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(54) **Burner for a stove fuelled with solid fuels**

(57) This is a burner for a stove fuelled with solid fuels, in particular pellet, wherein there is provided a brazier (1) with a substantially rectangular shape whereon a device acts for removing the burnt product consisting of a motor-driven spatula (6) provided with a pivoting movement, which has the function of keeping, the brazier holes free from burnt product. Such burner is **characterised in that** it exhibits, at the centre line thereof in longitudinal direction, a portion thereof provided with up-

wards facing concavity and subject to the action of the spatula, Such portion is provided with through holes wherethrough the primary air required for combustion flows outwards. On the other hand, the secondary air flows through the holes (12) obtained in a pair of elements (11) obtained by a metal sheet, which are curved substantially as a V, with upward facing apex, or as an up-turned "U", according to the combustion power of the burner.

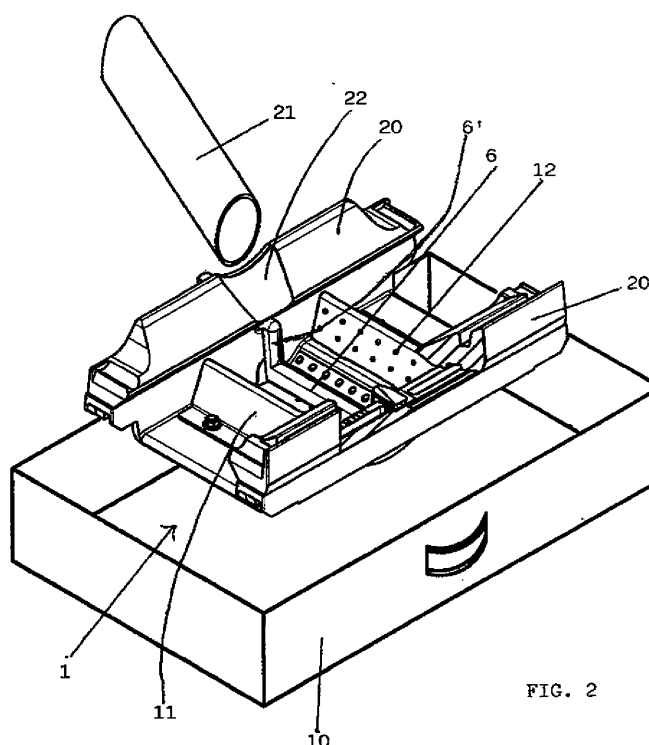


FIG. 2

Description

[0001] The present invention relates to a burner for a stove fuelled with solid fuels, in particular pellets but also for wood chips, cereals, vegetal waste in general, according to the general part of claim 1.

[0002] The use of solid fuels in heating stoves has long been known. In fact, the use of firewood first and then of coal too, in stoves, has been known respectively for a few thousands years and a few hundreds years.

[0003] However recently, the use of solid fuel called pellet has become particularly widespread, consisting of small pieces of fuel material obtained through special processes, of known type, starting from waste wood and other material that were once unwisely disposed of to dump or burnt in the open air, with consequent energy waste and pollution. The advantage of pellet over wood and coal consists in that it is much more easily managed by the manufacturer, as well as by the retailer and finally, by the end user too, since it can conveniently be arranged in bags of the desired weight and can be handled in a much easier manner compared to wood or coal. Moreover, in stoves that use pellet, the fuel is arranged in a storage space, located outside or directly inside the stove body, wherefrom it is taken, generally by a screw, to be gradually laid in the burner. In the practice, the pellet is fed in a substantially automated manner, unlike known solid fuels that need to be constantly put in the stove by the user, based on the combustion progress. The burner further exhibits a fuel collection tank provided with a pierced bottom where through the comburent air enters the combustion chamber.

[0004] The fuel collection tank normally exhibits a square or rectangular shape and is provided with vertical walls that delimit the brazier and are intended for containing the ashes.

[0005] However, such construction shape implies the drawback that after a certain operating period of the stove, ash and other combustion products become stagnant on the bottom, and in particular at the base edges, where the turbulence action caused by the blown air is weaker, with the result that a part of the air passage holes is obstructed, thus generating an irregular combustion. At present, such drawback occurs intensely since with the rapid spreading of pellet stoves, also the demand for this particular type of fuel, which gives rise to a considerably mount of ash, has increases accordingly.

