Dec. 10, 1974 H. M. W. AUTRAND Re. 28, 268
DEVICE FOR SIGNALING NEED FOR CLEANING OR REPLACING SUCTION CLEANER DUST BAG
Original Filed Nov. 3, 1969 3 Sheets-Sheet 1

FIG. 1

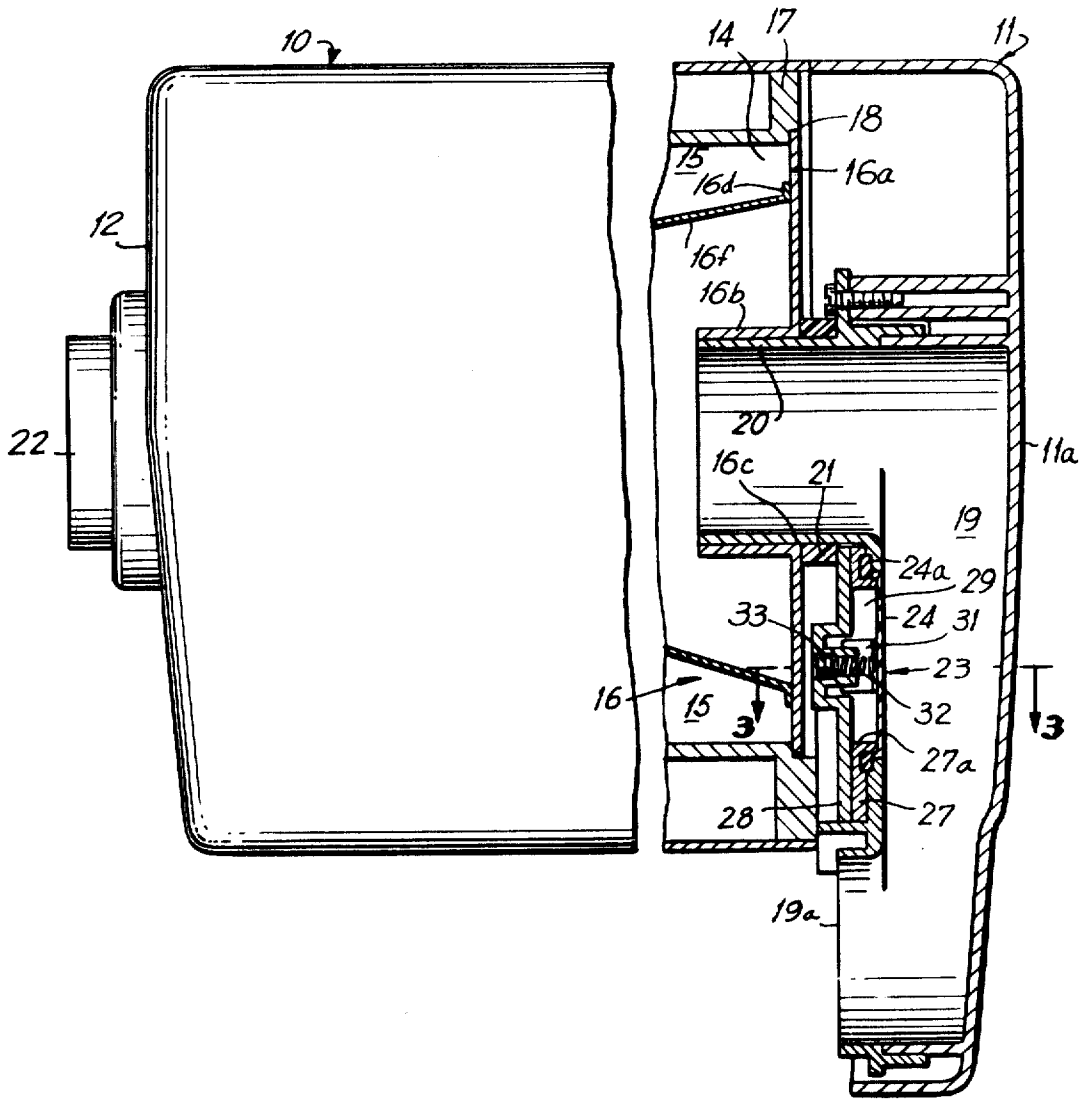


