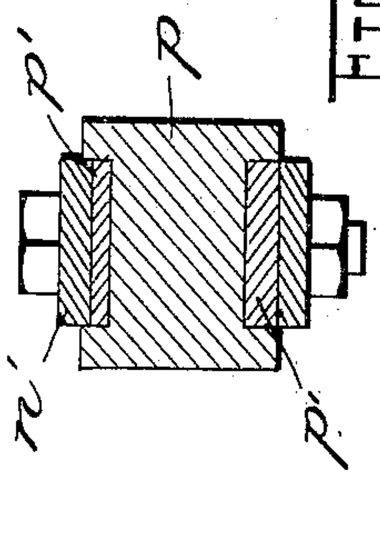
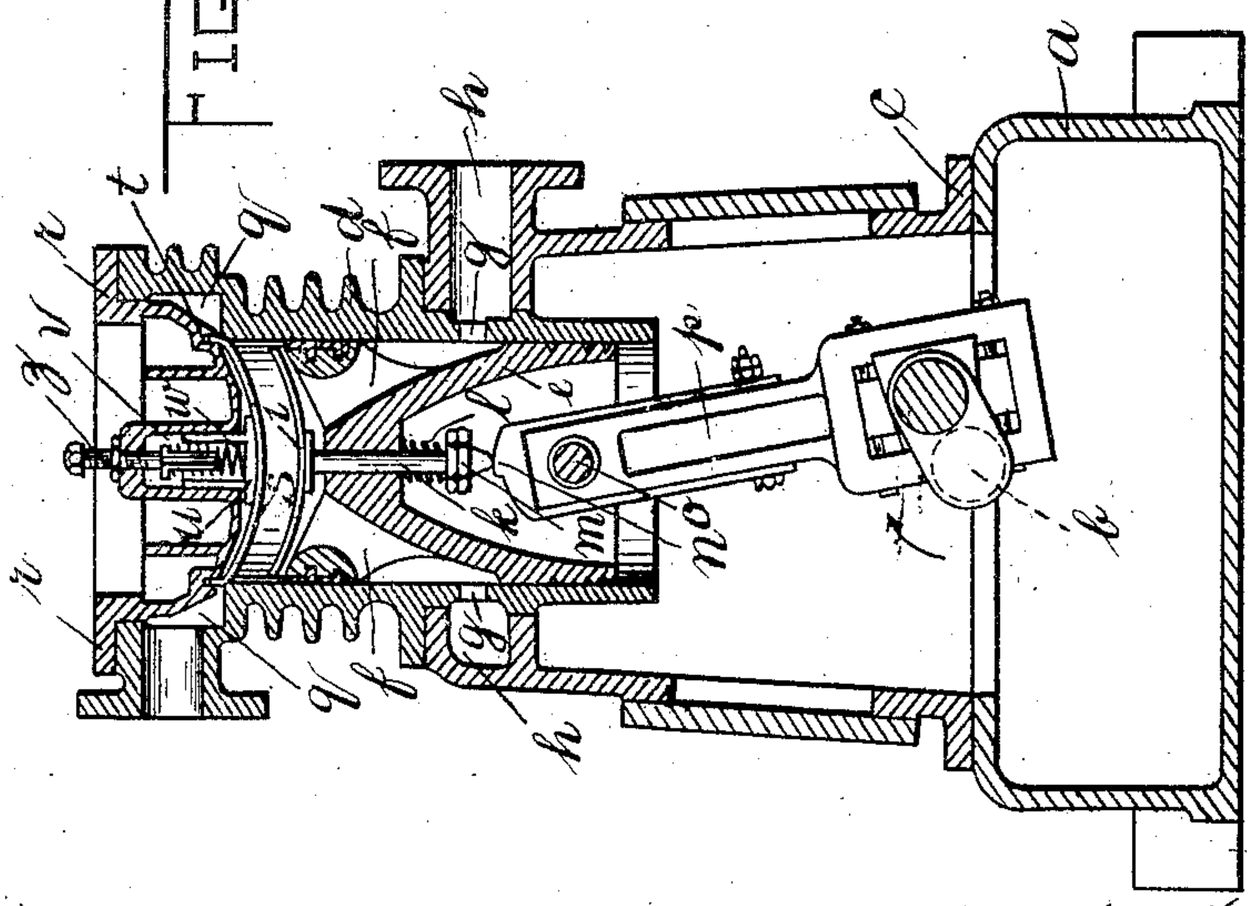



FIG. 2.

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# UNITED STATES PATENT OFFICE.

