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(54) Title of the Invention: Solid fuel stoves
Abstract Title: Pellet-burning stove with gravity feed

(57) A solid fuel stove 1 for burning a pelletised fuel, particularly wood pellets, has a combustion chamber with a basket (5, fig 2) in which the pellets are combusted, and a gravity feed for pellets comprises an inlet unit (8, fig 2) having an inlet head (8, fig 2) located on an exterior surface of a wall 7 of the stove 1, connected through an aperture in the wall 7 to a distributor head (10, fig 2) supported to deliver pelletised fuel introduced into the inlet unit to the basket (5, fig 2). Inlet head 8 has a lid (12, fig 3) and sprung flaps (13a,13b, fig 2) sealed against smoke. Distributor head 10 has ribs (17, fig 2) to distribute the fuel, and clips (18, fig 2) to locate onto the basket 5. The heads 8,10 can be joined by pipe (9, fig 2). A kit of parts for converting a wood-burning stove to burn pellets can include an inlet head, a distributor head and a basket.
SOLID FUEL STOVES

The present invention relates to solid fuel stoves intended particularly (but not necessarily exclusively) for domestic use for heating purposes. The invention relates more particularly to such stoves which may be used for burning wood pellets as the solid fuel. The invention also relates in certain embodiments to such stoves that may readily converted when required/desired to burn logs as the solid fuel and converted back again when required/desired to one for burning pellets. In further embodiments, the invention provides a kit of parts for use in producing a stove in accordance with the invention.

Solid fuel stoves for burning wood pellets have (in their combustion chamber) a basket in which the fuel is combusted. Unless the stove incorporates an automatic feed mechanism (e.g. an auger for feeding pellets from a hopper) for supplying pellets to the basket, the stove is initially and progressively re-fuelled through a door at the front or side of the stove body. This process can have potential health and safety issues, e.g. burn injuries, egress of smoke into a room in which the stove is located (which may particularly be a problem for asthma sufferers) and also possible spillage of either fuel or ash from within the chamber. The risk of burn injuries make the use of heat resistant gloves virtually essential.

It is an object of the present invention to obviate or mitigate the above mentioned disadvantages.

According to the present invention there is provided a solid fuel stove for burning a pelletised fuel, said stove having a combustion chamber provided therein with a basket in which the pelletised fuel is combusted, wherein the stove incorporates a feed arrangement for gravity feed of pellets to the basket, said feed arrangement comprising an inlet unit for pellets having an inlet head located on an exterior surface of a wall of the stove and connecting through an aperture in said wall to a distributor head supported in position within the combustion chamber to deliver pelletised fuel introduced into the inlet unit to the basket.

The present invention thus provides a simple and effective arrangement for introducing pelletised fuel into a basket provided within a combustion chamber of the
stove without the need to open the stove door with its attendant disadvantages as outlined above. In essence, the pelletised fuel is introduced into the feed unit provided externally of the stove and from there is gravity fed to a distributor head from which the pelletised fuel falls into the basket. In preferred embodiments of the invention, the feed arrangement incorporates a one-way flap arrangement biased to a (preferably sealed) closed position but openable against the bias by pelletised fuel falling down from the inlet head so that that fuel may pass to the distributor head. It will be appreciated that re-fuelling of the stove may be periodic and that between refuelling operations the flap is closed (and preferably sealed) to limit egress of smoke from the combustion chamber upwardly into the inlet head. Preferably this one-way flap arrangement is provided in the inlet unit.

In particularly preferred embodiments of the invention, the stove is readily convertible to one capable of burning logs as solid fuel. For this purpose, the distributor head (and any pipe by which it is connected to the inlet unit) are removable from the combustion chamber as is the basket. Conveniently the basket is located on top of a conventional log burning grate. To effect the conversion, the distributor head (and any pipe by which it is connected to the inlet unit) and the basket are removed from the combustion chamber. The stove is now ready for burning logs although preferably a removable cap is located over a portion of the inlet unit which is within the combustion chamber to help prevent egress of smoke and/or protect the aforementioned flap arrangement, if provided. It will be appreciated that the stove may readily be converted back to one for burning wood pellets by removing the cap (if fitted), replacing the basket on the grate and locating the distributor head (and any pipes required for connecting it to the inlet unit) back in position.

