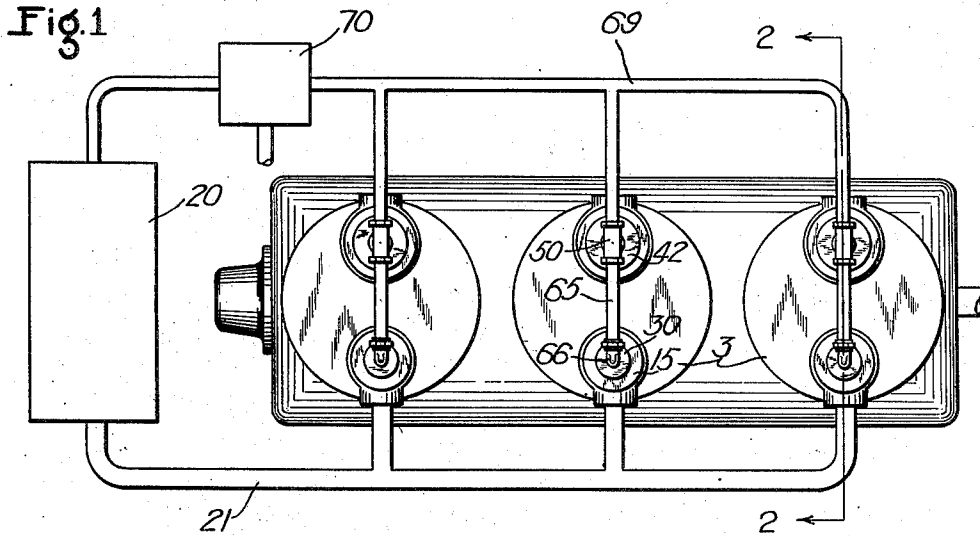
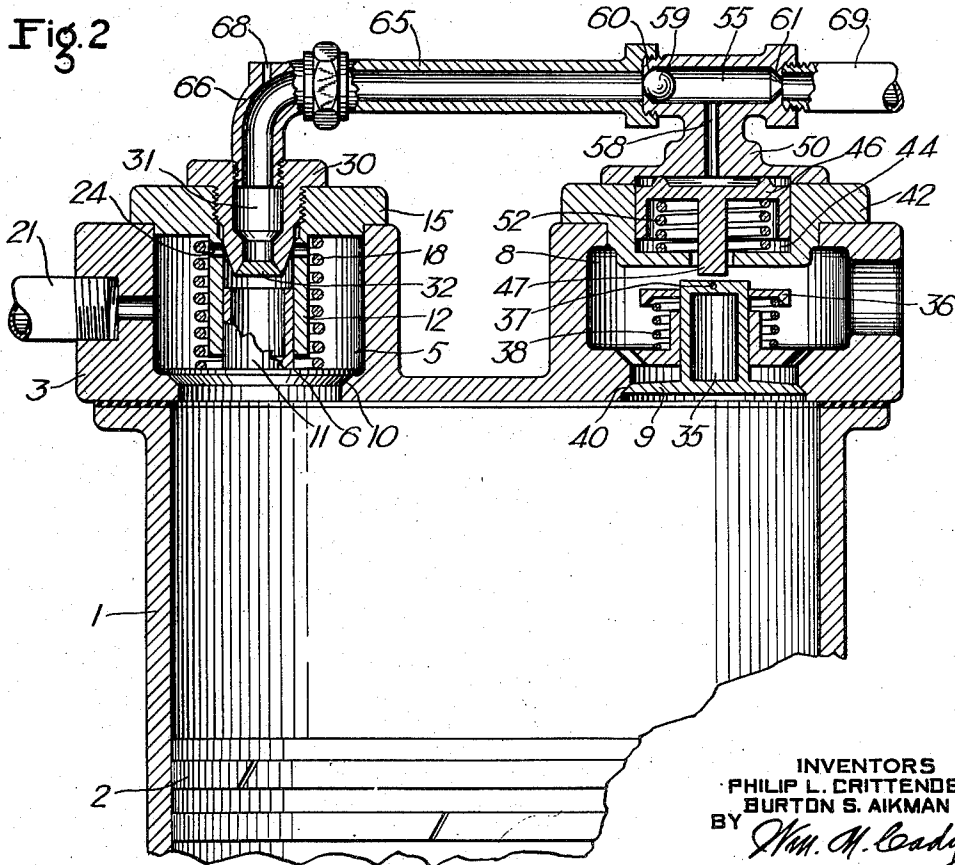


