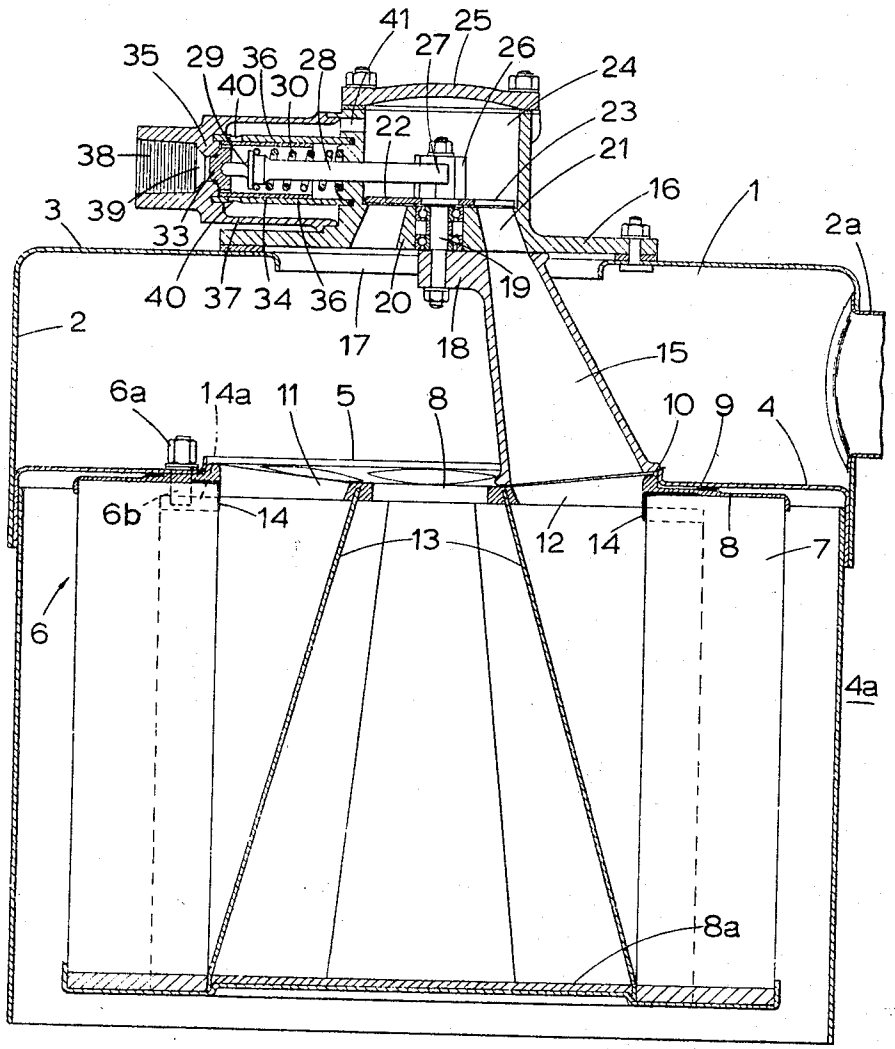
June 20, 1967 J. T. RYMER ET AL 3,325,978