In a modification of the stove described in the previous paragraph, the basket does not sit on a grate but rather a grate is put into the combustion chamber (after removal of the basket) when the stove is being converted to its log burning configuration and removed therefrom when being converted back to its pellet burning configuration.

Generally, the feed arrangement will be such that pellets introduced into the inlet unit are fed downwardly to the distributor head at an angle of 40°-50° and most preferably about 45°.
The inlet unit may comprise the aforementioned inlet head and a tubular outlet therefor. The head is mounted on the external surface of a wall of the stove and the tubular outlet extends through the aperture in the wall of the stove. A mounting of the inlet unit on the wall of the stove may, for example, be by means of a flange provided on the inlet unit and formed with apertures which align with apertures in the wall of the stove to receive fixing bolts or the like.

The inlet head may be in the form of a cup and optionally (but preferably) provided with a lid.

The inlet unit may be mounted on any wall of the stove and thus, for example, may be mounted on a side, rear or top wall thereof. Generally it is most convenient to have the inlet unit mounted on a side wall of the stove.

The inlet unit may be connected to the distributor head either directly or via an intermediate pipe which, if used, may be in the form of a flexible coupling. To allow for conversion of the stove to log burning configuration, the distributor head (and intermediate pipe if fitted) are removable from within the stove.

In preferred embodiments of the invention, the distributor head is supported (preferably removeably) on the basket in which combustion is effected. Thus, for example, the distributor head may be provided with clips, lugs or other fixing devices adapted to locate on the basket, conveniently on an upper edge thereof.

A preferred construction of distributor head for use in the feed arrangement of the invention has an upwardly extending, tubular inlet portion leading to a generally horizontal, open-topped distributor having formations for distributing pelletised fuel across the distributor prior to deposit in the basket. These formations may comprise ribs on the upper surface of the feeder and/or side walls of the feeder.

For preferred embodiments of the invention in which the inlet head is mounted on a side wall of the stove, it is convenient for the distributor head to locate rearwardly of the basket. In preferred constructions, pellets fall (under gravity) in a downwardly angled, straight line from the inlet unit to the distributor head which (because it is
positioned rearwardly of the basket) then needs to direct the pellets towards the basket. Thus the distributor head may be configured to move the direction of travel of the pellets through 90°. In the case of the aforementioned feeder with distributor ribs and/or side walls, these are preferably curved through about 90° from the inlet of the distributor head so as to effect the change in travel direction.

Most conveniently, the pellets “fall off” a free edge of the distributor into the basket.

It is envisaged that stoves in accordance with the invention may be manufactured and sold as such. However the invention does envisage, and extends to, a number of alternative possibilities. Thus, in one such alternative, a stove in accordance with the invention may be produced by modification of an existing wood-burning stove. Such a modification will require the cutting (or otherwise forming) of a hole in a wall of the stove. Additionally, the grate of the stove can either be replaced or supplemented by a basket (in the latter case located on or over the grate) and the stove fitted with a fuel feed arrangement as defined above. In a further envisaged alternative, a wood-burning stove may be manufactured with a pre-formed hole in a wall thereof in anticipation that the stove may subsequently be converted to one in accordance with the invention (i.e. incorporating the pelletised fuel feed arrangement).

In this envisaged embodiment, the preferred hole may be blanked-off with a plate (to prevent egress of smoke during wood burning) which would simply need to be removed for conversion of the stove as described above.

Thus it will be appreciated that the present invention also provides a kit of parts for use in producing a stove in accordance with the invention, the kit comprising an inlet unit for pellets having an inlet head adapted to be located on an exterior surface of a wall of the stove and a distributor head adapted to be supported in the position within the combustion chamber of the stove to deliver pelletised fuel to a basket.

Such a kit may further comprise a basket unit (comprising the basket and legs supporting the basket) to replace the grate of a conventional wood burning stove. In preferred embodiments, the basket unit may be of adjustable length and/or adjustable width so as to fit combustion chambers of a range of sizes.
The invention will be further described by way of example only with reference to the accompanying drawings, in which:

Fig 1 is a “see-through” view of one embodiment of domestic solid fuel stove in accordance with the invention;

Fig 2 is a schematic view of the pelletised fuel feed arrangement of the stove shown in Fig 1; and

Fig 3 shows the inlet end of the pelletised fuel feed arrangement illustrated in Fig 2.

