The present invention relates to improvements in valve operating mechanism.

More particularly the present invention relates to systems involving the application of motive power for operating a valve or the like supplemented by hand operating mechanism for operating said valve or the like.

The invention will be described with particular reference to a short valve such as used on the cold blast main of a blast furnace installation. However, as the description proceeds, it will be appreciated that the invention has a broader application.

An object of the present invention is to provide improved valve operating mechanism employing a motor drive supplemented by hand operating mechanism, interlocks being provided for insuring that the motor mechanism is inoperative when said hand operating mechanism is operative.

A further object is to provide improved valve operating mechanism including electromotive means for operating a valve, said electromotive means having control means which is responsive to the wind pressure within a conduit to be controlled by said valve, which electromotive means is supplemented by hand operating mechanism which may be used to operate said valve when said electromotive means is inoperative.

A further object is to provide improved valve operating mechanism including control means responsive to the wind pressure within a conduit directly or indirectly responsive to the operation of a valve to cause automatic opening of the valve and to hold said valve open until the wind pressure within said conduit falls below a predetermined maximum after which said valve is automatically moved to closed position.

A further object is to provide improved valve operating mechanism having control means, including electromotive means, for operating a valve which will permit opening and holding the valve at desired positions intermediate of its fully open and closed positions.

A further object is to provide improved valve operating mechanism including electromotive means for operating a valve supplemented by hand operating mechanism for said valve, provision being made for automatic switch-over to hand control in the event of power failure of the electromotive mechanism.

A further object is to provide improved valve mechanism including electromotive means, with a magnetic clutch, for operating a valve supplemented by hand operating mechanism for operating said valve, together with limit switch means for controlling said electromotive means, provision being made that in the event of failure of the limit switch means, no harm will result.

A further object is to provide improved valve operating mechanism well adapted to meet the needs of commercial practice.

Further objects will appear as the description proceeds.

Referring to the drawings—

Figure 1 is a schematic view illustrating one embodiment of the present invention; Figure 2 is an end view of the structure illustrated in Figure 1; Figure 3 illustrates a detail of construction; Figure 4 is a plan view of electromotive mechanism forming part of the mechanism illustrated in Figure 1 for operating a cable or the like to control a valve; Figure 5 is a side elevation of the structure illustrated in Figure 4; Figure 6 is a view in end elevation of the structure illustrated in Figures 4 and 5; Figure 7 is a plan view of hand operating mechanism for operating a cable for controlling the valve above referred to; Figure 8 is a view in front elevation of the structure illustrated in Figure 7; Figure 9 is a view in side elevation of the structure illustrated in Figures 7 and 8; and Figure 10 is an electrical diagram showing the controls for the mechanism illustrated in Figures 1 to 9 inclusive and cam switch development.

Referring first to Figure 1, the numeral 20 indicates a conduit provided with a short valve 21, which short valve may be of the conventional type or a proportional valve mechanism movable about the axis 22 between definite limits, and said mechanism is moved by means of the crank 23 which is illustrated as having approximately 60° travel. The swinging extremity of the crank 23 is connected to the connecting rod 24 through a resilient connection embodied in the springs 25, 26 (Fig. 3).

The rod 24, which moves the crank 23 of the short valve 21, is connected to be operated from the electromotive unit indicated as a whole by the numeral 26.

Electromotive unit 26 includes motor 27 provided with speed reduction mechanism 27a, which may include a worm gear and a planetary gear second reduction, to drive the shaft 28. Shaft 28, through a magnetic clutch 29 or other suitable clutch is connected to the spirally grooved sheave 30 and to the crank 31, both fixed to the shaft 30a, which crank 31 is connected to the lower extremity of the connecting rod 24 (Figs. 1 and 2). The two cooperating parts of the clutch 29 are indicated by the numerals 29a and 29b. It will be understood that in the event of power failure the two parts 29a and 29b of the clutch 29 will be free of each other whereby the sheave 30 and the crank 31 may be turned independently of the motor 27 and its speed reducing gear mechanism.

