



EUROPEAN PATENT APPLICATION

(43) Date of publication:
15.06.2022 Bulletin 2022/24

(51) International Patent Classification (IPC):
D06F 25/00 ^(2006.01)

(21) Application number: **21214203.8**

(52) Cooperative Patent Classification (CPC):
D06F 25/00; D06F 58/04; D06F 58/20;
D06F 37/266

(22) Date of filing: **13.12.2021**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **WHIRLPOOL CORPORATION**
Benton Harbor
Michigan 49022 (US)

(72) Inventor: **Rajendran, Arun**
21024 Cassinetta di Biandronno (VA) (IT)

(74) Representative: **Spina, Alessandro**
Whirlpool Management EMEA S.R.L.
Via Carlo Pisacane, 1
20016 Pero (MI) (IT)

(30) Priority: **14.12.2020 US 202017120436**

(54) **AIR FLOW BYPASS CONTROLLING MECHANISM FOR NO COMPROMISE COMBO**

(57) A combination washer/dryer machine (10) has a rotatable drum (30) inside a cabinet (14). The drum (30) has an exterior surface. A tub (32) is positioned inside the cabinet (14). The drum (30) is rotatable in the tub (32). The tub (32) has an inner surface. An electro-

magnetic seal (80) extends between the exterior surface of the drum (30) and the inner surface of the tub (32) during drying operations to minimize the bypass of drying air around the drum.

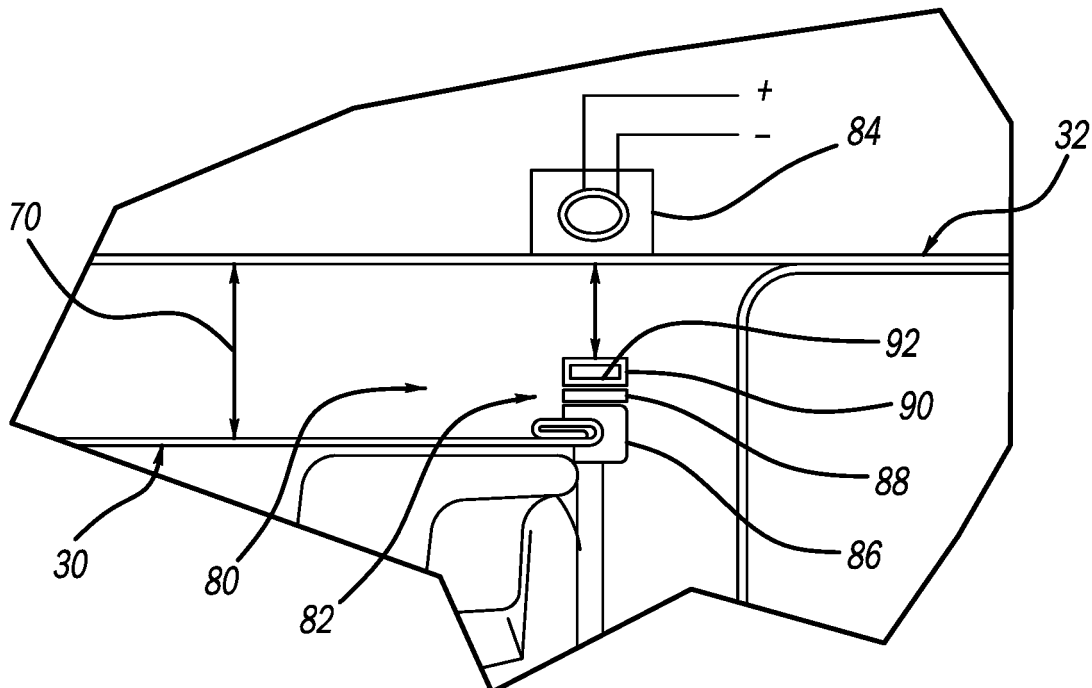


FIG - 3

Description

FIELD

[0001] The present disclosure relates to combination washer/dryer machines and, more particularly, to a combination washer/dryer machine with an electromagnetic seal to maximize the drying rate of clothes tumbling in the machine.