[0006] In view of such need, and in order to cope with the increasing demand, the manufacturers of pellet and wood chips have been led to use alternative base products to only the wood resulting from tree logs, such as processing residues coming from carpentry and furniture industries, which also contain chemical substances, plastics and adhesives; moreover, in order to reduce costs, they have introduced alternative fuel products to wood on the market, such as cereals and vegetal waste in general.

[0007] In the combustion, besides the standard ash,

these alternative fuels also produce substances that melt, forming a solid layer on the brazier base when they cool down; such layer adds up to unburnt products, such as salts, silicon and other impurities, thus causing the obstruction of the air passage holes on the brazier, in such an extent to extinguish the flame and thus drastically impair the stove thermal yield.

[0008] In order to obviate such disadvantages, devices have been devised which are capable of preventing the comburent air passage holes provide on the base grid from ever being obstructed, automatically removing ash and other solid combustion products from the brazier.

[0009] Actually, devices that have tried to solve the above drawback have already been devised for burners fuelled with "traditional" solid fuels, in particular coal. The following document may be mentioned to this purpose: DE 1142984 B. US-A-4672899, EP-A-0052499. However, such devices are quite "out-of-date", as they were devised when pellet stoves were not particularly widespread and are not adapted for operating with this type of fuel.

[0010] Publication EP-A-15559957, which relates to a European patent application whose Applicant is the same applicant of the present one, describes a device specifically provided for pellet stoves in the brazier whereof a device operates for removing the burnt product, consisting of a motor-driven spatula provided with a pivoting movement which has the function of keeping the brazier holes free from the burnt product. Such device is simple from the construction viewpoint and effective from the functional viewpoint. However in such device, the contribution of combustion air takes place almost totally through the burner grid, at the air passage holes, which is normally defined as "primary air". Such passage holes are distributed on the entire burner surface.

[0011] The object of the present invention is to provide a burner for a stove fuelled with solid fuels, in particular pellet, which compared to similar burners of the known type and in particular compared to that just described, exhibits an improvement of the combustion process in terms of emissions of CO, NO_x, powders and unburnt products. In particular, solutions should be provided in such burner to optimise the ratio between the so-called "secondary air" and the so-called "primary air" introduced into the burner, in order to achieve the above objects. This is achieved, according to the invention, by providing the burner according to the characterising portion of claim 1.

[0012] The present invention shall now be described in detail with reference to a particular embodiment thereof, made by way of a non-limiting example with the aid of the attached figures, wherein:

- fig. 1 (table I) shows an overall vertical cutaway view of the stove wherein the device of the invention is provide;
- fig. 2 shows an axonometric view of the burner and of other members provided in the stove;

- figs. 3, 4 and 5 (table II) show three orthogonal views of the brazier provided in the burner of the invention;
- fig. 6 shows an axonometric view of the above mentioned brazier;
- fig. 7 (table III) shows an axonometric exploded view of the above mentioned brazier;
- fig. 8 shows a front view of said brazier, where a section line relating to the following figure is highlighted;
- fig. 9 shows a cutaway view of said brazier according to line IX - IX of fig. 8. As is seen in fig. 1, the burner of the invention comprises a brazier, globally indicated with reference numeral 1, arranged within furnace 2 and which is fuelled, through screw 3, by fuel 4, advantageously consisting of pellet, contained in the storage space 5. As is better seen in fig. 2, said brazier comprises a tank 10 for collecting and containing fuel and ashes, which can be extracted from the burner body for cleaning the interior thereof. As is seen in said figure, as well as in the next figures, said brazier, in per se known ways, exhibits a substantially rectangular shape and a device is provided therein for removing the burnt product consisting of a motor-driven spatula 6, provided

[0013] with a pivoting movement, which has the function of keeping the brazier holes free from burnt product. Looking at fig. 7, moreover, it is seen that such spatula 6 is supported by a pair of vertical arms 6', in turn provided with horizontal pins 6'', inserted in special seats 17, obtained on the side partitions 10, which longitudinally delimit the brazier. Such spatula is set in swinging motion by per se known devices not shown in the figures for sake of simplicity.

