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ELECTROMOTOR-DRIVEN MECHANICAL STOKERS

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Fig. 1.

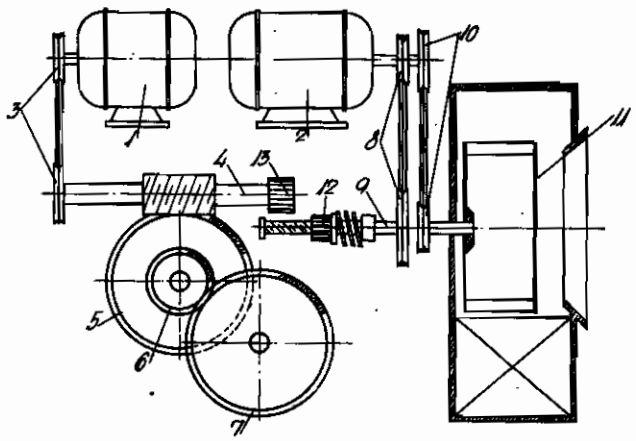


Fig. 2.

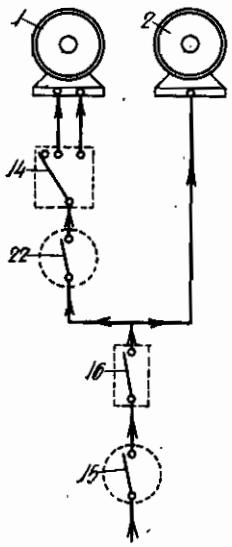


Fig. 3.

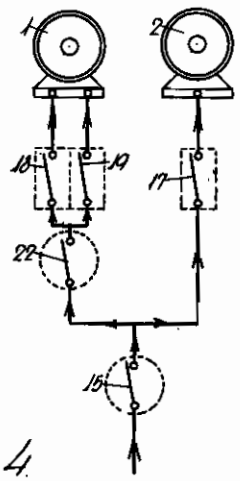
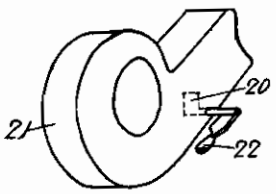


Fig. 4.



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ALIEN PROPERTY CUSTODIAN

ELECTROMOTOR-DRIVEN MECHANICAL STOKERS

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It is commonly known, from steam boilers and hot-water boilers in apartment houses, schools, cottages and the like and for industrial boilers, to use mechanical firing devices, the so-called stokers in which the fuel meehanically by means of a feeding deviee, is moved towards a furnace, and in which the combustion air is supplied under pressure from one or more fans to an air chamber below or around, maybe both below and around, the combustion grate. The consumption of heat in most heating plants is subject to many variations during the course of the day and night, for which reason several daily adjustments of the fuel-feeding member of the mechanical stoker are required. For this purpose generally a mechanical gear operated by hand is used between the driving parts of the stoker and the feeding device. These adjustments, however, cannot in practice accurately follow the large and frequently swinging variations in the amount of heat required. For the stokers used heretofore it may further be said that if the driving member viz. the electromotor fails, the operation may become stopped, and the production of heat may consequently cease. This drawback could heretofore only be remedied by fitting the plant with spare stokers which is an expensive arrangement.

The invention has for its object, by the use of two or more electromotors for driving the firing device, to provide a stoker that is arranged in such a manner that the adjustment of the supply of fuel to the furnace may either be effected manually by means of one or more hand-operated electric contact devices in the circuit for the individual electromotors or entirely automatically, in that the gear-changing is regulated electrically by means of one or more automatic apparatuses which operate either for rising or falling temperatures of the water in the hot-water boiler or for rising and sinking steam pressure in the steam boiler, in such a manner that the stoker, without any inspection, will always operate automatically at a rate suiting the quantity of heat required at the moment concerned. A further object of the invention is to provide a stoker adapted to continue the supply of fuel, even when one of the driving motors of the stoker might fail, and consequently the security of operation will be increased, and the demand for spare stokers in a plant will be smaller.