Fig 1 illustrates a solid fuel heating stove 1 which in conventional manner comprises a body 2 supported on legs 3. Within body 2 is a combustion chamber to which access may be gained via a door 4 in the front wall of the stove.

In its illustrated configuration, stove 1 is intended for burning wood pellets and for this purpose incorporates a basket 5 which may either be free-standing on the floor of the combustion chamber or located on top of a conventional log burning grate (not shown). In conventional manner, the basket is generally rectangular in view and has sheet-like side walls provided with apertures to allow air to reach the fuel to be combusted.

In accordance with the invention, the stove 1 incorporates a feed arrangement 6 for supplying wood pellets into the basket 5. This arrangement 6 is shown in Fig 1 and also in more detail in Figs 2 and 3 to which reference should also be made. For the purposes of understanding the construction of feed arrangement 6, it should be appreciated that an aperture is formed in an upper region of a side wall 7 of the stove 1.

In terms of its component parts, feed arrangement 6 comprises an inlet unit 8, a pipe 9 and a distributor head 10. In more detail, inlet unit 8 has an inlet head in the form of a cup 10 from one side of which extends a tubular outlet 11. Provided in the region of the junction of the cup 10 and tubular outlet 11 is an annular flange 10a. Cup 10 has a lid 12 and the arrangement is such that with the inlet unit 8 positioned with lid
12 uppermost, the tubular outlet 11 is angled downwardly away from cup 10 at an angle of about 45°.

An additional feature of the inlet unit 8 is that, provided at the discharge end of the tubular outlet 11, is a flap arrangement 13 which is circular and of the same diameter as that as the interior of the tubular outlet 11. Circular flap arrangement 13 is formed in two semi-circular plates 13a and 13b which are pivotally connected together along their diameters. Semi-circular plate 13a is fixed around its circumference to the interior of tubular outlet 11 whereas semi-circular plate 13b is able to pivot along the diameter of flap arrangement 13 towards the free end of tubular outlet 11 against the action of a biasing spring (not shown) which normally urges plate 13b to a position in which flap arrangement 13 is closed. In this closed position, flap arrangement 13 is able to provide a "smoke-tight" seal.

Distributor head 10 has a tubular inlet end 14 angled downwardly and leading to an open-topped feeder 15 having side walls 16 and provided on its base with distributor ribs 17. As will be appreciated from the drawings, at their ends adjacent the inlet 14 the side walls 16 and 17 are generally parallel to the inlet direction but curve through 90° to a free edge of the feeder.

Depending from this free edge of the feeder 15 are clips 18 which are capable of locating the feeder in position along a side of basket 5 (as will be described more fully below).

Assembly of the feed arrangement 6 in and on the stove 1 is effected as follows.

Tubular outlet 11 of the inlet feed 8 is initially inserted through the aforementioned aperture in the side wall 6 of the stove 1 and the head 8 oriented such that the lid 12 is uppermost. Securement of the head 8 in position may be effected in any conventional way, e.g. by means of nuts and bolts, with the bolts passing through pre-formed holes in the flange 10a and side wall 7. If desired, a sealant material may be interposed between flange 10a and side wall 7.
In the next step of assembly, pipe 9 may be fitted to the free end of tubular outlet 11 (of inlet feed unit 8). For this purpose, the internal diameter of the pipe 9 may be marginally greater than the external diameter of outlet 8 so that the former is a push-fit over the outside of the latter. Subsequently, distributor head 10 is located in position by connecting its tubular inlet 14 to the lower end of pipe 9 (the former preferably being a push-fit over and around the exterior surface of the latter) and locating the clips 18 (on the under surface of the distributor head 10) over the upper edges of the rear side of the basket 5. As an alternative, the distributor head 10 may be located on the basket before pipe 9 is located in position.

