IM3

Description

Technical sector

[0001] This invention relates to a hearth for solid fuel stoves and stoves incorporating such hearth.

[0002] More particularly, the invention relates to a hearth for wood pellet and/or biomass stoves and a stove incorporating such hearth.

Prior art

[0003] As is known, the hearth is the part of the stove where controlled combustion takes place in a confined environment.

[0004] A hearth for solid fuels generally comprises a grid or graticule, a combustion chamber in which the flame develops and an ash pit, that is the part of the hearth in which the combustion residues and ash are deposited.

[0005] In recent times, pellet stoves, a particular type of stove which uses a solid fuel in the form of small pellets obtained from pressing sawdust, have become widespread.

[0006] The structure of a pellet stove is similar to that of a conventional wood stove except that it provides a much cleaner device and therefore generally eliminates the need to transfer fuel from the house's wood store and avoids the escape of smoke within the environment in which it is used, operating with a leaktight door, which only has to be opened periodically for cleaning.

[0007] Pellet stoves are also regarded as being an ecological device because woodworking wastes (sawdust, etc.) are generally used to obtain the pellets, and it is not therefore necessary to fell further trees. The pellets are distinguished from wood by their low moisture content (generally less than 12%) and by their high density, as well as their uniformity, and therefore their constant performance. It is therefore obvious that for equal volumes pellets represent a material having an appreciably higher calorific value than wood.

[0008] As a consequence, through pellets it is possible to construct stoves provided with automatic pellet feeds, for example via a screw which draws them from a container, with a very high level of automation.

[0009] However the combustion of pellets produces ash which has to be periodically removed, although in lesser quantity than wood.

[0010] Pellet stoves are now constructed to increase independence as much as possible and therefore to reduce the frequency of actions to remove ash.

[0011] With this object the hearth of modem pellet stoves is made in such a way that the ash which forms as a result of pellet combustion is easily removed through a convective effect as a result of the upward motion of the hot air and precipitates out in an ash chamber, substantially by gravity and outside the combustion chamber.

[0012] Working in accordance with this principle the ash does not accumulate within the combustion chamber, which remains clean at all times to provide better and more efficient stove performance.

[0013] Nevertheless the system described, through which ash is naturally removed from the combustion chamber taking advantage of the abovementioned principle, is not always capable of operating correctly, with the result that there is an inexorable progressive build-up of ash in the bottom of the combustion chamber.

[0014] Like pellet stoves, biomass stoves have also become widespread, and these use a solid fuel based on ligneous biomass which may have an extremely varied composition, which in addition to pellets themselves may for example include olive pits, rapeseed and maize residues, straw, pomace, almond and nut husks and so on.

[0015] Although on the one hand biomass stoves can be used to bum a wide range of various ligneous biomass, they on the other hand produce ash which is very difficult to dispose of in comparison with the ash produced in pellet stoves, as the ash is less powdery and volatile.

[0020] A first object of this invention is therefore to provide a hearth for solid fuel stoves which overcomes the abovementioned problem by avoiding the build-up of ash within the combustion chamber.

[0021] A further object of this invention is to provide a hearth which will accept the use of both pellets and biomass.

[0022] Another object of the invention is to provide a hearth which can be incorporated in a conventional stove structure.

[0023] Yet another object of the invention is to provide a hearth for solid fuel stoves which is reliable and simple and economical to manufacture so it can be produced industrially on a large scale at low cost.

[0024] The above and other objects are accomplished through the hearth according to the invention as defined in the appended claims.

Description of the invention

[0025] Advantageously, given that the means for the forced removal of wastes and ash forming in the combustion chamber are at least partly directly located within the combustion chamber itself, without any wall, grid or other obstacle or impediment in between, the hearth according to the invention will not clog as a result of the build-up of ash, which is frequent in stoves of the known art, in particular when pellets manufactured using particular woods (for example olive wood) or biomass are used.

[0026] The hearth according to the invention may therefore be advantageously used for the combustion of a wide range of pellets and other ligneous biomass of different types.

[0027] According to a preferred embodiment of the invention the above forced removal means comprise at least one screw, and in particular a pair of screws, one right-handed and one left-handed, arranged symmetrically with respect to a median plane of the combustion chamber; as a result of this particular arrangement ash can be extracted simultaneously from the two opposite sides of the stove, thus preventing ash from building up at a single point in the collection container.