Connected to the shaft carrying the sheave 30a is a sprocket chain 32 for operating the cam limit switch 33. Trained over the sheave 30 is the cable 34, which cable may be controlled by the hand operating mechanism indicated as a whole by the numeral 35 (Figs. 1, 7, 8 and 9). Said hand operating mechanism embodies a hand wheel 36 adapted to turn the shaft 37, said shaft 37 being provided with the sheave 38 for receiving the cable 34. Said shaft 37 is also provided with the holding wheel 39 illustrated as having a plurality of indentations in its periphery, any one of which is adapted to receive the tooth 40 located at the extremity of the lever 41 which is pivoted intermediate of its length to swing about the axis 42. Said lever, through the link 43, is connected to the armature 44 of a solenoid 45. When energized said solenoid 45 will swing the lever 41 in a counterclockwise direction about its axis 42 (as the parts are viewed in Fig. 5) to a position in which the tooth 40 is free of the holding wheel 39. At this time the hand wheel 36 may be turned, whereby through the cable 34 it will turn the sheave 30 of the electromotive unit 26 to move the connecting rod 24 to operate the short valve 21. When the solenoid 45 is de-energized, the lever 41, biased by its own weight (or by means of a spring if
preferred), will move the tooth 40 into locking engagement with one of the indentations of the locking wheel 39. The lever 41 with its tooth 40 will be referred to as a holding means, and the operating solenoid 45 together with armature 44 and link 43 will be referred to in this specification as a magnetic hold releasing means 45. Though this holding means has been illustrated as a positive latch, it is clear that other forms of holding means may be employed, such, for example, as a weighted hand operated friction brake.

Located on the hand operating mechanism 32 is the interlocking control limit switch 46 which will close when the lever 44 is in its unbiased position; that is, when the resistor is controlled by the contact ASC (responsive to the accelerating shunt coil AS, circuit L). When said contacts ASC are closed, said resistor is shunted out of the circuit of the armature A. Also included in circuit b are the overload relay coils OL of an overload relay, the contacts of which are in circuit l.

Circuit c includes the shunt field winding SF cooperating with the armature A of the motor 27.

Circuit d has its two extremities connected inside of the magnetic clutch relay contacts CRIC and CR2C (circuit b). Said circuit d includes the contacts CR3C (biased to open position) of said relay clutch, as well as the magnetizing coil MC of the magnetic clutch 29.

Circuit e has its two extremities connected inside of the magnetic clutch relay contacts CRIC and CR2C (circuit b). Said circuit e includes the solenoid 45 (Fig. 8) of the magnetic hold releasing means 45 and is in parallel with circuit d.

Circuit f is connected across the two sides 48, 49 of the supply circuit and includes the Hand, Manual, and Automatic switch HMA1, forming part of a switch assembly HMA, the contacts SV06 of the slot valve operator cam switch 33 and the operating coil CR of the clutch relay. The contacts SV06 are one of six sets of contacts controlled by the cam limit switch 33 (Fig. 4) which is a number of circuits which are indicated by letters a, b, c, et cetera.

In general, in this specification, the operating devices will be indicated by the initial letter or letters of the name of the device and the contacts or other element controlled will be indicated by like indicia followed by a numeral and the initial letter of its name, as CR for clutch relay, and IC for first contact.

Circuit a, which is opened or closed when the switch 49 is either open or closed, includes a discharge resistor DR through which countervoltage of any of the equipment on the load side of the pole of the switch will be discharged.

Circuit b includes the contacts CRIC and CR2C of a clutch relay, the operating coil of which is indicated by the letters CR (circuit r). Said contacts CRIC and CR2C control the magnetic clutch 29 (Fig. 4) as well as many of the other elements of the system. Also located in circuit b is an assembly including the armature A of the motor 27 (Fig. 4), together with two on and off directional contacts, the contacts of which are indicated by the letters ON1C and ON2C, and the contacts of another of which are indicated by the letters OFF1C and OFF2C. Said contacts are biased to open position but are closed in response to energization of the directional contactor coils ON or OFF (circuits f and j).

