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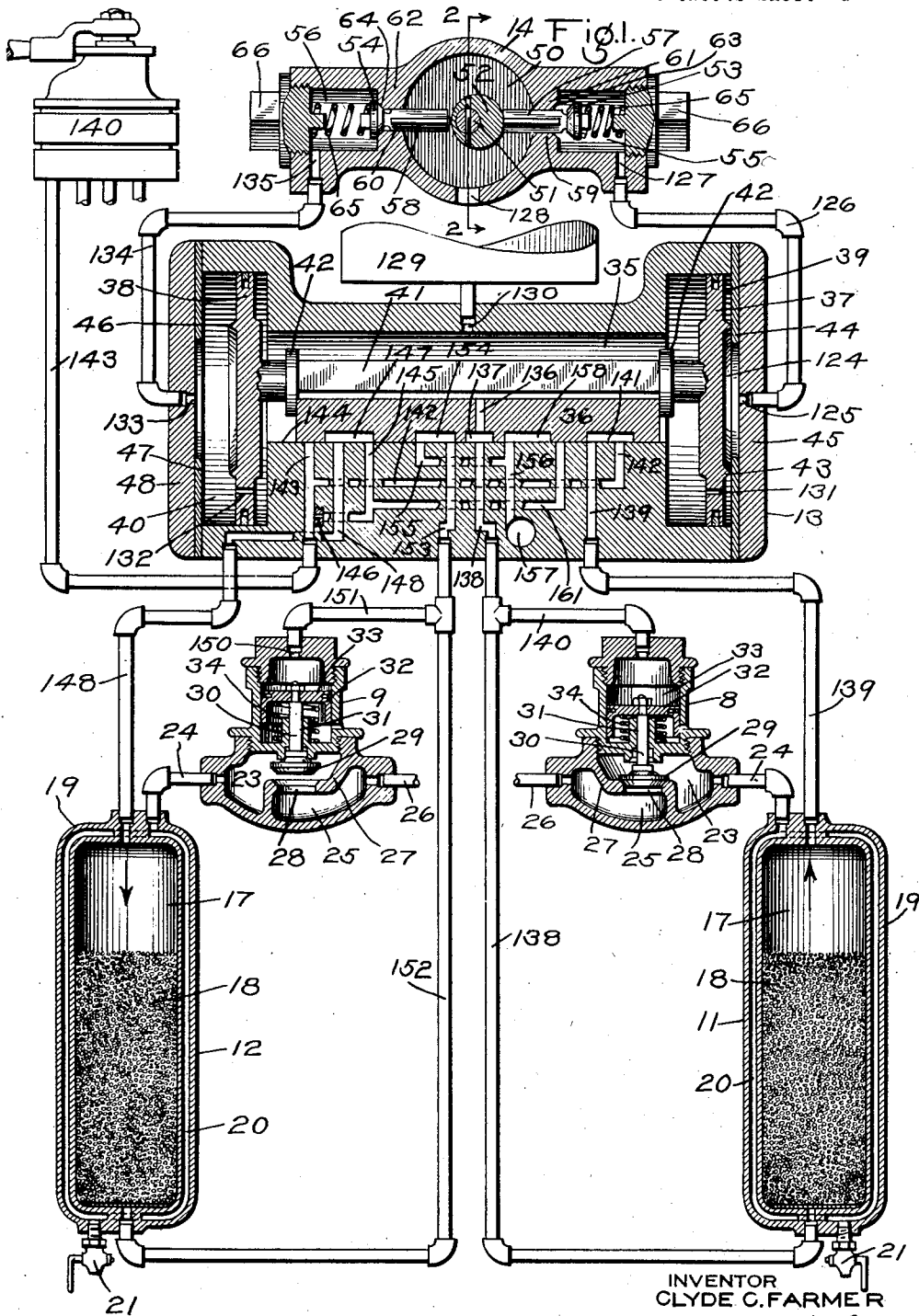
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AIR PURIFYING APPARATUS

