

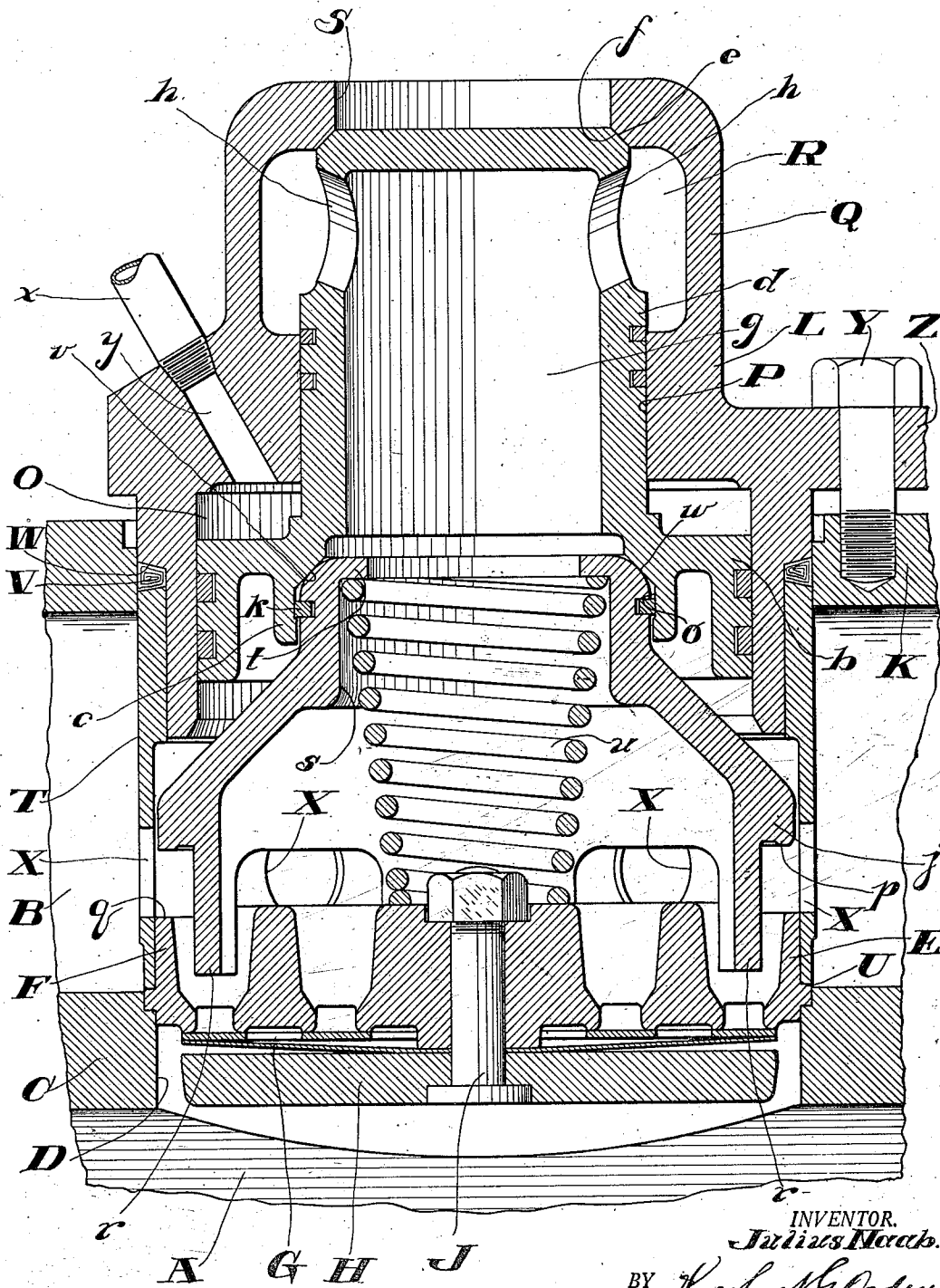
April 5, 1927.

1,623,489

J. NAAB

COMPRESSOR UNLOADER

Filed Dec. 14, 1926



INVENTOR.
Julius Naab.
BY *Herbert E. Guden*
HIS ATTORNEY

Patented Apr. 5, 1927.

1,623,489

UNITED STATES PATENT OFFICE.

JULIUS NAAB, OF EASTON, PENNSYLVANIA, ASSIGNOR TO INGERSOLL-RAND COMPANY,
OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

COMPRESSOR UNLOADER.

Application filed December 14, 1926. Serial No. 154,714.

This invention relates to compressors, but more particularly to a compressor unloader adapted to automatically unseat the inlet valve or valves of compressors whenever the pressure in the element into which the compressor discharges reaches a certain predetermined value.

One object of the invention is to prevent communication between the compressor cylinder and the channels through which air is admitted to the compressor during the normal operation of the compressor and to simultaneously establish direct communication between the compressor cylinder and the atmosphere during the unloaded period of the compressor.

