Westinghouse Variable Voltage Planer Controller

INSTRUCTIONS

Equipment Required

Reversing Planer Motor.
Unit Type Motor Generator Set.
Magnetic Controller.
Regulator Motor Generator Set.
(Mounted in the Controller)
Duplex Type Cut and Return Rheostat.
Reversing Stroke Limit Switches.
Slow Down Stroke Limit Switch.
Pendant Push Button 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 door in the front and a removable back so that all the apparatus is accessible.

The small regulator motor generator set is mounted in the cabinet above the control panel.

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 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. A removable plate is provided in the front of the cabinet at the bottom to hide from view the conduits and wiring when the door is open.

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 push button, 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 that due to shipment the adjustment has been disturbed.

The field weakening relay marked FW is set to pick up when the generator voltage reaches 200 volts in the return direction of operation.

The automatic relay marked AR is set to drop out when the generator voltage decreases to 250 volts.

The operation of these relays can not 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 relay marked FW for weakening the planer motor shunt field, one automatic relay marked AR for forcing the deceleration and acceleration at the end and beginning of each stroke, one AC 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 motor 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 a separate A-C motor. 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 inherent fastness of the main generator shunt fields provides a very fast equipment, and one which is unusually accurate at the point of reversal.

Referring to the scheme of control it will be noted there are three sets of field windings on the regulator generator. The regulator generator shunt field windings are connected in series with the main generator shunt field windings in a balanced wheat-stone bridge circuit. The regulator generator shunt field windings measure the current, set by the cut rheostat, 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 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 armature or load 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 wheat-stone bridge circuit in the direction required to hold the planer motor speed constant and in accordance with rheostat setting.

Since the main generator is separately excited, variable voltage is easily obtained by means of a rheostat in series with the main generator shunt field circuit. The cut speed range of 40 to 750 RPM is obtained by varying the main generator voltage and maintaining full field on the planer motor. The return speed range of 750 to 1200 RPM 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 deenergized position. Starting the main motor-generator set in the correct direction will cause the exciter voltage to build up to approximately 240 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 and regulator generator driving motor are 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 relay coils TR and C. The TR relay contacts open deenergizing the relay coil BR. Relay contact BR opens disconnecting the main generator differential field. The C relay contacts close energizing the main generator shunt fields. 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 deenergizes relay coils TR and C. The C relay contacts open deenergizing the main generator shunt fields. The main generator voltage decreases rapidly and the planer motor comes to rest. The TR relay contacts close after a short time delay and ener-

gize 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 relay contacts on closing energize the relay coils TR and C. The TR relay contacts open immediately deenergizing the relay coil BR. Relay contact BR opens disconnecting the main generator differential field. The C relay contacts close energizing the main generator shunt fields. The main generator voltage builds up to a value determined by the setting of the cut rheostat and the planer motor accelerates smoothly and rapidly with the main generator voltage. 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 limit switch is operated by the dog on the table. The relay coil C is deenergized and the relay coil R is energized. The TR relay contacts do not close even though the relay coil TR is momentarily deenergized because the TR relay has a time delay when deenergized. The C relay contacts open and the R relay contacts close, reversing the voltage on the main generator shunt fields causing the main generator voltage to decline rapidly, pass through zero and build up in the opposite direction. The planer motor follows the main generator voltage and is quickly decelerated, reversed and accelerated in the return direction. When the main generator voltage reaches approximately 200 volts the planer motor field weakening relay contact FW opens inserting the return rheostat in series with the planer motor field and the planer motor further accelerates to the speed determined by the setting of the return rheostat. The planer motor runs in the return direction at the speed set by the return rheostat.

