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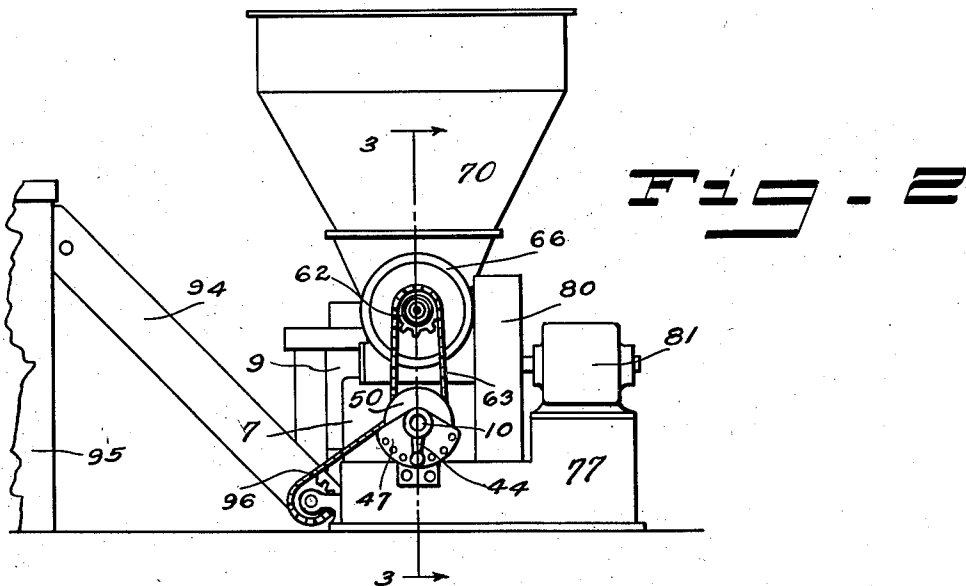
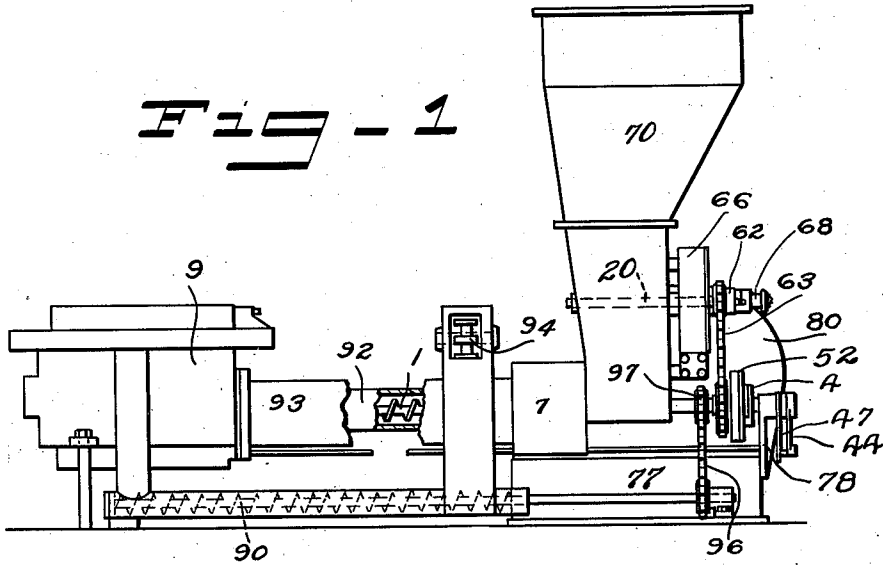
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1,785,456

AUTOMATIC COAL BURNER

Filed Feb. 10, 1925

6 Sheets-Sheet 1



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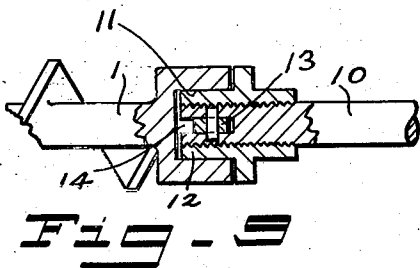
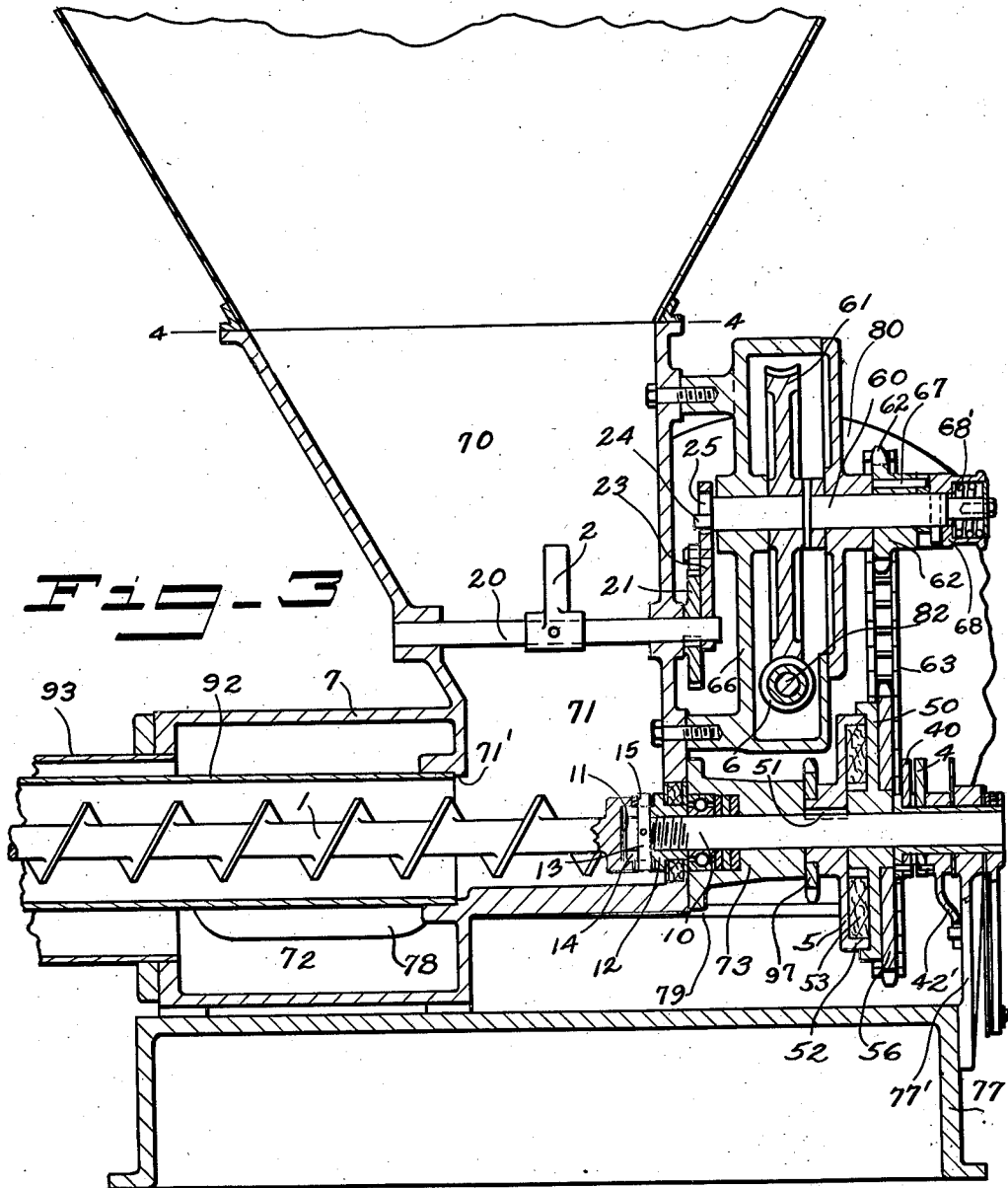
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AUTOMATIC COAL BURNER

