Jan. 1, 1957 E. E. FOWLER 2,776,024

SECONDARY AIR SUPPLY MECHANISM FOR FILTERS

Filed April 1, 1955 3 Sheets-Sheet 1

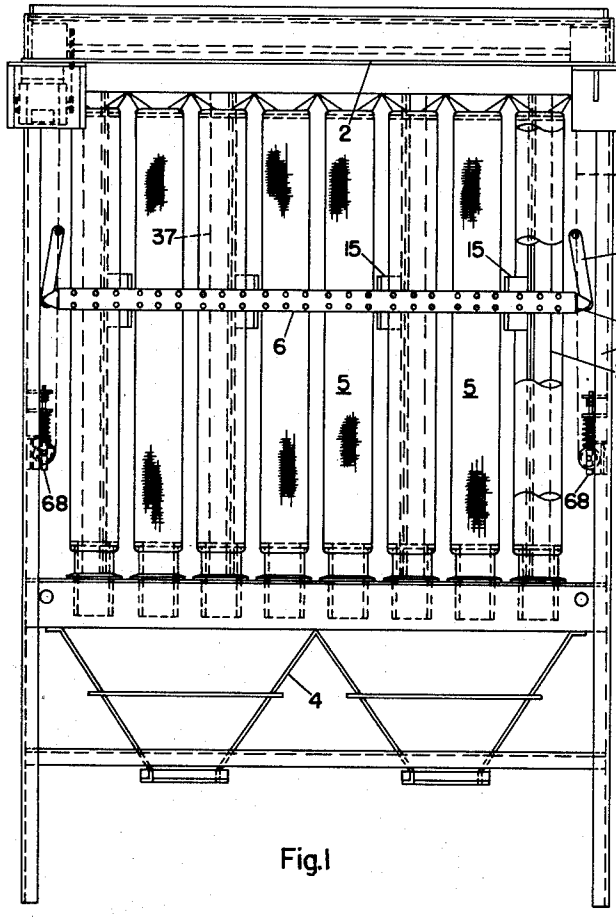


Fig.1

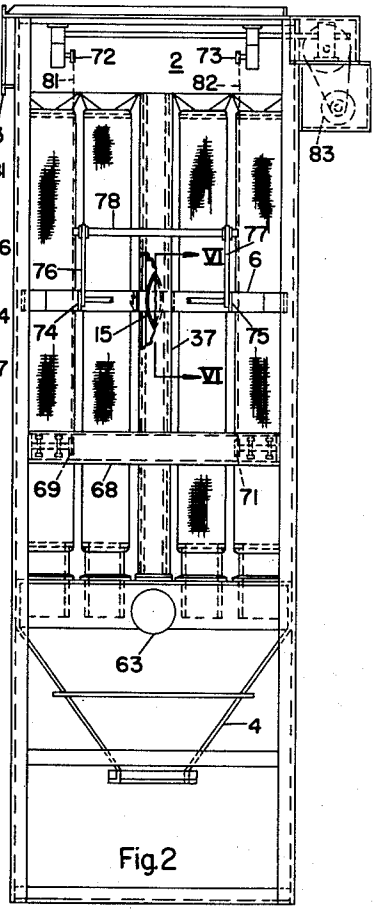


Fig.2

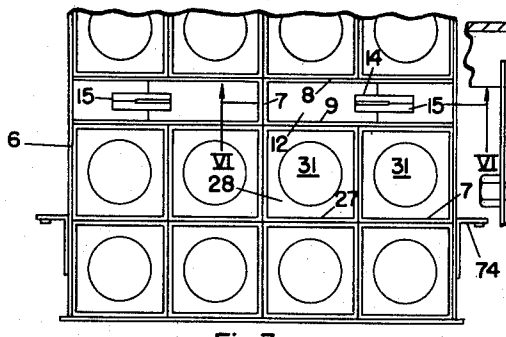


Fig.3

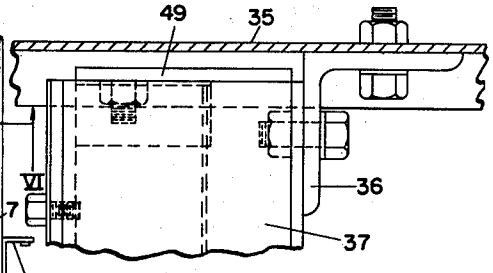


Fig.4

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SECONDARY AIR SUPPLY MECHANISM FOR FILTERS

Filed April 1, 1955 3 Sheets-Sheet 2

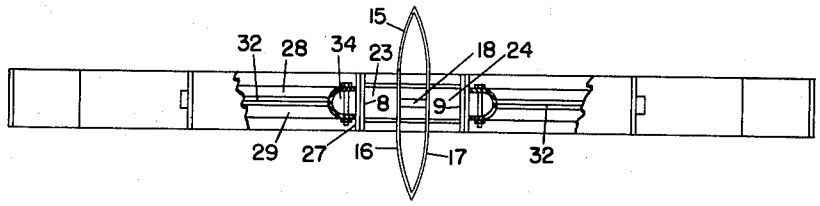


Fig.5

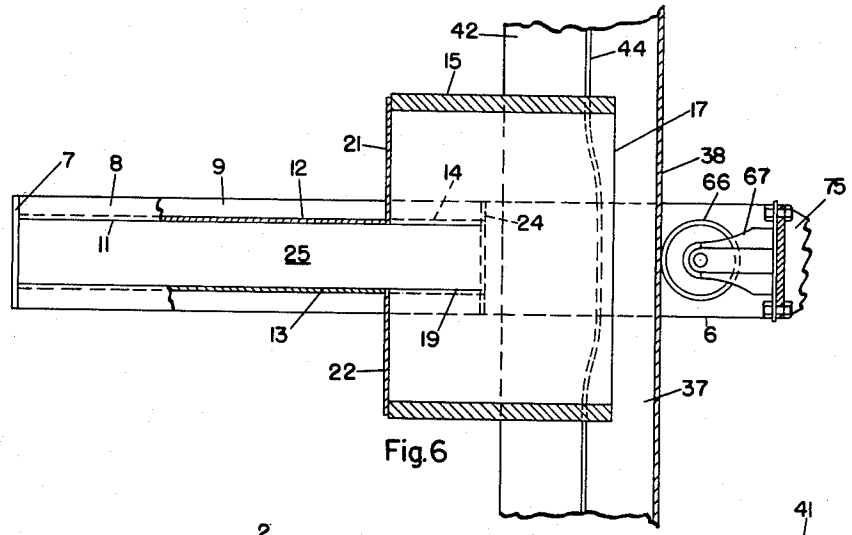


Fig.6

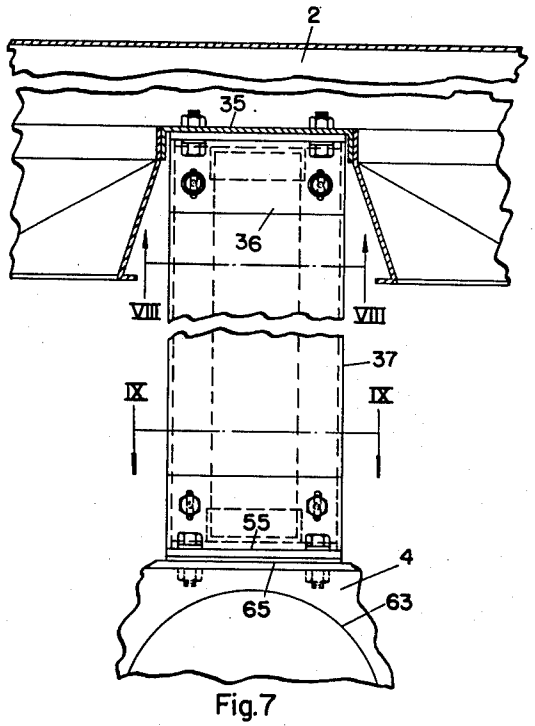


Fig.7

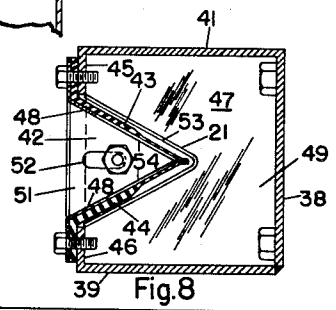


Fig.8

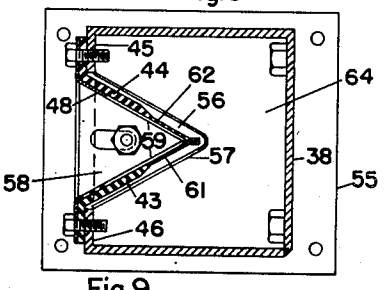


Fig.9