Near the end of the return stroke the return slow down limit switch is operated by the dog on the table. The field weakening relay coil FW is deenergized. The relay contact FW closes, 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 return limit switch. The relay coil R is deenergized and the relay coil C is energized. The R relay contacts open and the C relay contacts close reversing the voltage on the main generator shunt fields causing the main generator voltage to decline rapidly, pass through zero and build up in the opposite direction. The planer motor follows the main generator voltage and is quickly decelerated, reversed and accelerated in the cut direction. The operation from here on is exactly as described above.

The AR relay main coil is deenergized at the end of the stroke by the reversing 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. This naturally decreases the amount the platen drifts past the limit switches, thereby increasing the number of short strokes and the overall efficiency on longer strokes.

The automatic operation can be started initially in the return direction by pressing the return button.

Deflecting the pendant station stop lever will immediately deenergize the control relay coil CR and relay coils C (or R) and TR. The C (or R) relay contacts on opening deenergize the main generator shunt fields. The main generator voltage declines rapidly and the planer motor is brought to rest. The TR relay contacts close after a short time delay, energizing the relay coil 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.

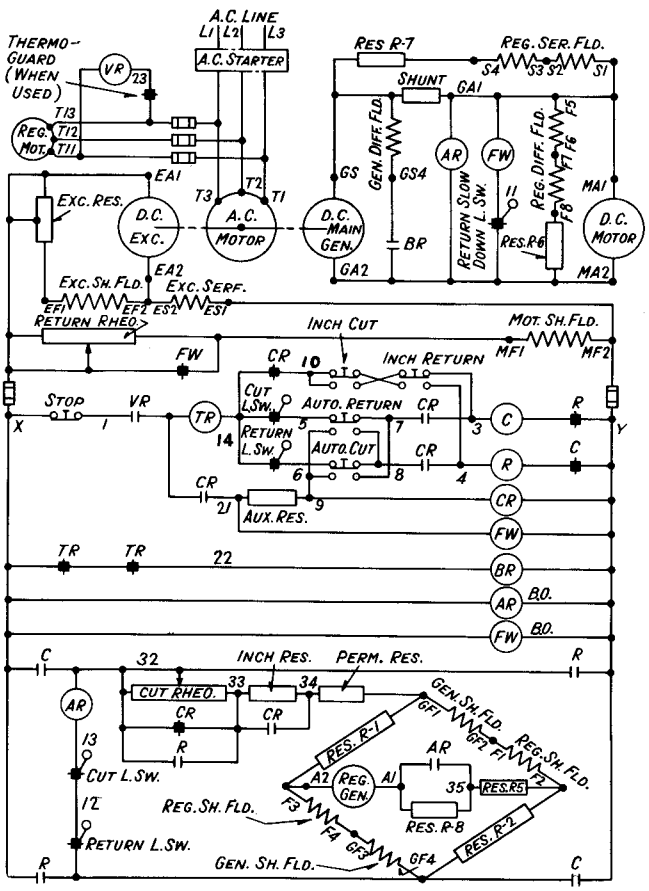

Fig. 1 - Variable Voltage Reversing Planer Controller

Inspection and Maintenance

Inspection should be made at relatively frequent intervals as often as feasible on a 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.

Do not file the contacts unless the surfaces are badly burned. In all cases the contacts should be removed if it is necessary to trim them with a file.

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.

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

Printed in U.S.A. (11-38)

DATA 4063

I.L. 3137

Westinghouse Variable Voltage Planer Controller

INSTRUCTIONS

Equipment Required

Reversing Planer Motor.
Unit Type Motor Generator Set.
Magnetic Controller.
Regulator Motor Generator Set.
(Mounted in the Controller)
Duplex Type Cut and Return Rheostat.
Reversing Stroke Limit Switches.
Slow Down Stroke Limit Switch.
Pendant Push Button 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 door in the front and a removable back so that all the apparatus is accessible.

The small regulator motor generator set is mounted in the cabinet above the control panel.

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 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. A removable plate is provided in the front of the cabinet at the bottom to hide from view the conduits and wiring when the door is open.

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 push button, 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 that due to shipment the adjustment has been disturbed.

