

Dec. 9, 1941.

W. A. STEWART
COMPRESSOR UNLOADER

2,265,675

Filed Aug. 7, 1941

3 Sheets-Sheet 1

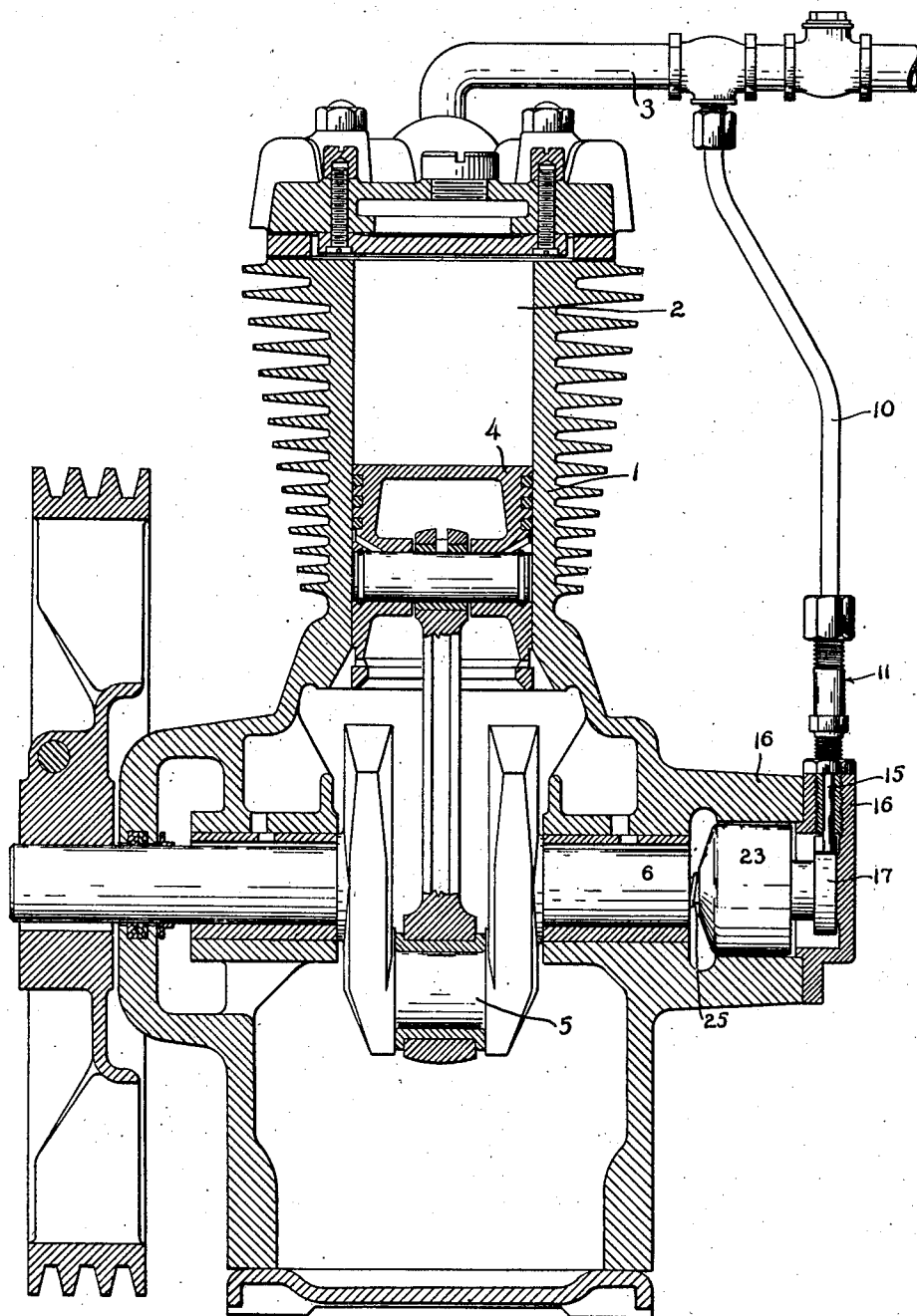


Fig. 1

Warren A. Stewart

INVENTOR

BY

Robert Dwyer

ATTORNEY

Dec. 9, 1941.

