D. J. AMES.

AUTOMATIC STOKER.

APPLICATION FILED AUG. 6, 1910.

1,018,690. Patented Feb. 27, 1912.

3 SHEETS—SHEET 1.

Fig. 1

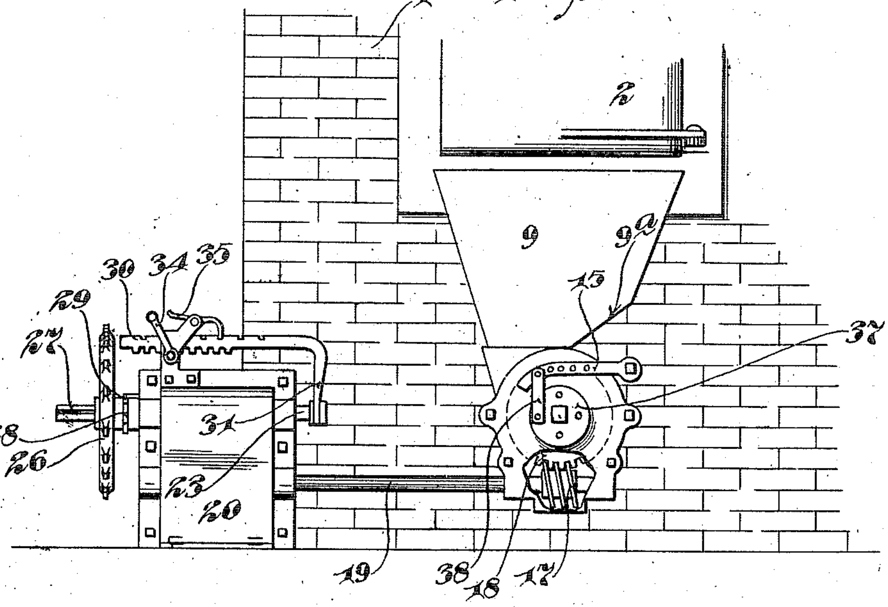
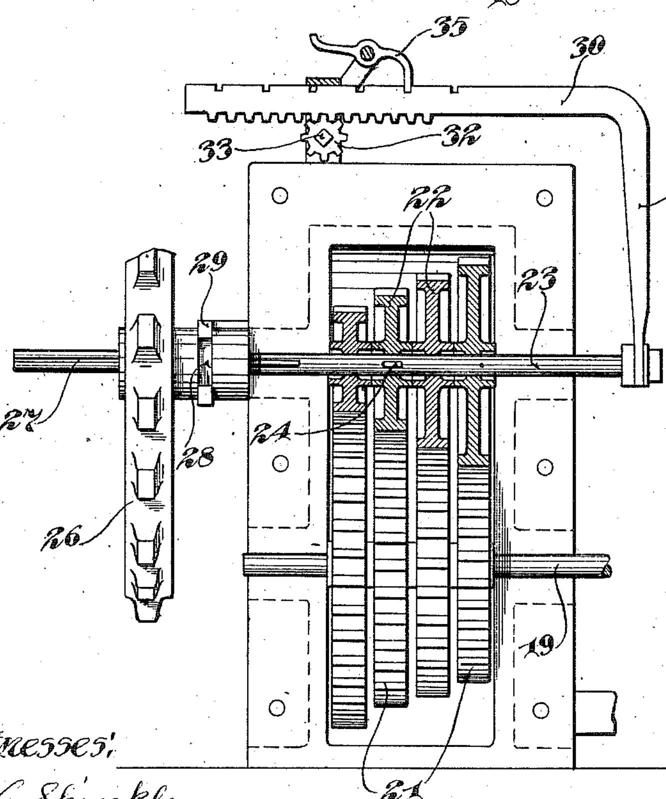


Fig. 2



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3 SHEETS—SHEET 2.

