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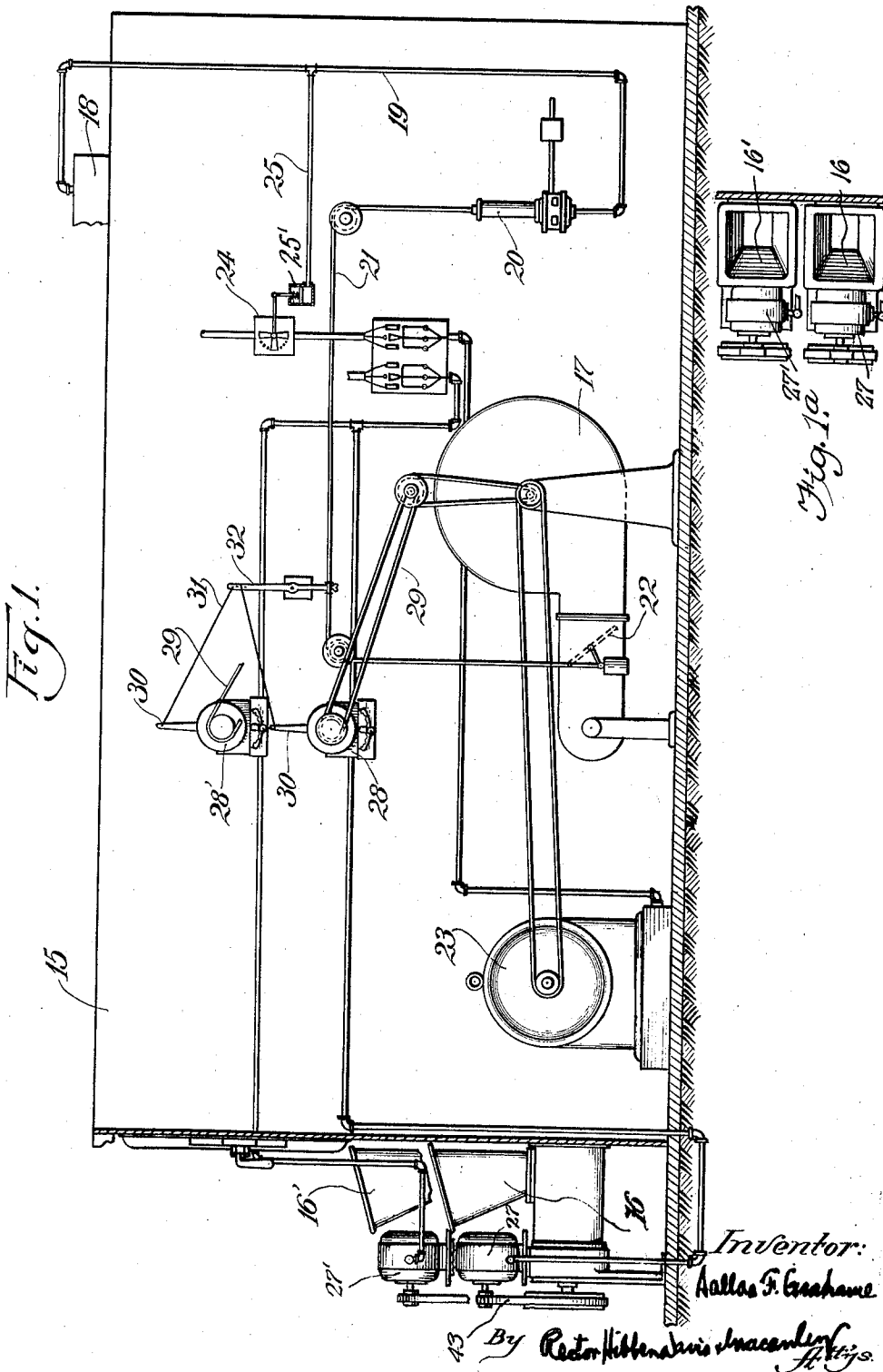
D. F. GRAHAME