The field weakening relay marked FW is set to pick up when the generator voltage reaches 200 volts in the return direction of operation.

The automatic relay marked AR is set to drop out when the generator voltage decreases to 250 volts.

The operation of these relays can not 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 relay marked FW for weakening the planer motor shunt field, one automatic relay marked AR for forcing the deceleration and acceleration at the end and beginning of each stroke, one AC 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 motor 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 a separate A-C motor. 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 inherent fastness of the main generator shunt fields provides a very fast equipment, and one which is unusually accurate at the point of reversal.

Referring to the scheme of control it will be noted there are three sets of field windings on the regulator generator. The regulator generator shunt field windings are connected in series with the main generator shunt field windings in a balanced wheat-stone bridge circuit. The regulator generator shunt field windings measure the current, set by the cut rheostat, 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 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 armature or load 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 wheat-stone bridge circuit in the direction required to hold the planer motor speed constant and in accordance with rheostat setting.

Since the main generator is separately excited, variable voltage is easily obtained by means of a rheostat in series with the main generator shunt field circuit. The cut speed range of 40 to 750 RPM is obtained by varying the main generator voltage and maintaining full field on the planer motor. The return speed range of 750 to 1200 RPM 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 deenergized position. Starting the main motor-generator set in the correct direction will cause the exciter voltage to build up to approximately 240 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 and regulator generator driving motor are 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 relay coils TR and C. The TR relay contacts open deenergizing the relay coil BR. Relay contact BR opens disconnecting the main generator differential field. The C relay contacts close energizing the main generator shunt fields. 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 deenergizes relay coils TR and C. The C relay contacts open deenergizing the main generator shunt fields. The main generator voltage decreases rapidly and the planer motor comes to rest. The TR relay contacts close after a short time delay and ener-

gize 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 relay contacts on closing energize the relay coils TR and C. The TR relay contacts open immediately deenergizing the relay coil BR. Relay contact BR opens disconnecting the main generator differential field. The C relay contacts close energizing the main generator shunt fields. The main generator voltage builds up to a value determined by the setting of the cut rheostat and the planer motor accelerates smoothly and rapidly with the main generator voltage. 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 limit switch is operated by the dog on the table. The relay coil C is deenergized and the relay coil R is energized. The TR relay contacts do not close even though the relay coil TR is momentarily deenergized because the TR relay has a time delay when deenergized. The C relay contacts open and the R relay contacts close, reversing the voltage on the main generator shunt fields causing the main generator voltage to decline rapidly, pass through zero and build up in the opposite direction. The planer motor follows the main generator voltage and is quickly decelerated, reversed and accelerated in the return direction. When the main generator voltage reaches approximately 200 volts the planer motor field weakening relay contact FW opens inserting the return rheostat in series with the planer motor field and the planer motor further accelerates to the speed determined by the setting of the return rheostat. The planer motor runs in the return direction at the speed set by the return rheostat.

Near the end of the return stroke the return slow down limit switch is operated by the dog on the table. The field weakening relay coil FW is deenergized. The relay contact FW closes, 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 return limit switch. The relay coil R is deenergized and the relay coil C is energized. The R relay contacts open and the C relay contacts close reversing the voltage on the main generator shunt fields causing the main generator voltage to decline rapidly, pass through zero and build up in the opposite direction. The planer motor follows the main generator voltage and is quickly decelerated, reversed and accelerated in the cut direction. The operation from here on is exactly as described above.

The AR relay main coil is deenergized at the end of the stroke by the reversing 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. This naturally decreases the amount the platen drifts past the limit switches, thereby increasing the number of short strokes and the overall efficiency on longer strokes.

The automatic operation can be started initially in the return direction by pressing the return button.

Deflecting the pendant station stop lever will immediately deenergize the control relay coil CR and relay coils C (or R) and TR. The C (or R) relay contacts on opening deenergize the main generator shunt fields. The main generator voltage declines rapidly and the planer motor is brought to rest. The TR relay contacts close after a short time delay, energizing the relay coil 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.

