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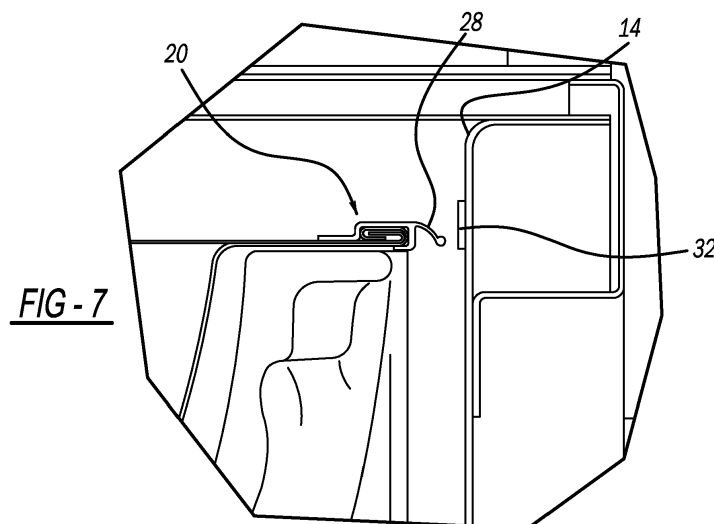
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(54) **DRUM BYPASS CONTROL**

(57) A seal (20, 60, 70) for a tub/drum assembly (10) of a combination washer/dryer unit (10). The seal (20, 60, 70) has a ring (22, 62) that secures the seal (20, 60, 70) to the tub/drum assembly (10) and an arm (28, 64) that extends from the ring (22, 62). Arm (28) reduces an axial gap (16) between the tub (14) and drum (12). A mass (30) at a terminal end of the arm (28) enables the arm (28) to deflect at high drum rotational speeds, which

increases the gap (16) between the tub (14) and the drum (12) during high rotational speed of the drum (12). Arm (64) is made of a material that limits deflection of the arm (64) so that a radial gap (50) is maintained at all speeds between the tub (14) and drum (12) without the arm (64) contacting the drum (12) and may include at least one lip (66) or wiper (74) to control or limit airflow around the drum (12).



Description

FIELD

[0001] The present disclosure relates to laundry appliances and, more particularly, to structures in combination washer/dryer units that control or limit the bypass of processed air around the drum.

BACKGROUND

[0002] In combination washer/dryer units, it is important to reduce the amount of time required to dry clothes during the drying cycle. In order to reduce the drying time, it is possible to increase the interaction of hot air with wet clothes within the drum. However, without proper air volume, this has a negative impact on the clothes within the drum. Thus, it is desirable to increase the airflow through the drum during the drying cycle and, if desired, increase the interaction of hot air with the clothes. Preferably, it is desirable to increase the airflow through the drum.

[0003] Accordingly, it is an object of the present disclosure to increase the airflow through the drum during the drying cycle. The present disclosure provides sealing between the drum and tub to increase the airflow into the drum, while decreasing the airflow passing around the drum, thus bypassing the clothes. The present disclosure provides a seal between the tub and drum that forces air to enter into the drum, increasing the airflow in the drum, which, in turn, reduces the drying time of the laundry appliance.

SUMMARY

[0004] According to a first aspect of the disclosure, a seal for a tub/drum assembly includes a ring secured to a drum of the tub/drum assembly and an arm that extends from the ring to reduce the size of a gap between the tub and the drum. A mass is at the end of the arm to enable the arm to deflect at high drum speeds, which increases the gap between the tub and the drum during a washing cycle. The arm includes a chamber to retain the mass inside the chamber. The mass can be a fluid or metal. A pocket is positioned in the ring to receive a crimped flange on the drum to secure the ring to the drum. A composite material may be positioned on the tub opposite the mass to preventing damage to the seal when the mass contacts the tub.

[0005] According to a second aspect of the disclosure, a seal for a tub/drum assembly includes a ring secured to a tub of the tub/drum assembly. An arm extends from the ring to reduce a gap between the tub and the drum. The arm is of a material prohibiting substantial deflection of the arm so that the gap is maintained, at all rotational speeds of the drum, between the tub and the drum without the arm contacting the drum. This restricts / limits airflow around the drum. The ring is secured to the tub and the arm may include a seal with a lip or wiper ex-

tending towards the drum. An additional seal may be positioned on the drum adjacent to the arm. This additional seal may include a lip extending towards the arm.

[0006] According to a third aspect of the disclosure, a tub/drum assembly for a combination washer/dryer unit comprises a tub and a drum that is rotatably received within the tub. A seal for the tub/drum assembly includes a ring that is secured to the drum. An arm extends from the ring to reduce a gap between the tub and the drum. A mass is at a terminal end of the arm to enable the arm to deflect at high drum speeds thereby increasing the gap between the tub and the drum during a washing cycle. The arm includes a chamber and a mass disposed inside the chamber. The mass can be a fluid or metal. A pocket is positioned in the ring to receive a crimped flange on the drum to secure the ring to the drum. A composite material may be positioned on the tub opposite the mass to preventing damage to the seal when the mass contacts the tub.

[0007] According to a fourth aspect of the disclosure, a tub/drum assembly for a combination washer/dryer unit comprises a tub and a drum that is rotatably received within the tub. A seal for the tub/drum assembly includes a ring that is secured to the tub. An arm extends from the ring to reduce a gap between the tub and the drum. The arm is of a material that prohibits substantial deflection of the arm so that the gap is maintained, at all rotational speeds of the drum, between the tub and the drum without the arm contacting the drum. This restricts / limits airflow around the drum. The ring is secured to the tub and the arm may include a seal with a lip or wiper extending towards the drum. An additional seal may be positioned on the drum adjacent to the arm. This additional seal may include a lip extending towards the arm.

[0008] According to a fifth aspect of the disclosure, a tub/drum assembly for a combination washer/dryer unit is provided. The tub/drum assembly includes a tub and a drum that is rotatably positioned within the tub. The drum includes a cylindrical wall that is connected to a base at a rear end of the drum. The drum is spaced from the tub such that a gap is formed between the drum and the tub through which air can flow instead of entering the drum during a drying cycle. The tub/drum assembly also includes a seal positioned near the cylindrical wall at the rear end of the drum. The seal extends at least partially across the gap between the drum and the tub to limit the amount of airflow through the gap between the drum and the tub during the drying cycle.

[0009] In accordance with one aspect of the present disclosure, the seal is secured to the rear end of the drum. In accordance with this aspect of the present disclosure, the seal includes a ring that is positioned around and secured to the drum and an arm that extends from the ring into the gap between the tub and the drum. The seal may include a mass at a terminal end of the arm, which enables the arm of the seal to deflect or extend at high rotational speeds of the drum to increase the size of the gap between the tub and the drum. The terminal end of

the arm may include a chamber for retaining the mass inside the chamber. The mass received in the chamber may be a fluid or metal. Optionally, a composite material may be provided on the tub and the seal may be positioned to make contact with the composite material. The composition of the composite material is purposely selected to prevent seal damage (e.g., a smooth, low friction material). In some embodiments, the rear end of the drum may include a crimped flange where the cylindrical wall of the drum is connected to the base of the drum. In accordance with this aspect, the seal may include a pocket that receives the crimped flange to secure the seal to the rear end of the drum.

