June 9, 1953 G. E. LOFGREN ET AL 2,641,330

VACUUM CLEANER

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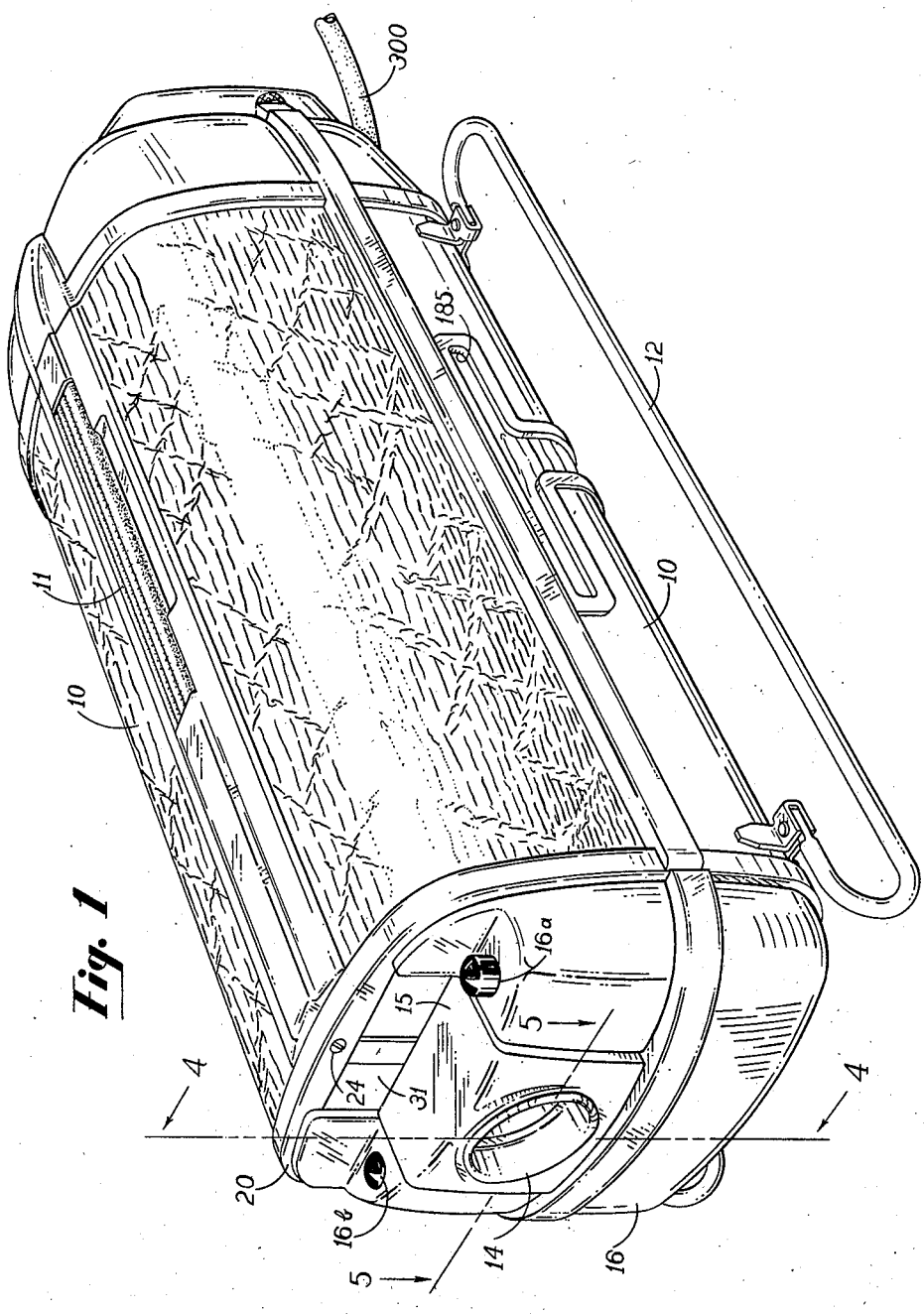

Fig. 1

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VACUUM CLEANER

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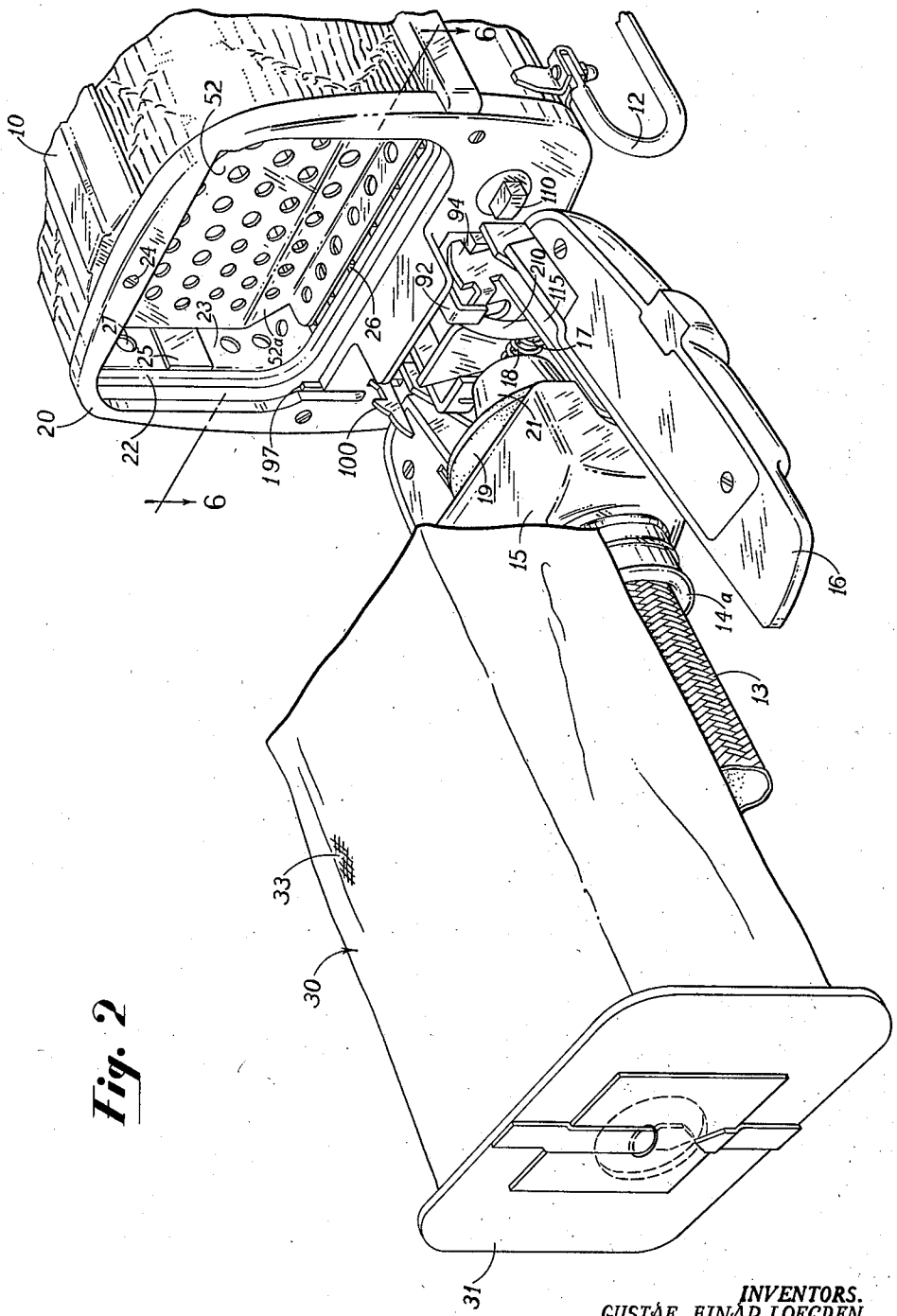

