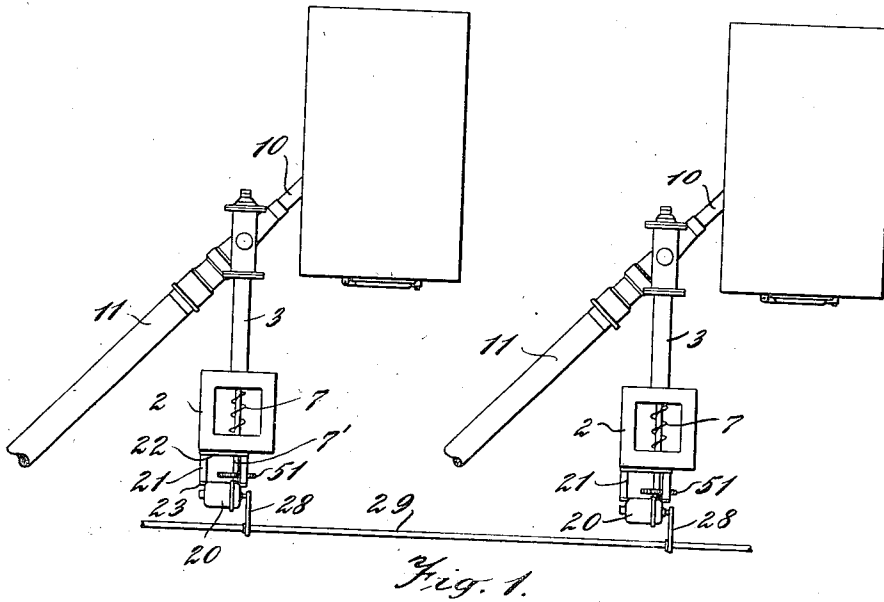
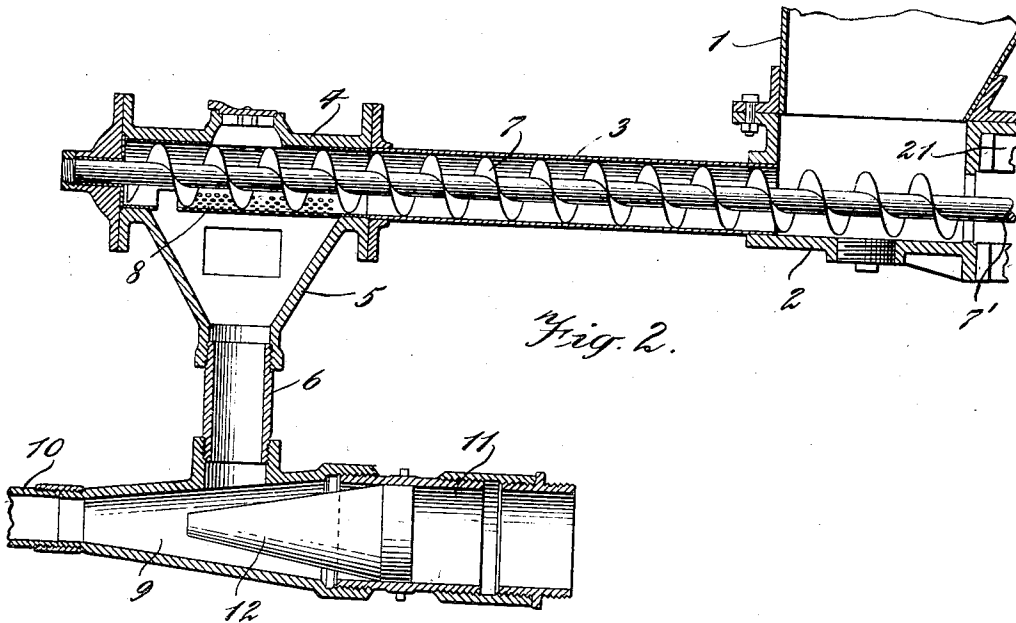


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 AUTOMATIC STOKER.
 APPLICATION FILED MAR. 30, 1917.