Filed Sept. 29, 1928

2 Sheets-Sheet 1



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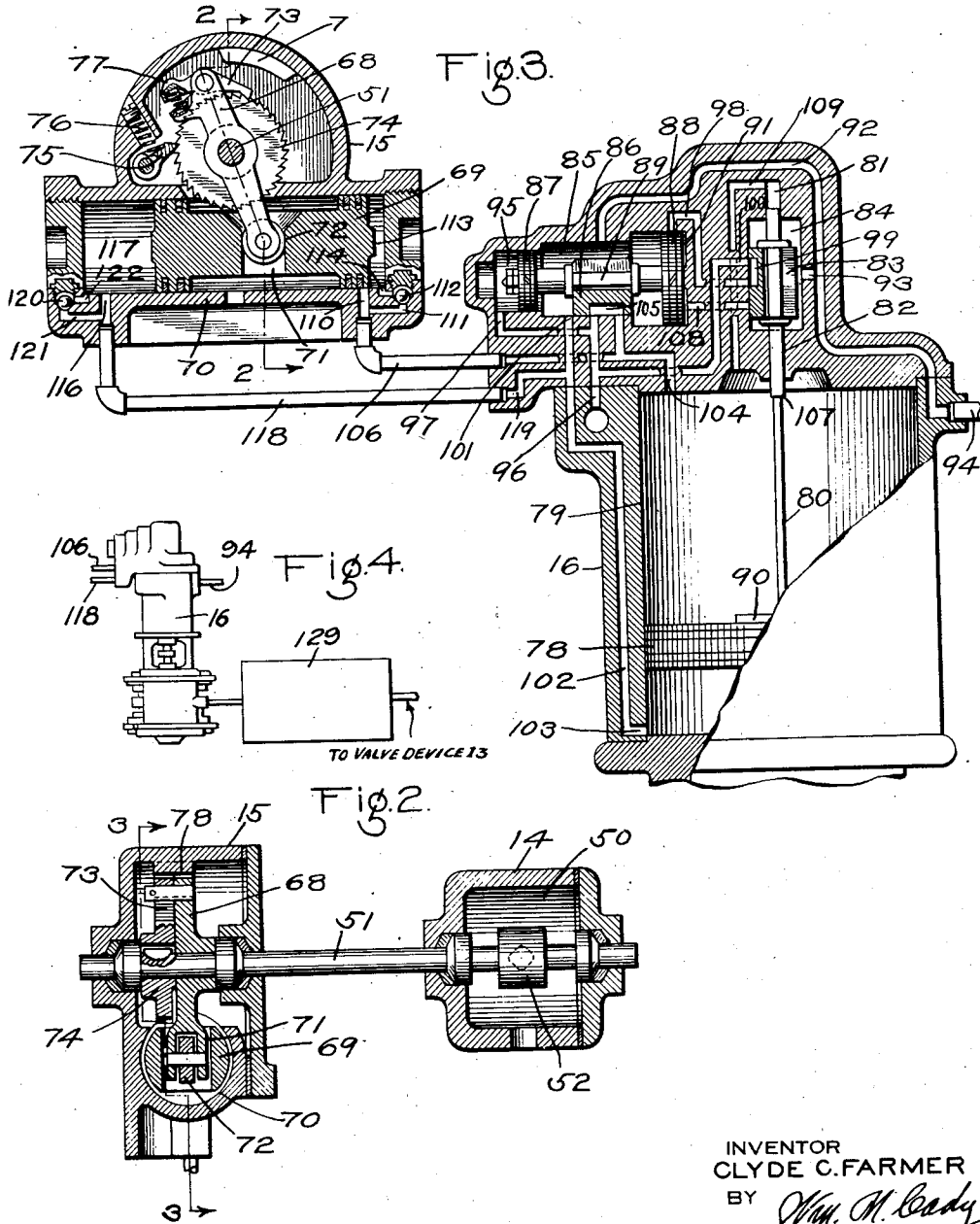
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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

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AIR PURIFYING APPARATUS

Application filed September 29, 1928. Serial No. 309,258.

This invention relates to air purifiers and more particularly to an apparatus for purifying air employed in a fluid pressure brake system.

5 An object of the invention is to provide an air purifying apparatus which is adapted to remove oil and water vapors contained in the fluid which is withdrawn from the main reservoir of an air brake system.

10 Another object of the invention is to provide an air purifying apparatus of the character specified in which the fluid is alternately conducted through a plurality of filters or purifying devices.

15 Another object of the invention is to provide an air purifying apparatus having a plurality of air purifying devices through which the fluid is alternately passed, and in which the means for altering the flow of fluid through the devices is controlled by the means provided for compressing the air.

20 Another object of the invention is to provide an air purifying apparatus containing a plurality of air purifying devices through which the fluid is alternately passed, and in which means are included for removing the impurities from the cleansing medium in the air purifying devices during the periods the devices are not functioning as filters.

25 Another object of the invention is to provide an improved air purifying apparatus of the character mentioned which is relatively simple in construction, and reliable and exact in function under all conditions of service.

30 The invention also comprises certain new and useful improvements in the construction, arrangement and combination of the several parts of which it is composed, as will be hereinafter more fully described and claimed.

35 In the accompanying drawings; Figure 1 is a diagrammatic sectional view of an air purifying apparatus constructed in accordance with my invention; Fig. 2 is a section taken on the line 2—2 of Fig. 1 showing the pilot valve and its actuator in transverse section; Fig. 3 is a section taken on the line 3—3 of Fig. 2 showing the pilot valve actuator operatively associated with a compressor; and Fig. 4 is a diagrammatic view of the fluid
40 compressor connected to the main reservoir.

With the usual fluid pressure brake system employed on railway trains and other vehicles, the apparatus is equipped with an air compressor and one or more main reservoirs into which the compressor compresses
55 air.

The compressed air carries in suspension more or less oil, which comes from the compressor, and water vapor, which is present in the air taken from the atmosphere by the
60 compressor.

It has been found that oil and water carried by the air, tends to collect in the several parts of the brake system, and in some cases, the deposits so formed, interfere with the desired operation of the brakes, and in view of this it is very desirable that the oil and water be removed from the air before it is supplied to the brake apparatus.

