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(54) Title: IMPROVED VACUUM CLEANER

(57) Abrégé/Abstract:
A vacuum cleaner assembly (10) comprising a main housing (12) having an inlet (14) and an outlet (16). A motor (17a) is disposed within the main housing (12) between the inlet (14) and the outlet (16) for providing motive force to a cooling fan (17b), a blower (17c), and a separator (22). The separator (22) is mounted below the blower (17c) for circulating the air and water bath (20) within a water bath pan (36) and provides with the water bath (20) a primary filter for filtering the air prior to exhausting the air outwardly toward the outlet (16). A second filter assembly (24) is also provided including a high efficiency filter (100 or 100a) for filtering microscopic dust and dirt particles that escape the primary filter (22, 20) and is disposed before the outlet (16) for additional filetring of the air prior to being exhausted to the atmosphere.

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A vacuum cleaner assembly (10) comprising a main housing (12) having an inlet (14) and an outlet (16). A motor (17a) is disposed within the main housing (12) between the inlet (14) and the outlet (16) for providing motive force to a cooling fan (17b), a blower (17c), and a separator (22). The separator (22) is mounted below the blower (17c) for circulating the air and water bath (20) within a water bath pan (36) and provides with the water bath (20) a primary filter for filtering the air prior to exhausting the air outwardly toward the outlet (16). A second filter assembly (24) is also provided including a high efficiency filter (100 or 100a) for filtering microscopic dust and dirt particles that escape the primary filter (22, 20) and is disposed before the outlet (16) for additional filetring of the air prior to being exhausted to the atmosphere.

IMPROVED VACUUM CLEANER

1. Field of the Invention

This invention relates to a vacuum cleaner of the type for household use.

2. Description of the Prior Art

Water bath vacuum cleaners typically include a main housing with a removably attached water bath pan. An intake opening in the water bath pan matingly engages an inlet in the main housing of the vacuum cleaner to allow dust and dirt entrained air to be ingested by a vacuum force through the inlet into the area defined by the water bath pan. The primary advantage of the water bath filter is that vacuum efficiency is not compromised as more dirt and dust is accumulated in the water bath, and no further filtering is viewed as necessary. The dust and dirt are trapped in the water bath as the incoming air is directed into the water bath pan and circulated within. Traditional filtering media allow the flow of air through the filtering media to be impeded by the accumulation of the dirt and dust that has collected thereon. However, just as traditional filter media will allow very tiny microscopic particles to escape capture, the water bath and separator may also fail to capture all of the very small or microscopic particles that are light enough to remain suspended in the air as the air is circulated in the water bath pan.

High efficiency filters, or HEPA rated filters, are used on vacuum cleaners in industrial and residential applications. These filters are made up of filter media with very tiny openings that are designed to capture the smallest microscopic particles that most traditional filter media or methods are incapable of capturing. The major drawback to the use of these types of filters is that due to the small size of the openings in the filter media, they capture all of the dirt and debris that hits them thereby clogging up very quickly, and requiring cleaning or replacement very often. For this reason, some vacuum cleaning products try to combine the HEPA rated filter with a more conventional dry filter media. The conventional dry filter media will capture the

larger particles of dirt and debris, and the HEPA rated filter will only capture the smaller particles that escape the conventional dry filter media. The overall efficiency of the vacuum cleaner (and the conventional dry filter media) is affected as the air is redirected and routed through the additional filter. Also, the full area of the high efficiency filter is not utilized because the air is typically directed through a small opening in the main housing of the vacuum cleaner, which concentrates the flow of air on the portion of the high efficiency filter that is directly in front of the opening.

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The present invention relates to a vacuum cleaner assembly comprising a main housing having an inlet and an outlet. A motor is disposed within the main housing between the inlet and the outlet for providing motive force to a cooling fan, a blower, and a separator. The cooling fan is mounted within the main housing above the motor to circulate cooling air around the motor. A baffle is mounted within the main housing for directing the cooling air around the motor, and to filter the air that is circulated around the motor before that air is exhausted. The blower is mounted within the main housing below the motor for drawing air into the inlet and exhausting air outwardly through the outlet. The separator is mounted below the blower for circulating the air and water within a water bath and providing, in combination with the water bath, a primary filter for filtering the air prior to exhausting the air outwardly through the outlet. A second filter assembly including a high efficiency filter, known as a HEPA rated filter, for filtering microscopic dust and dirt particles that escape the separator and water bath and may be disposed after both the water bath and the separator and before the outlet to atmosphere for additional filtering of the air prior to being exhausted. The second filter assembly may also include a third filter comprising a carbon impregnated filter of a reticulated foam or similar material for absorbing or trapping odors drawn from the air, including smoke and fish odors. The second filter and the carbon impregnated filter are disposed in a recess which is integral with the main housing allowing for direct and efficient flow of the air through the water bath, separator, second filter, and carbon impregnated filter. In an alternative embodiment, the second filter can be a non-HEPA filter used in combination with the carbon impregnated filter.

Accordingly, the present invention will utilize the separator and water bath filter to capture the larger particles of dirt and debris prior to routing the air through the second, HEPA rated or non-HEPA rated filter to capture microscopic particles that escape the water bath, and finally through the carbon impregnated filter to absorb or trap odors. The recess for the high efficiency filter is located integrally to the main housing allowing the air to flow directly from the water bath canister through the

second filter and the carbon impregnated filter with minimal redirection of the air and no noticeable impact on the primary filter. This will allow the air to flow smoothly through the series of filters. The second filter assembly will not be overly clogged because the separator and water bath will capture the majority of the larger dust and dirt particles before the air goes through the second filter assembly. The recess is designed to allow the majority of the surface area of the high efficiency filter to be in the direct line of airflow thereby the overall efficiency of the vacuum cleaner is maximized.

