Jan. 9, 1951 A. E. SCHMIDLIN 2,537,094

AIR FILTER FOR COMPRESSED AIR SYSTEMS

Filed May 8, 1947 2 Sheets-Sheet 1

Fig. 1

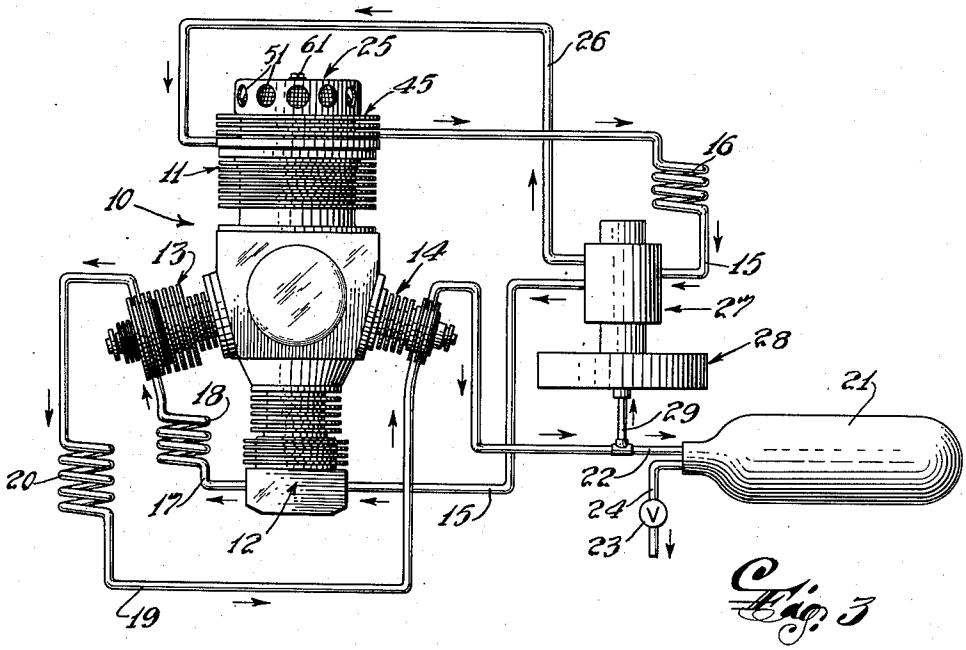


Fig. 3

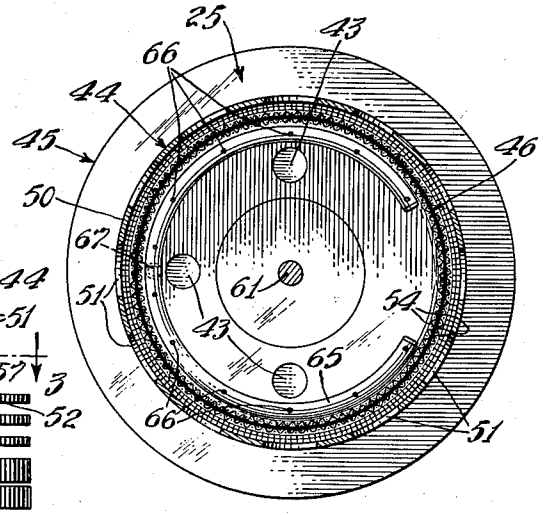
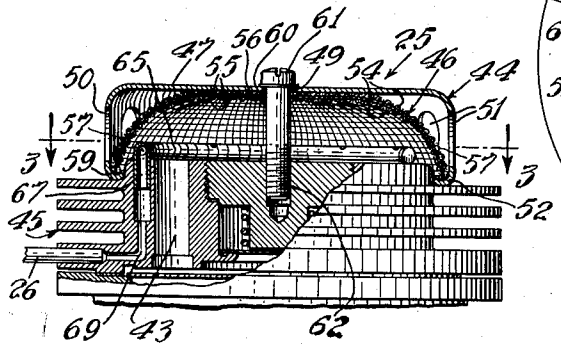


Fig. 2



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Filed May 8, 1947 2 Sheets-Sheet 2