FIG. 2

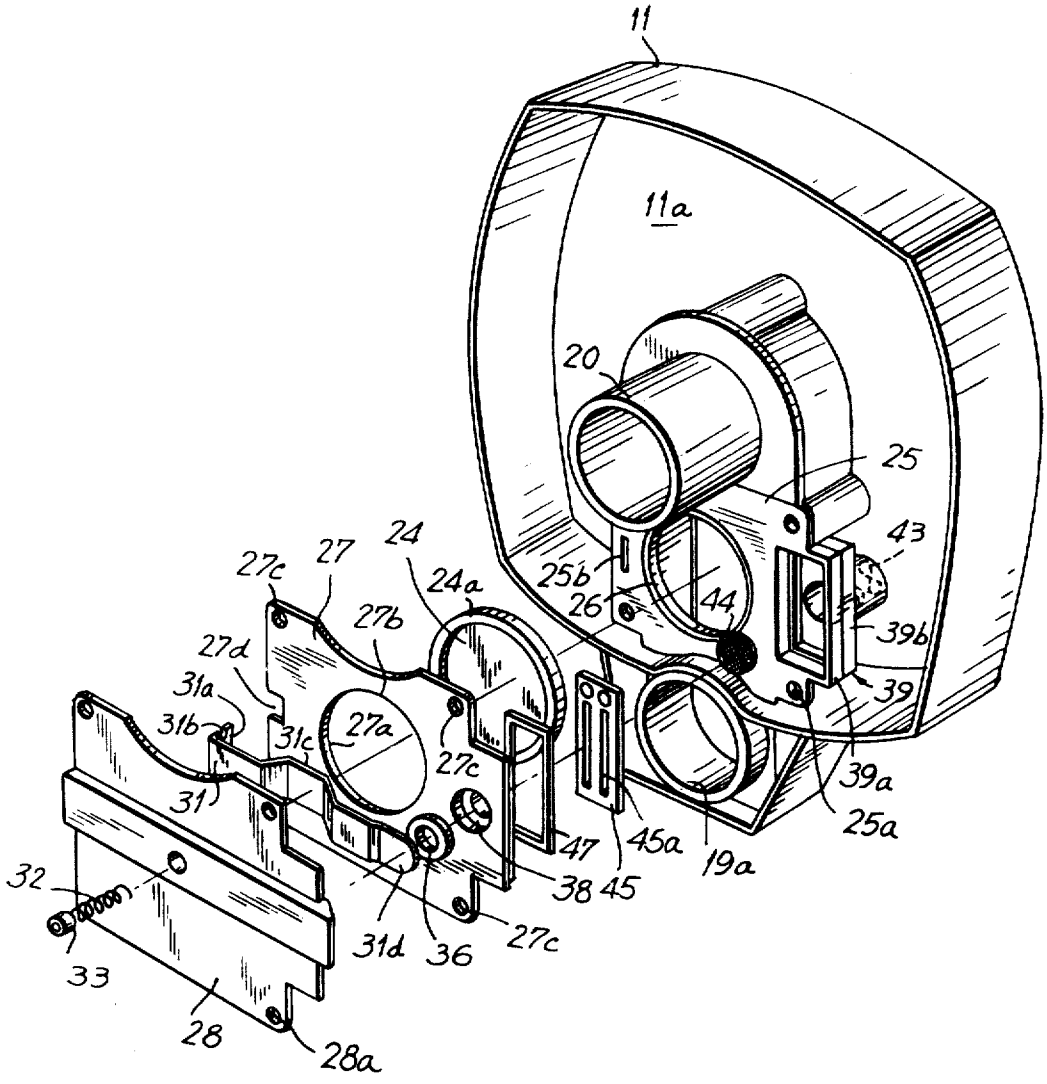

11
11a
20
25
43
24
27
27c
24a
25b
26
44
27b
27d
39b
31a
31b
31c
27a
39
27c
39a
31
25a
47
45a
19a
32
38
45
31d
36
27c
33
28
28a