By the present invention means are provided for purifying the air when it is withdrawn from a main reservoir of a fluid pressure brake system, the air being passed alternately through a plurality of filtering devices, each containing a filtering medium capable of removing all of the oil and water vapors. The invention also includes means wherein the filtering device which is idle is automatically cleaned, so that when the air is again directed therethrough the purifying
70 agent in the filtering device will be free of all foreign matter.

Referring to the drawings, the apparatus may comprise two or more filtering devices 11, 12 (two being shown in the present
85 instance). These filters are connected in a manner to be described to a valve device 13 adapted to periodically change the flow of the compressed fluid so that the fluid will flow alternately through the filters. The valve
90 device 13 may be actuated by a pilot valve device 14 which is positively operated through the medium of a motor device 15 that is connected to an air compressor 16 and actuated thereby. The air compressor 16 may
95 be of the steam type usually mounted on locomotives and adapted to compress fluid into the usual main reservoir 129, as shown in Fig. 4.

The filtering devices 11, 12 are similarly 100

formed, and each comprises a chamber 17 containing a suitable filtering material 18, such for instance as silicon dioxide (SiO_2).

The chamber 17 is enclosed by a jacket 19 which is spaced from the wall of the chamber so as to provide a steam chamber 20, for a purpose to be hereinafter more fully described. For the purpose of enabling the steam chambers to be drained, each of the filtering devices is provided with a drain cock 21.

Associated with the filtering device 11, and designed to permit the circulation of steam through the chamber 20 thereof, is a control valve device 8. A similar device 9 is also used in conjunction with the filtering device 12.

Each steam control valve device comprises a casing having a chamber 23 connected to the steam chamber 20 by a pipe 24 and a chamber 25 which is supplied with steam from a suitable source of supply through a pipe 26. The chambers 23 and 25 are separated by a wall 27 containing an opening 28 having a seat for a valve 29.

The valve 29 has a stem 30 which is slidably mounted in a bore 31 formed in the casing. The stem 30 carries a piston 32 mounted in a chamber 33. On one side, the piston 32 is subject to the pressure of an expansible coil spring 34, while on its opposite side the piston is subject to the pressure of fluid in chamber 33.

The valve device 13 has a chamber 35 containing a slide valve 36 which is actuated by two pistons 37 and 38, mounted respectively in chambers 39 and 40 formed in the casing of the valve device 13. The pistons 37 and 38 are connected by a rod 41 which has shoulders or flanges 42 engaging the slide valve 36 in such a manner that relative movement of the piston causes a corresponding movement of the slide valve.

The outer face of the piston 37 is provided with a seat rib 43 which is adapted to engage a gasket 44 mounted on the end wall 45 of the valve device 13.

Likewise, the outer face of the piston 38 is provided with a seat rib 46 which is adapted to engage a gasket 47 mounted on the end wall 48 of the valve device 13.

The pilot valve device 14 is formed with a cylindrical chamber 50 through which is passed a rotatable shaft 51 carrying a cam 52. The shaft 51 is centrally disposed relative to the chamber 50, while the cam 52 is eccentrically mounted on the shaft 51.

The cam 52 is adapted to actuate a pair of diametrically disposed valves 53 and 54, the head of the valve 53 being disposed in a chamber 55 formed in the casing of the pilot valve device 14 on one side of the chamber 50, while the head of the valve 54 is disposed in a chamber 56 formed in the opposite side of the casing of the pilot valve device.

The valves 53 and 54 are provided with fluted stems 57 and 58 respectively, which stems are slidably mounted in openings 59 and 60 respectively formed in walls 61 and 62 separating the chambers 55 and 56 from the chamber 50. The wall 61 is formed with a seat 63 for the valve 53, while the wall 62 has a seat 64 for the valve 54. The construction and arrangement of the valves 53 and 54 is such that when one valve is seated, the other valve will be unseated by the cam 52.

For the purpose of pressing the valves 53 and 54 towards their seats, use is made of expansible coil springs 65, one of which is mounted in the chamber 55 and bears against the head of valve 53, while the other is mounted in chamber 56 and bears against the head of valve 54. The tension of the valve springs 65 may be adjusted by means of nuts 66 threaded into the end walls of the chambers 55 and 56 respectively. The nuts 66 also serve as means for plugging the ends of the casing of the pilot valve device 14, and should it be necessary to reseal or replace the valves 53 and 54, the nuts 66 can be easily removed so as to expose the interior of the valve chambers 55 and 56, as will be readily understood.

The shaft 51 of the pilot valve device 14 is also mounted in the casing of the motor device 15 heretofore referred to. Loosely mounted on the portion of the shaft 51 within the casing of the motor device 15 is an arm 68 which is oscillated by a double end piston 69 mounted in a cylinder 70 formed as a part of the casing. The piston 69 has a slot 71 formed therein so as to receive a roller 72 carried by one end of the arm 68.

The end of the arm 68 opposite to the roller 72 carries a spring pressed pawl 73 which engages the teeth of a ratchet wheel 74 fixed to the shaft 51. The ratchet wheel 74 is adapted to be actuated in a manner to be described to revolve the shaft 51, and in order to prevent a back motion of the ratchet wheel, I utilize a second pawl 75 which is held in contact with the ratchet wheel by means of a spring 76.