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COMPRESSOR PROTECTIVE DEVICE

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COMPRESSOR PROTECTIVE DEVICE

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13 Claims. (Cl. 230—27)

This invention relates to a compressor protec-
tive means and more particularly to a safety or
protective means responsive to temperature con-
ditions of the fluid compressed by the compressor
and controlling means for unloading the com-
pressor.

In the operation of fluid compressors, such as
air compressors, there is a possibility that the
temperature of the fluid compressed will in-
crease beyond a safe limit, and if this occurs,
it may cause an explosion, a fire or result in
damage to the compressor.

As usually constructed multi-cylinder com-
pressors have unloading means associated with
each of the cylinders, together with common
means for controlling the operation of the un-
loading means for all of the cylinders.

It is the principal object of this invention to
provide a multi-cylinder compressor in which
each cylinder has fluid pressure operated unload-
ing means associated therewith, together with
means responsive to temperature conditions of
the fluid compressed in each of these cylinders
for controlling the operation of the unloading
means associated with said cylinder.

Another object of the invention is to provide
a compressor having unloading means associated
therewith, the unloading means being operable
in response to an unloading controller which is
operable in accordance with operating conditions
of the compressor, or to means responsive to tem-
perature conditions of the fluid compressed by the
compressor.

A further object of the invention is to pro-
vide a multi-cylinder compressor in which each
cylinder has fluid pressure operated unloading
means associated therewith, together with means
responsive to temperature conditions of the fluid
compressed in the cylinder for controlling the
operation of the unloading means associated with
said cylinder, and having common means for con-
trolling the operation of the unloading means
for all of the cylinders.

Another object of the invention is to provide
a multi-cylinder compressor having means for
effecting the unloading of all of the cylinders,
together with means associated with each of the
cylinders to effect unloading of the individual
cylinders in response to temperature conditions
of the fluid compressed in each of said cylinders.

A further object of the invention is to provide
a compressor having means to effect unloading
thereof in response to temperature conditions of
the fluid compressed by the compressor together
with a signal operable when the compressor is

unloaded by the means responsive to temperature
conditions of the fluid compressed therein.

Another object of the invention is to provide
a compressor having means responsive to tem-
perature conditions in the discharge passage
leading from the compressor, said means being
positioned so as to be protected from oil and
foreign matter discharged with the air com-
pressed by the compressor.

Other objects of the invention and features
of novelty will be apparent from the following
description taken in connection with the accom-
panying drawing, in which Fig. 1 is a diagram-
matic view of a compressor incorporating the
protective means provided by this invention, and
Fig. 2 is an enlarged sectional view taken sub-
stantially along the line 2—2 of Fig. 1.

Referring to the drawing, the safety means
provided by this invention is shown diagram-
matically in connection with a multi-cylinder
compressor. As shown, each of the cylinders
has a bore therein in which is located a piston,
and to which is detachably secured by suit-
able means, not shown, a cylinder head.

The cylinder head has a chamber formed
therein, in which is located the exhaust valve,
and in addition has a chamber formed
therein, with which is associated the inlet valve.

The exhaust valve is adapted to engage a
seat formed around a passage communicating
with the chamber and with the chamber in
the cylinder above the piston, and has a
hollow stem formed integral therewith which
is slidable in and is guided by the tubular ex-
tension, which is formed integral with the
closure member which is secured on the top
of the cylinder head and closes the chamber.
A spring is interposed between the closure
member and the exhaust valve and nor-
mally urges the valve into engagement with the
seat.

The chamber is connected with the reservoir
by way of the branched pipe, the other
branches of which are connected to the other
cylinders of the compressor as shown in Fig. 1
of the drawing.

The chamber within the tubular member
communicates with the chamber by way of
openings extending through the walls of the
tubular member.