FIG. 3

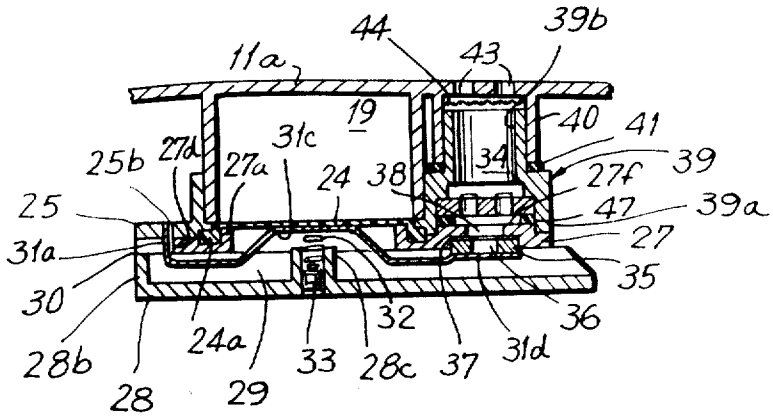
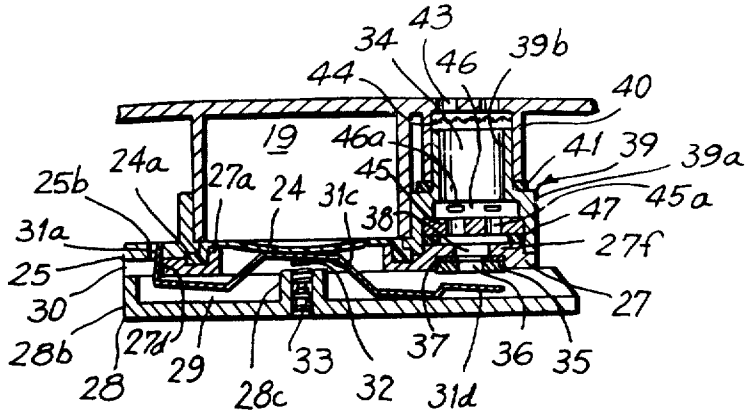

44
39b
11a
43
19
40
41
31c
25b
27d
27a
24
38
34
27f
39
25
47
39a
31a
27
35
30
32
36
28b
24a
33
28c
37
31d
28
29

FIG. 4


43
34
46
39b
44
40
19
46a
41
39
39a
24a
45
25b
27a
24
31c
45a
47
38
31a
27f
25
27
30
28b
27d
29
33
37
36
35
28
28c
32
31d

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DEVICE FOR SIGNALING NEED FOR CLEANING OR REPLACING SUCTION CLEANER DUST BAG

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Claims priority, application Sweden, Nov. 8, 1968, 15,154/68

Int. Cl. G08b *3/00*

U.S. Cl. 116—67 R 4 Claims

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

ABSTRACT OF THE DISCLOSURE

This invention relates to a device for indicating or signaling the need for cleaning or replacing a suction cleaner dust bag due to dirt trapped therein. The device produces an audible signal when a valve moves from a closed to an open position to allow air to flow to the atmosphere through a passageway from the interior of the suction cleaner. The valve forms a part of an armature member which is magnetically attracted by a magnet and is movable therefrom. A diaphragm is movable from a first position to one of several second positions responsive to the pressure differential at opposite sides of the dust bag, the diaphragm in its second positions acting on the armature member. When the valve is moved quickly from its closed position to a wide open position air flows at a high velocity through the passageway to cause the device to produce an audible sound of high intensity. Such quick movement of the valve from its closed to its open position is effected simultaneously with movement of the armature member from the magnet by a force which is dependent upon the particular second position to which the diaphragm is moved and which exceeds the force magnetically attracting the armature member to the magnet.

BACKGROUND OF THE INVENTION

Field of the Invention

It is known to provide a signaling or indicating device which functions responsive to the pressure differential at opposite sides of a suction cleaner dust bag. This pressure differential becomes increasingly greater responsive to dirt trapped at the side thereof initially contacted by the air. The indicating device may produce an audible signal responsive to flow of air in a passageway having a valve which, as the pressure differential builds up, gradually moves from its closed toward its open position. This is objectionable because, under these conditions, the audible sound produced by the signaling device initially is weak and gradually increases in intensity as the rate at which the air flows through the passageway increases. In an indicating or signaling device of this type, it is difficult to know precisely at what point the dust bag should be cleaned or replaced due to dirt trapped therein.