1,632,401

STOKER RAM DRIVE

Filed Jan. 28, 1922

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D. F. GRAHAME

STOKER RAM DRIVE

Filed Jan. 28, 1922

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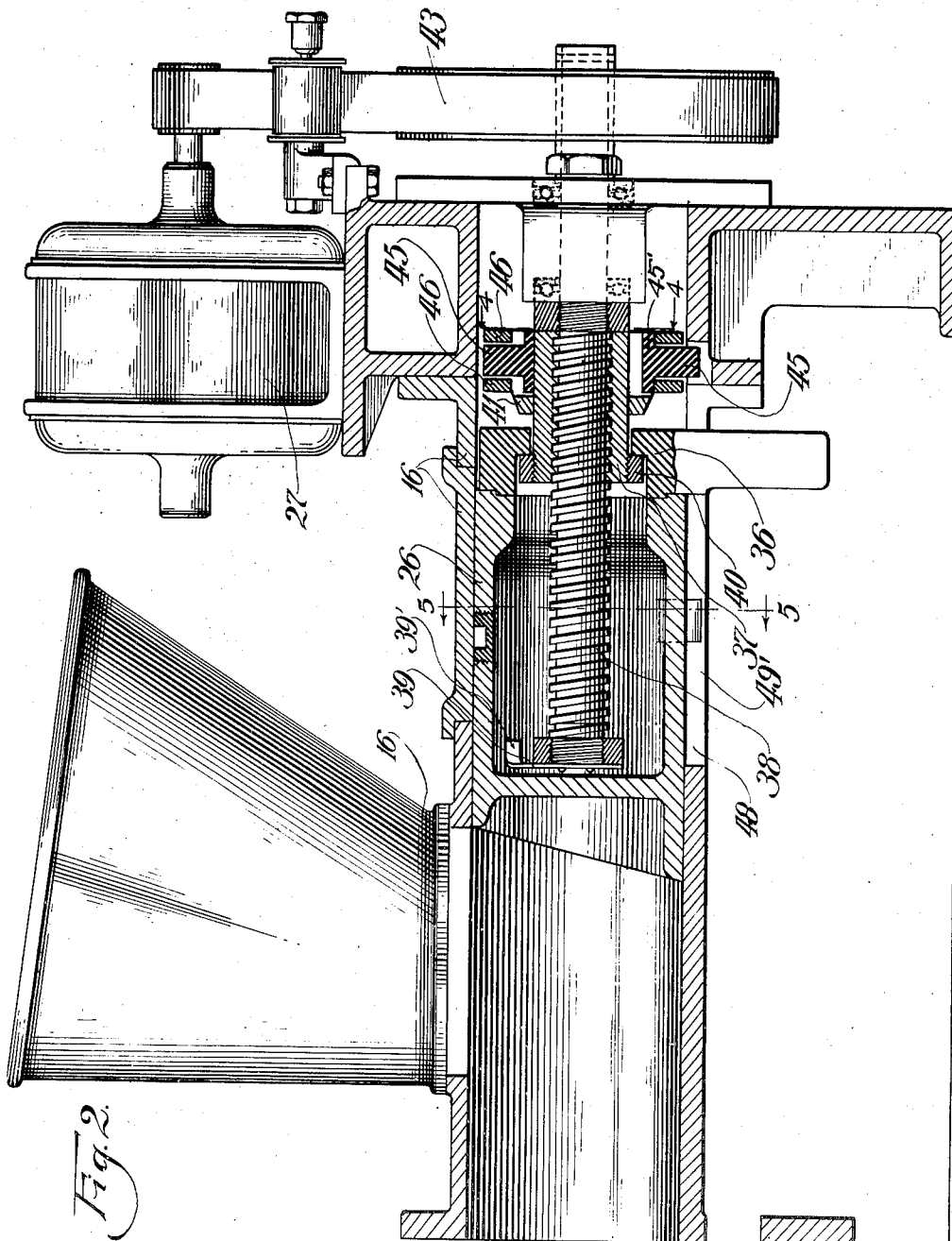


Fig. 2.

