DATA 3820-4

Westinghouse Variable Voltage Planer Controller

INSTRUCTIONS

EQUIPMENT REQUIRED

Reversing Planer Motor
Unit Type Motor Generator Set
Magnetic Controller
Regulator Generator (Part of Unit Motor Generator Set)
Duplex Type Cut and Return Rheostat
Reversing Stroke Limit Switch
Slow Down Stroke Limit Switches
Pendant Pushbutton Station
Multi-conductor Cable for Pendant Station
Starter for Motor Generator Set
Safety Disconnecting Switch

DESCRIPTION OF CONTROLLER

The control panel on which are mounted all the necessary contactors, relays, etc., is enclosed in a substantial steel cabinet. The cabinet is thoroughly ventilated and is provided with a single door in the front and a removable back so that all the apparatus is accessible.

The resistors are mounted inside the cabinet at the top so that the rear of the panel is unobstructed and the heat dissipated does not affect the contactors and relays. The resistors are accessible both from the front and the rear of the cabinet.

The cabinet is open at the bottom so that it may be placed directly over the conduits passing through the floor. The connections to the panel are made to terminal boards located at the rear of the panel.

STARTING AND ADJUSTING EQUIPMENT

The wiring to all apparatus should be checked very carefully to make certain it agrees with the wiring diagram. With the power off, the contactors, relays, and interlocks should be operated by hand to insure that they operate freely without friction and make good contact.

Should the planer operate in the reverse direction from that indicated by the marking on the pushbutton, reverse the connections to the planer motor shunt field leads marked MF1 and MF2.

The relays are adjusted carefully on the test floor before shipment and should not be changed unless it is evident the adjustment has been disturbed during shipment.

The field weakening relay, marked FWR, is set to pick up when the generator voltage reaches approximately 200 volts, and to drop out when either slow down limit switch is opened.

Relay TR is adjusted to drop out to allow relay BR to apply the generator differential field at the time the motor speed approaches zero.

The operation of these relays cannot be checked very accurately by observation of a voltmeter during normal operation. To adjust these relays, open the planer motor armature circuit and adjust the generator voltage by means of the cut rheostat.

OPERATION OF THE CONTROLLER

The magnetic controller consists of two contactors marked C and R for reversing the main generator shunt fields, one control relay marked CR for selecting either automatic or inching operation, one field weakening contactor marked FW for weakening the planer motor shunt field, one field weakening relay to operate the FW contactor, one automatic relay marked AR for forcing the deceleration and acceleration at the end and beginning of each stroke, one a-c. voltage relay marked VR, and two relays marked TR and BR for connecting the main generator differential field to the main generator armature to prevent the residual voltage in the main generator from building up and causing the planer to creep.

The scheme of control as shown on Figure 1 makes use of a regulator generator, which is driven at a constant speed by the a-c. motor of the unit motor generator set. This regulator generator functions to maintain a constant speed on the planer motor for a given setting of the rheostat, regardless of load and other variables. The regulator generator also tends to provide uniform acceleration and deceleration of the planer motor. This action of the regulator generator, combined with the small time constant of the main generator shunt field circuit, provides a very fast equipment and insures accurate and consistent reversals of the table.

It will be noted that there are three sets of regulator generator field windings, shown on Figure 1. The regulator generator shunt field windings are connected in series with the main generator shunt field windings in a balanced Wheatstone bridge circuit. The regulator generator shunt field windings measure the current, determined by the rheostat setting, going through the main generator shunt fields. This current is intended to cause the planer motor to run at some definite speed. The regulator generator differential field windings are connected across the planer motor armature and measure the terminal voltage of the planer motor, which roughly represents speed. The terminal voltage of the planer motor, however, is

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the sum of the counter electromotive force (which is directly proportional to speed) and the voltage or IR drop due to the internal resistance of the armature. The voltage or IR drop varies with the load or armature current. It is, therefore, necessary to use the regulator generator series fields to compensate for this voltage drop. Part of the load current is shunted around the regulator generator series field windings to protect them from overheating and also as a means to adjust the speed regulation of the planer motor.

When the speed of the planer motor is correct for the setting of the rheostat, the three sets of regulator generator fields balance each other and the voltage across the regulator generator armature is zero. Should the motor speed attempt to change, the regulator generator fields become unbalanced and the regulator generator generates a voltage causing current to flow through the Wheatstone bridge circuit in the direction required to hold the planer motor speed constant and in accordance with rheostat setting.