The invention is illustrated on the drawing in which Fig. 1 shows a construction of a driving plant with two motors for a firing plant, Fig. 2 a wiring plant showing how the change of gear in a driving plant with two motors is operated manually by means of one or more electric contact devices, Fig. 3 a wiring diagram showing how the same driving plant is rendered entirely automatic, as far as the change of gear is concerned, by means of automatically operating electric contact devices, and Fig. 4 a construction of a tilting contact.

Fig. 1 shows how two or more motors coupled singly and independent of one another to the stoker may operate as a driving power for the fuel-feeding device and for the fan or, maybe, for several fans. 1 and 2 are two electric motors, one of which the motor 1 either by way of chain drive, direct coupling, gear wheel drive or, as shown, by way of cord discs and a wedge belt 3 drives a worm shaft 4. The worm shaft 4 drives, by way of a worm wheel 5, one or more sets of gear wheels 6 and 7. The shaft of the gear wheel 7 is either directly or by way of a coupling connected to the feeding device for the fuel. The motor 2 drives either by way of chain drives, direct coupling, a gear-wheel drive or, as shown by way of cord pulleys and wedge belt 8, a shaft 9 in the gearing device and besides, for instance as shown, by way of cord pulleys and belt drives 10 or one or more fans 11. Between the shaft 9 and the worm shaft 4, there is inserted a Bendix pinion or free wheel 12 known per se which acts as an automatic coupling. If the motor 2 drives the stoker, and the motor 1 is not connected to the circuit, the shaft 9 will drive the worm shaft 4 and, thus, the feeding device for the fuel, as the coupling 12, when the motor 2 starts, is flung into engagement with the gear wheel 13 on the gear shaft 4. If now the motor 1 is started, the number of revolutions of the worm shaft is increased, as the gear ratio from motor 1 to the worm shaft is higher than the gear ratio from the motor 2 to the worm shaft, so that the coupling 12 will be flung out of engagement with the gear wheel 13 of the worm shaft 4. Motor 1 alone drives then the feeding device at a higher gear, and motor 2 alone the fan. The quantity of fuel supplied to the furnace is consequently regulated by coupling to the feeding device either one or the other of the motors 1 and 2.

If more than two motors are used, one or more of the same may solely drive the fan, while for instance two other motors are coupled to the shafts 4 and 9, respectively. Each of the last mentioned motors may have two or more numbers of revolution, and thus the stoker may be given two or more speeds.

In Fig. 2 1 and 2 indicate electromotors out of

which the motor 1 may have two or more speeds. 14 is an electric change-over contact device known per se with two or more contacts acting as changing switches for the two or more speeds of the motor 1. 15 is a contact by means of which the supply of current to the motors 1 and 2 can be closed or interrupted, and 16 is an automatic contact device reacting either for rising and sinking water temperatures or for rising and falling steam pressures.

When the current is closed by means of the contact 15, and the automatic contact device 16 has been closed, then the motor 2 will first start, driving at the same time the feeding device at lowest gear as well as the fan. If the current is closed by way of the change-over contact 14 to motor 1, then the latter which drives the feeding device at a higher speed will take care of the operation of the feeding apparatus, while motor 2 is uncoupled automatically by means of the automatic coupling 12 (Fig. 1), but continues to drive the fan. By way of the contacts in the change-over switch 14 the current may then be connected to another one of the speeds of motor 1, after which the feeding device acquires a still higher speed, while motor 2 continues to drive the fan. The contacts 14 and 15 may be disposed in other rooms than the feeding device, in such a manner that stop and start as well as gear-changing of the feeding device will be effected by remote control.