Summary description of the figures

[0028] Some embodiments of the hearth according to the invention will be described purely by way of example and without restriction with reference to the appended drawings in which:

- Figure 1 is a diagrammatical view in lateral cross-section of a generic pellet stove comprising the hearth according to the invention,
- Figure 2 is a view from above of the hearth in a first embodiment of the invention,
- Figure 3 is a view in lateral cross-section along a longitudinal plane of the hearth in Figure 1,
- Figure 4 is a view in lateral cross-section along a transverse plane of the combustion chamber incorporated in the hearth in Figure 1,
- Figure 5 is a view in lateral cross-section along a longitudinal plane of the combustion chamber in Figure 4,
- Figure 6 is a view in lateral cross-section along a transverse plane of the hearth in Figure 1, in a variant embodiment,
- Figure 7 is a view in lateral cross-section along a transverse plane of the hearth in a second embodiment of the invention.

Detailed description of some preferred embodiments of the invention

[0029] The same reference numbers have been used to identify identical or functionally equivalent components in all the figures.

[0030] With reference to Figure 1, this illustrates a generic embodiment of a pellet or biomass stove in which a hearth according to the invention is housed.

[0031] In accordance with the known art, a generic pellet or biomass stove indicated as a whole by reference 11 substantially comprises a containment structure 13, a hearth 15 provided with a combustion chamber 17, an ash pit 19, a duct 21 for the discharge of smoke, a duct 23 for delivering fuel to the hearth by means of a motor-driven screw 25, and a container 27 from which the fuel is taken to be delivered to the hearth by means of screw 25.

[0032] With reference to Figures 2 to 5, these illustrate a preferred embodiment of hearth 15 according to the invention.

[0033] Hearth 15 comprises a combustion chamber 17 formed within a prismatic enclosure 29, substantially in the form of an inverted pyramid in the example illustrated, which is open at the top and provided with side walls 29a and a base 29b at the bottom.

[0034] Still according to the invention, a device 33 for the removal of ash provided with a moving transfer unit 35 for the removal of wastes and ash produced following combustion within chamber 17 is at least partly located directly within combustion chamber 17, at the said base 29b.

[0035] In particular base 29b has an opening 31 within which device 33 provided with moving transfer unit 35 is located.

[0036] As may be clearly seen in Figure 3, in the structure of the hearth according to the invention in which removal device 33 is located within combustion chamber 17 without any wall, grid or other obstacle in between, moving transfer unit 35 penetrates at least partly within combustion chamber 17 so as to extract the wastes and combustion ash directly from the combustion bed. In this way it is ensured that the ash is extracted at a sufficiently high temperature which is suitable for removal, before it cools and solidifies. This special feature of the invention makes it possible to effectively remove combustion wastes and ash whatever the solid fuel used and - specifically - even when biomass is used as the solid fuel.

[0037] Furthermore, given that removal device 33 is located within said combustion chamber 17, the risk of the ingress of air from the exterior through the said removal device and consequently the risk of changing the right excess air values for perfect combustion is overcome.

[0038] Device 33 comprises a cylindrical duct 37 communicating with the said at least one opening 31 and

therefore with said combustion chamber 17 through a corresponding opening provided in its lateral wall; said duct 37 is located substantially parallel to opening 31 and base 29b of combustion chamber 17 in which moving transfer unit 35 is housed.

[0039] In this embodiment duct 37 is in line with the longitudinal axis "S" of chamber 17. According to this embodiment of the invention moving transfer unit 35 comprises a screw 39 which extends around a rotating shaft 41 associated with a motor 43 located outside the hearth.

[0040] Screw 39 is housed within duct 37 between a pair of bearings 45 which support rotating shaft 41.

[0041] According to a preferred embodiment of the invention, duct 37 runs horizontally beneath base 29b of combustion chamber 17 over a distance which is greater than the length of the said base. This duct therefore comprises two opposite terminal portions 37a, 37b, at least one of which projects beyond the perimeter of base 29b. An opening 47 for the discharge of combustion wastes and ash is provided at one of these terminal portions.