CLEANERS FOR FLUIDS, PARTICULARLY GASES

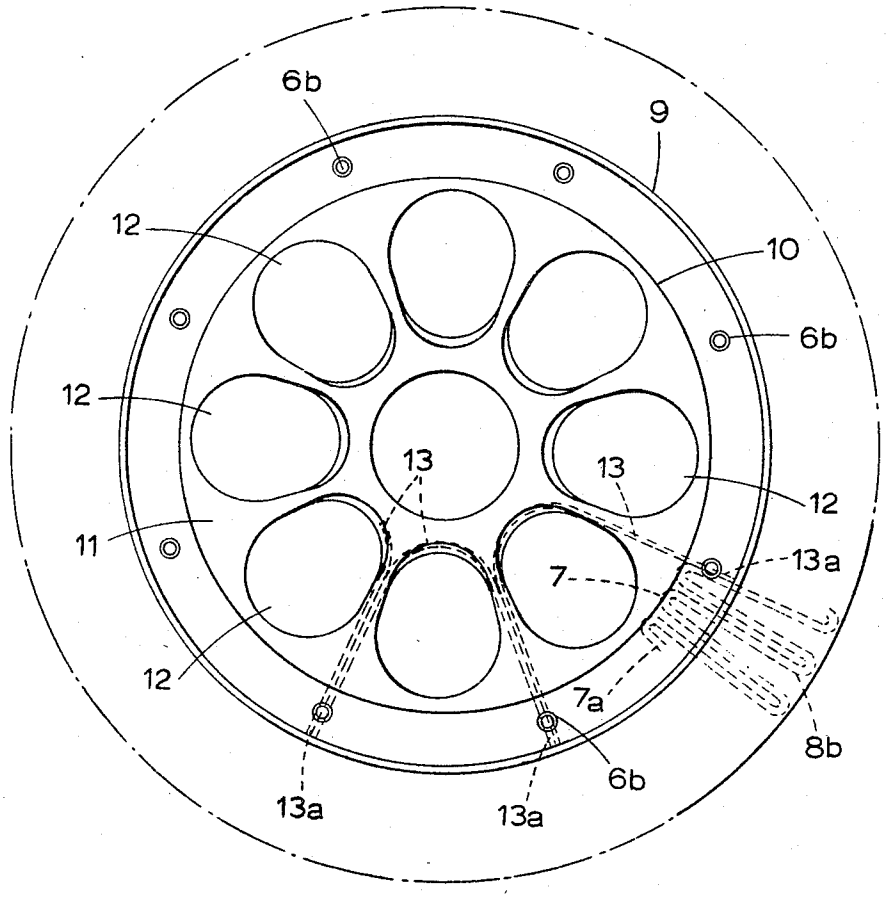
Filed July 27, 1964 3 Sheets-Sheet 1

FIG. 1.



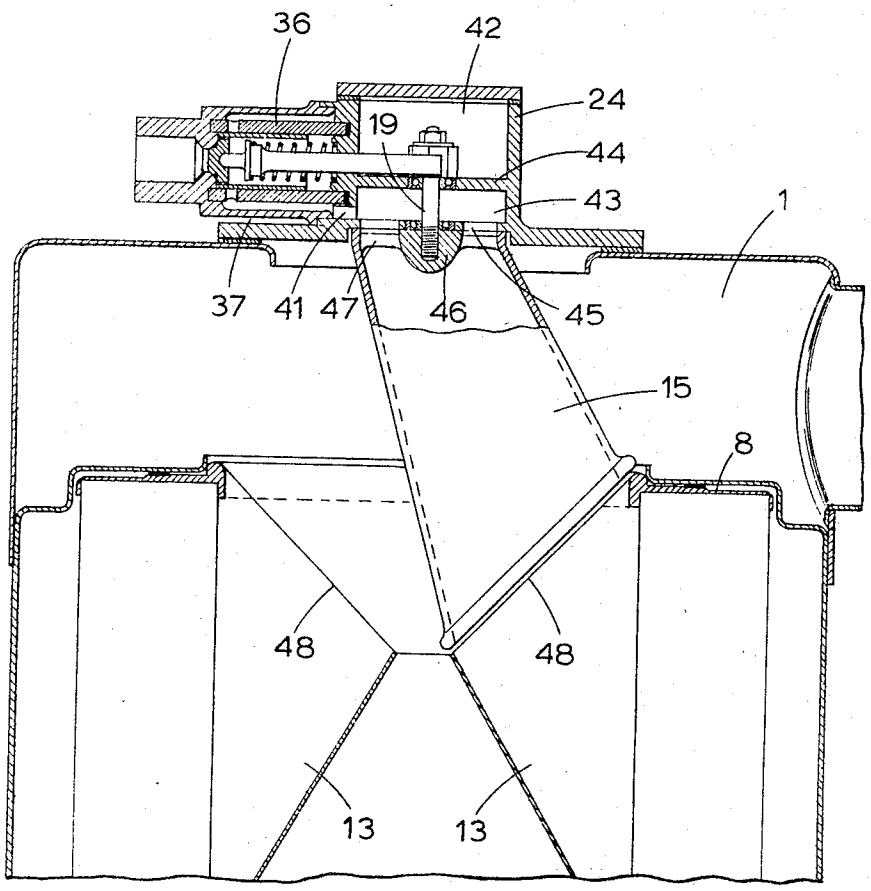
June 20, 1967 J. T. RYMER ET AL 3,325,978
CLEANERS FOR FLUIDS, PARTICULARLY GASES
Filed July 27, 1964
3 Sheets-Sheet 2

FIG. 2.



June 20, 1967 J. T. RYMER ET AL 3,325,978
CLEANERS FOR FLUIDS, PARTICULARLY GASES
Filed July 27, 1964
3 Sheets-Sheet 3

FIG. 3.