SUMMARY OF THE INVENTION

It is an object of my invention to provide an improved device for indicating the need for cleaning or replacing a suction cleaner dust bag due to dirt trapped therein. I accomplish this by providing an indicating device comprising a magnet and an armature member which is adapted to be magnetically attracted by the magnet and is movable therefrom, the device becoming operable to move the armature member from the magnet to produce the indication positively by means responsive to a force which is dependent upon the pressure differential at opposite sides of the dust bag and exceeds the force magnetically attracting the armature member to the magnet.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a fragmentary elevational view of a suction cleaner, partly in section, embodying my invention;

FIG. 2 is an exploded perspective view of parts shown in FIG. 1;

FIG. 3 is a horizontal sectional view, taken at line 3—3 of FIG. 1, illustrating the relative positions parts assume when one operating condition of the suction cleaner prevails; and

FIG. 4 is a sectional view similar to FIG. 3 illustrating the relative positions the parts assume when another operating condition of the suction cleaner prevails.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1 of the drawing, the suction cleaner which I have shown embodying my invention comprises a casing **10** having front and rear end covers **11** and **12**, respectively, secured thereto in any suitable manner. The front end cover **11** coacts with an open end **14** of the casing **10** when it is in its closed position illustrated in FIG. 1. A space **15** within the casing **10**, which is located adjacent to its open end **14**, is adapted to receive a dirt-collecting member **16**.

Although I do not wish to be limited thereto, the dirt-collecting member **16** may comprise an end closure **16a** formed of suitable sheetlike material like cardboard, for example, having a pair of flaps **16b** cut therefrom which, when moved from the plane of the end closure **16a**, define an opening **16c**. The open end **16d** of a paper dust bag **16f** is fixed in any suitable manner, as by an adhesive, to the inner face of the end closure **16a**.

The casing **10** is provided with a collar or ring **17** at the open end **14** thereof which is formed to provide a seat **18** in which the end closure **16a** is positioned with the dust bag **16f** extending within the space **15** of the casing **10**. The front end cover **11** is formed with a U-shaped passageway **19**, one arm of which is defined by a tubular member **20** projecting inward from the end cover **11**. The end cover **11** is provided with a collar or ring **21** which functions as a sealing gasket and is disposed about the tubular member **20** and bears against the end closure **16a** when the cover **11** is in its closed position shown in FIG. 1. The ring **21** may be formed of a material like foamed plastic, for example, to provide an airtight seal at the end closure **16a** about the tubular member **20**.

When the end cover **11**, which is removably mounted on the casing **10** in any suitable manner, is moved from its open position to its closed position, the inner free end of the tubular member **20** will engage the flaps **16b** and move them inward to form the opening **16c** in the end closure **16a**, as shown in FIG. 1. The U-shaped passageway **19**, which may be referred to as a suction passageway, is adapted to receive dirt-laden air at its air inlet end **19a**. The dirt-laden air is drawn through the passageway **19** into the interior of the casing **10** by a motor-fan unit (not shown) which may be located adjacent to the dirt-collecting member **16**.

During operation of the suction cleaner, air is drawn into the interior of the casing **10** through the U-shaped passageway **19** in the front end cover **11**. Dirt entrained in the air during cleaning collects in the dust bag **16f**, and air free of such dirt passes through the dust bag into the space **15** and flows through the casing **10** and eventually is discharged through an end opening **22** in the rear end cover **12**. Since dirt is trapped at the inner surface of the

dust bag **16f** there is a tendency for the dirt-collecting member **16** to become clogged during operation of the cleaner, the pressure differential at opposite sides of the dist bag **16f** becoming increasingly greater responsive to dirt trapped at the inner side of the dust bag which is initially contacted by the dirt-laden air.

In accordance with my invention, in order to indicate when the dirt-collecting member should be cleaned or replaced by a new dirt-collecting member, I provide a device **23** which automatically is rendered operable responsive to a predetermined pressure differential at opposite sides of the dust bag **16f** to produce a signal or other suitable indication. The device **23** is associated with the front end cover **11** and forms a unitary part thereof.

The indicating device **23** comprises a member **24** formed of elastomeric material, such as rubber or soft plastic, for example, which serves as a diaphragm having a beaded rim **24a** positioned at an upright wall **25** of the suction passage **19** about an opening **26** therein. Hence, the suction passageway **19** is defined in part by the diaphragm **24** which is held against the wall **25** at the opening **26** therein by an intermediate plate **27** of the shape shown in FIG. 2, such plate having a flange **27a** about an opening **27b** therein which coacts with the wall **25** to hold the rim **24a** therebetween.