Fig. 4

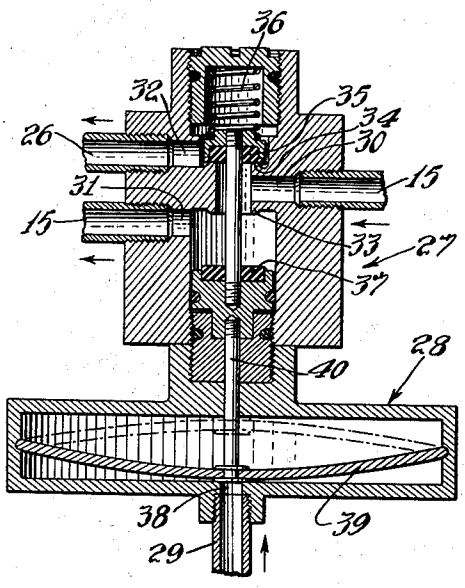


Fig. 6

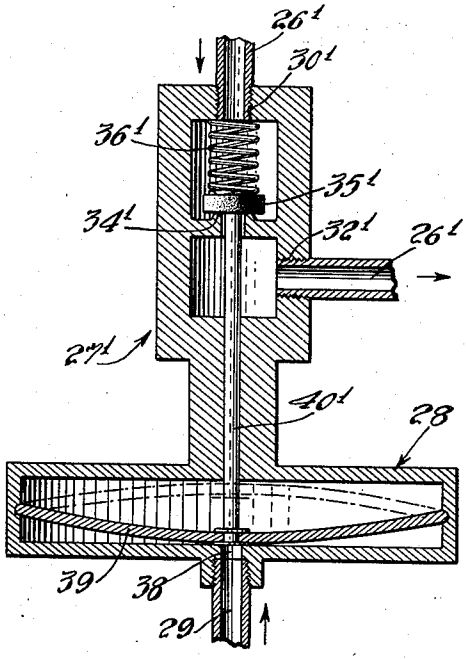
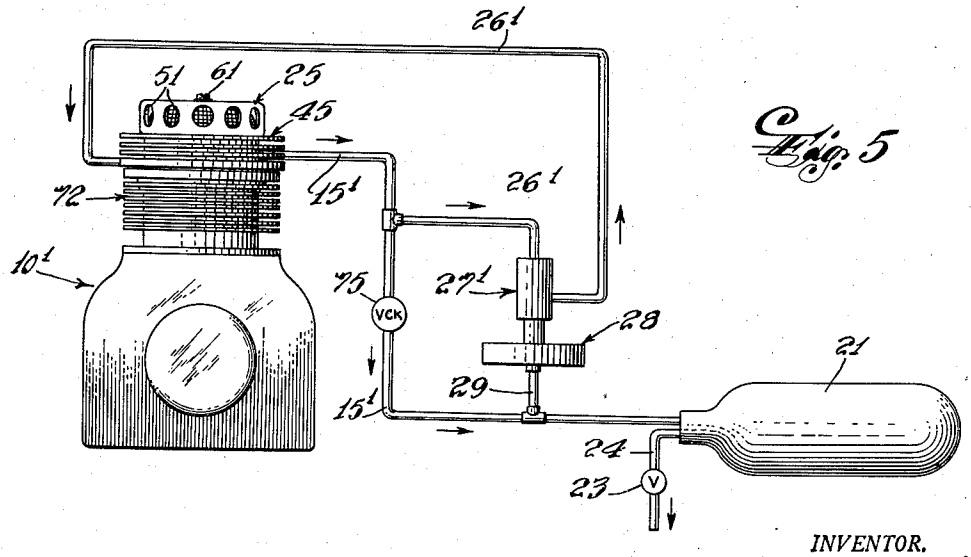


Fig. 5



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UNITED STATES PATENT OFFICE

2,537,094

AIR FILTER FOR COMPRESSED AIR SYSTEMS

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8 Claims. (Cl. 183—57)

1

The present invention relates to compressed air systems, and, more particularly, relates to air filter means for such systems.

The present invention is applicable to compressed air systems wherein the compressor is driven continually and the compressed air is stored in a receiver but is used only from time to time. In order to maintain the stored air at a predetermined pressure in such a system, by-pass means are provided for venting the compressed air supplied by the compressor to the atmosphere when the stored air attains a predetermined pressure value and for again supplying air to the receiver when the pressure therein falls to a predetermined value.