Mounted within the casing of the motor device 15 and disposed within the path of a projection 77 formed on the pawl 73, is a cam face 7 adapted to disengage the nose end of the pawl from its engagement with the ratchet wheel 74 when the arm reaches the forward end of its stroke.

The air compressor 16 has a main steam piston 78 which is mounted in a cylinder 79. The piston 78 has a rod 80, one end of which is guided by a pair of spaced bores 81 and 82 formed in the head of the compressor.

The piston rod 80 carries a reversing valve 83 which is disposed within a chamber 84 formed in the head of the compressor between the guide openings 81 and 82.

A main valve 86 for the compressor is mounted in a chamber 85. This valve is

operated by two pistons 87 and 88 of unequal diameters and connected by the valve stem 89.

The movement of pistons 87 and 88 and the main valve 86 is controlled by the reversing valve 83 which in turn is operated by the main steam piston 78, by means of rod 80 and a reversing plate 90.

The purpose of the reversing valve 83 is to alternately admit steam or to discharge it from a chamber 91, at the right of piston 88, thus alternately balancing or unbalancing this piston. The reversing valve 83 is operated by the rod 80. This rod is alternately moved up and down by the plate 90 in the manner understood by those skilled in the art.

In operation, chambers 84 and 85 of the air compressor 16 are always in free communication with each other and with the steam inlet through ports 92 and 93, as shown in Fig. 3. Live steam, which is admitted to the port 92 through supply pipe 94, is therefore always present in chambers 84 and 85. Chamber 95, at the left of small piston 87, is always open to the exhaust passage 96 through port 97. Exhaust steam, substantially at atmospheric pressure, is therefore always present in chamber 95.

A balancing port 109 leads from the bore 81 and enters the upper end of the cylinder 79. The object of this port is to assure the same pressure above as below the reversing rod 80, whether there is live or exhaust steam in the upper end of the cylinder, thus balancing it so far as steam pressure is concerned.

When reversing slide valve 83 is in its lower position, as shown in Fig. 3, chamber 91 is connected through port 98, reversing valve exhaust cavity 99 and port 100 with main exhaust passage 96, and there is, therefore, only atmospheric pressure at the right of piston 88.

Therefore, as chamber 95, at the left of piston 87, and chamber 91, at the right of piston 88, are then both connected to the exhaust, as already explained, the pressure of the steam in chamber 85 has driven the larger piston 88, to the right, and it has pulled the smaller piston 87, and the main valve 86, with it to the position shown in Fig. 3.

The main valve 86, is then admitting steam below piston 78, through ports 101, 102, 103. Piston 78 is thereby forced upward, and the steam above piston 78 passes through port 104, exhaust cavity 105 of main valve 86 to passage 96 which discharges the steam into the atmosphere. However, inasmuch as port 104 is also connected to a pipe 106 leading to the driving device 15, not all of the steam passing through the port 104 will be exhausted to the atmosphere.

When piston 78 reaches the upper end of its stroke, reversing plate 90 strikes a shoulder 107 on rod 80, forcing the rod and the

reversing slide valve 83 upward sufficiently to open port 108. The pressures upon the two sides of piston 88 are thus equalized or balanced. Considering piston 87, the conditions are different. Chamber 95, as heretofore stated, is always open to the exhaust. As piston 88 is now balanced, the steam pressure in chamber 85 forces piston 87 to the left, drawing with it piston 88 and the main slide valve 86.

With main valve 86 thus positioned, steam is admitted from chamber 85, through port 104, above piston 78 forcing it down, at the same time the steam below piston 78 is exhausted to the atmosphere through ports 103, 102, 101, exhaust cavity 105, and port 96.

When piston 78 reaches the lower end of its stroke, the reversing valve 83 will be drawn down to the position shown in Fig. 3, and one complete cycle of the steam end of the compressor has been completed.

The pipe 106 leading from port 104 of the air compressor 16 is connected to a port 110 provided in the driving device 15. The port 110 is intersected by a passage 111 containing a ball check 112 which normally closes the passage 111 from a chamber 113 at the right of piston 69.

As shown in Fig. 3, when piston 78 of the air compressor is down, piston 69 of the driving device 15 will be disposed at the right end of cylinder 70, the head of the piston 69 covering port 110. Therefore, steam forced through port 104 during the upward movement of piston 78, will flow through pipe 106, port 110 and passage 111, unseat the ball check 112, and enter chamber 113 through restricted passage 114, forcing piston 69 to the left. When port 110 is uncovered, due to this movement of the piston 69, unrestricted pressure will be admitted into chamber 113 to drive the piston to the left.

The end of the cylinder 70 to the left of piston 69 is provided with a port 116 which leads from chamber 117 through pipe 118 and passage 119 to port 102 of the compressor 16. Inasmuch as port 102 communicates to the atmosphere through port 101, exhaust cavity 105, and port 96, as has been heretofore described, pressure in chamber 117 will be relieved and therefore piston 69 will be free to move to the left.