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SECONDARY AIR SUPPLY MECHANISM FOR FILTERS

Filed April 1, 1955 3 Sheets-Sheet 3

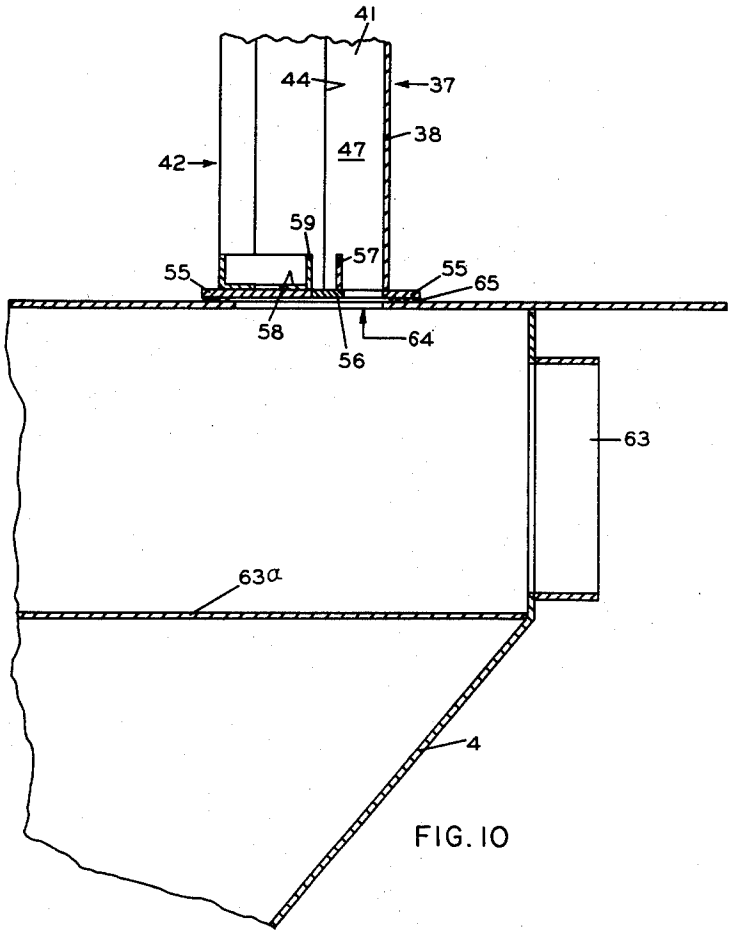


FIG. 10

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United States Patent Office

2,776,024

Patented Jan. 1, 1957

2,776,024

SECONDARY AIR SUPPLY MECHANISM FOR FILTERS

Evans E. Fowler, Louisville, Ky., assignor to American Air Filter Company, Inc., Louisville, Ky., a corporation of Delaware

Application April 1, 1955, Serial No. 498,665

9 Claims. (Cl. 183—61)

The present invention relates to dust collectors of the tubular stocking type, and relates in particular to improvements in supplying secondary air to the filter elements.

In one typical form of such filter or dust collector, one or more tubular air permeable filter elements extend between a supply header and a dust hopper, and the air to be cleaned flows from the header through the wall of the filter element, depositing dust on the inside surface thereof. Some of this dust falls into the hopper, and some dust accumulates on the interior surfaces of the filter elements. Periodically, a nozzle which traverses the filter elements, directs a stream of secondary air against the exterior surfaces of the filter elements, to dislodge dust on the interior surfaces. The present invention is directed to a structure for supplying secondary air to the nozzle.