Fig. 3

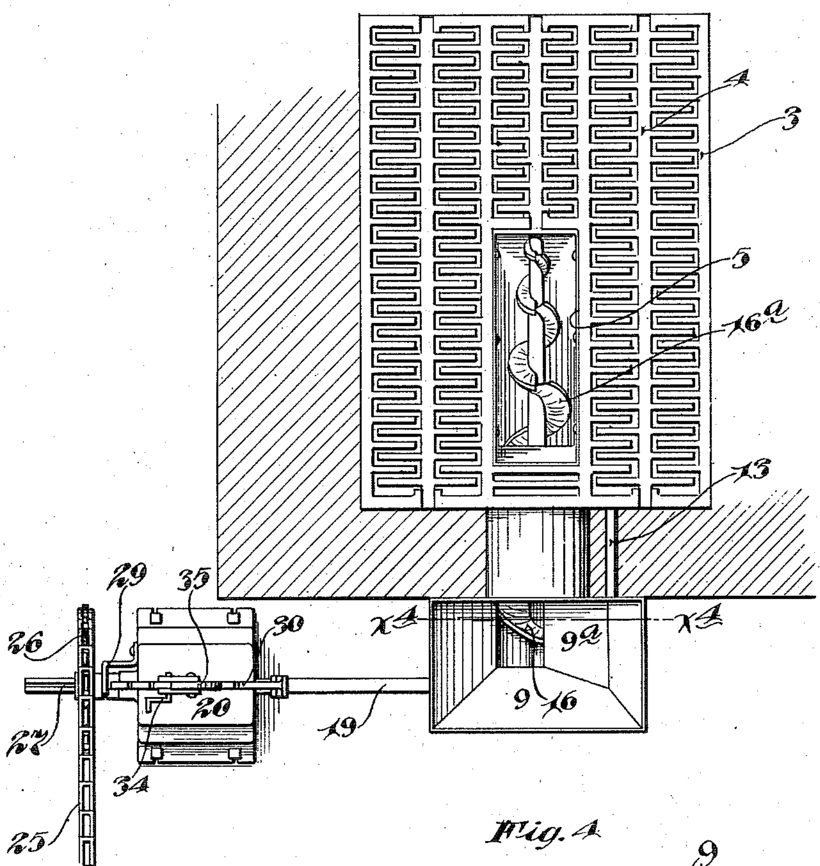
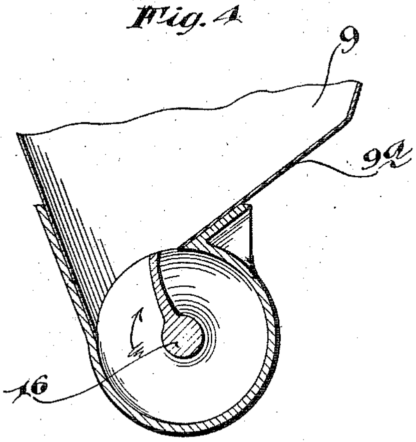


Fig. 4



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3 SHEETS—SHEET 3.