As pawl 73 is engaged with ratchet wheel 74, the movement of piston 69 will swing arm 68 forwardly thereby transmitting an angular movement to the ratchet wheel, and consequently to shaft 51. The movement of arm 68 will continue until the projection 77 on the pawl 73 is brought into contact with cam face 7 which latter will trip the pawl 73. Pawl 75 will then prevent any reversal of the ratchet wheel, as has been heretofore pointed out.

When port 116 is covered by piston 69, a pressure build up will occur bringing the pis-

ton to rest without shock, as ball check 120 will prevent any further exhaust.

From the foregoing it will be noticed that pistons 69 and 78 are arranged in parallel, an upward stroke of piston 78 causing a stroke to the left of piston 69. When the direction of the stroke of piston 78 is reversed, steam will be admitted to chamber 117, through ports 103, 102, 119, pipe 118, passage 121, past ball check 120, and through restricted passage 122, to cause a reversal of stroke of piston 69. The movement of piston 69 to the right will be an idle stroke, returning the parts to their original position. Thus a continuous reciprocating motion of piston 69 will be converted into an intermittent rotary motion of shaft 51.

Referring to Fig. 1, when cam 52 on shaft 51 is in the position illustrated, valve 53 will be unseated, and valve 54 will be seated. When valve 53 is unseated chamber 124 on the right of piston 37 of the reversing valve device 13 will be open to atmosphere through port 125, pipe 126, port 127, chamber 55, opening 59, chamber 50, and vent 128. Therefore, piston 37 will be tightly seated against gasket 44 by the pressure of the fluid in chamber 35.

On the other hand, air from the main reservoir 129 enters chamber 35 through supply port 130, and flows through port 131 in piston 37 into the closed chamber 39 surrounding seat rib 43, and through port 132 in piston 38 into chamber 40, and thence through port 133, pipe 134, port 135, to chamber 56. However, as valve 54 is closed, pressure will build up in chambers 40 and 56 until the pressure in chamber 40 equalizes with that in chamber 35, and the pistons 37 and 38 will be positioned to the right, as shown.

With the valve 36 in the position shown, the air from main reservoir 129 flows through port 136, valve cavity 137, passage and pipe 138 to the bottom of the filtering device 11, where it is filtered and then conducted to the reversing valve 13 through pipe and passage 139.

The valve 29 of the steam control device 8 is seated by the pressure of fluid admitted to chamber 33 through pipe 140 leading from pipe 138, which fluid acts on piston 32. With valve 29 seated, steam from the supply pipe 26 will be prevented from flowing into chamber 20, and therefore the air flowing through the filtering device 11 will not be heated.

When the purified air enters the valve device 13 through passage 139, it is conducted to the supply port of the brake valve 140 by valve cavity 141, passage 142, and passage and pipe 143. Passage 143 terminates, at one end, at valve seat 144, and the open end of this passage will be lapped by the slide valve 36, as shown in Fig. 1.

Passage 143 is open to a passage 145 having a restricted portion or choke 146 formed

therein. Therefore, a portion of the purified air from the filtering device 11 will pass from passage 143 into passage 145, and be conducted thereby to valve cavity 147, and then flow through passage and pipe 148 to the top of the filtering device 12.

The steam control valve device 9 for the filtering device 12 will be so positioned that steam from the supply pipe 26 can flow into the steam chamber 20, inasmuch as valve 29 of the device 9 will be unseated through pressure exerted by spring 34 against piston 32. With valve 36 in the position shown in Fig. 1 chamber 33 of valve device 9 will be open to atmosphere through port 150, pipe 151 which is connected to the main air supply pipe 152 for the filtering device 12, passage 153, valve cavity 154, passages 155 and 156, and atmospheric exhaust port 157.

Passage 156 terminates, at one end at valve seat 144. When the valve 36 is positioned as shown in Fig. 1, the upper end of this passage will be lapped, and therefore all fluid flowing through the filtering device 12 will pass to the atmosphere.

In this manner while air is passing upwardly through the filtering device 11, air will flow downwardly through the filtering device 12 (see arrows Fig. 1), the air carrying the impurities in the filtering material of the filter 12 outwardly through the atmospheric exhaust port 157.

The air will continue to pass through filtering device 11, until cam 52 has been rotated in the manner heretofore described an amount sufficient to permit spring 65 to force valve 53 to its seat thereby closing the vent to chamber 55.

When valve 53 is seated, pressure of fluid in chamber 35 passing through port 131 of piston 37 will build up in chamber 39 and the pistons 37 and 38 and slide valve 36 will be moved to the left.

In the meantime, cam 52 will have been rotated an amount sufficient to engage the end of valve stem 58 thereby gradually unseating valve 54. This action will vent the fluid in chamber 40 to the atmosphere through port 133, pipe 134, port 135, chamber 56, opening 60, chamber 50 and vent 128, and thus pistons 37 and 38 will be permitted to move freely to shift the position of slide valve 36 whereby passage 153 will register with valve cavity 137.

