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2,730,707

SIGNALLING DEVICES FOR COKE-OVEN BATTERIES

Filed April 18, 1951

4 Sheets-Sheet 1

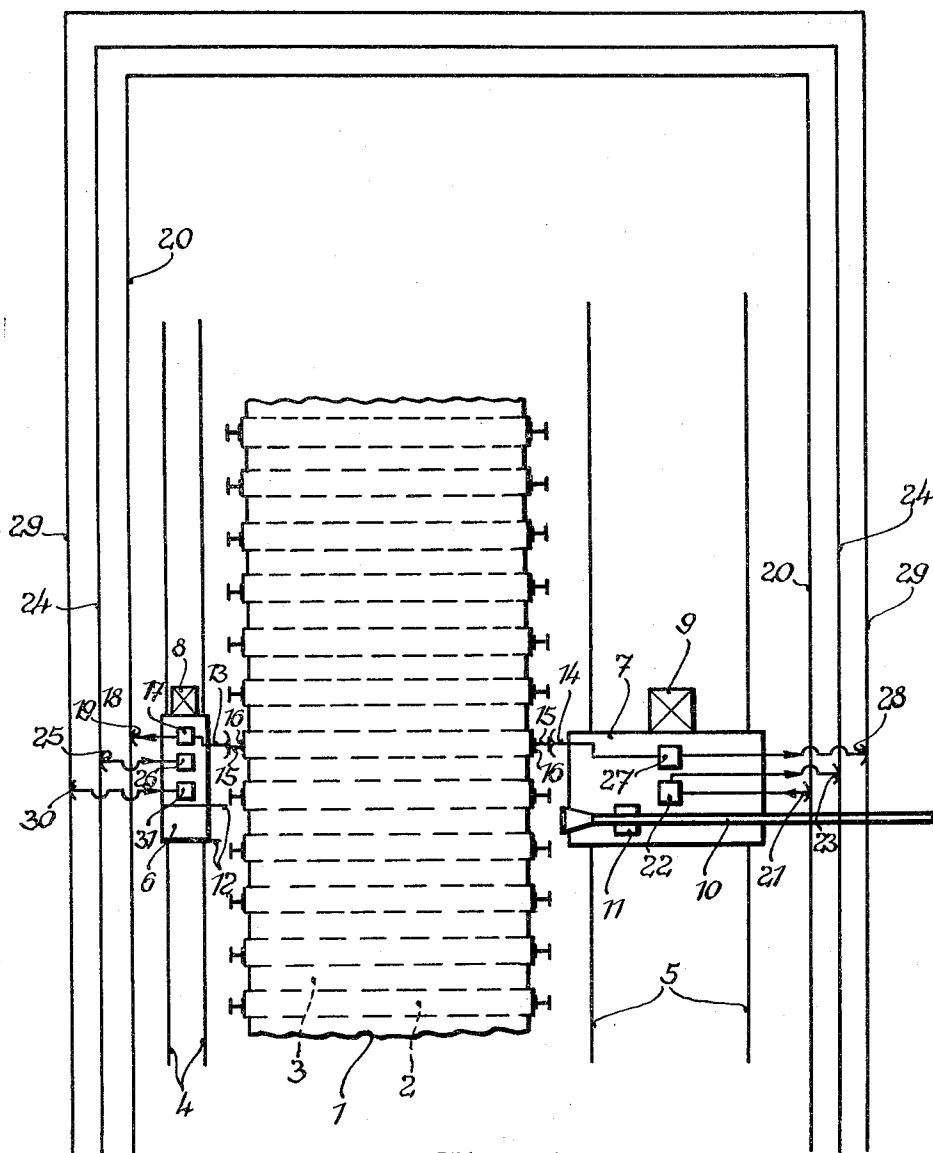


Fig. 1

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4 Sheets-Sheet 2

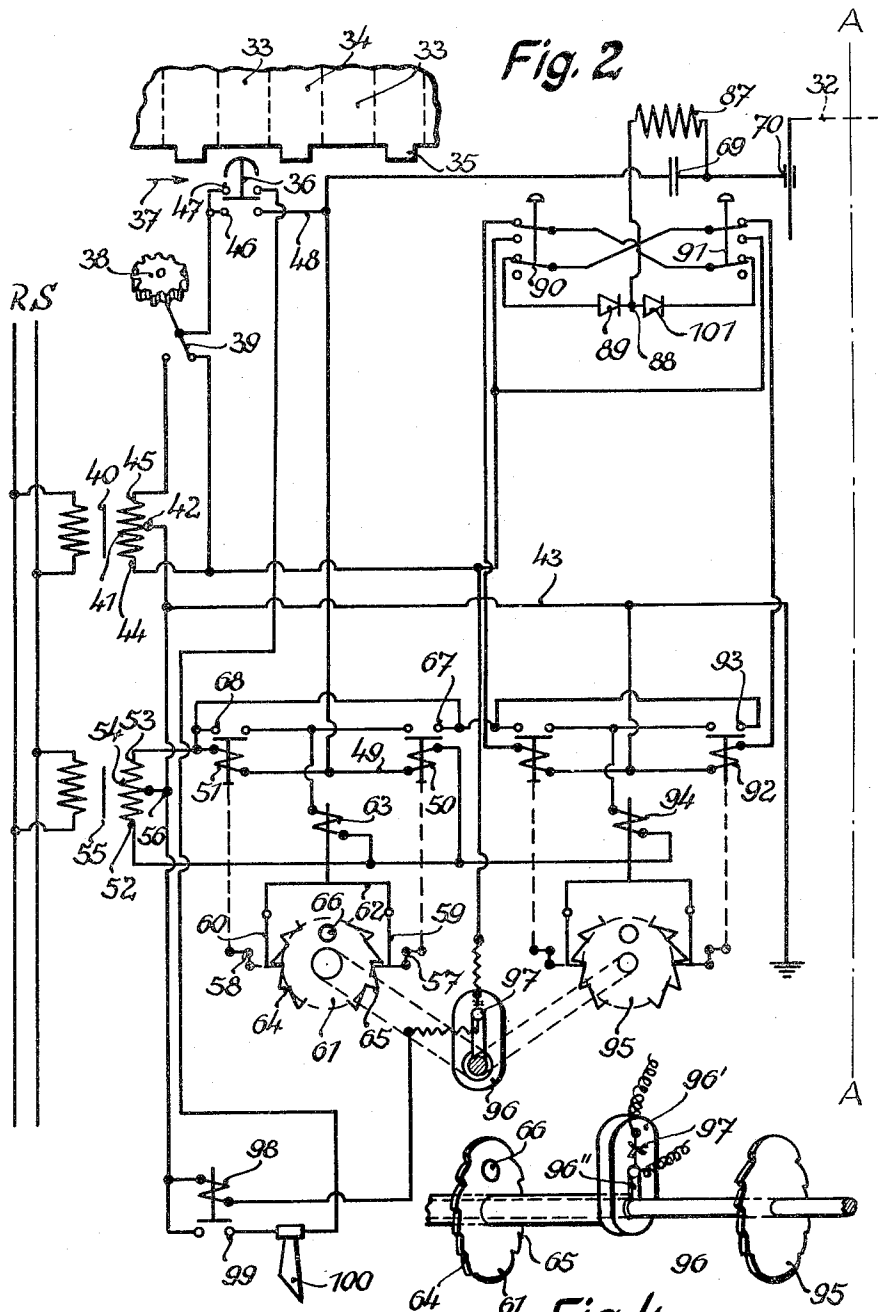


Fig. 4

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4 Sheets-Sheet 3

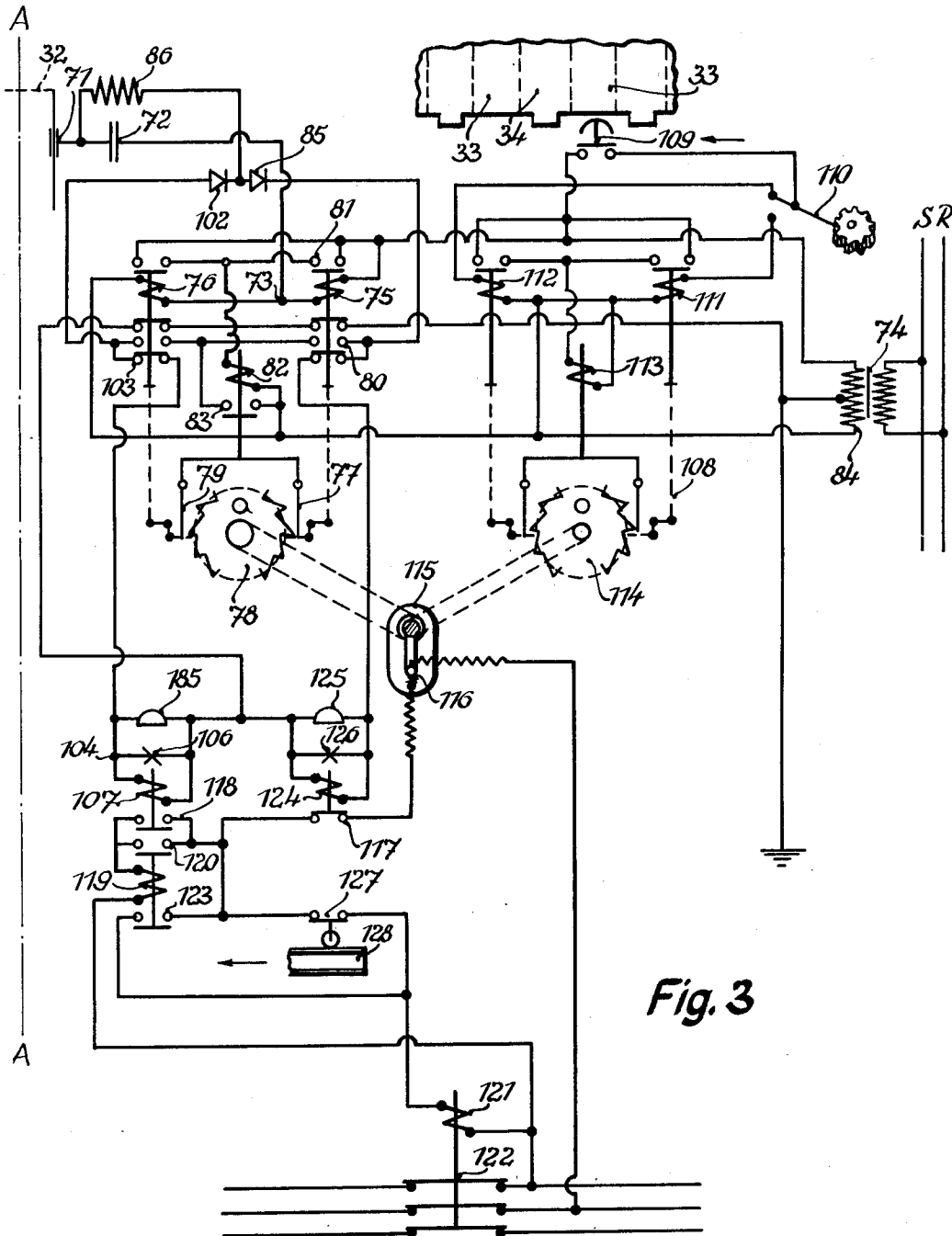


Fig. 3

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4 Sheets-Sheet 4

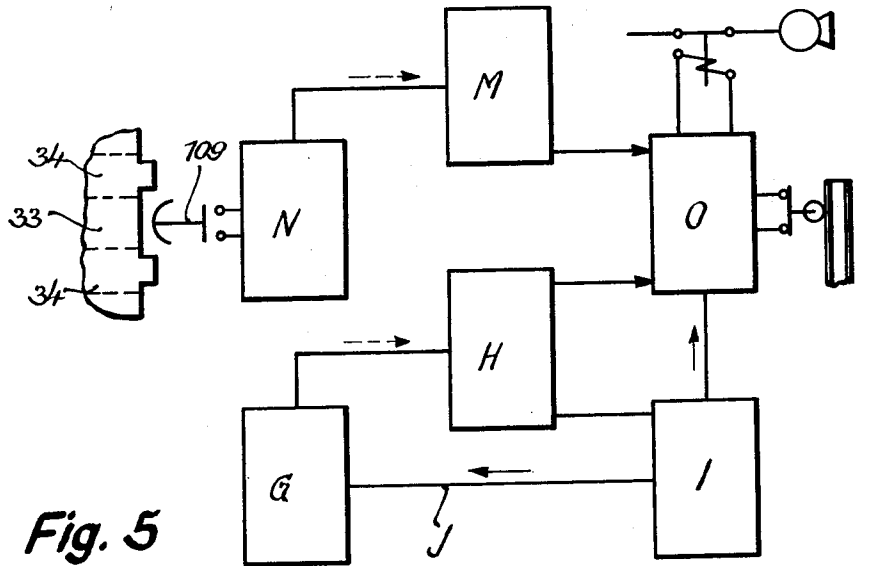
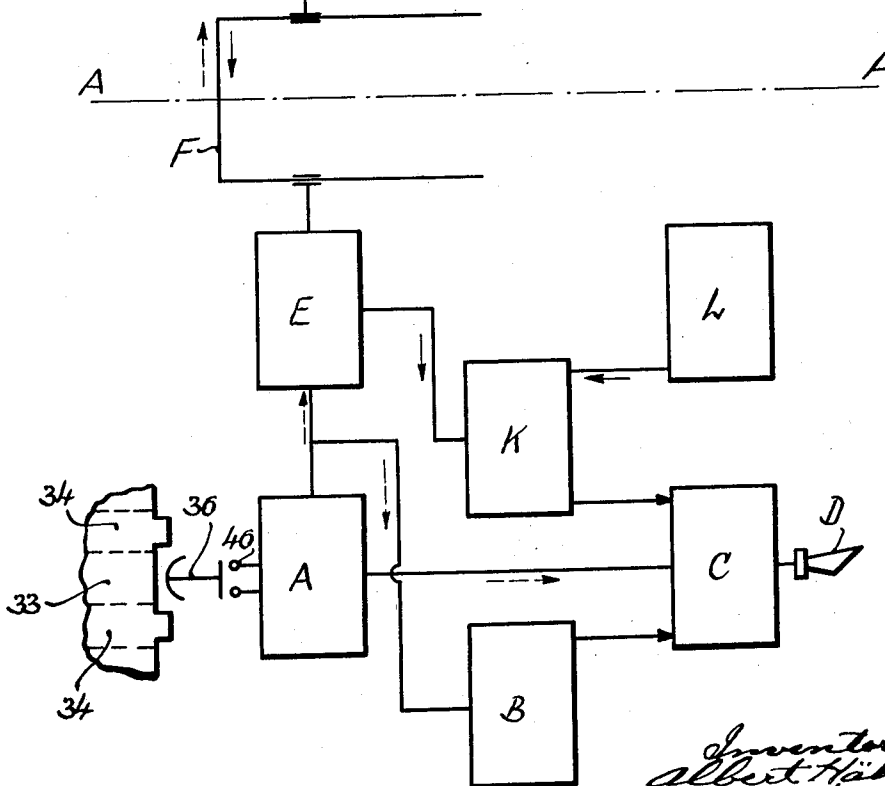


Fig. 5



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SIGNALLING DEVICES FOR COKE-OVEN BATTERIES

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Application April 18, 1951, Serial No. 221,574

7 Claims. (Cl. 340—282)

The present invention relates to an improved signalling device for use in conjunction with coke oven batteries of the type comprising a number of adjacent horizontally disposed coking chambers.

An object of this invention is to provide means for ensuring the correct alignment of the pusher machine and the coke guide machine relative to one another as well as in respect of a particular coking chamber to be discharged.