The diaphragm **24** and an outer plate **28**, which overlies the intermediate plate **27**, define a space **29**, as best shown in FIG. 1. The upright wall **25**, intermediate plate **27** and outer plate **28** are formed with aligned openings **25a**, **27c** and **28a**, respectively, to receive suitable fastening screws (not shown). As seen in FIGS. 2, 3 and 4, the intermediate plate **27** is notched at **27d**. The notch **27d**, at the vicinity of the flanged end **28b** of the outer plate **28**, defines a passageway opening **30**, whereby the space **29** is in communication with the space **15** in the casing **10**.

Within the space **29** is disposed an elongated leaflike member **31** of the shape shown in FIGS. 2, 3 and 4. The member **31** is formed with a right-angle bent portion **31a** at one end thereof which extends through the bottom of the notch **27d** and into a slot **25b** in the wall **25** which is in a part thereof outside the suction passage **19**. The top and bottom edges of the bent portion **31a** of the member **31** are notched at **31b**, the notch at the top edge being illustrated in FIG. 2, to provide a fulcrum for the leaflike member **31** on the intermediate plate **27** at the vicinity of the notch **27d**, to enable the member **31** to pivotally move between the positions shown in FIGS. 3 and 4.

The member **31** is biased to its position shown in FIG. 3 by a helical spring **32** which is disposed in a hollow sleevelike part **28c** of the outer plate **28**. The sleevelike part **28c** is internally threaded to receive a nut **33** for adjusting the compression of the spring **32** and hence its biasing action on the member **31**. In the position shown in FIG. 3 an elongated flat intermediate portion **31c** of the leaflike member **31** is biased by the spring **32** toward the surface or face of the diaphragm **24** which is subject to the pressure prevailing in the space **15** in the casing **10**.

The outer free end portion **31d** of the leaflike member **31** serves as a valve which, depending upon the position of the member **31**, closes or opens a passageway **34** leading from the space **29** to the atmosphere. The passageway **34** is defined by a collar or ring **35** which has an opening **36** and snugly fits in a recessed portion **37** of the intermediate plate **27** which has an opening **38** in alignment with the opening **36**.

A hollow sleeve **39** of rectangular shape, as shown in FIG. 2, is formed integrally with the wall **25**. The sleeve **39** includes a first section **39a** adjacent to the intermediate plate **27** and a second section **39b** adjacent to the end wall **11a** of the end cover **11**. The intermediate plate **27** is formed with a boss **27f** at the vicinity of the opening **38** therein which snugly fits in the open end of the first sleeve section **39a**. The second sleeve section **39b** telescopically fits within a hollow sleeve **40** which is of rectangular shape and is formed integrally with the end wall **11a** of the end cover **11**. A sealing gasket **41** is provided between the open end of the sleeve **40** and a shoulder **42** of the sleeve **39**.

The end wall **11a** of the cover **11** is provided with openings **43** so that, when the valve **31d** is in its open position seen in FIG. 4, air can flow through the passageway **34** from the space **29** exteriorly of the suction cleaner through the openings **43**.

A filter **44**, which may be formed of suitable material which is permeable to air, is provided in the passageway **34** at the vicinity of the openings **43**. Further, members **45** and **46** are held against internal shoulders of the sleeve **39**, the member **45** having vertically extending oblong openings **45a** and the member **46** having metal reeds **46a** closely adjacent to the openings **45a**. A suitable sealing member **47** is interposed between the member **45** and the boss **27f** of the intermediate plate **27**.

During operation of the suction cleaner when air is drawn through the suction passageway **19** into the dirt-collecting member **16**, the pressure in the suction passageway **19**, at the right side of the diaphragm **24** in FIG. 1, will be the same as the pressure existing within the dust bag **16f** at the side thereof which is initially contacted by the air. Since the space **29** within the device **23** is in communication with the space **15** in the casing **10** through the passageway **30**, a path of flow for air will be provided so that the space **29** at the left side of the diaphragm **24** in FIG. 1 will be substantially at the same pressure as the pressure in the space **15** at the outer surface of the dust bag **16f**.