When the two contacts ON1C and ON2C are closed, current will be directed through the motor armature A in one direction. Conversely, when the two contacts OFF1C and OFF2C are closed, current will be directed through the armature A in the opposite direction, thereby controlling the direction of rotation of motor 27 (Figs. 1 and 4) to move the slot valve 21 (Fig. 1) selectively to the "on" position, or to the "off" position. Connected across the armature A is the countervoltage coil CV which controls the contacts CVC (circuit i) biased to closed position. Also connected across the armature A is a braking resistor BR controlled by the normally closed contacts ON3C and OFF3C, responsive to the direction of the contactor coils ON and OFF, respectively. The contacts ON3C and OFF3C are biased to closed position and are elements of directional contactors which control the dynamic braking circuit across the armature A of the motor 27. The relay comprising the countervoltage coil CV and its normally closed contacts CVC controls the coils ON and OFF (circuits f and j). Reversal of the motor 27 is prevented until after it approaches approximately zero speed. Also connected in circuit b is an accelerating resistor AR to prevent excessive current on the motor when starting as is well known in the art. The resistor is controlled by the contact ASC (responsive to the accelerating shunt coil AS, circuit L). When said
contacts PR2C (biased to closed position and opening in response to energization of the coil PR) through the contacts SVOI of the cam limit switch 33, Fig. 4, through the operating coil ON (controlling the directional contacts in circuit b, as well as the contact ON4C, circuit j helping through the contacts CVC and the thermal overload contacts OLC (response to the coils OL in circuit b) to the right hand conductor 48. Disposed in parallel relationship with the contacts CVC are the contacts ONSC biased to open position. Also in parallel with the contacts CVC are the contacts OFFC biased to open position.

Circuit j at its left extremity is connected to circuit i between the two switches marked Wind On of the switch assembly Main WO-N—WON and the switch assembly Aux. WO-N—WON. Circuit j leads through the contacts PR2C (biased to open position) through one set of contacts of the percentage switch assembly, Pct. Ass., through the contacts SVO2 (of the cam limit switch 33) through the operating coil OFF through the contacts ON4C (biased to closed position). Said circuit j has its right hand extremity connected to circuit i at a point between the contacts OFFC and the contacts CVC. Said circuit j also includes a branch circuit which leads from the contacts PR2C through another set of contacts of the percentage switch assembly Pct. Ass. through the contact SVO3 of the cam limit switch 33 to a point between the switch SVO2 and the operating coil OFF. As will be explained presently, the percentage switch assembly Pct. Ass permits the automatic selection of preferred intermediate positions of the snort valve 21.

Circuit k has its left extremity connected to circuit g between the snap lock limit switch 46 and the switch marked HMA2 of the switch assembly HMA. Circuit k leads through WO-N—WON through the contacts SVO4 to a point in circuit j between the contacts SVO2 and the operating coil OFF. In parallel in circuit k with the Wind Off switch in the Aux. WO-N—WON switch assembly is the similar Wind Off switch in the Main WO-N—WON switch assembly in the main station at the hand wheel 36 (Fig. 8) in the Cast House. Said parallel switches marked Wind Off lead through the contact SVO4 of the cam limit switch 33 to a point in circuit j between the contacts SVO2 and the operating coil OFF, thence through ON4C and the normally closed contacts CVC and thermal OLC to the other side of the supply circuit 48, 49.

The circuit I has its left hand extremity connected to the left hand conductor 48 of the supply circuit inside of the snap lock limit switch 46. Said circuit I leads through the contacts ON6C and OFF6C (in parallel with each other), through the accelerating shunt operating coil AS for the contacts ASC (above mentioned) to a point in circuit i between the contacts OFF4C and the contacts CVC.