Other objects will appear hereinafter.

The invention consists of the combinations of elements and arrangement of parts substantially as hereinafter described and claimed and illustrated in the accompanying drawing, in which is shown a sectional elevation of a compressor unloader applied to an inlet valve of a compressor.

Referring more particularly to the drawing, A represents a portion of a compressor cylinder and B an inlet passage which may lead from a cylinder of lower stage for conveying pressure fluid to the cylinder A. In a wall C dividing the cylinder A from the inlet passage B is an opening D in which is seated a plate valve assembly designated generally by E. The valve assembly E is in this instance intended to represent an inlet valve having the usual valve seat F, a plate valve G and a stop plate H, all of which are held in assembled position with respect to each other by means of a bolt J.

In an outer wall K of the inlet passage B is inserted an unloader cylinder L having a piston chamber O in its inner end and a reduced bore P leading from the piston chamber O through an outwardly extending reduced portion Q of the unloader cylinder L. The rearward end of the reduced bore P is enlarged somewhat to form a recess R which may communicate with the atmosphere through an aperture S formed in the end of the reduced portion Q.

To the end that the unloader cylinder L may be held in suitably spaced relation with respect to the plate valve assembly E, a sleeve T is interposed between these elements to seat with its inner end against a flange U of the valve seat F and, in the

present construction, with its opposite end against a packing V interposed between the sleeve T and a shoulder W on the unloader cylinder L. Ports X are formed in the sleeve T to afford communication between the inlet passage B and the interior of the sleeve T.

Any suitable means may be provided for clamping the cylinder L, the sleeve T and the valve seat F securely in assembled position. In the present instance, bolts Y are provided for this purpose. These bolts extend through a flange Z of the cylinder L and are screwed into the wall K of the inlet passage B. This construction provides a simple means for clamping the casing parts of the unloader mechanism as well as the valve assembly E securely in position and enables these elements to be readily assembled and disassembled in the compressor.

Disposed within the unloader cylinder L is a piston b in which is formed an annular forwardly projecting flange c. The piston b carries an upwardly extending valve d slidable in the bore P and has a tapered end portion e adapted to cooperate with a seat f at the juncture of the recess R and the aperture S for controlling communication between the said recess R and the atmosphere. The valve d has a central passage g from the rearward or outer end of which radiate passages h to establish communication between the passage g and the recess R.

Suitable and novel means are provided for preventing communication between the inlet passage B and the compressor cylinder A whenever the pressure in a storage receiver (not shown) exceeds a value which it may be desirable to maintain. To this end a bell j is secured to the end of the flange c by means of a spring ring k carried by the bell and adapted to slide in an internal annular groove o in the flange c. The groove o is preferably of ample width to permit slight oscillatory movement of the bell in order to insure a perfect seal between its end p and a surface q of the seat F in the various positions that the bell may occupy in practice.

In order that the valve plate G may be constantly held open during the unloaded period of the compressor and to prevent fluttering of said valve plate, fingers r are provided on the large end of the bell j to

bear against the valve plate G and hold it firmly against the stop plate H. The small end of the bell is preferably provided with a central passage *s* to permit the free passage of air from the plate valve to the passage *g* of the valve *d*.

An internal annular flange *t* is in this instance formed at the rearward end of the passage *s* and the bell *j* to provide a seat for one end of a conical spring *u* which bears with its other end against the valve seat F for holding the bell *j* free of the valve seat F and also for holding the valve *d* closed during the normal operation of the compressor.

Preferably the outer end of the small portion of the bell *j* is provided with a spherical surface *v* to cooperate with a conical surface *w* in the piston *b* for forming a seal between the bell and the piston.

The piston *b* is intended to be actuated in a forwardly direction to move the bell *j* on the seat F by pressure fluid preferably conveyed from a receiver tank by a suitable conduit *x* connected to the unloader cylinder L and communicating with the piston chamber O through a passage *y*. Any suitable and well known means may be interposed in the conduit *x* for automatically controlling the admission of pressure fluid into the piston chamber O. Such means preferably consist of a suitable valve or valves adapted to be opened when the receiver pressure exceeds a certain predetermined value and to remain open until the pressure in the receiver tank has again dropped slightly below the pressure which it is desired to maintain.

During the normal operation of the compressor, that is, when the compressor is operating under full load conditions, the piston *b* together with the associated reciprocatory parts will be held retracted by the spring *u*. With the piston *b* in this position the recess R will be sealed by the valve *d* and the bell *j* will be held suspended above the valve assembly E. In this position of the bell it will be noted that free communication between the inlet passage B and the cylinder A is afforded and that the fingers *r* of the bell *j* are sufficiently removed from the valve plate G to permit free reciprocation of the said valve plate.