When the slide valve 36 is thus positioned to the left, seat rib 46 on piston 38 will engage the gasket 47 thereby closing port 133, and the air entering chamber 35 from the main reservoir 129 will flow through port 136, valve cavity 137, passage 153 and pipe 152, and enter the bottom of the filtering device 12. A portion of the air flowing through pipe 152, will pass through branch pipe 151 and enter chamber 33 of the steam control device 9. In this way sufficient pressure is

built up in chamber 33 of the steam control device 9 to force piston 32 downwardly, thereby seating valve 29 and shutting off the supply of steam to the chamber 20 of the filtering device 12.

The air flowing upwardly through the filtering device 12 is conducted by pipe and passage 148 to valve cavity 147, and as this cavity registers with passage 143, the purified air will be conducted therethrough to the brake valve 140.

Inasmuch as passage 143 communicates with passages 142 and 145, a portion of the air flowing upwardly through the filtering device 12 will pass from passage 143 into passages 142 and 145, the amount of air entering the latter passage being restricted by choke 146. However, as the end of passage 142 at the valve seat 144 will be lapped by the end of the slide valve 36 no air will flow there-through. Similarly, the open end of passage 142 at the valve seat 144 will also be lapped by the slide valve 36, but as passage 142 is in communication with a passage 161 leading to the valve seat 144 adjacent to valve cavity 141, the air will be conducted to passage and pipe 139 and enter the top of the filtering device 11. The air then flows downwardly through this filtering device and is conducted to the atmosphere by pipe and passage 138, valve cavity 158, passage 156 and exhaust port 157.

As has been just described, the air in pipe and passage 138 is vented to the atmosphere when the slide valve 36 is moved to the left. Therefore fluid in chamber 33 can pass through pipe 140 to the atmosphere, and with the pressure of the fluid in chamber 33 thus relieved, spring 34 will force piston 32 of the steam supply valve device 8 upwardly, thereby unseating valve 29, whereupon steam from the supply pipe 26 of the device 8 will be free to flow into the chamber 20 of the filtering device 11, heating the chamber for the purpose permitting the ready removal of the foreign matter contained in the chamber 17, as will be understood.

In this manner the air from the main reservoir 129 of an air brake system is effectively cleansed of all oil and water vapors by passing the same alternately through the filtering devices 11 and 12. The invention also includes the novel arrangement of reversible valves which are actuated by the air compressor so that a predetermined amount of air is passed through one filtering device, while the other filtering device is being automatically cleaned by passing the air therethrough in the opposite direction to which it flows when being purified.

While one illustrative embodiment of the invention has been described in detail, it is not my intention to limit its scope to that

embodiment or otherwise than by the terms of the appended claims.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. An air purifying apparatus including in combination, a reservoir, a compressor for supplying fluid into said reservoir, a plurality of filters, and means controlled by said compressor for alternately forcing fluid from said reservoir through said filters.

2. An air purifying apparatus having a reservoir, means for supplying air under pressure to the reservoir, two filters, and means actuated by said pressure means for directing the air from the reservoir alternately to each filter.

3. An air purifying apparatus having a reservoir, means for supplying air under pressure to the reservoir, a pair of filters, and means actuated by said pressure means for alternately directing the air from the reservoir to each filter in a direction for removing the impurities from the air and in a direction for removing impurities from the filters.

4. An air purifying apparatus having a reservoir, means for supplying air under pressure to the reservoir, a pair of filters, means actuated by said pressure means for alternately directing the air from the reservoir to each filter in a direction for removing the impurities from the air and in a direction for removing impurities from the filters, and means for heating the filters when the same are being cleaned.

5. An air purifying apparatus having a reservoir, means for supplying air under pressure to the reservoir, a pair of filters connected to the reservoir and adapted to alternately receive air therefrom, and valve means actuated by the said pressure means for directing the air from the reservoir alternately to each of the filters.

6. An air purifying apparatus having a reservoir, means for supplying air under pressure to the reservoir, a pair of filters connected to the reservoir means for heating the filters, valve means actuated by the said pressure means for directing the air from the reservoir alternately to each filter in a direction for removing impurities from the air and in a direction for removing impurities from the filters, and means actuated when the said air valve is actuated for directing a heating agent through the filter being cleaned.

7. An air purifying apparatus having a pair of filters adapted to operate alternately to remove impurities from air and also adapted to be automatically cleaned when not filtering air, and means actuated by the pressure of air flowing through one filter for heating the other filter.

8. An air purifying apparatus having a plurality of steam heated filters adapted to operate alternately to remove impurities

from air and also adapted to be automatically cleaned when not filtering air, and means actuated by the pressure of air flowing through one filter for admitting steam to the other filter.

9. An air purifying apparatus having a plurality of filters, each provided with a jacket to form a steam receiving chamber, means for directing air to be purified alternately to the filters, means actuated simultaneously by the air directing means for alternately admitting steam to said chamber of the filter through which the air has previously flowed, and means for directing air through said last named filter in an opposite direction while said filter is heated.

10. An air purifying device having two filters arranged to alternately receive air flowing in one direction from a reservoir to filter the same and to alternately receive air flowing in the opposite direction to clean the filters, means for supplying air under pressure to the reservoir, means for delivering the air simultaneously to both filters, the air passing through one filter in one direction and passing through the other filter in the opposite direction, and means actuated by said air pressure supply means for operating said delivering means.