BRIEF DESCRIPTION OF THE DRAWINGS

Other advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Figure 1 is a perspective view of the vacuum cleaner assembly, partially broken away and in cross section;

Figure 2 is an exploded perspective view of the vacuum cleaner assembly;

Figure 3 is an elevational view of the vacuum cleaner main housing shown with the second filter seated in the recess defined by the housing;

Figure 4 is an exploded perspective view of the second filter assembly including a five sectioned HEPA rated filter and a carbon impregnated reticulated foam filter;

Figure 5 is an exploded perspective view of the second filter assembly including a nine sectioned HEPA rated filter and a carbon impregnated reticulated foam filter;

Figure 6 is an exploded perspective view of the second filter assembly including a filter that is not HEPA rated and a carbon impregnated reticulated foam filter; and

Figure 7 is a cross-section along lines 7-7 of Figure 2.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the Figures, wherein like numerals indicate like or corresponding parts throughout the several views a vacuum cleaner assembly is generally shown at **10.** The vacuum cleaner assembly **10** includes a main housing **12** having an inlet **14** and an outlet **16**. A motor **17a** is supported by support rings **18** within the main housing **12** between the inlet **14** and the outlet **16** for providing motive force to a cooling fan **17b**, a blower **17c**, and a separator **22**. The cooling fan **17b** is mounted within the main housing **12** above the motor **17a** to circulate cooling air around the motor **17a**. A baffle **19** surrounds the motor **17a** to direct the cooling air around the motor **17a** and to filter the cooling air prior to being exhausted. The blower **17c** is mounted within the main housing **12** below the motor **17a** for drawing air into the inlet **14** and exhausting air outwardly through the outlet **16**. The separator **22** is mounted below the blower **17c** for circulating the air and a water bath **20** within a water bath pan **36** and providing, in combination with the water bath **20**, a primary filter for filtering the air prior to exhausting the air outwardly through the outlet **16**. Vacuum cleaners using a water bath **20** filter are known to those skilled in the art as described in United States Patent No. 5,096,475, which is hereby incorporated by reference to this specification.

A second filter assembly **24** is secured to the main housing **12** and preferably includes a high efficiency filter **100** or **100a**, known as a HEPA rated filter, for filtering microscopic dust and dirt particles that escape the separator **22** and water bath **20** and is disposed after both the water bath **20** and the separator **22** and before the outlet **16** for additional filtering of the air prior to being exhausted. The differences between filter **100** and filter **100a** are shown in Figures 4 and 5. The filter **100** has compartments sectioned along five sets of ribs **102**, and made preferably of sheet polypropylene. The filter **100a** has compartments sectioned along nine sets of ribs **103**. The ribs maintain the integrity of the filter against air pressure and other environmental effects and are preferably made from hot metal glue, although stamped aluminum and plastic ribs are alternatives.

In another alternative embodiment, the second filter assembly **24** can include a filter that is not HEPA rated **101**, as shown in Figure 6 and combined in the description as discussed below and shown in Figure 6.

As a further alternative, a third filter **110** can be included as shown in Figures 4, 5 and 6 which comprises a carbon impregnated reticulated foam filter **110** for absorbing or trapping odors and is disposed in the air flow after the second filter **100, 100a or 101** and before the outlet **16** to atmosphere. The second filter **100, 101,** or **100a** and the carbon impregnated filter **110** are secured together by glue or some equivalent means into a molded styrene frame **112** with a sealing gasket **114** associated with one edge of the frame **112**. This is shown in section in Figure 7 where the filter of Figure 2 is shown with the non-HEPA rated filter configuration of filter **101**, but which could just as readily be shown with the HEPA rated filter configurations of **100** or **100a** inserted for the filter **101**. The surface area of the frame **112** adjacent the main housing **12** is at least five times larger than the surface area of the main housing **12** outlet. Preferably, the surface area of the frame **112** adjacent the main housing is nine times larger than the surface area of the main housing **12** outlet. The main housing **12** defines a recess **26** and the second filter assembly **24** is seated in that recess **26** with the sealing gasket **114** sealing against the main housing **12** at surface **115** to force the air to the outlet **16** through the second filter assembly **24**.

Figure 2 shows an exploded view of the vacuum cleaner assembly **10**. The second filter assembly **24** is secured in position by a rear cover **28** which is removably attached to the main housing **12** via screws to cover the opening of the recess **26** and secure the second filter assembly **24** in position. The rear cover **28** includes a stowage device **30** for stowing an electrical cord. A foam seal **34** is disposed between the assembly **24** and the rear cover **28** to cushion and sound deaden that area of the vacuum as well as further prevent air from escaping anywhere other than via the outlet **16**. The second filter assembly **24** has smaller openings to capture particles passing through the separator **22** and water bath **20**. In the preferred embodiment, the second filter assembly **24** includes a HEPA rated filter **100** or **100a** for capturing tiny microscopic dust and dirt particles.

Reuseable washable HEPA rated filter media, such as a pleated GORE-TEXtm material, can also be used as the second filter **100** or **100a**. Preferably, the reuseable washable filter media would be used as a HEPA rated filter, although if the particulate penetration size of the media selected were greater, the filter media would not be a HEPA rated filter, such as is the case with filter **101**. Reuseable washable filter media would be advantageous in this device because it can be washed and reused along with or intermittently with the disposal of the water bath **20** from the water bath pan **36** after use.