CHARLES HERBERT SCOTT, OF GLOUCESTER, ENGLAND.

## COMPRESSOR OR EXHAUSTER FOR AIR OR OTHER FLUIDS.

No. 924,942. Specification of Letters Patent. Patented June 15, 1909.

Application filed March 23, 1905. Serial No. 251,587.

*To all whom it may concern:*

Be it known that I, CHARLES HERBERT SCOTT, a subject of the King of Great Britain and Ireland, and a resident of Gloucester, England, have invented certain new and useful Improvements in Compressors or Exhausters for Air or other Fluids, of which the following is a detailed description to enable others to understand and employ same.

My invention relates to compressors or exhausters of the nature of pumps, and the object of my invention is to provide an apparatus of this character having superior features of construction and operation to those hitherto known and used. Among these may be mentioned the elimination of practically all clearance or dead space in the pump; mechanically operated suction valves, which are opened and closed only at the proper moments and held open during the whole of the suction stroke; the construction, operation and control of the delivery valve to cause the same to work efficiently and without chattering irrespective of the speed of the pump.

All of these features are of the greatest importance for compressors, exhausters, as well as wet and dry pumps, as, for instance, employed in condensing plants.

In the accompanying drawings I have shown two forms of my invention in sectional elevation adapted respectively for dry and wet work, Figure 1 showing a compressor adapted for dry work with the crank shaft below the piston, while in Fig. 2 this arrangement is reversed with the modification necessary for wet pumps. Figs. 3 and 4 are detail views showing the construction of the pitman or connecting rod, Fig. 3 being a side elevation of the rod and Fig. 4 being a transverse sectional view, both views being upon an enlarged scale.

With reference to Fig. 1, *a* is the base plate or frame in which the crank shaft *b* is suitably supported and upon which the frame *c* holding the cylinder *d* is properly secured. I prefer to arrange the cylinder vertically so as to take full advantage of the inertia of the valves, but it is obvious that a horizontal position or any other desired angle may be arranged for. The piston *e* is provided with suitable packing and cored out so as to form preferably a series of radially arranged ports *f* which, through openings *g* in the cylinder *d*, are in constant communication with the inlet channel or conduit *h* surrounding the cylinder wall. The inlet valve which closes off these piston ports *f* may consist of a dished steel stamping *i* extending over nearly the entire piston area and normally resting upon its seat on said piston. In its center this steel stamping *i* is secured to a spindle *k* sliding in a boring of the piston and held in its lower position by its own weight and by a spiral spring *l* mounted on its lower projecting end and secured between a pair of adjustable nuts *m* and the piston body. This lower end of the spindle *k* terminates in a cam projection of preferably hardened material or an antifriction roller (not shown) so as to coöperate with an adjustable cam surface *n* of the pitman or connecting rod *p* projecting above the gudgeon pin *o* which is secured in the piston *e*.

The construction of the cam and pitman rod may be as shown in Figs. 3 and 4, cam *n* being formed on a strap *n'* embracing the sides of the pitman or connecting rod *p* with a bolt $n^2$ passing through the strap and pitman to secure the parts together. Adjustability is secured by providing a slot $n^3$ for the bolt in the strap *n'*. Lateral adjustment of the cam may be obtained by means of liners *p'* inserted between the strap *n'* and the rod *p'*.

The exhaust channel *q* is formed by a continuation of the cylinder *d* and the inwardly projecting cylinder cover *r*. Owing to the exhaust of the pressure medium being thus effected at the entire circumference of the cylinder this passage needs only to be very narrow and results therefore in a small lift of the exhaust valve *s* which is preferably also made in the form of a dished steel stamping closely fitting the form of the inlet valve *i* and resting with a narrow surface near its outer edge upon a corresponding seat formed at the upper end of the cylinder wall. The upwardly bent edges of this valve *s* are guided in an annular groove *t* of the cylinder cover *r* which groove is of sufficient depth to allow the lifting of the valve and by the air confined in this so-formed annular pocket, cushions the operation of same. The tubular valve stem *u* slides in a pocket *v* of the cover *r* and presses the valve upon its seat by means of spring *w* which may be adjusted by a screw *z*.

