This invention relates to small, domestic, stoker-fired, coal-burning heaters of the type shown in my U.S. Patent No. 3,149,625, granted Sept. 22, 1964 and entitled, "Power Stoked, Coal-Fired Heating Unit.

It has now been found desirable to produce such stokers with even smaller heating capacity than originally contemplated, for example, with a capacity of approximately 40,000 B.t.u. per hour as compared with 85,000 B.t.u. per hour. This has posed problems, in that the use of a conventional feedscrew large enough to supply required amounts of coal to the firebox without exerting a crushing action on the coal requires such slow feeding of a large mass of coal that the fire can easily burn back through the feed assembly into the hopper.

If the feedscrew and tube in which it operates are simply made smaller in diameter, to decrease the mass of coal fed per unit time so the feed rate can be increased sufficiently to prevent back burning, the coal is subjected to crushing action between the solid core of the screw and the tube. This necessitates an excessively large power source. Moreover, crushing of the coal tends to compact it in the feed tube and to thereby not only increase frictional resistance to its movement, but to also require higher pressure for the combustion air forced into the fuel bed. As a practical matter, these problems have heretofore made it impossible to produce a stoker-fired, coal-burning heater of unusually low heat output for very small homes and other enclosures.

The principal object of the present invention is to provide a construction for stoker-fired, coal-burning heaters of the type concerned that will enable coal to be efficiently burned at an exceptionally slow rate without the problems mentioned above.

Although the present invention makes production of such a heater both possible and practical, its benefits are not restricted to heaters of excessively small size but can be also applied with advantage to larger capacity heaters of the type concerned.

In accordance with the invention, a special spiral shaped feed member, differing from the usual feedscrew in that it has no central core and in that is has heavy bar-like convolutions for structural strength in the small diameters involved, is used to move coal from a hopper to a firebowl. The continuous open spaces between the heavy bar-like convolutions provide pockets through which coal is pushed without being crushed. It is therefore possible to feed relatively small quantities of coal through a small diameter tube at a rate sufficient to prevent burning back of the coal from firebowl to hopper and to do this by means of a relatively small electric motor. Moreover, a single, relatively small fan can be used to both cool the motor and provide the air necessary for efficient combustion.

There is shown in the accompanying drawings a specific embodiment of the invention representing what is presently regarded as the best mode of carrying out the generic concepts in actual practice. From the detailed description of this presently preferred form of the invention, other more specific objects and features will become apparent.

In the drawings:

FIG. 1 is a view in side elevation of a heater conforming to the invention, portions being broken away to show internal operating mechanism and the feed tube being shown in axial longitudinal section to reveal the helical feed member in side elevation;

FIG. 2, a fragmentary longitudinal section taken on the line 2—2 of FIG. 1 and drawn to a somewhat larger scale;

FIG. 3, a fragmentary vertical section taken on the line 3—3 of FIG. 2 and drawn to the same scale as FIG. 2;

FIG. 4, a fragmentary vertical section taken on the line 4—4 of FIG. 1 and drawn to the same scale as FIGS. 2 and 3, hidden parts being shown by dotted lines;

FIG. 5, a fragmentary elevation View taken on the line 5—5 of FIG. 1 and drawn to the same scale as FIGS. 2, 3, and 4;

FIG. 6, a perspective view of the fan housing taken from the right of FIG. 5 and in vertical section at the rear of such housing.

Referring now to the drawings:

In the illustrated embodiment the heater 10, FIG. 1, includes an exterior housing 11 of simple box-like configuration compartmentalized by internal walls 12, 13, and 14 to provide a coal hopper 15 and separate compartments for operating equipment 16. A convenient 16 is positioned in one of the compartments above a firebowl 17. A door 18 in the top of housing 11 opens into hopper 15 for the introduction of coal, which feeds into a well 19 and into a helical feed member 20 which takes the place of the usual feedscrew.

Feed member 20 operates in a tube 21, which leads into the bottom of firebowl 17 in the usual manner. It is turned by a small electric motor 22 positioned within a fan housing 23 that is located in another compartment of housing 11 beneath sloping wall 13.

Unlike the usual feed mechanism employing feedscrews having a helical flight wrapped about an elongate shaft forming a solid core, there is no solid core in the feed member or feed screw 20. A helical flight along, formed of heavy bar stock or cast to formation preferably polygonal in cross section, provides an open helix through whose open center 28a and between whose convolutions 28b the coal is moved. Passage for pieces of coal of slack size is provided without crushing action, even though the internal diameter of the tube and external diameter of the helix are unusually small, e.g., approximately one and a quarter inches. Thus, the torque required to turn the feed member is low.

In practice, it has been found that the illustrated rectangular cross section of the convolutions is best adapted to move coal through the tube, and, at the same time provides necessary structural strength. The spaces between convolutions can easily be made wide enough to accommodate pieces of coal up to ⅛ inches in diameter, as ordinarily required by reason of the fact that most slack coal is screened through a ⅛-inch screen.