Because the main generator is separately excited, variable voltage is easily obtained by means of a rheostat in series with the main generator shunt field circuits. Part of the speed range is obtained by varying the main generator voltage and maintaining full field on the planer motor. The rest of the speed range is obtained by weakening the planer motor shunt field and maintaining full voltage on the main generator.

On power failure there is sufficient stored energy in the main motor generator set to stop the planer motor.

The apparatus is shown on Figure 1 in the de-energized position. Starting the main motor generator set in the correct direction will cause the exciter voltage to build up to approximately 230 volts. This will energize the planer motor shunt field and the coil of relay, BR. Relay contact, BR, closes, connecting the main generator differential field, GS to GS4, across the main generator armature, preventing the main generator from building up a voltage on residual magnetism, which would cause the planer motor to creep. The a-c. voltage relay coil, VR, is energized through the a-c. starter. The controller is now ready to operate.

Inching Operation

The inching operation is independent of the setting of the limit switches and rheostats.

Pressing the "Inch Cut" button energizes contactor coil C. The contacts of contactor C close, energizing the main generator shunt fields. The TR relay contacts open, de-energizing the relay coil BR. Relay contact BR opens, disconnecting the main generator differential field. The main generator builds up a voltage causing the planer motor to operate in the cut direction. The planer motor will continue to run until the "Inch Cut" button is released.

Releasing the "Inch Cut" button de-energizes relay coil C. The contacts of contactor C open, de-energizing the main generator shunt fields. The main generator voltage decreases rapidly and the planer motor comes to rest. The TR relay contacts close and energize the relay coil BR. The BR relay contact closes, connecting the main generator differential field across the main generator armature.

Pressing the "Inch Return" button causes the same sequence of operation except the R relay coil is energized instead of the C relay coil.

Automatic Operation

The initial direction of the table can be selected at the pendant station provided the table is between the limits of travel.

Pressing the "Auto-Cut" button energizes the control relay coil CR. The CR contacts on closing energizes the coil of contactor C. The contacts of contactor C close, energizing the main generator shunt fields. The TR relay contacts open immediately, de-energizing the relay coil BR. Relay contact BR opens, disconnecting the main generator differential field. The main generator voltage builds up to a value determined by the setting of the generator rheostat and the planer motor accelerates smoothly and rapidly with the main generator voltage. When the main generator voltage reaches approximately 200 volts, the planer motor field weakening contactor FW opens, inserting the motor rheostat in series with the planer motor field, causing the planer motor to accelerate to the speed determined by the rheostat setting. The planer motor runs in the cut direction at the speed set by the cut rheostat.

Near the end of the cut stroke, the cut slow-down limit switch is operated by the dog on the table. The field weakening contactor coil FW, is energized and the contacts of FW close, shorting out the planer motor field rheostat. The planer motor shunt field builds up to full field strength, and the motor slows down to the full field speed. The same dog now operates the cut stroke limit switch. The relay coil C is de-energized and the relay coil, R, is energized. The C relay contacts open and the R relay contacts close, reversing the voltage on the main generator shunt fields and causing the main generator voltage to decline rapidly, pass through zero, and build up on the opposite direction. The planer motor follows the main generator voltage and is quickly decelerated, reversed, and accelerated in the return direction. The planer motor runs in the return direction at the speed set by the return rheostat.

At the end of the return stroke, the return slowdown and stroke limit switches are operated by the dog on the table. The planer motor is thus decelerated, reversed, and accelerated in the cut direction in the same manner as

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at the end of the cut stroke. This automatic reversing sequence continues until either the stop lever or the "Inch" buttons are operated.

The AR relay main coil is de-energized at the end of the stroke by the slow down limit switches. The AR relay contact is held closed by the holding coil until the main generator voltage drops to approximately 250 volts. The AR relay contact on opening changes the resistance value of the bridge circuit forcing the main generator shunt fields at the end and beginning of each stroke.

Automatic operation can be started initially in the return direction by pressing the "Return" button.