Fig. 2

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VACUUM CLEANER

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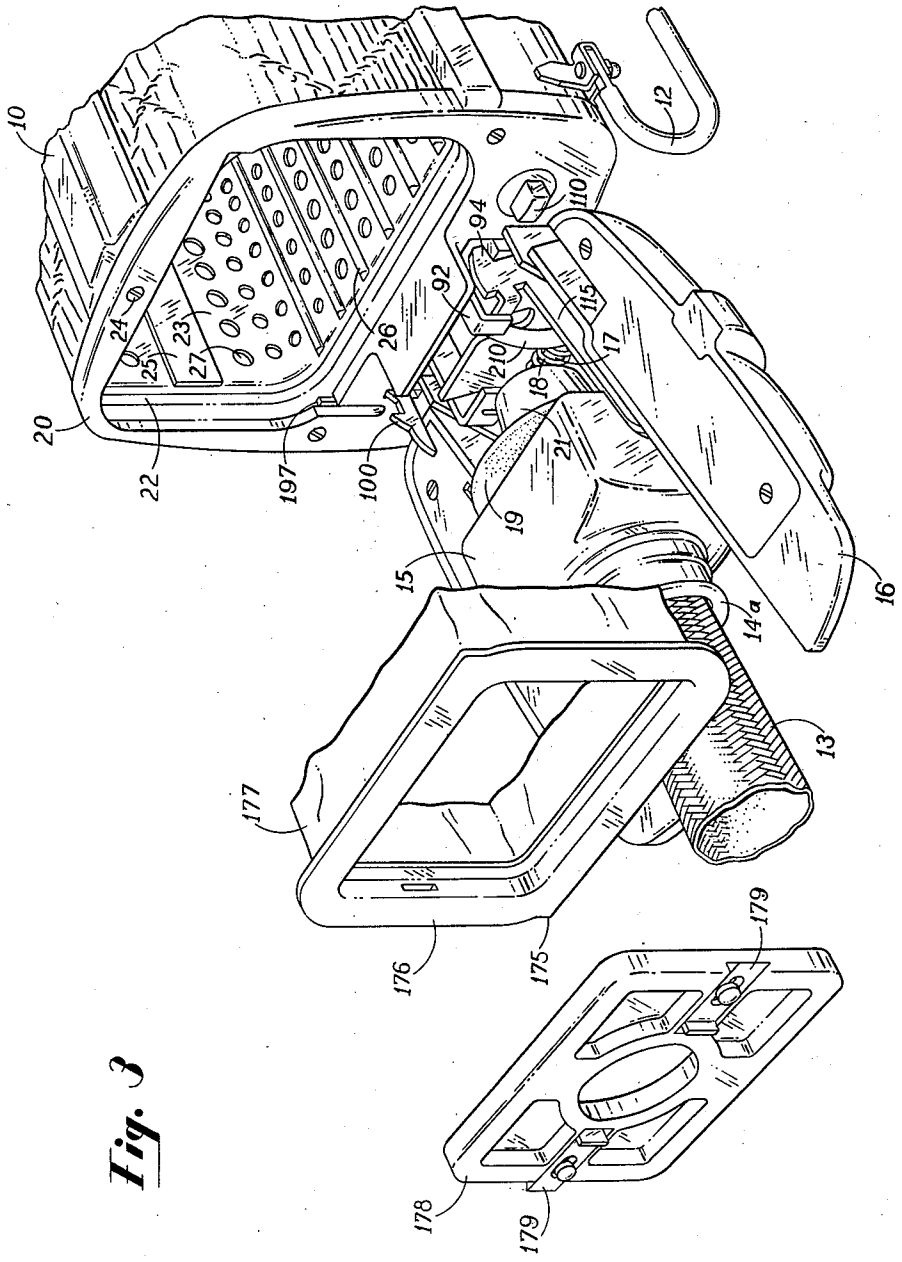

Fig. 3

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VACUUM CLEANER

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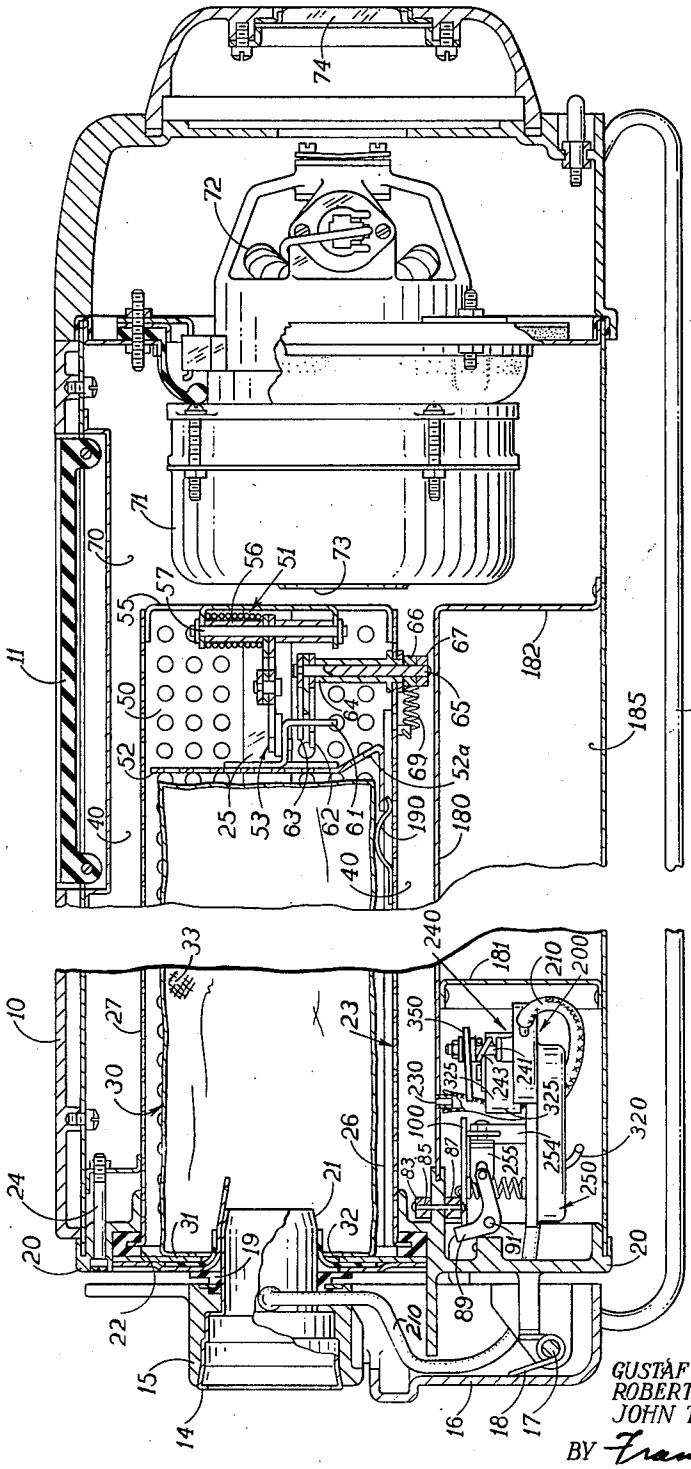