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6 Sheets-Sheet 2



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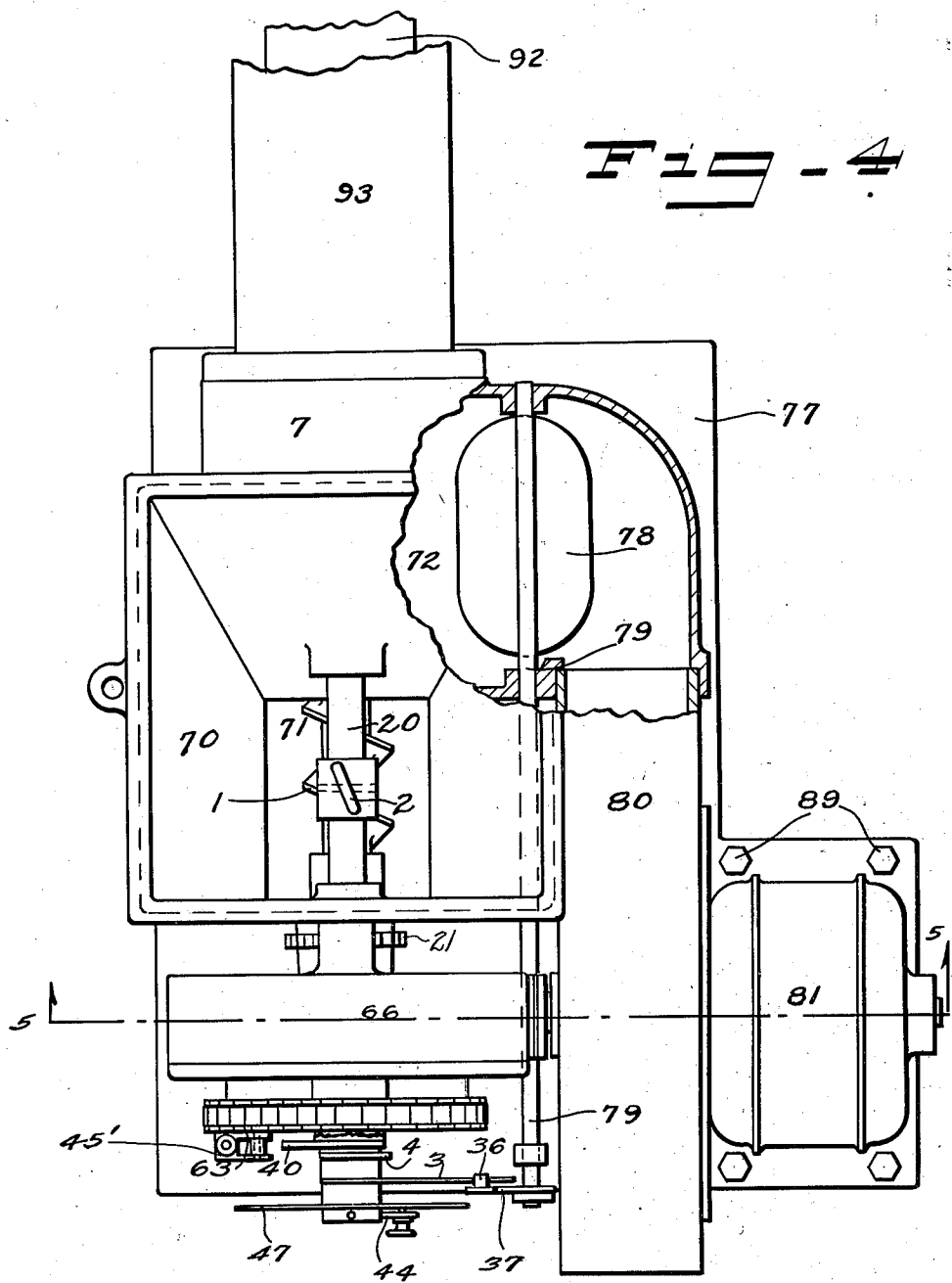
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AUTOMATIC COAL BURNER