11. In a fluid purifying apparatus, the combination with a filtering device, of automatic means for first passing fluid through said device to remove impurities from the fluid and for then passing fluid through said device to remove impurities collecting in said device, and automatically operating means for heating said device when the same is being cleaned.

12. In a fluid purifying apparatus, the combination with a filtering device, of means operating automatically for passing fluid through said device in a direction to remove impurities from the fluid and for then passing fluid through said device in an opposite direction to remove impurities collecting in said device, and automatically operating means for heating said device when the same is being cleaned.

13. In a fluid purifying system, the combination with a plurality of fluid filtering devices, of automatic means for periodically employing one of said devices to filter fluid, means for periodically cleaning said device, and means for heating the device while the same is being cleaned.

14. A fluid purifying device having two filters, means for alternately supplying fluid to said filters to filter said fluid and for alternately supplying fluid to said filters to clean the filters, the fluid for cleaning one filter being purified by flow through the other filter, and means for alternately heating said filters.

15. A fluid purifying device having two filters, means operating automatically for al-

ternately supplying fluid to said filters to filter said fluid and for alternately supplying fluid to said filters to clean the filters, and means operating automatically for heating said filters when the same are being cleaned.

16. A fluid purifying device having two filters, means for alternately supplying fluid to said filters to filter said fluid and for alternately supplying fluid to said filters to clean the filters, the fluid for cleaning one filter being purified by flow through the other filter, and means for heating said filters when the same are being cleaned.

17. A fluid purifying device having two filters, means for alternately supplying fluid first through one filter and then through the other filter for purifying the fluid, means for supplying fluid purified by flow through one filter to the other filter for cleaning said other filter, and means for heating said filters only when the same are being cleaned.

18. An air purifying apparatus comprising a plurality of filters, automatically operating means for alternately heating said filters, and automatically operating means for passing air alternately through said filters in opposite directions.

19. An air purifying apparatus having two filters, automatically operating means for alternately directing air through each filter in one direction for removing the impurities from the air and in the opposite direction for removing impurities from the filters, and automatically operating means for alternately heating said filters.

20. An air purifying apparatus having two filters adapted to operate alternately, means for directing air through each filter in a direction for removing the impurities from the air and in the opposite direction for cleaning the filters, the filters being adapted to operate simultaneously in opposite directions, and means for applying a heating agent alternately to the filters so that said filters will be heated when the filters are being cleaned.

21. An air purifying apparatus comprising a filtering chamber, a jacket enclosing said chamber and spaced therefrom, and automatically operating means for periodically passing a heating agent through the space between the jacket and the chamber.

22. An air purifying apparatus comprising a pair of filtering chambers, a jacket enclosing each of said chambers and spaced therefrom, and automatically operating means for periodically passing a heating agent through the spaces between the jackets and the chambers.

23. An air purifying apparatus comprising a plurality of filtering chambers, a jacket enclosing each of said chambers and spaced therefrom, and automatically operating means for periodically passing a heating

agent through the spaces between the jackets and the chambers.

24. An air purifying apparatus comprising two filtering chambers, a jacket enclosing each of said chambers and spaced therefrom, and automatically operating means for passing a heating agent alternately through the spaces between the jackets and the chambers.

25. An air purifying apparatus comprising a reservoir, means for supplying air under pressure to the reservoir, a filter, and means actuated by said pressure means for alternately directing the air through said filter in opposite directions.

26. An air purifying apparatus comprising a reservoir, means for supplying air under pressure to the reservoir, a filter, and means actuated by said pressure means for alternately directing the air from the reservoir through said filter in opposite directions.

27. An air purifying apparatus comprising a reservoir, means for supplying air under pressure to the reservoir, a plurality of filters, and means actuated by said pressure means for directing the air through the filters alternately in opposite directions.

28. An air purifying apparatus comprising a reservoir, means for supplying air under pressure to the reservoir, a filtering chamber, a jacket enclosing said chamber and spaced therefrom, and means actuated by said pressure means for periodically passing a heating agent through the space between the jacket and the chamber.

29. An air purifying apparatus comprising a reservoir, means for supplying air under pressure to the reservoir, a filter valve means for directing the air through the filter alternately in opposite directions, and means actuated by said pressure means for operating said valve means.

30. An air purifying apparatus comprising a reservoir, means for supplying air under pressure to the reservoir, a filter, valve means for controlling the supply of air from the reservoir to the filter, and means actuated by said pressure means for operating said valve means whereby the air is caused to flow through the filter periodically in opposite directions.

31. An air purifying apparatus comprising a reservoir, means for supplying air under pressure to the reservoir, two filters, valve means for controlling the flow of air from the reservoir to said filters, and means actuated by said pressure means for operating said valve means whereby the air is directed alternately to said filters.

32. An air purifying apparatus comprising a reservoir, means for supplying air under pressure to the reservoir, two filters, and valve means operated by said pressure means for simultaneously directing the air from the reservoir to the filters in opposite directions.