Fig. 5

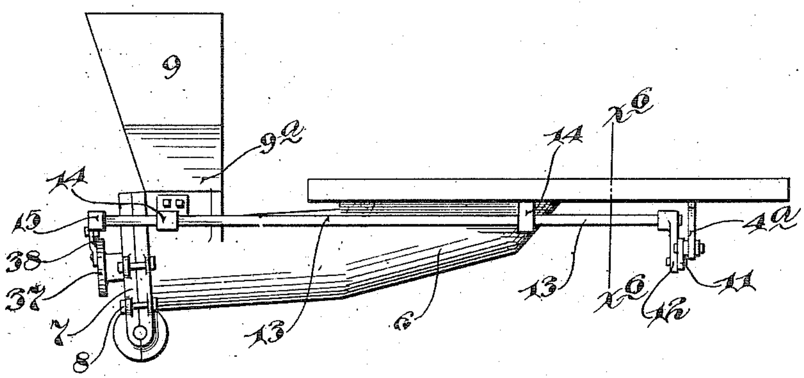


Fig. 8

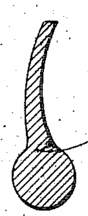


Fig. 6

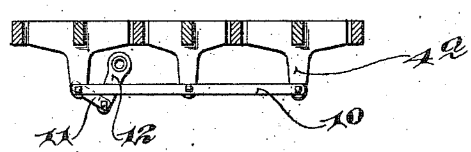


Fig. 9

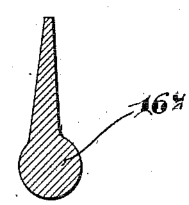
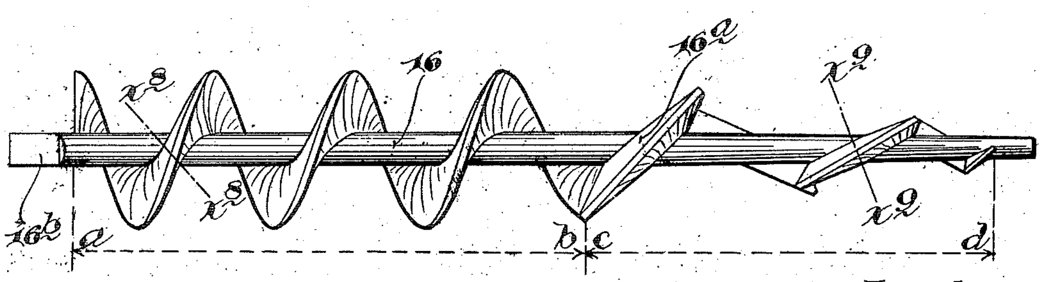


Fig. 7



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UNITED STATES PATENT OFFICE.

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AUTOMATIC STOKER.

1,018,690. Specification of Letters Patent. Patented Feb. 27, 1912.

Application filed August 6, 1910. Serial No. 575,951.

To all whom it may concern:

Be it known that I, DAVID J. AMES, a citizen of the United States, residing at Austin, in the county of Mower and State of Minnesota, have invented certain new and useful Improvements in Automatic Stokers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention has for its special object to provide an improved mechanical stoker, and to this end it consists of the novel devices and combinations of devices hereinafter described and defined in the claims.

In the accompanying drawings, which illustrate the invention, like characters indicate like parts throughout the several views.

Referring to the drawings: Figure 1 is a front elevation of an ordinary boiler fire box having my invention applied thereto some parts being broken away. Fig. 2 is a detail view partly in elevation and partly in vertical section and with some parts broken away showing a variable speed mechanism for operating the stoker proper. Fig. 3 is a view partly in plan and partly in horizontal section and with some parts broken away showing my improved stoker and its actuating mechanism applied in connection with the grates of the fire box. Fig. 4 is a detail in section taken approximately on the line x^4 x^4 of Fig. 3. Fig. 5 is a side elevation showing the stoker applied to the grate and other parts of the furnace being removed. Fig. 6 is a transverse vertical section taken through the grate on the line x^6 x^6 of Fig. 5. Fig. 7 is a plan view of the fuel feed screw, and Figs. 8 and 9 are sections taken respectively on the lines x^8 x^8 and x^9 x^9 of Fig. 7.

Of the parts of the furnace the numeral 1 indicates the masonry walls and the numeral 2 a door which opens into the fire box above the grates. So far as my invention is concerned, the grate may be of any suitable form, but as shown and preferred it is made up of a rectangular toothed fixed structure 3, and a multiplicity of rocking toothed bars 4. The fixed grate structure 3 is horizontally disposed and its teeth are interlapped with the teeth of the rocking grate bars 4, the latter at their ends being detachedly journaled in open seats formed in the former.

At the transverse center the fixed grate structure 3 is formed with a large longitudinally extended fuel admission passage 5 that is in communication with the delivery end of a fuel supply spout 6. This fuel spout 6 is preferably a cast structure having at its extreme outer end a detachable head 7 connected thereto, as shown, by short nutted bolts 8, best shown in Fig. 5. The outer and receiving end of the spout 6 is in communication with the lower end of a fuel supply hopper 9; one wall 9^a of which is inclined at an angle of approximately 45 degrees, and terminates at a point substantially directly above the axis of the said spout 6. This latter feature is important and is for a purpose which will be hereinafter noted. The delivery end of the spout 6 is tapered so that its bottom rises quite abruptly throughout that space underlying the fuel delivery passage 5 of the grate. The rocking grate bars 4 at their intermediate portions are provided with depending arms 4^a that are connected by link 10. One of the arms 4^a is also connected by a short link 11 to the depending arm 12 of a horizontal rock shaft 13 mounted in suitable bearings 14 on the spout 6 and provided at its front end with a rigidly secured arm 15, the purpose of which will hereinafter appear.