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6 Sheets-Sheet 3



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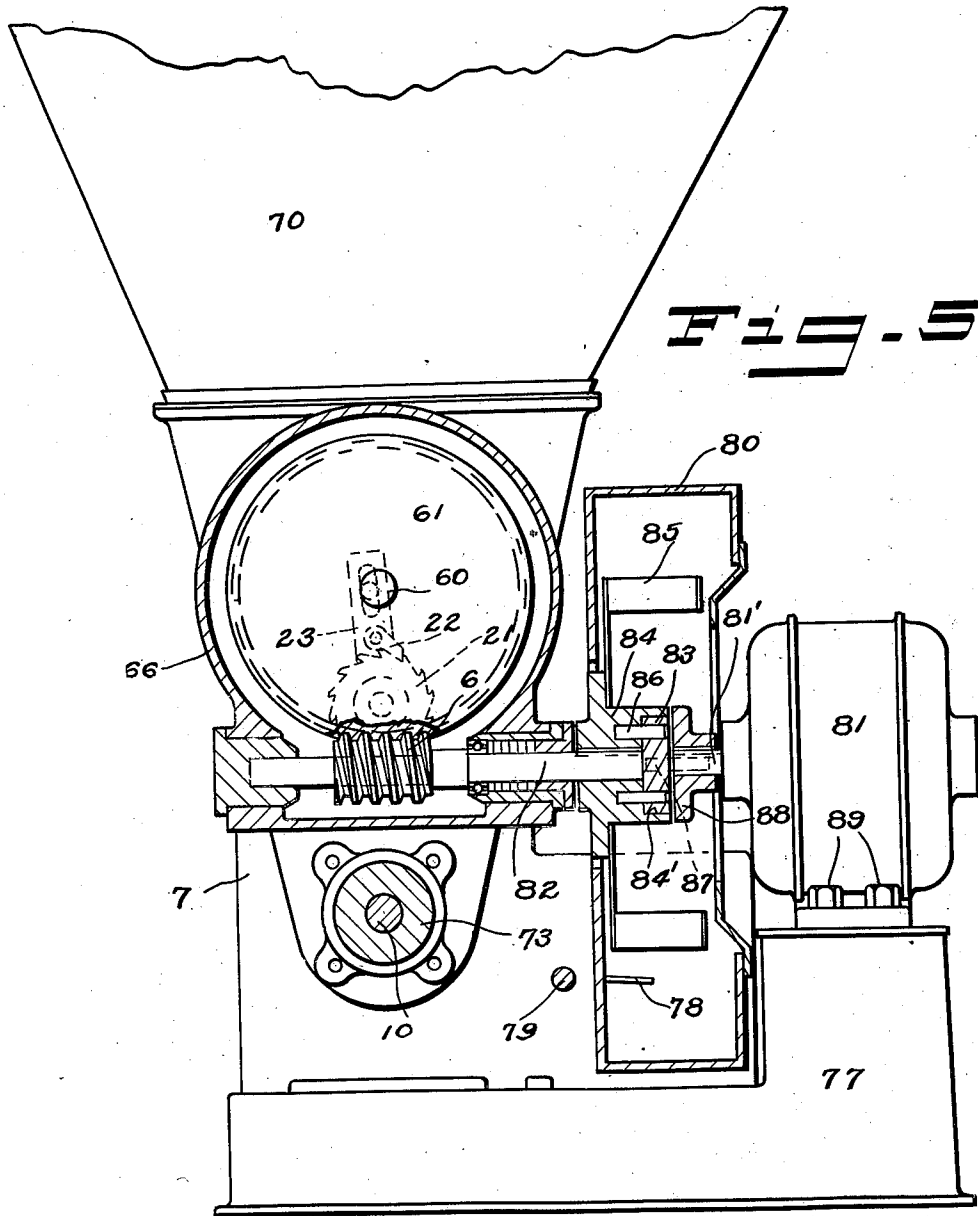
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AUTOMATIC COAL BURNER