Hitherto various devices have been proposed for controlling and adjusting the position of the pusher machine and the coke guide machine with respect of a coking chamber to be discharged. However, all these proposed devices show a number of disadvantages, one such disadvantage residing in the fact that the operating personnel are obliged to devote considerable time and attention to attain the correct alignment of the two machines. Moreover, since modern coke oven batteries often comprise 50 or more coking chambers, and the coke discharge operations of the individual chambers thus follow each other in rapid succession, it is hardly possible for the operators to devote the necessary time and care to ensuring the proper alignment of the two machines.

According to this invention, there is provided a signalling device for use with the coke guide and pusher machines of a coke oven battery of the type specified, such device comprising signal emitting apparatus adapted to be carried by at least one of the said machines and a signal recording device adapted to be carried by the other of said machines, said signal emitting apparatus being adapted, as the machine carrying said apparatus passes each coking chamber, to transmit a signal in the form of an electric impulse to said signal recording device to cause the latter to indicate the position of the signal emitting apparatus carrying machine with respect to the said battery.

A further disadvantage of the said prior devices, particularly in the case of electrically operated control devices, consists in that hitherto no safety measures were provided to eliminate possible failures of the devices.

Now, according to a further feature of this invention, these disadvantages are overcome by providing a cross-check recording device adapted to be carried by the machine, or one of the machines, carrying said signal emitting apparatus, said cross-check recording device being adapted to repeat the indications of said signal recording device of the other machine. Thus the operator of the machine carrying the said cross-check recording device can verify that the correct indication is given by the said signal recording device of the other machine.

Further features of this invention will become apparent from the subsequent description of two embodiments of the invention, and various modifications thereof, illustrated diagrammatically in the appended drawings in which:

Figure 1 is a diagrammatic plan view of one embodiment of this invention;

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Figures 2 and 3 are diagrammatic representations of a second embodiment;

Figure 4 is a perspective representation of the checking switch employed in the apparatus illustrated by Fig. 2; and

Figure 5 is a block diagram of the wiring employed in the apparatus illustrated by Figs. 2 and 3.