Fig. 4

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Fig. 5

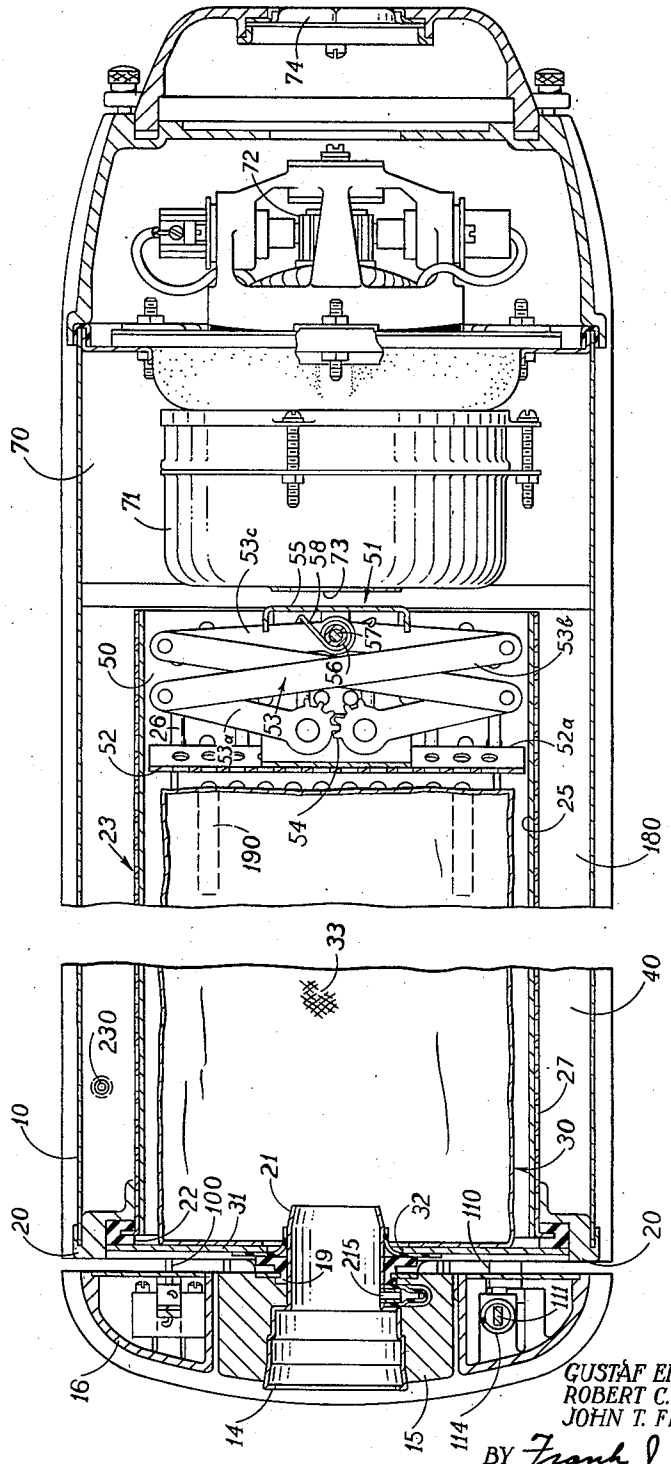

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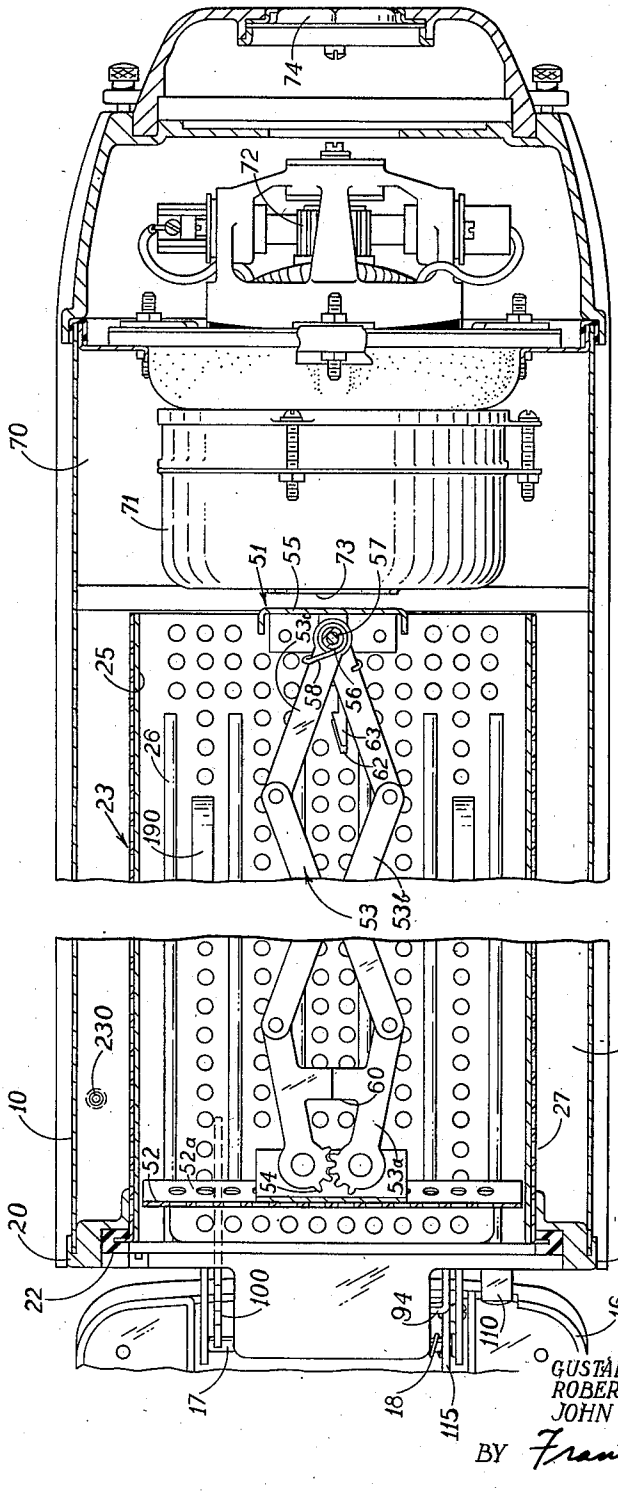
Fig. 6



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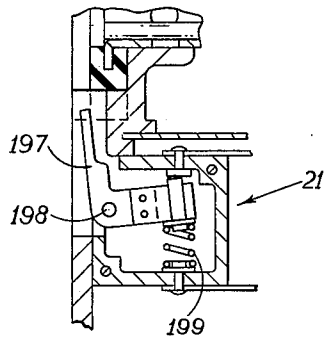