Filed Feb. 10, 1925

6 Sheets-Sheet 4



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AUTOMATIC COAL BURNER

Filed Feb. 10, 1925

6 Sheets-Sheet 5

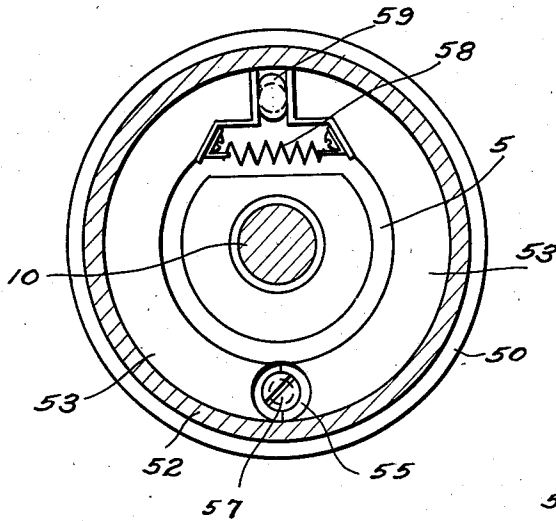


FIG-8

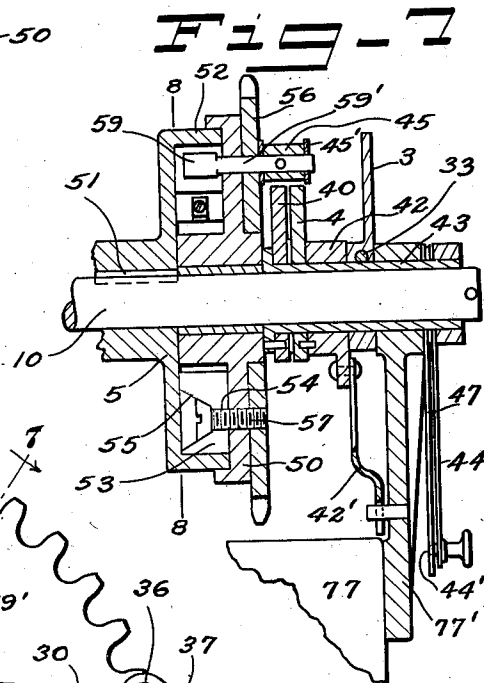
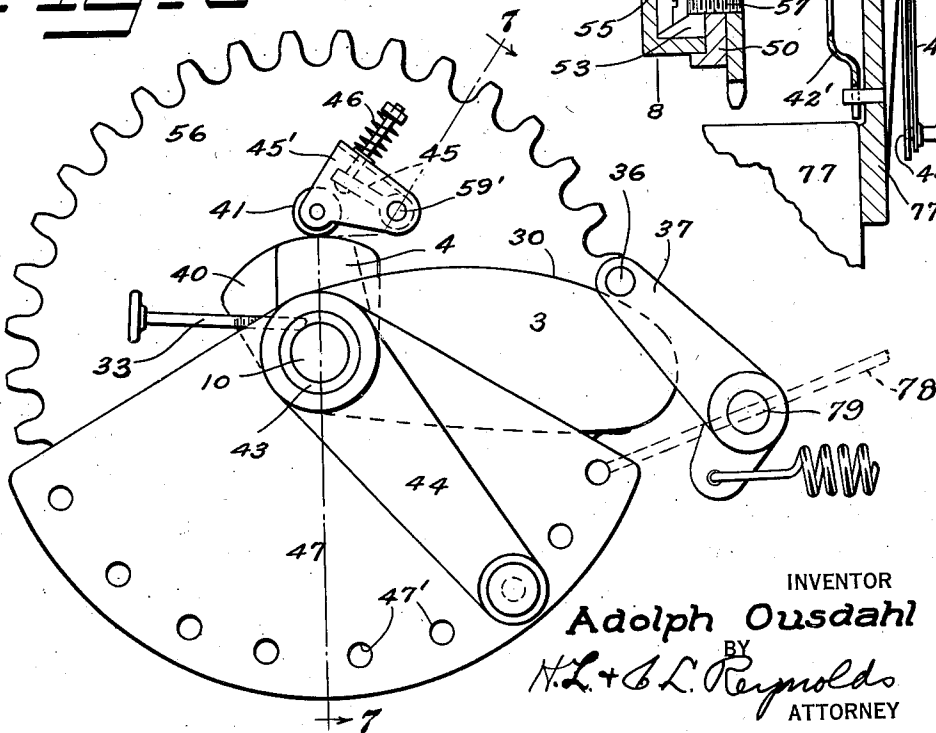


FIG-7

FIG-6



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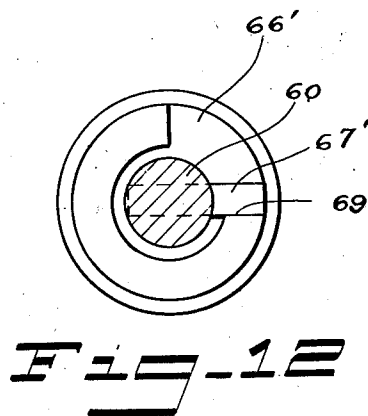
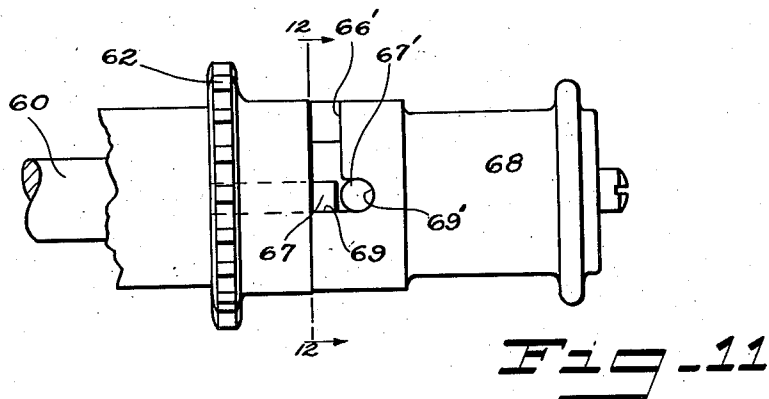
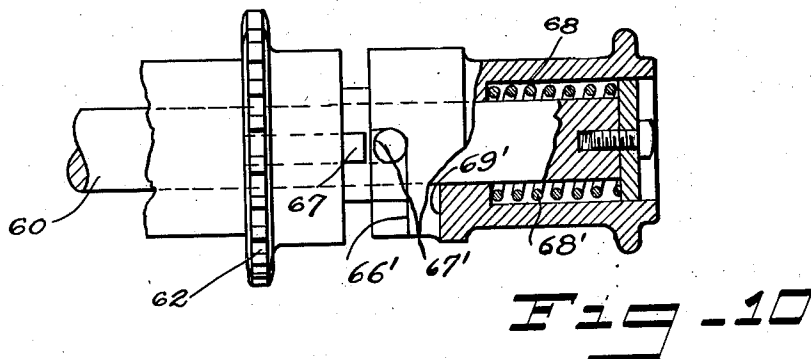
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AUTOMATIC COAL BURNER

Filed Feb. 10, 1925

6 Sheets-Sheet 6



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UNITED STATES PATENT OFFICE

ADOLPH OUSDAHL, OF SEATTLE, WASHINGTON

AUTOMATIC COAL BURNER

Application filed February 10, 1925. Serial No. 8,294.

My invention relates to coal burning apparatus and more particularly to the mechanism for handling the coal and delivering it to a fire-pot or burner. In a companion application, Serial No. 8,295, filed February 10, 1925, I have more particularly described the type of burner for which my apparatus is particularly intended and designed, but it will be evident that the features forming the present invention can be employed with other types of burners and I do not desire to be restricted, therefore, solely to the type of burner shown herein or described in connection with my companion application referred to above.

