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AIR SEALING REWIND CONSTRUCTION FOR ROLL-TYPE FILTER

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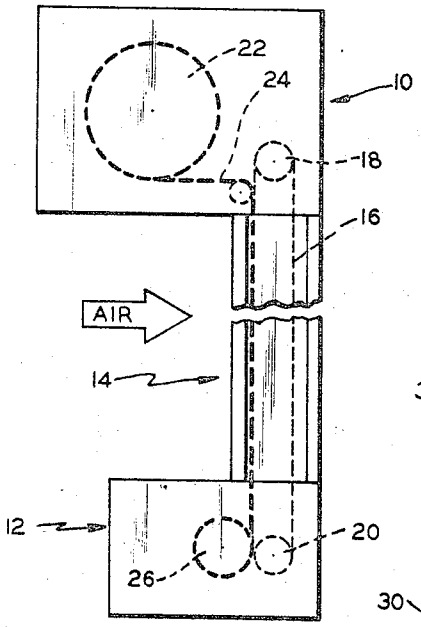

FIG. 1

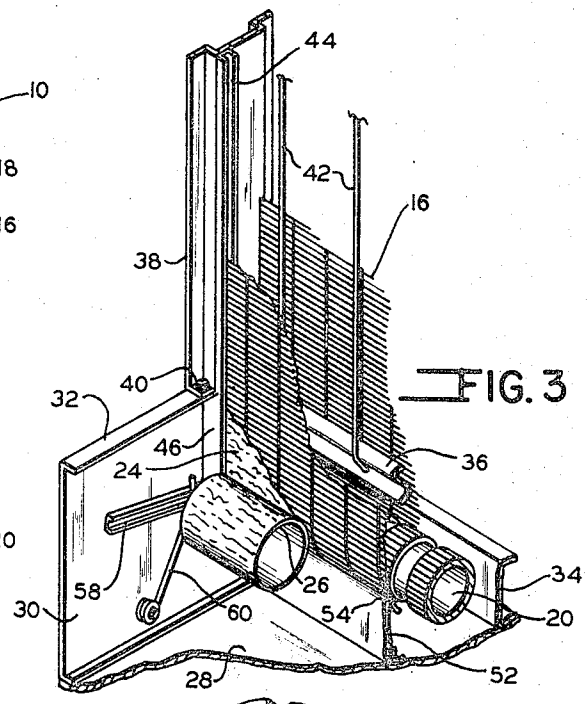

FIG. 3

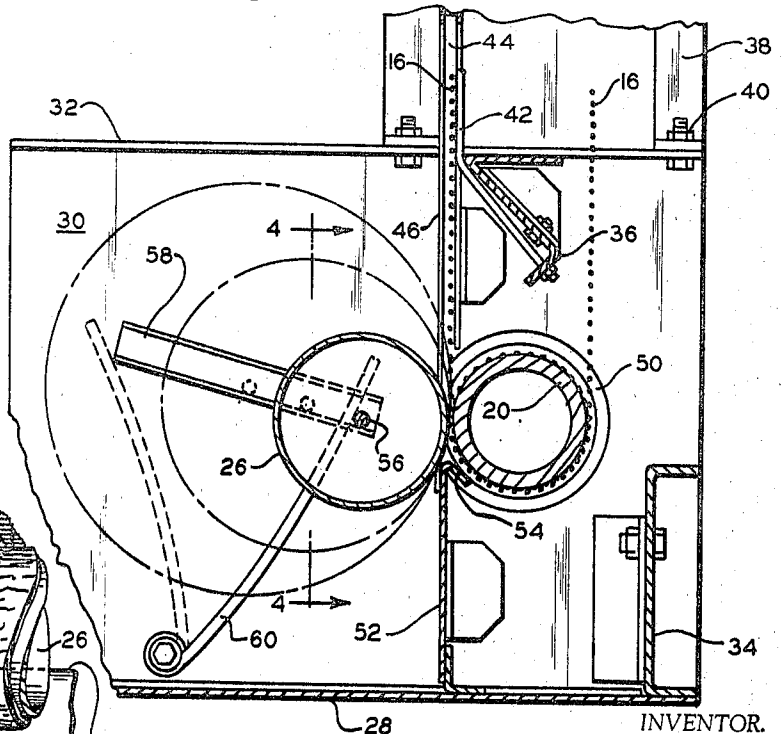

FIG. 2

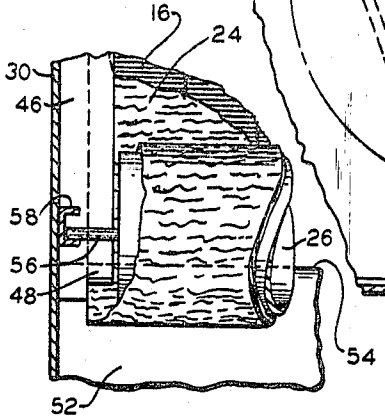

FIG. 4

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AIR SEALING REWIND CONSTRUCTION FOR ROLL-TYPE FILTER

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This invention relates to an improved base section construction for an automatic lint condenser of the general character described in U.S. Patent 2,881,859.

The lint condenser or filter described in the noted patent has the general form of what is commonly called a roll-type filter in which a supply roll of filter material is provided at the upper end of the air filter, is advanced in curtain form across an air stream opening, and is rewound on a rewind roll at the bottom of the filter apparatus. The filter material used in the apparatus to which this invention relates is an extremely thin, limp, flimsy material which is supported in the air stream against displacement, and is advanced across the air stream to the rewind roll, by means of a porous, endless-belt, conveyor. The rewind roll is arranged with its periphery bearing against the endless belt conveyor so that it is rotated to effect rewinding of used material by movement of the conveyor.

While filters constructed in accordance with the noted patent have been well accepted by those who use such devices, problems have arisen in connection with sealing the lower part of the apparatus against leakage of air and lint therethrough. Consequently from time-to-time the commercial version of the device has undergone changes in the nature of adding and rearranging the sealing means in the lower part of the filter device. In fact, in some commercial versions of the filter there are at least six separate elements in the base section performing a particular sealing function.

Consequently the object of the invention is to provide a base section construction which has an improved sealing and rewind arrangement affording manufacturing savings without detracting from the performance of the filter.