In operation, the stove may be ignited in conventional manner. This will involve filling the basket 5 (accessed via the door 4) with appropriate fuel. Once combustion has become established, periodic refuelling of the basket is effected using the feed arrangement 6. More particularly, lid 12 is opened and pelletised fuel (shown as pellets 20) are fed into the cup 10 from which they descend under gravity into the tubular outlet 11. By the time the pellets 20 have reached the flap 13, they have acquired adequate energy to be able to displace flap 13b sufficiently to move past flap arrangement 13 and thus descend along the pipe 9 to the distributor head 10. The configuration of the side walls 16 and ribs 17 of the distributor head 10 ensures that pellets 20 are distributed relatively uniformly across the width of feeder 15 along which they travel until they fall over the free edge thereof into the basket 5. It will be appreciated that once the requirement amounts of pellets 20 have been introduced, the flap 13b is biased back to its closed position. This prevents smoke from the combustion chamber passing upwardly into the cup 10 and being discharged into a room in which the stove is located.

A number of modifications may be made to the illustrated construction. Thus, for example, the tubular outlet 11 (of inlet feed head 8) and the tubular inlet 14 (of distributor head 10) may be made longer during the manufacturing processes of these components whereby inlet feed head 8 and distributor head 10 may be connected directly to each other without the intermediary of pipe 9.

Additionally, tubular parts of the feed arrangement 6 may be of rectangular or square (rather than circular) internal cross-section. This has a particular advantage in that flap arrangement 13 may be of a one-piece construction pivoted along one of its
sides to the square/rectangular internal cross-section of the tubular outlet 11. As such, the flap is in the case able to open the full internal cross-section of the tubular outlet to allow the introduction of fuel pellets 20 into the combustion chamber. This is contrast to the flap arrangement illustrated in Fig 3 which is only able to open a maximum of 50% of the cross-sectional area of tubular outlet 11.

Furthermore, Fig 1 has illustrated the feed-supply arrangement 6 being such that the inlet feed unit 8 is mounted on the wall 7 at the right hand side (as viewed from the front) of the stove 1. Equally, however the feed arrangement 6 could be such that inlet feed head 8 is mounted on the left hand side wall, in which case the distributor head 10 will need to be of “opposite hand” to that illustrated in Figs 1 to 3.

The stove 1 may be manufactured and sold as illustrated. Alternatively the stove as illustrated may be a conversion from a conventional log-burning stove. In this case, conversion is effected by cutting a hole of appropriate size in the side wall 7 so that the inlet feed head 8 may be located in position as described above. Additionally the conventional grate of the wood-burning stove is replaced by the basket 5. The feed arrangement 6 may then be assembled as described more fully above.

It should be appreciated that, for the purposes of effecting a conversion as described in the previous paragraph, a kit of parts may be supplied comprising the inlet feed head 8, the pipe 9 (optional) and distributor head 10. The kit may additionally comprise a basket 5 which can be constructed to be of adjustable length and/or width to locate in wood-burning stoves of different sizes.

A further point to note is that a stove as illustrated in the drawings may readily be converted (back) into a log-burning stove by removing the distributor head 10 and pipe 9 (if fitted) whilst leaving the inlet feed head 8 in position. A removeable cap (not shown) may be fitted over the free end of the tubular outlet 11 (of the inlet feed unit 8). This cap helps protect the flap arrangement 13. Additionally the basket 5 is removed from the combustion chamber and replaced by a conventional log burning grate (if one was not already present in the combustion chamber). The stove is now in a log burning configuration. Conversion back to a pellet burning configuration is effected by a reversal of this sequence of operations.
CLAIMS

1. A solid fuel stove for burning a pelletised fuel, said stove having a combustion chamber provided therein with a basket in which the pelletised fuel is combusted, wherein the stove incorporates a feed arrangement for gravity feed of pellets to the basket, said feed arrangement comprising an inlet unit for pellets having an inlet head located on an exterior surface of a wall of the stove and connecting through an aperture in said wall to a distributor head supported in position within the combustion chamber to deliver pelletised fuel introduced into the inlet unit to the basket.

2. A stove as claimed in claim 1 wherein the feed arrangement incorporates a one-way flap biased to a closed position.

3. A stove as claimed in claim 2 wherein, in its closed position, the flap provides a smoke-tight seal.

4. A stove as claimed in claim 2 or 3 wherein the flap arrangement is provided in the inlet unit.

5. A stove as claimed in any of claims 1 to 4 wherein the inlet unit comprises said inlet head and a tubular outlet therefore, said tubular outlet extending through said aperture in the wall of the stove.