My burner as a whole is flexible in the sense that when high temperatures are required, or when the attainment of a given temperature is desired in a short space of time, it is possible to force the machine, and by feeding additional coal to generate additional heat without waste of coal. This is accomplished, as described in the companion application referred to, by the employment of a rotary grate and certain feeding and control mechanism associated therewith.

It is an object of the present invention, therefore, to provide fuel handling apparatus for use in connection with such a burner whereby the action of the burner may be speeded up and the device made extremely flexible to enable it to feed coal to the burner at rates varying from a minimum, just sufficient to maintain the fire properly, to a maximum which will rapidly attain a desired temperature.

A further object is the provision of simplified control means both for the fuel feed and for the air to be supplied to the burner.

A further object is the provision of such a feed and control means and an assembly of the elements thereof which is simple, convenient, and readily assembled or disassembled when the occasion requires.

A further object is the provision of such a burner in which the several parts are compactly yet simply arranged and one requiring the minimum of bolts, screws and like permanent securing means, yet withal, sturdy and well-built.

A further object is the provision of an intermittent clutch mechanism particularly designed for employment with such coal-handling mechanism which is simple, cheap, enduring and effective, both to release the drive connection during periods of rest and to grip it during the driving periods.

A further object is the provision of control means for such a burner all of which are readily accessible, which are operable during operation of the machine, and which may be controlled either manually or automatically.

My invention comprises the novel parts and the combinations and assembly thereof as shown in the accompanying drawings, described in the specification and particularly defined by the claims terminating the same.

In the accompanying drawings I have shown my invention in a form which is at present preferred by me.

Figure 1 is a general elevation of the entire machine, parts being broken away.

Figure 2 is an end elevation thereof.

Figure 3 is a section on line 3—3 of Figure 2.

Figure 4 is a plan view taken substantially on line 4—4 of Figure 3, a portion being broken away.

Figure 5 is a vertical section on the line 5—5 of Figure 4.

Figure 6 is a detail elevation of the control mechanism.

Figure 7 is an axial section on line 7—7 of Figure 6 and Figure 8 is a transverse section on the line 8—8 of Figure 7, illustrating the clutch mechanism.

Figure 9 is a detail of the mounting of the feed screw.

Figs. 10, 11, and 12 are details of a clutch mechanism I employ, Figure 10 being a side elevation with the elements disengaged, Figure 11 being a like view with the elements engaged, and Figure 12 being a transverse section on the line 12—12 of Figure 11.

As has been noted above, the complete apparatus comprises coal handling and feeding mechanism with which this application is particularly concerned, and coal-burning mechanism which forms the subject-matter

of my companion application. The burner is indicated at 9 (Fig. 1) and may be of any suitable type, particularly a burner capable of functioning through a wide range of rates of feed. Conveniently it may be of the type shown and described in the companion application, wherein a rotary grate is employed, this being driven through a feed screw 1 extending through a coal conduit 92 connecting the burner 9 with the feed mechanism. An air conduit 93 also extends between the burner 9 and the feed mechanism to deliver air from a fan shown as enclosed within a casing 80, to the burner. I have shown means such as the conveyor 90 for removing ashes from the burner 9 to a point where they can be raised by an elevator 94 into a suitable receptacle such as the ash-can 95. The conveyor 90 and elevator 94 may conveniently be driven through a chain 96 extending about a sprocket wheel 97 operated through the feed mechanism.

Coal is delivered from a hopper 70 into a coal chamber 71 formed in a casing 7 which is supported on the base or bed frame 77 as shown in the drawings. A second chamber 72 is formed in the casing 7, this forming an air chamber and being in communication with the fan housing 80 to receive air therefrom. The air conduit 93 and the coal conduit 92 are connected to the outlets of their respective chambers, the coal conduit preferably extending through the air conduit.

Extending through the coal chamber 71 and through its outlet 71' and thence through the coal conduit 92 to the burner 9, is the feed screw 1. This is designed to advance coal from the chamber 71 through the conduit 92 and to the burner. One end, that nearest the burner, is supported in any suitable manner, although preferably both ends are supported alike, and in the manner shown in Figures 3 and 9. Thus an extension 10 of the feed screw shaft extends through the wall of the casing 7 opposite the outlet 71' and is journaled in a bearing member 73 secured upon the casing. The head 12, formed or secured on the end of the extension 10, is received in a socket 11 in the end of the feed screw 1, thus alining the feed screw and its extension. The drive connection between the two is formed by a transverse key 13, secured in a slot 14 in the end of the extension 10 and head 12, with its ends projecting beyond the head 12 to be received in transverse notches 15 (see Figure 3) in the end of the feed screw 1. This drive connection may be reinforced, or even formed solely, by making the head 12 and its socket 11 non-circular. These parts are held in engagement by the securement of the bearing member 73 in place, and the securement of the arm 77', as will be explained hereafter. Thus the feed screw can be separated from the extension 10 by movement axially of the latter, the arm 77'

and bearing member 73 being first unfastened, but the feed screw, being engaged endwise with the extension 10, will be rotated by the extension 10 when the latter is rotated. It will be noted, also, that the conduits 92 and 93 are likewise held in position by being inserted by axial movement into the corresponding outlets of the coal and air chambers. Thus, by movement of the casing 7 axially relative to the feed screw and conduits, it may be disengaged therefrom and as readily reassembled.