[0010] In accordance with another aspect of the present disclosure, the seal is secured to the tub. In accordance with this aspect of the present disclosure, the seal may include a ring that is secured to the tub and an arm that extends from the ring into the gap between the drum and the tub. The seal may also include a lip or wiper that extends towards the drum. The tub/drum assembly may additionally include a groove seal that is secured to the rear end of the drum. The groove seal may include at least one extending member that cooperates with the lip or wiper to provide a labyrinth seal that limits the airflow through the gap between the drum and the tub. In one embodiment, the groove seal includes two extending members and the lip or wiper is received between the two extending members. In another embodiment, the seal that is secured to the tub includes multiple wipers and the groove seal, which is secured to the cylindrical wall near the rear end of the drum, includes multiple grooves that receive the multiple wipers to provide a labyrinth seal that limits the airflow through the gap between the drum and the tub.

[0011] 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

[0012] 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 side cross-sectional view of an exemplary combination washer/dryer unit;

Fig. 2 is an enlarged side cross-sectional view of the combination washer/dryer unit shown in Fig. 1;

Fig. 3 is a side cross-sectional view of an exemplary seal according to a first embodiment of the present disclosure, which closes a gap between a drum and a tub of the combination washer/dryer unit;

Fig. 4 is a side cross-sectional view of a second embodiment of the seal;

Fig. 5 is a side cross-sectional view of a third em-

bodiment of the seal;

Fig. 6 is a side cross-sectional view of a fourth embodiment of the seal;

Fig. 7 is a side cross-sectional view of the gap between the drum and the tub with the seal of Fig. 4 positioned on the drum;

Fig. 8 is a side cross-sectional view of the gap between the drum and the tub with an exemplary seal according to a fifth embodiment where the seal is positioned on the tub;

Fig. 9 is side cross-sectional view of a sixth embodiment of the seal where the seal is mounted to a flange on the tub;

Figs. 10A-10C are side cross-sectional views of various seals that may be installed on the flange shown in Fig. 9;

Fig. 11 is a side cross-sectional view of a seventh embodiment of the seal; and

Fig. 12 is a side cross-sectional view of an eighth embodiment of the seal.

DETAILED DESCRIPTION

[0013] Figure 1 illustrates a combination washer/dryer unit, which includes tub/drum assembly designated with the reference numeral 10. The tub/drum assembly 10 is positioned inside of a housing of the combination washer/dryer unit. The tub/drum assembly 10 includes a drum 12 and a tub 14. The drum 12 is rotatably positioned within the tub 14. With additional reference to Figure 2, an axial gap 16 is formed between the drum 12 and the tub 14. The drum 12 includes a rear end 18, which may include a crimped flange connecting a base 17 of the drum 12 with a cylindrical wall 19 of the drum 12.

[0014] With additional reference to Figure 3, a seal 20 is positioned on the rear end 18 of the drum 12, around the crimped flange, to close the axial gap 16 between the tub 14 and drum 12. The seal 20 controls the amount of airflow that is permitted to pass/flow around the drum 12, which enables a maximum amount of air to enter into the drum 12 during the drying cycle.

[0015] The seal 20 includes a ring 22 that is positioned around and secured to the drum 12. The seal 20 also includes a retention portion 24 that wraps around the crimped flange at the rear end 18 of the drum 12 to enhance the retention of the seal 20 onto the drum 12. The retention portion 24 includes a pocket 26 that enables the crimped flange at the rear end 18 of the drum 12 to be positioned inside of the retention portion 24.

[0016] The seal 20 also includes an arm 28 that extends from the ring 22 into the axial gap 16 between the drum 12 and the tub 14. The arm 28 includes a mass 30 at its terminal end to enable movement of the arm 28 and mass 30 during rotation of the drum 12. During the washing cycle, the drum 12 may rotate at 400 RPM or greater. During this time, the arm 28 unfolds or deflects to enable the axial gap 16 to become larger between the drum 12 and tub 14. This enables the air and water between the

drum 12 and tub 14 to exit.

[0017] During the spin cycle and drying cycle, the drum 12 spins at about 50-55 RPM. During this rotation speed, the arm 28 does not unfold or deflect and enables the axial gap 16 to become smaller between the drum 12 and the tub 14. Thus, during the drying cycle, airflow is forced into the drum 12 to enhance the drying of the clothes within the drum 12.

[0018] Due to the extension, deflection or unfolding of the arm 28 and mass 30 during washing cycles, the arm 28 or mass 30 may contact the tub 14. As shown in Fig. 7, a coating or part 32 may be positioned onto the tub 14 to prevent the seal from being damaged or torn during rotation of the drum 12. The coating or part 32 is generally manufactured from a composite material and is generally positioned on the tub 14 at a location where the seal 20 rubs against the tub 14.

[0019] Turning to Figs. 4-6, additional seals 20 are illustrated. Thus, the same numerals are utilized to identify the same parts. In Fig. 4, the seal 20 includes a ring 22 with a retention portion 24. The arm 28' extends in a downward fashion. The mass 30 is at the terminal end of the arm 28'.

[0020] In Figs. 5 and 6, the arm 28' includes a chamber 40 that is configured to receive a fluid in Fig. 5 and a metal mass in Fig. 6. Thus, the mass 30 can be altered to provide the desired movement of the arm 28' and mass 30 during the rotation of the drum 12. Also, a wiper 42 may extend from the mass 30 toward the tub 14.

[0021] Turning to Fig. 8, an additional embodiment of the disclosure is shown. In Fig. 8, the drum 12 and the tub 14 are illustrated with a radial gap 50 between the drum 12 and the tub 14. The size of the radial gap 50 controls / limits the amount of air that exits around the drum 12.

[0022] A seal 60 includes a ring 62 that is secured to the tub 14. The seal 60 also includes an arm 64 that extends from the ring 62 into the radial gap 50. The arm 64 may include a lip 66 that extends transverse to the arm 64, toward the drum 12, to provide an additional member to control / limit the airflow through the radial gap 50. The seal 60 may be made of a metal or resin material that provides a desired amount of rigidity. This rigidity enables the seal 60 to provide a high resistance in the airflow path while maintaining a small radial gap 50 between the drum 12 and the arm 64.

[0023] Turning to Figs. 9 and 10A, an additional embodiment is shown. Here, the arm 64 does not include the lip 66. This enables a seal 70 to be secured to the arm 64. The seal 70 generally includes a retention portion 72 to secure the seal 70 to the arm 64. Also, the seal 70 includes a wiper 74 that extends from the retention portion 72 toward the drum 12. The wiper 74 is positioned at a desired distance away from the drum 12 so that a small radial gap is formed between the drum 12 and seal 70 to control / limit the airflow passing through the radial gap between the drum 12 and the seal 70.