[0014] A fundamental feature of the device of the invention is that a first portion 8 provided with an upward facing concavity is provided at the centre line in longitudinal direction of the brazier. Such portion is provided with through holes 9 at the entire extension thereof and the primary air required for combustion flows out of said holes. In the figures again (in particular figs. 3 and 6) it is seen that said portion 8 is transversally delimited by a pair of elements 11 obtained by a metal sheet, which project relative to the brazier surface and are curved substantially as a "V", with upward facing apex. Such elements are provided with holes 12 (fig. 7) at the face thereof facing the conclave portion 8 and said elements surmount second portions 14 provided with holes 13 of the brazier flat surface. In the practice, such "V" shaped elements serve as side distributor elements for the secondary air required for the combustion process.

[0015] As an alternative, elements 11 may also be shaped as an upturned "U", according to the burner combustion power. Each one of the two longitudinal partitions 10 is surmounted by a further wall 20 inclined towards the inside of the brazier, said wall having the function of facilitating the retaining of the fuel and of the burnt products within the brazier itself. Wall 20 placed at the feeding

conduit 21 of the fuel, pushed by screw 3, exhibits at portion 22 with a slight upward concavity for facilitating the drop of the fuel at the centre of the brazier. The presence of the "V" or "U" shaped elements that act as distributor elements does not hinder the movement of the motor-driven spatula. The ash that is moved by the motor-driven spatula may go beyond said distributor elements, in particular if the fuels used are of a low quality. If on the other hand the fuel is of a high quality, the burnt residue is finely reduced by the motor-driven spatula and concurrently ejected by the presence of the primary air or made to drop in the underlying tank 10.

[0016] Said distributor elements may advantageously be made of steel, as well as of cast iron or any other metal or ceramic material capable of withstanding high operating temperatures.

[0017] In the practice, the fundamental differences of the device of the invention compared to similar devices of the known type consist in that the primary air passage holes in the above are provided at the entire brazier surface. On the other hand, with the solution just described, wherein the primary air only enters at the centre of the brazier and where the secondary air is introduced through the "V" or "U" shaped distributor elements, there occurs an optimisation of the ratio between the introduced secondary air and primary air of the burner, which is capable of considerably reducing, based on the tests performed, the combustion products, consisting in particular of Co, NOx, powders and unburnt products. At the same time, the overall thermal yield of the stove is improved compared to that of known similar stoves.

[0018] Finally, from the above description it is clear that the device of the invention is simple from both the construction viewpoint and from the functional viewpoint, allowing the achievement of the above objects.

[0019] The present invention may in any case have shapes and aspects other than those described herein, the essential features thereof being understood, without departing from the scope of the present invention.

Claims

1. BURNER FOR A STOVE FUELLED WITH SOLID FUELS, IN PARTICULAR PELLETS, wherein there is provided a brazier (1) with a substantially rectangular shape whereon a device acts for removing the unburnt product, consisting of a motor-driven spatula (6) provided with a pivoting movement, which has the function of keeping the brazier holes free from the burnt product, said burner being **characterised in that** it exhibits, at the centre line thereof in longitudinal direction, a first portion (8) provided with an upward facing concavity and subject to the action of the spatula, said portion being provided with through holes (9) wherethrough the primary air required for combustion flows outwards, said first portion being delimited in longitudinal direction, at both the sides

thereof, by two fixed partitions (10) and in crosswise direction by a pair of elements (11) obtained from a sheet, which project relative to the brazier surface, which are curved substantially as a "V", with upwards facing apex, or shaped as an upturned "U" and are provided with holes (12) at the face thereof facing the concave portion, said elements surmounting second portions (14) provided with holes (13) of the brazier flat surface, such elements acting as side distributor elements for the secondary air required for the combustion process.

2. BURNER according to claim 1, **characterised in that** the spatula (6) is supported by a pair of vertical arms (6'), in turn provided with horizontal pins (6'') inserted in special seats (17) obtained on the side partitions (10).
3. BURNER according to claims 1 or 2, **characterised in that** each one of the side partitions (10) is surmounted by an inclined side wall (20), it being provided that the outlet conduit (21) of the solid fuel leads above one of said inclined walls (20), the above mentioned side partition exhibiting a portion (22) at said conduit with an upward facing concavity, for facilitating the pouring of the solid fuel in the brazier.
4. BURNER according to one or more of the previous claims **characterised in that** a tank (10) is provided underneath the brazier (1), removable from the stove, suitable for allowing the collection of the burner solid combustion products.