The present invention is directed to a compressed air system of the foregoing type wherein filter means are provided for filtering the air delivered from the exterior to the intake of the compressor and the by-passed compressed air is supplied to the intake of the compressor when the stored air in the receiver attains a predetermined pressure value.

Accordingly, an object of the present invention is to utilize the by-passed compressed air for cleaning the filter means.

Another object is to provide a blast of air for removing dirt particles from the filter means to reactivate the same.

Another object is to direct lubricating oil carried by the compressed air against the filter means to facilitate cleaning of the filter means.

Another object is to conserve the supply of lubricating oil by recirculating the by-passed air carrying oil picked up during its compression.

A further object is to provide apparatus for accomplishing the foregoing objects and advantages.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

In the drawings:

Figure 1 is a schematic view of a compressed air system embodying the present invention.

Figure 2 is a fragmentary enlarged view of the compressor, partly in section and partly in elevation, illustrating the filter means and the means for reactivating the same.

Figure 3 is a sectional view taken along the line 3—3 on Figure 2.

Figure 4 is an enlarged longitudinal sectional view illustrating by-pass control means.

Figure 5 is a schematic view of a modified compressed air system embodying the present invention.

2

Figure 6 is an enlarged longitudinal sectional view illustrating modified by-pass control means adapted to be utilized in the system shown in Figure 5.

Referring to Figure 1 of the drawings, there is shown an air compressor 10 of the multi-stage type herein illustrated as a radial compressor having first, second, third and fourth stages 11, 12, 13 and 14, respectively. The outlet of the first stage is connected to the inlet of the second stage by a conduit 15 provided with an intercooler 16 and a valve 27; the outlet of the second stage is connected to the inlet of the third stage by a conduit 17 provided with an intercooler 18; the outlet of the third stage is connected to the inlet of the fourth stage by a conduit 19 provided with an intercooler 20; and the outlet of the fourth stage is connected to a receiver or reservoir 21 for the compressed air by a conduit 22. The contents of the receiver are adapted to be dispensed through a discharge valve 23 in a conduit 24 connected to the receiver. The arrows applied to the conduits illustrate the direction of the flow of the air therethrough.

Air from the atmosphere is adapted to be supplied to the inlet of the first stage through a filter assembly 25 (Figures 2 and 3) and by-passed compressed air is adapted to be supplied to the inlet by a conduit 26 connecting the interior of the filter assembly to the conduit 15 by means of the valve 27 which is controlled by pressure operable means 28 (Figure 4) connected by a conduit 29 to the conduit 22.

As shown in Figure 4, the valve 27 comprises a body having a chamber therein provided with an inlet 30 and an outlet 31 for connection in the conduit 15, and a by-pass outlet 32 for connection to the conduit 26. A valve seat 33 is formed between the inlet 30 and the outlet 31 and a valve seat 34 is formed between the inlet 30 and the outlet 32. A valve member 35 for the seat 34 normally is retained thereon by a spring 36 and a valve member 37 for the seat 33 connected for movement with the valve member 35 normally is retained in unseated position and is arranged so that it is seated upon unseating of the valve member 35.

This operation is adapted to be effected by the pressure operable means 28 comprising a body connected to the valve body and having a chamber provided with an inlet 38 to which the conduit 29 is connected, a snap action diaphragm 39 in the chamber responsive to the pressure of the air admitted through the inlet 38, and a stem 40 connected to the diaphragm and the valve member 37.

The filter assembly 25, illustrated more particularly in Figures 2 and 3, comprises a cap-like casing 44 mounted over the intake ports 43 in the head 45 of the first stage cylinder, and an absorbent air filter element 46 positioned within the casing.

The casing 44 comprises a circular top wall 47 provided with a central aperture 49, and a cylindrical depending skirt or side wall 50 provided with a plurality of circumferentially spaced air inlet apertures 51 and having its lower edge turned inwardly and upwardly to form an annular groove 52. The filter element 46 is supported between a pair of disk-like screens 54 each having a top wall 55 adjacent the underside of the top wall 47 of the casing provided with a central aperture 56 and each having an arcuate downwardly and outwardly extending side wall 57 terminating in a free edge 59 seated in the annular groove 52. The filter element conforms to the shape of screens 54 and has a central aperture 60 in alignment with the aperture 49 of the casing 44 and the apertures 56 of the screens 54.