1,425,519.

Patented Aug. 15, 1922.
 3 SHEETS—SHEET 1.

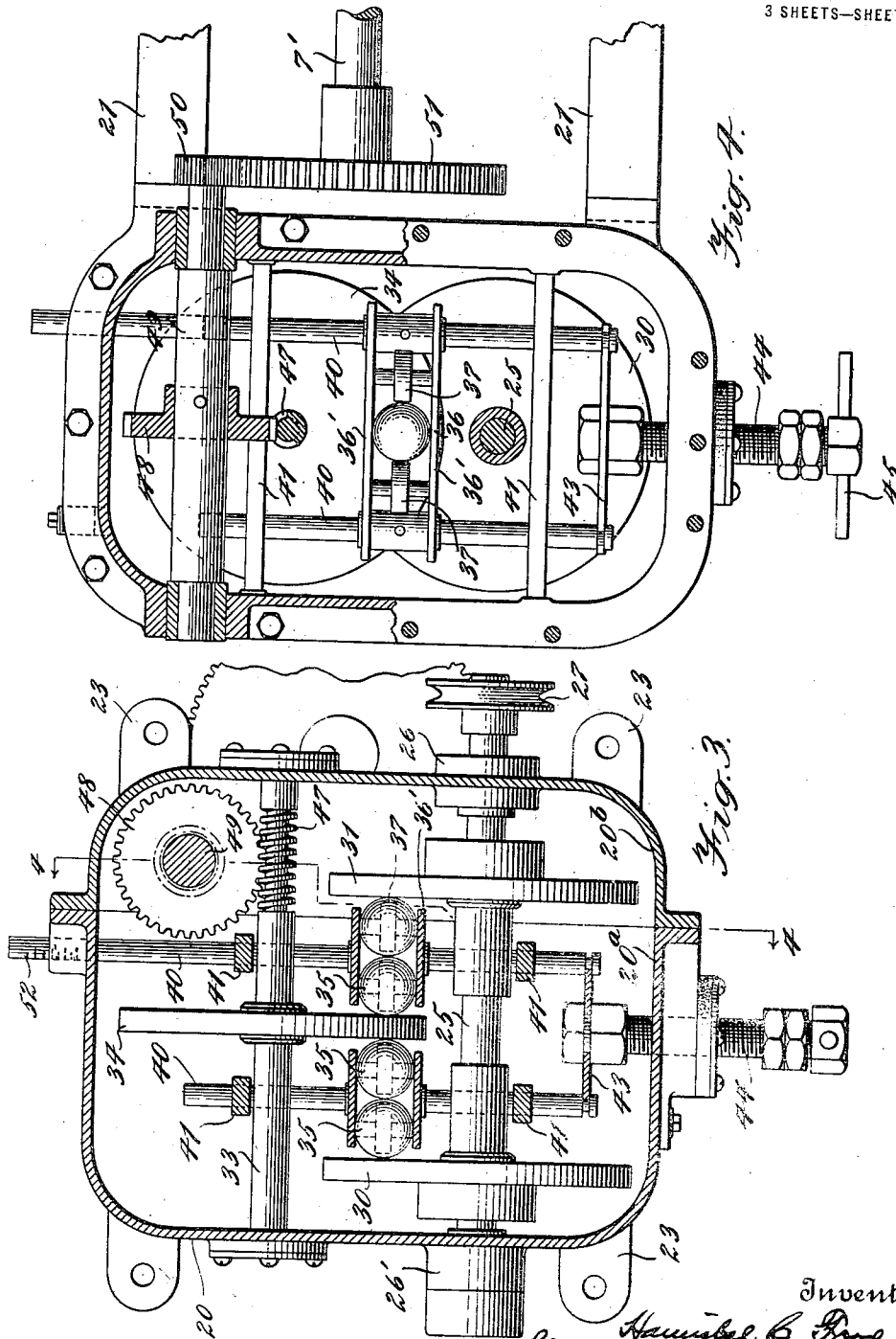


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