A motor 81 or other suitable power source forms the prime mover for the entire device. This, as is best shown in Figure 5, is provided with a flexible and readily disengageable coupling to a transverse shaft 82, i. e. shaft extending transversely across and above the axial line of the screw 1, and journaled in a gear box 66 supported upon the casing 7, and carrying a worm pinion 6. The connection between the motor shaft 81' and the shaft 82 is preferably one which is readily disengageable and engageable without the employment in the coupling itself of screws, bolts or the like, and as shown in Figure 5 comprises a leather or like flexible disk 83 received in a cup 84' in the hub 84 of the fan 85. Pins 86 secured in the hub 84 are received in holes arranged in the disk 83 for the purpose, and pins 87 secured in the hub 88 secured upon the end of the motor shaft 81' are likewise received in holes provided in the disk 83. By placing the motor shaft and the shaft 82 in substantial alinement, engaging the pins 86 and 87 in the disk 83 and then securing the motor 81 to the bed frame 77, as by means of the bolts 89, a secure connection is made to the transverse drive shaft 82 and considerable space is saved. As will be apparent from Figure 5, the connection of the motor can in this way be made within the fan housing and a coupling to the motor shaft is thus eliminated. Further, the device can readily be disassembled, merely by the removal of the bolts 89 and as readily can be assembled.

The worm pinion 6 meshes with a worm gear 61 secured upon a counter shaft 60 which is journaled in the gear box 66 and which extends parallel with the extension 10 and preferably thereabove. From the counter shaft extends the drive connection for the feed screw 1. This, in the present embodiment includes a sprocket wheel or pulley 62 upon the counter shaft 60 outside of the gear box 66 and connected through a chain 63 to a sprocket wheel 56 mounted upon but not secured to the extension 10. The sprocket wheel 56 is continuously rotating and forms part of or is secured to a clutch element 50 which rotates continuously about the extension 10 and which cooperates with a complementary clutch element 5, the latter being keyed to the extension 10, as indicated at 51.

These cooperating clutch elements 5 and 50 function as do the ratchet wheel and dog, respectively, of a ratchet drive, except as they are engageable at any point, without being dependent upon the exact location of teeth. Preferably the clutch element 5 is provided with a peripheral flange 52 and the elements 5 and 50 are connected through two or more shoes 53 which are secured to rotate with the member 50 and which when expanded will engage the flange 52 of the element 5 to grip the same.

The shoes 53 are formed of some gripping material, any which is suitable for the purpose being employed. Preferably, but not essentially, two such shoes are employed, each semi-circular in shape with their ends substantially abutting. At one end the abutting ends are provided with a hole 54, half of the hole being in each shoe, the hole being countersunk to provide a taper 55. Fitting in this countersunk hole is a taper-headed screw 57 which is received in the rotating clutch element 50 and which if screwed down so that its tapered head presses against the taper 55 of the hole, will tend to spread the ends of the shoes 53. By this means adjustment for wear is accomplished in a simple and convenient manner.

The opposite ends of the semi-circular shoes 53 are connected by a spring 58 in tension, and do not quite come together but are separated by a spreader cam 59. Thus, by oscillating the spreader cam 59 the clutch elements 5 and 50 may be engaged and disengaged. To perform this operation, therefore, I have extended a pin 59' upon which the spreader cam 59 is secured externally of the clutch element 50 and the sprocket wheel 56 secured thereto, and have mounted thereon an arm 45 which is arranged to be moved by engagement of a cam follower 41 with a two-part cam 4, 40, forming the clutch operating mechanism.

It is desirable, in the interest of insuring proper operation of the clutch notwithstanding long wear without adjustment or attention, that some yielding connection be provided between the clutch-actuating cam 59, and its operating means, the cam members 4 and 40. This engagement of the arm 45 may therefore be through a second arm 45', shown in Figure 6 as embracing the arm 45 in the shape of a U, and yieldingly held thereagainst by means of a spring 46.

The cam member 4 is pinned to a sleeve 42 which is held against rotation by securing it or an arm 42' connected thereto, to the bed frame 77 or an arm 77' secured thereto. This arm 77' also serves to support the outer end of the extension 10. Within the sleeve 42 is journaled a second sleeve 43 which itself is journaled upon the extension 10, the cam member 40 being pinned to the sleeve 43 to oscillate therewith. To control movement

of the sleeve 43 and consequently of the cam member 40 at all times, and during operation of the device, I provide an arm 44 secured to the sleeve 43 outwardly of the end of the sleeve 42, which cooperates with a fixed segment 47 having notches or holes 47' within which a pin 44' of the arm 44 is engageable. All of these connections may be made by simple axially extending pins, whereby the parts may be conveniently assembled or disassembled merely by axial movement.

By proper manipulation of the arm 44 the cam members 4 and 40 may be made to assume their minimum combined angular extent, or may be moved angularly relative to each other to cover a more extended angle. The two part cam 4, 40 lies in the plane of rotation of the cam follower 41 and as the latter rotates with the continuously rotatable clutch member 50, the two-part cam is engaged thereby, and as the follower 41 passes this cam the arm 45 is oscillated to move the spreader cam 59 and thus to connect the two clutch members 5 and 50. This rotates the feed screw 1 in a direction to advance the fuel, the ratio of the period of advancement to the period of rest being determined by the ratio of the angular extent of the two part cam 4, 40 to the complete circle of 360°.

In Figure 4 I have shown a damper 78 between the outlet of the fan housing 80 and the air chamber 72. This I have shown as oscillatable, being mounted upon an oscillatable shaft 79 extending parallel with the extension 10 and feed screw 1. At one end I have secured upon this shaft 79 an arm 37 having a cam follower 36 secured thereto. This cam follower bears upon a cam surface 30' of a cam 3, which cam is secured preferably to the sleeve 43 to oscillate therewith. The cam surface 30 is so arranged that as the sleeve 43 is moved to reduce the amount of feed of the feed screw 1 in the manner heretofore described, thus cutting down the amount of fuel supplied, the damper 78 will be closed by an amount corresponding therewith, thus cutting down the amount of air supplied to the burner. As the rate of feed of the coal is increased the amount of air supplied is likewise increased and by an amount which will compensate for and consume the additional coal supplied. By employing a set screw 33 to secure the cam 3 to the sleeve 43, it is possible readily to vary the proportion of increase in air to increase of fuel supplied by means of adjustment of the cams 4, 40.