BACKGROUND

[0002] In combination washers/dryers, it is difficult to provide a drying cycle without a lengthy finishing drying time. Several reasons exist for the lengthy drying time of the clothes within the drum. One such reason is a gap exists between drum and the tub. The gap enables drying or heated air to bypass the drum. Thus, the drying air exits the machine without providing its heated air to the clothes within the drum. Accordingly, the drying cycle is inefficient and necessitates a longer drying time or period.

[0003] It is desirable to provide a combination washer/dryer machine with an efficient drying cycle time. It would also be desirable to utilize all of the created drying air to pass it into the drum for its intended drying purpose. It is desirable to eliminate air bypassing around the drum. Thus, drying air would be forced to enter into the drum. Accordingly, with all the drying air forced into the drum, this would, in turn, reduce drying cycle time.

[0004] It is desirable to provide a combination washer/dryer machine that overcomes the deficiencies of the prior art. It is desirable to provide a combination washer/dryer machine that provides a flow restriction to avoid air from bypassing around the drum. Thus, it is desirable to move substantially all of the generated heated air to enter into the drum.

SUMMARY

[0005] In accordance with the present disclosure, a combination washer/dryer machine comprises a rotatable drum inside of a cabinet. The drum has an external surface. A tub is positioned inside of the cabinet. The drum is rotatable in the tub. The tub has an inner surface. An electromagnetic seal extends between the external surface of the drum and the inner surface of the tub during a drying operation to minimize bypass of drying air. The electromagnetic seal includes a bellows seal with a magnet in the bellows seal and an electromagnetic setup. The rotatable drum has a cylindrical shape with a cylindrical sidewall and an end plate. The seal is positioned in contact with the exterior surface of the cylindrical sidewall. The electromagnetic setup is in contact with a wall of the tub. The bellows seal and an electromagnetic setup are positioned in contact with the endwall of the tub.

[0006] Accordingly to a second embodiment of the present disclosure, a combination washer/dryer comprises

a cabinet with a door to enable access into the cabinet. The controls operate the washer/dryer machine. A washing system and drying system are provided. A rotatable drum is positioned inside the cabinet. The drum has an external surface. A tub is positioned inside the cabinet. The drum is rotatable inside the tub. The tub has an inner surface. An electromagnetic seal extends between the exterior surface of the drum and the inner surface of the tub during the drying operation to minimize bypass of drying air around the drum. The electromagnetic seal includes a bellows seal with a magnet in the bellows seal and an electromagnetic setup. The rotatable drum has a cylindrical shape with a cylindrical sidewall and an end wall. The seal is positioned in contact with the exterior surface of the cylindrical sidewall. The electromagnetic setup is in contact with a wall of the tub. The bellows seal and an electromagnetic setup are positioned in contact with the end wall of the tub.

[0007] According to a third aspect of the present disclosure, a combination washer/dryer machine drum and tub combination comprises a drum rotatably positioned inside the tub. An electromagnetic seal extends between an exterior surface of the drum and an inner surface of tub during the drying operation to minimize bypass of drying air around the drum. The electromagnetic seal includes a bellows seal with a magnet in the bellows seal and an electromagnetic setup. The rotatable drum has a cylindrical shape with a cylindrical sidewall and an end plate. The seal is positioned in contact with the exterior surface of the cylindrical sidewall. The electromagnetic setup is in contact with a wall of the tub. The bellows seal and an electromagnetic setup are positioned in contact with the endwall of the tub.

[0008] Further areas of applicability will become apparent from the description provided herein. The description and specific examples in this summary are intended for purposes of illustration only and are not intended to limit the scope of the present disclosure.

DRAWINGS

[0009] The drawings described herein are for illustrative purposes only of selected embodiments and not all possible implementations, and are not intended to limit the scope of the present disclosure.

FIG. 1 is a perspective view of a combination washer/dryer machine in accordance with the disclosure.

FIG. 2 is a cross-section view of FIG. 1.

FIG. 3 is an enlarged cross-section view of FIG. 2.

FIG. 4 is a view like FIG. 3 with the seal activated.

FIG. 5 is a cross-section view of a second embodiment of the disclosure.