It is an object of this invention to provide a simple, effective structure for supplying secondary air from a fixed source to the moving nozzle or blow ring.

A further object is the provision of a structure for supplying secondary air to the filter tubes which is relatively inexpensive to manufacture and is trouble free in service.

A further object is the provision of a structure for supplying secondary air to the filter tubes, which involves an improved leakage free joint between relatively reciprocating parts in the secondary air system.

The invention is described in detail in the following specification taken in connection with the accompanying drawing, illustrating a preferred embodiment by way of example, and wherein:

Figure 1 is a front elevation of a dust separator embodying the invention; parts being broken away;

Figure 2 is a side elevation of Figure 1 with parts broken away;

Figure 3 is a plan view, with part broken away, of a blow ring structure;

Figure 4 is an elevation view with parts in section, of a detail;

Figure 5 is an end elevation, with parts broken away of a blow ring structure;

Figure 6 is a fragmentary sectional view, corresponding to one taken along line VI—VI of both Figures 2 and 3, showing the high pressure air supply duct in section;

Figure 7 is an end elevation showing the mounting of the air supply duct, with parts in section;

Figure 8 is a section taken on line VIII—VIII of Figure 7;

Figure 9 is a section taken on line IX—IX of Figure 7; and

Figure 10 is a fragmentary vertical sectional view showing the relationship of the high pressure inlet to the dust hopper and to the high pressure distribution tube.

Referring to the drawing, the typical filter unit illustrated comprises a frame **1** carrying a top duct or header **2** having a side inlet opening **3** for the entrance of gas to be cleaned. Downwardly spaced from the header is a bottom dust hopper **4**, and a series of cylindrical filter elements or tubes **5** constructed of suitable fabric, or other gas permeable material, are connected at their tops to suitable openings in the header, and are connected at their bottoms to suitable openings in the dust hopper **4**. The connections to the dust hopper are arranged to allow vertical contraction of the tubes **5**, without loss of seal with the hopper. The header, dust hopper and filter elements may be constructed, for example, as described and claimed in the application of Stig G. Sylvan, Serial No. 363,322, filed June 22, 1953, now Patent No. 2,751,042, dated June 19, 1956, for Mechanical Dry Tubular-Stocking Dust Collector, etc., and as this construction forms no part of the present invention, it will not be described in greater detail.

It will be seen the tubes **5** are arranged in banks of any desired number, and the vertically slideable blow ring frame **6** is common to the bank of tubes. The frame **6** carries a plurality of blow rings to be later described. Periodically, the tubes **5** are traversed by the blow ring frame **6**, and the blow rings discharge high pressure air against the tubes as they move downwardly, so as to dislodge dust from the inside surface of each tube and allow the dust to fall into the hopper.

An air inlet portion of the frame **6** (Figs. 3 to 6) comprises a generally U-shaped frame having an end wall **7** and side panels **8** and **9** with an opening **11** in each side panel. The inlet portion of the frame may be made by bending a single strip of metal into a U-shape, or as shown, by uniting a separate back panel **7** to the side panels **8** and **9**. This structure is closed in by top and bottom plates **12, 13** secured in air tight relation to the back and side panels, respectively above and below opening **11**. At its forward edge each plate is notched out at **14**.

A shoe or nozzle **15** in the general shape of a sharp edge ellipse is formed by welding together bowed side plates **16** and **17** at the top and bottom, and if desired a middle brace bar **18** may be welded in the shoe. Each side plate of the shoe is notched out at **19**. The shoe is placed within the notches **14** of the top and bottom plates so that part of the shoe overlaps these plates, and the shoe may be welded in this position. The overlapping end of the shoe is closed by end plates **21, 22**, and end plates **23, 24** close the space between the forward edges of the top and bottom plates **12, 13** at the sides of the shoe. Thus, air which enters the shoe is directed into the chamber **25** between plates **12, 13** and can flow through side openings **11**.