The filter assembly is removably secured to the cylinder head 45 by a bolt 61, or the like, extending through the apertures 49, 56 and 60 and screwed into a threaded aperture 62 of the head.

In order to clean or reactivate the filter element 46, a substantially annular tube 65 is mounted on the cylinder head 45 underneath and adjacent to the arcuate side wall 54 of the inner screen. The tube 65 has a plurality of circumferentially spaced upwardly facing apertures 66 for directing compressed air against the filter element. The tube is connected in fluid flow communication with the conduit 26 by a depending tube portion 67 thereof which is secured in one end of a passage 69 formed in the cylinder head and has the conduit 26 secured in its other end.

In operation, while the pressure of the air in the receiver 21 is below a predetermined value, the pressure operable means 28 maintains the valve members 35 and 37 in seated and unseated position, respectively, whereby the air compressed in the first stage 11 flows by way of the inlet 30, the outlet 31 and the conduit 15 to the intake of the second stage. Air is admitted to the intake ports 43 of the first stage through the apertures 51 in the casing 44, the filter element 46 and its supporting screens 54.

When a predetermined pressure has been established in the receiver, the pressure operable means 28 effects sudden unseating of the valve member 35 and seating of the valve member 37, whereby air compressed in the first stage is by-passed through the valve 27 by way of the inlet 30 and the outlet 32 and is conducted by the conduit 26 to the distributing tube 65 which directs it against the filter element 46.

The by-passed compressed air directed against the filter element is effective to blow out dust, dirt or other foreign particles which have collected on the filter element whereby the filter element is cleaned to increase the life of its effective use. At the commencement of the unloading phase, the rate of flow of by-passed air exceeds the intake rate of the first stage due to release of compressed air stored in the intercooler 16. This effect provides a sudden blast of air which has a highly efficient cleaning action on the filter.

Also, the by-passed compressed air picks up lubricating oil from the first stage of compression and portions of this oil are absorbed by the filter element to further reactivate its dirt catching properties. Since a substantial portion of the by-passed air re-enters the intake ports, the oil carried by this air remains in the system and serves to lubricate the piston and cylinder of the first stage.

When compressed air stored in the receiver is dispensed through the valve 23, the pressure in the receiver drops and pressure operable means 28 is rendered effective to cause sudden seating and unseating of the valve members 35 and 37, respectively, whereby the compressor supplies compressed air to the receiver.

While the invention has been described in connection with by-passing compressed air from the first stage, it will be understood that compressed air could be by-passed from any of the other stages if so desired.

In Figure 5, a modified compressed air system is illustrated, wherein similar parts have like reference numerals applied thereto. This system illustrates the present invention applied to a single stage compressor 10' having a cylinder 72, the outlet of which is connected to the receiver 21 by a conduit 15'. Air from the atmosphere is supplied to the inlet of the cylinder through the filter assembly 25 shown in Figures 2 and 3, and by-passed compressed air is supplied to the inlet by a conduit 26' connecting the interior of the filter assembly to the conduit 15'. The conduit 26' is provided with a by-pass valve 27' (Figure 6) controlled by pressure operable means 28 connected by a conduit 29 to the conduit 15'

The valve 27' comprises a body having a chamber therein provided with an inlet 30' and an outlet 32' for connection in the conduit 26', and a valve seat 34' between the inlet and outlet. A valve member 35' is retained on the valve seat by the pressure of the air admitted through the inlet and the pressure exerted by a spring 36' and is adapted to be unseated by the stem 40' of the pressure operable means 28 illustrated in Figure 6.

A check valve 75 is provided in the conduit 15' between the points at which the conduits 26' and 29 are connected thereto for preventing compressed air in the receiver from flowing back into the compressor outlet or into the by-pass conduit.

The head of the cylinder adjacent its intake ports is provided with a tube 65 (not shown) for distributing by-passed compressed air and directing the same on the filter element as described in connection with the first embodiment.

In operation, while the pressure of the air in the receiver is below a predetermined value, the pressure operable means 28 maintains the valve member 35' in seated position, whereby the air compressed in the cylinder 72 flows by way of the conduit 15' through the check valve 75 to the receiver. Air is admitted to the intake of the cylinder through the filter assembly 25.