Deflecting the pendant station stop lever will immediately de-energize the control relay coil CR and relay coil C (or R). The C (or R) relay contacts on opening de-energize the main generator shunt fields. The main generator voltage declines rapidly and the planer motor is brought to rest. Relay TR is adjusted to drop out at approximately 150 volts to energize relay BR. The BR relay contact closes connecting the main generator differential field across the main generator armature. This prevents the main generator from building up a residual voltage which would cause the planer motor to creep.

INSPECTION AND MAINTENANCE

Inspection should be made at relatively frequent intervals as often as feasible on the basis of the amount the equipment is used.

Inspection should consist of the examination of all working parts. The apparatus should be cleaned and all badly worn parts replaced.

Remove all dust and other foreign matter from the controller, limit switches, pendant station, and rheostat.

Inspect all contactors, relays, and interlocks to make sure they operate freely and without friction.

All bolts and screws in the main and control wiring must always be tightly drawn. A complete check should be made occasionally.

Inspect the arc horns, arc boxes, contacts and shunts.

Contacts and arc boxes which are badly burned should be cleaned or replaced. The contacts may be cleaned with a cloth moistened in gasoline.

Contacts should not be filed merely to brighten a dull surface, but should be filed only when they are badly burned or pitted. If filing is necessary, care should be taken to see that the contacts are properly aligned after the filing is completed.

The contacts should never be greased.

Special attention should be given to the reversing and slow-down limit switches to keep them free from oil and metal dust.

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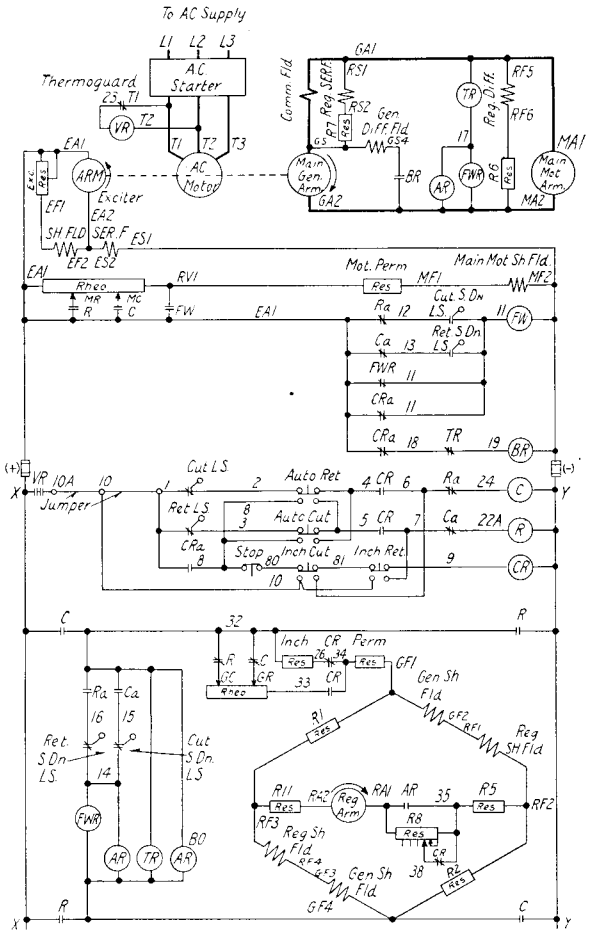

FIG. 1

Contactors Or Relays	Off	INCH		AUTOMATIC OPERATION							
				CUT				RETURN			
		Cut	Return	Start Stroke	△ Generator Builds Up To Approx. 200 Volts	Hit Slow Down L.S.	Hit Stroke L.S.	Start Stroke	△ Generator Builds Up To Approx. 200 Volts	Hit Slow Down L.S.	Hit Stroke L.S.
C		∅		∅	∅	∅					
R			∅					∅	∅	∅	
CR				∅	∅	∅	∅	∅	∅	∅	∅
AR		∅	∅	∅	∅	∅	∅	∅	∅	∅	∅
TR	●						●				●
BR	∅										
△ FWR	●	●	●	●		●	●	●		●	●
FW	∅	∅	∅	∅		∅	∅	∅		∅	∅
VR	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅

● Indicates spring closed.
∅ Indicates magnet closed.
△FWR pickup value of 200 volts is approximate value only. See paragraph 4 under "Starting and Adjusting Equipment".

FIG. 2—VARIABLE VOLTAGE CONTROLLER SEQUENCE TABLE

Westinghouse Electric & Manufacturing Company
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Westinghouse Press
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