In accordance with the invention, the base section is constructed to support the rewind roll for movement along a path, as the roll enlarges, which maintains the roll periphery in engagement along two horizontal lines; one of said lines being a stationary sealing line formed by the upper edge of a sealing panel, and the other line shifting upwardly along the conveyor face as the roll enlarges. The parts which contribute to the sealing and rewind functions are arranged in a particular relationship so that the transverse sealing is effected along the upper edge of the panel and the rewind drive operation is attained with a simplified construction.

The invention will be described in some detail in connection with the accompanying drawing illustrating an embodiment thereof by way of example, and wherein:

FIGURE 1 is a broken, side elevational view of an automatic air filter of the character incorporating the invention, with certain major interior parts being shown in broken lines;

FIGURE 2 is a sectional view of the base section taken in a vertical plane parallel to the direction of air flow through the filter;

FIGURE 3 is a fragmentary front isometric view illustrating the relationship of the parts of the base section; and,

FIGURE 4 is fragmentary front sectional view corresponding to one taken along the line 4—4 of FIG. 2.

The embodiment of the filter illustrated in the drawing generally comprises a top supply roll section **10**, a

base section **12**, and an open-faced intermediate section **14** which generally frames the vertical edges of the air flow zone. An upright, endless belt or conveyor **16** is mounted to be moved about an upper roller **18** in the top section, and a lower roller **20** in the base section. The belt is of openwork construction and serves to move the filter material through the intermediate section air flow zone as well as to support it against displacement by air flowing in the direction indicated in FIGURE 1.

The preferred filter material is of a thin, limp, flimsy character as described in U.S. Patent 2,881,859 and is supplied in the form of a roll **22** which is rotatably mounted in the top section. The filter material **24** is threaded off the roll, advanced into the intermediate section and directed downwardly along the upstream flight of the endless conveyor **16**, and is then attached for rewinding to a rotatable rewind core **26** located in the base section **12** of the filter apparatus.

Referring now to FIGURES 2–4 illustrating details of the base section **12**, its framing members include a bottom wall **28**, opposite side walls **30** having inwardly directed flanges **32** along their upper edges, a rear lower cross member **34** having the cross-sectional shape of a channel, and an upper cross member **36** which is Z-shaped in cross section.