When the suction cleaner is being operated dust-laden air is drawn into the dust bag **16f** through the suction passageway **19**. Dirt is trapped in the dust bag and air separated from such dirt passes into the space **15**. When the dust bag **16f** is clean, the pressure differential at opposite sides of the dust bag is relatively small. Under these conditions, the pressure in the space **29** will be effective to maintain the diaphragm **24** in such a position that the leaflike member **31**, aided by the biasing action of the spring **32**, will be effective to maintain the valve **31d** at the outer free end of the member **31** in intimate physical contact with the collar or ring **35** which serves as a seat for the valve. Under these conditions, which is illustrated in FIG. 3, air in the space **29** cannot pass into the passageway **34**.

However, when the dust bag **16f** becomes clogged due to dust and dirt collected therein, the pressure in the space **15** at the outside of the dust bag **16f** will be less than the pressure inside the dust bag due to the suction effect produced by the motor-fan unit. When the pressure differential at opposite sides of the dust bag **16f** reaches a definite value, the pressure in the space **29** will be reduced sufficiently so that the diaphragm **24** will flex from the position shown in FIG. 3 to the position shown in FIG. 4 against the biasing action of the spring **32**. When this occurs valve **31d** moves from its seat or collar **35** and opens the passageway **34**. Air in the space **15** in the casing **10** can flow at a relatively high velocity through the passageway **30** into the space **29** and thence through the passageway **34** and openings **43** in the end cover end wall **11a** to the atmosphere. The air flowing through the passageway **34** past the metal reeds **46a** will cause the latter to vibrate rapidly and produce an audible sound. When this audible sound is produced, anyone in the vicinity of the suction cleaner will become aware of the fact that the dust-collecting member **16** should be withdrawn from the casing **10** for cleaning the latter or a fresh filter bag should be provided in the event that paper dust bags of the throwaway type are provided.

Heretofore it has been the practice to employ signaling and indicating devices in which the diaphragm **24** moves gradually from the position shown in FIG. 3 to the position shown in FIG. 4 which means that the valve **31d** in turn will move gradually from its seat on the collar or ring **35** as the bag **16f** becomes more and more clogged due to dust and dirt collected therein. Under these conditions

the audible sound produced by the signaling device initially is weak and gradually increases in intensity as the rate at which air flows through the passageway **34** increases.

In order to provide a signaling device which produces an audible sound of high intensity from the very moment when it becomes operative, so as to positively indicate a clogged condition of the dust bag **16**f which impairs the cleaning ability of the suction cleaner, the collar or ring **35** is a magnet and the leaflike member **31** serves as an armature member therefor which is formed at least in part of magnetic material. When the dust bag **16**f is clean, the pressure differential at opposite sides of the dust bag is relatively small, as explained above, and the parts of the device **23** will assume the relative positions shown in FIG. 3 and the armature member **31** will be attracted by the ring magnet **35** and the valve **31**d will be in its seated position on the ring magnet.

As the dust bag **16**f becomes clogged with dust and dirt during operation of the suction cleaner, the pressure differential at opposite sides of the dust bag **16**f gradually increases and the diaphragm flexes from a first position shown in FIG. 3 to one of several second positions, one of which is shown in FIG. 4. In FIG. 3 it will be seen that the armature member **31** is not acted upon by the diaphragm **24** when the latter in in its first position. In any event, the diaphragm **24** will not be effective to move the valve **31**d from its closed position in FIG. 3 to its open position in FIG. 4 until the leaflike member **31** is acted upon by a force generated or developed by the diaphragm **24** in one of its second positions which exceeds the force magnetically attracting the member **31** to the ring magnet **25**, such force developed by the diaphragm being dependent upon the pressure differential at opposite sides of the dust bag **16**f. When this occurs the valve **31**d will move practically instantaneously from a fully closed position to a fully open position and air at a high velocity will flow through the passageway **34** so that the reeds **46**a, from the very moment when they begin to vibrate, will produce an audible sound of high intensity.

A sudden flow of air through the passageway **34** when valve **31**d opens possesses the advantage that foreign matter tending to collect in the opening **45**a of the member **45** will be forcibly removed therefrom and prevent sticking of the vibrating reeds **46**a at the openings **45**a. Such sticking of the reeds **46**a, which often tends to persist when the initial velocity of air through the passageway **34** is not high, renders the signal device ineffective. By insuring flow of air at a high velocity through the passageway **34** when the valve **31**d opens, a distinctive audible signal always will be produced which leaves no doubt in the mind of the user that the dirt-collecting member **16** should be cleaned or replaced.