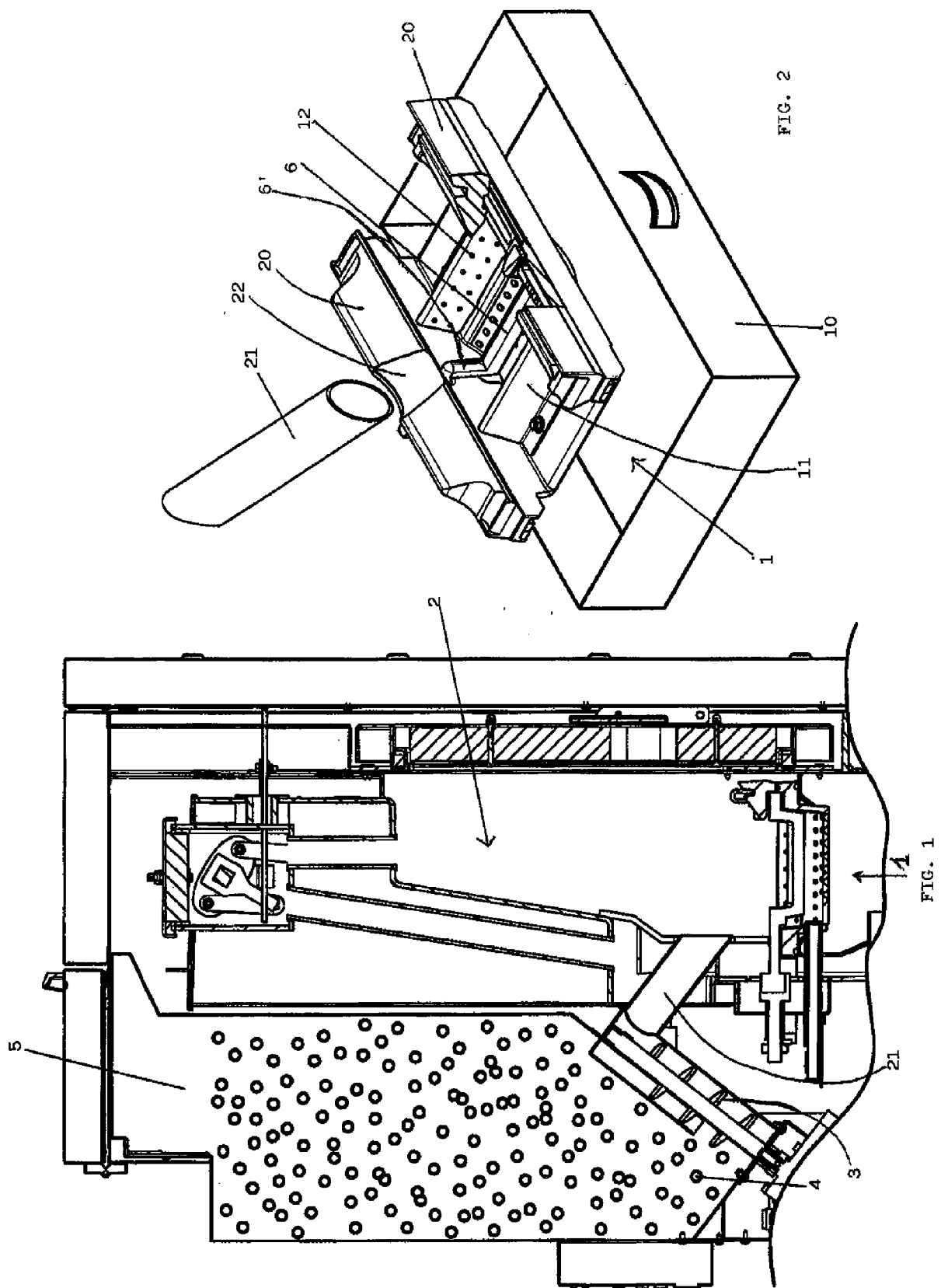
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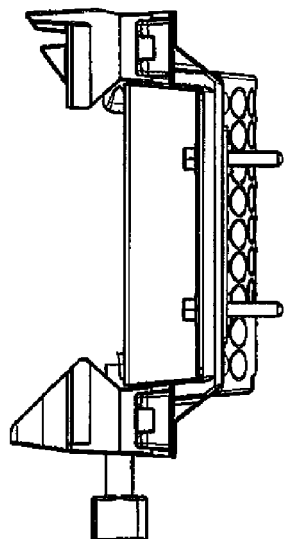