The side members **38** which frame the intermediate section **14** vertical edges are generally channel-shaped in cross section, as best shown in FIGURE 3, and are mounted on top of the base section with the bottom ends of the side members secured by bolts **40** to the top flanges **32** of the base section side walls.

A series of vertically-extending, horizontally-spaced, wires **42** have their bottom ends secured to the cross member **36** in the base section, and have their top ends secured to a similar cross member (not shown) in the top section to provide a back-up grid for the upstream flight of the conveyor **16**. The vertical edges of the upstream flight of the conveyor **16** are supported and track in inwardly-open channels **44** attached to the respectively opposite inner faces of the side members **38**. The vertical edges of the filter material **24** also track in these side channels which also serve to seal against passage of air therearound. Extensions **46** of the side channels are provided in the base section and are directed downwardly along the inner faces of the base section sidewalls **30**. The rear flange of the extension **46** terminates slightly above the bottom roller **20** while the forward flange extends down some distance further and has a tab portion **48** (FIG. 4) bent out forwardly and downwardly so that the edges of the filter material may leave the channel extensions **46** to be rewound around the core **26**. As is also shown in FIG. 4, the ends of the rewind core **26** are spaced inwardly from the edge of the channel extensions **46** so that the core is not held away from the conveyor **16** and roller **20**. Thus the marginal edges of the filter material **24** assume a ruffled form at the ends of the roll.

Each of the side walls **30** carries a bearing **50** on its inner face in which the opposite ends of the bottom roller **20** are journalled. The roller **20** is provided with alternating toothed and smooth segments (illustrated in FIG. 3) arranged so that the toothed segments mesh with certain columns of the endless belt to drive it. The drive for the bottom roller is provided by external means not shown.

To prevent air flow from passing below the roller **20**, an upright wall **52** is provided to extend upwardly from the bottom wall **28** with its upper horizontal margin flanged rearwardly as shown. The upper forward edge **54** of this panel serves as a seal against which the periphery of the rewind roll (also designated as **26**) bears.

The core **26** of the rewind roll is a hollow metal shaft having a diameter somewhat larger than the diameter of

the bottom roller **20**. The ends of the core are closed by end caps welded thereto, and small diameter spindles **56** are welded to extend outwardly from the end caps in alignment with the axis of the core. These spindles ride in tracks formed by inwardly-open channels **58** secured to the inner faces of each of the side walls **30**. For reasons to be later explained, the web of the channel **58** is substantially wider than the diameter of the spindles. A wire spring **60** with a spiral bottom end attached to the side wall **30** is provided adjacent each of the side walls in a position in which the arm of the spring bears in a rearward direction to force the spindles **56** and rewind core or roll **26** toward the roller **20** and the sealing edge **54**. The spring **60** may be pulled back and lodged against the forward ends of the channel **58**, as shown by the broken line spring position in FIG. 2, when the rewind roll is to be removed from the base section.

The concept of sealing the base section against leakage of unfiltered air and contaminants therethrough entails locating the rewind roll **26** for a path of movement such that as its periphery enlarges (as indicated by the long and short dash line outline of the roll in FIG. 2) the periphery always bears against the sealing edge **54**. However, since the rewind roll is also driven by having its periphery bear against the conveyor adjacent the bottom roller **20**, it is also necessary that the engagement of the rewind roll against the conveyor be maintained. It will also be appreciated that as the rewind roll enlarges due to additional filter material being wound thereon, clearance must be provided for such enlargement.

As shown, the channels **58** in which the spindles **26** of the rewind core ride are inclined so that as the circumference of the rewind roll enlarges and its axis moves forwardly, the roll will also move upwardly to provide clearance between the bottom of the roll and the bottom wall of the base section. The inclination of the channels **58** also results in gravity urging the rewind roll in a rearward direction against the conveyor and sealing edge **54**, this gravitational force of course being normally supplemented by the force of the wire spring **60**.

The preferred disposition of the channels **58** is perhaps best explained with reference to a plane (hereinafter called the sealing-driving plane) which passes through the upper edge **54** of the sealing wall **52** and is tangent to the forward circumferential portion of the bottom roller **20**. The two channels are located with their axes on the same level and disposed substantially normal to this sealing-driving plane, and with the plane in which the channel axes lie bisecting that vertical dimension of the sealing-driving plane bounded along the top by the line of tangency with the roller **20** and along the bottom by the sealing edge **54**. While the term substantially normal has been used in a definitive sense, it is noted that currently preferred practice is to tilt the channels upwardly in the order of from 3–10° above the plane normal to the sealing plane to insure the driving engagement between the rewind roll periphery and the conveyor at all times.