The operation is as follows: The crank shaft *b* having driving connection with any suitable or convenient source of power (not shown) and being driven in the direction in-

dicated by the arrow (Fig. 1.), when the piston completes its up-stroke the valve *i* will commence to open by its own inertia. Immediately the cam *n* operates on the valve stem *k* and positively acts to open the valve by giving it a slight lift, which may be less than the full extent which the valve is free to go. The cam *n* is so arranged and timed as to insure the valve being open at the right time. It is held open by the cam for the full extent of the suction or down stroke when it closes in a similar way—the inertia of the valve, and the cam passing out from under the valve stem insuring the closing of the valve at the moment the piston begins to reverse its direction. The cam is so constructed and the angular position of the crank is such that the opening and closing of this valve is of so gentle a character that there is no damage to the valve or seat and no chattering. It will be noted that the valve is open and kept open during the entire suction stroke. This is a feature of great importance, particularly where the pumps are used in condensing plants where there is no pressure available to lift the valves. The delivery valve opens automatically by the pressure in the cylinder. Mechanical opening is not feasible for this valve since the compressor may be required to work at different pressures for different work and the time of opening would therefore have to be varied. The valve is closed mechanically and its closing is controlled by the piston. At the end of the compression stroke the piston valve comes into contact with the delivery valve. As the piston commences its return movement it lowers the delivery valve gently and without shock on to its seat. Owing to the arrangement of the crank and pitman, the angularity of the latter, this movement is very slow, the result being that even at high speeds this valve works gently and without chattering.

With reference to the water or wet pump shown in Fig. 2, *d* indicates the cylinder, *e* the piston which is cored out forming the radial ports *f* which are in constant communication with the suction or inlet channel *h* at the upper end of the cylinder. The mechanically actuated inlet valve consists preferably of a dished plate *i* extending over the inner face of the piston *e*. The spindle *k* of said valve passes through the piston and holds the valve normally on its seat by means of a spring *l* confined between the piston body and a nut *m* secured to the upper end of spindle *k*, which is acted upon by a cam projection *n* of the connecting rod *p*.

The exhaust or delivery channel *q* formed at the lower end of the pump cylinder *d*, is controlled by a valve *s'* corresponding in form to the suction valve *i'* and resting on a seat at the circumference of said cylinder and sliding with its downwardly extending sides in the inwardly projecting flange *r'* of the cylinder cover *r*. Between the latter and the valve is a spring *x* tending to close the valve and normally maintaining this position while openings *y* in the downwardly projecting sides of valve *s* allow the pressure in the delivery channel *q* to enter behind said valve and to regulate the lift of same, as these openings *y* will be more or less covered by the inwardly projecting part of cover *r* on the opening of valve *s*. The operation is practically the same as described with reference to the compressor construction. In both cases the delivery valve is opened by the pressure stroke of the piston *e* which at the end of its movement may bring the two valves in close contact and on its return allow the delivery valve to quietly settle down on its seat, thus preventing any chattering of same or clearance space.

It is evident that the length of the pitman rod may be adjusted by any suitable means to regulate the stroke of the piston, while the adjustment of the cam surface on said connecting rod for operating the piston valve regulates the positive lift of same. By arranging two or more pumps or compressors of such construction in series in order to compress in stages, an efficient compound system can be formed.

Although I have shown dished valves and other details of my invention in the drawings as preferably to be employed in carrying out my invention I do not want to limit myself to such details which may be changed within the scope of the following claims and in accordance with the different requirements for machines of this kind.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. In a machine of the character described, the combination of a cylinder, a piston operating with practically no clearance or dead space therein, suction ports open to the piston throughout its stroke, ports in the piston and a valve controlling the same, a connecting rod driving said piston and valve actuating means on said rod coming into engagement with the valve to open the same at the moment the piston reverses its stroke from compression to suction, and going out of engagement with the valve to permit the same to close at the moment the piston reverses its stroke from suction to discharge.

2. In a machine of the character described, the combination of a cylinder, suction and delivery ports therein, a delivery valve controlling the delivery port, a piston working in said cylinder, ports and a valve therefor carried by the piston, a pitman driving said piston, and means acting positively on the piston valve to open the same at the limit of the compression stroke and cause said valve to contact with the delivery valve in the open

position of the latter, whereby the closing of said delivery valve is controlled by the return stroke of the piston.

3. In a machine of the character described, the combination of a cylinder, a piston operating therein, a valve mounted in said piston, said valve capable of movement by its own inertia independently of the piston or piston actuating means, and means engaging said valve at the limit of the compression stroke to move said valve into open position simultaneously with the independent movement of said valve due to inertia, said means engaging the valve to hold the same open throughout the suction stroke and disengaged from the said valve at the limit of the suction stroke to permit the valve to close by the independent movement thereof.