If now the pressure in the receiver where-with the piston chamber O communicates through the conduit *x* reaches a value in excess to that which it is desired to maintain, pressure fluid from such receiver will automatically be admitted through the conduit *x* and the passage *y* into the piston chamber O to force the piston *b* downwardly against the pressure of the spring *u*. Such movement of the piston will carry the flared end of the bell *j* against the surface *g* of the valve seat F and will cut off communication

between the cylinder A and the inlet passage B. With the bell *j* thus carried forwardly against the seat F the fingers *r* will press against the valve plate G and will hold said valve plate against the stop plate H.

Since the movement of the valve *d* is entirely dependent upon that of the piston *b* it will be seen that when the piston *b* is carried forwardly the valve *d* will be unseated so that the interior of the bell *j* may then be in direct communication with the atmosphere through the passage *s* in the bell *j* and the passages *g* and *h* in the valve *d*. In this way the compressor may be entirely unloaded and any pressure fluid which has previously been discharged into an inter-cooler or other similar device may be retained therein at its discharge pressure until conditions in the final receiver are such that the unloading device may be permitted to return to the inoperative position illustrated in the drawing.

By thus establishing direct communication between the atmosphere and the pressure cylinder air at atmospheric temperature will be drawn into the compressor and during its passage through the unloading device and the valve assembly will have the effect of thoroughly cooling the valve assembly and thus increasing the efficiency of the compressor.

I claim:

1. A compressor unloader comprising a valve plate and its seat adapted to lie in an aperture in the wall between a compressor cylinder and an inlet passage, an unloader cylinder over the plate valve, and means reciprocable in the unloader cylinder for preventing communication between the inlet passage and the compressor cylinder.

2. A compressor unloader comprising a valve plate and its seat adapted to lie in an aperture in the wall between a compressor cylinder and an inlet passage, an unloader cylinder over the plate valve, and means reciprocable in the unloader cylinder cooperating with the valve seat for preventing communication between the inlet passage and the compressor cylinder.

3. A compressor unloader comprising a valve plate and its seat adapted to lie in an aperture in the wall between a compressor cylinder and an inlet passage, an unloader cylinder over the plate valve, means reciprocable in the unloader cylinder for preventing communication between the inlet passage and the compressor cylinder, and means associated with the first said means for establishing communication between the compressor cylinder and the atmosphere.

4. A compressor unloader comprising a valve plate and its seat adapted to lie in an aperture in the wall between a compressor cylinder and an inlet passage, an unloader cylinder over the plate valve, a piston in the

unloader cylinder, and a bell carried by the piston adapted to seat on the valve seat to form a fluid tight joint for preventing communication between the inlet passage and the compressor cylinder.

5 5. A compressor unloader comprising a valve plate and its seat adapted to lie in an aperture in the wall between a compressor cylinder and an inlet passage, an unloader cylinder over the plate valve, a piston in the unloader cylinder, a bell supported by the piston to seat on the valve seat for sealing the valve plate from the inlet passage, and fingers carried by the bell for holding the valve plate open when the bell is in sealing position.

6. A compressor unloader comprising a valve plate and its seat adapted to lie in an aperture in the wall between a compressor cylinder and an inlet passage, an unloader cylinder over the plate valve, having a reduced bore and an aperture to establish communication between the reduced bore and the atmosphere, a piston in the unloader cylinder, a valve integral with the piston controlling communication between the bore and the aperture, a bell carried by the piston adapted to seat on the valve seat for preventing communication between the inlet passage and the compressor cylinder, said bell and said valve having passages for establishing communication between the compressor cylinder and the reduced bore.

7. A compressor unloader comprising a valve plate and its seat adapted to lie in an aperture in the wall between a compressor cylinder and an inlet passage, an unloader cylinder over the plate having a reduced bore and an aperture to establish communication between the reduced bore and the

atmosphere, a piston in the unloader cylinder, a valve integral with the piston controlling communication between the bore and the aperture, a bell carried by the piston adapted to seat on the valve seat for preventing communication between the inlet passage and the compressor cylinder, means for connecting the bell to the piston and for permitting limited oscillatory movement of the bell with respect to the piston, and fingers on the large end of the bell adapted to bear on the valve plate for holding said valve plate open.

8. A compressor unloader comprising a valve plate and its seat adapted to lie in an opening in the wall between a compressor cylinder and an inlet passage, an unloader cylinder over the plate valve having a reduced bore and an aperture to afford communication between the bore and the atmosphere, a piston in the unloader cylinder, a valve integral with the piston to control the aperture, a bell adapted to cooperate with the valve seat for preventing communication between the compressor cylinder and the inlet passage, fingers on the large end of the bell adapted to hold the valve plate open when the bell rests on the valve seat, said bell and said valve having passages affording communication between the compressor cylinder and the outer end of the reduced bore, a spring ring connecting the bell to the piston, means for conveying pressure fluid to the unloader cylinder for actuating the piston in one direction, and spring means for actuating the piston in the opposite direction.

In testimony whereof I have signed this specification.

JULIUS NAAB.