Fig. 8

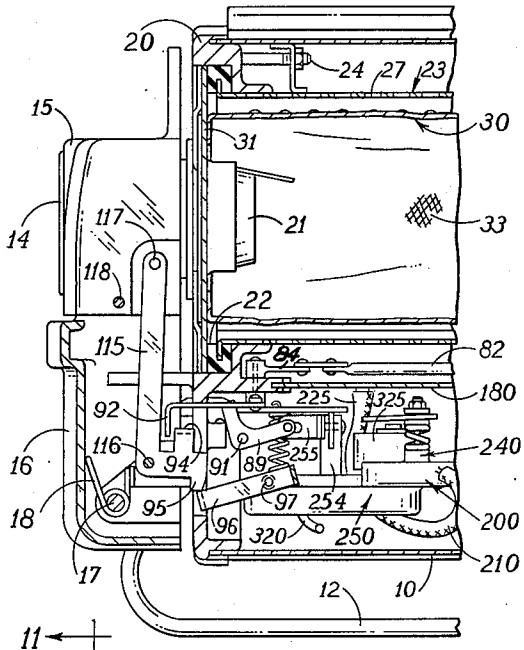

Fig. 7

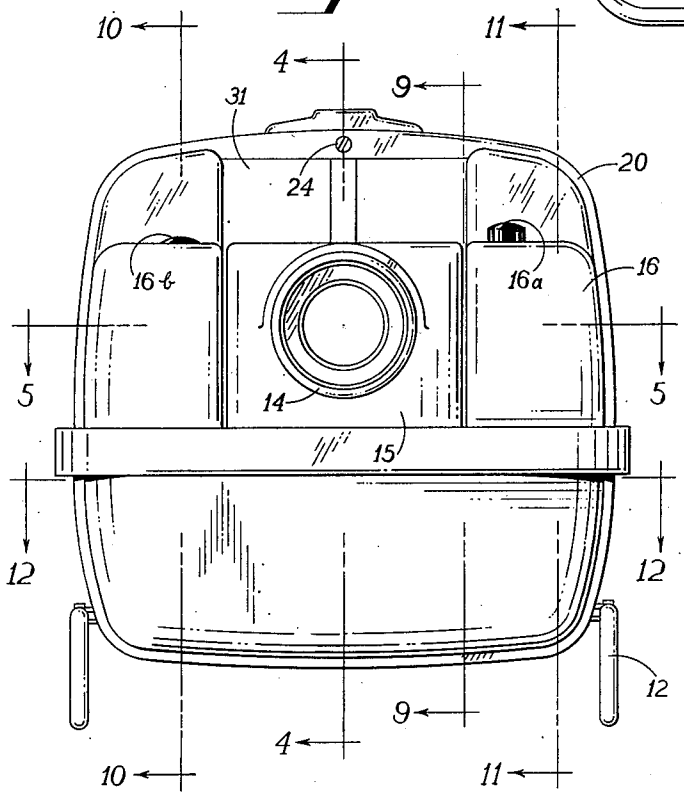

Fig. 9

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VACUUM CLEANER

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Fig. 10

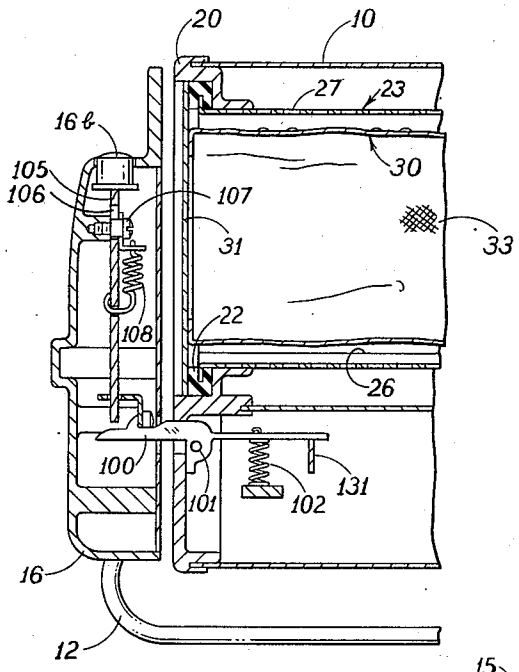
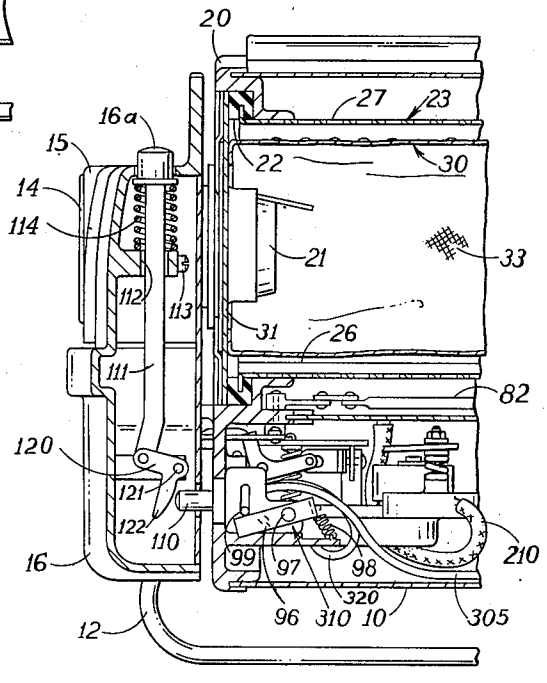


Fig. 11



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VACUUM CLEANER

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Fig. 12

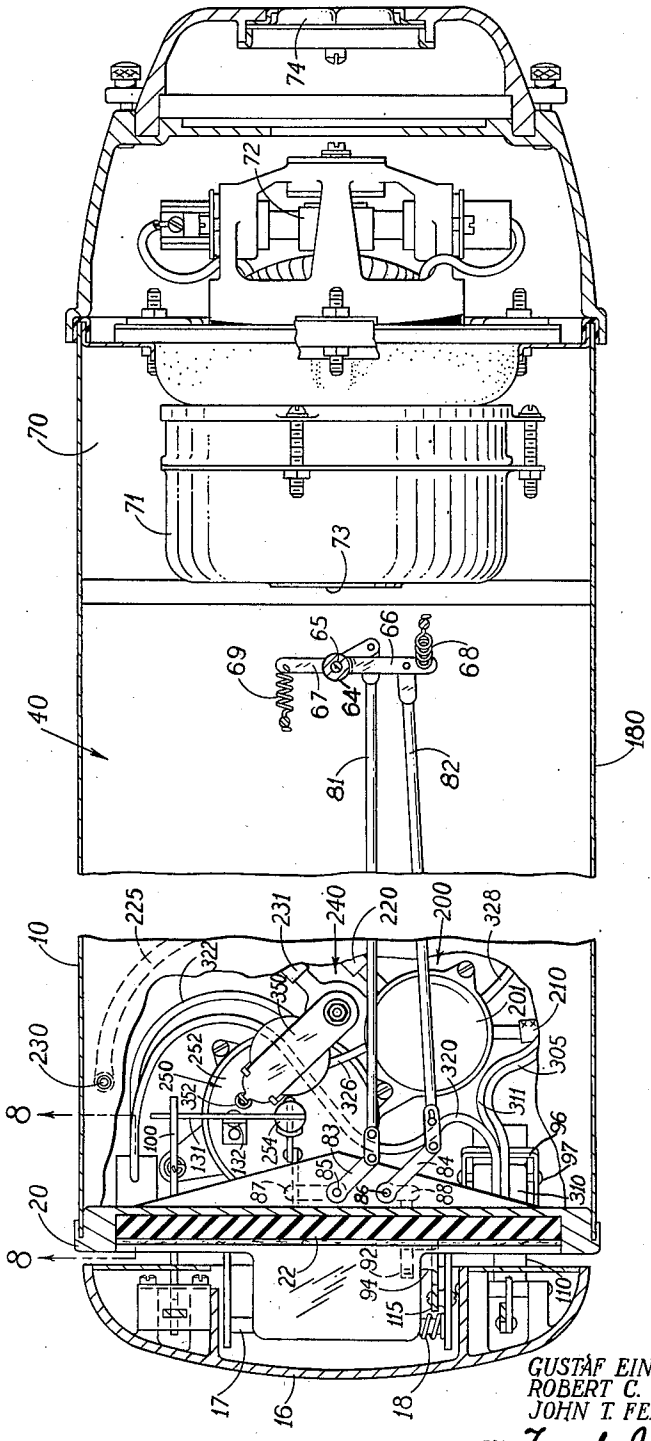

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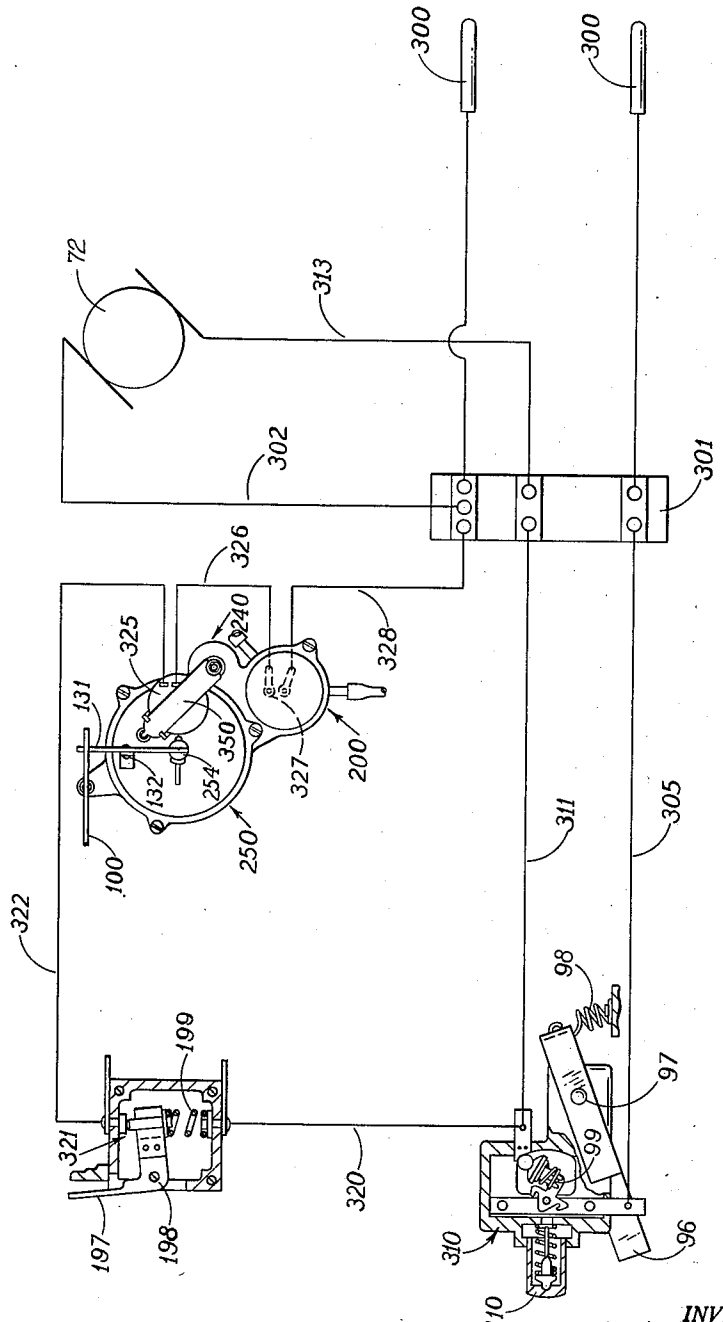
Fig. 13