When a predetermined pressure has been established in the receiver, the pressure operable means effects unseating of the valve member 35', whereby air compressed in the cylinder is by-passed through the valve 27' and is conducted by the conduit 26' to the interior of the filter assembly in the previously described manner.

From the foregoing description, it will be seen that the present invention provides a simple, economical and practical compressed air system

wherein by-passed air is used for cleaning or reactivating the filter, a sudden blast of air is provided to blow out particles accumulated by the filter, lubricating oil picked up by the compressed air is recirculated in the system to provide lubrication for the cylinder and piston, and a portion of this lubricating oil is utilized advantageously for further cleaning the filter and increasing its dirt catching ability without increasing its resistance to the flow of air therethrough.

As various changes may be made in the form, construction and arrangement of the parts herein, without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in any limiting sense.

It is also to be understood that the following claims are intended to cover all the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

I claim:

1. In a compressor having an intake port, the combination of a closure attached to the compressor over the intake port having an aperture for admitting air from the exterior to the intake port, air filter means between said aperture and the intake port, conduit means extending into said closure having an aperture adjacent said filter means for directing compressed air against said filter means at the interior thereof, means for conducting compressed air from the compressor to said conduit means, and means for controlling the supply of compressed air to said last mentioned means.

2. In a compressor having an intake port, the combination of a closure secured to the compressor over the intake port having apertures for admitting air from the exterior to said intake port, air filter means between said apertures and the intake port, means having a plurality of distributing apertures for directing compressed air against said filter means at the interior thereof, means for conducting compressed air from the compressor to said directing means, and means for controlling the supply of compressed air to said last mentioned means.

3. In a compressed air system, the combination of compressor means having means for admitting air from the exterior, air filter means for said admitting means, a receiver, means for conducting compressed air from said compressor means to said receiver, means for directing compressed air against said filter means, a by-pass conduit for conducting compressed air from said conducting means to said directing means, valve means in said by-pass conduit for controlling the flow of compressed air therethrough, and means operable in response to the pressure in said receiver for controlling said valve means.

4. In a compressed air system, the combination of a compressor having means for admitting air from the exterior, air filter means for said admitting means, a receiver, means for conducting compressed air from said compressor to said receiver having a check valve therein, means for directing compressed air against said filter means, and a by-pass conduit connected to said conducting means between said valve and said compressor for conducting compressed air from said conducting means to said directing means.

5. In a compressed air system, the combination of a compressor having means for admitting air from the exterior, air filter means for said admitting means, a receiver, means for conducting compressed air from said compressor to said receiver having a check valve therein, means for directing compressed air against said filter means, a by-pass conduit connected to said conducting means between said valve and said compressor for conducting compressed air from said conducting means to said directing means, valve means in said by-pass conduit for controlling the passage of compressed air therethrough, and means operable in response to the pressure in said receiver for controlling said valve means.

6. In a compressed air system, the combination of a multistage compressor having means for admitting air from the exterior at the first stage thereof, air filter means for said admitting means, a receiver, means for conducting compressed air from the first stage to a subsequent stage of compression, a conduit for conducting compressed air from the last stage of said compressor to said receiver, means for directing compressed air against said filter means, and a by-pass conduit for conducting compressed air from said conducting means to said directing means.

7. In a compressed air system, the combination of a multistage compressor having means for admitting air from the exterior at the first stage thereof, air filter means for said admitting means, a receiver, means for conducting compressed air from the first stage to a subsequent stage of compression including means for accumulating compressed air, a conduit for conducting compressed air from the last stage of said compressor to said receiver, means for directing compressed air against said filter means, and a by-pass conduit connected to said conducting means between the subsequent stage of compression and said accumulating means for conducting compressed air from said conducting means to said directing means.

8. In a compressed air system, the combination of a multistage compressor having means for admitting air from the exterior at the first stage thereof, air filter means for said admitting means, a receiver, means for conducting compressed air from the first stage to a subsequent stage of compression including means for accumulating compressed air, a conduit for conducting compressed air from the last stage of said compressor to said receiver, means for directing compressed air against said filter means, a by-pass conduit connected to said conducting means between the subsequent stage of compression and said accumulating means for conducting compressed air from said conducting means to said directing means, valve means in said by-pass conduit for controlling the passage of compressed air therethrough, and means operable in response to the pressure in said receiver for controlling said valve means.

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