The vacuum cleaner assembly **10** includes a water bath pan **36** for containing the water bath **20**. The water bath pan **36** presents a first opening **38** which is disposed directly below the main housing **12** which has a bottom opening **39** that corresponds to the first opening **38** in the water bath pan **36**. A foam seal **40** forms a sealed engagement between the water bath pan **36** and the bottom opening **39** of the main housing **12**. The water bath pan **36** also includes a second opening **42** which corresponds to a tubular member extending from an inlet face plate **44**. The foam seal **40** forms a sealed engagement between the second opening **42** in the water bath pan **36** and the inlet face plate **44**. The inlet face plate **44** is mounted to the main housing **12** at the inlet **14** and allows attachments to be connected in direct communication with the inlet **14**.

The motor **17a** is centrally supported by support rings **18** in the main housing **12** above the bottom opening **39**. The separator **22** is attached to the motor **17a** below the blower **17c** and extends downwardly through the bottom opening **41** in the main housing **12** and the first opening **38** in the water bath pan **36**. The separator **22** is rotated by the motor **17a** for circulating the air within the water bath pan **36** and for drawing the dust and dirt entrained air, along with water from the water bath **20**, within the separator **22** for further capture of debris in the water bath **20** and to direct, by centrifugal force, the water and any remaining dirt or dust back outward into the water bath pan **36** for additional separation as it is drawn within the separator **22** again. As the dust, dirt, and water are forced outward from the separator by centrifugal force, the

filtered air is drawn upward out of the separator **22** outwardly through the second filter assembly **24**.

A dolly **46** is positioned below the water bath pan **36.** The water bath pan **36** attaches to the main housing **12** with at pair of latches **47** to secure the water bath pan **36** to the main housing **12.** The main housing **12** attaches to the dolly **46** and is held securely in place by a latch which is released upon activation of a release button **49**. An interlock switch **48** is mounted to the main housing **12** and detects the presence of the water bath pan **36** when the dolly **46** is assembled to the main housing **12**. The dolly **46** includes a seat **51** for the main housing and casters **50** are mounted to the dolly **46** to provide movable support for the vacuum cleaner assembly **10**. The vacuum cleaner assembly **10** also includes a top cover **52** with a handle attached to the top of the main housing **12** to close off the top and cover the motor **17a,** cooling fan **17b**, support rings **18**, and blower **19**. The top cover **52**, main housing **12**, and dolly **46** when assembled enclose all inner components of the vacuum cleaner assembly **10**.

The invention has been described in an illustrative manner, and it is to be understood that the terminology which has been used is intended to be in the nature of words of description rather than of limitation.

Modifications and variations of the present invention are possible in light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims, wherein reference numerals are merely for convenience and are not to be in any way limiting, the invention may be practiced otherwise than as specifically described.

CLAIMS

What is claimed is:

1. A vacuum cleaner assembly comprising:

a main housing having an inlet, a recess remotely disposed from said inlet and integrally formed within said main housing, and an outlet positioned within said recess,

a motor disposed within said housing between said inlet and said outlet for providing motive force to said vacuum cleaner assembly components,

a fan mounted within said main housing driven by said motor for circulating air around said motor,

a primary filter system for filtering of the air prior to being exhausted outwardly through said outlet,

a secondary filter system placed in downstream airflow from said primary filter system, removably positioned within said recess and aligned with said outlet for additional filtering of the air prior to being exhausted outwardly through said outlet.

2. An assembly as set forth in claim 1, wherein said primary filter system comprises:

a water bath pan within said main housing below said motor for holding a liquid bath and a separator mounted within said main housing, driven by said motor, extending downward into said water bath pan, for circulating the air and said liquid bath within said water bath pan and filtering particles of dust and dirt from the air prior to exhausting the air outwardly through said secondary filter system.

3. An assembly as set forth in claim 1, wherein said secondary filter system comprises a first filter and a carbon filter wherein said first filter and said carbon filter abut each other.

4. An assembly as set forth in claim 3, further comprising a one piece frame molded from styrene, wherein said first filter and said carbon filter are both glued into said frame with a glue and said frame is seated within said recess in said main housing.

5. An assembly as set forth in claim 4, wherein said glue is polyurethane based.

6. An assembly as set forth in claim 5, further comprising a gasket that is applied to said frame to seal between said frame and said main housing to prevent the escape of air around said frame.

7. An assembly as set forth in claim 6, wherein said gasket is made of polyurethane.

8. An assembly as set forth in claim 4, wherein said frame surface area adjacent said main housing is more than five times larger than said main housing outlet surface area.

9. An assembly as set forth in claim 8, wherein said frame surface area adjacent said main housing is nine times larger than said main housing outlet surface area.

PCT/US 00/ 11562
IPEA/US 27 NOV 2000

10. An assembly as set forth in claim 3, wherein said first filter is not a HEPA rated filter.

11. An assembly as set forth in claim 3, wherein said first filter is a HEPA rated filter.

12. An assembly as set forth in claim 11, wherein said first filter is a pleated plastic material where said pleats are separated into five stages across.

13. An assembly as set forth in claim 12, wherein said plastic material is polypropylene.

14. An assembly as set forth in claim 11, wherein said first filter is pleated plastic material where said pleats are separated into nine stages across.

15. An assembly as set forth in claim 14, wherein said plastic material is glass fiber reinforced polypropylene.

16. An assembly as set forth in claim 11, wherein said HEPA rated filter is made from a material that can be washed and reused.

17. An assembly as set forth in claim 3, wherein said carbon filter is made from reticulated urethane foam impregnated with activated charcoal.

AMENDED SHEET

PCT/US 00/11562
IPEA/US 27 NOV 2000

18. A method of filtering air through a vacuum cleaner, comprising the steps of:

(A) drawing air into a vacuum cleaner housing;

(B) drawing air into a water bath to filter dirt and dust particles;

(C) filtering particles of dust and dirt from the air through a separator;

(D) filtering smaller particles of dust and dirt from the air through a first filter; and

(E) filtering odors from the air through a carbon filter.