Referring to Figure 1, the coke oven battery 1 comprises a number of horizontally extending elongated coking chambers 3 separated from one another by heating flues 2. Rail tracks 4 and 5 for the coke guide machine 6 and the pusher machine 7 are provided along the two sides respectively of the oven battery 1. The said machines are driven respectively by motors 8 and 9.

At the termination of a coking operation in any of the said coking chambers, the coke which is in the form of a large cake, is pushed out of the chamber by means of the pusher mechanism 10 which is operated by a motor 11. The coke then slides forward between the guides 12 of the coke guide machine 6, whence it drops into a coke quenching car which is not shown in this drawing.

The two machines, i. e. the coke guide machine and the pusher machine, are provided with laterally projecting switch actuating members, 13 and 14 respectively which are adapted to cooperate with striker plates 15 and 15' associated with each of the coking chambers, conveniently carried by joists 16 and 16'.

When the coke guide machine is driven on its rails past the striker plates 15, the switch actuating member 13 performs a movement which is transmitted to a signal emitting apparatus 17 mounted on the coke guide machine. This transmission of movement from the switch actuating member 13 to the signal emitting apparatus 17 may, for example, be effected by connecting the switch actuating member 13 with gear wheels which in turn are connected with electric contacts so that an electric circuit is made or broken each time a movement of the switch actuating member 13 occurs.

Alternatively, however, the transformation of the mechanical movements of the said switch actuating member into electric impulses acting on the signal emitting apparatus may be effected by constructing the switch actuating member 13 itself as a contact carrying member of an electric switch adapted directly to make and break an electric circuit.

An electric impulse from the signal emitting apparatus 17 is transmitted via the wire 18 to a sliding contact 19 on the coke guide machine by means of which it is transmitted to the contact wire 20 alongside the coke side of the battery, a further sliding contact 21 on the pusher machine being provided by which the impulse is transmitted from a portion of line 20 also alongside the pusher side of the oven battery to a recorder device 22 on the pusher machine. The said recorder device is conveniently a simple step recorder actuated by an electromagnet and adapted to rotate a graduated disc through a predetermined angle each time an impulse is received by the recorder device.

If the graduations on the said disc are numbered in accordance with the number of coking chambers in the battery, and it is arranged that each impulse received by the said recorder device is adapted to cause the disc to rotate by an angle corresponding to the angular separation of the successive numbered graduations, the latter may be presented seriatim in a suitable aperture or window visible to the operator of the pusher machine. Thus the operator of the pusher machine may be informed automatically of the number of the coking chamber in front of which the coke guide machine is located at any instant, and the said operator may adjust the position of the pusher machine accordingly.

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In order to minimise the effects of faulty contacts between the sliding contacts 19 and 21 and the wire 20, or of a breakdown of the signal emitting apparatus 17 or of the recorder device 22, the reading of the recorder device 22 is reported back to the coke guide machine and is presented to the operator thereof by means of a cross check recorder device 26. The said cross check recorder device 26 is conveniently a simple step recorder provided with a graduated disc similar to the said recorder device 22 and is actuated by impulses transmitted thereto via the sliding contact 23 on the pusher machine, contact wire 24 alongside the pusher side of the battery and sliding contact 25 on the coke guide machine and a portion of contact wire 24 alongside the coke side of the battery, the recorder device 22 being adapted to close the electric circuit of line 24 to produce one of said impulses each time its graduated disc makes a movement.

The order for the pushing operation to commence, which is usually given by the operator of the coke guide machine, must not be issued until the operator of the latter is absolutely certain that the pusher machine on the other side of the oven battery has actually drawn up in front of the correct oven chamber. To this end, the pusher machine is equipped with a laterally projecting switch actuating member 14 adapted to cooperate with striker plates 15' and operate signal emitting apparatus 27 in a manner similar to the above described arrangement for 17 on the coke guide machine. The impulses of the signal emitting apparatus 27 are transmitted by a sliding contact 28 on the pusher machine and an associated contact wire 29 alongside the pusher side of the battery to a further sliding contact 30 on the coke guide machine and a portion of line 29 alongside the coke side of the battery whence they are transmitted to a signal recorder device 31 which is carried by the coke guide machine. In this way, the operator of the latter can verify whether or not the pusher machine has actually arrived at the same coking chamber as his coke guide machine before giving the order to the pushing operation to commence. On receipt of such order, the operator of the pusher machine will switch on the motor 11 which operates the pusher ram 10 in a longitudinal direction.

The transmission of signalling impulses from one machine to the other, as a result of movement of the machines, may continue after the machines have ceased to move. Thus, for example, the movements of the switch actuating members 13, 14 may be adapted to wind up a mechanical clockwork which will actuate the signal emitting apparatus after the machines have stopped moving.

The present invention also provides means for automatically controlling the pusher machine in accordance with the setting of the cross check recorder device 26 and the signal recorder device 22 in such a manner that the driving motor 9 of the pusher machine receives current supply only as long as the numerals indicated on these two recorder devices are dissimilar.

A still further development of the invention consists in an arrangement wherein the motor 11 of the pusher mechanism cannot be switched on until the recorder device 31 and the cross check recorder device 26 on the coke guide machine show the same reading, thus indicating that both machines have in fact taken up a position at the two ends respectively of a particular oven chamber to be discharged by the pusher machine.

As hereinbefore described, a switch actuating member may be provided on each of the two machines, which member cooperates with the striker plates provided on each of the joists 16 or 16' in order to create electric impulses in accordance with the movement of the machines. In an alternative arrangement, however, the said joists serve as armatures for an electromagnet carried by each of the machines so that the magnetic flux of the electromagnet is altered when the machine passes each of said joists, thereby inducing in a coil arranged on the electro-

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magnet an impulse which actuates the signal emitting device.