FIG. 5

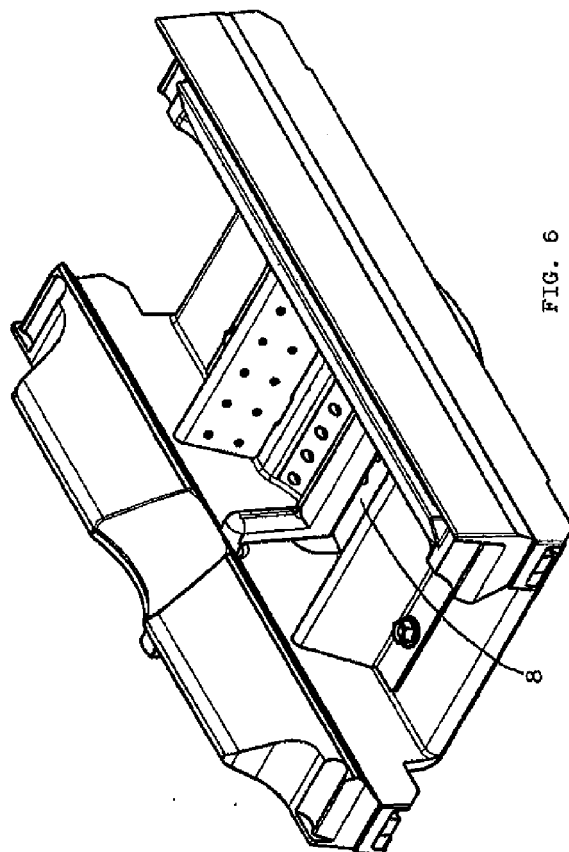


FIG. 6

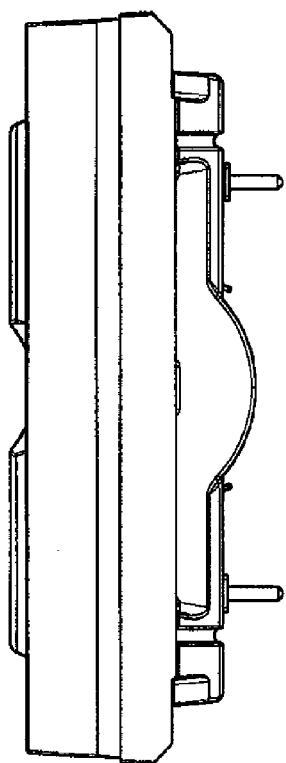


FIG. 4

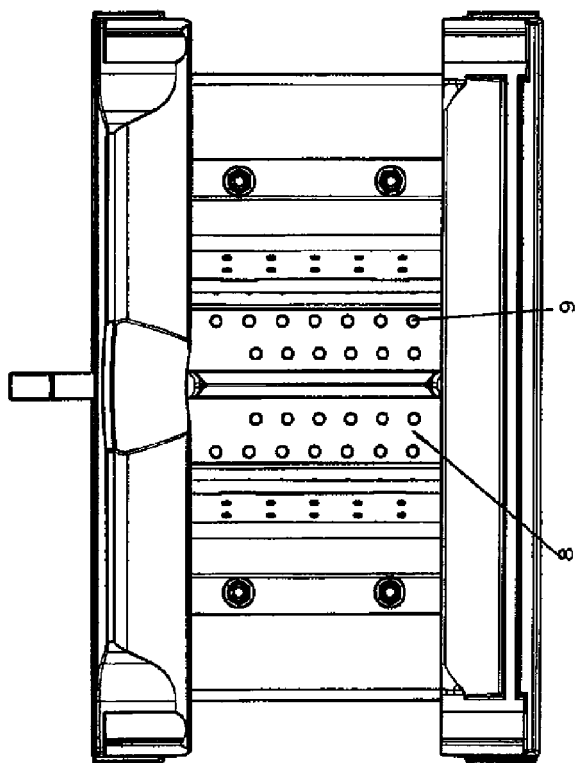


FIG. 3

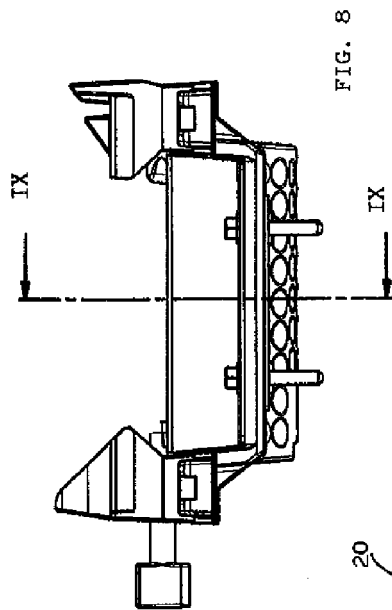
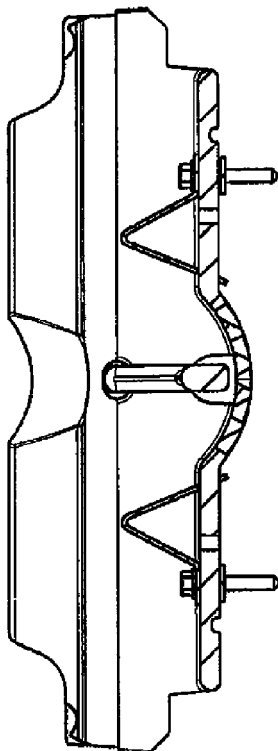


FIG. 8



SEZIONE IX - IX

FIG. 9

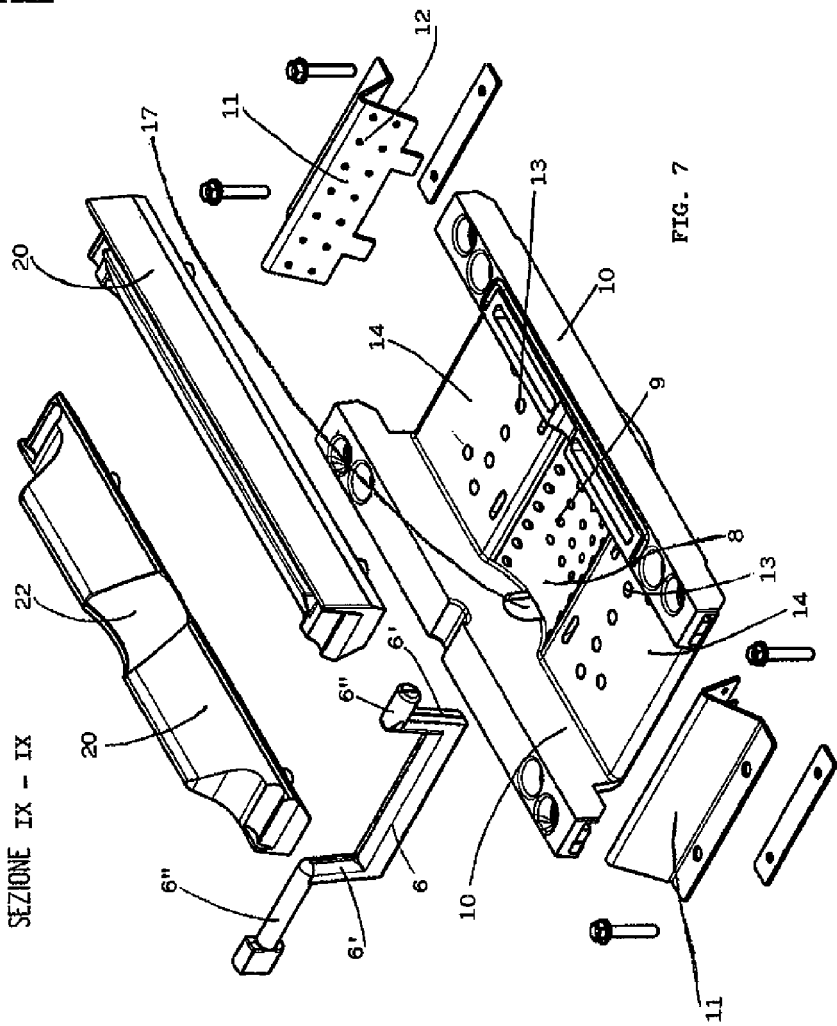


FIG. 7



EUROPEAN SEARCH REPORT

Application Number
EP 10 15 5693

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 10 June 2010	Examiner Mougey, Maurice
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			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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10-06-2010

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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