W. A. STEWART
COMPRESSOR UNLOADER

2,265,675

Filed Aug. 7, 1941

3 Sheets-Sheet 2

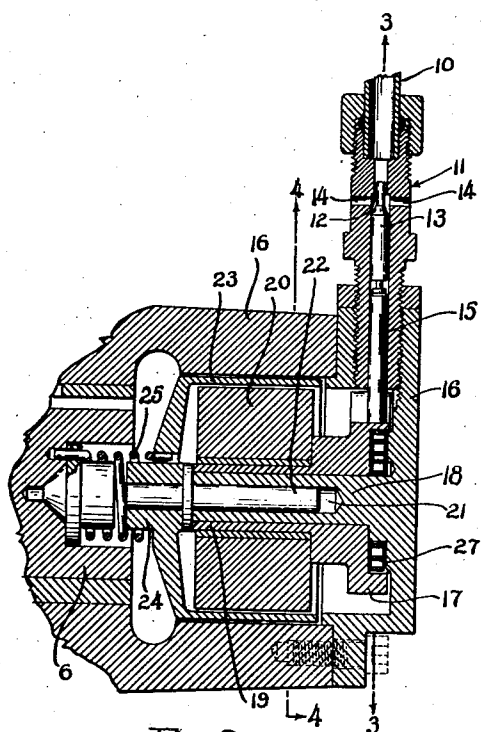


Fig. 2

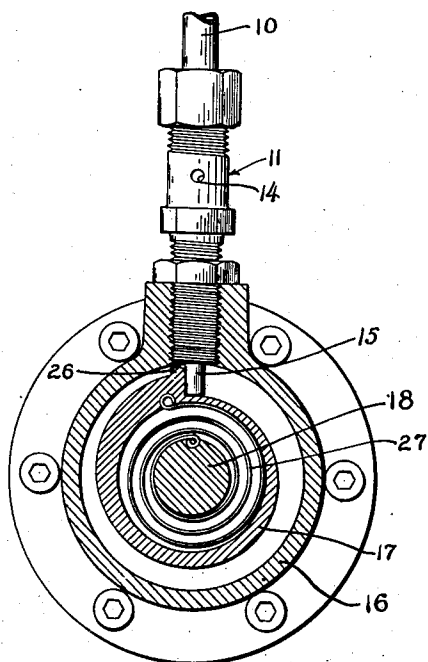


Fig. 3

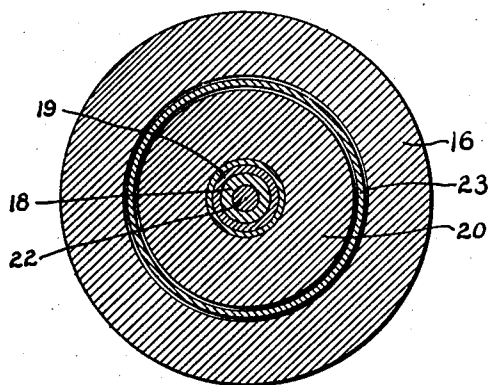


Fig. 4

Warren A. Stewart

INVENTOR

BY

Robert A. Stewart

ATTORNEY

Dec. 9, 1941.

W. A. STEWART
COMPRESSOR UNLOADER

2,265,675

Filed Aug. 7, 1941.