19. A vacuum cleaner assembly comprising:

a main housing having an inlet, a recess integrally formed within said main housing, and an outlet positioned within said recess,

a motor disposed within said housing between said inlet and said outlet for providing motive force to said vacuum cleaner assembly components,

a fan mounted within said main housing driven by said motor for circulating air around said motor,

a primary filter system for filtering of the air prior to being exhausted outwardly through said outlet,

a secondary filter system placed in downstream airflow from said primary filter system and positioned within said recess directly adjacent said main housing outlet to allow the air to flow directly from said main housing outlet into said secondary filter system.

AMENDED SHEET

20. A vacuum cleaner assembly comprising:

a main housing having an inlet, a recess integrally formed within said main housing, and an outlet positioned within said recess,

a motor disposed within said housing between said inlet and said outlet for providing motive force to said vacuum cleaner assembly components,

a fan mounted within said main housing driven by said motor for circulating air around said motor,

a primary filter system for filtering of the air prior to being exhausted outwardly through said outlet, and

a secondary filter system generally rectangular shaped having a first transverse surface and a second transverse surface and positioned within said recess, wherein the air exiting from said main housing outlet enters said first transverse surface and the air exits from said secondary filter system through said second transverse surface into atmosphere.

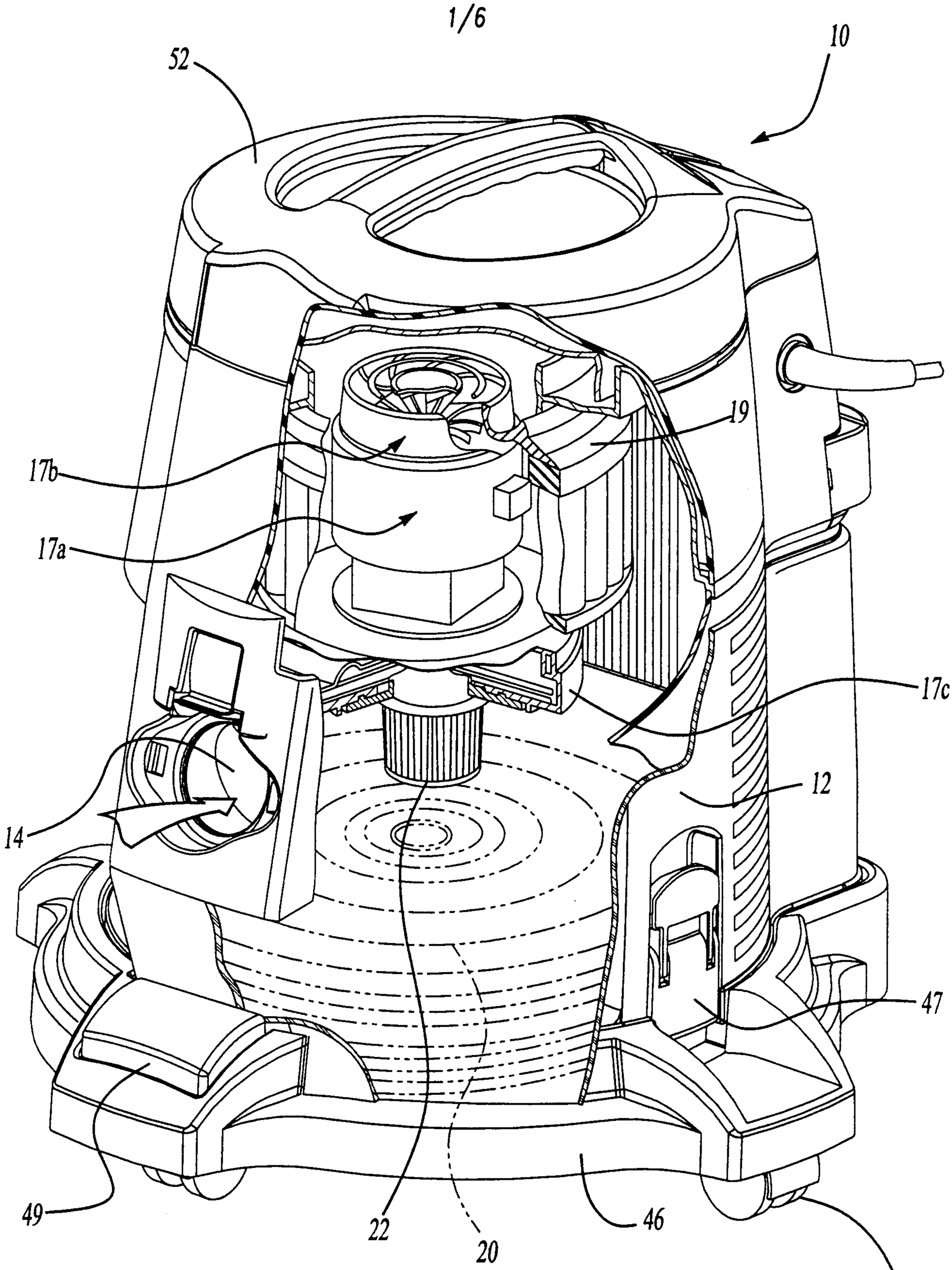


Fig-1

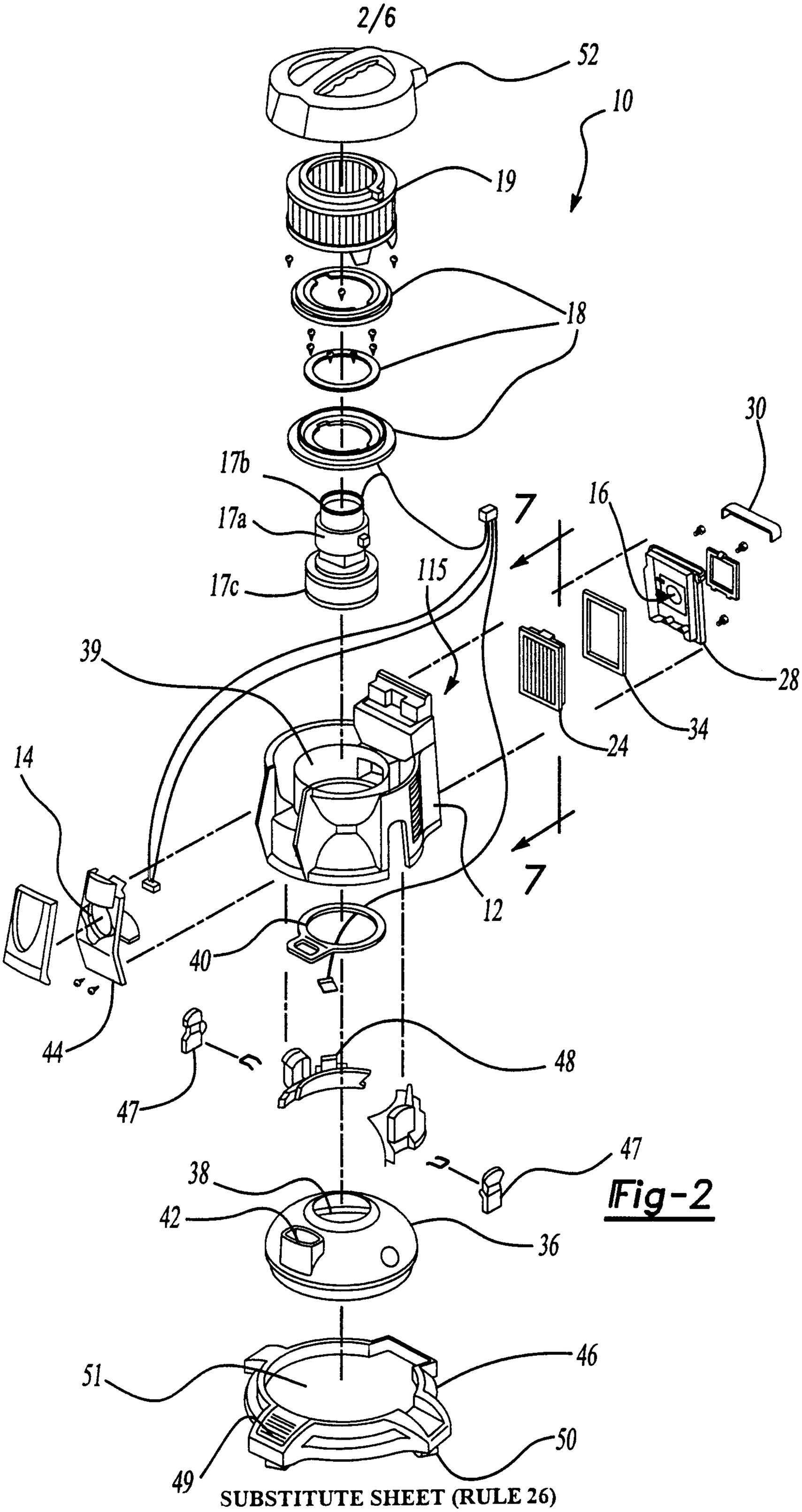

52
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Fig-2

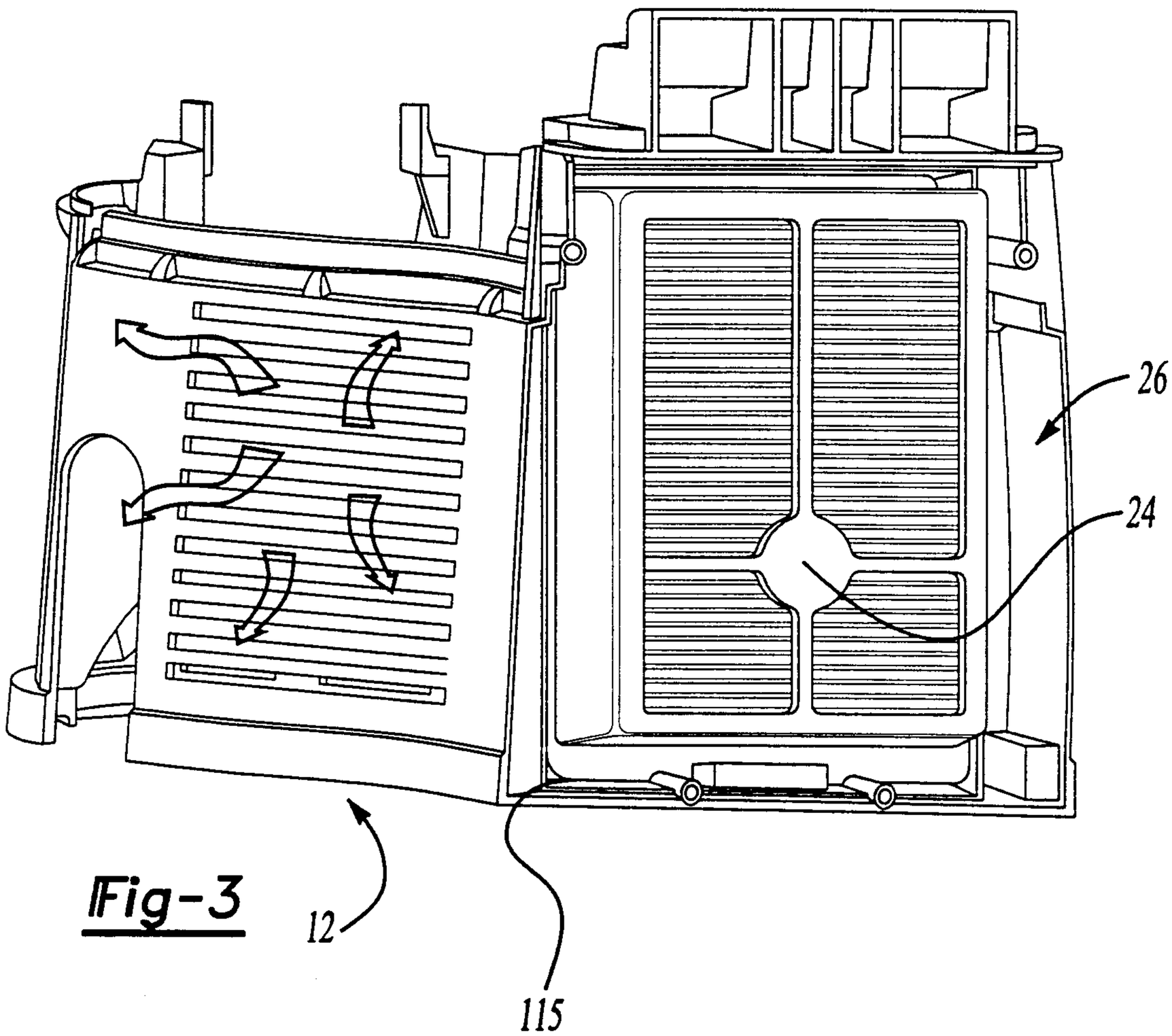


Fig-3

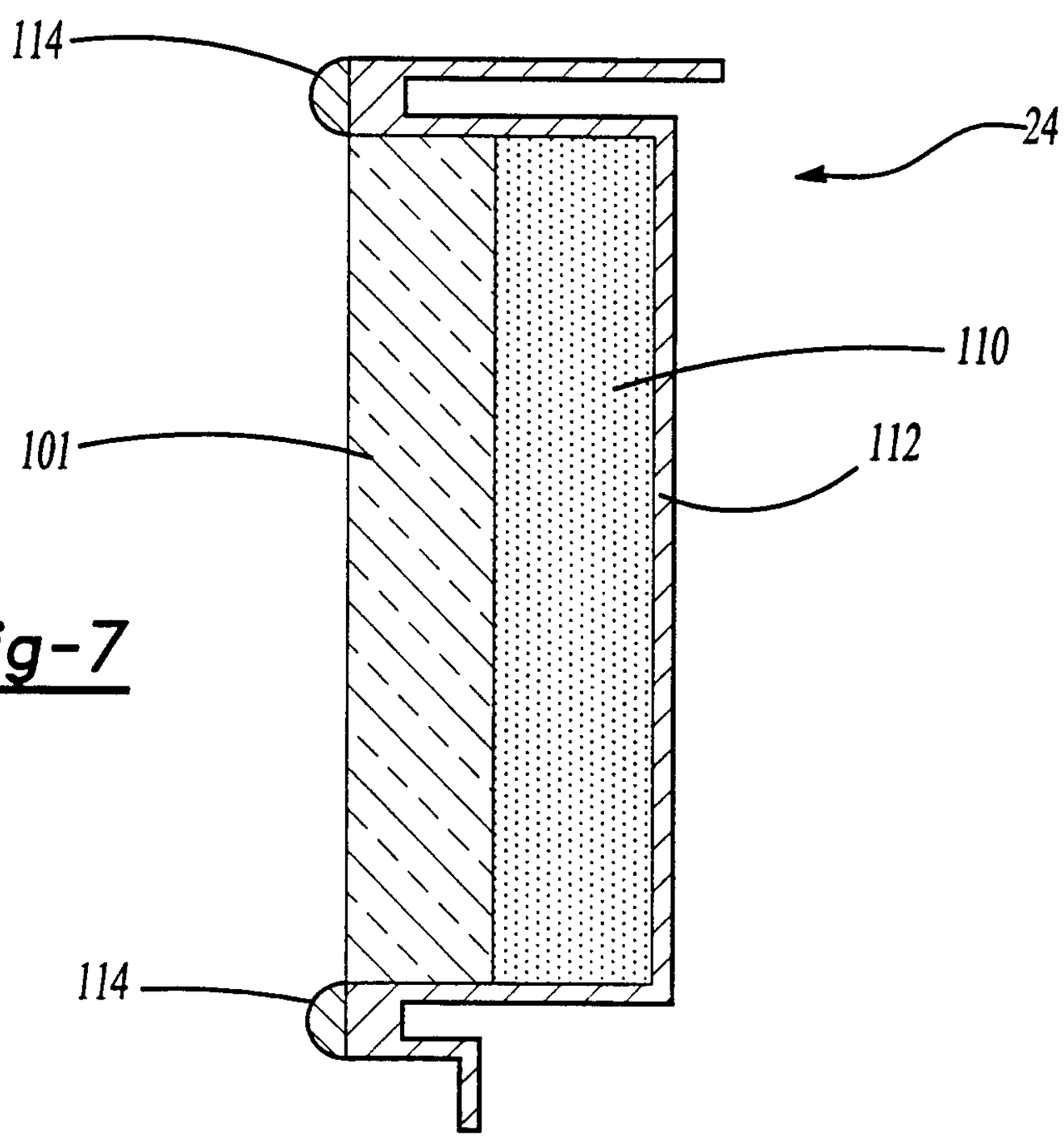


Fig-7

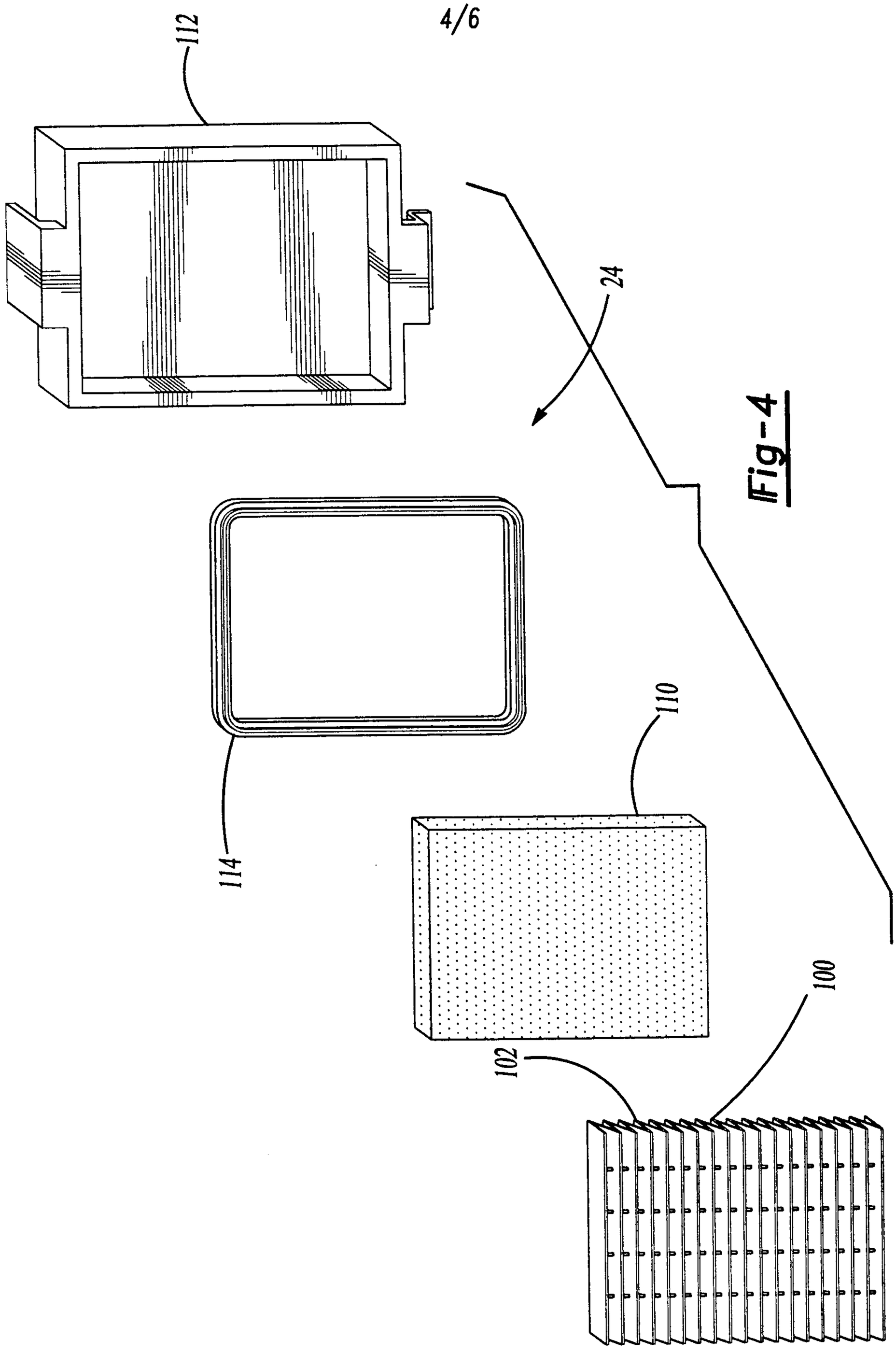


Fig-4

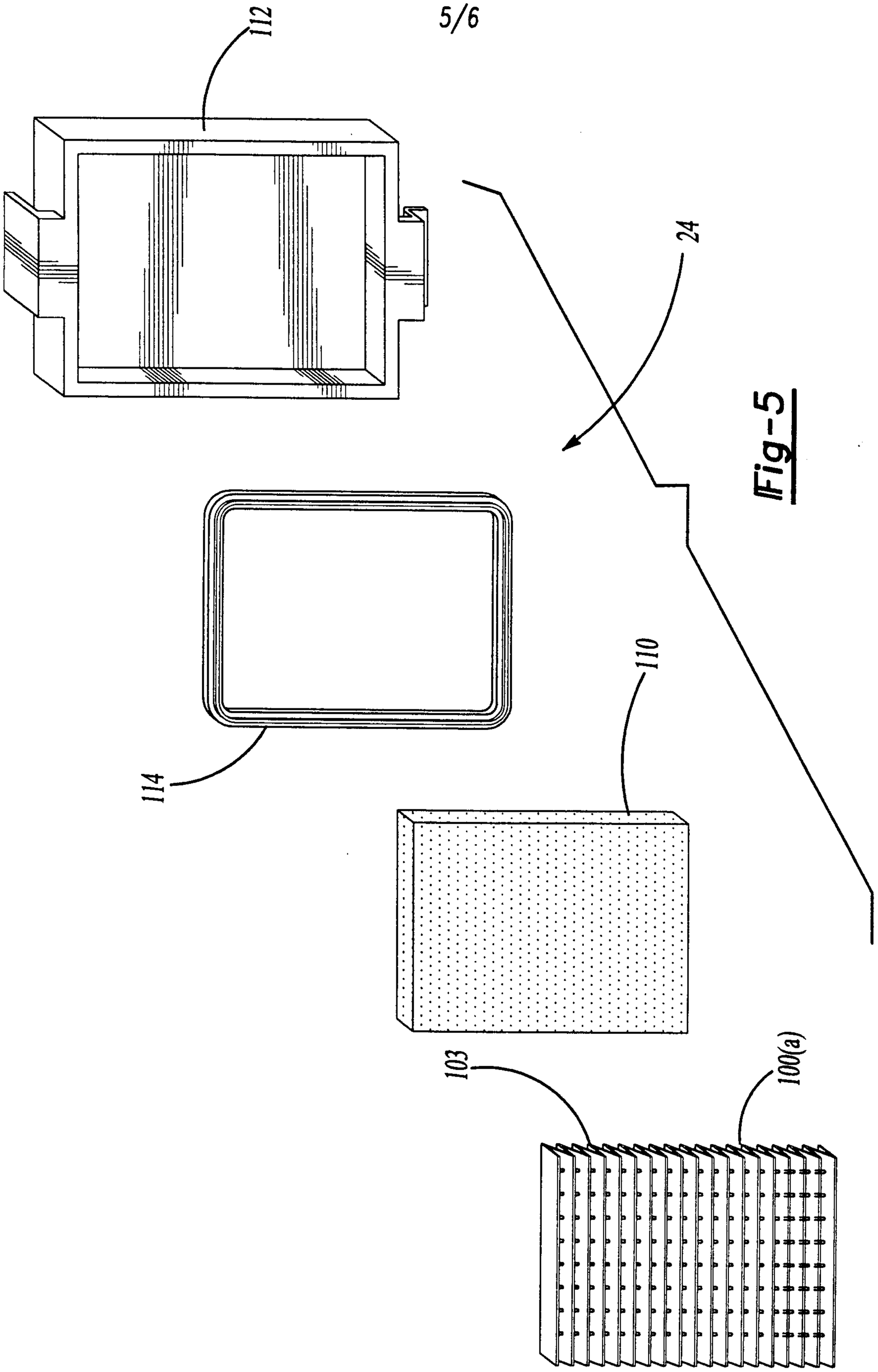


Fig-5

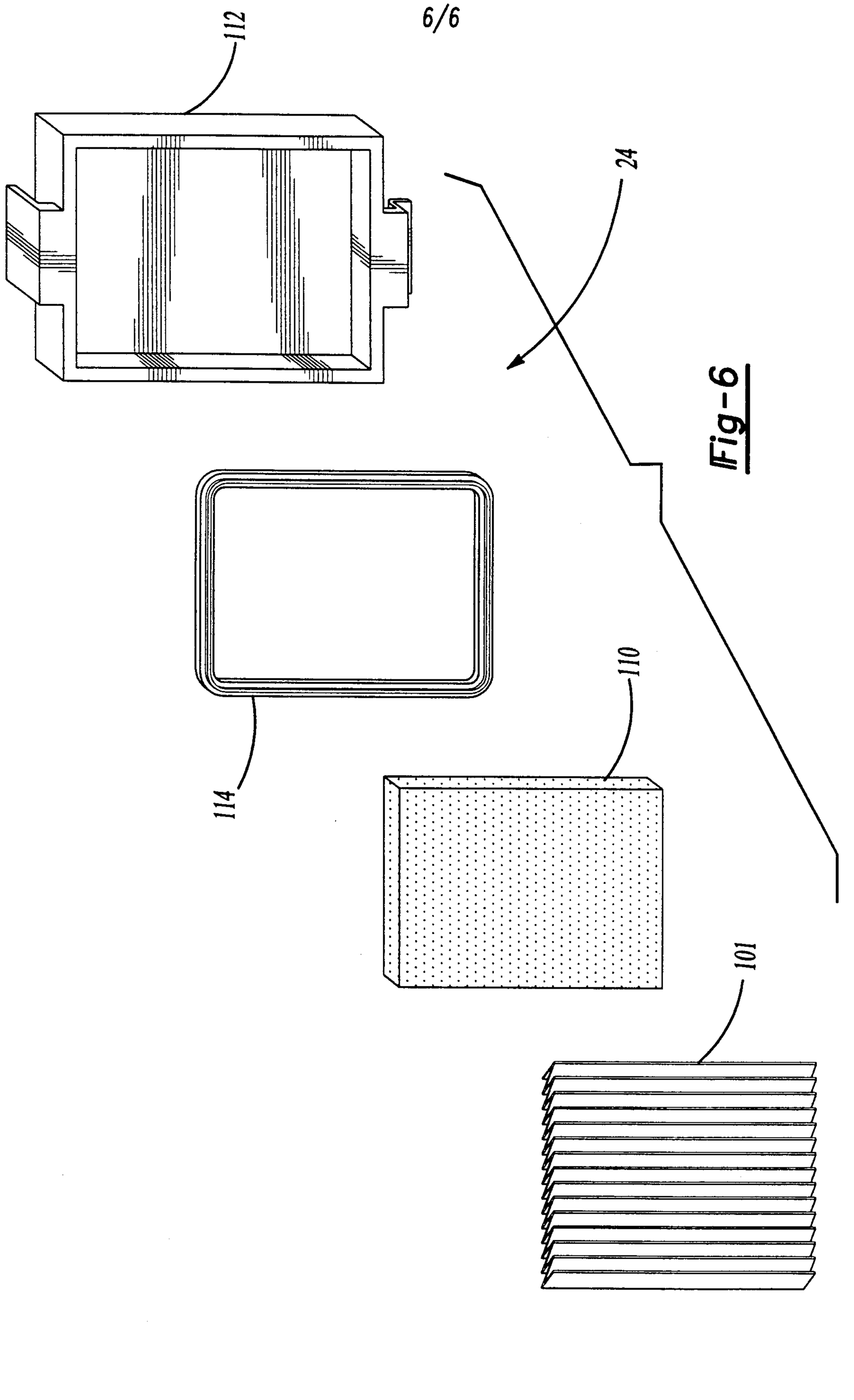


Fig-6