Circuit m is connected to the left hand conductor 48 inside of the snap lock limit switch 46, and leads through the contacts SVO5 through the signal lights L, L to the opposite conductor 48. Said signal lights may be located at convenient locations about the plant and will when illuminated, indicate that the wind is on the furnace.

Recapitulating, certain of the elements above referred to may, for convenience, be classified as follows:

(1) The first drive means the electrical unit 26 including the motor 27, speed reduction mechanism 27e, shaft 28, and magnetic clutch 29, with its parts 29a and 29b. These elements comprise one combination by means of which the snort valve mechanism may be driven.

(2) Second drive means: the hand wheel 36, the cable 34 and the cable drum 30. This combination can likewise drive the mechanism when the magnetic clutch is disengaged, whereby the motor 27 is disconnected.

(3) Power transmitting means for transmitting power from either the first drive means or the second drive means to the snort valve mechanism. This power transmitting means includes the shaft 30e, crank 31 connecting rod 24, resilient connection 25, and the valve crank 23.

(4) Holding means including the locking wheel 39, the lever 41 with its tooth 40, which lever is swung about the axis of the shaft 42.

(5) Electromagnetic hold releasing means 45' for releasing the holding means 41, including the solenoid 45 with its armature 44 and link 43, plus the interlocking limit switch 46.

(6) The electric control means for governing, sequenc ing, interlocking and co-ordinating the operating elements referred to in the preceding five paragraphs, which control means includes the controls illustrated schematically in Figure 10.

In describing the operation of the illustrated embodiment of the present invention, it may be assumed that the selector switch assembly HMA has been placed in Manual position. In this position the two timing coils T1 and T2 are out of circuit since the HMA2 switch is so designed as to be closed in Automatic only and open in Manual. The HMA1 switch which is designed to be closed in both Manual and Automatic allows the circuit in line 1 to be complete and thereby by energizing the right hand conductor 48 through the operating coil CR of the clutch relay. When CR is thus energized the contacts CR1C, CR2C and CR3C, all of which are normally biased to open position, are closed. Since CR3C is closed, the magnetizing coil MC of the magnetic clutch 29 will thereby be energized causing the electromagnetic unit 26 to be connected to the snort valve operator and the solenoid 45 (circuit e) is also energized pulling the tooth 40 out of engagement with holding wheel 39 and closing switch 46.

By then moving both the Main WO—N—WON switch assembly and the Aux. WO—N—WON switch assembly to the Wind Off position, the circuit will be completed, assuming SVO1, OLC being normally closed. The completion of this circuit results in the energization of the directional contactor coil ON and thus the closing of the contacts ON1C and ON2C (circuit b) to energize the motor 27 to move the snort valve 21 toward Wind On position. In the event that the motor 27 over-travels, the contact SVO6 of the cam limit switch 33 will be opened causing the operating coil CR to be deenergized. Ordinarily, this would never happen. Further, in the event the motor 27 is continuously overloaded, the coil OL of an overload relay will be energized by excess current to cause the normally closed overload contacts OLC to open and thus break circuit i.

When the controls have been set in one directional contactor position (i.e. Wind On) it is not possible to reverse the motor 27 to drive in the other position until the motor speed approaches zero. The reason for this is that a rapid reversal of the motor will draw excessive current from the line and cause sparking on the commutator. The rapid reversal is prevented through the countervoltage relay coil CV which is shunted across the armature and is energized from the motor countervoltage. When the countervoltage approaches zero, as a result of the motor 27 slowing down, the CV coil will permit the normally-closed contact CVC to close as is well known in the art, whereupon the circuit is completed, allowing either directional contactor coil ON or OFF to be energized. Activation of the directional contactor starts the motor in the reverse direction and the CV coil relay again opens the normally closed contact CVC. This does not interrupt the coil circuit of the directional contactor for the reason that there is a circuit by-passing contact CVC through either contact ONSC or OFFSC depending upon which directional contactor is closed.