Preferably, in the first arrangement above described, the impulses which are generated by the movement of the machines are unidirectional, the E. M. F. for the circuits closed by the operation of the said switch actuating members being readily derived, with the aid of a dry rectifier, from the alternating current which is utilised by the driving motors of the machines. If a polarity changer is associated with the driving motors, a change of polarity of said E. M. F. will be obtained when the direction of travel of the machines is reversed; in this manner the signal recorder devices can be constructed so that the impulses will cause rotation of the said graduated discs thereof in one direction or the other according to the direction in which the machines travel.

In the embodiment of the invention hereinbefore described with reference to Figure 1, three contact wires, 20, 24 and 29, are employed for the transmission of the electric impulses. However, in the embodiment illustrated by Figures 2, 3, 4 and 5 only a single transmission wire extending on both sides of the oven battery is provided for the transmission of all the electric impulses, the return being through earth. This considerably reduces the cost of the installation and appreciably increases the certainty of operation owing to the absence of a number of sliding contacts, each of which is a potential source of a breakdown or of faulty operation.

A further feature of the embodiment illustrated in Figures 2, 3, 4 and 5 is that the electric impulses, by which the position of the coke guide machine is primarily indicated at the pusher machine, differ characteristically from those by which this primary indication is reported back to the cross check recorder device.

Referring to Figures 2, 3, 4 and 5, all the components and wires shown on Figure 2, are arranged on a control stand on the coke guide machine, i. e. on that side of the battery on which the coke is discharged, whilst all the components and wires shown on Figure 3 are arranged on a similar control stand mounted on the pusher machine on the so-called "pusher-side" of the battery.

The said two control stands are connected with one another merely by one single contact wire 32, the earth serving as a return.

The coke side of the battery is roughly indicated in the drawing by three coking chambers 33 which are separated from one another by heating flues 34. Striker plates 35 are associated respectively with each of the coking chambers; whilst the coke guide machine carries a switch actuating member 36, the arrangement being such that the said switch actuating member rides against the said striker plates when the coke guide machine is driven past the oven chambers.

Assuming now that the coke guide machine is travelling to the right, i. e. in the direction of arrow 37, the pinion 38 of the driving motor rotates in a clockwise direction and the switch 39 associated therewith is in the position shown. The switch 39 is adapted to co-operate with a transformer 40, the latter being a single phase transformer having its primary winding connected to the mains R, S, whilst its secondary winding 41 is centre tapped at 42 and earthed, grounded, by wire 43 so that the instantaneous voltages at the ends 44 and 45 of the secondary winding 41 with respect to earth, grounded, are equal but differ by 180 degrees in phase. Depending upon the direction in which the machine is travelling, the switch 39 connects the contacts 46 and 47 associated with the switch actuating member 36 and either the end 44 (when travelling in the direction of arrow 37), or the end 45 (when travelling in the opposite direction), of the secondary winding 41 of the transformer 40.

Every time the switch actuating member 36 of the coke guide machine strikes one of the striker plates, the contact 46 is closed so that current flows from the transformer 40 through wires 48 and 49 through the coils of

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relays 50 and 51 to the ends 52 and 53 of the secondary winding 54 of a further transformer 55 having its primary winding connected to mains R, S, whilst its secondary winding is centre tapped and earthed at 56. The armatures of the relays 50 and 51 are adapted, when the latter are energised, to act on crank levers 57 and 58 which in turn are adapted to withdraw the pawls 59 and 60 from engagement with the ratchet teeth of the graduated disc 61 of the indicator device.

The two pawls 59 and 60 are interconnected by means of a bridge member 62 with the armature of an electromagnet 63 which is energised by the transformer 55.

The disc 61 is provided over one half of its circumference with the same number of ratchet teeth 64 as the number of coking chambers which must be passed by the coke-guide machine, whilst the other half of the disc is provided with an identical number of ratchet teeth 65 but inclined in the opposite direction. An indicating window 66 shows the number of the particular coking chamber in front of which the coke guide machine has arrived, each number being associated with a separate ratchet tooth.

The relays 50 and 51 are energized not only by current from the secondary winding of transformer 40 by way of contact 46, but also by current from the secondary winding of transformer 55. The relays 50 and 51 are arranged in series with the transformer 55 whilst they are connected in parallel with transformer 40. It is arranged that the secondary voltage of the transformer 55 is insufficient by itself, to energize the relays 50 and 51 to close the contacts 67 or 68. Similarly, secondary voltage of the transformer 40 is by itself insufficient to energize the said relays 50 and 51 to close the contacts 67 or 68.

However, since both relays 50 and 51 are simultaneously supplied with current from both transformers 40 and 55 as soon as the switch actuating member 36 has closed the contacts 46, the combined current which now flows through one of the relays will now be of sufficient value fully to energize that relay; in the other relay, in which the voltages of the two transformers differ by 180°, the combined current will be of very small value, preferably zero, so that this relay will not be energized. It thus depends solely upon the direction in which the coke guide machine is being driven past the coking chambers when contacts 46 are closed, which one of the two relays, 50 or 51, is fully energized.

Thus, assuming the switch 39 to be in the position shown in Figure 2, then, at a given instant, the end 45 of the secondary 41 of transformer 40 and the end 52 of the secondary 54 of transformer 55 may have a positive voltage with respect to earth. This is achieved by choosing suitable connections for the primary windings of both transformers 40 and 55 to the mains R, S. A negative potential with respect to earth then obtains, of course, at the opposite ends 44 and 53 of the transformer secondary windings respectively.

Thus, if at this instant the contacts 46 are closed, the negative potential derived from transformer 40 will obtain at those ends of coils of the relays 50 and 51 which are connected to the wire 49, whilst a positive potential obtains at the opposite end of the relay coil 50 and a negative potential obtains at the opposite end of the said relay coil 51. However, the transformer 55 is at this instant causing a current to flow through the coil of relay 50 in the same direction as the current derived from the transformer 40, whilst in the coil of relay 51 these two currents are opposed to one another. Consequently the relay 50 is sufficiently energized to withdraw the pawl 59 from its locking position by means of the crank lever 57, whilst closing the contact 67, whilst the pawl 60 remains unaffected in its locking position.