[0024] Fig. 10B illustrates another seal 70 that includes

a curved wiper 76. It is positioned to form a radial gap between the drum 12 and the sealing wiper 76. Fig. 10C illustrates a seal 70 with a bulb 78. The bulb 78 extends toward the drum 12 to form a constant radial gap between the bulb 78 and the drum 12.

[0025] Turning to Fig. 11, an additional embodiment is illustrated. Here, the drum 12 includes a groove seal 80 positioned peripherally about an external surface of the drum 12. The groove seal 80 may have one or two extending members 82 that provide a labyrinth seal when the seal 70 is attached to the arm 64. Thus, the gap between the tub 12 and drum 14 can be further modified to control / limit airflow through the gap between the drum 12 and tub 14.

[0026] Fig. 12 shows an additional embodiment of the groove seal 80. Here, the arm 64 includes multiple wipers 90 while the groove seal 80 includes multiple grooves 94, 96 that receive the wipers 90 from the arm 64. Thus, this provides a labyrinth seal to control the airflow through the gap between the drum 12 and the tub 14.

Claims

1. A tub/drum assembly (10) for a combination washer/dryer unit, comprising:
 - a tub (14);
 - a drum (12) rotatably positioned within the tub (14), the drum (12) including a cylindrical wall (19) that is connected to a base (17) at a rear end (18) of the drum (12) and the drum (12) is spaced from the tub (14) such that a gap (16, 50) is formed between the drum (12) and the tub (14) through which air can flow instead of entering the drum (12) during a drying cycle; and
 - a seal (20, 60, 70) positioned near the cylindrical wall (19) at the rear end (18) of the drum (12) that extends at least partially across the gap (16, 50) between the drum (12) and the tub (14) to limit the amount of airflow through the gap (16, 50) between the drum (12) and the tub (14) during the drying cycle.
2. The tub/drum assembly (10) according to Claim 1, wherein the seal (20) is secured to the rear end (18) of the drum (12).
3. The tub/drum assembly (10) according to Claim 1 or 2, wherein the seal (20) includes a ring (22) that is positioned around and secured to the drum (12), and an arm (28, 28') that extends from the ring (22) into the gap (16) between the tub (14) and the drum (12).
4. The tub/drum assembly (10) according to Claim 3, wherein the seal (20) includes a mass (30) at a terminal end of the arm (28, 28'), the mass (30) enabling the arm (28, 28') of the seal (20) to deflect or extend

at high rotational speeds of the drum (12) to increase the gap (16) between the tub (14) and the drum (12).

5. The tub/drum assembly (10) according to Claim 4, wherein the terminal end of the arm (28, 28') includes a chamber (40) for retaining the mass (30) inside the chamber (40). 5
6. The tub/drum assembly (10) according to Claim 5, wherein the mass (30) received in the chamber (40) is a fluid. 10
7. The tub/drum assembly (10) according to Claim 5, wherein the mass (30) received in the chamber (40) is metal. 15
8. The seal (20) for a tub/drum assembly (10) according to any one of the preceding Claims, wherein the rear end (18) of the drum (12) includes a crimped flange where the cylindrical wall (19) of the drum (12) is connected to the base (17) of the drum (12) and wherein the seal (20) includes a pocket (26) that receives the crimped flange to secure the seal (20) to the rear end (18) of the drum (12). 20
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9. The tub/drum assembly (10) according to one of Claims 2-8, further comprising a composite material (32) on the tub (14), wherein the seal (20) is positioned to make contact with the composite material (32) and the composite material (32) is configured to prevent seal damage. 30
10. The tub/drum assembly (10) according to Claim 1, wherein the seal (60, 70) is secured to the tub (14). 35
11. The tub/drum assembly (10) according to Claim 10, wherein the seal (60, 70) includes a lip (66) or wiper (74) that extends towards the drum (12). 40
12. The tub/drum assembly (10) according to Claim 11, further comprising a groove seal (80) secured to the rear end (18) of the drum (12), wherein the groove seal (80) includes at least one extending member (82) that cooperates with the lip (66) or wiper (74) to provide a labyrinth seal that limits the airflow through the gap (50) between the drum (12) and the tub (14). 45
13. The tub/drum assembly (10) according to Claim 12, wherein the groove seal (80) includes two extending members (82) and the lip (66) or wiper (74) is received between the two extending members (82). 50
14. The tub/drum assembly (10) according to Claim 10, wherein the seal (60) that is secured to the tub (14) includes multiple wipers (90) and wherein a groove seal (80) is secured to the cylindrical wall (19) near the rear end (18) of the drum (12) and wherein the groove seal (80) includes multiple grooves (94, 96) 55

that receive the multiple wipers (90) to provide a labyrinth seal that limits the airflow through the gap (50) between the drum (12) and the tub (14).

- 5 15. The tub/drum assembly (10) according to any one of Claims 10-14, wherein the seal (60) includes a ring (62) that is secured to the tub (14) and an arm (64) that extends from the ring (62) into the gap (50) between the drum (12) and the tub (14).