3 Sheets-Sheet 3

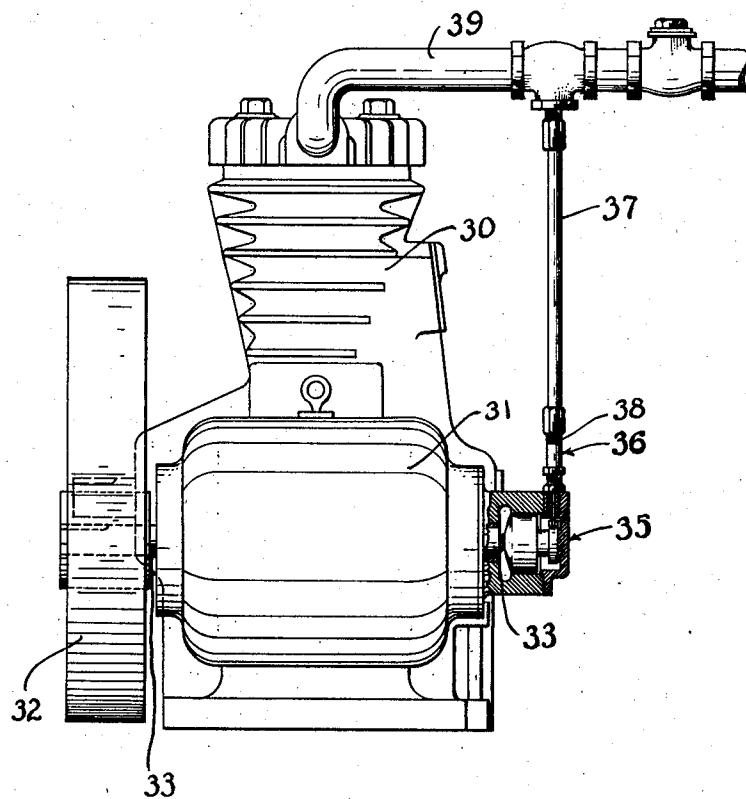


Fig. 5

Warren A. Stewart
INVENTOR

BY

Robert H. Meyer

ATTORNEY

UNITED STATES PATENT OFFICE

2,265,675

COMPRESSOR UNLOADER

Warren A. Stewart, Holyoke, Mass., assignor to
Worthington Pump and Machinery Corpora-
tion, Harrison, N. J., a corporation of Delaware

Application August 7, 1941, Serial No. 405,733

7 Claims. (Cl. 230-22)

This invention relates to compressors, and more particularly to compressor loading and unloading means.

An object of this invention is to provide an unloading mechanism of the start and stop type for compressors, which will unload the compressor upon its stopping and maintain it in unloaded condition after it has started, until the compressor has picked up speed, thereby minimizing the load upon the prime mover of the compressor during starting and stopping periods of operation.

Another object of the present invention is to provide a stop and start unloader for compressors which utilizes a combination of centrifugal and magnetic actions for operating a valve to control the loading and unloading of the compressor.

With these and other objects in view, as may appear from the accompanying specification, the invention consists of various features of construction and combination of parts, which will be first described in connection with the accompanying drawings, showing a compressor unloader of the preferred form embodying the invention, and the features forming the invention will be specifically pointed out in the claims.

In the drawings:

Figure 1 is a vertical section through an air or gas compressor showing the improved unloading means associated therewith.

Figure 2 is an enlarged sectional view of the improved unloading means.

Figure 3 is a cross-section on line 2-3 of Figure 2.

Figure 4 is a cross-section on line 4-4 of Figure 2.

Figure 5 is an elevation, partly in section, of a modification of the invention showing the unloader operated from the shaft of the motor employed in driving the compressor.

Referring more particularly to the drawings, an air or gas compressor of any approved type is illustrated at 1, having the compression space 2 in the cylinder thereof, from which the air or gas compressed passes into the discharge line or pipe 3. The piston 4 of the compressor is reciprocated in the usual manner from the crank 5 of the compressor shaft 6, and the latter is rotated by any suitable type of prime mover (not shown).

The discharge pipe 3 has a conduit 10 connected thereto. However, this conduit may be connected to the compression space 2 of the compressor, directly, instead of through the dis-

charge outlet line 3, without departing from the spirit of the present invention.

The conduit 10 opens into a valve casing 11, which has a valve seat 12 formed therein, against which a valve 13 is adapted to seat, for cutting off communication from the interior of the conduit 10 with atmosphere, through the ports 14 in the valve housing 11.

A valve operating stem 15 extends into the valve housing 11, for moving the valve 13. The inner or lower end of the stem 15 projects into the hub housing 16 formed on the compressor 1, and rests upon the perimeter of a cam member 17. This cam member 17 rotates upon a stub shaft 18, formed on the housing 16. The cam 17 has a sleeve 19 thereon upon which is mounted, for rotation with the cam, an electric magnet 20. This electric magnet 20 may be of any suitable type and size, of a type which may be purchased upon the market.