Working within the feed spout 6 is a spiral feed screw of novel construction, indicated as an entirety by the numeral 16. Between the points marked *a*—*b* (Fig. 7) the spiral blade of this feed screw 16 is given a constantly increasing pitch or travel, for a highly important purpose presently to be described, and between the points marked *c*—*d* the said feed screw is formed in approximately flat contiguous blade sections 16^a that are obliquely set with adjacent sections reversely inclined. The blade sections 16^a work in that portion of the spout 6 which underlies the fuel delivery passage 5.

The feed screw 15 is preferably cast integral with an axial shaft, the inner end of which is journaled in the seat formed in the delivery end of the spout 6 below the grate. The outer end of the shaft of the said feed screw is preferably square at 16^b and is extended outward through the head 7 of the spout 6. The said head 7 and the flanged end of the spout 6 are recessed to afford a seat for a coöperating worm 17 and worm gear 18. The said gear 18 is seated on the square end 16^b of the feed screw shaft while the worm 17 is secured to one end of an operating shaft 19. One end of the shaft 19 is journaled in a divided seat formed in the depending portions of the head 7 and flanged upper end of the spout 6, and the other end of the said shaft 19 is journaled in a gear case or housing 20 shown as rigidly secured to the floor in front of the furnace and at one side of the fuel supply hopper 9. Preferably the housing 20 is a divided or two part structure the sections of which are rigidly secured by suitable bolts and one section of which in Fig. 2 is removed.

Within the housing 20 the shaft 19 carries a plurality of spur gears 21 of varying diameter. The gears 21 are in mesh with spur gears 22 that are normally loose on a shaft 23 that is extended through the hubs thereof, and is journaled in the housing 20 and with freedom for endwise movements. The gears 21 and the gears 22 are in reverse conical arrangement so that by coupling the driving shaft 23 to different members of the gears 22 a variable speed transmission mechanism is afforded. The driving shaft 23 as shown is provided with a short key 24 which by axial movements of the shaft 23 is adapted to be engaged with the hub of any one of the said gears 22, or it may be positioned in recesses formed in the said hubs, to thereby throw the variable speed moving mechanism out of action.

The shaft 23 is adapted to be rotated from power driven connections including, as shown, a sprocket 26 connected to the said shaft 23 by a long key 27. The shaft 23 moves through the sprocket 26 and the hub of the latter is provided with a groove 28 that is engaged by a forked bearing 29 rigidly secured to the housing 20. The said bearing 29 holds the sprocket against lateral movements, but permits the same to freely rotate. A sprocket chain 25 runs over the sprocket 26.

The shaft 23 is adapted to be given axial movements and to be set in its different operative and inoperative positions preferably by means of the rack bar 30 that is mounted in the top portion of the housing 20 and is provided with a depending end 31 of which the corresponding end on the said shaft 23 is swiveled. The teeth of the rack 30 are engaged by a spur pinion 32 that is rotated and mounted in a suitable seat formed within the housing 20 and is provided with a projecting shaft 33 which in practice will be equipped with an operating crank 34. The rack 30 is adapted to be locked in its various positions by a lock dog 35 pivoted on top of the housing 20 and engageable with notch 36 in the top of the said rack 30.

The projecting end 16^b of the shaft of feed screw 16 is provided with a crank head 37 that is connected by a short lock 38 to the end of the arm 15, which as before noted, is secured to the front end of the rocking shaft 13. The arm 15 is provided with several longitudinally spaced perforations which adapt the upper end of the lock 38 to be connected thereto at different points. The crank head 37 is provided with several circumferentially spaced perforations located variable distances from the axis of the said crank head and adapting the lower end of the lock 38 to be connected to said crank disk for variable thrust or crank actions.

By reference to Fig. 9 it will be noted that the surface of the blades 16^a of the feed screw, in a radial direction are straight or approximately flat; and by reference to Fig. 8 it will be noted that the operative surface of the main body of the feed screw in a radial direction is made concave. Furthermore, the concavity of the working face of the feed screw is such that its greatest depression is at the central portion of the said working face. This latter feature particularly is of very great importance, as will be presently more fully explained.