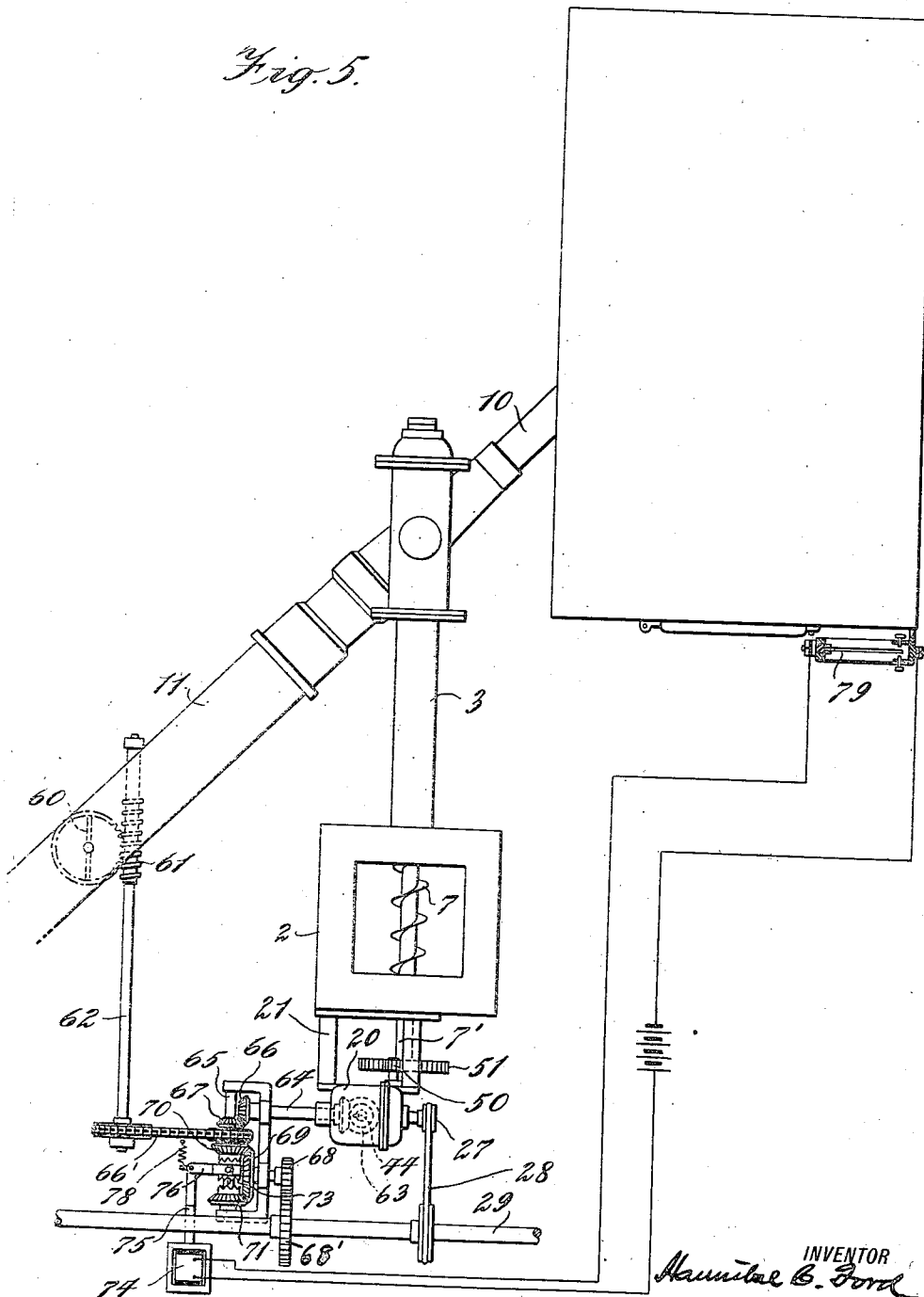
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Fig. 5.