This feature of automatic regulation of the amount of air in accordance with the amount of fuel supplied is one of considerable importance in my invention and contributes in large measure to the ability of the device to handle greatly varying amounts of coal in a given period of time. It will be evident in this connection that the control of the handle

44 might be other than the purely manual control shown.

In kindling fire it is desirable to create a strong draft, yet it is impracticable to advance the coal through the fire-pot until it is well started. To allow operation of the fan by the motor, yet to prevent advancing the feed-screw 1 at such times, I may provide a clutch as illustrated in Figures 3, 10, 11 and 12, interposed between the fan and the clutch 5, 50. The sprocket wheel 62 is loosely mounted on the shaft 60, and has a pin 67 projecting therefrom parallel with its axis. A complemental clutch member 68, normally pressed towards the sprocket wheel 62 by a spring 68', is engageable therewith through engagement of the pin 67 with a shoulder 69 upon the member 68. The member 68 in turn is connected to the shaft 60 through engagement of a radial pin 67' with the same shoulder 69. For driving engagement the pin 67' is received in a recess 69'. To disengage it the member 68 is drawn outward in opposition to the spring 68', is then given a slight turn about the shaft and then rests upon the shoulder 66', thus holding the member 68 beyond the end of the pin 67, as is seen in Figure 10. In this position the motor may operate to drive the fan, but as the sprocket wheel 62 is not in engagement with the member 68 or the pin 67, it may not rotate, and the coal is not advanced by the feed screw 1. A slight reverse turn of the member 68 reengages the clutch, and places the mechanism in condition to advance coal through the conduit 92.

It is desirable to provide means for maintaining the entrance to the coal chamber 71 free of obstructions and filled with coal at all times, and for this purpose I may employ an agitator in the form of a finger 2 mounted upon a shaft 20 extending through the bottom of the hopper 70. The agitator 2, or several of them if the fuel is found to require more than one, is slowly rotated through a suitable connection to the drive means, and as shown through a ratchet wheel 21 secured upon the shaft outside of the casing 7, and a ratchet dog 22 engageable therewith and carried by an arm 23, which arm is oscillated regularly by rotation of an eccentric pin 24 upon the countershaft 60, the pin being engaged in a slot 25 in the end of the arm 23.

It will be noted that the sprocket wheel 97 through which the ash removing mechanism is actuated, is intermittently driven through the same arrangement as the feed screw 1 is driven. Thus the ashes are collected as rapidly as they are formed, but if the rate of feed of coal is increased the rate of removal of the ashes is likewise increased to correspond therewith. The entire device is compactly arranged, the countershaft 60 being arranged above the drive connections and all drive and control connections being cen-

tered upon the extension 10. All parts which are liable to require inspection or adjustment are assembled with the minimum of bolts, screws, and the like, generally in such manner that relative axial movement of parts permits disassembling them. The fan being placed at one side of the hopper, may lie beneath a flaring side thereof and by the connection of the motor described above this may be brought very close to the fan. This not only saves in floor space, but in the cost of castings, and the assembly permits economy through elimination of securing means except where essential.

What I claim as my invention is:

1. In coal burning apparatus, in combination with a burner, an air conduit discharging into said burner, a damper therein, a feed screw discharging into said burner, a continuously rotating power source, an intermittent drive connection between said power source and the feed screw, means comprising a two-part adjustable cam for varying the ratio of the rest period of said intermittent drive connection to its active period, a second cam adjustable with said first cam and operatively connected with said damper to increase or decrease the opening of said damper in accordance with the increase or decrease in the ratio of active to rest periods in the intermittent drive connection, and means for varying the initial setting of said second cam angularly relative to the first cam.

2. In coal-burning apparatus, in combination, a feed screw including a shaft, an extension operatively connected to said shaft, a two-part cam upon said extension of the feed screw shaft, one part being stationary, a sleeve mounted upon said extension and carrying the other part of said cam, means for adjusting said sleeve and the cam member carried thereby angularly relative to the stationary cam member, a clutch upon said extension and comprising one member fixed thereto and a second member continuously rotatable thereabout, and means carried by said rotatable clutch member and engageable by said cam to determine the period of engagement of the clutch members.

3. In coal-burning apparatus, in combination, an air conduit, a damper therein, a feed screw including a shaft, an extension of said shaft operatively connected thereto, a two-part cam upon said extension of the feed screw shaft, one part being stationary, a sleeve mounted upon said extension and carrying the second cam part, a second cam carried by said sleeve and movable therewith, said sleeve and the second cam carried thereby being oscillatable to vary the total angular extent of said two-part cam, a clutch upon said extension and including one member fixed thereto and a second member continuously rotatably thereabout, means carried by said rotatable clutch member and engaging said

two-part cam to cause the engagement of the clutch members, and operative connection between said second cam and said damper, said second cam being oscillatable with its supporting sleeve, and so formed and disposed, relative to the first or two-part cam, that the damper is opened or closed in accordance with the increase or decrease in angular extent of the first cam.

4. In coal burning apparatus, in combination with a burner, a casing defining an air chamber and a coal chamber each having an end outlet, a coal conduit and an air conduit connected to the respective chambers in the casing and discharging into said burner, a feed screw including a shaft extending through the coal chamber and conduit, an extension from its shaft without the casing and opposite the coal chamber outlet, a hopper above said coal chamber, a fan positioned beside said coal chamber and hopper and connected to discharge into said air chamber, a drive shaft extending transversely of the feed screw axis, a motor operatively connected to said drive shaft, a countershaft above and parallel to said feed screw shaft extension and connected to be driven continuously by said transverse drive shaft, drive means connecting said extension and said countershaft and including a continuously rotating clutch element journaled upon said extension, a complementary clutch element secured upon said extension, clutch operating means carried by said continuously rotating clutch element, clutch control means mounted upon said extension and engageable by said clutch-operating means as the latter rotates, a damper interposed between said fan and air conduit, means for adjusting said clutch control means to vary the period of engagement of the clutch elements, and means operable simultaneously with said latter means to correspondingly adjust said damper.