The closing of contact 67 closes an auxiliary circuit which is supplied with current by the secondary winding of transformer 55 and which also includes the winding of the electromagnet 63. In this auxiliary circuit the current flows as follows: from transformer 55, through

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52, 63, 67 and 53. When this auxiliary circuit is closed, the electromagnet 63 lifts the pawl 60 by means of the crank lever 58 and causes the disc 61 of the indicator device to rotate through the distance of one tooth in a clockwise direction. As soon as the switch actuating member 36 is disengaged from the striker plate on the joist, the contact 46 is opened and the relay 50 and the electromagnet 63 return to their initial conditions.

When the direction of travel of the coke guide machine is reversed, switch 39 will connect the end 45 of the secondary of transformer 40 to the contacts 46, and consequently when these contacts are closed, the voltages applied to the relay 51 will be in phase and this relay will be energized to close the contacts 68 and to raise pawl 60 out of engagement with the ratchet teeth 64. Thus, when the electromagnet 63 is energized, the disc 61 will be rotated in an anti-clockwise direction.

The operator of the pusher machine is informed as to the particular oven chamber at which he is required to place his machine in the following manner:

The A. C. impulse which has been generated in the above described manner by the impact of the switch-actuating member 36 of the coke-guide machine with a striker plate 36 is transmitted via wire 48 and a condenser 69 to the sliding contact 70 and thence via the contact wire 32 to the second sliding contact 71 which is arranged on the pusher side of the battery, through a further condenser 72, to contact point 73. From this point onwards the A. C. impulse derived from the coke guide machine cooperates with the A. C. voltage derived from the secondary winding of a transformer 74 to energize one or the other of the relays 75 and 76, according to the phase relationship of the voltages applied to the relays 75 and 76. Thus when relay 75 is energized, pawl 77 is withdrawn from the ratchet disc 78, and when relay 76 is energized, pawl 79 is withdrawn from ratchet disc 78, in the same manner as pawls 59 and 60 are withdrawn from the teeth 65 or 64 on energization of relay 50 or 51.

Thus it will be apparent that the recorder device on the pusher machine is synchronized, i. e. records the numbers in the same fashion and simultaneously, with the indicator device 34 on the coke-guide machine in order that the operator of the pusher machine should always be informed of the exact position of the coke-guide machine on the coke-side of the battery.

Owing to the fact that the impulses emitted from the coke-guide machine are transmitted to the pusher machine via two sliding contacts, it is possible that they arrive in a weakened state and thereby cause an incorrect number to be recorded by the recorder device 79 on the pusher machine whilst the operator of the coke-guide machine remains unaware of this imperfect transmission. In order to counteract such an occurrence, the invention provides an arrangement whereby the movement on the ratchet disc 78 of the recorder device is automatically reported back to the coke-guide machine. If now, owing to imperfectly transmitted impulses, the recorder device should not operate correctly, the reading thereon is always reported back to the coke-guide machine, so that the operator of the coke-guide machine is immediately informed and can act accordingly. In this way a considerable degree of safety is achieved.

As hereinbefore stated, the electric impulses by which the position of the coke-guide machine is primarily indicated at the pusher machine differ characteristically from those by which this primary indication is reported back to the said cross-check recorder device. Since both these sets of impulses are transmitted by the said wire 32, it is necessary to discriminate between them, and this may be effected in a known manner by means of selectors. Thus conveniently A. C. of a frequency of 50 cycles per second is employed for the primary indicator impulses transmitted from the coke-guide machine whilst D. C. may be employed for the said cross-check

impulses from the pusher machine. One of the chief advantages in employing D. C. for these latter impulses lies in the fact that the said selectors may then be of particularly simple construction.

The said cross-check report of the indication of the recorder device of the pusher machine to the coke-guide machine is effected in the following manner:

When the coke-guide machine travels in the direction of arrow 37, the impulses from the coke-guide machine cause the energization of relay 75, as previously explained, and the consequent closing of contacts 80 and 81, thereby energizing electromagnet 82 and effecting the rotation of disc 78 in a clockwise direction and the closing of contacts 83. A. C. from the end 84 of the secondary winding of transformer 74 passes via 83 and 80 to the half-wave rectifier 85, which suppresses one half wave so that pulsating D. C. obtains at the other side of said rectifier 85. This pulsating D. C. then flows through the choke coil 86, via sliding contact 71, contact wire 32, sliding contact 70, through choke coil 87 to contact point 88, and thence through the half-wave rectifier 89, switches 90 and 91 and relay 92 to earth, thereby energizing this relay 92, closing contacts 93 and causing the energization of the electromagnet 94 in such a manner that the cross check recording-device disc 95 rotates in the same sense as the indicator-device disc 61 and the recorder device-disc 78.

In order further to lessen the responsibility of the operator of the coke-guide machine, an arrangement may be provided whereby the indicator device disc 61 and the cross-check recorder device disc 95 are automatically checked for an identical position in both these instruments. To this end, there is provided a checking switch 96, which is diagrammatically shown in Figures 1, 2 and 3. Thus as shown in Figure 4 the checking switch 96 conveniently comprises contact members 96' and 96'' respectively associated with disc 61 and 95, each arranged for rotation with its associated disc and each carrying a contact terminal 97. When the two discs are in identical positions, the contact terminals cooperate.

The contact terminals 97 of said checking switch 96 are in series with a relay 98, the arrangement being such that contacts 99 are kept open by said relay 98 so long as the same reading is registered by the said indicator device and the cross-check recorder device and the contact terminals 97 cooperate. If, however, owing to a faulty transmission or other failure, different readings are registered on these instruments, the contact terminals 97 are separated and hence the relay 98 is released and closes the contacts 99, whereby an acoustic signal (e. g. a horn) 100 is operated in order to warn the operator of the coke-guide machine that he must not at this stage issue the command signal for the pushing operation to commence.