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AUTOMATIC STOKER.

1,425,519.

Specification of Letters Patent. Patented Aug. 15, 1922.

Application filed March 30, 1917. Serial No. 158,509.

To all whom it may concern:

Be it known that I, HANNIBAL C. FORD, a citizen of the United States, residing at the city of New York, in the borough of Queens and State of New York, have invented certain new and useful Improvements in Automatic Stokers, of which the following is a full, clear, and exact description.

This invention relates to automatic stokers and more particularly to stokers having a revoluble fuel-supplying part which delivers coal to a furnace in proportion to the speed of the fuel-supplying part.

One of the objects of the invention is to provide a plurality of stokers of this character each of which may be mechanically driven from the same source of power and at the same speed and yet permit each of the stokers to be controlled at will to regulate to a nicety the quantity of fuel and air supplied to each furnace.

Another object of the invention is to provide a stoker having a variable speed power transmission which can be regulated at will to progressively and continuously vary the speed of the revoluble part which supplies the coal to the furnace.

With these and other objects in view, the invention consists of the constructions and combinations which will be hereinafter described in connection with the accompanying drawing, and will be particularly pointed out in the appended claims.

Figure 1 shows a group of automatic stokers driven from a main shaft;

Figure 2 is a section through the fuel-supplying part of the stoker;

Figure 3 is a vertical longitudinal section through the variable speed transmission of the stoker;

Figure 4 is a section on the line 4—4 of Fig. 3, looking in the direction of the arrow; and

Figure 5 is a view of a complete unit.

Referring first to Figure 2, the fuel-supplying part of the stoker is shown and comprises a hopper 1 which is mounted upon a feed-box 2 into which the fuel, which is ordinarily powdered coal, is fed from the hopper 1. Extending laterally from the feed-box is a cylindrical casing or pipe 3 which leads to and is connected at its end with a delivery box which is formed with a cone-shaped chute 5 from which the fuel is discharged into a pipe 6. The fuel is con-

veyed from the feed-box to the discharge box 4, by means of an endless screw 7 which is mounted upon a shaft 7' within the cylindrical chamber or pipe 3, and extends through the top of the discharge box and through the bottom of the feed-box 2. A cylindrical sieve 8 is preferably provided within the delivery box 4 surrounding the endless screw 7. From the pipe 6 the coal is fed into a chamber 9 from where it is forced into a pipe 10 by a blast of compressed air conducted to the chamber 9 by a pipe 11 connected to a nozzle 12. The pipe 10 leads to the fire box of the furnace where the coal, which is blown through the pipe 10, is consumed.

In furnaces which are supplied with coal by the construction described, the temperature of the fire is regulated by varying the amount of coal and air which is fed to the furnace. It is frequently desirable that the temperature be varied within narrow limits, making it essential to provide means for gradually increasing or diminishing the quantity of coal supplied which can be accomplished by causing infinitesimal variations in the speed of the endless screw. The invention contemplates a variable speed transmission for the endless screw which is of a mechanical construction and yet is operable at will to give the desired continuous variations in the speed of the endless screw. One embodiment of this transmission, which is similar to that shown in my co-pending application Serial No. 83,749, filed March 13, 1915, is shown in Figures 3 and 4 of the drawing. This transmission is mounted in a closed casing 20 which may be filled with oil to lubricate the parts of the transmission. The casing 20 is provided with ears 23 which are secured to the legs or standards 21 carried by a plate 22 secured to the end wall of the feed-box 2. Mounted within the casing 20, which is in two sections 20^a and 20^b, is a shaft 25 which is supported in suitable bearings 26 and 26'. The shaft 25 carries at its one end a pulley 27 which is adapted to be driven by means of a belt or chain 28 from a main shaft 29 (see Fig. 1). Mounted upon the shaft 25 are two spaced disks 30 and 31, which disks rotate with the shaft 25. Also mounted within the casing is a shaft 33 which is parallel to the shaft 25 and carries a disk 34. Between the disks 30, 31 and 34 power transmitting balls