United States Patent Office 3,325,978
Patented June 20, 1967

1

3,325,978

CLEANERS FOR FLUIDS, PARTICULARLY GASES

Jesse Talbot Rymer, Nailsworth, and Stanley Paul Witchell, Llanfoist, England, assignors to Coopers Mechanical Joints Limited, Abergavenny, England

Filed July 27, 1964, Ser. No. 385,264
Claims priority, application Great Britain, July 30, 1963, 30,192/63
5 Claims. (Cl. 55—294)

This invention relates to cleaners for fluids, particularly for air and other gases.

According to the specification of applicant's copending U.S. Patent No. 3,234,714, a filter element for the removal of dust, grit, or other finely divided particles from a fluid includes a pervious wall through which the fluid passes to deposit the impurities on one face of the wall, and a number of ducts covering and opening into the opposite face of the wall so as simultaneously to receive the fluid and deliver it to an outlet location on the element, the ducts being arranged also to receive gas pulses at the said location and to deliver them, in the reverse direction to the normal fluid flow, to the associated areas of wall and thereby cleanse the wall of impurities. In the preferred construction, the pervious wall is in the form of a tubular member formed with longitudinal pleats moulded at their ends into caps, and the ducts consist of tapered scoops distributed round the inside of the tubular member, the scoops being open to the wall along their lengths and tapered towards the wall from their open to their closed ends.

The aforesaid specification describes an air cleaner including the said filter element and furnished with a cluster of nozzles for the delivery of pulses of fluid into the scoops, as many nozzles as there are scoops being provided and the outlet aperture of each nozzle being substantially smaller than the area of the adjacent mouth of the associated scoop.

An object of the present invention is to provide a more positive application of the air blasts to the scoops.

According to the present invention, a cleaner for fluids, for use with a filter element having a series of scoops through which the cleaned fluid is delivered and through which pulses of fluid for cleaning the elements are delivered in the reverse direction, is provided with a nozzle for circulating over the ends of the scoops and for delivering the pulses through the scoops in sequence, a motor for causing the nozzle so to circulate, means for positioning the element in position for the scoops to receive the pulses in sequence, and a manifold arranged to receive cleaned fluid from the scoops. Preferably the motor is driven by the cleaned fluid and is arranged to move the nozzle in steps from scoop to scoop and to control the delivery of the pulses through the scoops.

In order that the invention can be clearly understood and readily carried into effect, air cleaners in accordance therewith will now be described, by way of example, with reference to the accompanying drawings, in which:

FIGURE 1 is a sectional elevation of one form of air cleaner,

FIGURE 2 is a plan of part of the air cleaner of FIGURE 1, and

FIGURE 3 is a sectional elevation of upper portions of a second form of air cleaner.

Referring to FIGURE 1, the air cleaner includes a circular manifold 1 having a cylindrical side wall 2 with

2

an integral top wall 3. The bottom of the manifold 1 is closed by a plate 4, formed with a comparatively large central opening 5 and provided with a skirt 4*a*. A cylindrical filter element 6, similar to that described in the aforesaid specification, is attached to the plate 4 by nuts 6*a* on studs 6*b* and is located inside the skirt 4*a*. An outlet duct 2*a* is fixed to the wall 2. In practice this outlet duct is connected to the air inlet of an internal combustion engine, which draws air from the space between the skirt 4*a* and the outer periphery of the filter element 6, then through the filter element 6 and scoops (described below) into the manifold 1, and through the outlet duct 2*a*.

The active portion of the filter element 6 consists of a tubular member in the form of a cylinder 7 having a pleated wall 7*a* (FIGURE 2) of tightly woven wool which may have nylon added. This woolen fabric may be stiffened by being sandwiched between layers of wire gauze. The top and bottom of the cylinder are sealed respectively into a top cap 8 and into a bottom cap 8*a*. So as to prevent air from finding its way between the top of the cap 8 and the plate 4, the cap 8 is sealed with an annular ring 9, which bears against the plate 4, and with a circular shoulder 10 that fits in the opening 5. The portion of the cap 8 within the shoulder 10 constitutes the outlet location of the filter element 6, this location being formed with a frusto-conical surface 11 round which the cap 8 is formed with a ring of equidistantly spaced openings 12.