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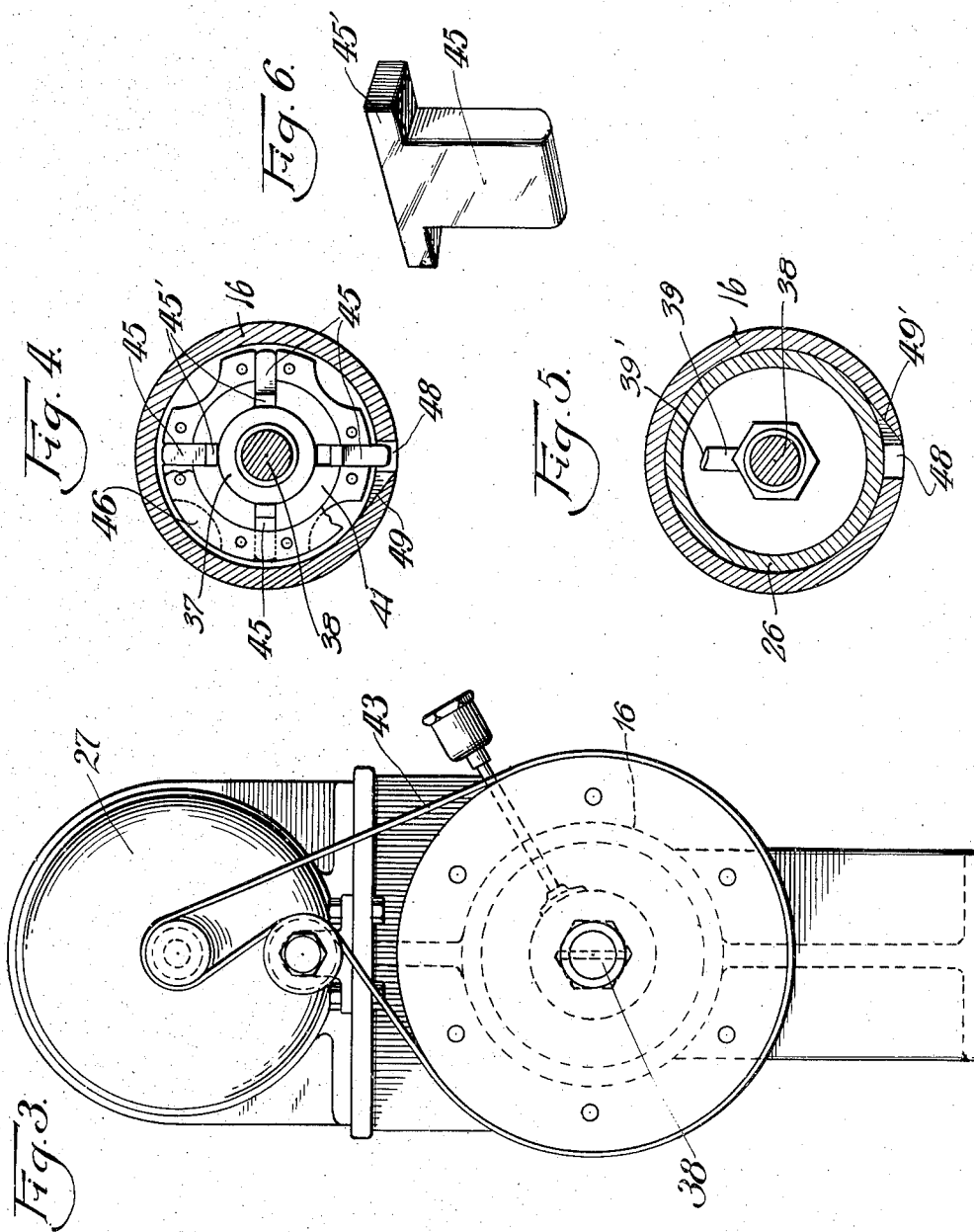
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STOKER RAM DRIVE