A bushing is secured in the closure member
and has a tapered end portion which extends
into the chamber within the tubular member.
The bushing has an aperture extending
therethrough, the lower end of which is conical

in form, the portion of larger diameter being located at the bottom. A plug 32, formed of a suitable fusible metal adapted to melt when increased to a predetermined temperature is positioned in the conical portion of the aperture 31.

The inlet valve 9 has a tubular extension 35 formed integral therewith and extending through a bore in the cylinder head 3 and has a spring seat 36 secured on the upper end thereof by means of a pin 37. A spring 38 is interposed between the spring seat 36 and a portion of the cylinder head 3 and normally urges the inlet valve 9 into engagement with a seat 40 formed on the cylinder head 3.

The compressor has unloading means associated with the inlet valve, and as shown comprises a closure member 42 secured on the cylinder head 3 over the inlet valve 9. This member has a bore 44 formed therein in which is mounted a piston 46 having a stem 47 formed integral therewith and engageable with the tubular extension 35 on the inlet valve 9.

The upper end of the bore 44 is closed by a member 50 and the piston 46 is normally urged into engagement with this member by means of a spring 52.

The member 50 has a double seating check valve incorporated therein. As shown in the drawing the member 50 has a bore or passage 55 formed therein and communicating intermediate its ends by way of the passage 58 with the chamber above the piston 46. A ball check valve 59 is positioned in the bore 55 and is engageable with the seat 60 formed at one end of the bore 55 and the seat 61 formed at the other end of the bore 55.

One end of the passage 55 is connected by way of a pipe 65 and an elbow 66 with the aperture 31 in the bushing 30 above the plug 32. The elbow 66 has an atmospheric exhaust passage 68 therein communicating with the passage in the elbow and with the atmosphere.

The other end of the passage 55 is connected by means of a branched pipe 69 with an unloading device, indicated generally by the reference numeral 70, and which may be of any suitable well known construction, and which operates to control the supply and release of fluid under pressure to and from the pipe 69 in response to the variations in the pressure of the fluid compressed by the compressor or to other operating conditions, such as the speed of the compressor or the operation of the compressor lubricating system. One form of unloading controller which we may employ is shown in the co-pending application of Burton S. Aikman, Serial No. 4,042, filed January 30, 1935.

In the operation of the compressor on the downward stroke of the piston fluid is drawn into the chamber above the piston 2 through the chamber 8 and past the inlet valve 9. On the upward stroke of the piston the inlet valve 9 seats and the fluid which is compressed unseats the exhaust valve 6 so that the fluid flows to the chamber 5 and therefrom by way of the pipe 21 to the reservoir 20.

When the pressure of the fluid in the reservoir 20 is built up to a predetermined value or upon the occurrence of other conditions to which the unloading means is responsive, the unloading device 70 operates to supply fluid under pressure from the reservoir by way of the branched pipe 69 to the passage 55, where the fluid forces the ball check valve 59 away from the seat 61 and into engagement with the seat 60. Fluid

thereupon flows from the passage 55 by way of the passage 58 to the chamber above the piston 46 and forces this piston downwardly against the spring 52 so that the stem 47 engages the end of the tubular portion 35 associated with the inlet valve 9, with the result that the inlet valve 9 is moved away from the seat 40 and the compressor is unloaded.

The ball check valve 59 operates at this time to prevent fluid from flowing from the passage 55 to the pipe 65 and therefrom to the aperture 31 where it might operate to displace the fusible plug 32. The compressor remains unloaded until the unloading device 70 operates to effect loading thereof by releasing fluid under pressure from the pipe 69, which permits the spring 52 to move the piston 46 upwardly and thus permit the inlet valve 9 to again be moved to its seat by the spring 38.

If for any reason, such as for instance, a leaking exhaust valve 6 which permits fluid to flow from the reservoir 20 back into the chamber above the piston 2, thereby increasing pressure of fluid in this chamber and causing a corresponding increase in the temperature of the fluid compressed by the compressor, the temperature of the fluid compressed should exceed a predetermined value, the temperature of the fusible plug 32 will be increased, and if the increase in the temperature of this plug is sufficient the plug will be melted and fluid will be permitted to flow from the chamber 5 through the aperture 31 to the pipe 65.