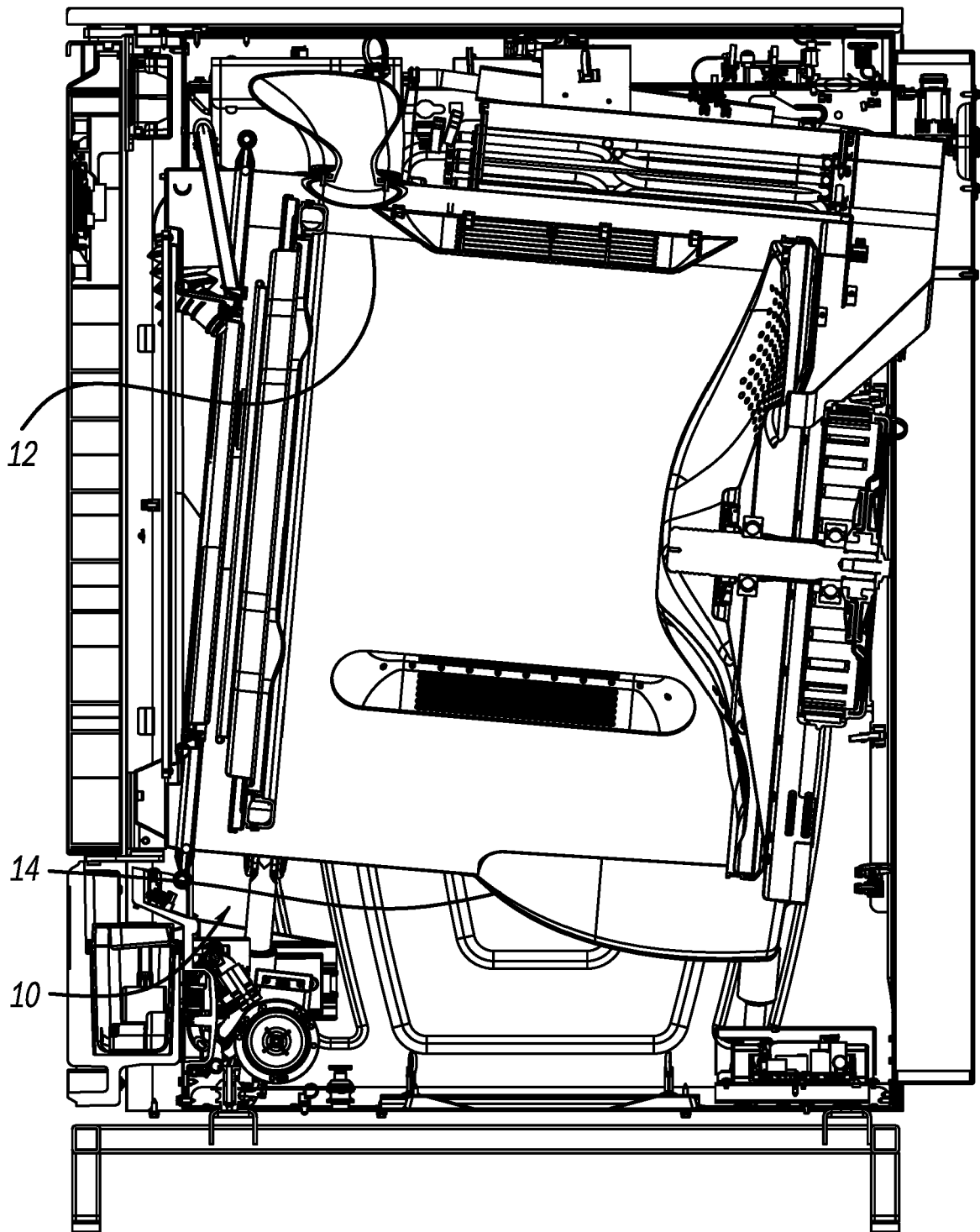


FIG - 1

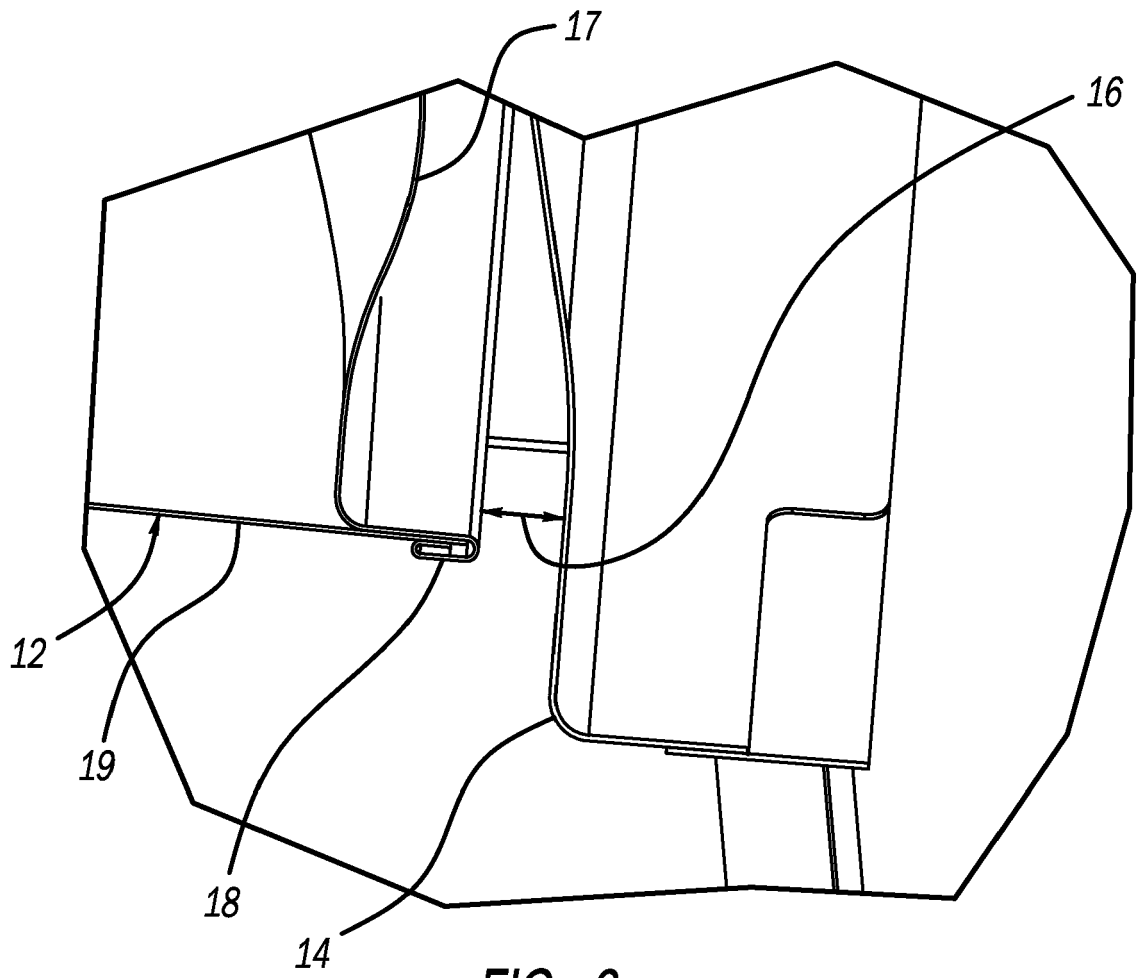


FIG - 2