FIG. 6 is a view like FIG. 5 with the seal activated.

DETAILED DESCRIPTION

[0010] Example embodiments will now be described

more fully with reference to the accompanying drawings.

[0011] Turning to the figures, a combination washer/dryer machine is illustrated and designated with the reference numeral 10. The combination washer/dryer machine includes a cabinet 14 having a plurality of panels 16. The front panel 18 includes a door 20 to enable access into the combination washer/dryer 10. Controls 22 are positioned on the front panel 18. The controls 22 control the operation of the combination washer/dryer machine.

[0012] Turning to FIG. 2, a cross-section of the washer/dryer machine is illustrated. The combination washer/dryer machine includes a drum 30 rotationally positioned within a tub 32. The drum is rotated via a motor 34 and a shaft 36. A conventional washing circuit 40 provides for washing of the clothes within the drum 30. A heating circuit 50 provides heat for drying the clothes within the drum.

[0013] The heating circuit 50 includes a heater 52 with a conduit 54 passing heated air into the tub 32. The drum 30 includes apertures 33 in the end plate that enables the heated air to enter into the drum 30. Also, the drum 30 includes apertures 35 in the cylindrical wall. The heated air exits the drum 40 via the gap G as seen in FIG. 2. An outlet 38 on the tub 32 enables the exit of air. Piping or conduit 56 connects the outlet 38, via a blower 58, to an exhaust tube 60. Thus, the used air is exhaust from the combination washer/dryer machine 10. The exhaust tube 60 is connected with piping in the building to exit to ambient.

[0014] A gap 70 is formed between the drum and the tub 32. The gap 70 provides for the recovery of water or the like between the drum 30 and tub 32. The drum has a cylindrical sidewall 72 and an end plate 74. Likewise, the tub 32 has cylindrical wall 76 and an end wall 78. The external surface of the sidewall 72 and end plate 74 face an inner surface of the tub 32.

[0015] A seal 80 is connected between the drum 30 and tub 32. The seal can be connected to either the drum 30 or the tub 32 as illustrated. The seal 80 is positioned either between the end faces 74, 78 of the drum 30 and tub 32 or the cylindrical side surfaces 72, 76 of the drum 30 and tub 32.

[0016] Turning to FIGS. 3 and 4, the seal 80 includes a bellows seal 82 and an electromagnetic setup 84. The bellows seal 82 includes a securement portion 86, a bellows portion 88 and a retaining portion 90. The retaining portion 90 includes a magnet 92 retained within the retaining portion 90. The electromagnetic setup 84 is activated which, in turn, draws the magnet 92 toward the electromagnetic setup 84. As this occurs, as illustrated in FIG. 4, the bellows portion 88 closes the gap between the drum 30 and tub 32.

[0017] As seen in FIGS. 5 and 6, the seal 80 includes a securement portion 94 securing it to the end surface 78 of the tub 32. Here, the electromagnetic setup 84 is activated which pushes the magnet 92 away from the electromagnetic setup 84. As this occurs, it expands the

bellows portion 88 to close the gap between the drum 30 and tub 32 as seen in FIG. 6. Thus, as the electromagnetic setup is activated during the drying cycle, the gap is narrowed. Thus, the drying air is forced into the drum 30 and does not bypass the drum 30. Accordingly, drying of the clothes within the drum 30 is more efficient and the drying time period is reduced.

[0018] The foregoing description of the embodiments has been provided for purposes of illustration and description. It is not intended to be exhaustive or to limit the disclosure. Individual elements or features of a particular embodiment are generally not limited to that particular embodiment, but, where applicable, are interchangeable and can be used in a selected embodiment, even if not specifically shown or described. The same may also be varied in many ways. Such variations are not to be regarded as a departure from the disclosure, and all such modifications are intended to be included within the scope of the disclosure.