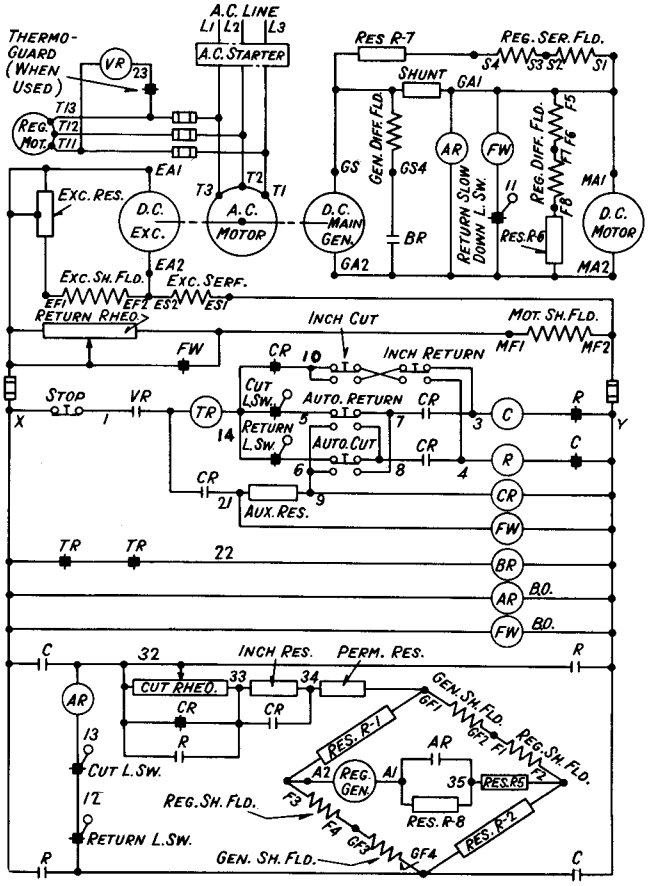

Fig. 1 - Variable Voltage Reversing Planer Controller

Inspection and Maintenance

Inspection should be made at relatively frequent intervals as often as feasible on a 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.

Do not file the contacts unless the surfaces are badly burned. In all cases the contacts should be removed if it is necessary to trim them with a file.

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.

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

Printed in U.S.A. (11-38)

Data 4000. 4034

I.L. 3137

Westinghouse Variable Voltage Planer Controller

INSTRUCTIONS

Equipment Required

Reversing Planer Motor.
Unit Type Motor Generator Set.
Magnetic Controller.
Regulator Motor Generator Set.
(Mounted in the Controller)
Duplex Type Cut and Return Rheostat.
Reversing Stroke Limit Switches.
Slow Down Stroke Limit Switch.
Pendant Push Button 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 door in the front and a removable back so that all the apparatus is accessible.

The small regulator motor generator set is mounted in the cabinet above the control panel.

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 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. A removable plate is provided in the front of the cabinet at the bottom to hide from view the conduits and wiring when the door is open.

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 push button, 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 that due to shipment the adjustment has been disturbed.

The field weakening relay marked FW is set to pick up when the generator voltage reaches 200 volts in the return direction of operation.

The automatic relay marked AR is set to drop out when the generator voltage decreases to 250 volts.

The operation of these relays can not 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 relay marked FW for weakening the planer motor shunt field, one automatic relay marked AR for forcing the deceleration and acceleration at the end and beginning of each stroke, one AC 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 motor 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 a separate A-C motor. 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 inherent fastness of the main generator shunt fields provides a very fast equipment, and one which is unusually accurate at the point of reversal.

