June 15, 1954 G. W. HARTWELL 2,681,177

COMPRESSOR UNLOADING MECHANISM

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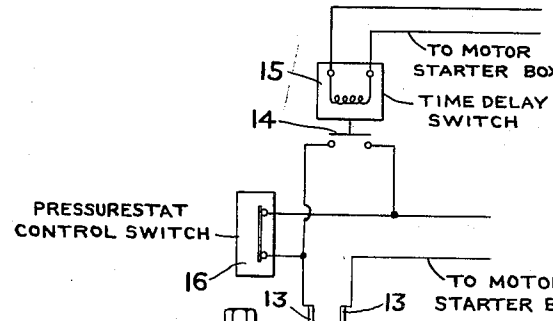


FIG. 1

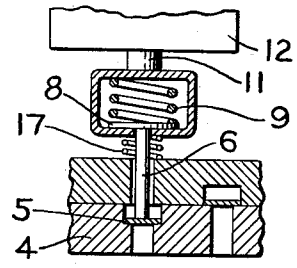
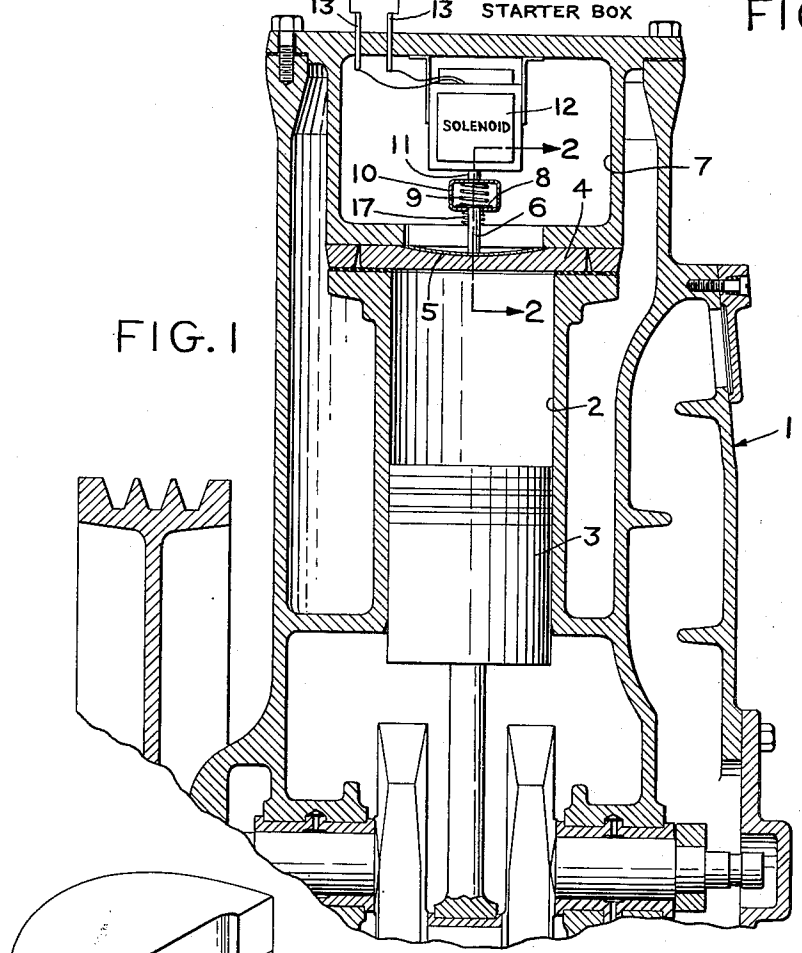


FIG. 2



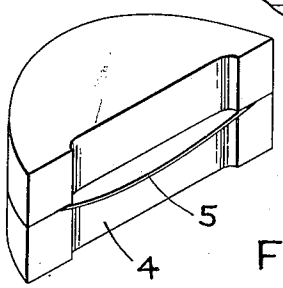


FIG. 3

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COMPRESSOR UNLOADING MECHANISM

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3 Claims. (Cl. 230—24)

1

This invention relates to air and gas compressors and more particularly to an unloader mechanism for unloading and loading compressors.

An object of the present invention is to provide mechanism for unloading compressors wherein the inlet valve is held open to unload the compressor by means of an unloader finger or fingers moved into valve opening position by an electric current operated solenoid.

Heretofore, in attempted compressor unloading mechanisms employing solenoids difficulty has been experienced due to an "air gap" being left in the electric solenoid under some operating conditions, thus causing vibration, overheating and burning of the solenoid coil and rendering the mechanism impractical.

An object of the present invention is to provide a compressor unloading mechanism employing an electric solenoid for operating the valve operating finger or fingers which includes a yieldable connection between the solenoid core and valve operating finger so that in the event the valve is moved to the limit of its open position before the solenoid core has traversed its travel range, the core may continue its movement to the limit of its range and prevent any "air gap" being left in the solenoid.

Another object of the present invention is to provide a compressor unloading mechanism employing an electric solenoid which has associated in combination therewith a time delay switch and a pressurestat control switch whereby the compressor is unloaded upon starting to enable it and its operating motor to "pick up" normal operating speeds before loading of the compressor, and also whereby the compressor may be unloaded and loaded while operating upon the attainment of predetermined suction pressure conditions, discharge pressure conditions, or load demand as expressed by pressure in the receiver into which the compressor discharges.