[0042] Preferably duct 37 projects beyond base 29b at both extremities and houses bearings 45 substantially in the outermost part of portions 37a, 37b in a position such as to leave sufficient space between bearings 45 and corresponding lateral wall 29a adjacent to combustion chamber 17 to define a pair of openings 47 for the removal of ash on opposite sides of base 29b of combustion chamber 17.

[0043] Referring in particular to Figure 4, according to a preferred embodiment of the invention, opening 31 is substantially defined at the centre of base 29b of combustion chamber 17 between the two portions 29b' and 29b" of said base 29b which are inclined towards said opening 31 in such a way as to form an ash chute when combustion chamber 17 is mounted in a stove.

[0044] In this embodiment enclosure 29 has a substantially trapezoidal transverse cross-section. In addition to this, opening 31 preferably extends substantially over the entire length of base 29b of combustion chamber 17.

[0045] Both walls 29a and portions 29b' and 29b" of base 29b of chamber 17 may also comprise holes 49 for the passage of air.

[0046] Referring again to Figures 2 to 5, combustion chamber 17 is also preferably at least partly housed in a container 51 comprising a sealed base 51a, lateral sides 51b, an upper opening 51c for enclosure 29 which defines said chamber 17 and a lateral opening 51d for the entry of combustion air. Preferably said lateral opening 51d is provided with flanges 53 provided with holes 55 for the attachment of container 51 and consequently hearth 15 to the structure 13 of a stove, for example of the type illustrated in Figure 1, by means of for example screws or bolts.

[0047] Duct 37 also extends through opposite lateral sides 51b of container 51, beyond which there extend portions 37a, 37b of conduit 37 in which bearings 45 are housed and openings 37a and 37b are defined for the fall of ash.

[0048] Again according to this embodiment of the invention, screw 39 extends around shaft 41 in such a way as to define a pair of screws 39a, 39b which are respectively right-handed and left-handed. In this way when shaft 41 is caused to rotate by motor 43 the combustion residues and ash which precipitate out through slot 31 in duct 37 beneath are drawn horizontally out of combustion chamber 17 in opposite directions as indicated by arrows F1, F2, through duct 37 which they leave through openings 47. As a result of this arrangement the combustion wastes and ash are distributed between the two screws 39a, 39b, part leaving through an opening 47 at one extremity of conduit 37 and part through an opening 47 at the opposite extremity of said conduit 37, thus avoiding all the said wastes and ash being discharged at a single point.

[0049] In accordance with the invention, the diameter of screw 39 is advantageously slightly smaller than the internal diameter of duct 37, for example by 1-2 mm, to allow screw 39 to rotate in duct 37 in a substantially leak-tight manner as a result of the presence of combustion residues and ash penetrating between the screw and the duct and substantially acting as a seal.

[0050] With reference to Figure 6, this illustrates a variant embodiment of hearth 15 according to the invention which differs from that previously described in that enclosure 29 which defines the said hearth has a substantially triangular transverse cross-section with opposing inclined walls 29a connected directly to duct 37.

[0051] With reference to Figure 7, this illustrates a second embodiment of the hearth according to the invention which incorporates a moving transfer unit 35 comprising a rotating member 139 provided with radial fins 139a. Rotating member 139 is housed in a duct 137 which has a substantially square transverse cross-section and is open at the top at slot 31 and at the bottom at a second slot 131.

[0052] In accordance with a second embodiment of the invention, the combustion residues and ash present in the base of combustion chamber 17 are drawn downwards in the direction indicated by arrow F3, out of the combustion chamber, thanks to the rotation of rotating member 139.

[0053] Removal device 33 according to the invention may be advantageously controlled by an electronic control system through which the times when moving transfer unit 35 is switched on and switched off can be varied at will. In particular the duration of the said periods during which it is switched on and switched off may be set according to the type of fuel used, thus making it possible to extract ash of different types having different physical and chemical properties with great efficiency.

[0054] Through the aforesaid electronic control system, it would also be possible - for example - to set an initial cleaning cycle when the stove is switched on and a final cleaning cycle when it is switched off.

[0055] The hearth described is susceptible of many variants, all of which fall within the scope of the invention

as described by the appended claims.