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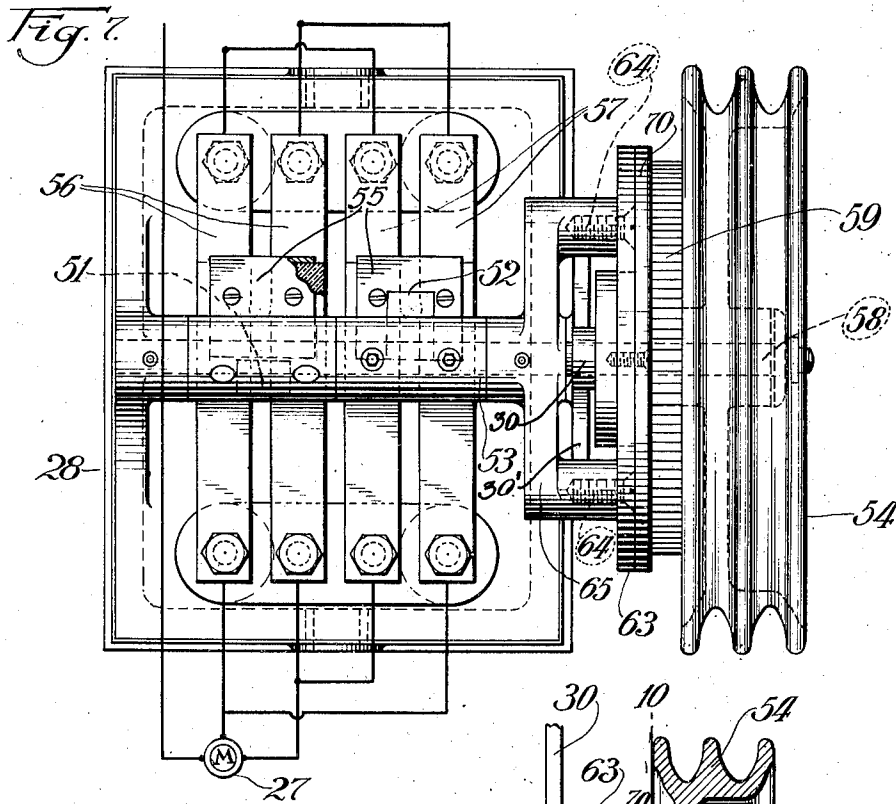
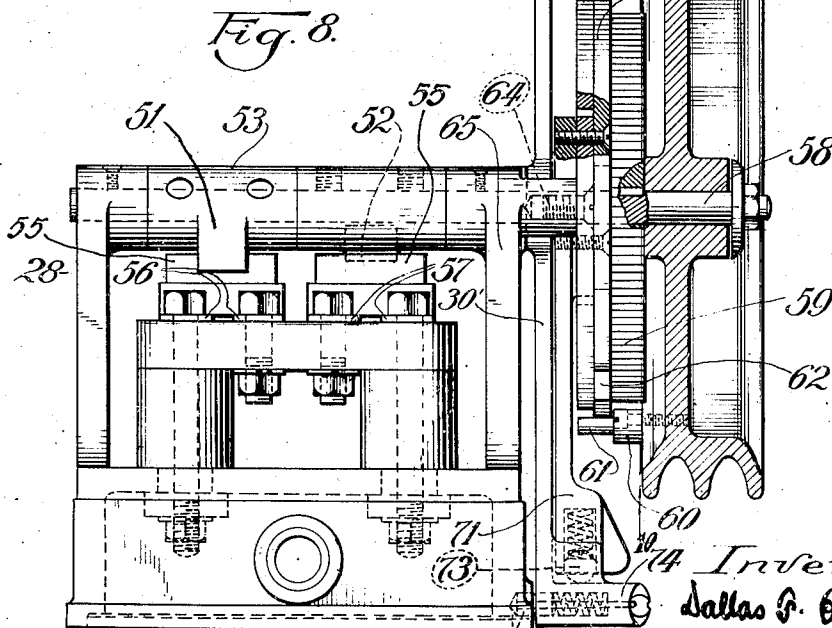
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STOKER RAM DRIVE

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STOKER RAM DRIVE

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Fig. 10.

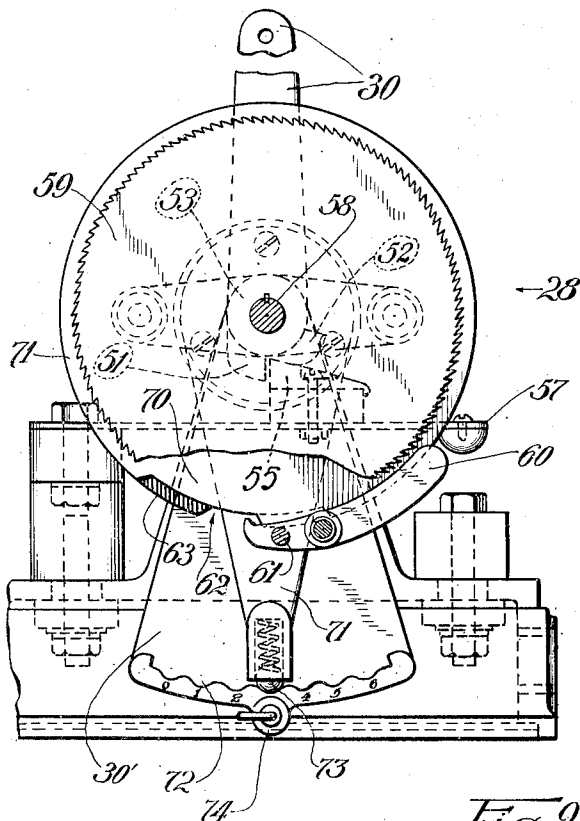
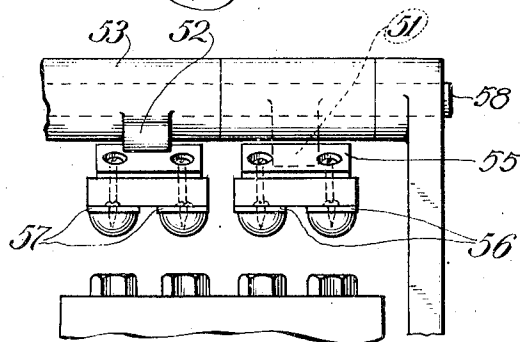


Fig. 9.