It is possible to "inch" the valve along by repeatedly moving either the Main WO—N—WON on the Aux. WO—N—WON switch assembly from the Wind On position to the neutral position and back again. When the
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snort valve is in its fully closed position, that is, in the position in which the wind is one hundred percent on the furnace, the cam limit switch 33 contacts SVO1 will be open, thereby interrupting the circuit through the direction coil ON to permit the contacts ONFC and ON2C to move to their open position. Conversely, by moving either the main WO-N-WON switch assembly or the Aux. WO-N-WON switch assembly to the Wind-Off position the snort valve will be operated toward Wind Off position until contacts SVO2 of circuit 2 are opened to interrupt the circuit through the coil OFF to stop the motor.

Referring now to a situation in which the HMA selector switch is placed in the Auto, position thereby closing contacts HMA1 and HMA2, the parts are so disposed that the wind is checked in the event of high top pressure. When the pressure, for example the gas pressure at the top of the furnace, reaches a predetermined high value, the pressure switch Press, Sw. which may be diaphragm operated, will close to cause the energization of the operating coil T1. Said operating coil T1 will close its normally open contacts T1C after a predetermined time interval (sufficiently long to insure that the top pressure was not a momentary swing) to complete a circuit to the operating coil PR. Energization of the coil PR causes its contacts PR3 to close, completing circuit to the operating coil OFF, causing the snort valve to open and to continue the flow of wind on the furnace.

The degree to which the snort valve is opened (wind checked) is determined by whether or not the contacts SVO2 or contacts SVO3 of the limit switch 33 are in circuit. This selection is made by means of the selector switch Pct. Ass. which has been illustrated as having two selectable positions chosen arbitrarily as twenty percent on and ten percent on. This Pct. Ass. switch will be located in the main control station. Simultaneously with the energization of the operating coil PR the timer coil T2 is energized. The energization of the timer coil T2 will result in the opening of its contacts T2C after a predetermined interval. This time interval will be selected for the duration of time for which it is desired to have the wind checked in the event that high top pressure is quickly eliminated. The opening of the normally closed contacts T2C results in the opening of the holding circuit on the timer coil T1, Press. Sw. now being open due to relief of pressure, thereby de-energizing the operating coil PR. The de-energization of the coil PR causes the contacts PR2C to close which causes the snort valve to go to the closed position (full wind on) under the control of the contacts SVO1 of the cam limit switch 33.

However, should the high pressure not have been eliminated at the end of the time interval set by the timer coil T2, the timer coil T1 will still be energized by virtue of the diaphragm pressure switch Press. Sw. and the snort valve will remain in open position (that is, wind checked) until the top pressure drops sufficiently to permit the pressure switch Press. Sw. to open.

Referring now to a situation in which the HMA selector switch assembly is placed in the Hand position, the control circuit of the operating coil CR is broken, causing its normally closed contacts CR1C and CR2C to open, thereby interrupting the power supply to the motor 27, to the magnetic clutch 29 and to the solenoid 45 of the magnetic hold releasing means 45". As a result the following actions take place: (1) The solenoid 45 for releasing the holding means 41 is de-energized, thereby permitting the tooth 49 of said holding means 41 to engage the drum on the hand wheel 36, thereby maintaining the hand wheel 36 in the position in which it happened to stand; (2) de-energization of the magnetic clutch 29 disconnects the motor drive unit from the operating shaft driving the sheave 30 and the crank 34; and (3) as a result of the conditions described in items numbered 1 and 2 above, the snort valve 21 is under the direct control of the hand wheel 36 which operates the cable 34 trained over the sheave 30 of the drive unit 26. Inasmuch as the magnetic clutch 29 is disengaged at this time, the snort valve 21 may be manually operated by lifting the lever 41 and turning the hand wheel 36, with the result that the snort valve 21 is under direct manual control.

It will be noted that the contacts SVO3 of the cam limit switch 33 are closed in the Wind On position of the snort valve; that is, when the snort valve is fully closed, thereby closing the circuit to the signal lights L, L. Which may be located at the main and auxiliary control stations, or elsewhere about the plant.