Claims

1. Hearth (15) for solid fuel stoves comprising a combustion chamber (17) defined within an enclosure (29) open at the top and having a base (29a), said hearth comprising a device (33) having a moving transfer unit (35) for the removal of combustion wastes and ash, **characterized in that** said device (33) is directly and at least partly located within the combustion chamber (17) so that the moving transfer unit (35) penetrates at least partly within the said combustion chamber (17).

2. Hearth according to claim 1, wherein said device (33) is provided in correspondence with said base (29a) of said combustion chamber (17), said base (29a) correspondingly comprising at least one slot (31).

3. Hearth according to claim 2, wherein said at least one slot (31) is arranged essentially parallel to the base (29b) of the enclosure (29) in which the combustion chamber (17) is defined and wherein said device (33) comprises a duct (37) communicating, through a corresponding opening provided in its side wall, with said at least one slot (31) and being located essentially parallel thereto, in which the moving transfer unit (35) is housed.

4. Hearth according to claim 3, wherein said duct (37) extends horizontally beneath the wall defining the base (29b) of the combustion chamber (17), for a length greater than the length of said base, said duct comprising two opposite end portions (37a,37b), of which at least one projects over said base (29b), said at least one projecting portion comprising an opening (47), for discharging combustion residues and ashes.

5. Hearth according to claim 1, wherein said moving transfer unit comprises a rotating body associated with a rotating shaft (41) driven by a motor (43), said rotating body comprising at least one worm screw (39) and/or at least one rotor (139) provided with radial blades (139a).

6. Hearth according to the claims 4 and 5, wherein said at least one projecting portion (37a,37b) houses a rotatable bearing (45) for said shaft (41) essentially in the outermost part of said projecting portion (37a, 37b), between said bearing (45) and the corresponding side wall (29a) adjacent to the combustion chamber (17), said opening (47) being defined as for the discharge of ash.

7. Hearth according to claim 6, wherein said worm screw (39) extends around the rotating shaft (41) so as to define a pair of worm screws (39a,39b), right-handed and left-handed respectively, so that when the shaft (41) is rotated by the motor (43), the combustion residues and ashes falling down through the slot (31) into the duct (37) beneath, are entrained towards the outside of the combustion chamber (17), in opposite directions.

8. Hearth according to any of the preceding claims, wherein said slot (31) is defined essentially at the centre of the base (29b) of the combustion chamber (17) between two portions (29b') and (29b") of said base (29b) that are inclined towards said opening so as to define a chute for the ashes to fall by gravity when the combustion chamber is mounted in a stove.

9. Hearth according to any of the preceding claims, wherein the enclosure (29) comprises an essentially trapezoidal or triangular cross-section and wherein said duct (37) is upperly open at said slot (31) and downwardly open at a second opening (131) so that the combustion residues and ashes lying at the bottom of the combustion chamber are entrained downwards, outside the combustion chamber by means of the rotation of the moving transfer unit (35).

10. Hearth according to any of the preceding claims, wherein said combustion chamber (17) is housed, at least partially, in a container (51) comprising a closed base (51a), lateral sides (51b), an upper opening (51c) for the enclosure (29) defining said camera (17) and a lateral opening (51d) for the inlet of combustion-supporting air, said duct (37) extending through the opposite lateral sides (51b) of the container (51), over which the end portions (37a,37b) of the duct (37) project, in which the rotatable bearings (45) are housed and said openings (47) are defined.

11. Hearth according to any of the preceding claims, wherein the device (33) is associated with an electronic control system through which the times when said moving transfer unit (35) is switched on and switched off can be varied for removal of the combustion residues and ashes.

12. Solid fuel stove comprising a containment structure (13), a hearth (15) provided with a combustion chamber (17), an ash pit (19), a duct (21) for the discharge of smoke, **characterized in that** said hearth is made in accordance with any of the claims from 1 to 11.