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UNITED STATES PATENT OFFICE.

DALLAS F. GRAHAME, OF TORONTO, ONTARIO, CANADA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO RILEY STOKER CORPORATION, OF WORCESTER, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

STOKER-RAM DRIVE.

Application filed January 28, 1922. Serial No. 532,429.

In the installation of underfeed stokers, it is sometimes desirable that the coal-feeding ram be operated by a mechanical drive, rather than a steam cylinder piston, and further it is desirable that the ram of a single-unit stoker, or each ram of a multiple-retort stoker shall be operatable at intervals the periodicity of which is settable by a controlling device individual to that ram, and which periodicity may, if desired, be additionally subject to modification (affecting all of the rams of a multiple-retort furnace in common) by a suitable general regulator, responsive, for example, to boiler-pressure conditions.

These and other desiderata I satisfy in the embodiment of my invention, wherein I provide for the ram, or each ram, a novel screw-drive; preferably provide for each such ram-drive an individual source of power supply such as an electric motor; and arrange for individualized motor control to afford the desired individual periodicity of operation of each ram; although subject, if desired, to further control over the periodicity of ram operation, which further control may be common to all of the ram-driving devices.

Attainment of these desiderata by simple, rugged, advantageous structures, and efficient coordination of the devices are among the objects of my invention sought and attained; and other and further objects will become apparent from the following description setting forth one particular embodiment of my invention for purposes of disclosure.

In the drawings Fig. 1 is a schematic elevation of an underfeed stoker drive installed in accordance with my invention; Fig. 1^a is a plan view of two stoker rams and their driving motors; Fig. 2 is a longitudinal vertical section, with parts in elevation, of an individual screw-drive; Fig. 3 is a front end view thereof; Fig. 4 is a sectional detail on line 4—4 of Fig. 2, showing the pawl-carrying nut with parts thereof broken away; Fig. 5 is a section on line 5—5 of Fig. 4; Fig. 6 is a perspective detail of one of the pawls of said nut shown in Fig. 4; Figs. 7 and 8 are respectively plan view and end elevation of a switch structure, and Fig. 9 is

a fragmentary detail of switch-parts viewed from the right side of Fig. 10; Fig. 10 is a side elevation, with parts broken away, of the ratchet and pawl mechanism of the switch, as seen on line 10—10 of Fig. 8.

In the drawings 15 indicates generally a furnace to which fuel is supplied by an underfeed stoker involving one or more hopper-equipped ram structures (one being shown at 16 and another schematically indicated by representation of its hopper 16') for fuel consumption under draft supplied by fan 17 for generation of steam in boiler 18 in which the pressure should, in many instances, be maintained approximately constant. For part of the regulating action, which may be effected in generically-known fashion, I schematically indicate that the boiler 18 has steam pipe connection 19 with a damper regulator 20, the movable element of which has a movable connection, typified by cord 21, with a suitable draft-regulator, typified by weighted damper 22 in the fan-duct. As the boiler pressure drops the damper regulator 20 pays out cord 21 to permit the damper 22 to move toward open position. Further, typically of known control of air supply accordantly with steam pressure, the fan 17 is indicated to be driven from an electric motor 23, governed as to speed by control rheostat 24 which is responsive to boiler pressure supplied through pipe 25 to a pressure-responsive rheostat-actuator 25' of any suitable construction. Thus, by the means suggested, or other known organization, fan-speed will be increased and draft-controlling damper will be opened further, upon drop in the boiler pressure; opposite regulating action of the parts following rise in the boiler pressure.