The fluid which is supplied to the pipe 65 forces the ball check valve 59 away from the seat 60 and into engagement with the seat 61 so as to cut off communication between the unloading means and the unloading controller 70 and the passage leading to the unloading means associated with the other cylinders of the compressor. The fluid which is supplied to the passage 55 flows through the passage 58 to the chamber above the piston 46, forcing the piston downwardly and moving the inlet valve 9 away from the seat 40. It will be seen, therefore, that on an increase in the temperature of the fluid compressed in a cylinder to a value above a predetermined value the cylinder will be unloaded.

It will be seen also that the unloading means is arranged so that the unloading means for each cylinder is separate and individual to itself and the unloading of any cylinder as a result of temperature conditions in this cylinder does not affect the other cylinders of the compressor, the unloading means for each cylinder being cut off from the unloading controller when fluid under pressure is supplied thereto as a result of the operation of the temperature responsive means. The other cylinders of the compressor, therefore, will continue to operate in the normal manner after a cylinder has been unloaded because of temperature conditions of the fluid compressed in this cylinder.

When fluid is supplied to the unloading means as a result of melting of the fusible plug 32, fluid under pressure is permitted to escape to the atmosphere by way of the passage 68 and this produces an audible signal to indicate to the operator that a cylinder is unloaded.

It will be seen also that the fusible plug 32 is located in the chamber within the tubular member 12 and is shielded from the fluid in the chamber 5, although it is in communication therewith. As the fusible plug is shielded from the flow of fluid through the chamber 5 it will not become

covered with carbon or oil deposited in the chamber 5 as a result of the flow of fluid therethrough and hence will at all times be immediately responsive to an increase in the temperature of the fluid in the chamber 5.

While one embodiment of the compressor protective device provided by this invention has been illustrated and described in detail it should be understood that the invention is not limited to these details of construction and that numerous changes and modifications may be made without departing from the scope of the following claims.

Having now described our invention, what we claim as new and desire to secure by Letters Patent, is:

1. In a fluid compressor, a plurality of cylinders in which fluid is compressed, each of said cylinders having unloading means associated therewith, common means to control the operation of the unloading means for all of the cylinders, each of said cylinders having means associated therewith and responsive to temperature conditions of the fluid compressed in said cylinder and operable to effect the operation of the unloading means associated with said cylinder.

2. In a fluid compressor, a plurality of cylinders in which fluid is compressed, each of said cylinders having unloading means associated therewith, common means to control the operation of the unloading means for all of the cylinders, each of said cylinders having means associated therewith and responsive to temperature conditions of the fluid compressed in said cylinder and operable to effect the operation of the unloading means associated with said cylinder independently of the common means controlling the operation of the unloading means for all of the cylinders.

3. In a fluid compressor, a plurality of cylinders in which fluid is compressed, each of said cylinders having fluid pressure operated unloading means associated therewith, common means for controlling the supply of fluid to all of said unloading means, each of said cylinders having means associated therewith and responsive to temperature conditions of the fluid compressed in the cylinder and operable to control the supply of fluid under pressure to the unloading means associated with said cylinder.

4. In a fluid compressor, a plurality of cylinders in which fluid is compressed, each of said cylinders having fluid pressure operated unloading means associated therewith, common means for controlling the supply of fluid to all of said unloading means, each of said cylinders having means associated therewith and responsive to temperature conditions of the fluid compressed in the cylinder and operable to control the supply of fluid under pressure to the unloading means associated with said cylinder, each of said cylinders having means associated therewith and operable responsive to the supply of fluid to the unloading means by the temperature responsive means to close the communication through which fluid is supplied to the unloading means by the common means.

5. In a fluid compressor, a plurality of cylinders in which fluid is compressed, each of said cylinders having fluid pressure operated unloading means associated therewith, common means for controlling the supply of fluid to all of said unloading means, each of said cylinders having means associated therewith and responsive to temperature conditions of the fluid compressed in the cylinder and operable to control the supply

of fluid under pressure to the unloading means associated with said cylinder, each of said cylinders having means associated therewith and operable responsive to the supply of fluid to the unloading means by the common means to close the communication through which fluid is supplied to the unloading means by the temperature responsive means.