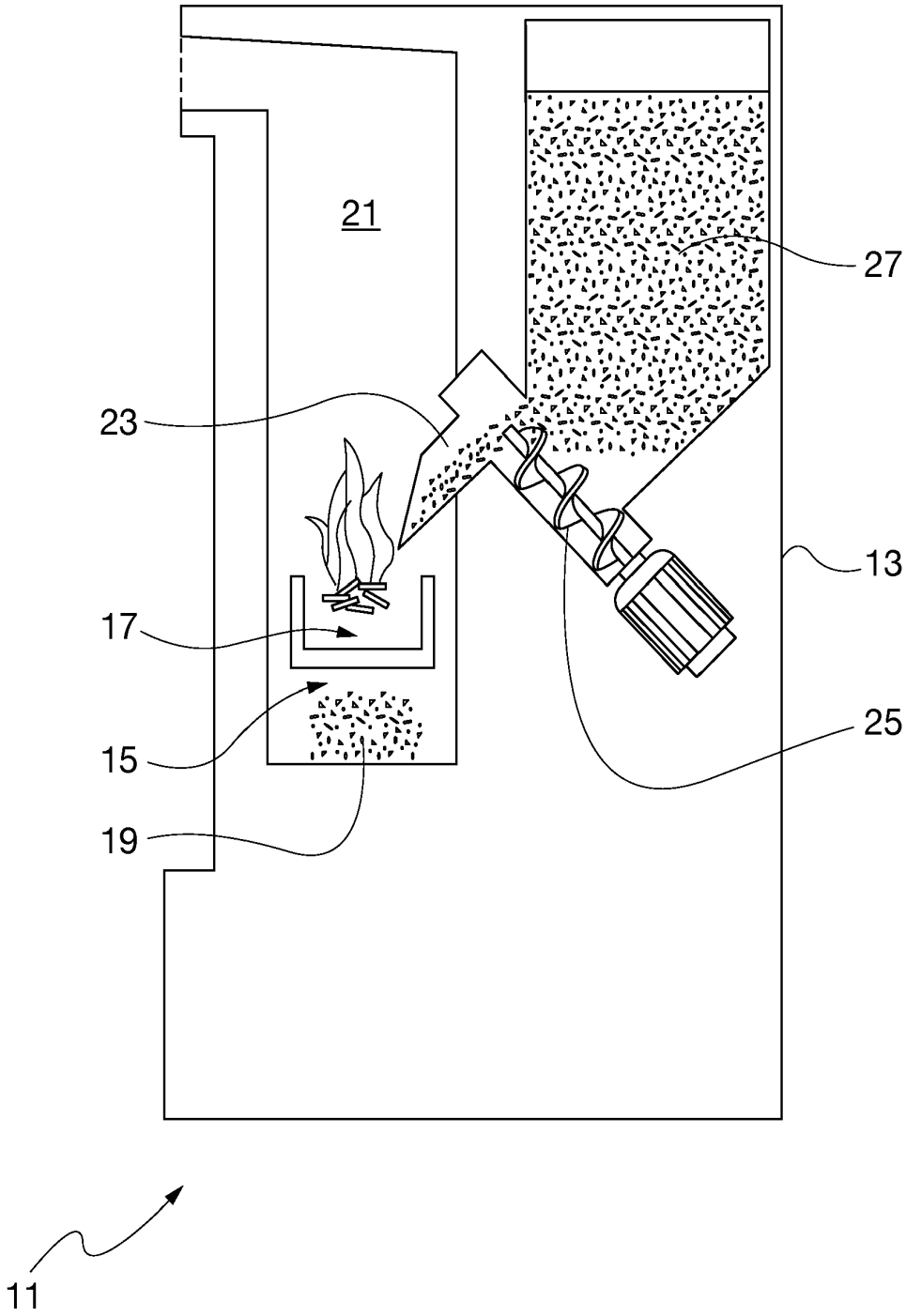


Fig. 1