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VACUUM CLEANER

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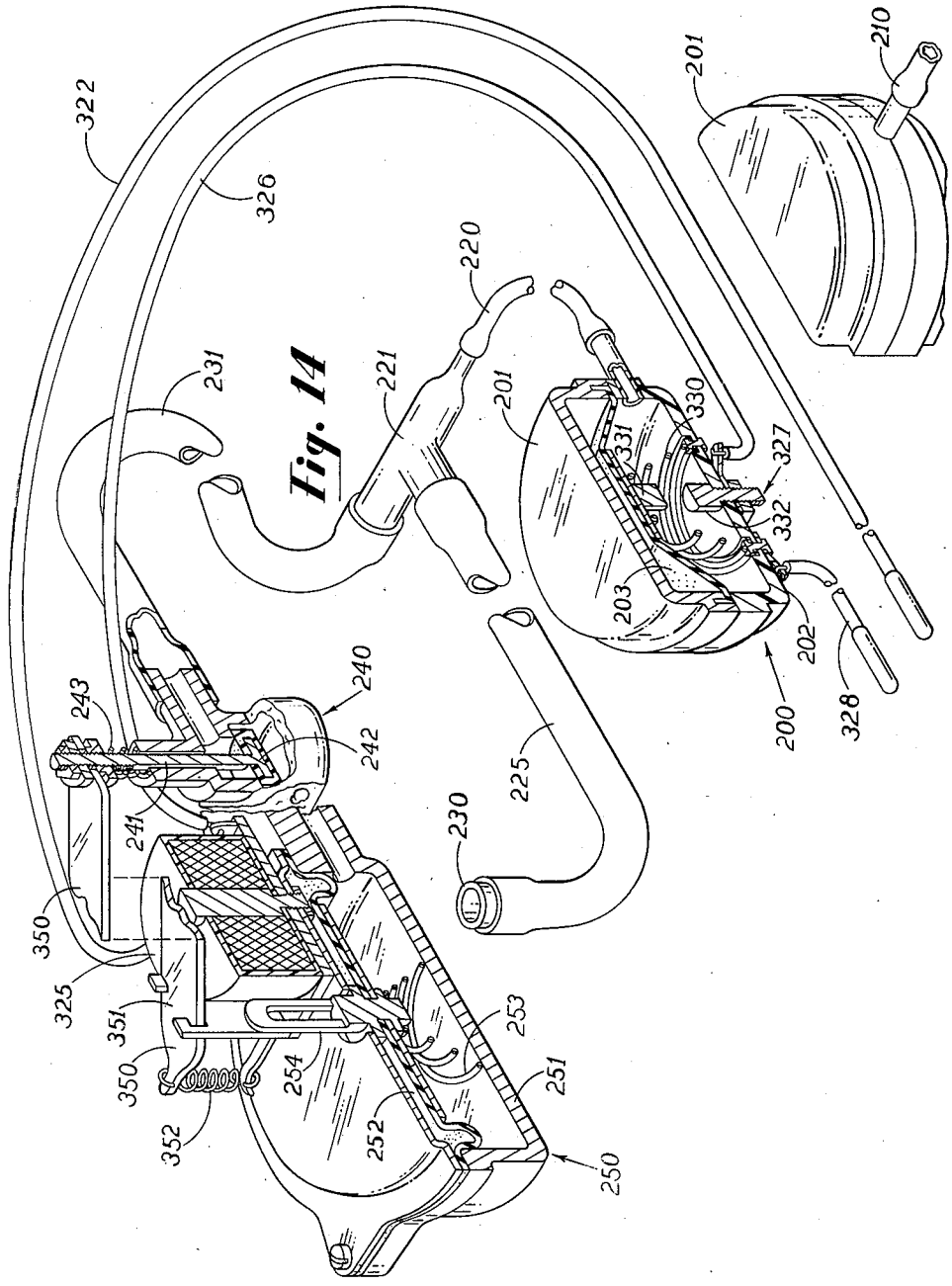

Fig. 14

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Patented June 9, 1953

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UNITED STATES PATENT OFFICE

2,641,330

VACUUM CLEANER

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Application January 25, 1950, Serial No. 140,394

22 Claims. (Cl. 183—37)

1

This invention relates to improvements in a vacuum or suction type cleaner having automatic controls. More particularly, it embraces an automatically conditioned tank type cleaner having self-contained control mechanisms for removing accumulated dirt in packaged form readied for immediate disposal. With this cleaner the dirt entrained in the incoming air suction stream is collected in a porous disposable bag located within the cleaner and when the collected dirt effects a predetermined change in the operating efficiency of the cleaner, the latter automatically shuts itself off and disposes of the dirt-filled bag by ejecting the latter from the cleaner.

It is a major object of this invention to provide a new and improved vacuum cleaner having automatic means for disposing of dust and dirt by ejecting from the cleaner a self-sealing porous and disposable paper bag filled with dust and dirt separated from the suction air stream drawn through the cleaner.

It is a further and important object hereof to provide completely automatic means for effecting the operation of a dust bag ejecting device upon the attainment of a predetermined condition or status of operation within the cleaner.

A still further object is to provide a vacuum cleaner which has a large dust collecting capacity and which operates at a substantially uniform efficiency.

A further object of this invention is to provide a device which avoids the inconveniences present in the conventional suction type of vacuum cleaning device using the customary cloth or paper dust bag which periodically necessitates indiscriminate removal or replacement in order to maintain a semblance of efficient operation, such bag removal steps being heretofore effected manually and with considerable difficulty and discomfiture on the part of the operator.

Still other and further objects will be disclosed hereinbelow or will become evident to those skilled in the art after a careful study of the following description together with the appended drawings wherein:

Figure 1 is a perspective view of the complete cleaner as seen from the air intake end, sans nozzle, conventional wand and hose;

Figure 2 is a perspective view of a portion of the cleaner and hose taken from a position similar to that of Fig. 1 showing the cover open, the ejector plate forward and the dust-filled bag in ejected position just prior to its coming to rest on the floor;

Figure 3 is a view similar to that shown in Fig. 2 with the cover open, the hose attached, the ejector plate pushed back and a conventional

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cloth type bag in exploded view and with its cloth portion partly cut away, the bag being in position for insertion into the dust bag compartment of the cleaner housing;

Figure 4 is a vertical sectional view taken on the line 4—4 of Figs. 1 and 7;

Figure 5 is a horizontal sectional view taken on the line 5—5 of Figs. 1 and 7;

Figure 6 is a partial horizontal sectional view taken on the line 6—6 of Fig. 2, showing the cover opened and the scissors ejector mechanism fully distended;

Figure 7 is a front plan view of the cover of Fig. 1 in closed position;

Figure 8 is a vertical sectional view taken on the line 8—8 of Fig. 12, showing the cut-out switch, which cooperates with a projection on the non-disposable cloth dust bag of Fig. 3 for disconnecting the automatic controls from operation;

Figure 9 is a vertical sectional view taken on the line 9—9 of Fig. 7 showing the parallel linkage of the hose coupling assembly to the cover;

Figure 10 is a sectional view taken on the line 10—10 of Fig. 7, showing the manually operable button for releasing the front cover;

Figure 11 is a sectional view taken on the line 11—11 of Fig. 7 showing the manually operable switch actuating button for energizing and de-energizing the motor fan unit;

Figure 12 is a horizontal sectional view taken on the line 12—12 of Fig. 7 showing the linkage control for automatically releasing the dust bag ejector device;

Figure 13 is a wiring diagram including some of the pneumatic controls; and

Figure 14 is an exploded perspective view with portions cut away in section showing the electro-pneumatic control unit and details of its internal construction.

It is a feature of this invention that the functioning of the cleaner in its dust disposal capacity is automatic, self-contained and after being once initiated by the establishment of predetermined changes in the operational characteristics of the air suction stream within the cleaner, the entire sequence of operations terminating in the ejection of the dust-filled bag is effected in a series of steps. Thus, with continued dust collection during the regular operation of the cleaner, a pressure difference is gradually built up within the cleaner between the inside and the outside of the dust-collecting bag. This results in a continuous and progressively increasing force being exerted upon a pressure differential measuring diaphragm, the opposite sides of which are subjected to the different pressures built up on the

outside and inside of the dust bag, the chamber on one side of the diaphragm being connected to an opening communicating with the clean side of the dust bag, the space on the other side of the diaphragm being connected to an opening communicating with the dirty side of the dust bag. Then, upon the attainment of a predetermined value in the resultant force exerted upon the pressure differential diaphragm, motion is imparted to this diaphragm and at a predetermined distortion the diaphrgam conditions means which sets into operation a series or sequence of steps (electrically actuated, pneumatically actuated, mechanically actuated, etc., etc.,) which sequence when once initiated culminates finally in the ejection of the dust-filled bag from the cleaner housing.

In a preferred embodiment, the differential pressure diaphragm actuates a switch which closes a circuit for energizing an electromagnetically actuated armature or solenoidal unit. The armature or plunger of the electromagnetic device in turn opens a valve for admitting suction from the motor fan unit to actuate a second diaphragm which operates through a series of linkages to release (1) a first ejector mechanism restraining latch and thereafter or in timed relation thereto (2) the cover of the cleaner housing. Then, the cover after a predetermined angular travel toward its fully opened position in turn breaks a circuit cutting off the power supply to the motor fan unit. Continued travel of the cover towards fully opened position subsequently releases a second and final ejector restraining latch for actually releasing the bag ejector mechanism for dust bag ejection, whereupon the dust-filled bag is expelled from the cleaner housing and deposited upon the floor. During these cover opening steps, the timely breaking of the motor fan circuit results in a progressively slowing down in motor fan speed and consequently the air suction stream also progressively decreases to a value at which highly effective bag ejection is more readily attained.