The stub shaft 18 is provided with a longitudinally extending bore 21, in which is rotatably seated a pin or shaft 22. A cup member 23 is carried by the shaft 22, and is rotatable either with or independently of the magnet 20, as will be hereinafter described. This cup member 23 is connected through its hub 24 and a yieldable coupling 25 with the crank shaft 6 of the compressor, so that the cup 23 will rotate with the rotation of the shaft 6.

The inner surface of the cup 23 is spaced from the perimeter of the magnet 20, as clearly shown in the drawings.

In operation, when the compressor starts, the rotation of the shaft 6 will be imparted to the cup 23, and this cup will rotate independently of the magnet 20. As the speed of rotation of the cup 23 increases, with the increase in speed of the compressor shaft rotation, the magnetic pull correspondingly increases until at a certain speed of compressor operation the magnetic pull will be such as to cause the magnet 20 to rotate with the cup 23. The rotation of the magnetic member 20 with the cup 23 will in turn cause rotation of the cam 17. The cam 17, as will be noted in Figure 3 of the drawings, has a perimeter concentric of its axis of rotation, so that as the cam rotates it will push the stem 15, which rests thereon, outwardly, thus moving the valve 13 towards its seat, until the stop 26 formed on the perimeter of the cam engages the stem 15, at which time the valve 13 will be held on its seat, closing communication between the discharge line 3 of the compressor and atmosphere and resulting in loading of the compressor. The contact of the stop 26 with the

stem 15 arrests the rotation of the cam 17 and consequently of the magnet 20 so that during the continued operation of the compressor the cup 23 will rotate independently of the magnet 20.

When the compressor stops operation the spring 27, which is connected to the cam 17 at its one end and to the housing 16 at its other, will reverse the rotation of the cam, allowing the stem 15 to move inwardly or downwardly under its own weight, permitting the valve 13 to move off its seat 14 and thus opening the discharge of the compressor, or the compression space of the compressor, to atmosphere by means of the conduit 10, valve housing 11 and ports 14. This action allows the compressor to be operated in an unloaded condition upon the compressor being again started, until of course such time as the compressor reaches its proper compressing speed, when the before described cycle of operation of the unloader will again shut off communication with atmosphere.

In the modified construction shown in Figure 5 of the drawings the compressor 30 is shown as driven by an electric motor 31 through the medium of a suitable power transmission means 32. While an electric motor 31 is shown, it is to be understood that any suitable type of prime mover may be employed for driving the compressor without departing from the spirit of the present invention.

The motor 31 has a driving shaft 33 from which the compressor is driven, and in this modified form the magnetic unloading mechanism 35 is associated with the shaft 33 of the motor 31 and is driven thereby for controlling the loading and unloading of the compressor. The valve structure 36 is identical in construction with the valve structure shown in Figures 1 to 4 inclusive, and in fact the entire unloader mechanism 35 is identical with the unloader mechanism shown in Figures 1 to 4 of the drawings, and operates in the same manner.

The conduit 37, which corresponds to the conduit 10, connects the valve housing 38 with the discharge line 39 of the compressor 30 to open this discharge line and the compression space of the compressor 30 to atmosphere for unloading the compressor, in the same manner as described in connection with Figures 1 to 4 inclusive of the drawings.

It will be understood that the invention is not to be limited to the specific construction or arrangement of parts shown, but that they may be widely modified within the invention defined by the claims.

What is claimed is:

1. In an unloader for compressors, the combination with a compressor including an operating shaft and a compression space, of a valve housing having a passage open to said compression space and to atmosphere to permit unloading of the compressor, a valve in said housing seated to close said passage to atmosphere to load the compressor and unseated when the compressor is not operating to unload the compressor, a magnet, a cam connected to said magnet for movement therewith for seating said valve and holding it in seated position, means yieldably connected to said compressor shaft for rotation therewith and cooperating with said magnet when the shaft reaches a predetermined speed of rotation to set up magnetic pull sufficient to rotate said magnet and cam for seating the valve and holding it seated.