Claims

1. A combination washer/dryer machine comprising:
 - a tub (32);
 - a drum (30) rotatably positioned inside the tub (32);
 - an electromagnetic seal (80) extending between an exterior surface of the drum (30) and an inner surface of tub (32) during a drying operation to minimize bypass of drying air.
2. The combination washer/dryer machine according to Claim 1, wherein the tub (32) is positioned inside of a cabinet (14).
3. A combination washer/dryer machine as set forth in any of the preceding claims, further comprising:
 - a door (20) enabling access into the cabinet (14);
 - controls (22) for operating the washer/dryer machine;
 - a washer circuit (40);
 - a drying circuit (50).
4. The combination washer/dryer machine as set forth in any of the preceding claims, wherein the rotatable drum (30) has a cylindrical shape with a cylindrical sidewall (72) and an end plate (74).
5. The combination washer/dryer machine as set forth in any of the preceding claims, wherein the electromagnetic seal (80) includes a bellows seal (82) with a magnet (92) in the bellows seal (82) and an electromagnetic setup (84).

6. The combination washer/dryer machine of claim 5,
wherein the electromagnetic setup (84) is positioned
in contact with a wall (76) of the tub.
7. The combination washer/dryer machine of claim 6, ⁵
wherein the seal (80) is positioned in contact with
the exterior surface of the cylindrical sidewall (72).
8. The combination washer/dryer machine of claim 6, ¹⁰
wherein the bellows seal (82) and the electromag-
netic setup (84) are positioned in contact with the
end wall (78) of the tub (32).