Thus in accordance with this preferred embodiment of the invention, automatic dust bag ejection is effected by mechanical means, after being initiated by a tripping mechanism including a pressure differential measuring device which actuates a responsive triggering apparatus. The pressure differential measuring device is conditioned for operation by utilizing the air pressure difference built up within the cleaner casing by dust layers collected in the dust bag. This pressure difference is established between the inside and outside of the dust collecting bag and is communicated therefrom by appropriate conduit means throughout the dust collecting process.

Referring now more particularly to the drawings, vacuum cleaner housing **10**, Fig. 1, is a hollow casing having a handle **11**. It is appropriately supported on a pair of runners **12**. The suction or inlet portion of the casing **10** is provided with an air inlet nozzle and wand (not shown) together with a suitable flexible hose **13**, Figs. 2, 3, and connecting coupling **14***a* fitted into a movable hose coupling assembly **15** mounted on cover **16**. Cover **16**, Fig. 6, hinged at **17** to front body ring **20** and biased to open position by spring **18**, effects with casing **10** an air tight seal formed by rubber sealing ring member **19**, cardboard disc **31** of dust bag **30** and sealing ring **22** positioned in the bag insertion opening of front body ring **20**, Fig. 5. Tubular member **21** of the hose coupling assembly **15** extends through the opening **32** cut in cardboard disc **31** well into the dust collecting receptacle **30**, and is sealed against disc **31** by rubber sealing ring **19**. Switch button **16***a* on cover **16** provides the on-and-off manual control for the cleaner unit.

A perforated sleeve **23** is affixed at one end to front body ring **20** and is adapted for supporting dust bag **30** (of disposable paper or cloth construction). This entire unit (sleeve **23**, body ring **20**, etc.) is slidably fitted within the open end of cleaner housing **10** and is affixed thereto by retaining screws **24**, Figs. 1, 2, 3, etc. In the embodiment shown, sleeve **23**, reinforced by lateral stiffening plates **25** and base rods **26**, is substantially rectangular in cross-section and is thus adapted to take a bag **30** of substantially similar but slightly smaller cross-section, Figs. 2, 3 and 4.

Two types of dust bag are illustrated, a disposable and a permanent one. Dust bag **30**, Fig. 2, comprises a dust receptacle of paper or similarly air-pervious, dust-impervious, material **33** affixed at its mouth to the rear surface of a hard paper or cardboard disc **31**, the latter being clamped between rubber sealing ring **19** of hose coupling assembly **15** and the open end of front body ring **20** with the aid of sealing ring **22**. Cardboard disc **31** has a central opening **32** through which tubular member **21** is inserted in order to introduce the air and entrained dust directly into the interior of dust bag **30**. The permanent cloth bag of Fig. 3 is used when the automatic controls and dust bag ejection are not desired (see detailed description below).

The entire inner surface of perforated sleeve member or dust bag receiving compartment **23** is provided with apertures **27**, Figs. 3, 4, and 6, in order to permit suction air current to pass freely therethrough and into chamber **40**, the air also passing to compartment **50** containing the ejector scissors **53** and its associated expulsion spring assembly **51**. Thereafter the suction air current passes through motor fan compartment **70** which contains mounted therein fan **71** and motor **72**. The fan is provided with an air inlet **73** through which the air passes to the housing of motor **72** and out through louver openings **74**.

The scissors ejector mechanism **51**, **53**, Figs. 4, 5 and 6, for operating the bag ejector plate **52** is in the form of a collapsible spring loaded lazy tongs **53** which can be collapsed into fully flexed (loaded) condition, Fig. 5, by pushing back ejector plate **52** hingedly attached by pins to the front pair of scissors blades **52***a*. Mutually intermeshing gear teeth **54** cut in coacting portions of the front pair of scissors blades keep plate **52** oriented correctly throughout the extent of its travel. U-shaped frame member **55** affixed to the rear end of perforated sleeve **23** supports the ends of the rear pair of scissors blades **53***c* by holding the latter between a pair of sleeves **56**, all being bearinged on pin **57**. The scissors mechanism is biased to fully distended position by loading springs **58** mounted over each sleeve **56**.

The scissors ejector mechanism **51**, **53**, is held in spring loaded position by a depending lug **61**, Fig. 4, which is integral with plate **52** and engages, sequentially, front latch **62** and rear latch **63** when plate **52** is pushed to its most rearwardly or spring loaded position, Fig. 5. Front latch **62** together with sleeve **64** and lever **66**, Fig. 12, forms a bell crank biased to latching position by spring **68** while rear latch **63** together with pin

65 and bell crank 67, Fig. 12, forms another composite bell crank biased to latching position by spring 69.

The above latches for restraining the ejector mechanism are operated through appropriate linkages. Thus rear latch 63 is moved to releasing position by automatic triggering initiated by pneumatically actuated means (described below) and transmitted through link 81, and a bell crank formed of lever arm 83, pin 85 and lever arm 87, Fig. 12, while lever arm 87 is actuated in turn by bell crank 89, Figs. 4, 9 and 12, fulcrumed at 91 and linked directly to the pneumatically operated triggering device 250.

Front latch 62 is moved to releasing position by the final opening stages of the released front cover 16 through link 82, and a bell crank form of lever arm 84, pin 86, and lever arm 88, while the latter is actuated by slide or draw bar 92 which is pulled outwardly by a cam 94 on the parallel linkage 115 of the hose coupling assembly 15.

With this particular latching device for restraining the scissors ejector mechanism 51, plate 52 is held in loaded position until cover 16 is practically fully opened. Cover 16 is normally held closed by latch 100, Figs. 2, 3 and 10, fulcrumed at 101 and biased to retain cover 16 in closed position by tension spring 102.

The cover may be opened for inspection of the bag and its contents, however, without necessarily ejecting the dust bag, by pressing release button 16b on cover 16 downwards and (Fig. 10) causing plunger 105 held through elongated slot 106 by retaining screw 107 and biased upwards by spring 108 to contact latch 100. Pressing button 16b forces plunger 105 downwards against latch 100 thus releasing cover 16. Then, even with front latch 62 released by the opening of cover 16 to its full extent, rear latch 63 restrains scissors ejector 53 from discharging the dust bag. Latch 63 thus serves as an auxiliary safety latch preventing the dust bag in either full or empty condition from being ejected upon manually opening cover 16. On the other hand, with cover 16 closed, latch 62 similarly serves as an auxiliary safety latch preventing the compression and jamming of bag 30 within sleeve member 23 even though latch 63 may have been released by the triggering action of pneumatically operated device 250.

It is to be noted that pneumatically operated device 250 in addition to triggering rear ejector latch 63 also releases cover restraining latch 100 by actuating lever 131, Figs. 10, 12, 13, fulcrumed at 132.

The parallel linkage of the hose coupling assembly 15 to the cover 16 is most clearly shown in Fig. 9, where bell crank 115 fulcrumed at 116 to front ring 20 and at 117 to hose coupling assembly 15 forms one link of the complete parallel linkage while cover 16 (itself), fulcrumed at 17 to front ring 20 and at 118 to hose coupling assembly 15, forms the other link.

Button 16a on cover 16 operates the switch button 110, Fig. 11, of a conventional on-and-off toggle type snap switch 310 through plunger 111 slidably held in a groove 112 by retaining screw 113 and biased upwards by spring 114. Plunger 111 actuates bell crank 120 fulcrumed at 121 through one arm thereof, the other 122 of which operates switch button 110. However, although button 16a may be used to start and stop the motor fan unit while the cover 16 is closed, the opening Fig. 9 of cover 16 causes a lug 95 of parallel linkage 115 to release one leg of a U-shaped switch rocker arm 96, Figs. 11, 12 and 13, fulcrumed at 97 and biased for clockwise rotation by spring 98. Thus when the cover is opened the other leg of switch arm 96 actuates pin 99 of the on-and-off switch 310 to its "off" position, thereby stopping the motor fan unit and otherwise deenergizing the entire cleaner unit.