Referring to the scheme of control it will be noted there are three sets of field windings on the regulator generator. The regulator generator shunt field windings are connected in series with the main generator shunt field windings in a balanced wheat-stone bridge circuit. The regulator generator shunt field windings measure the current, set by the cut rheostat, 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 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 armature or load 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 wheat-stone bridge circuit in the direction required to hold the planer motor speed constant and in accordance with rheostat setting.

Since the main generator is separately excited, variable voltage is easily obtained by means of a rheostat in series with the main generator shunt field circuit. The cut speed range of 40 to 750 RPM is obtained by varying the main generator voltage and maintaining full field on the planer motor. The return speed range of 750 to 1200 RPM 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 deenergized position. Starting the main motor-generator set in the correct direction will cause the exciter voltage to build up to approximately 240 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 and regulator generator driving motor are 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 relay coils TR and C. The TR relay contacts open deenergizing the relay coil BR. Relay contact BR opens disconnecting the main generator differential field. The C relay contacts close energizing the main generator shunt fields. 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 deenergizes relay coils TR and C. The C relay contacts open deenergizing the main generator shunt fields. The main generator voltage decreases rapidly and the planer motor comes to rest. The TR relay contacts close after a short time delay and ener-

gize 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 relay contacts on closing energize the relay coils TR and C. The TR relay contacts open immediately deenergizing the relay coil BR. Relay contact BR opens disconnecting the main generator differential field. The C relay contacts close energizing the main generator shunt fields. The main generator voltage builds up to a value determined by the setting of the cut rheostat and the planer motor accelerates smoothly and rapidly with the main generator voltage. 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 limit switch is operated by the dog on the table. The relay coil C is deenergized and the relay coil R is energized. The TR relay contacts do not close even though the relay coil TR is momentarily deenergized because the TR relay has a time delay when deenergized. The C relay contacts open and the R relay contacts close, reversing the voltage on the main generator shunt fields causing the main generator voltage to decline rapidly, pass through zero and build up in the opposite direction. The planer motor follows the main generator voltage and is quickly decelerated, reversed and accelerated in the return direction. When the main generator voltage reaches approximately 200 volts the planer motor field weakening relay contact FW opens inserting the return rheostat in series with the planer motor field and the planer motor further accelerates to the speed determined by the setting of the return rheostat. The planer motor runs in the return direction at the speed set by the return rheostat.

Near the end of the return stroke the return slow down limit switch is operated by the dog on the table. The field weakening relay coil FW is deenergized. The relay contact FW closes, 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 return limit switch. The relay coil R is deenergized and the relay coil C is energized. The R relay contacts open and the C relay contacts close reversing the voltage on the main generator shunt fields causing the main generator voltage to decline rapidly, pass through zero and build up in the opposite direction. The planer motor follows the main generator voltage and is quickly decelerated, reversed and accelerated in the cut direction. The operation from here on is exactly as described above.

The AR relay main coil is deenergized at the end of the stroke by the reversing 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. This naturally decreases the amount the platen drifts past the limit switches, thereby increasing the number of short strokes and the overall efficiency on longer strokes.

The automatic operation can be started initially in the return direction by pressing the return button.

Deflecting the pendant station stop lever will immediately deenergize the control relay coil CR and relay coils C (or R) and TR. The C (or R) relay contacts on opening deenergize the main generator shunt fields. The main generator voltage declines rapidly and the planer motor is brought to rest. The TR relay contacts close after a short time delay, energizing the relay coil 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.