Utilizing the feed mechanism of the invention, it has been possible to maintain the necessary rate of feed of coal to the firebowl to prevent burn-back, without supplying more coal than will produce the limited amount of heat desired. For example, with a tube having a two inch inside diameter and a helix feed member having convolutions of one-half inch by one-half inch bar stock steel, the spaces between the convolutions being slightly more than 1/₁₆ inches across, it has been possible to feed as little as three pounds of coal per hour or as much as six pounds of coal per hour to the firebowl, the amount depending on the speed of rotation of the feed member. This has maintained the fire in the firebowl without burn-back.

Since the torque required to turn helix 20 is low, the small electric motor 22 can be used both as a power source therefor, operating through reduction gearing in a gear box 24, and to provide power for operating a fan 25, of preferably bladed centrifugal type as illustrated,
to supply forced draft to firebox 17 for combustion of
the coal fed thereto. The fan and gear box are advan-
tageously positioned, along with motor 22, in fan housing
23. As illustrated, motor 22 is fixed to posts 26 and 27
that extend outwardly from the gear box.

Air sucked into housing 23 through openings 11a of
housing 11 and intake opening 23a of the fan housing
by fan 25 operating with respect to a preferably involute
baffle 28 inside the first directed against elec-
tric motor 22 to keep it cool and then into a pair of ducts
29 and 30 that carry it to the firebowl. The usual need
for separate fans to cool the motor and to provide com-
bustion air is thereby eliminated.

Ducts 29 and 30 extend parallel to feed helix 20, with
the upper duct 29 leading from fan housing 23 to an
overfire air jet conduit 31, FIGS. 1 and 3, that has a
curved end 31a terminating above the firebowl. The
lower duct 30 leads into a plenum chamber 32 communi-
cating with tuyeres 33 of the firebowl.

The amount of air carried by each of the ducts 29 and
30 is regulated by dampers 34 and 35, respectively, which
can be set to cover any desired portion of their respective
duct openings merely by sliding their respective slidable
slots 36 with respect to guide pins 37, FIGS. 3–5, that are
fixed to a plate 38.

As illustrated, fan housing 23 is removable fixed to
plate 38 by ears 39 that are positioned over studs 40 and
held in place by nuts 41. Gear box 24 is also fixed to
plate 38 with screws 42, FIG. 4, or other conventional
anchoring arrangement, and the plate 38 is fixed to wall
14 by bolts 43 and nuts 44.

A screen 45 is positioned to cover the opening 23a of
the fan housing to prevent entrance of undesired for-

gnient matter into the fan blades 24a.

Whereas there is here illustrated and specifically de-
scribed a certain preferred construction of apparatus
which is presently regarded as the best mode of carrying
out the invention, it should be understood that various
changes may be made and other constructions adopted
without departing from the inventive subject matter par-
ticularly pointed out and claimed herebelow.

I claim:

1. A stoker-fired, coal-burning heater, comprising
a housing;
partition walls within said housing defining a hopper
for coal to be burned;
a firebowl within said housing remote from the hop-
per;
a coal feed tube extending from the hopper to the fire-
bowl;
feed means for moving coal through said tube from
the hopper to the firebowl;
drive means connecting the motor with the said feed
means, whereby said motor operates said feed means;
a fan, driven by the motor;
duct means for carrying air from the fan to the fire-
bowl; and
means arranging the fan to discharge air against
the motor before passage into the duct means.

2. A stoker-fired, coal-burning heater according to
claim 1, wherein the feed means comprises
a bar of helical shape and having an open central pas-
sage forming a longitudinal axis therethrough.

3. A stoker-fired, coal-burning heating unit according
to claim 2, further including a fan housing communi-
cating at one end with the duct means, the motor being
mounted within the fan housing intermediate its length
and the fan being mounted within the fan housing at its
other end; and a baffle positioned within the fan housing
to direct air from the fan toward the motor and duct
means.

4. A stoker-fired, coal-burning heater according to
claim 3, wherein the fan is of bladed centrifugal type and
the baffle is of involute formation.

5. A stoker-fired, coal-burning heater according to
claim 3, wherein the firebowl includes tuyere structure
for supplying primary combustion air; wherein there is
additionally provided overhead jet means for supplying
secondary air to the firebowl; and wherein the duct means
includes a duct communicating with said jet means and
a duct communicating with said tuyere structure.

6. A stoker-fired, coal-burning heater according to
claim 2, wherein the inside diameter of the feed tube and
the outside diameter of the feed means are of the magni-
tude of approximately one and a quarter inches.

References Cited by the Examiner

UNITED STATES PATENTS

459,518 9/1891 Brown -------------- 110--45
1,206,071 11/1916 Wood -------------- 110--44
1,880,840 10/1932 Currier -------------- 110--44
2,141,831 12/1938 Stockstrom -------------- 110--110
2,170,277 8/1939 Richardson -------------- 110--45
2,378,576 6/1945 Ackron -------------- 110--45
2,507,245 5/1950 Dady -------------- 110--45

KENNETH W. SPRAGUE, Primary Examiner.