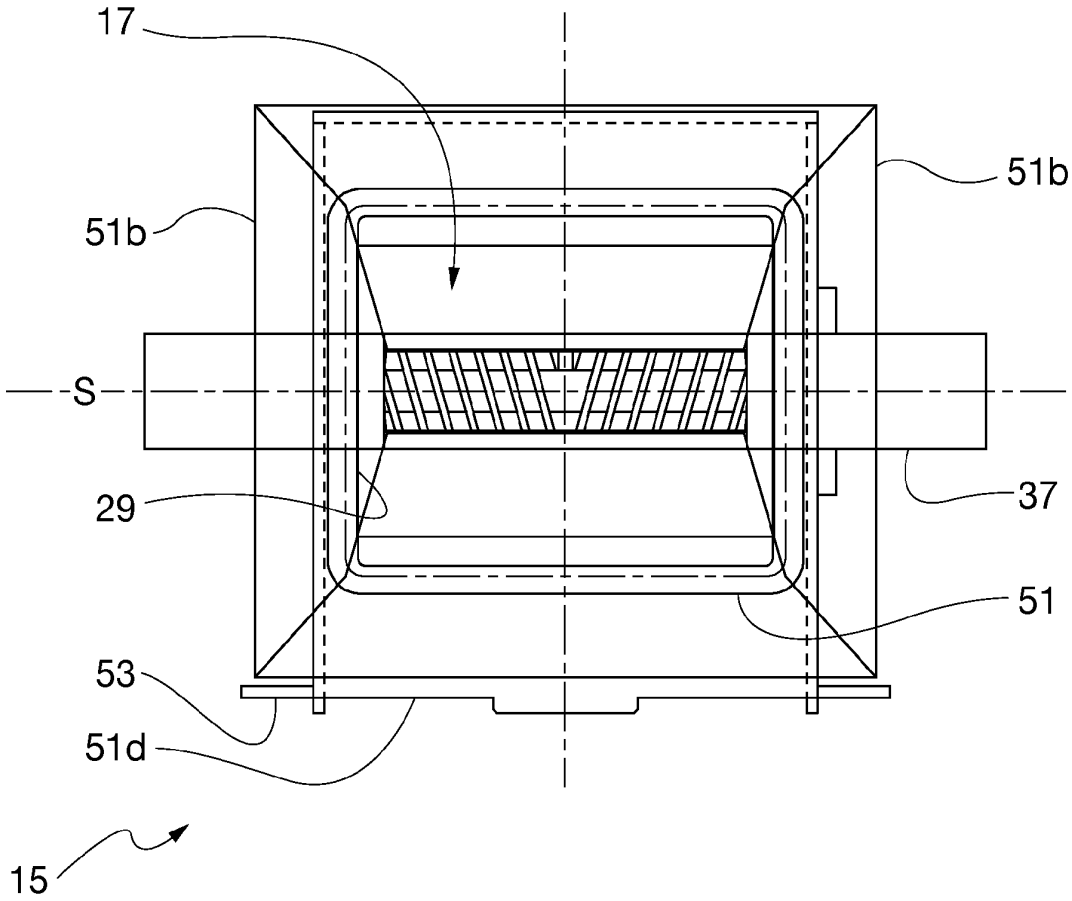
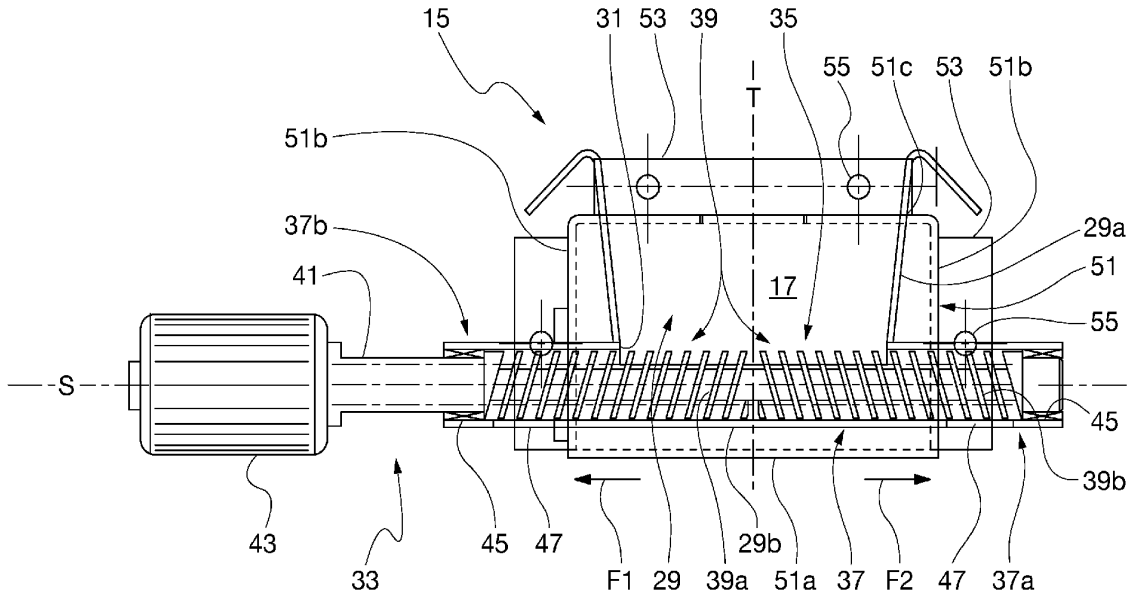