15

20

25

30

35

40

45

50

55

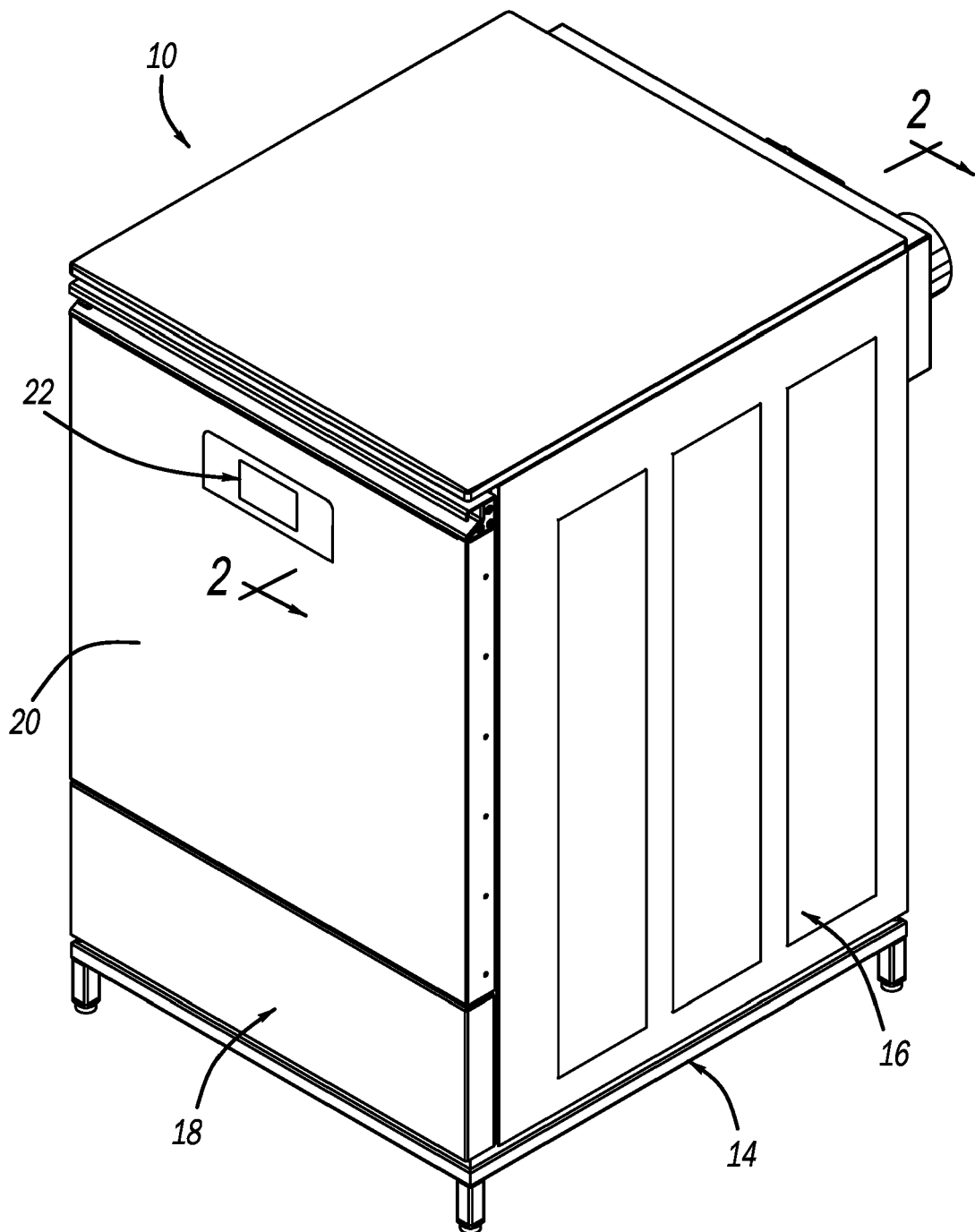


FIG - 1