With the bare core **26** having a diameter approximately half again as great as the diameter of the bottom roller, it has been determined that the path of movement of the axis of the rewind roll during enlargement to the point where the used filter material is stripped off the rewind roll is a nearly straight line. To the extent that the path is not straight, the sealing and driving engagement are accommodated by making the web of the channels **58** somewhat wider than the diameter of the spindles **56** of the rewind roll. Thus with the springs **60** urging the rewind roll rearwardly, the roll seeks a position of stability in which its periphery bears against two spaced lines—one being the driving engagement line, and the other being the sealing engagement line. This accommodating arrangement not only compensates for the path of movement not being a straight line, but also accommodates variations in the rewind roll periphery curvature resulting from differences in thickness of the layer of contaminants along the lengths of the filter material. Also, depending upon the character of the contaminant collected, the periphery of the enlarged rewind roll will normally flatten out to some degree where it is pressed against the surface of the conveyor adjacent the forward portion of the bottom roller, and also where it is pressed against the sealing edge **54**.

In determining the exact location of the channels, the following method may be used. The upper edge **54** of the sealing panel is in the form of an arc of small radius. The point where the axis of the core **26** will be when no filter material is wound on the core is found by striking one arc (having a radius equal to the sum of radii of the core **26** and the upper edge **54** arc) from the center point of the upper edge **54** arc, and striking another arc (having a radius equal to the sum of radii of the core **26** and roller **20**) from the center point of the roller **20**. Additional pairs of arcs are then struck using successively larger radii for the core or rewind roll radius. The successive points where each pair of arcs intersect traces the theoretical path of movement of the rewind roll. The disposition of the channels closely follows this theoretical path, with any departure being governed primarily by the extent to which the roll **26** presses against the conveyor **16** above the level of the axis of the roller **20**.

The invention claimed is:

1. In a roll-type air filter including a filter media supply section, a filter media rewind section, an air passage intermediate the supply section and said rewind section through which a stream of air to be filtered is passed, filter media extending through said air passage from said supply section to said rewind section so said stream of air is passed through said media in said air passage in filtering relation, media conveyor means including an endless belt conveyor supporting said media in said air passage and moving said filter media from said supply section through said air passage to said filter media rewind section, said conveyor passing around and in contact with roller means disposed in said rewind section, and means sealing the sides of said media passed through said air passage and preventing air leakage around the sides of said media,

(a) a filter media rewind roll receiving and rewinding filter media which has passed through said air passage section from said supply section, said rewind roll having opposite end spindles and being disposed generally parallel to said roller and upstream of said roller, relative to the direction of flow of gas to be filtered through said air passage, and means urging a peripheral section of said rewind roll, including filter media wound thereon, against said conveyor and urging said conveyor against said roller means at the nip formed at the line of contact between said conveyor and said rewind roll periphery, said line of contact defining a rewind roll driving engagement line which is tangential to said rewind roll at the point of contact of said rewind roll and said conveyor;

(b) a stationary panel extending continuously across the width of said rewind section and rigidly fixed to said rewind section in sealing relation, to prevent air to be filtered from passing around said stationary panel, said panel terminating adjacent said nip in an upper sealing edge parallel to the axis of said rewind roll and said sealing edge continuously contacting media wound on said rewind roll preventing the passage of air between said sealing edge and said rewind roll; and,

(c) spindle receiving channel means forming substantially straight channels, one of said channel means being disposed on each of the opposite sides of said rewind section receiving and supporting said spindles of said rewind roll and said channel means being disposed within said rewind section, said spindles of said rewind roll removing through

said channel means in response to accumulation of filter media on said rewind roll while maintaining contact between said rewind roll, including said media wound thereon, and both said sealing edge of said stationary panel and said conveyor means along said driving engagement line.

2. The construction according to claim 1 wherein: said channels are inwardly directed and the width of each of said channels is greater than the diameter of said spindles of each rewind roll.

3. The construction according to claim 1 wherein said rewind section includes cooperative spring means adapted to urge said rewind roll, including filter media wound thereon, against said conveyor means to urge said belt conveyor against said roller means.

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