The openings 12 are in register respectively with the upper ends of an equal number of scoops 13 distributed round the inside surface of the cylinder 7. Each scoop 13 has a U-shaped horizontal cross-section (FIGURE 2) with its inner curved surface tapering (FIGURE 1) in a radially outward direction from top to bottom of the filter element. Along the major portion of its length, each scoop has the edges 13*a* (FIGURE 2) of its two limbs lying on vertical lines located between pleats 7*a* so that the limbs of each scoop are in contact with the limbs of the two adjacent scoops, and so that the whole of the filter cylinder 7 is covered internally by the scoops. The tops of the limbs of the scoops are recessed at 14*a* so as to provide vertical edges that are embraced by an annular metal flange 14 secured to the cap 8. The top edge of each scoop 13 is moulded into the cap 8 around the associated one of the openings 12, which constitutes the mouth of the scoop. The bottom of the curved surface of each scoop merges into an arcuate flange fixed to the bottom cap 8*a* which is, of course, formed so as to prevent air from flowing straight through the centre of the filter element 6.

Normally the air, cleaned by passing through the pleated wall of the cylinder 7 passes upwards through all but one of the scoops 13 and through the associated opening 12 into the manifold 1. The exception is the scoop 13 with which a nozzle 15, that is rotated in steps about the axis of the filter element 6, happens to be in register. Pulses of scavenging air are delivered through this nozzle into the scoops in rotation, so that the pleats associated with each scoop periodically receive pulses of air on their inner surfaces which dislodge dust, grit or other finely divided particles that are deposited outside the pleats as a result of the normal air flow.

The mechanism for delivering the pulses of air in sequence to the scoops 13 will now be described. This

mechanism is carried by a plate **16** that covers an opening **17** in the top wall **3** of the manifold **1**. The nozzle **15** is formed with an arm **18** that is keyed to a shaft **19** rotatably mounted in a thickened portion **20** of the plate **16**. This portion is formed with a ring of passages **21** allocated respectively to the openings **12**. In each operative position of the nozzle **15**, the nozzle provides a continuous passage from one of the passages **21** to the associated opening **12**, the nozzle **15** being formed at its upper and lower ends with surfaces that provide slight clearances with respect to the bottom surface of the plate **16** and the frusto-conical surface **11** of the cap **8**.

Fixed to the shaft **19** is a ported member in the form of a port plate **22**, formed with a single port **23**, arranged to rotate over the top surface of the portion **20**, in a cylindrical casing **24** closed by a cover plate **25**. A ratchet wheel **26** is also fixed to the shaft **19** within the casing **24**. The ratchet wheel **26** is turned periodically by a pawl **27** fixed to one end of a rod **28**, to the other end of which is fixed an abutment member **29** for one end of a compression spring **30**, the outer end of which bears against the casing **24**. Thus, the outer end of the rod **28** is maintained by the spring **30** in a central recess in the crown **33** of a piston having a skirt **34**. Also, when permitted to do so, the spring **30** keeps the crown **33** in engagement with a head **35** of a cylinder **36**, in which the piston can slide. The cylinder **36** is interposed between the head **35** and the casing **24**, the head **35** being formed at the end of a tubular member **37** fixed to the casing **24**. The head **35** is formed with an inlet duct **38** communicating with a port **39** closed by the piston crown **33**, when the piston is at its outer-most position as shown in FIGURE 1. A compressed air reservoir (not shown) is connected to the inlet duct **38**. This reservoir is fed continuously by a pump driven by the engine that receives the air cleaned by the air cleaner. The inlet air for the pump draws in clean air received from the manifold **1**.

When the pressure in the reservoir reaches a predetermined value, the pressure of the portion of the crown **33** that covers the port **39** is sufficient to overcome the spring **30** and move the piston inwardly. This permits the air pressure to act on the full area of the piston crown **33**, and consequently move the piston against the increasing spring stress to an extent sufficient to uncover ports **40** in the cylinder **36**. The air blast escapes through these ports **40** and passes along the space between the cylinder **36** and the tubular member **37** to a port **41** in the casing **24**. The air blast leaves the casing **24** through the port **23** in the port plate **22** and through the selected passage **21**, the nozzle **15** and the corresponding opening **12**, to the associated scoop **13** so as to clean the arc of the filter cylinder **7** embraced by the scoop.

During this phase of the operation, a detent (not shown) prevents reverse movement of the ratchet wheel **26**, while the pawl **27** snaps past one of the ratchet teeth. When the pressure in the reservoir falls sufficiently to allow the spring **30** to return the piston to the position of FIGURE 1, the pawl **27** acts on the aforesaid ratchet tooth to bring the port **23** and the nozzle **15** into register with the next passage **21** and with the associated opening **12**. The pressure in the reservoir then builds up once more and the cycle is repeated.