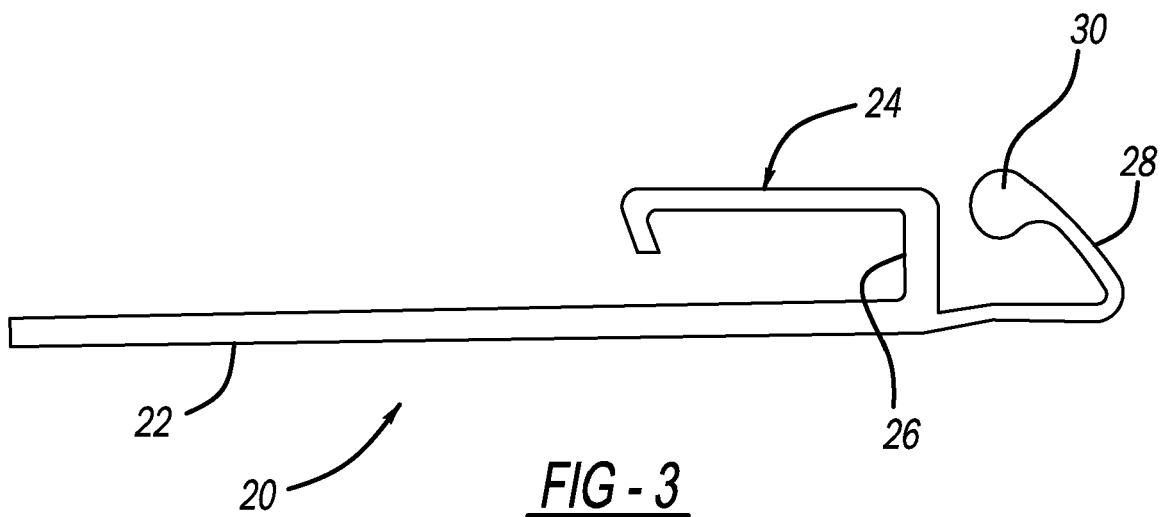


FIG - 3

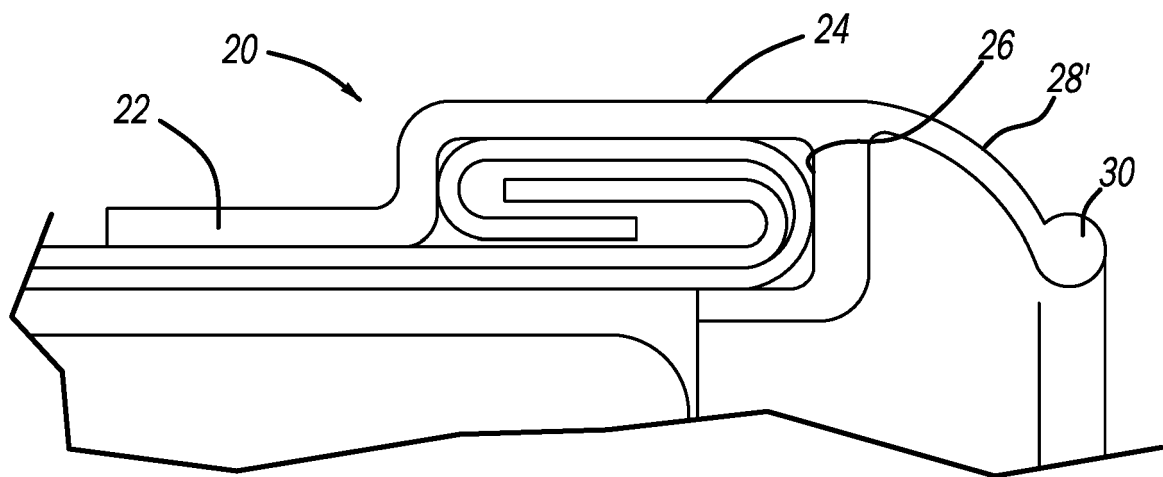


FIG - 4

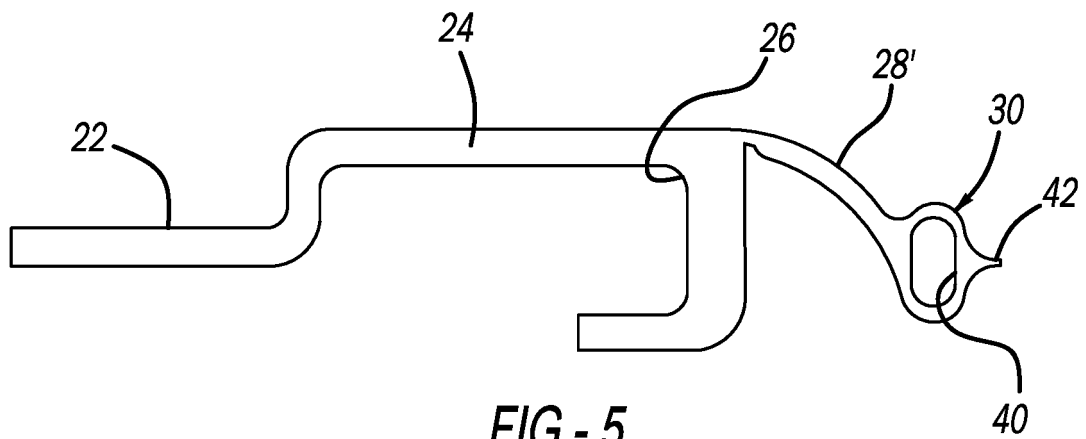