35 are interposed. These balls are in the embodiment shown arranged in pairs, one pair co-operating with the disks 30 and 34, and the other pair with the disks 31 and 34, the balls being in rolling contact with each other and with their respective disks. Each pair of balls is surrounded by a cage 36 consisting of side plates 36' carrying rollers 37 which rollers rest against the balls 35 as do also the plates 36' of the cages to prevent relative lateral movement of the balls. The cages 36 are carried by rods 40 which slide through openings provided in standards or braces 41 which are supported between opposite walls of the casing 20. The rods 40 are connected at one end by a cross head 43, which cross head carries a screw shaft 44. The screw shaft 44 extends exteriorly of the casing and carries means for manually rotating it, as for example, a cross arm 45. When the screw 44 is rotated, since it is threaded into the casing 20, the rods 41 and the cages and balls which are mounted thereon will be moved to change the position of these balls with respect to the disks, and hence cause a variation in the relative speeds of the shafts 25 and 33. The shaft 33 carries a worm 47 which meshes with a worm wheel 48 carried by a shaft 49 arranged at right angles to the shafts 25 and 33. The shaft 49 is also mounted in suitable bearings in the casing and carries at one end which projects beyond the casing, a pinion 50 which engages a spur-gear 51 carried at the end of the shaft 7' upon which the endless screw 7 is mounted, the pinion 50 and gear 51 giving the necessary speed reduction to the endless screw.

To indicate the speed of the shaft 7' which is determined by the position of the balls 35, one of the rods 40 may be extended through the casing and provided with a scale 52 (see Fig. 3).

In Figure 1 of the drawing, a plurality of stokers each having a variable speed transmission of the character described, are connected with the main shaft 29, which may be driven at a substantially constant speed and yet permit each of the revoluble screws 7 to be rotated at variable speeds by regulation through the manually-operated part 45.

The operation of the elements above described is obvious from the description, but will be briefly referred to. Assuming that the pair of furnaces, as shown, are in operation, each being under the control of an operator who can, by either the color of the heat chamber of the furnace or by any improved type of thermometer, determine the temperature at which the furnace should be maintained. Assuming that the temperature of one furnace has risen slightly above this point, the operator may then by rotating the screw 44 vary the speed of the endless screw 7 progressively and continuously

until the color of the heat or the thermometer registers correctly. This may only require an infinitesimal change in the speed of the endless screw which is permitted by the construction of the variable speed transmission described. The operator can, in a similar manner, regulate at will the speed of the endless screw 7 which supplies the coal to the other furnace, and can, in the manner previously described, accurately maintain this furnace also at a proper temperature.

It will, therefore, be seen that while each of the stokers are driven from the main shaft, nevertheless they are capable of being independently controlled to vary the amount of coal which is fed to each furnace, and this variation can, by virtue of the variable speed transmission, take place continuously without any sudden breaks or changes in the speed of the endless screw which would cause a sharp increase or decrease in the amount of coal supplied to a furnace to prevent the accurate regulation thereof.

In the complete unit shown somewhat diagrammatically in Figure 5, both the amount of air and coal which is supplied to the furnace is automatically controlled by a thermostatic device. The furnace is supplied with coal through a pipe 10 to which air is supplied by a pipe 11, the coal being fed to the pipe 10 by means of an endless screw as previously described. Mounted within the pipe 11 is a valve 60 which is adapted to be opened and closed by means of any suitable mechanism such as a worm and screw 61 which is connected to a shaft 62. The shaft 44 which controls the variable speed transmission is connected by bevel gears 63 to a shaft 64, it being understood that the connection between one of the gears 63 and the shaft 44 is such as will permit the shaft 44 to move longitudinally, as well as rotate. The shaft 44 is driven from a shaft 65 through bevel gears 66 and 67, the bevel gear 67 being fastened to the shaft 65. The shaft 62 is also driven by a chain and sprocket wheel construction 66' from the shaft 65 and it will be evident that by rotating the shaft 65 in opposite directions, the quantity of coal supplied to the furnace, as well as the quantity of air, may be increased or diminished. The shaft 65 is driven from the main shaft 29 through gears 68 and 68', the gear 68 driving bevel gear 69, which engages two bevel pinions 70 and 71 which are loosely mounted upon the shaft 65. A clutch sleeve 73 which is keyed to the shaft 65, but is capable of sliding therealong, is brought into engagement with either one of the pinions 70 and 71 by means of a solenoid 74 whose core 75 is connected by a link 76 to the sliding clutch sleeve 73. It will therefore be evident that when the solenoid is energized, the clutch sleeve will be