Fig. 2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F2
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37a

Fig. 3

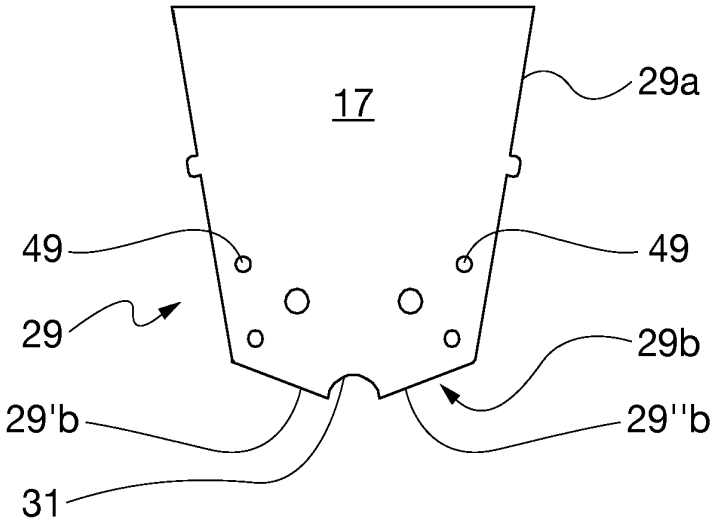


Fig. 4

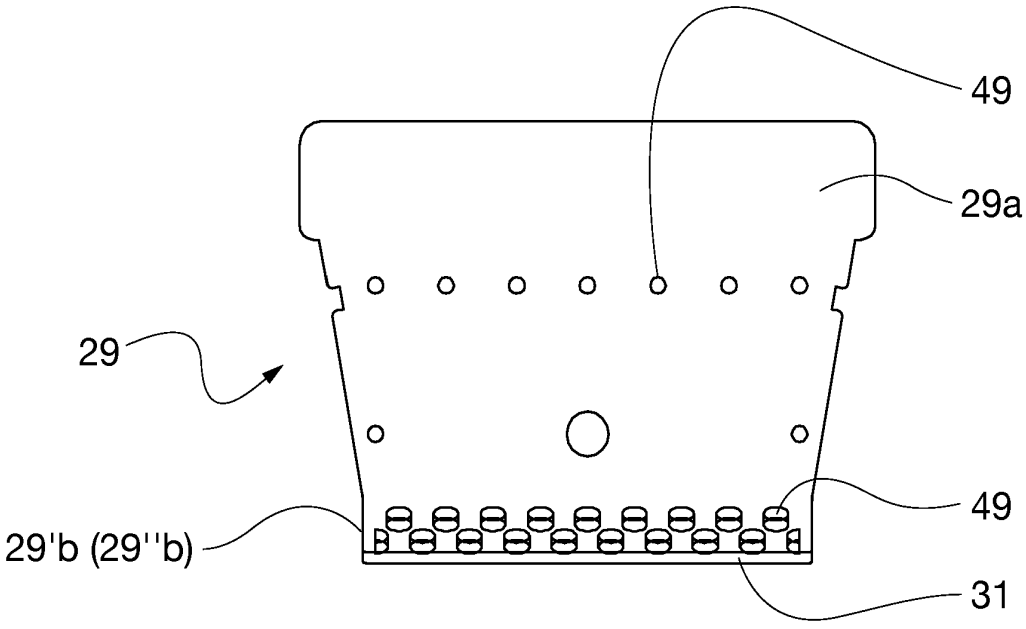
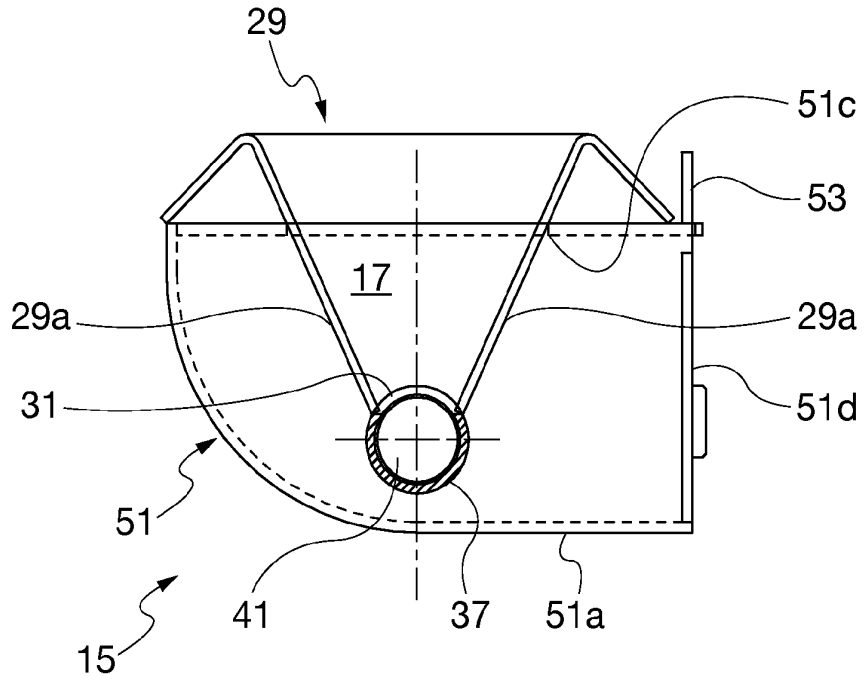