Accordantly with the stated regulation, it is desirable that fuel supply shall be augmented when boiler pressure drops and decreased when the pressure rises, and this is accommodated in the organization herein shown. Preferably the plunger, or ram proper, 26, of each ram structure is driven by a separate electric motor, respective motors 27 and 27' for the two ram structures 16 and 16' being diagrammatically shown. Each such motor has electrical switch-means for controlling its operation individually,

but these switch-means are jointly controllable in unison. Considering first the controlling-means for motor 27 singly, a timing-switch structure 28 is connected with its energizing circuit, and the timing switch is constructed for periodic operation. By suitable construction shown in Fig. 10 its periodicity is variably settable by manual adjustment. In the construction shown the periodicity of such switch operation is also controllable accordantly with air-supply regulation. To this end a rotatable part of said switch 28 is actuated by a power connection 29 from the fan shaft, to vary its speed of rotation as the fan speed varies. Additionally, in the construction shown periodicity of operation of the switch 28 is controllable directly from the boiler steam pressure, and to this end the timing-switch structure 28 has a switch controlling arm 30 operatively connected with a part which is movable in response to variations in boiler pressure, such operative connection being diagrammatically illustrated in Fig. 1 where the arm 30 is shown as connected through a suitable lever 32 with the cord or cable 21 so that movement of said arm 30 is controlled by the boiler-pressure responsive device 20 aforesaid. Where a plurality of motors are to be controlled, in a multiple-stoker equipment, the power connections 29 thereof may all be driven in common from the fan 17 and the switch-controlling arms of all of the switches (28 and 28') may be connected in common to lever 32, each such connection preferably involving a link 31 that can be disconnected. In general it is desirable that the dwells or intervals between operations of each motor, to cause functioning of the ram plunger, may be shortened or lengthened accordantly with respective drop or rise of boiler pressure, and the connections diagrammatically illustrated, together with the mechanical construction of the time-switch hereinafter described are effective to that end.

In the specific construction shown ram-plunger 26 is hollow, for reception of the operating screw, and is provided with a fixed reducing collar 36 at its open, outer end for cooperation with the traveling nut 37 which rides on the screw-shaft 38. The hollow plunger, kept practically closed by the collar and nut, is preferably grease-filled, and the screw is provided on its end with a grease-stirring blade 39 with a suitably-angled end 39'. The collar 36 is loosely embraced (for some axial lost-motion) between collar 40 and head 41 fixed on the body of nut 37 or made integral with it, and as the nut travels along its screw stem it will carry with it the ram-plunger. The nut structure will idly turn in unison with the screw, rather than travel axially along the screw and work upon the ram plunger, whenever

the nut is left free for such rotative movement, and so I make provision whereby the freedom or restraint of the nut in this regard is controlled in such fashion that after completing an excursion along the screw shaft in either direction the nut will turn idly with the screw until such time as the direction of rotation of the screw shaft is reversed, whereupon the nut will be restrained against idle rotation and forced to make a new excursion in return-direction along the screw. Motor 27 drives the screw-shaft 38 through simple belt and pulley connections 43, and the direction of screw rotation is reversed by reversal of the motor. For control of the idling action of the nut above mentioned, the nut-head 41, easily fitted into the cylinder, or body structure, of ram 16, carries a series of radially arranged gravity pawls 45, radially shiftable in notches of the head, these pawls being laterally positioned by side rings 46 which also act as stops for the pawl-lugs 45' to limit radially-outward displacement of the pawls. Any such pawl 45, when in bottom position as shown in Fig. 4, engages in a slot 48 extending longitudinally along the bottom of the cylinder, but at each end of the range of travel of the nut one wall of the slot 48 is beveled as at 49 or 49', these two bevels being oppositely arranged, so that when an active pawl reaches either end of its range of excursion it encounters a beveled surface across which the pawl will readily slip (being cammed back into its recess), enabling the nut to idle, pending reversal of direction of movement of the screw shaft. The slot has, opposite its level, a squared shoulder so that, after such an idling operation, reversal of the screw-shaft will cause the first approaching pawl to engage the squared shoulder, and thereupon the nut will start its return travel.

It will be apparent that the screw-drive construction above characterized is importantly related to the fact of motor drive of the screw, in that the slight lost-motion afforded between collar 40 and head 41 of the screw nut as respective plunger-pushing abutments, and the collar 36 of the plunger to be pushed thereby, insures that the motor will pick-up without substantial load, and the free rotation of the nut after completion of a working excursion does away with the necessity for accurately timing the cessation of running of the motor. Especially this latter is important where the actual running time of the motor is variable, as it will be with the controlling devices herein illustrated.