Though a preferred embodiment of the present invention has been described in detail, it is intended to include all modifications which fall within the scope of the appended claims. For example, a second hand wheel, or even a third, may be connected through additional cables to the drive sheave and a release cable placed near the second and third hand wheels for releasing the holding means of the first hand wheel and thus permit the additional hand wheels of the type of the hand wheel 36 to be actuated operatively to drive the snort valve.

What is claimed is:

1. Actuating apparatus for a valve operating member comprising a first drive means including a first power means and a clutch, a second drive means including a second power means, power transmitting means for connecting said first and second drive means to the valve operating member, holding means for said second drive means, said holding means being biased into holding relationship with said second drive means, said power transmitting means adapted to release said second drive means when actuated, movement of the holding means operable by the movement of, and governed in accordance with the position of, the power transmitting means according to its position with respect to the position of the valve operating member for controlling the movement of said first power means including switching means for controlling the operation of said control means, of said clutch and of said hold-releasing means.

2. Actuating apparatus for a valve operating member comprising a first drive means including an electromotive means and a clutch, a second drive means including a hand wheel, power transmitting means for connecting said first and second drive means to the valve-operating member, holding means for holding said second drive means, said holding means being biased into holding relationship with said second drive means, said releasing means adapted to release said second drive means when actuated, movement of the holding means operable by the movement of said first and second drive means, movement control means operable by the movement of, and governed in accordance with the position of, the power transmitting means according to its position with respect to the position of the valve operating member for controlling the movement of said electromotive means including switching means for controlling the operation of said control means, of said clutch and of said releasing means.

3. Actuating apparatus for a valve operating member comprising a first drive means including an electromotive means and a clutch, a second drive means including a hand wheel, power transmitting means for connecting said first and second drive means to the valve operating member, holding means for holding said second drive means, said holding means being biased into holding relationship with said second drive means, said releasing means adapted to release said holding means when actuated, movement of the holding means operable by the movement of, and governed in accordance with the position of, the power transmitting means according to its position with respect to the position of the valve operating member for controlling the movement of said electromotive means including switching means for controlling the operation of said control means, of said clutch and of said hold-re-
leasing means, said holding means being manually releasable from said hand wheel.

4. Actuating apparatus for a valve operating member comprising a first drive means including an electromagnetic means and an electromagnetic clutch, a second drive means including a hand wheel, power transmitting means connecting said first and second drive means to the valve operating member, holding means for holding said second drive means, said holding means being biased into holding relationship with said second drive means, hold-releasing means adapted to release said holding means when activated so as to permit operation of said first and second drive means, movement control means operable by the movement of, and governed in accordance with the position of, the power transmitting means according to its position with respect to the position of the valve operating member for controlling the movement of said electromotive means including switching means for controlling the operation of said second drive means, said holding means being manually releasable from said hand wheel, and means responsive to movement of said first drive means for controlling the operation of said holding means.

5. Actuating apparatus for a valve operating member comprising a first drive means including an electromagnetic means and an electromagnetic clutch, second drive means including a hand wheel, power transmitting means connecting said first and second drive means, said holding means being biased into holding relationship with said second drive means, electromagnetic hold-releasing means adapted to release said holding means when activated so as to permit operation of said first and second drive means, movement control means operable by the movement of, and governed in accordance with the position of, the power transmitting means according to its position with respect to the position of the valve operating member for controlling the movement of said electromotive means including switching means for controlling the operation of said second drive means, said holding means being manually releasable from said hand wheel, and means responsive to movement of said first drive means for controlling the operation of said holding means.