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 unloading mechanism of a 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 fragmentary section through a compressor showing the unloading mechanism associated therewith.

Figure 2 is an enlarged detail section taken on the line 2—2 of Figure 1.

2

Figure 3 is a fragmentary perspective view of one type of compressor valve with which the unloader mechanism is applicable for use.

Referring more particularly to the drawings, 1 indicates a compressor of any approved type embodying the cylinder 2 and the piston 3. The compressor includes an inlet valve 4 which in the present application is shown as the flexible strip type of valve specifically illustrated in Figure 3 of the drawings, wherein a thin "feather-like" valve strip flexes between an open and closed position, moving upwardly (as seen in Figure 3 of the drawings) or downwardly (as shown in Figure 1 of the drawings) into its bowed valve opening position and moving flat into straight valve closing position. While this particular type of valve, known in the compressor trade as a "feather" valve is shown in the drawings, it is understood that the unloading mechanism of the present invention may be employed with any suitable type of compressor inlet valve without departing from the spirit of the present invention.

In the drawings, the valve strip 5 is engaged by the unloading finger or fingers 6 which extend into the open suction space 7 in the head of the cylinder 2 of the compressor. The finger or fingers 6 have a flat head 8 on their outer ends which is engaged by a power expansion type coil spring 9. The spring 9 is enclosed in a housing 10 which also encloses the head 8 and is slidable relative to the unloading finger or fingers 6. The housing 10 is connected to the core of a solenoid 12 by a stem 11. The solenoid 12 is of any approved construction of electrical solenoid and is supported in any suitable manner within the head 7 of the cylinder 2 of the compressor.

The solenoid 12 is connected in the electric circuit which energizes the motor (not shown) which operates the compressor through suitable leads 13. Connected in the electrical circuit between the solenoid and the energizing source (not shown) are two control elements, namely, a switch 14 which is operated by a time delay relay 15 of any approved construction which may be purchased upon the open market, and a pressurestat control switch 16 which is of any approved construction that may be purchased upon the open market. The time delay relay actuated switch structure 14 and 15 is connected in the energizing circuit which controls operation of the motor (not shown) of the compressor so that when the compressor is first started this switch will operate to energize the solenoid and move the unloading finger or fingers 6 under action of the core of the solenoid 12 and the power spring 9 will move the valve 5 into open position and

thus permit the compressor to operate in an unloaded condition. After the time has elapsed for which the time delay relay is set, the relay will act to open the switch 14 and deenergize the solenoid thereby permitting the return spring 17 which engages the housing 10 to move the unloading finger or fingers 6, power spring 9, solenoid core and stem 11 outwardly to permit the valve 5 to operate in its normal manner and to permit the compressor to operate in a loaded condition. It is understood, of course, that the time delay relay is set so that sufficient time interval will elapse when the switch is closed to permit the compressor to reach its normal operating speed before the compressor is loaded.

The pressurestat control switch 16 may have its pressure actuated elements (not shown) connected in the suction line of the compressor so that while the compressor is running and when the suction pressure reaches a predetermined degree, i. e., the degree at which the pressurestat control 16 is set the switch 16 will operate to energize the solenoid to move the unloader fingers to open the suction valve 5 and unload the compressor. Thus the loading and unloading of the compressor is provided both as a starting unloader and as a safety unloader when the suction pressure reaches the desired or predetermined degree.

The provision of the power spring 9 which transmits the movement of the solenoid core and stem 11 to the unloader finger 6 provides a flexible operating connection between these elements so that in the event the unloading fingers reach the maximum point of their movement before the core of the solenoid has reached the maximum of its range of movement the spring 9 will permit the solenoid core to continue its movement until it does reach the limit of its range of movement, thus preventing the leaving of an "air gap" in the solenoid which causes vibration and burning of the solenoid and consequently would destroy the effectiveness of the unloader mechanism.

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 unloading mechanism for compressors, an unloader finger engaging the inlet valve of a compressor, an electric solenoid including a core, a housing connected to said core, a head on said unloader finger and slidably located within said housing, a power spring in said housing and in engagement with said head for establishing a yieldable connection between the solenoid core and unloader finger, and a return spring engaging said housing.

2. In an unloading mechanism for compressors, a compressor comprising a cylinder, a valve controlling the flow of fluid to the cylinder and a head including a suction space, a solenoid located within said suction space and including a movable core, a housing connected to said core, a valve operating finger having a head thereon slidably connected to said housing, a spring engaging said housing and said head to urge said finger in valve engaging position and a second spring engaging said housing for moving said finger out of valve engaging position.

3. In an unloading mechanism for compressors, a compressor comprising, a cylinder, a valve controlling the flow of fluid to the cylinder and a head including a suction space, a solenoid located within said suction space and including a movable core, a housing connected to said core, and a valve operating finger having a head thereon located in said housing and yieldably and slidably connected thereto whereby when said solenoid is energized the core can traverse its full distance and no air-gap will be formed in said solenoid.

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