Fig. 3 shows two motors 1 and 2 of which the former one may have two or more speeds. 17, 18 and 19 indicate automatic contact devices known per se which react either for rising and falling water temperatures or for rising and falling steam pressures. When the stoker is started by means of a contact 15, and the contact in the device 17 is closed, the motor 2 will first start, while driving at the same time the feeding device at lowest gear as well as the fan. By way of the contact in device 18 the current is subsequently connected to motor 1 which then alone and at a higher speed drives the feeding device, as the motor 2 is uncoupled automatically from the feeding device by means of the automatic coupling (12 on Fig. 1), but continues to drive the fan. By way of the contact in device 19 the current may then be connected to another one of the speeds of motor 1, and thus the feeding member will acquire a still higher speed, while motor 2 continues to drive the fan.

The number of speeds for the stoker may be varied from one to more by means of the number of motors and the number of speeds for each of these. On the drawing the motor 1 is assumed to have two speeds, the motor 2 one speed.

If the contact 19 breaks the current automatically, for instance at too high a water temperature relatively to the heat requirements or too high a steam pressure, then the current to one of the two or more speeds of motor 1 will be broken, while at the same time a current is closed automatically to another and lower one of the speeds of motor 1, and thus the speed of the stoker will be reduced. At any further rise of the water temperature or the steam pressure, the contact in the device 18 will break the current to the lowest speed of motor 1, and motor 1 will stop, after which the motor 2 is coupled by means of the automatic coupling 12 to the fuel-feeding device at the lowest gear, as the gear wheel on the coupling 12 runs forward on the coarse screw thread, and comes into engagement with the gear wheel 13, when the latter has its lowest number of revolutions, and motor 2 acts then as a driving power for the fuel-feeding device as well as for the fan. If then the water temperature or the steam pressure rises further, the contact in the device 17 will automatically break the current to motor 2, and the stoker stops then entirely. At falling water temperature or steam pressure owing to a rising consumption of heat, the stoker will first be started at the lowest gear, and then an automatic adjustment of the stoker will be effected in opposite succession, from a lower to a higher and higher gear, as the contacts 17, 18 and 19 will be closed in succession.

By constructing the gearing arrangement of the stoker as shown by Fig. 1, with two or more motors acting independently of one another as a driving power by means of the coupling 12, and by letting these motors be controlled by automatic devices 17, 18 and 19, the advantage is attained that the stoker at any time not only automatically starts and stops, but also automatically changes gear, in such a manner that the speed of the fuel supply closely follows the variations in the heat required.

If the motor 1 fails for one reason or another, the supply of fuel will not cease, as the motor 2 in that case automatically, by means of the coupling 12 is coupled to the feeding device at the lowest gear, and the stoker continues then in this gear, and cessations in the operation will therefore occur less frequently, and spare stokers for the heating plant will thus not be required.

Fig. 4 shows a tilting contact inserted in the air duct from the fan of the stoker and consisting of a tilting or swinging device, for instance a plate 20 which is pivoted about a horizontal or vertical shaft in the air duct 21, on which shaft an electric contact is disposed which closes or breaks the controlling current or the main current to the motor which drives the feeding device for the fuel. On the drawing the contact is shown as a mercury tube 22. The tilting contact is shown on Figs. 2 and 3 as 22.

In the position of repose, the tilting device stands with the plate 20 vertical, and the contact 22 is disconnected. If for instance motor 2 is connected, then fan 11 will be started, and the resulting pressure in the air duct 21 tilts the plate 20 whereby the current is closed in the mercury tube 22, and only when this current is closed the current can reach the motor 1.

By this arrangement a co-operation is attained between the operation of the fan and the operation of the feeding device, as the motor 1 cannot drive the feeding device, unless the fan is running. The fan may be imagined to stop, for instance when the safety fuses of the motor 2 are blown, but as the tilting contact thus breaks the current to the motor 1, the latter will be stopped automatically. By means of the tilting contact the supply of fuel to the furnace will thus be stopped, when the quantity of air required for the combustion is not supplied by the fan.

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