6. Actuating apparatus for a valve operating member comprising a first drive means including an electromagnetic means and an electromagnetic clutch, a second drive means including a hand wheel, power transmitting means connecting said first and second drive means to the valve operating member, holding means for holding said second drive means, said holding means being biased into holding relationship with said second drive means, electromagnetic hold-releasing means adapted to release said holding means when activated so as to permit operation of said first and second drive means, movement control means operable by the movement of, and governed in accordance with the position of, the power transmitting means according to its position with respect to the position of the valve operating member for controlling the movement of said electromotive means including switching means for controlling the operation of said second drive means, said holding means being manually releasable from said hand wheel, and control limit switch responsive to the position of said holding means for controlling the operativeness of said first drive means.

7. Actuating apparatus for a valve operating member comprising a first drive means including an electromagnetic means and an electromagnetic clutch, second drive means including a hand wheel, power transmitting means connecting said first and second drive means to the valve operating member, holding means for holding said second drive means, said holding means being biased into holding relationship with said second drive means, electromagnetic hold-releasing means adapted to release said holding means when activated so as to permit operation of said first and second drive means, movement control means operable by the movement of, and governed in accordance with the position of, the power transmitting means according to its position with respect to the position of the valve operating member for controlling the movement of said electromotive means including switching means for controlling the operation of said second drive means, said holding means being manually releasable from said hand wheel, and means responsive to movement of said first drive means for controlling the operation of said holding means.

8. Actuating apparatus for a valve operating member comprising a first drive means including an electromagnetic means and an electromagnetic clutch, second drive means including a hand wheel, power transmitting means connecting said first and second drive means to the valve operating member, holding means for holding said second drive means, said holding means being biased into holding relationship with said second drive means, electromagnetic hold-releasing means adapted to release said holding means when activated so as to permit operation of said first and second drive means, movement control means operable by the movement of, and governed in accordance with the position of, the power transmitting means according to its position with respect to the position of the valve operating member for controlling the movement of said electromotive means including switching means for controlling the operation of said second drive means, said holding means being manually releasable from said hand wheel, and means responsive to movement of said first drive means for controlling the operation of said holding means.

9. An actuated operating member comprising a valve operating member, a first drive means including an electromagnetic means and an electromagnetic clutch, an alternative second drive means including a hand wheel, power transmitting means connecting said electromotive means of said first drive means through said clutch to the valve operating member and said hand wheel of said alternative second drive means to the operating member, holding means for said hand wheel biased into holding relationship with said hand wheel, electromagnetic releasing means adapted to release said holding means from holding relationship with said hand wheel, movement control means operable by the movement of, and governed in accordance with the position of, the power transmitting means according to its position with respect to the position of the valve operating member for controlling the movement of said electromotive means and including switching means for selectively rendering said first drive means operative for driving said operating member and further including a control limit switch adapted to be responsive to said electromagnetic releasing means, said holding means being manually releasable from said hand wheel, electromagnetic means is disposed of.

10. An actuating apparatus for a valve operating member comprising a first drive means including an electromagnetic means and an electromagnetic clutch, an alternative second drive means including a hand wheel, power transmitting means connecting said electromotive means of said first drive means through said clutch to the valve operating member and said hand wheel of said alternative second drive means to the operating member, holding means for said hand wheel biased into holding relationship with said hand wheel, electromagnetic releasing means adapted to release said holding means from holding re-
11. Relationship with said hand wheel, said holding means being inoperative when said electromagnetic clutch is energized, and movement control means operable by the movement of, and governed in accordance with the position of, the power transmitting means according to its position with respect to the position of the valve operating member for controlling the direction of movement of said electromagnetic means and including switching means for selectively rendering said drive means operable for driving said operating member and further including a control limit switch adapted to be responsive to said electromagnetic releasing means, said movement control means being operative in accordance with the position of said control limit switch.