FIG - 5

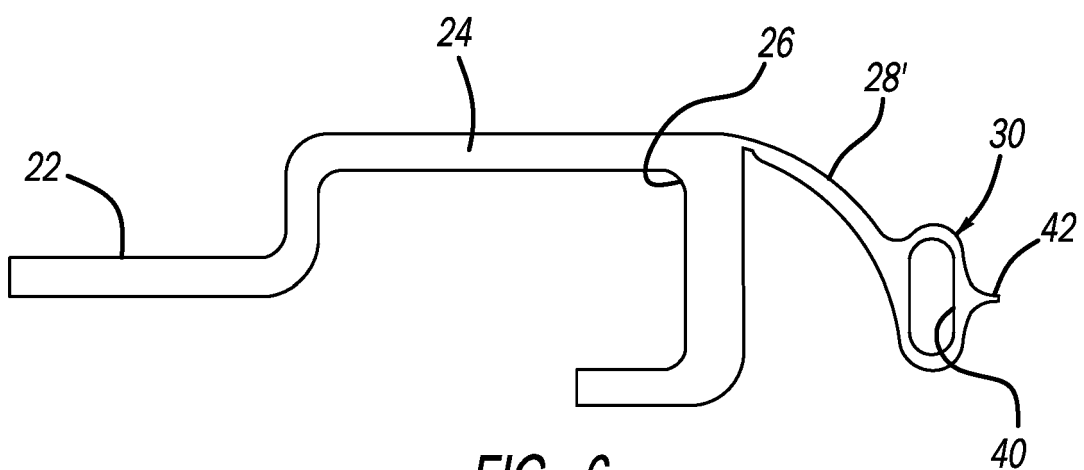
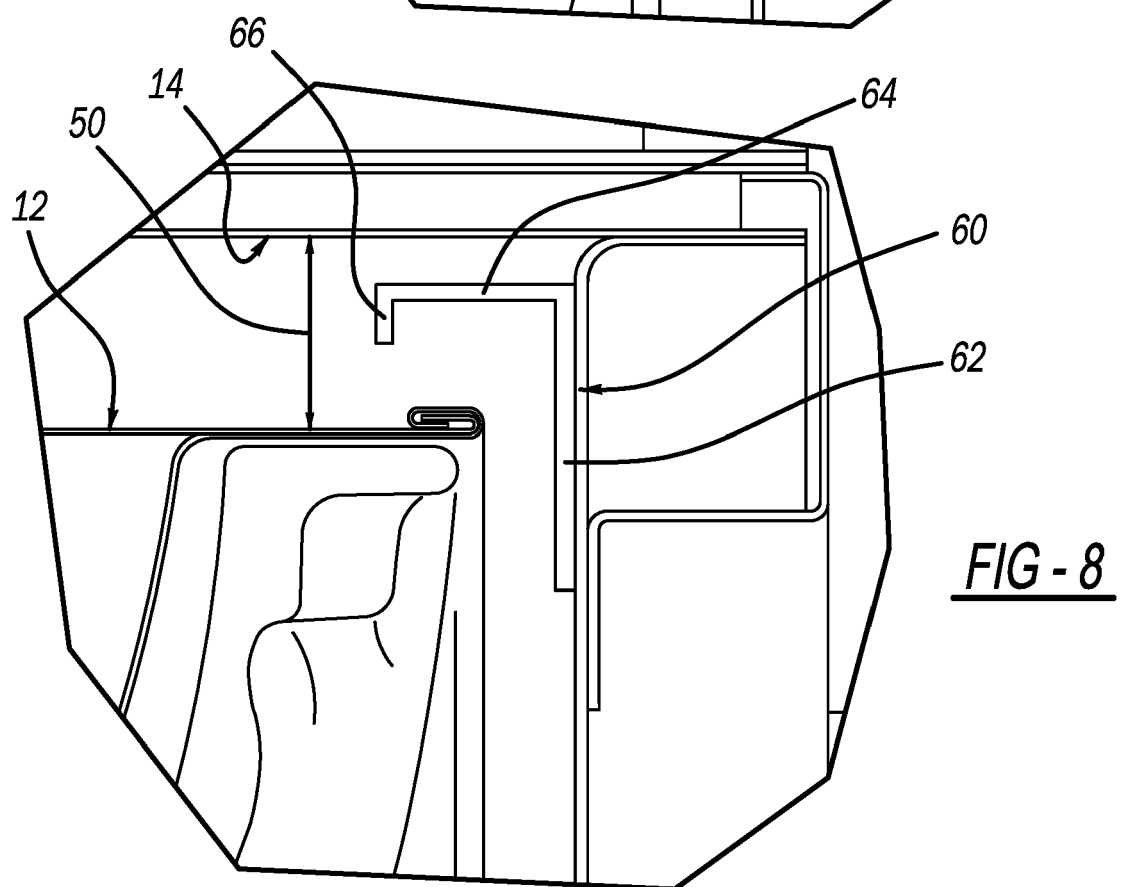