Fig. 5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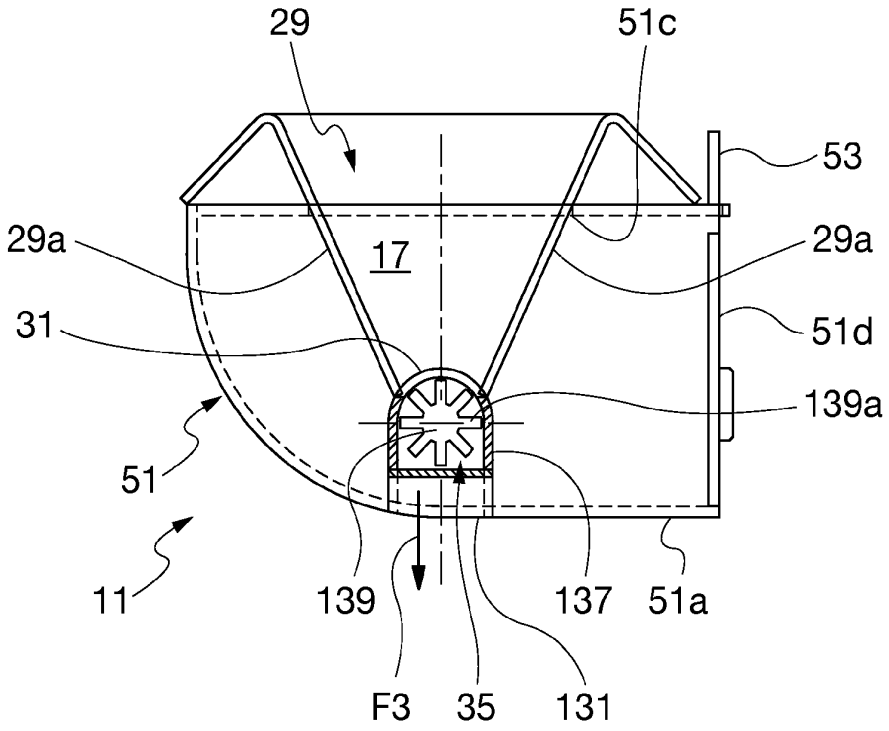
51c
53
17
29a
29a
31
51d
51
41
37
51a
15

Fig. 6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35
131

Fig. 7