I claim:

[1. In a suction cleaner of the class described having a casing provided with an inlet and outlet for air adapted to flow therethrough and a dust bag therein for removing dirt from the air, the pressure differential at opposite sides of said dust bag becoming increasingly greater responsive to dirt trapped at the side thereof initially contacted by the air, the combination of a device for indicating the need for cleaning or replacing the dust bag due to dirt trapped therein, said device comprising a magnet and an armature member which is adapted to be magnetically attracted by said magnet and movable therefrom, and means responsive to a force which is dependent upon the pressure differential at opposite sides of said dust bag and exceeds the force magnetically attracting said armature member to said magnet to move said armature member from said magnet to render said device operable to produce said indication.]

[2. Apparatus as set forth in claim 1 which includes means for biasing said armature member toward said magnet.]

[3. Apparatus as set forth in claim 1 in which said device produces said indication with the aid of air and includes an element which has a passageway therein and defines a valve seat, and valve means which is movable to and from said seat with movement of said armature member to and from said magnet, said valve means moving from said seat with movement of said armature member from said magnet for effecting flow of air through said passageway to render said device operable to produce said indication.]

[4. Apparatus as set forth in claim 3 in which said valve means is carried by said armature member.]

[5. Apparatus as set forth in claim 3 in which said magnet is apertured and forms a part of said element and serves as said valve seat.]

[6. Apparatus as set forth in claim 5 in which said valve means comprises a part of said armature member which overlies said apertured magnet and closes said passageway when said armature member is magnetically attracted by said magnet.]

[7. In a suction cleaner of the class described having a casing provided with an inlet and outlet for air adapted to flow therethrough and a dust bag therein for removing dirt from the air, the pressure differential at opposite sides of said dust bag becoming increasingly greater responsive to dirt trapped at the side thereof initially contacted by the air, the combination of a device for indicating the need for cleaning or replacing the dust bag due to dirt trapped therein, said device comprising a magnet and an armature member which is adapted to be magnetically attracted by said magnet and movable therefrom, a diaphragm movable from a first position to one of several second positions responsive to the pressure differential at opposite sides of said dust bag, and said armature member being movable from said magnet to render said device operable to produce said indication responsive to a force which is dependent upon the particular second position to which said diaphragm is moved and which exceeds the force magnetically attracting said armature member to said magnet.]

[8. Apparatus as set forth in claim 7 in which said diaphragm in its first position is ineffective to produce a force which exceeds the force magnetically attracting said armature member to said magnet.]

[9. Apparatus as set forth in claim 7 which includes resilient means for biasing said diaphragm toward its first position.]

[10. Apparatus as set forth in claim 9 in which said resilient means also biases said armature member toward said magnet.]

11. In a suction cleaner of the class described having a casing provided with an inlet and outlet for air adapted to flow therethrough and a dust bag therein for removing dirt from the air, the pressure differential at opposite sides of said dust bag becoming increasingly greater responsive to dirt trapped at the side thereof initially contacted by the air, the combination of

(a) a device for producing an audible signal with the aid of air to indicate the need for cleaning or replacing the dust bag due to dirt trapped therein,

(b) said device comprising structure including a magnet and an armature member which is adapted to be magnetically attracted by said magnet and movable therefrom, said structure defining a passageway having a valve seat at the inlet end thereof,

(c) valve means which is movable to and from said seat with movement of said armature member to and from said magnet, and

(d) means responsive to a force which is dependent upon the pressure differential at opposite sides of said dust bag and exceeds the force magnetically attracting said armature member to said magnet to move said armature member from said magnet, said valve means moving from said seat with movement of said armature member from said magnet for effecting flow of air through said passageway to render said device operable to produce said audible signal.

12. Apparatus as set forth in claim 11 in which said valve means is carried by said armature member.

13. Apparatus as set forth in claim 11 in which said magnet is apertured and defines a part of said passageway and serves as a valve seat.

14. Apparatus as set forth in claim 13 in which said valve means comprises a part of said armature member which overlies said apertured magnet and closes said passageway when said armature member is magnetically attracted by said magnet.

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LOUIS J. CAPOZI, Primary Examiner

U.S. CL. X.R.

15—339; 116—70, 112; 210—90