The electrical and pneumatic control units are closely and operatively interrelated. The pneumatic system includes a pressure differential measuring control device 200, Fig. 14, comprising an upper casing 201 and a lower casing 202 separated by a diaphragm 203 pneumatically sealed therebetween. The space in the upper casing above diaphragm 203 is connected by communicating conduit 210, Figs. 4 and 14 to opening 215, Fig. 5, on the dirty or dust collecting side of the dust bag. The space in the lower casing below diaphragm 203 is connected by communicating conduit 220, T-shaped coupling 221 and common conduit 225 to opening 230, Figs. 4, 5, 6 and 12, on the clean side of the dust bag. The remaining connection from T-shaped coupling 221 communicates by means of conduit 231 with one side of valve 240 comprising valve stem 241 and valve face 242 biased to closed position by spring 243. When valve 240 is open it communicates high suction to the interior of pneumatically operating triggering device 250, comprising a lower casing 251 pneumatically sealed by diaphragm 252 biased to distended or upward position by spring 253 and capable of actuating tripping mechanism through link member 254.

The electrical system for energizing the motor fan unit and the electrical controls are clearly shown in diagrammatic form in Fig. 13. Vacuum cleaner electrical cord 300 conveys current from the house lines at 110 volts to terminal strips 301 located within the cleaner housing and from which one line 302 goes to motor 72, while the other line goes to motor 72 through a circuit including line 305, on-and-off switch 310, line 311 and line 313. The circuit for energizing the electrical controls comprises line 320, cut-out switch 321, line 322, electromagnet 325, line 326, pneumatically operated switch 327 of pressure differential pneumatic control unit 200, and line 328 to the house circuit through the cleaner cord 300. Cut-out switch 321, Figs. 8 and 13, is normally closed, bell crank 197 fulcrumed at 198 being biased to switch closing position by spring 199 except when a special cloth bag unit Fig. 3 (described below) is used for dust collection. The switch 327 of pressure differential pneumatic control unit 200 comprises a biasing spring 330, Fig. 14, which serves as a conducting element and for maintaining switch 327 normally open, together with contacts 331 and 332.

In detail and particularly with respect to the operation of the pneumatic and electrical controls, and referring especially to Figs. 13 and 14 where details of structure are clearly illustrated, the force exerted on the pressure differential diaphragm 203 progressively increases with continued dust collection, until it attains sufficient value to actuate switching means 327 and complete a circuit by closing contacts 331 and 332 in pressure differential control unit 200 Figs. 4, 13, 14 and thereby energize electromagnet 325. The armature 350 of energized electromagnet 325 fulcrummed at 351 and biased by spring 352 to hold valve 240 more securely closed, then moves downwardly and opens valve 240 allowing high suction to be communicated to and operate dia-

phragm 252 which in turn through a series of linkages 254, 255, bell crank 89, etc., releases rear latch 63, Figs. 4, 6, 9 and 12, holding ejection plate 52. Also by actuating lever 131, Figs. 12 and 13, diaphragm 252 by way of linkage 254 trips cover releasing latch 100, Figs. 4, 10 and 12, which latch holds cover 16 closed against spring tension. The release of cover 16 first breaks a circuit at the contact points of switch 310 through release of rocker arm 96 which is biased by spring 98 to throw switch 310 to "off" position, Figs. 9, 11, thereby deenergizing the motor fan unit. Thereafter the front cover continues to open and after opening substantially 90°, mechanical trigger mechanism comprising cam 94 of parallel linkage 115 trips draw bar 92 releasing front latch 62 and hence the bag ejector mechanism 51 through a previously traced series of linkages, allowing the bag ejector plate 52, Figs. 4, 6 to push the bag forward and throw the bag and its contained dirt out of the cleaner casing.

The ejector plate 52 moves forward and outward when released until stops 60, Fig. 6, abut in the forepart of the scissors mechanism 53. The momentum of the moving dust-filled bag causes it to continue onward in its own trajectory out of the cleaner casing after which it comes to rest on the floor.

The cloth bag shown in Fig. 3 is used when it is not desired to effect dust bag ejection. With this bag, a projection 175 on the lower edge of the metal ring 176 to which cloth dust bag 177 is attached pushes against the upper end of bell crank 197, Fig. 8, interrupting the electrical circuit of the control mechanism Fig. 13. The operator then decides himself when to empty this cloth bag. To empty this cloth bag, inner cover 178 is removed by releasing two latches 179, whereupon the dust and dirt is shaken out manually.

Various other details of construction are shown in the accompanying drawings. Thus, the base plate 130, Fig. 4, sealing off the housing at the bottom of the dust bag and screen compartment 40 together with depending partitions 181 and 182 forms a bag storage chamber 185 (see also Fig. 1), which may also be used for storage of a cord reel. Leaf springs 190 keep the inner folded end of paper dust bag 30 from jamming under plate 52 and between the bottom edge of plate 52 and the floor of the dust bag compartment 23. The angularly bent portion 52a of plate 52 serves to keep the bag from crimping and jamming during ejection.

It is to be understood that the invention is not to be limited to the various structural features illustrated and described but that the same may be variously otherwise embodied within the scope of the appended claims.

What we claim is:

1. In a vacuum cleaner, the combination comprising a casing formed with an opening, a dust bag removable from said casing through said opening, a cover member for said opening, an inlet conduit having its inner end communicating with the interior of said bag, means for inducing flow of air through said conduit into said bag, and a control member movable to open said cover in response to variations in the differential of the air pressure existing in said conduit at a point spaced outwardly from its inner end and the air pressure existing in said casing between said bag and said flow producing means.

2. In a vacuum cleaner, the combination comprising a casing formed with an opening, a dust bag removable from said casing through said opening, a cover member for said opening, an inlet conduit having its inner end communicating with the interior of said bag, means for inducing flow of air through said conduit into said bag, a diaphragm subject on one side to the air pressure existing in said conduit at a point spaced outwardly from its inner end and on the other side to the air pressure existing in said casing between said bag and said flow producing means, and means responsive to movement of said diaphragm for opening said cover.

3. In a vacuum cleaner, the combination comprising a casing having compartments and an opening, a movable cover for said opening, releasable means for holding said cover in closed position, means for producing a flow of air through said casing, a dust bag in said casing in the path of said air flow for separating entrained dirt from said air, means responsive to a predetermined change in the pressure characteristics between predetermined compartments within said casing for operating said cover releasing means, manually operative means for operating said cover releasing means, and means for ejecting said dust bag actuated only by opening of said cover in response to said change in pressure.

4. In a vacuum cleaner, the combination comprising a casing having an opening, a movable cover for said opening, releasable means for holding said cover in closed position, means for producing a flow of air through said casing, a dust bag in said casing in the path of said air flow for separating entrained dirt from said air, means responsive to the establishment of a predetermined pressure difference between the inside and outside of said dust bag for operating said cover releasing means, releasable means for ejecting said dust bag, means responsive substantially simultaneously with the opening of said cover for placing said releasable bag ejecting means in condition for operation, additional means responsive to the opening of said cover for deenergizing the air flow producing means, and further means responsive to the complete opening of said cover for effecting the operation of said releasable bag ejecting means whereby the bag ejecting means is capable of more effective ejection of the dust bag.

5. In a vacuum cleaner, the combination comprising a casing having an opening, a movable cover for said opening, releasable means for holding said cover in closed position, means for producing a flow of air through said casing, a dust bag in said casing in the path of said air flow for separating entrained dirt from said air, air pressure means for operating said cover releasing means, valve means for controlling said air pressure means, electromagnetic means for actuating said valve means, differential air pressure responsive means operative upon the attainment of a predetermined pressure difference between the inside and outside of the dust bag for energizing said electromagnetic means, and additional means responsive to the opening of said cover for ejecting said dust bag.

6. In a vacuum cleaner, the combination comprising a casing having an opening, a movable cover for said opening, releasable means for holding said cover in closed position, means for producing a flow of air through said casing, a dust bag in said casing in the path of said air flow for separating entrained dirt from said air, means responsive to a predetermined change in the pressure characteristics within and without said dust bag for moving said dust bag to a predetermined

position, air pressure means for operating said cover releasing means, valve means for controlling said air pressure means, electromagnetic means for actuating said valve means, differential air pressure responsive means operative upon the attainment of a predetermined pressure difference between the inside and outside of the dust bag for energizing said electromagnetic means, and additional means responsive to the opening of said cover for ejecting said dust bag.