2. In an unloader for compressors, the combi-

nation with a compressor including an operating shaft and a compression space, of a valve housing having a passage open to said compression space and to atmosphere to permit unloading of the compressor, a valve in said housing seated to close said passage to atmosphere to load the compressor and unseated when the compressor is not operating to unload the compressor, a magnet, a cam connected to said magnet for movement therewith for seating said valve and holding it in seated position, means yieldably connected to said compressor shaft for rotation therewith and cooperating with said magnet when the shaft reaches a predetermined speed of rotation to set up magnetic pull sufficient to rotate said magnet and cam for seating the valve and holding it seated, and a stop on said cam for arresting movement of the cam and magnet when the valve is fully seated.

3. In an unloader for compressors, the combination with a compressor including an operating shaft and compression space, of a valve housing having a passage open to said compression space and to atmosphere to permit unloading of the compressor, a valve in said housing seated to close said passage to atmosphere to load the compressor and unseated when the compressor is not operating to unload the compressor, a magnet, a cam connected to said magnet for movement therewith for seating said valve and holding it in seated position, means yieldably connected to said compressor shaft for rotation therewith and cooperating with said magnet when the shaft reaches a predetermined speed of rotation to set up magnetic pull sufficient to rotate said magnet and cam for seating the valve and holding it seated, a stop on said cam for arresting movement of the cam and magnet when the valve is fully seated, and a spring connected to said cam to move it out of valve holding position upon stopping of the compressor.

4. In an unloader for compressors, the combination with a compressor including an operating shaft and a compression space, of a valve housing having a passage open to said compression space and to atmosphere to permit unloading of the compressor, a valve in said housing seated to close said passage to atmosphere to load the compressor and unseated when the compressor is not operating to unload the compressor, a pair of elements mounted for independent or unitary movement and operative to seat said valve and to hold it seated for loading the compressor, one of said elements being connected to said shaft for movement upon operation of the compressor, one of said elements being a magnet, said elements co-acting when the compressor reaches a predetermined speed of operation to set up magnetic pull sufficient to move them in unison to seat said valve and load the compressor.

5. In an unloader for compressors, the combination with a compressor including an operating shaft and a compression space, of a valve housing having a passage open to said compression space and to atmosphere to permit unloading of the compressor, a valve in said housing seated to close said passage to atmosphere to load the compressor and unseated when the compressor is not operating to unload the compressor, a pair of elements mounted for independent or unitary movement and operative to seat said valve and to hold it seated for loading the compressor, one of said elements being connected to said shaft for movement upon operation of the compressor,

one of said elements being a magnet, said elements co-acting when the compressor reaches a predetermined speed of operation to set up magnetic pull sufficient to move them in unison, and means operated upon unitary movement of said elements to seat said valve and load the compressor.

6. In an unloader for compressors, the combination with a compressor including an operating shaft and a compression space, of a valve housing having a passage open to said compression space and to atmosphere to permit unloading of the compressor, a valve in said housing seated to close said passage to atmosphere to load the compressor and unseated when the compressor is not operating to unload the compressor, a pair of elements mounted for independent or unitary movement and operative to seat said valve and to hold it seated for loading the compressor, one of said elements being connected to said shaft for movement upon operation of the compressor, one of said elements being a magnet, said elements co-acting when the compressor reaches a predetermined speed of operation

to set up magnetic pull sufficient to move them in unison, means operated upon unitary movement of said elements to seat said valve and load the compressor, and means connected to said valve seating means to move the valve seating means upon stopping of the compressor to permit unseating of the valve and unloading of the compressor.

7. In combination, a compressor including a compression space, an operating motor for said compressor having an operating shaft, a valve housing carried by said motor and having a passage open to the compression space and to atmosphere to permit unloading of the compressor, a valve in said housing seated to close said passage to atmosphere to load the compressor, a magnet, means actuated by movement of said magnet to seat said valve to load the compressor, means movable by rotation of said motor shaft and cooperating with said magnet to set up magnetic pull when the shaft reaches a predetermined speed of rotation to move the magnet for operating said valve seating means.

WARREN A. STEWART.