forced into engagement with the bevel pinion 71 so that the drive from the main shaft is through the bevel gear 69 and the bevel pinion 71, which will move the valve 60 and also change the speed of the endless screw 7. A spring 78 draws the clutch 73 into engagement with the bevel pinion 70 when the solenoid 74 is de-energized, which will cause a rotation of the valve 60 in the opposite direction and will change the speed of the endless screw 7. The solenoid 74 is controlled by means of a thermostatic device 79 which can be of any usual construction, and is adapted, for example, to close the circuit through the solenoid 74, as for example, when the temperature of the furnace rises above a predetermined point. When the thermostatic device is so arranged, the connections to the endless screw 7 and valve 60 are such that when the circuit is closed through the solenoid 74, these parts are moved to decrease both the quantity of air and fuel supplied to the furnace until the temperature of the furnace drops below the required temperature, at which time the solenoid 74 will be de-energized and the shaft 65 will be driven in the opposite direction to increase the quantity of fuel and air which is supplied to the furnace. It will, therefore, be seen that the temperature of the furnace may be automatically kept within fixed limits determined by the sensitivity of the thermostatic device 79.

I claim:

1. In an automatic stoker, a conduit for supplying air to a furnace, a valve for controlling said conduit, means for supplying fuel to the furnace, a main drive operable in a single direction, variable speed mechanism for driving the fuel-supplying means from the main drive and having speed-regulating means, means driven by said main drive and operable in reverse directions to operate said conduit valve in a plurality of directions and to actuate the regulating means of said variable speed mechanism to drive said fuel-supplying means in a single direction at variable speeds.

2. In an automatic stoker, a conduit for supplying air to a furnace, a valve for controlling said conduit, means for supplying fuel to the furnace, a main drive shaft

revolvable in a single direction, a variable speed mechanism driven therefrom to drive said fuel-supplying means in a single direction, means for varying the velocity of said mechanism, another drive operable from said main drive shaft to give simultaneous reverse drives, an operating connection between said valve and the means for altering the velocity of said variable speed mechanism, and thermostatically controlled means for combining said operating connection with one or the other of said reversed drives.

3. In an automatic stoker, a conduit for supplying air to a furnace, a conduit-controlling valve, means for supplying fuel to the furnace, a main drive shaft, variable speed mechanism for driving the fuel-supplying means from said shaft, a reversible connection extending to said valve to reversely operate the same and to said mechanism to regulate the speed thereof said connection including a shaft, gears loosely mounted on the last named shaft, a connection from said main shaft arranged to drive said gears in opposite directions, and means selectively engaging one of said gears in driving relation to the shaft on which they are mounted.

4. In an automatic stoker, a conduit for supplying air to a furnace, a conduit-controlling valve, means for supplying fuel to the furnace, a main drive shaft, variable speed mechanism for driving the fuel-supplying means from said shaft, a reversible connection extending to said valve to reversely operate the same and to said mechanism to regulate the speed thereof said connection including a shaft, gears loosely mounted on the last named shaft, and provided with clutch members, an intermediate clutch member drivingly combined with the same shaft, a connection from said main shaft to said loosely mounted gears to drive them in opposite directions, and thermostatically controlled means for shifting said intermediate clutch into engagement with one or the other of said loosely mounted gears.

In witness whereof, I subscribe my signature.

HANNIBAL C. FORD.