7. In a vacuum cleaner, the combination comprising a casing having an opening, a movable cover for said opening, releasable means for holding said cover in closed position, means for producing a flow of air through said casing, a dust bag in said casing in the path of said air flow for separating entrained dirt from said air, air pressure means for operating said cover releasing means, valve means for controlling said air pressure means, electromagnetic means for actuating said valve means, differential air pressure responsive means operative upon the attainment of a predetermined pressure difference between the inside and outside of the dust bag for energizing said electromagnetic means, releasable means for ejecting said dust bag, means responsive substantially simultaneously with the opening of said cover for placing said releasable bag ejecting means in condition for operation, additional means responsive to the opening of said cover for deenergizing the air flow producing means, and further means responsive to the complete opening of said cover for effecting the operation of said releasable bag ejecting means.

8. In a vacuum cleaner, the combination comprising a casing having an opening, a movable cover for said opening, releasable means for holding said cover in closed position, means for producing a flow of air through said casing, a dust bag in said casing in the path of said air flow for separating entrained dirt from said air, releasable means for ejecting said dust bag, pneumatically operable diaphragm means for operating said cover releasing means and for placing said ejecting means in condition for operation, valve means for controlling said pneumatically operable means, electromagnetic means for actuating said valve means, differential air pressure responsive means operative upon the attainment of a predetermined pressure difference between the inside and outside of the dust bag for energizing said electromagnetic means, additional means responsive to the opening of said cover for deenergizing the air flow producing means, and further means responsive to the complete opening of said cover for effecting the operation of said releasable bag ejecting means.

9. In a vacuum cleaner, the combination comprising a casing having an opening, a movable cover for said opening, releasable means for holding said cover in closed position, means for producing a flow of air through said casing, a dust bag in said casing in the path of said air flow for separating entrained dirt from said air, means for ejecting said dust bag, restraining means for preventing operation of said bag ejecting means, means responsive to the establishment of a predetermined pressure difference between the inside and outside of said dust bag for operating said cover releasing means, means responsive substantially simultaneously with the opening of said cover for placing said restraining means in condition for releasing the ejecting means, and further means responsive to the complete opening of said cover for effecting the release of said restraining means.

10. In a vacuum cleaner, the combination comprising a casing having an opening, a movable cover for said opening, releasable means for holding said cover in closed position, means for producing a flow of air through said casing, a dust bag in said casing in the path of said air flow for separating entrained dirt from said air, releasable means for ejecting said dust bag, mechanically operable triggering means operable for placing the ejecting means in condition for operation, pneumatically operable diaphragm means for operating said triggering means and said cover releasing means, valve means for controlling said pneumatically operable means, electromagnetic means for actuating said valve means, differential air pressure responsive means operative upon the attainment of a predetermined pressure difference between the inside and outside of the dust bag for energizing said electromagnetic means, means responsive to opening of said cover for releasing the means for ejecting said dust bag, whenever said ejecting means has been placed in condition for operation, a cut-out means for rendering said electromagnetic means inoperative, and means on the dust bag for actuating said cut-out means to render the automatic ejecting means inoperable.

11. In a vacuum cleaner, a casing having an opening, a movable cover for said opening, means for producing flow of air through said casing, a dust separating bag in said casing in the path of air flow therethrough, spring biased means for ejecting said bag from said casing through said opening, first latching means for retaining said ejecting means in fully retracted position, means responsive to a predetermined pressure drop through said bag for releasing said first latching means and for opening said cover, second latching means for arresting movement of said ejecting means after the latter has been released by said first latching means, and means responsive to opening of said cover for releasing said second latching means.

12. In a vacuum cleaner, a casing having an opening, a movable cover for said opening, electrically driven means for producing flow of air through said casing, means for supplying current to said electrically driven means, a dust separating bag in said casing in the path of air flow therethrough, spring biased means for ejecting said bag from said casing through said opening, first latching means for retaining said ejecting means in fully retracted position, means responsive to a predetermined pressure drop through said bag for opening said cover and for releasing said first latching means, second latching means for arresting movement of said ejecting means after the latter has been released by said first latching means, and means responsive to opening of said cover for interrupting said supply of current and for releasing said second latching means.

13. In a vacuum cleaner, a casing having an opening, a movable cover for said opening, means for producing flow of air through said casing, a dust separating member in said casing in the path of air flow therethrough, pneumatic means for opening said cover, valve means for controlling said pneumatic means, electromagnetic means for actuating said valve means, and means responsive to difference in pressure at opposite sides of said dust separating member for operating said electromagnetic means.

14. In a vacuum cleaner, a casing having an opening, means for producing flow of air through said casing, a dust separating container in said casing in the path of air flow therethrough, spring biased means for ejecting said container from said casing through said opening, pneumatically operated means for releasing said ejecting means, valve means for controlling said pneumatically operated means, electromagnetic means for actuating said valve means, and means responsive to difference in pressure at opposite sides of said dust separating container for operating said electromagnetic means.

15. In a vacuum cleaner, a casing having an opening, a movable cover for said opening, means for producing flow of air through said casing, a dust separating container in said casing in the path of air flow therethrough, spring biased means for ejecting said container through said opening, pneumatically operated means for opening said cover and releasing said ejecting means, valve means for controlling said pneumatically operated means, electromagnetic means for actuating said valve means, and differential pressure responsive means subjected to the pressures at opposite sides of said dust separating container for operating said electromagnetic means.

16. In a vacuum cleaner, a casing having an opening, a movable cover for said opening, fan means for creating a pressure in said casing different from atmospheric pressure to thereby produce flow of air through the casing, a dust separating member in said casing in the path of air flow therethrough, pneumatically operable means for opening said cover, valve means for controlling the application to said pneumatic means of the pressure difference created by said fan, electromagnetic means for actuating said valve means, and means responsive to difference in pressure at opposite sides of said dust separating member due to the pressure drop of the air flowing therethrough for operating said electromagnetic means.

17. In a vacuum cleaner, a casing having an opening, a movable cover for said opening, fan means for creating suction in said casing to thereby produce flow of air therethrough, a dust separating member in said casing in the path of air flow therethrough, a power diaphragm for opening said cover, valve means for controlling the application of said suction to said diaphragm, electromagnetic means for actuating said valve means, an electric switch for energizing said electromagnetic means, and a control diaphragm responsive to difference in pressure at opposite sides of said dust separating member due to the pressure drop of air flowing therethrough for operating said switch.

18. In a vacuum clearer, a casing having an opening, a movable cover for said opening, means for producing flow of air through said casing, a dust separating bag in said casing in the path of air flow therethrough, spring biased means for ejecting said bag from said casing through said opening, first latching means for retaining said ejecting means in fully retracted position, pneumatic means for opening said cover and for releasing said first latching means, valve means for controlling said pneumatic means, electromagnetic means for actuating said valve means, means responsive to difference in pressure at opposite sides of said dust bag for operating said electromagnetic means, second latching means for arresting movement of said ejecting means after the latter has been released by said first latching means, and means responsive to opening of said cover for releasing said second latching means.

19. In a vacuum cleaner, a casing having an opening, a movable cover for said opening, electrically driven means for producing flow of air through said casing, means for supplying current to said electrically driven means, a dust separating bag in said casing in the path of air flow therethrough, spring biased means for ejecting said bag from said casing through said opening, first latching means for retaining said ejecting means in fully retracted position, pneumatic means for opening said cover and for releasing said first latching means, valve means for controlling said pneumatic means, electromagnetic means for actuating said valve means, means responsive to difference in pressure at opposite sides of said dust bag for operating said electromagnetic means, second latching means for arresting movement of said ejecting means after the latter has been released by said first latching means, means responsive to partial opening of said cover for interrupting said supply of current, and means responsive to substantially complete opening of said cover for releasing said second latching means.

20. In a vacuum cleaner, a casing having an opening, means for producing flow of air through said casing, a dust separating container in said casing in the path of air flow therethrough, spring biased means for ejecting said container from said casing through said opening, means responsive to an increase in pressure drop through said container for releasing said ejecting means, and means associated with said dust separating container for rendering the pressure responsive means inoperative.

21. In a vacuum cleaner, a casing enclosing a dust receptacle compartment with an opening to the exterior, a dust separating member insertable into said compartment through said opening, means for producing a flow of air through said member, a movable cover for said opening, pneumatically operated means for controlling the opening of said cover, valve means for controlling said pneumatic means, and means responsive to difference in pressure at opposite sides of said dust separating member for controlling said valve means.

22. In a vacuum cleaner, a casing enclosing a dust receptacle compartment with an opening to the exterior, means for producing a flow of air through said compartment, a dust receptacle in said compartment in the path of air flow, spring biased means for outwardly moving said dust receptacle, pneumatically operated means for releasing said spring biased means, valve means for controlling said pneumatic means, and means responsive to difference of pressure at opposite sides of said dust receptacle for operating said valve means.

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