The command signals, e. g. "ready for discharge," or "stop discharge," which are given by the operator of the coke-guide machine to the operator of the pusher machine are also transmitted via the said single contact wire 32. These command signals are preferably issued only after both machines have stopped moving, i. e. at a time when the contact wire 32 is free from impulses. The command for the pushing operation to commence, e. g. "ready for pushing" is given and transmitted in the following manner:

The operator of the coke-guide machine depresses the switch 90 thereby energizing the following circuits: source of A. C. voltage 44, switch 90, switch 91, rectifier 101, choke coil 87, contact wire 32, choke coil 86, rectifier 102, contacts 103, and signal-receiving device 104, the signal (e. g. a lamp and an alarm) 106, 185 and a relay 107. When the signal 185 sounds or the lamp 106 lights, the operator of the pusher machine begins the pushing operation by switching on the driving motor of the pusher mechanism.

In order to give further assistance to the operator of

the pusher machine and to avoid the danger of accidents due to lack of attention on the part of the operators, the pusher machine is provided with a further switch-actuating member 109, a contact switch 110, controlled by the direction of travel of the vehicle, and two relays 111 and 112 and an electromagnet 113 for rotating a ratchet disc 114 in a similar manner as described above for the other signalling and recording devices. The ratchet disc 114 cooperates with the recorder device disc 78 by means of a checking switch 115 which is similar in construction to the checking switch 96.

Thus, when the pusher machine has arrived at the correct coking chamber, as indicated by the recorder device, the contact 115 is closed so that the following flow of current results when the command signal "ready for pushing" is received: Phase Y, contact 116, contacts 117, contacts 118, auxiliary relay 119 and Phase X.

In this manner the auxiliary relay 119 is energized and contacts 120 are closed. Consequently, the coil 121 of the magnetically operated circuit-breaker 122 in the three-phase power supply, represented by X, Y and Z for the driving motor for the pusher mechanism receives current through the following circuit: Phase Y, contact 116, contacts 117, contacts 123, coil 121, and Phase X. The circuit-breaker 122 is thus closed so that the pusher ram can be advanced.

In practice it sometimes becomes necessary for a signal to be given from the coke-side of the battery to stop the pushing operation when this is in progress. In this embodiment of the invention, such a signal may be transmitted by depression of the press-button switch 91 which is arranged on the control stand of the coke-guide machine. In the same manner as switch 90, the operation of switch 91 causes a D. C. impulse to be transmitted to the pusher machine whereby the command signal relay 124 is energized. This command signal relay 124 is connected in parallel with an alarm 125 and a control light 126 which are both energized by the said impulse, whilst the energization of relay 124 opens the contacts 117, thereby de-energizing coil 121, opening the circuit breaker 122 and stopping the pusher motor. At the same time, the operator of the pusher machine is informed by the command signal elements 125 and 126 that this stoppage of the motor is not due to accident or break-down but is intentional and desired by the operator of the coke-guide machine.

Since it frequently happens that the pusher machine has completed all the necessary preparations for a pushing operation, such as taking up its correct position and the removal of the coke oven door, before the coke-guide machine on the other side of the battery is ready for the pushing to commence, and in that event the operator of the pushed machine is fully exposed to heat radiated from the glowing coke inside the open oven chamber for a more or less considerable length of time, that is to say, until he receives the signal to commence pushing, an over-ride switch 127 is provided which cooperates with the pusher ram 128 and which short-circuits the contact 123 until the pusher ram 128 has arrived immediately in front of the coke to be discharged so that the pressure surface of the pusher ram provides a shield against the radiated heat from the glowing coke in the open coking chamber. This may thus be done irrespectively of whether or not the coke-guide machine has already reached its correctly aligned position. Beyond this stage, however, the push ram cannot be advanced before the command signal or pushing arrives from the coke-guide machine owing to the fact that the switch 127 brings about the interruption of the current supply to the pusher motor until this command has been given by the operator of the coke-guide machine.

Figure 5 is a general wiring diagram of the device according to the invention wherein the individual electrical units are indicated by blocks and the principal directions of the impulses are indicated by arrows. In this figure,

the impulse-transmitting device, which is controlled by the movement of the coke-guide machine in accordance with the direction of travel thereof, is indicated by A. Alternating-current impulses (indicated by broken arrows) issue from the devices A and pass on to the signal indicating device B on the coke-guide machine and thence to the checking switch C (which controls the acoustic signal D), and also to the electric selector E and, via the contact wire F, to the selector G, from whence they are passed on to the recorder device H on the pusher machine.

This recorder device H co-acts mechanically (as indicated by the thickly drawn continuous arrows) with the check report signalling device I by which direct-current impulses (indicated by thin continuous arrows) are sent back through wire J, selector G, contact wire F and selector E to the cross-check recorder device K of the coke-guide machine; the signal indicating device B and the cross-check recorder device K on the coke-guide machine co-act mechanically with the checking switch C.

The block L contains the signal-emitting device for the command signals (e. g. "ready for pushing" or "stop pushing") which are transmitted only after the vehicles have stopped moving. The reading of the signal recorder device H on the pusher machine is compared with the reading of the signal indicator device M on the pusher machine (which latter reading is, of course, produced by operation of the signal-emitter N) by means of a mechanical connection including the checking switch O. The check-report signalling device I also controls the command signal receiving device comprised in block O for the command signals which are issued from block L of the coke-guide machine.

The invention as hereinabove set forth is embodied in particular form and manner but may be variously embodied within the scope of the claims hereinafter made.