Referring now to FIGURE 3, it will be seen that the casing **24** is divided into compartments **42**, **43** by a horizontal partition **44**. The port plate **22** is omitted and the shaft **19** is mounted in bearings respectively in the partition **44** and in a spider **45** spanning the bottom of the compartment **43**. The top of the nozzle **15** is concentric with the shaft **19**, to which the nozzle is fixed by means of a hub **46** carried in the top of the nozzle by a spider **47**.

The port **41** opens into the lower compartment **43** and the ratchet mechanism is contained in the upper compartment **42**. Thus, each time an air blast passes between the cylinder **36** and the tubular member **37**, it finds its way immediately through the spiders **45**, **47** into the nozzle **15**

and thence into the one of the scoops **13** with which the nozzle **15** is in register.

It will be seen that in FIGURE 3 the central portion of the cap **8**, containing the openings **12**, has been omitted, and that the upper edges **48** of the scoops **13** are considerably bevelled and approach more closely than in FIGURE 1 the axis of the filter cylinder **7**. The plans of these upper edges **48** are, in fact, more clearly V-shaped than U-shaped. The lower end of the nozzle **15** is shaped to conform to each of these edges, a small clearance being provided between the periphery of the nozzle and the adjacent edge **48**. This enlargement of the outlet of the nozzle **15** and of the inlet to each scoop **13** increases the efficiency of the assembly, in that the kinetic energy of the air pulse undergoes a considerable conversion to pressure energy with increased effect in cleaning the filter cylinder **7**. In addition, the enlargement of the upper end of each scoop **13** reduces the restriction of the cleaned air passing from the scoop to the manifold **1** and enables the air cleaner to be used for higher overall air flows.

What we claim is:

1. A cleaner for the removal of impurities from a fluid stream, comprising, in combination, a filter element having a tubular member consisting of a continuous pervious filter wall having a central axis formed with spaced radial longitudinally extending pleats, two caps moulded respectively to the ends of said tubular member to cover the ends of said pleats, and a plurality of scoops distributed around the inside of said tubular member so as to cover one face thereof, each of said scoops extending longitudinally from one of said caps substantially to the other of said caps and being open to said wall along its length for communication therebetween, and each of said scoops being open at one end and closed at the other end, and tapered so that its cross-sectional area diminishes continuously from its open end to its closed end, the cleaner further including a nozzle mounted for rotation about said central axis upstream of said scoops, said nozzle having an inlet end and said nozzle having an outlet end of substantially the same shape and size as the open end of each of said scoops, means rotatably mounting said nozzle for rotation to successively traverse the open ends of said scoops, a motor means connected to said nozzle operative to traverse said nozzle successively into alignment with each scoop and means adapted to control the delivery of fluid pulses through said nozzle and along the aligned scoop and simultaneously through said filter wall, and a manifold mounted in communication with the open ends of said scoopes to receive cleaned fluid passing through said pervious wall and along said scoops.

2. A cleaner accordang to claim **1** in which said nozzle has an outlet end which closely engages the open end of each of said scoops adopted to prevent substantial pressure loss upon delivery of gas pulses through said nozzle to the respective scoops.

3. A cleaner according to claim **1**, including a ratchet wheel fixed to said nozzle, a reciprocable pawl for rotating said ratchet wheel and nozzle in steps, said motor means being positioned to reciprocate said pawl.

4. A cleaner according to claim **1** including means defining a chamber having one wall formed with a series of passages, said passages being allocated to said scoops and located in a circular pattern, the inlet end of said nozzle positioned adjacent said passages and mounted to traverse each of said passages in succession, a rotary member mounted inside said chamber and connected to said nozzle to rotate therewith, said rotary member being mounted adjacent said passages and having a port therein which will align with said passages upon rotation to allow a fluid pulse to pass through the passage into said nozzle and through the respective scoop for cleaning a respective portion of said pervious filter wall.

5. A cleaner according to claim 3, including a compartment means, the inlet end of said nozzle being mounted adjacent said compartment means to rotate in sealing engagement with one wall of said compartment, and said ratchet wheel being rotatably mounted outside an opposite wall of said compartment means, a shaft passing through said compartment means forming a driving connection between said ratchet wheel and said nozzle, and means adapted for feeding the fluid pulses into said compartment means, and said compartment means being formed with openings which are in continuous communication with the inlet end of said nozzle.

References Cited

UNITED STATES PATENTS

2,800,976	7/1957	Pellon	55—302
2,850,112	9/1958	Dru	55—287
3,193,990	7/1965	Smith	55—294

FOREIGN PATENTS

880,043	10/1961	Great Britain.
1,360,904	4/1964	France.

HARRY B. THORNTON, *Primary Examiner.*

B. NOZICK, *Assistant Examiner.*