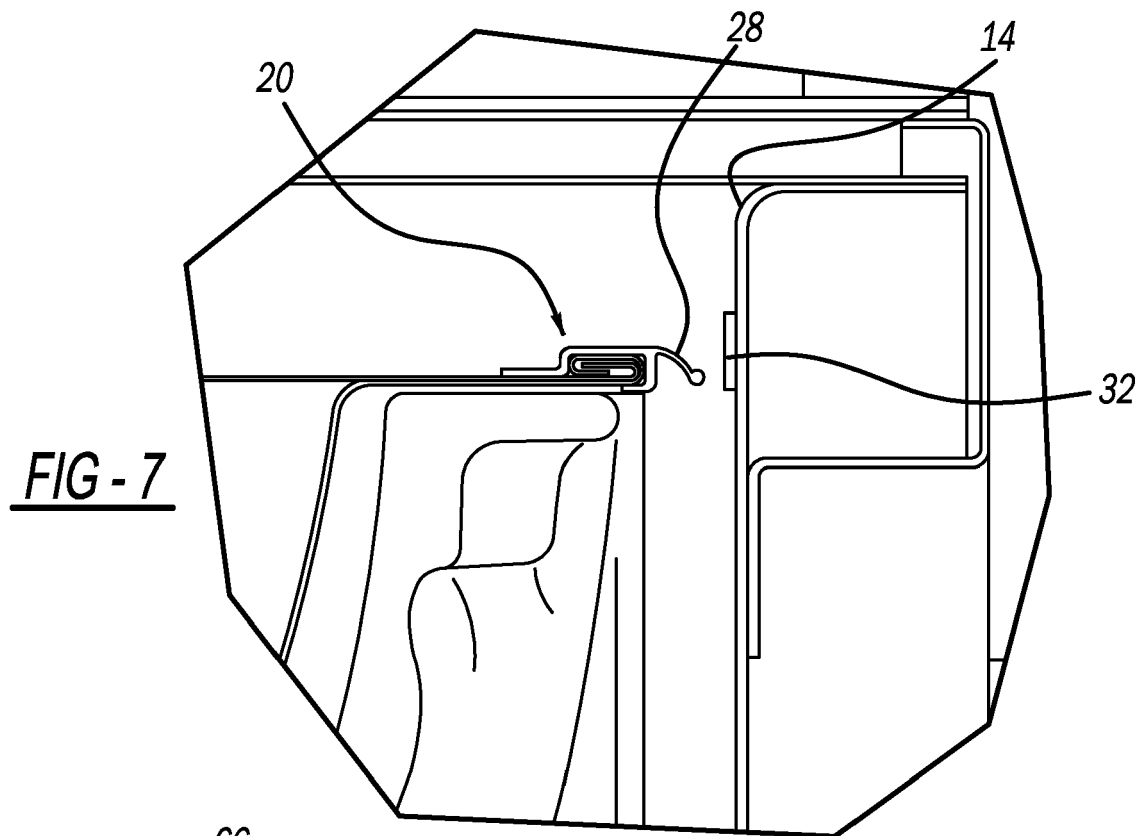
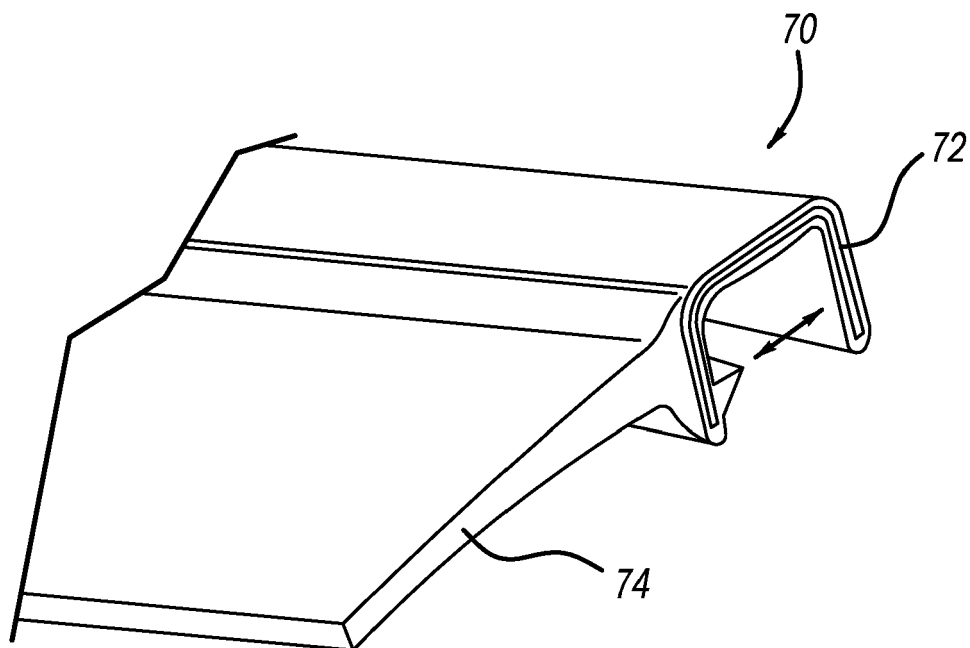
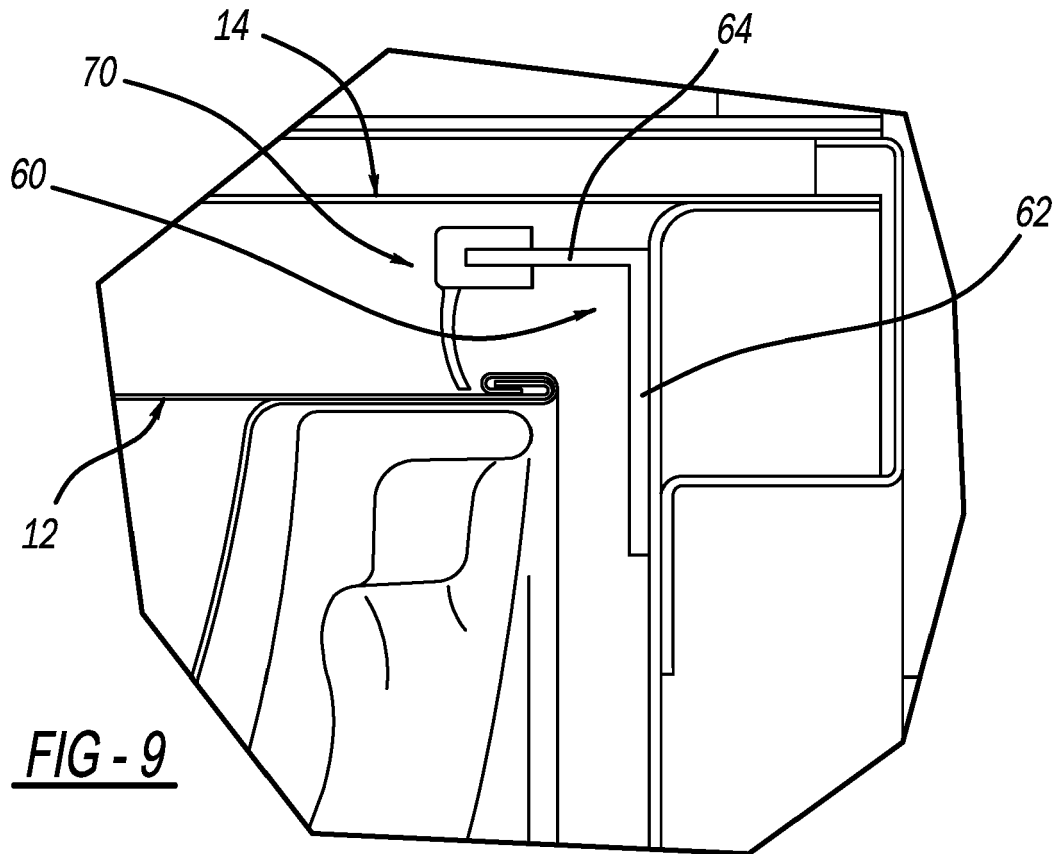