The blow rings are constructed in units and any desired number of units may be connected together in the frame **6** to constitute a bank. As illustrated, each blow ring assembly comprises a frame **27** of generally square shape in plan, and a pair of dished plates **28, 29** are suitably secured in the frame in vertically spaced relation. The blow ring plates converge about a central opening **31** approximately the diameter of a filter cylinder, and are vertically spaced about said opening to

provide a slit or nozzle **32** by which a narrow jet or stream of air is directed against the filter tube. The space **34** between the plates provides an air distributing chamber for the nozzle, and openings (not shown), are provided through the frame **27** to connect the distributing chamber **34** with the inlet chamber **25**. Thus, air introduced into nozzle member or shoe **15** is conducted from chamber **25** to the various ring nozzles **32** where it is discharged against the respective filter tubes. The frame **6** may have a plurality of elliptical nozzles **15** and distribution or plenum chambers **25**, depending on the number of blow ring nozzles in a bank.

The arrangement by which air is supplied to the nozzle member **15** now will be described.

A tube or air supply channel **37** is mounted on the hopper, and at the top is held in place in a channel **35** by an angle plate **36** bolted to the channel **35** and air supply channel **37**. As shown in Figure 8, the air supply channel comprises a vertical base wall **38**, and side walls **39**, **41** having flanges **45**, **46** respectively which provide an opening **42** opposite wall **38**. Converging flaps **43** and **44** are bolted to the flanges **45**, **46**, and these flaps extending substantially the full length of the channel and thus separate the opening **42** from the air supply chamber **47**. The flaps are protected by suitable cover plates **48**. The top of channel **37** is closed by a plate **49** which may be welded in place, and a triangular plate **51**, having a slot **52**, is adjustably bolted to the bottom of plate **49**. This triangular plate carries horizontally spaced vertically-depending flanges **53** and **54** which embrace the top edges of flaps **43**, **44**.

The bottom of column **37** receives a flange **55** having a triangular internal projection **56** to which a vertical flange **57** is welded. A triangular plate **58** (similar to plate **51**) is adjustably bolted to bottom flange **55** and carries vertical flange **59**. The flanges **57**, **59** embrace the bottom edges of the flaps **43**, **44**. It will be seen the flaps **43**, **44**, which may be made of flexible material, such as "Neoprene" rubber or silicone rubber, have lips **61**, **62** respectively of reduced thickness. The pressure of air in supply chamber **47** holds the flaps against the outer flanges **54**, **59** at the ends, and holds the lips **61**, **62**, together to prevent leakage of air between them.

An air inlet duct **63** extends through but is partitioned from the bottom hopper **4** as indicated at **63***a*. It is connected to supply high pressure air to column **37** through bottom opening **64** in the column, the connection between bottom flange **55** and the hopper top being sealed by a gasket **65**.

Referring to Figures 1, 2 and 6, it will be seen that the frame **6** is guided in its vertical movement by casters **66** mounted in suitable bearings or brackets **67** in the frame **6**, the casters bearing against the base plates **38** of the air channels **37**. The frame **6** is positioned so that the shoe **15**, which is ground to knife edges at the top and bottom, enters between the flaps **43** and **44** and the air pressure in chamber **47** holds the flaps against the shoe to prevent leakage of air around the exterior edge of the shoe. Thus, air is supplied from chamber **47** to the shoe, as the shoe **15** and blow ring frame **6** move down, and from the shoe air flows to the blow ring nozzles.

At each end of the frame **1** there is a cross bar **68** which carries sprockets **69**, **71** in suitable bearings, and sprockets **72**, **73** are mounted at the top of the frame **1** at each end. The blow ring frame **6** has brackets **74**, **75** to which are swivelled links **76**, **77** connected by a bar **78**. Endless chains **81**, **82** extend around the pairs of sprockets **72**, **69**, and **73**, **71**, respectively, and the bar **78** is connected at each end to each chain. Thus, as the chains move around the sprockets they carry frame **6** down, then up, and down again, etc. The chains are driven by a motor **83** through suitable transmission mechanism which need not be described in detail. In operation, the supply of air to column **37** may be controlled so that air is admitted thereto only when the blow ring frame is moving down, and the drive mechanism may be timed to move the blow ring at any suitable intervals.