The controlling switch 28 for the electric motor 27 is shown (Figs. 7 to 10) as a reversing switch construction having two pairs of normally open contacts suitably connected in the circuit of the reversible motor 27 so

that closure of one pair will energize the motor for operation in one direction while closure of the other pair will energize the motor for operation in reverse direction. These two pairs of contacts are respectively closable by cams 51 and 52 on a rotor 53 which is uni-directionally operatable, step by step, from a constantly running power wheel or pulley 54, the step-length through which the rotor will be advanced by each revolution of the power wheel being variable by adjusting means, of which more will be said. Such adjusting means, however, are preferably adjustable automatically and to this end they are shown as including the arm 30 which (as heretofore stated) is automatically movable in response to variations of steam pressure. More specifically, the insulatedly connected pair of contactors 56 carry an inclined wear plate 55 arranged in the path of rotation of cam 51, so that they will be cam-closed upon the relatively fixed pair of contact points 56' for a predetermined portion of each cycle of revolution of the rotor, such switch closure establishing an energized circuit for the motor. Similarly, the duplicate structure of contactors 57 will be sprung into engagement with the fixed points 57' by the action of cam 52, to establish a reverse circuit for the motor, the cams working successively, and their arrangement preferably being such that closure of switch 57 occurs rather shortly after closure of switch 56, leaving a considerable portion of a complete turn of the rotor 53 to be made before the first-acting cam 51 again comes into operation on the next cycle. The power wheel 54 runs loose on the rotor shaft 58, but to the latter a ratchet wheel 59 is fixed, and upon the wheel 54 is carried a pawl 60, gravity-urged toward the ratchet wheel. The pawl engages the ratchet only when lifting pin 61 near the pawl-nose drops into a peripheral recess 62 of a shield ring 63 which is fastened as by screws 64 to the frame 65 of the switch. The effective length of the shield-notch is variable by adjustment of another notched shield-plate 70, the hub-portion of which, projecting through the center opening of the fixed shield-ring, is secured to and movable with a manual adjusting lever 71 pivoted coaxially with shaft 58. The before-mentioned lever 30 for automatic control of step-length is similarly pivoted and extends alongside of lever 71 as a segmental end 30', provided with a series of notches 72 with any selected one of which a spring-latch 73 of the manual adjusting arm 71 may engage. Therefore, with lever 30 in an intermediate or neutral position, the manual adjusting arm 71 may be engaged therewith at such point as the operator selects so as to give any desired effective size of notch 62 within the allowable range of adjustment, but if lever 30 be automatically

moved to one side or the other of its initial position, the effective size of notch 62 will accordingly be varied, lever 30 carrying manual adjusting lever 71 with it. To enable automatic adjustment to be dispensed with on occasions, lever segment 30' is provided with a spring latch 74 that may be locked in a recess 75 of the switch frame 65.

It will now be apparent that, with each of several rams individually motor-operated, the switch for controlling each ram-driving motor may individually be set to govern the desired periodicity of operation of the motor. If, as herein suggested, the power wheel of the motor-controlling switch be itself driven from the fan shaft or some other part the speed of which is dependent upon conditions of the furnace or of the boiler, the time taken for a complete cycle of operations of the individually adjusted switch will accordingly be varied; and furthermore the periodicity within that variable unit of time may further be automatically varied by the adjustment of lever 30 accordantly with conditions existing in the furnace or the boiler. Notwithstanding that, as it plainly follows, the actual length of time that the ram driving motor will work in causing an operation of the ram screw will thus be a variable quantity, the connections between the motor and the ram-plunger, effected through the screw mechanism, will invariably give the motor time to pick up substantially free from load, and permit the motor to run after the ram plunger has completed its full excursion, with the screw-nut simply idling.

While I have herein described in some detail a particular embodiment of my invention it will be apparent to those skilled in the art that in many respects my invention, under the appended claims, is not limited to the specific details of structure and arrangement that are shown in the drawings for illustrative purposes, and that in many specific features of novelty and advantage my invention may be embodied in forms widely differing in detail from those herein illustratively shown.

I claim:

1. The combination with an underfeed stoker having a plurality of rams, a boiler, and a boiler-pressure responsive device, of respective ram-plunger driving means, an electric motor for each said means, a circuit control switch for each motor to start and stop the same, and means controlled by said boiler-pressure responsive device controlling the periodicity of such operation of said switches, whereby the duration of dwells between ram-plunger reciprocations is varied.