FIG - 6





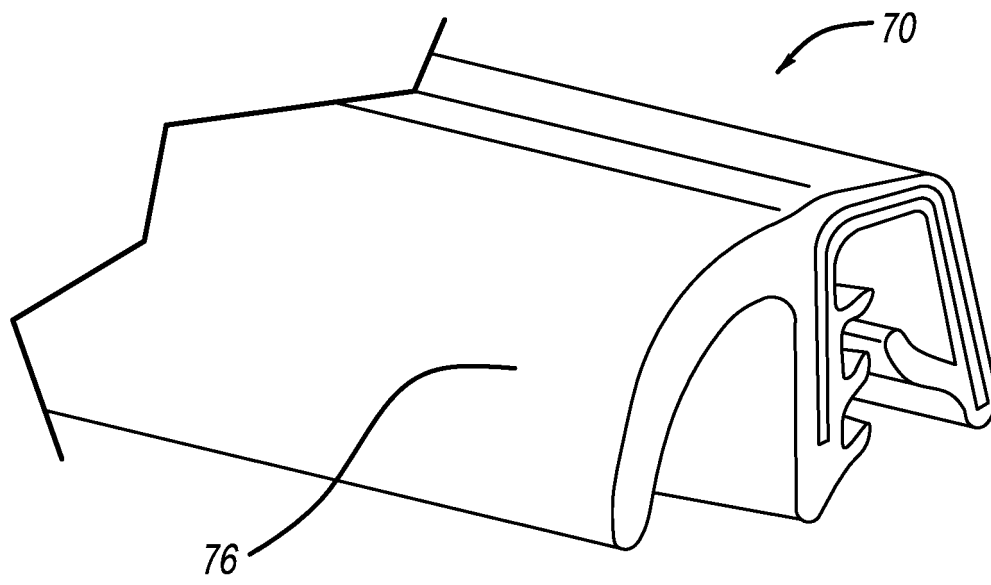


FIG - 10B

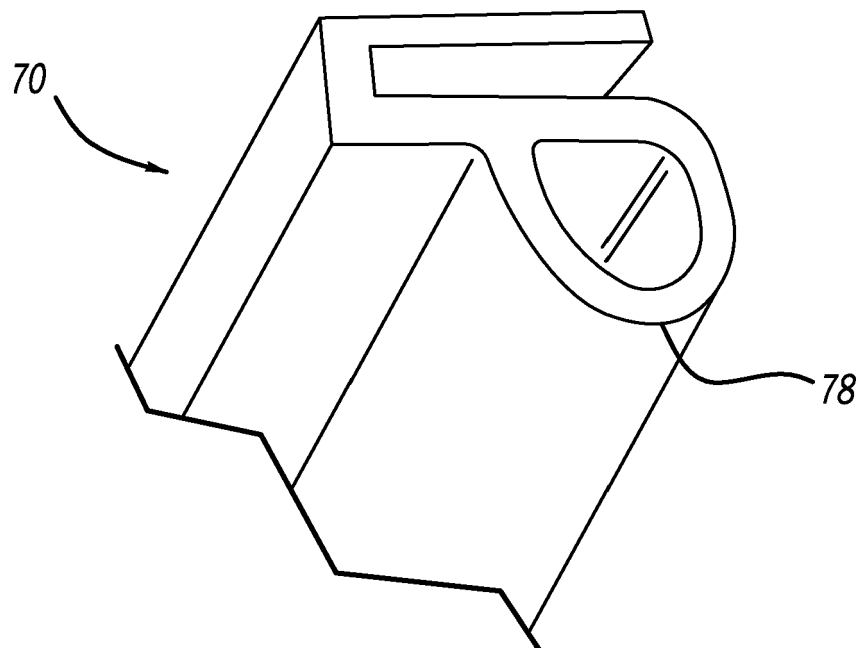
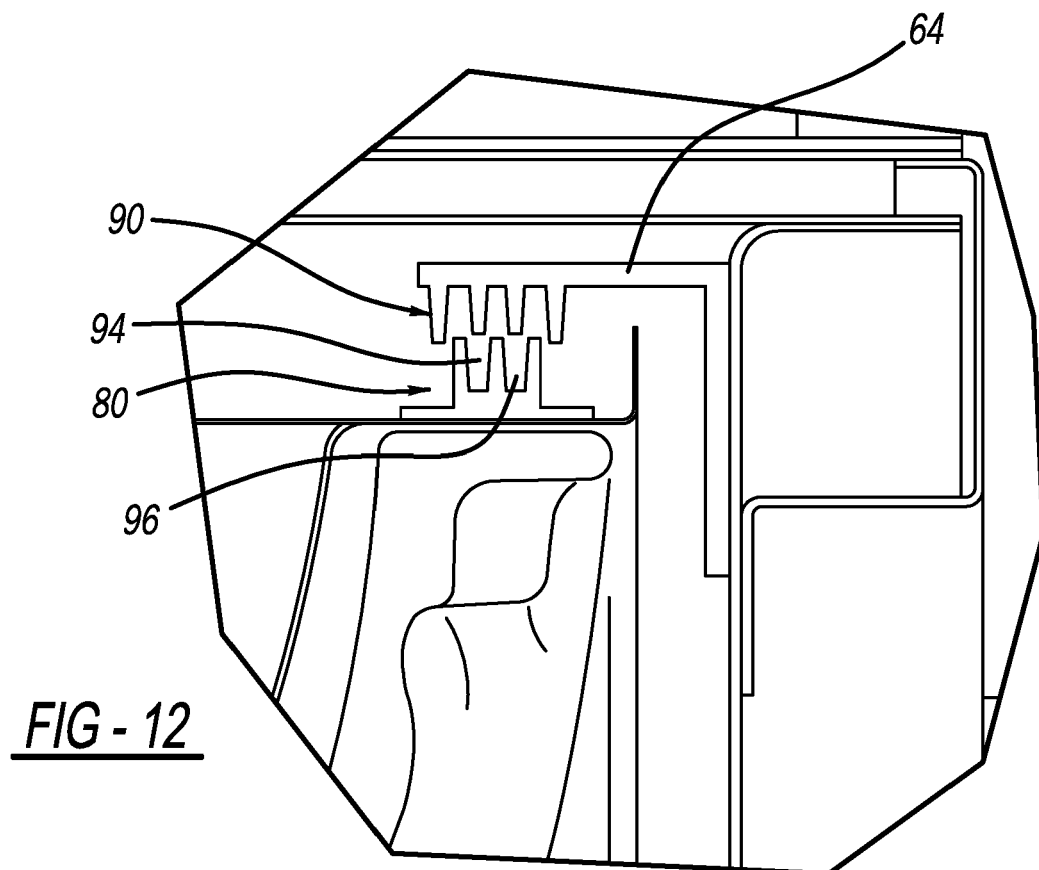
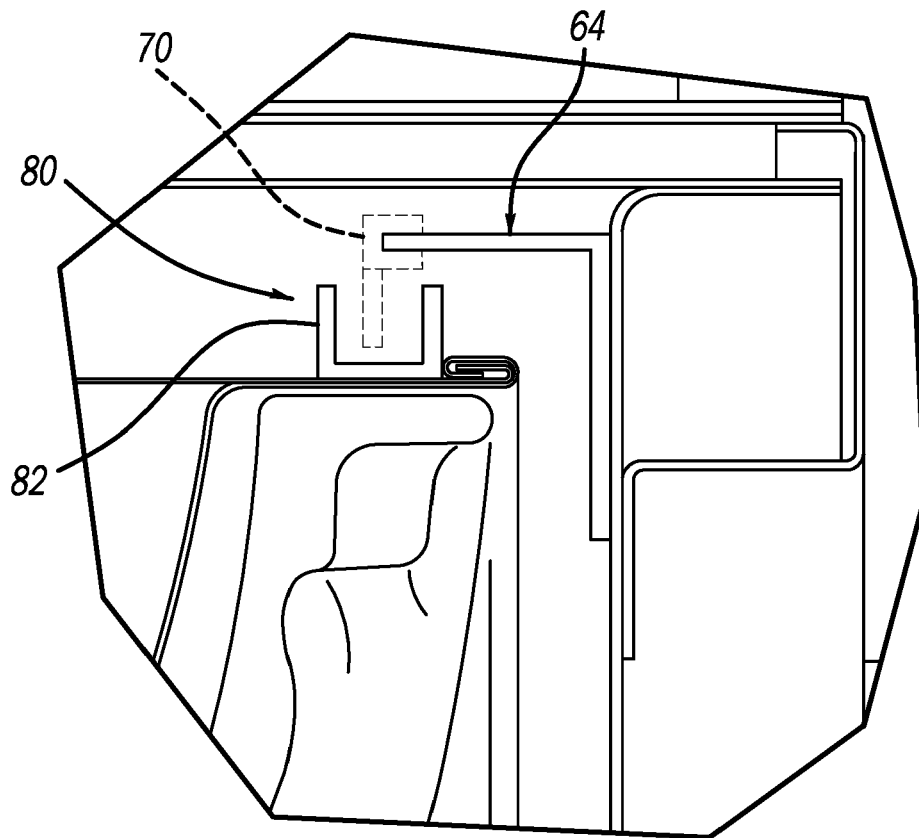


FIG - 10C





EUROPEAN SEARCH REPORT

Application Number

EP 22 17 7103

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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)
X	WO 2014/181493 A1 (PANASONIC IP MAN CO LTD [JP]) 13 November 2014 (2014-11-13) * the whole document *	1-15	INV. D06F25/00 D06F37/26 D06F58/04
X	WO 2009/041345 A1 (SANYO ELECTRIC CO [JP]; YONEZAWA TAKAAKI [JP]; NAKAMURA SATOSHI [JP]) 2 April 2009 (2009-04-02) * the whole document *	1-15	
X	KR 2005 0037187 A (LG ELECTRONICS INC [KR]) 21 April 2005 (2005-04-21) * the whole document *	1-15	
X,P	EP 3 995 615 A1 (WHIRLPOOL CO [US]) 11 May 2022 (2022-05-11) * paragraphs [0015] - [0019]; figures *	1-15	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			D06F
Place of search		Date of completion of the search	Examiner
Munich		23 November 2022	Stroppa, Giovanni
CATEGORY OF CITED DOCUMENTS		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	
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 22 17 7103

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
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23-11-2022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2014181493 A1	13-11-2014	JP 6212701 B2	18-10-2017
		JP 2014217499 A	20-11-2014
		WO 2014181493 A1	13-11-2014
WO 2009041345 A1	02-04-2009	JP 4911623 B2	04-04-2012
		JP 2009077966 A	16-04-2009
		TW 200923157 A	01-06-2009
		WO 2009041345 A1	02-04-2009
KR 20050037187 A	21-04-2005	NONE	
EP 3995615 A1	11-05-2022	CN 114457553 A	10-05-2022
		EP 3995615 A1	11-05-2022
		US 2022145516 A1	12-05-2022