6. In a fluid compressor, a plurality of cylinders in which fluid is compressed, each of said cylinders having fluid pressure operated unloading means associated therewith, common means for controlling the supply of fluid to all of said unloading means, each of said cylinders having means associated therewith and responsive to temperature conditions of the fluid compressed in the cylinder and operable to control the supply of fluid under pressure to the unloading means associated with said cylinder, and a signal operable in response to the supply of fluid to the unloading means by the temperature responsive means.

7. In a fluid compressor, a plurality of cylinders in which fluid is compressed, each of said cylinders having unloading means associated therewith, common means to control the operation of the unloading means for all of the cylinders, each of said cylinders having means associated therewith and responsive to temperature conditions of the fluid compressed in said cylinder and operable to effect the operation of the unloading means associated with said cylinder, and a signal operable in response to operation of the temperature responsive means to effect operation of the unloading means.

8. In a fluid compressor, a plurality of cylinders in which fluid is compressed, each of said cylinders having fluid pressure operated unloading means associated therewith, each of said cylinders having means associated therewith and responsive to temperature conditions of the fluid compressed therein and controlling a passage through which fluid may be supplied to the unloading means associated with said cylinder, an unloading controller controlling passages through which fluid may be supplied to the unloading means associated with all of said cylinders, each of said cylinders having means associated therewith and operable responsive to the supply of fluid to the unloading means through the passage controlled by the temperature responsive means or through the passage controlled by the unloading controller to cut off communication between the unloading means and the other of said passages.

9. In a fluid compressor, a cylinder in which fluid is compressed, fluid pressure operated unloading means associated with said cylinder, said cylinder having associated therewith means responsive to temperature conditions of the fluid compressed therein and controlling a passage through which fluid under pressure may be supplied to the unloading means, an unloading controller controlling a passage through which fluid may be supplied to the unloading means, and means responsive to the supply of fluid to the unloading means through either of said passages for cutting off communication between the unloading means and the other of said passages.

10. In a fluid compressor, a cylinder in which fluid is compressed, fluid pressure operated unloading means associated with said cylinder, said cylinder having associated therewith means responsive to temperature conditions of the fluid compressed therein and controlling a passage

through which fluid under pressure may be supplied to the unloading means, an unloading controller controlling a passage through which fluid may be supplied to the unloading means, means
5 responsive to the supply of fluid to the unloading means through either of said passages for cutting off communication between the unloading means and the other of said passages, and a
10 signal operable in response to the supply of fluid to the unloading means through the passage controlled by the temperature responsive means.

11. In a fluid compressor, a cylinder in which fluid is compressed, fluid pressure operated unloading means associated with said cylinder,
15 means operated in response to operating conditions of the compressor for supplying fluid under pressure to said unloading means to effect unloading of the compressor, and means responsive
20 to the temperature conditions of the fluid compressed by the compressor for also supplying fluid under pressure to said unloading means.

12. In a fluid compressor, a cylinder in which fluid is compressed, fluid pressure operated unloading means associated with said cylinder,
25 means operated in response to operating conditions of the compressor for supplying fluid under

pressure to said unloading means to effect unloading of the compressor, means responsive to the temperature conditions of the fluid compressed by the compressor for also supplying
5 fluid under pressure to said unloading means, and a check valve operated by the flow of fluid under pressure from one of said fluid pressure supply means for cutting off communication from
10 said unloading means to the other fluid pressure supply means.

13. In a fluid compressor, a cylinder in which fluid is compressed, fluid pressure operated unloading means associated with said cylinder, means operated in response to operating conditions of the compressor for supplying fluid under
15 pressure to said unloading means to effect unloading of the compressor, means responsive to the temperature conditions of the fluid compressed by the compressor for also supplying fluid under pressure to said unloading means, and a
20 signal operable in response to operation of the temperature responsive means to supply fluid under pressure to the unloading means,

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