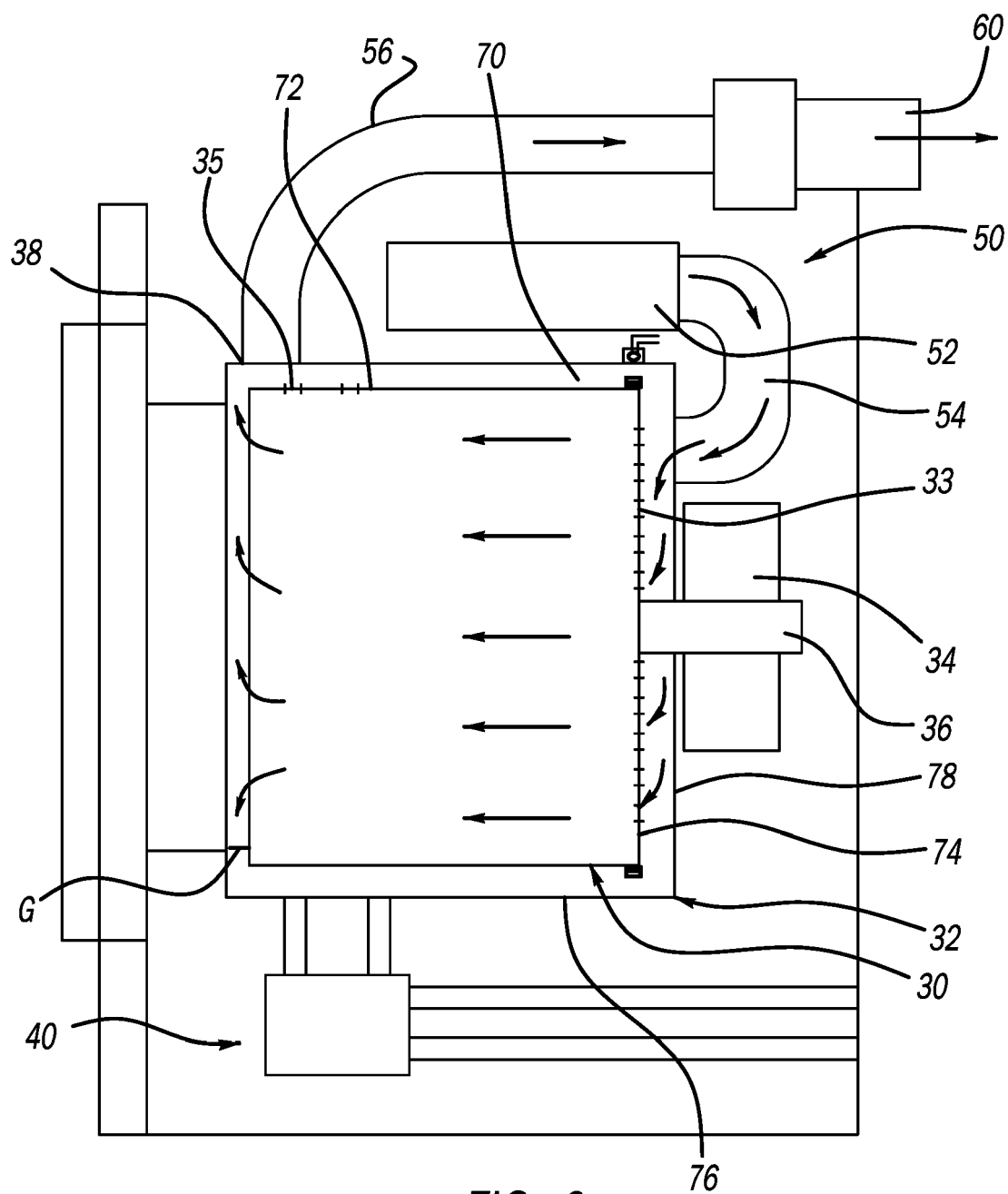
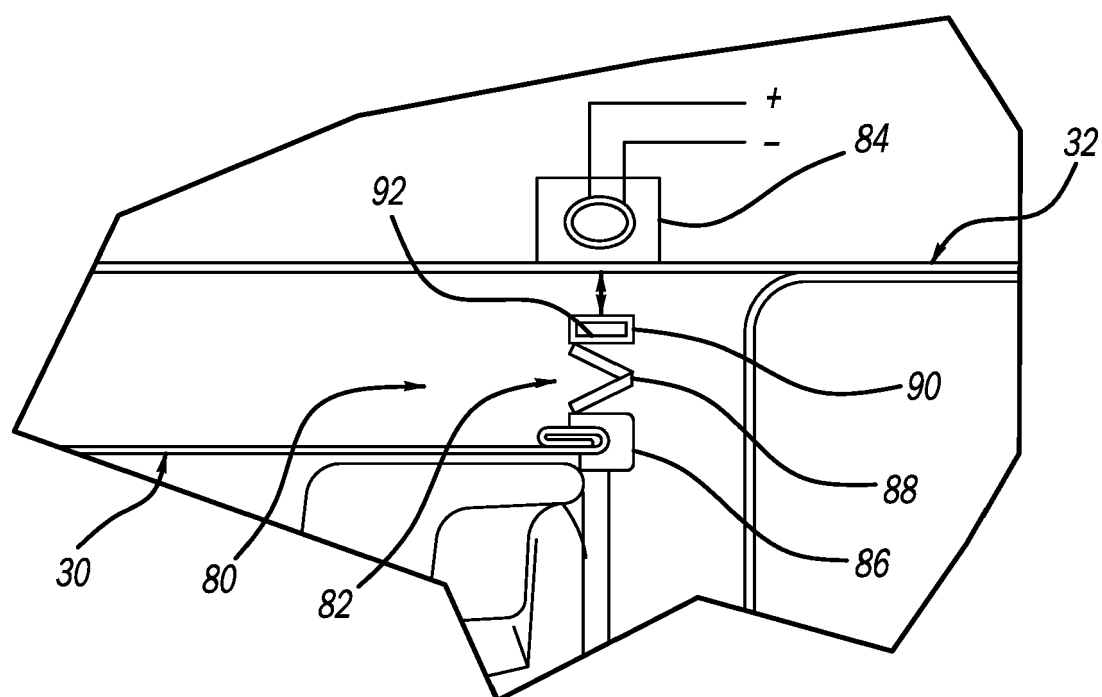
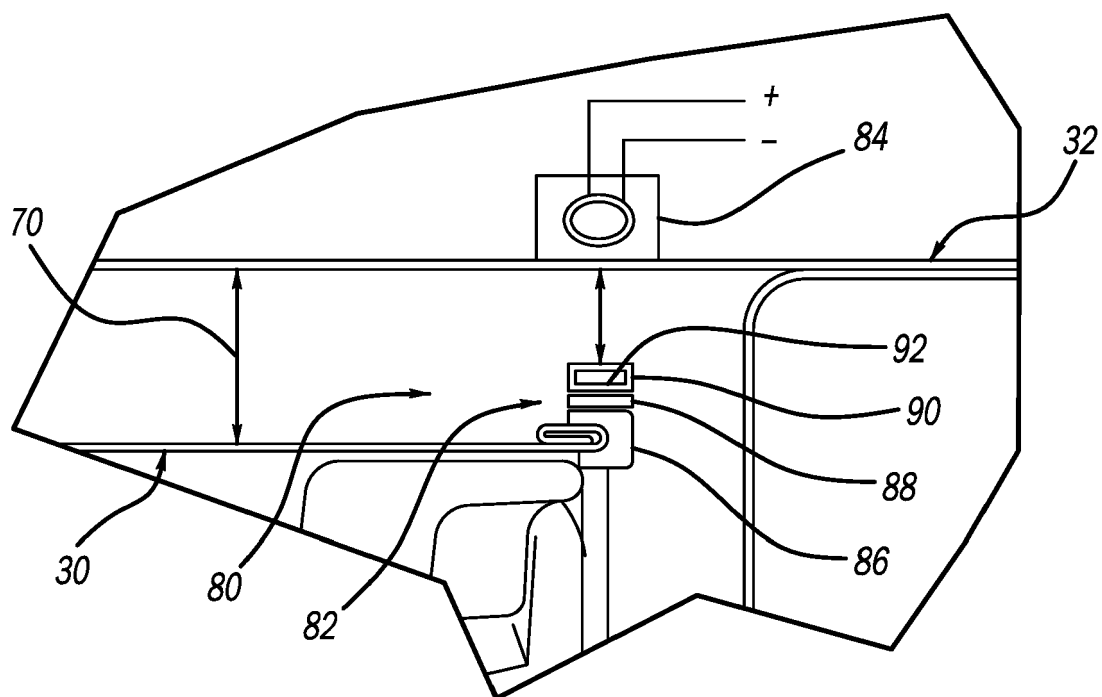