4. In a machine of the character described the combination of a delivery or discharge valve, an adjustable spring for closing the same, a piston in said cylinder, a pitman driving said piston, a valve mounted in the piston, and means engaging said valve at the limit of the compression stroke of the piston to open and move the same into contact with the delivery valve in the open position of the latter, whereby the closing of the delivery valve is controlled by the return stroke of the piston.

5. In a machine of the character described, the combination of a cylinder, a piston having ports therein, a valve carried by said piston and controlling said ports, a connecting rod directly operating said piston, and a cam surface on said connecting rod controlling the operation of said valve, substantially as described.

6. In a machine of the character described, the combination of a cylinder, a piston having radially arranged ports therein, a valve carried by said piston and controlling said radially arranged ports, a spring pressed valve spindle sliding in said piston, a connecting rod directly operating said piston, and a cam surface at the inner end of said connecting rod and actuating said valve spindle, substantially as described.

7. In a machine of the character described, the combination of a cylinder, a piston having radially arranged ports therein, a valve carried by said piston and controlling the radially arranged ports, a spring pressed valve spindle sliding in said piston, and an adjustable connecting rod directly operating said piston, and an adjustable cam surface on the inner end of said connecting rod and actuating said valve spindle against its spring pressure, substantially as described.

8. In a machine of the character described, the combination of a cylinder, a piston having radially arranged ports therein, a valve carried by said piston and controlling said ports, a channel surrounding the wall of said cylinder and in constant communication with said radially arranged ports, a connecting rod directly operating said piston, and a cam surface at the inner end of said connecting rod and actuating said valve, substantially as described.

9. In a machine of the character described, the combination of a cylinder, a piston having radially arranged ports therein, a valve carried by said piston and controlling said ports, a channel surrounding the wall of said cylinder and in constant communication with said ports, a spring pressed valve spindle sliding in said piston, a connecting rod directly operating said piston, and a cam surface at the inner end of said connecting rod and actuating said valve spindle, substantially as described.

10. In a machine of the character described, the combination of a cylinder, a piston having radially arranged ports therein, a valve carried by said piston and controlling said ports, a channel surrounding the wall of said cylinder and in constant communication with said ports, a spring pressed valve spindle sliding in said piston, an adjustable connecting rod directly operating said piston, and an adjustable cam surface at the inner end of said connecting rod and actuating said valve spindle against its spring pressure, substantially as described.

11. In a machine of the character described, the combination of a vertically arranged cylinder, a piston having arranged ports therein, a valve carried by said piston and controlling said ports, a channel surrounding the wall of said cylinder and in constant communication with said ports, a spring pressed valve spindle sliding in said piston, a connecting rod directly operating said piston and adjustable so as to regulate the clearance, and a cam surface at the inner end of said connecting rod and actuating said valve spindle against its spring pressure said cam surface being adjustable so as to properly time the operation of said valve, substantially as described.

12. In a machine of the character described, the combination of a cylinder, a piston having ports therein, a dished valve of approximately the diameter of said piston at the inner side of same and controlling said ports, a valve spindle sliding in said piston and normally holding said dished valve upon its seat by suitable pressure, and positive means for operating said valve, substantially as described.

13. In a machine of the character described, the combination of a cylinder, a piston having radially arranged ports therein, a dished valve of approximately the diameter of said piston at the inner side of same and controlling said ports, a channel surrounding said cylinder and in constant communication with said ports, a valve spindle sliding in said piston, and a spring surrounding said

spindle so as to normally press the disked valve upon its seat, a cam surface actuating said valve spindle, and a connecting rod operating said cam surface, substantially as described.

14. In a machine of the character described, the combination of a cylinder and cover therefor leaving a channel between, a steel stamping of somewhat larger diameter than the cylinder and normally resting upon its seat at the end of the cylinder wall thereby closing said channel, said steel stamping having a bent-up outer edge, a groove in said cylinder cover guiding said bent-up outer edge, a spring normally pressing said steel stamping upon its seat, and means to regulate the pressure of said spring, substantially as described.

15. In a machine of the character described, the combination of a cylinder, a piston working therein, a pitman driving said piston, a valve carried by the piston, and a cam on the pitman arranged to engage the valve to open the same at the limit of the compression stroke and to pass out of engagement with the valve at the limit of the suction stroke.

16. In a device of the character described, the combination of a cylinder, a piston in the same, a valve carried by the piston, a pitman connected with the piston for actuating the same, a cam for operating the piston valve, the action of said cam controlled by the change in the angular position of the pitman at each end of the piston stroke.

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Witnesses:
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