6. A stove as claimed in claim 5 when dependent from any one of claims 2 to 4 wherein said closure flap arrangement is provided in the tubular outlet.

7. A stove as claimed in any one of claims 1 to 6 wherein the inlet head is in the form of a cup.

8. A stove as claimed in any one of claims 1 to 7 wherein the inlet head is provided with a lid.

9. A stove as claimed in any one of claims 1 to 8 wherein the inlet head is located on a side wall of the stove.
10. A stove as claimed in any one of claims 1 to 9 wherein the distributor head is connected directly to the inlet unit.

11. A stove as claimed in claim 10 wherein the distributor head is detachable from said inlet unit.

12. A stove as claimed in any one of claims 1 to 11 wherein the distributor head is connected to the inlet unit via an intermediate pipe.

13. A stove as claimed in claim 12 wherein the pipe is a flexible coupling.

14. A stove as claimed in claim 12 or 13 wherein the distributor head and pipe are removable from within the stove.

15. A stove as claimed in any one of claims 1 to 10 wherein the distributor head as an upwardly extending, tubular inlet portion which leads on to a generally horizontal, open-topped distributor having formations for distributing pelletised feed across the distributor prior to deposit in the basket.

16. A stove as claimed in claim 15 wherein said formations comprise ribs on the upper surface of the feeder.

17. A stove as claimed in claim 15 or 16 wherein the feeder is provided with side walls.

18. A stove as claimed in claim 17 wherein the side walls and the ribs curve through about 90° from the inlet of the distributor head towards a free edge of the distributor over which the pelletised fuel falls into the basket.

19. A stove as claimed in any one of claims 1 to 18 wherein the distributor head is provided with clips which locate over an upper edge of the basket for supporting the distributor head in position with the combustion chamber.
20. A stove as claimed in any one of claims 1 to 19 wherein the basket of adjustable length and/or adjustable width.

21. A stove as claimed in any one of claims 1 to 20 wherein the basket locates over a log burning grate provided in the combustion chamber.

22. A kit of parts for converting a wood burning stove to one for burning pelletised fuel, the kit comprising an inlet unit for pellets having an inlet head adapted to be located on an exterior surface of a wall of the stove and a distributor head adapted to be supported in position within the combustion chamber of the stove to deliver pelletised fuel to a basket.

23. A kit as claimed in claim 22 wherein the inlet unit is as defined in any one of claims 5 to 8.

24. A kit as claimed in claim 22 or 23 wherein the distributor head is as defined in any one of claims 15 to 19.

25. A kit as claimed in any one of claims 22 to 24 further comprising a length of pipe for connecting the inlet unit to the distributor head.

26. A kit as claimed in any one of claims 22 to 25 further comprising a basket unit for the burning of pelletised fuel.

27. A kit as claimed in claim 26 wherein the basket unit comprises the basket and legs supporting the basket.

28. A kit as claimed in claim 26 or 27 wherein the basket is of adjustable length and/or adjustable width.

29. A solid fuel stove for burning a pelletised fuel substantially as hereinbefore described with reference to Figs 1-3 of the accompanying drawings.

30. A kit of parts substantially as hereinbefore described with reference to Figs 1-3 of the accompanying drawings.
Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

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<th>Category</th>
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<td>X,Y</td>
<td>X:1,8,10,22,26, Y:2,4</td>
<td>US5183028 A TRAEGER, note combustion chamber 40, basket 60, inlet head 70 &amp; distributor head</td>
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<td>X,Y</td>
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<td>US2572674 A STRANGE, note combustion chamber 8, basket 16, inlet head 27 &amp; distributor head 30 suitable for pellets</td>
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Categories:

| X | Document indicating lack of novelty or inventive step |
| Y | Document indicating lack of inventive step if combined with one or more other documents of same category. |
| & | Member of the same patent family |

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^X:

Worldwide search of patent documents classified in the following areas of the IPC
The following online and other databases have been used in the preparation of this search report
WPI, EPODOC

International Classification:

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