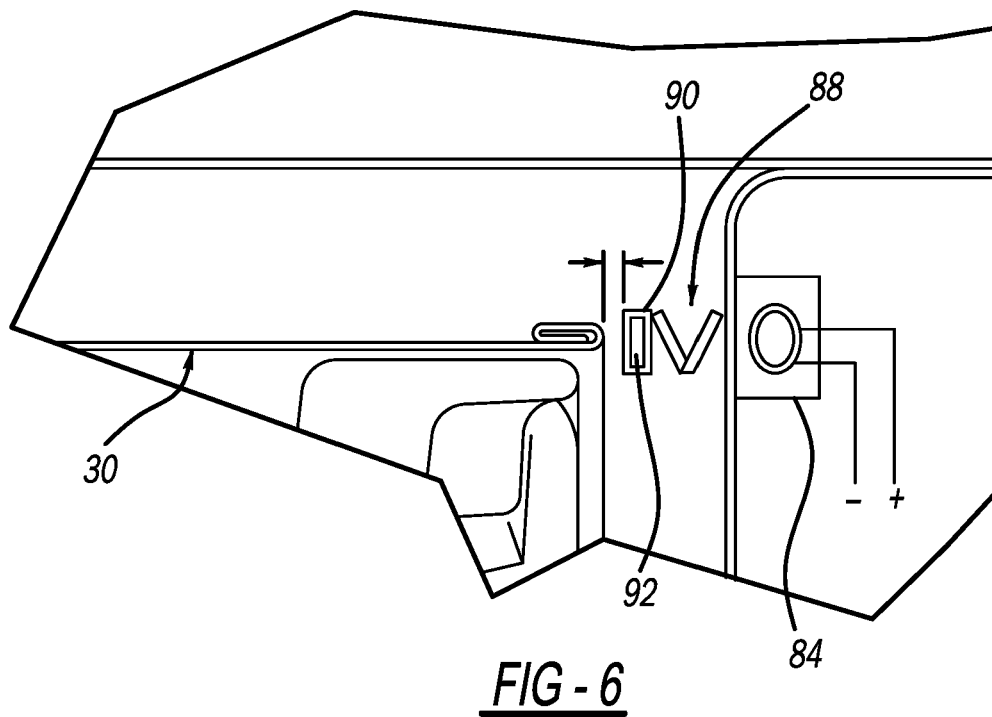
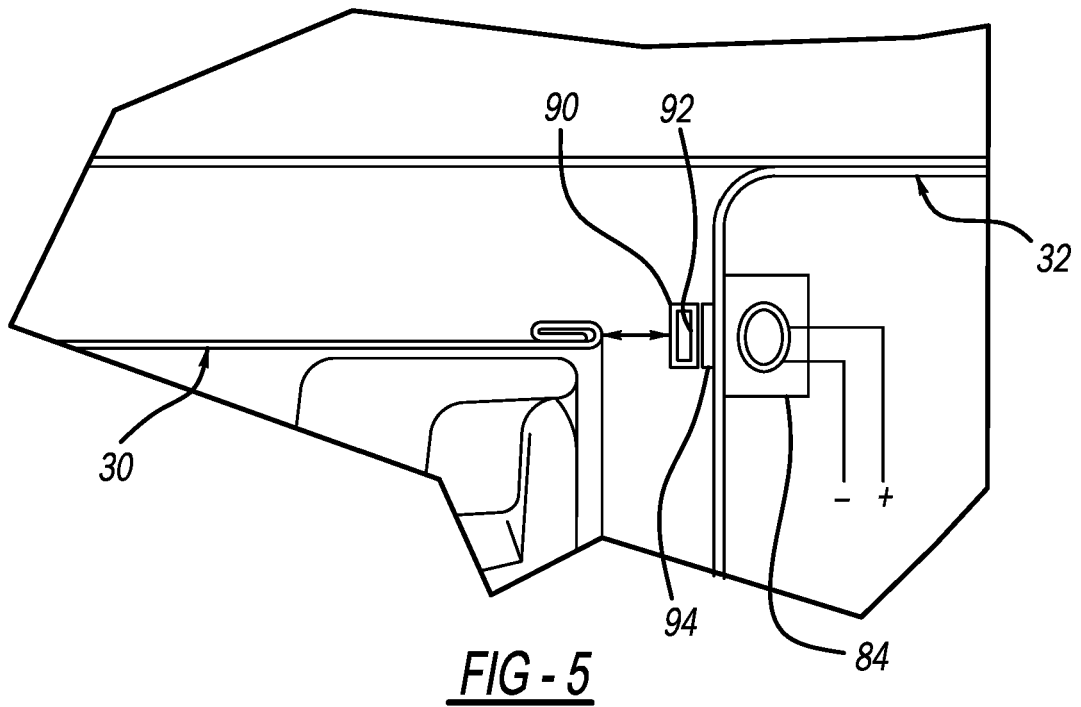