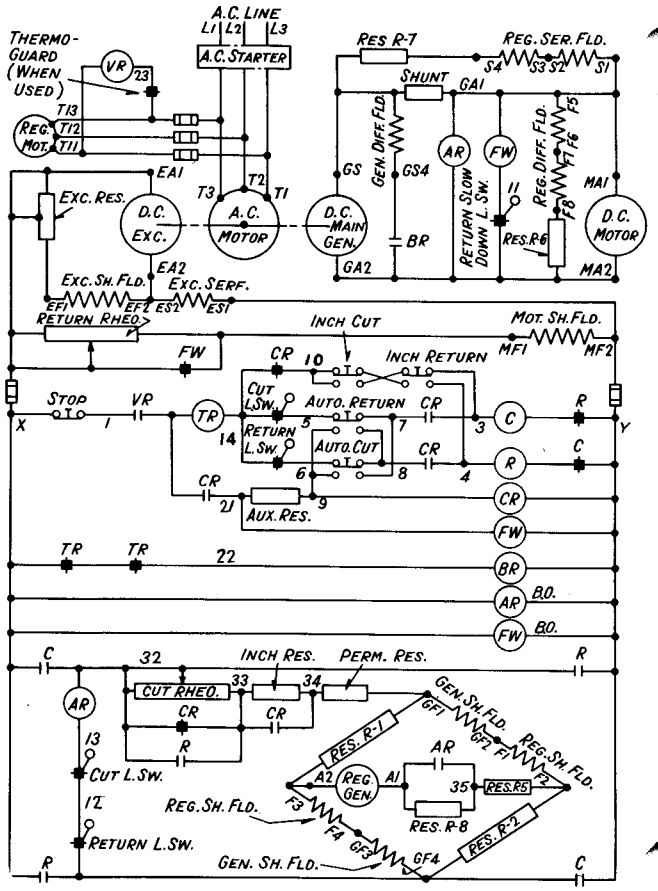

Fig. 1 - Variable Voltage Reversing Planer Controller

Inspection and Maintenance

Inspection should be made at relatively frequent intervals as often as feasible on a 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.

Do not file the contacts unless the surfaces are badly burned. In all cases the contacts should be removed if it is necessary to trim them with a file.

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.

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

Printed in U.S.A. (11-38)

Catalog 4034

I.L. 3137

Westinghouse Variable Voltage Planer Controller

INSTRUCTIONS

Equipment Required

Reversing Planer Motor.
Unit Type Motor Generator Set.
Magnetic Controller.
Regulator Motor Generator Set.
(Mounted in the Controller)
Duplex Type Cut and Return Rheostat.
Reversing Stroke Limit Switches.
Slow Down Stroke Limit Switch.
Pendant Push Button 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 door in the front and a removable back so that all the apparatus is accessible.

The small regulator motor generator set is mounted in the cabinet above the control panel.

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 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. A removable plate is provided in the front of the cabinet at the bottom to hide from view the conduits and wiring when the door is open.

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 push button, 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 that due to shipment the adjustment has been disturbed.

The field weakening relay marked FW is set to pick up when the generator voltage reaches 200 volts in the return direction of operation.

The automatic relay marked AR is set to drop out when the generator voltage decreases to 250 volts.

The operation of these relays can not 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 relay marked FW for weakening the planer motor shunt field, one automatic relay marked AR for forcing the deceleration and acceleration at the end and beginning of each stroke, one AC 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 motor 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 a separate A-C motor. 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 inherent fastness of the main generator shunt fields provides a very fast equipment, and one which is unusually accurate at the point of reversal.

Referring to the scheme of control it will be noted there are three sets of field windings on the regulator generator. The regulator generator shunt field windings are connected in series with the main generator shunt field windings in a balanced wheat-stone bridge circuit. The regulator generator shunt field windings measure the current, set by the cut rheostat, 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 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 armature or load 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 wheat-stone bridge circuit in the direction required to hold the planer motor speed constant and in accordance with rheostat setting.