11. Apparatus for operating a valve in a system in accordance with the pressure at some selected point in the system comprising a valve, a first drive means for said valve, including an electromotive means and an electromagnetic clutch, an alternative second drive means for said valve including a hand wheel, power transmitting means connecting said first and second drive means to said valve, holding means for said hand wheel biased into holding relationship with said hand wheel, said holding means being manually releasable from said hand wheel, electromagnetic releasing means for releasing said holding means from holding relationship with said hand wheel, electromagnetic means operable by the movement of, and governed in accordance with the position of, the power transmitting means according to its position with respect to the position of the valve operating member for controlling the movement of said electromagnetic means and including switching means for selectively rendering said electromotive means operable for driving said valve and further including a control limit switch adapted to be responsive to said electromagnetic releasing means and also including pressure switch means responsive to pressure at a selected point in the system adapted to cause operation of said movement control means to position said valve through said electromotive means in accordance with the pressure at the selected point to which the pressure switch is responsive.

12. The apparatus of claim 11, said movement control means further including a time delay switch means cooperating with said pressure switch means for causing or not causing said electromotive means operable for said valve to be selected at said valve to selected positions in its range of movement under the control of said pressure switch, said movement control means also including an electromotive means operable by the movement of, and governed in accordance with the position of, the power transmitting means according to its position with respect to the position of the valve operating member for controlling the direction of movement of said electromagnetic means and including switching means for selectively rendering said electromotive means operable for driving said operating member and further including a control limit switch adapted to be responsive to said electromagnetic releasing means, said movement control means being operative in accordance with the position of said control limit switch.

14. Apparatus for operating a valve in a system in accordance with the pressure at some selected point in the system comprising a valve, a first drive means for said valve including an electromotive means and said electromagnetic clutch, an alternative second drive means for said valve including a hand wheel, power transmitting means connecting said first and second drive means to said valve, holding means biased into holding relationship with said hand wheel, said holding means being manually releasable from said hand wheel, electromagnetic releasing means adapted to be energized when said electromagnetic clutch is energized to hold said holding means in an unbiased position, said holding means being manually releasable from said hand wheel when said electromagnetic release means is de-energized, movement control means operable by the movement of, and governed in accordance with the position of, the power transmitting means according to its position with respect to the position of the valve operating member for controlling said electromotive means and including pressure switch responsive to pressure at a selected point in the system, and a selector switch assembly having three selectable positions, circuits adapted to be closed when said selector switch is in the first of said positions for controlling said electromotive means to move said valve to selected positions in its range of movement under the control of said pressure switch, said movement control means also including a first manually operable switch adapted to be connected in circuit when said selector switch assembly is in the first and second of said positions for controlling said electromotive means to move said valve and said selector switch assembly in its third position for controlling said electromotive means and its clutch whereby said driven member may be moved by said hand wheel, said movement control means also including a second manually operable switch in spaced relation from said first manually operable switch, whereby said valve member may be manually controlled when one of said manually operable switches is inoperable.

15. The apparatus of claim 14, said movement control means further including a control limit switch means adapted to render said movement control means operative only when said holding means is disengaged by said electromagnetic release means.

16. The apparatus of claim 15, said movement control means further including contact means operating in synchronism with said electromotive means for controlling said movement control means for stopping said electromotive means at selected positions.

17. Apparatus for operating a snort valve in the cold blast main of a blast furnace system comprising a cold blast main, a snort valve positioned therein, a first drive means for said valve including electromotive means and an electromagnetic clutch, a second drive means for said valve including a hand wheel and a cable connecting said hand wheel to said first drive means, power transmitting means including resiliently connecting linkage for communicating power from said first and second drive means to said valve, holding means for holding said hand wheel of said second drive means, electromagnetic release means for releasing said holding means, control means operable by the movement of, and governed in accordance with the position of, the power transmitting means according to its position with respect to the position of the valve operating
member for governing operation of said electromotive means and said electromagnetic release means, said control means being adapted to effect automatic transposition from said first drive means to said second drive means in the event of power shut-off to said electromotive and its clutch means, said control means including a control limit switch means adapted to render said control means operative only when said holding means is disengaged by said electromagnetic release means, and further including contact means operating in synchronism with said electromotive means for controlling said control means for stopping said electromotive and its clutch means at selected positions, and pressure switch means responsive to pressure in said system and adapted to control said control means.

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