2. The combination with an underfeed stoker having a plurality of rams, a boiler, and a boiler-pressure responsive device, of

- respective ram-plunger driving screws, an electric motor for each said screw, arranged to actuate it, a circuit control switch for each said motor, arranged to start and stop it, and means whereby said pressure-responsive device controls the periodicity of such operation of said motor switches thereby to vary the duration of dwells between ram-plunger reciprocations.
3. The combination with an underfeed stoker having a plurality of rams, a boiler, and a boiler-pressure responsive device, of respective ram-plunger driving screws, an electric motor for each thereof, a circuit control switch mechanism for each motor individually settable to determine periodicity of operation of each motor, and means for operating said mechanisms controlled by said pressure-responsive device.
4. The combination with an underfeed stoker having a plurality of rams, a boiler, and a boiler-pressure responsive device, of respective ram-plunger driving screws, an electric motor for each thereof, a circuit control switch mechanism for each motor including means settable to determine periodicity of the motors' operation, means for operating said mechanisms, and means controlled by said pressure responsive device for varying the setting of said switch parts.
5. The combination with an underfeed stoker having a plurality of rams, of respective ram-plunger driving means, an electric motor for each thereof, a circuit control switch mechanism for each motor individually settable to determine periodicity of said motors' operation, and means for operating said mechanisms.
6. The combination with an underfeed stoker having a plurality of rams, a boiler, and a boiler-pressure responsive device, of respective ram-plunger driving means, an electric motor for each thereof, a circuit control switch mechanism for each motor individually settable to determine periodicity of each motor's operation, and means for operating said mechanisms controlled by said boiler-pressure responsive device to vary the time of a cycle of operations of said switches.
7. The combination of a boiler, an underfeed stoker therefor having a ram-plunger, a boiler-pressure responsive device, a motor-controlling switch, means controlled by said responsive device to control said switch, an electric motor connected with said switch to be started and stopped thereby, a screw driven by the motor, and means for connecting said screw and the ram plunger to drive the latter in either direction, said means arranged to idle during continued rotation of the screw after screw-impelled movement of the plunger to an end of a definite travel-range.
8. The combination of a boiler, an underfeed stoker therefor having a plurality of ram-plungers, a boiler-pressure responsive device, and a plurality of sets of controlling instrumentalities, each respectively for one of said ram-plungers, each comprising a motor circuit controlling switch operatively connected with said pressure-responsive device for control thereby, an electric motor connected with said switch to be started and stopped thereby, a screw driven by the motor, and means for connecting said screw and the ram-plunger to drive the latter in either direction, said means arranged to idle during continued rotation of the screw after screw-impelled movement of the plunger to either end of a definite travel-range.
9. The combination of a boiler, a steam-pressure responsive device operatively associated therewith, an underfeed stoker for said boiler having a ram-plunger, an electric motor operatively connected with said ram-plunger to actuate it, a circuit-controlling switch for said motor to start and stop the same, and means normally operating periodically to actuate said circuit-controlling switch to occasion dwells between operations of said plunger by stoppage of the motor, said means being operatively connected with said pressure responsive device to be controlled thereby for variation of the periodicity of operation of said switch.
10. The combination with an underfeed stoker having a feed-ram and a steam boiler, of an electric motor operatively connected with said ram to drive it, a circuit-controlling switch mechanism for said motor, said mechanism being power driven to open and close the motor circuit periodically; and means for varying the periodicity of operation of said switch, said means being operatively connected with said boiler to respond to changes of steam-pressure conditions.
11. The combination of a boiler, an underfeed stoker therefor having a ram-plunger, a steam-pressure responsive device operatively associated with the boiler, a reversible electric motor operatively connected with said ram-plunger to drive the latter in reciprocation as the direction of operation of the electric motor is reversed, a switch mechanism including electric switch means in the circuit for said motor and adapted and arranged to start, stop and reverse said motor, means to drive said switch mechanism in cyclic operation, and means controlled by said pressure-responsive device controlling the periodicity of said cyclic operations of the switch mechanism.
12. The combination of a boiler, an underfeed stoker therefor having a ram-plunger, a steam-pressure responsive device operatively associated with the boiler, a reversible electric motor operatively connected with said ram-plunger to drive it in reciprocation, reversing the reciprocative direction as

the direction of operation of the motor is reversed, a timing-switch mechanism including electric switch means in the circuit for said motor and adapted and arranged to start, stop and reverse said motor, means to drive such switch mechanism in cyclic operation, means controlled by said pressure-responsive device controlling the periodicity of said cyclic operation of said switch mechanism, and additional means, manually settable, for varying the periodicity of said cyclic operations. 10

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