What we claim is:

1. A signalling device for synchronously controlling the coke guide and pusher machines on opposite sides of a coke oven battery, comprising a series of elements arranged along the coke side of the battery in correspondence with the individual oven chambers; a coke guide position electrical signal impulse emitting apparatus carried by said coke guide machine and a coke guide position signal recording device carried by said pusher machine and adapted to be operated by impulses of the coke guide position signal impulse emitting apparatus on the coke guide machine into positions that correspond with the respective positions of the coke guide machine relative to the individual oven chambers of the battery; said signal impulse emitting apparatus being adapted, as the coke guide machine passes each coking chamber, to be operated by the respective said elements of the oven chambers to transmit a signal in the form of an electric impulse to said coke guide position signal recording device on the pusher machine to cause said recording device to indicate on the pusher machine the individual position of the coke guide machine with respect to the ovens of said battery; a cross-check recording device carried by the coke guide machine and adapted to be operated by electric impulses into positions to repeat the indications of said coke guide position signal recording device on the pusher machine; an electric impulse emitting apparatus on the pusher machine operable on operation of the coke guide position recording device to transmit an equivalent electric impulse to the cross-check recording device on the coke guide machine; a coke guide position signal recording device carried by the coke guide machine and adapted to be operated by the impulses of the coke guide position signal impulse emitting apparatus on the coke guide machine into positions that correspond with the respective positions of the coke guide machine relative to the individual oven chambers of the battery; a circuit for the pusher machine for effecting the forward travel of a pusher ram on that machine to push coke charges in the oven chambers out of the same through the coke guide

machine and electrical control means on the coke guide machine for opening and closing the forward travel circuit on the pusher machine for its pusher ram; means on the coke guide machine operable, when the coke guide position signal recording and the cross-check recording devices on the coke guide machine show different oven positions, to prevent operation of said electrical control means and to permit such operation when said devices show identical oven positions; and which includes an override switch on the pusher machine for completing the pusher ram forward travel circuit independently of the electrical control means for that circuit on the coke guide machine, for advancing the ram up to the oven charges to be pushed but not beyond this stage of travel.

2. A signalling device for synchronously controlling the coke guide and pusher machines on opposite sides of a coke oven battery, comprising a series of elements arranged along the coke side of the battery in correspondence with the individual oven chambers; a coke guide position electrical signal impulse emitting apparatus carried by said coke guide machine and a coke guide position signal recording device carried by said pusher machine and adapted to be operated by impulses of the coke guide position signal impulse emitting apparatus on the coke guide machine into positions that correspond with the respective positions of the coke guide machine relative to the individual oven chambers of the battery; said signal impulse emitting apparatus being adapted, as the coke guide machine passes each coking chamber, to be operated by the respective said elements of the oven chambers to transmit a signal in the form of an electric impulse to said coke guide position signal recording device on the pusher machine to cause said recording device to indicate on the pusher machine the individual position of the coke guide machine with respect to the ovens of said battery; a cross-check recording device carried by the coke guide machine and adapted to be operated by electric impulses into positions to repeat the indications of said coke guide position signal recording device on the pusher machine; and electric impulse emitting apparatus on the pusher machine operable on operation of the coke guide position recording device to transmit an equivalent electric impulse to the cross-check recording device on the coke guide machine; a coke guide position signal recording device carried by the coke guide machine and adapted to be operated by the impulses of the coke guide position signal impulse emitting apparatus on the coke guide machine into positions that correspond with the respective positions of the coke guide machine relative to the individual oven chambers of the battery; and which includes a circuit on the pusher machine for effecting the forward travel of a pusher ram on that machine to push coke charges in the oven chambers out of the same through the coke guide machine; a series of elements arranged along the pusher side of the battery in correspondence with the individual oven chambers; pusher machine position electrical signal impulse emitting apparatus carried by the pusher machine; a pusher machine position signal recording device carried by the pusher machine and adapted to be operated by the impulses of the pusher machine position signal impulse emitting apparatus on the pusher machine into positions that correspond with the respective positions of the pusher machine relative to the individual oven chambers of the battery; said pusher machine position signal emitting apparatus being adapted, as the pusher machine passes each oven chamber, to be operated by the respective elements of the oven chambers to transmit a signal in the form of an electric impulse to the pusher machine position signal recording device to cause the latter to indicate the individual position of the pusher machine with respect to the ovens of said battery; and means on the pusher machine operable to close the circuit for forward travel of the pusher ram only when the coke guide position signal recording device on the pusher machine, and the pusher machine position signal

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recording device on the pusher machine are in positions showing identical oven positions.

3. Apparatus as claimed in claim 2 and which includes a pusher machine position signal recording device carried by the coke guide machine and adapted to be operated by the impulses of the pusher machine position signal emitting apparatus on the pusher machine into positions that correspond with the respective positions of the pusher machine relative to the individual oven chambers of the battery.

4. A signalling device according to claim 3, wherein the said signal-recording devices include a graduated sector or disc adapted to be rotated in steps in either direction in accordance with the direction of travel of the coke guide and pusher machines.

5. A signalling device according to claim 4, wherein the rotation of the said graduated sector or disc is effected by means of electromagnetically-operated pawls cooperating with ratchet teeth associated with said sector or disc, one such pawl being adapted to effect rotation of the sector or disc in one direction, and another such pawl being adapted to effect rotation of the sector or disc in the other direction, said pawls being energized simultaneously by two alternating voltages applied thereto, one such voltage being applied continuously thereto and the other being derived from the impulse transmitted from said signal-emitting apparatus; the circuits by which these voltages are applied to energize said pawls being so arranged that the voltages are opposed in phase at one pawl and similar in phase at the other pawl to energize the latter pawl to effect rotation of the sector or disc, the phase relationship of the impulse voltage with respect to said

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continuously applied voltage being varied in accordance with the direction of motion of the respective coke guide and pusher machine signal-carrying emitting apparatus.

6. A signalling device according to claim 5, wherein the said impulse voltage is derived from a center-tapped secondary winding of a transformer, the said impulse voltage being obtained between the said center-tapping and one or the other ends of said secondary winding in accordance with the direction of motion of the coke guide and pusher machines carrying signal-emitting apparatus.

7. A signalling device according to claim 2 and in which the means on the pusher machine operable to close the circuit for forward travel of the pusher ram comprises a checking switch adapted to prevent advancement of the pusher ram of the pusher machine when dissimilar indications are shown by said pusher machine position signal-recording devices and said coke guide position signal-recording device on the pusher machine.

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