Since the main generator is separately excited, variable voltage is easily obtained by means of a rheostat in series with the main generator shunt field circuit. The cut speed range of 40 to 750 RPM is obtained by varying the main generator voltage and maintaining full field on the planer motor. The return speed range of 750 to 1200 RPM 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 240 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 and regulator generator driving motor are 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 relay coils TR and C. The TR relay contacts open deenergizing the relay coil BR. Relay contact BR opens disconnecting the main generator differential field. The C relay contacts close energizing the main generator shunt fields. 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 deenergizes relay coils TR and C. The C relay contacts open deenergizing the main generator shunt fields. The main generator voltage decreases rapidly and the planer motor comes to rest. The TR relay contacts close after a short time delay and ener-

gize 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 relay contacts on closing energize the relay coils TR and C. The TR relay contacts open immediately deenergizing the relay coil BR. Relay contact BR opens disconnecting the main generator differential field. The C relay contacts close energizing the main generator shunt fields. The main generator voltage builds up to a value determined by the setting of the cut rheostat and the planer motor accelerates smoothly and rapidly with the main generator voltage. 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 limit switch is operated by the dog on the table. The relay coil C is deenergized and the relay coil R is energized. The TR relay contacts do not close even though the relay coil TR is momentarily deenergized because the TR relay has a time delay when deenergized. The C relay contacts open and the R relay contacts close, reversing the voltage on the main generator shunt fields causing the main generator voltage to decline rapidly, pass through zero and build up in the opposite direction. The planer motor follows the main generator voltage and is quickly decelerated, reversed and accelerated in the return direction. When the main generator voltage reaches approximately 200 volts the planer motor field weakening relay contact FW opens inserting the return rheostat in series with the planer motor field and the planer motor further accelerates to the speed determined by the setting of the return rheostat. The planer motor runs in the return direction at the speed set by the return rheostat.

Near the end of the return stroke the return slow down limit switch is operated by the dog on the table. The field weakening relay coil FW is deenergized. The relay contact FW closes, 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 return limit switch. The relay coil R is deenergized and the relay coil C is energized. The R relay contacts open and the C relay contacts close reversing the voltage on the main generator shunt fields causing the main generator voltage to decline rapidly, pass through zero and build up in the opposite direction. The planer motor follows the main generator voltage and is quickly decelerated, reversed and accelerated in the cut direction. The operation from here on is exactly as described above.

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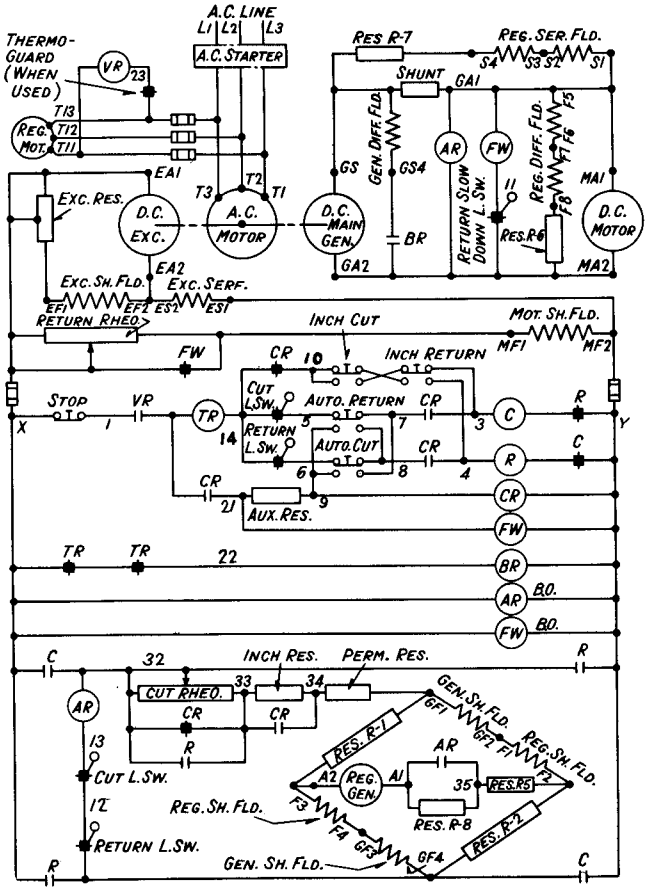

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