The operation of the apparatus now will be described. Air to be cleaned is introduced at inlet **3**, flows into header **2**, and thence through filter tubes **5**, depositing dust on the inner surfaces. At the proper time, secondary air under pressure is supplied by inlet **63** to the chamber **47** in column **37**, and this air flows into shoe or nozzle **15** projecting between the lips **61**, **62** of flaps **43**, **44**. The pressure in chamber **47** holds these lips against the surface of the shoe tightly enough to prevent substantial leakage therebetween, and also holds the lips together along the length of the column in sealing relation. Secondary air thus flows through shoe **15** to chamber **25** and thence to the blow ring nozzles **32**, which directs the air against the outside surface of the filter tubes **5**. As the frame **6** carrying shoe **15** moves downwardly, the shoe forces apart the lips **61**, **62** to allow the shoe to slide downwardly, while the pressure within chamber **47** maintains the lips in sealing contact with the shoe. Thus, the blow ring frame **6** carries the blow rings down while maintaining a supply of secondary air thereto to dislodge the dust from the inner surfaces. The dislodged dust falls into the hopper **4**.

When the bar **78** on chains **81**, **82** reach the lower sprockets **69**, **71**, the frame **6** is at the bottom of the filter tubes, and at this point the supply of secondary air may be cut off by any suitable mechanism. The chains continue around the sprockets and carry the frame **6** up again toward the top, and when the frame reaches the top, the motor **83** is stopped by any suitable mechanism.

I claim as my invention:

1. In a filter, the combination comprising: at least one vertically arranged pervious filter tube; a blow ring frame carrying a corresponding number of blow nozzle means, one for around each filter tube, said frame being adapted to longitudinally traverse said tube; a generally elliptically shaped hollow inlet nozzle carried by said frame, said hollow inlet nozzle communicating with said blow nozzle means; and an air supply tube having an elongated opening covered by converging flexible flaps receiving said hollow inlet nozzle therebetween, for supplying air through said hollow inlet nozzle to said blow nozzle means.

2. A filter as specified in claim 1 wherein: said air supply tube has at its ends vertically arranged pairs of flanges embracing and sealing the ends of said flaps against escape of air.

3. A filter as specified in claim 1 wherein: said air supply tube provides a vertical track, and said blow ring frame carries cooperating guide means engaging said track in the traversing movement of said frame.

4. A filter as specified in claim 1 wherein: said blow nozzle means comprises a plurality of dished plates with an opening therethrough to receive said filter tube, said plates converging about said tube in spaced relation to form a slit ring nozzle.

5. A filter as specified in claim 4 wherein: said blow ring frame provides a plenum chamber communicating with said hollow nozzle, and with the space between said dished plates.

6. A filter as specified in claim 1 wherein: a plurality of said filter tubes are arranged in a bank; said blow ring frame carries a plurality of blow nozzles; and said hollow nozzle communicates with said blow nozzles to supply air thereto.

7. A filter as specified in claim 1 wherein: said flaps comprise a silicone rubber.

8. A filter as specified in claim 1 wherein: a plurality of endless bands pass around vertically spaced pairs of wheels at the sides of said frame; means are provided for driving said bands; and links are attached to said frame and bands, for moving said frame vertically.

9. A dust collector comprising: a filter tube vertically arranged between a tube supporting header and a dust

hopper to receive dusty gas, filter that gas as it passes radially outward through the tube wall into the surrounding atmosphere and ultimately discharge the separated dust axially into the hopper; a tube-traversing reverse-jet blow ring providing a nozzle encircling the tube and being operative to discharge an annular jet of high pressure gas radially inward through the tube wall into the interior of the tube to dislodge dust deposited on the inner face of the tube; means for reciprocating the blow ring along the tube; a tubular gas-inlet piece projecting from said blow ring; and a stationary, vertically arranged high pressure gas supply header for supplying high pressure gas through said tubular inlet piece to said blow ring, said header having a vertically elongated section formed by inwardly converging flexible flaps which are held against each other in gas sealing position by the gas supply pressure, said flaps being positioned to receive and extend snugly around said tubular inlet piece as it travels upwardly and downwardly along the tube.

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