The coal or similar fuel which is to be fed to the furnace is delivered in a suitable way into the hopper 9. The direction or rotation of the feed screw 16 is indicated on Fig. 4, by reference to which it will be seen that the spiral blade of the feed screw cuts off the fuel from the bottom of the hopper against the sharp overlying edged portion of the inclined bottom section 9^a of said hopper, in such manner that the body of fuel in the hopper is not forced with any considerable pressure against the side of the hopper. Coal dust or screenings are very largely and quite generally used in furnaces employing automatic stokers, and this form of fuel when used by a feed screw through a spout has a very great tendency to pack tight in the spout and produce such friction that it is practically impossible to feed the material as far as usually required to deliver the same properly to the furnace grates. In fact, it frequently happens that very strong feed screws are twisted off in an attempt to deliver the fuel which has become tightly packed in the feed spout. It of course also follows that very great power is required to operate the feed screw even under the most favorable conditions hereto provided for.

My improved feed screw has been thoroughly tested in actual use and seems to be a solution of the problem of making a feed screw operative for the purposes above stated. Two highly important features contribute to this result. The first and more important of the two is the arrangement of the spiral feed blade with an increasing pitch or travel in the direction of the feed of the material. This in itself gives a spiral space of increasing width and conducting capacity, in the direction of the travel of the material and therefore constantly relieves the material pressure which would, with a feed screw of constant pitch and diameter, be accumulative and increasing. The second important feature is making the feeding surface of the feed screw concave in a radial direction. This tends to hold the material inward and materially reduces the outward pressure and friction of the material against the inner wall of the feed spout. The first and second noted features must be combined in the same feed screw in order to secure the desired result, and it is further important that the working face of the feed screw have its greatest concavity, or depression, approximately at its central portion, that is, about midway between its periphery and the line of its junction with the screw shaft. This gives the desired relief from both outward pressure of the material being fed against the spout, and against the shaft of the screw. A third important novel feature of the feed screw is the arrangement of the alternated and approximately flat blade sections in space or capacity through which the fuel is delivered from the feed spout upward through the bottom of the grate. These blade sections lift the fuel upward on to the top of the grate and insure good and proper distribution of the fuel over the upper surface of the grate.

By adjustments of the shaft 23, in respect to the gears 22, and already described, the rate of rotation of the feed screw may be varied, without changing the speed of the driving sprocket 26 or the primary source of power, and this as is evident provides for a variable supply of fuel to the furnace. Through the described connections 37, 38, 15, 12, 11 and 10, the rocking grate bars will be slowly but constantly moved so as to keep the proper amount of ashes worked through the grate and into the ash pit. With the adjustable connection of the link 38 to the arm 15 and crank head 37 makes it possible to vary at will, the extent of oscillatory movement imparted to the rocking grate bars, at each complete vibration. The number of vibrations, per unit of time of the rocking grate bars, varies with the speed of the rotation of the feed screw, but the grate cleaning action may be independently varied by the adjustments just noted. The efficiency of the mechanism just described has been demonstrated in actual practice.

What I claim is:

1. The combination with a furnace and a grate therein, of a feed spout leading into said furnace and opening upward through the bottom of said grate, and a feed screw rotatively mounted in said feed spout and provided at its delivery or inner end with flat contiguous and connected oblique blade sections, the adjacent oblique blade sections being reversely inclined, and the said oblique sections being arranged to work in the space through which the fuel is delivered upward from the said feed spout through said grate.

2. The combination with a furnace and a grate therein, of a feed spout leading into said furnace and opening upward through the bottom of said grate, and a feed screw rotatively mounted in said feed spout, the spiral blade of which screw throughout the main body portion thereof having a progressively increasing pitch in the direction of the feed of the material into the furnace, the working face of said blade being concave in cross section, and the said feed screw at the point of delivery of the fuel upward through said grate being provided with contiguous and connected flat blade sections, the adjacent members of which are inclined in reverse directions, and the said spiral and flat blade sections being cast integral with said feed screw and the first of said flat blade sections being integrally united with the spiral blade of said screw.

3. The combination with a furnace and a grate therein, said grate having rocking sections, of a feed spout extending into said furnace and arranged to deliver the fuel upward from the bottom of said grate, a feed screw working in said feed spout, a power driven variable speed transmission mechanism for driving said feed screw, and connections from the said variable speed mechanism for oscillating the said rocking grate sections, the said grate operating connections being adjustable to vary the extent of vibration of the rocking grate sections independently of the adjustments of the variable speed mechanism.

In testimony whereof I affix my signature in presence of two witnesses.

DAVID J. AMES.

Witnesses:

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