FIG - 2







EUROPEAN SEARCH REPORT

Application Number

EP 21 21 4203

5

10

15

20

25

30

35

40

45

50

55

1

EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	KR 100 529 954 B1 (LG ELECTRONICS INC [KR]) 22 November 2005 (2005-11-22) * page 2, line 22 - page 6, line 11; figures * -----	1-8	INV. D06F25/00
A	WO 2018/093205 A2 (LG ELECTRONICS INC [KR]) 24 May 2018 (2018-05-24) * paragraph [0043] - paragraph [0109]; figures * -----	1-8	
A	JP 4 444016 B2 (MATSUSHITA ELECTRIC IND CO LTD) 31 March 2010 (2010-03-31) * the whole document * -----	1-8	
A	WO 2016/050295 A1 (ARCELIK AS [TR]) 7 April 2016 (2016-04-07) * paragraph [0032] - paragraph [0057]; figures * -----	1-8	
			TECHNICAL FIELDS SEARCHED (IPC) D06F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 28 April 2022	Examiner Sangiorgi, Massimo
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 21 21 4203

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

28-04-2022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
KR 100529954 B1	22-11-2005	NONE	
WO 2018093205 A2	24-05-2018	KR 20180055419 A	25-05-2018
		WO 2018093205 A2	24-05-2018
JP 4444016 B2	31-03-2010	JP 4444016 B2	31-03-2010
		JP 2006000354 A	05-01-2006
WO 2016050295 A1	07-04-2016	NONE	