5. In a coal burning apparatus, in combination, a burner, a coal hopper, a fan, coal and air conduits connecting, respectively, the hopper and fan with the burner, a coal feed screw in said coal conduit, a damper in said air conduit, a continuously-operable intermittent drive means for said feed screw, means for adjusting the ratio of active to rest periods in said intermittent drive means, means mounted independently of said adjusting means but operable thereby to vary the setting of said damper in the air conduit in accordance with the adjustment of the feed screw drive means, and means for varying the setting of said damper independently relative to said feed screw drive control means.

6. In coal burning apparatus, in combination, a coal chamber, a hopper thereabove, a coal conduit leading from one side of said chamber, the opposite side thereof being apertured, a feed screw in said conduit and chamber, a bearing at said aperture, a separable

extension shaft for said feed screw journaled in said bearing, drive means for said screw coupled to said extension, said bearing being secured externally to said chamber to close said aperture when in operative position, said feed screw being removable through said aperture upon removal of said bearing and drive means.

7. In coal burning apparatus, in combination, a casing defining a coal chamber and an air chamber each having an outlet facing in the same direction, and forming a socket, said coal chamber having an aperture opposite said socketed outlet, a burner, a coal conduit and an air conduit parallel thereto, and each connecting with the burner and seating in the socketed outlet of its respective chamber to connect the burner therewith, a feed screw extending through said coal conduit, and having drive means extending outwardly through the aperture of said coal chamber, opposite the coal conduit, bearing and drive means therefor adapted to be secured exteriorly of said coal chamber to close said aperture and to support and drive said feed screw, said feed screw being removable by axial movement through said aperture upon removal of said bearing member, and said conduits being disengageable from the chambered casing by like relative axial movement.

8. In coal burning apparatus, in combination, a casing including a coal chamber and an air chamber each having a lateral outlet forming a socket, a burner, a coal conduit connecting said burner with said coal chamber, and seating in the socket at the outlet from said chamber, an air conduit having its axis substantially parallel to the axis of said coal conduit, and similarly seating in the socketed outlet from the air chamber, and connecting the latter with the burner, a feed screw extending through said coal conduit, drive means for said feed screw, and a non-circular socketed drive connection between said feed screw and its drive means, said drive connection and said conduits and the casing being connected and disconnectible solely by relative endwise movement.

9. In coal burning apparatus, in combination with a burner, a casing enclosing an air chamber and a coal chamber having adjoining outlets, a coal conduit and an air conduit connected to the respective chambers in the casing, and discharging into said burner, a feed screw extending through the coal chamber and conduit, and including a shaft, an extension of said shaft extending through the casing at the side opposite the coal chamber outlet, a hopper above said coal chamber, a drive shaft extending transversely of the feed screw axis, a fan on said transverse shaft discharging into said air chamber, a motor operatively connected to said drive shaft, a countershaft above and parallel to said feed screw shaft extension and con-

nected to be driven continuously by said transverse drive shaft, drive means connecting said extension and said countershaft and including a variable step-by-step drive associated with said extension, and control means operable step-by-step and mounted upon said extension.

10. In coal burning apparatus, in combination with a burner, a casing enclosing an air chamber and a coal chamber having adjoining outlets, a coal conduit and an air conduit connected to the respective chambers in the casing, and discharging into said burner, a feed screw extending through the coal chamber and conduit, and including a shaft, an extension of said shaft extending through the casing at the side opposite the coal chamber outlet, a hopper above said coal chamber, a fan positioned beside said coal chamber and hopper and connected to discharge into said air chamber, a drive shaft extending transversely of the feed screw axis, a motor outward of the fan and operatively connected to said drive shaft, a countershaft above and parallel to said feed screw shaft extension and connected to be driven continuously by said transverse drive shaft, drive means connecting said extension and said countershaft and including a variable step-by-step drive associated with said extension, and drive control means mounted upon said extension and operable from the end thereof away from said feed screw, a damper interposed between said fan and said air conduit, and damper-control means associated and operable with said control means.

11. In an automatic coal burning apparatus, the combination of a burner, a material-carrying conveyor conduit extending thereto, and a screw conveyor in said conduit arranged to be withdrawn lengthwise from the burner and conduit when its end remote from the burner is released, and to be replaced again by movement lengthwise of the conveyor screw, of means remote from the burner for confining the screw conveyor in the conduit and for journalling the end of the screw conveyor remote from the burner, supporting means for said journalling means provided with an opening therethrough lengthwise of the conveyor screw and larger than the cross dimension of the conveyor screw, and at which opening said journalling means is removably secured, and a shaft rotatable in said journalling means, said remote end of the conveyor screw being releasably connected to the end of said shaft for support and rotation by the latter.

12. In an automatic coal burning apparatus, the combination with a burner, a substantially-horizontal material-carrying conveyor conduit extending thereto, and a screw conveyor in said conduit arranged to be withdrawn lengthwise from the burner and conduit when its end remote from the burner

is released, and to be replaced again by movement lengthwise of the conveyor screw, of means remote from the burner for confining the screw conveyor in the conduit and for journalling the end of the screw conveyor remote from the burner, said means including a shaft the inner end of which has a socketed supporting and driving connection with the end of said conveyor screw, a bearing member providing a bearing for said shaft adjacent said inner end thereof, and means providing another bearing for said shaft nearer the outer end thereof, supporting means for said bearing member provided with an opening therethrough lengthwise of the conveyor screw and larger than the cross dimensions of the conveyor screw, and at which opening said bearing member is removably secured to said supporting means, whereby the screw conveyor can be withdrawn lengthwise by operations at the end of the screw conveyor remote from the burner, and drive means connected to said shaft.

Signed at Seattle, King county, Washington, this 4th day of February, 1925.

ADOLPH OUSDAHL.