33. An air purifying apparatus comprising a reservoir, means for supplying air under pressure to the reservoir, two filters, valve means for controlling the air supplied from the reservoir to the filters whereby the air passes alternately through the filters in opposite directions, and means actuated by said pressure means for intermittently operating said valve means whereby the direction in which the air passes through the filters is reversed.

34. An air purifying apparatus comprising a reservoir, means for supplying air under pressure to the reservoir, two filters, valve means for controlling the air supplied from the reservoir to the filters whereby the air passes through one filter in the opposite direction to which the air passes through the other filter, and means actuated by said pressure means for periodically operating said valve means whereby the direction in which the air passes through the filters is reversed.

35. An air purifying apparatus comprising a reservoir, means for supplying air under pressure to the reservoir, a plurality of filters, valve means for controlling the air supplied to the filters from the reservoir whereby the air passes alternately through the filters in opposite directions, and means actuated by said pressure means for periodically operating said valve means whereby the directions in which the air passes through the filters are reversed.

36. An air purifying apparatus comprising a reservoir, means for supplying air under pressure to the reservoir, a chamber containing filtering material, a jacket enclosing said chamber and spaced therefrom, valve means for directing the air from the reservoir through the chamber, means actuated by said pressure means for operating said valve means whereby the air is caused to flow through the chamber periodically in opposite directions, means for supplying a heating agent to the space between the chamber and the jacket, and means operated only by the flow of air to said chamber in one direction for controlling the supply of the heating agent to the space between the chamber and the jacket.

37. An air purifying apparatus comprising a reservoir, means for supplying air under pressure to the reservoir, a filtering device comprising a chamber containing filtering material and having a jacket enclosing said chamber and spaced therefrom, valve means for directing the air from the reservoir through the filtering chamber, means actuated by said pressure means for operating said valve means whereby the air is caused to flow through the filtering chamber periodically in opposite directions, means for supplying a heating agent to the filtering device, and fluid pressure actuated valve means adapted to be operated by the flow of air in one direction

only for controlling the supply of the heating agent to the filtering device.

38. An air purifying apparatus comprising a reservoir, means for supplying air under pressure to the reservoir, two filtering devices, each comprising a chamber containing filtering material and having a jacket enclosing said chamber and spaced therefrom, valve means for controlling the flow of air from the reservoir whereby the air is caused to flow simultaneously through both of said filtering chambers, the air passing through one chamber in the direction opposite to the air passing through the other chamber, means actuated by said pressure means for periodically operating said valve means whereby the directions in which the air passes through the filtering chambers is reversed, means for supplying a heating agent to each of said filtering devices, and fluid pressure actuated valve means adapted to be operated by the flow of air in one direction only for controlling the supply of the heating agent to the filtering devices.

39. A fluid purifying device comprising two chambers containing a filtering agent, each adapted to be periodically heated, and automatically operating means for supplying a heating agent alternately to each chamber and out of contact with said filtering agent.

40. A fluid purifying device comprising two chambers, each adapted to be periodically heated, and fluid pressure operated means for supplying a heating agent alternately to each chamber.

41. A fluid purifying device comprising a plurality of filtering chambers containing a filtering agent, each adapted to be periodically heated, and automatically operating means for supplying a heating agent successively to each chamber and out of contact with said filtering agent.

42. A fluid purifying device comprising a plurality of filtering chambers containing a filtering agent, each adapted to be periodically heated, means for supplying a heating agent to each chamber out of contact with the filtering agent, and automatically operating means for operating said heating agent supply means whereby said chambers are successively heated.

43. A fluid purifying apparatus comprising two filtering chambers containing a filtering agent, each adapted to be periodically heated, means for supplying a heating agent to each chamber out of contact with the said filtering agent, and automatically operating means for operating said heating agent supply means whereby said chambers are alternately heated.

44. An air purifying apparatus comprising two filters adapted to operate alternately, fluid pressure operated means for directing the air through each filter in a direction for removing the impurities from the air and in

the opposite direction for cleaning the filters, the filters being adapted to operate simultaneously in opposite directions, and means operated by the air flowing in one direction only through the filters for supplying a heating agent alternately to the filters, whereby said filters will be heated when the filters are being cleaned.

45. An air purifying device for a fluid pressure system comprising a chamber containing a filtering agent, means for passing air through the filtering agent for alternately discharging it to the system and to the atmosphere, and means for heating the chamber during the time when air is being passed through the filtering agent to the atmosphere.

46. An air purifying device for a fluid pressure system comprising a chamber containing a filtering agent, means for passing air through the filtering agent and for automatically alternately discharging it to the system and to the atmosphere, and means for heating the chamber during the time when air is being passed through the filtering agent to the atmosphere.

47. An air purifying device for a fluid pressure system comprising a plurality of chambers containing a filtering agent means for passing air through the filtering agent in the chambers and for alternately discharging the passed air to the system and to the atmosphere and for discharging the air from one chamber to the atmosphere while discharging air from the other chamber to the system, and means for heating the chambers during the time when air is being passed through the filtering agent to the atmosphere.

In testimony whereof I have hereunto set my hand this 27th day of September, 1928.

CLYDE C. FARMER.