Westinghouse Constant Voltage Equipment

for

Metal Planers

INSTALLATION, OPERATION AND MAINTENANCE

EQUIPMENT REQUIRED

Safety Disconnecting Switch
Controller
Duplex Type Cut and Return Rheostat
Pendant Station (or Stations)
Multi-conductor Cable for Pendant station
Limit Switch (or Switches)
Motor

Safety Switch

A suitable safety switch should always be installed ahead of the controller so that the controller may be completely disconnected from the source of power when inspection or repairs are being made. A line switch mounted on the control panel does not provide safety.

Rheostats

The cut and return field rheostats are enclosed in a single rigid steel case suitable for wall mounting, and should be so located as to be convenient to the operator. The holding bolt holes in the rear of the cabinet are of the buttonhole type so that the case may be easily hung on bolts screwed into a suitable support. Holes are provided in the bottom of the case for the insertion of conduit. All wiring is accomplished from the front of the cabinet by opening the hinged cover. Front-connected terminals are provided. The stationary and moving contacts have a very large cross section, assuring cool operation and long life.

The rheostats provide independent adjustment of speed over the entire speed range of the motor for both the cut and return directions of table travel.

Pendant Station

The pendant station is designed to provide for complete control of the platen from a single point. It is provided with four buttons and a stop lever marked "Inch Cut", "Inch Return", "Automatic Cut", "Automatic Return", and "Stop". By means of the "Inch" buttons, it is possible to traverse the platen the full length of the bed in either direction, travel continuing only while the button is depressed. Either of the buttons marked "Automatic" will cause the motor to start and continue to run and reverse automatically, the initial direction of travel depending on which automatic button is depressed.

The stop lever which protudes from the bottom of the pendant station may be deflected in any direction, pulled downward, or the pendant station struck lightly with the hand to terminate automatic operation.

The pendant station is intended for suspension by means of an armored cable supported on a swiveled conduit attached to the top of the planer arch. It is, however, also suitable for attachment to a flexible cable where the nature of the work makes it desirable that the operator carry the station with him.

On wide planers it is customary to suspend a pendant station over each side of the platen. Where it is desirable to fasten this station in a rigid position, suitable clamps may be obtained. A grounding terminal is provided within the case of the pendant station, and in every case the station should be grounded so as to protect the operator from the possibility of shock.

An 8-button station is required when electric feed equipment is used.

Multi-conductor Cable

This cable has the proper number of conductors necessary for operation of the planer control. It is not furnished unless ordered, as it is not possible to determine the exact length of the cable required. This cable has an outside diameter of 1.07 inches and consists of 13 conductors. When electric feed is used, a 19-conductor cable is required which has an outside diameter of 1.25 inches.

Platen Limit Switch

The platen limit switch is designed for mounting on the side of the planer bed and is provided with holding bolt holes in the back and bottom of the case.

The width and height of the case and the position of the levers is such as to make the switch suitable for mounting on any planer. The dimensional drawings indicate the space and position of the dogs that are required to operate the limit switch. The limit switch is designed to be operated directly from the dogs attached to the platen which renders the tumbler mechanism unnecessary and undesirable. The presence of a multiplicity of moving parts on the side of the planer constitutes a hazard and hampers rather than improves the operation of the planer. This is particularly true of high speed planers.

The limit switch construction is such as to provide for rapid and positive operation of its contacts at the end of the platen travel, irrespective of the rate of travel. The circuit for a given direction of travel is broken by the limit switch when actuated by the dog and is re-established by the same dog when the platen is reversed, so that at the end of the stroke in the opposite direction of platen travel, a connection has been established that will cause the platen to again travel in the original direction.

When starting the platen up for the first time deflect first one lever and then the other away from the center of the switch or away from each other. This will cause the switches to be in the proper position for subsequent operation. If at any time the planer fails to operate automatically, the operator should be instructed to deflect the limit switch levers by hand away from the center of the switch. This action will never be necessary unless the levers have been inadvertently moved. It will be noted, however, that if the levers are not in proper position to obtain correct operation, no improper or undesirable operation is possible.

It is desirable to have a limit switch on each side of the platen on wide planers as it facilitates the operation of the planer. These switches may also be used in connection with reciprocating devices for final limits.

MOTOR

The motors are especially designed for planer service. The armatures are of small diameter to reduce to a minimum the power required for acceleration and retardation. The armature coils are mica insulated to withstand long service without deterioration. The coils are banded and the general construction is such as to successfully withstand the frequent reversals and shock incident to planer service. Commutating field windings are used to obtain good commutation, and series field windings are supplied to stabilize the speed of the motor under all load conditions.

Four shunt field coils are supplied, one on each pole. Four leads for these fields are located at the conduit fitting. Leads F1 and F3 are joined together when the motor is installed and are then connected to the lead marked F1 in the terminal compartment in the controller. Motor field leads F2 and F4 are also joined at the time of installation and are connected to the terminal marked F2 in the terminal compartment of the controller.

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The shunt field coils are wound on micarta spools with double cotton covered wire and thoroughly impregnated under pressure, then thoroughly insulated with empire cloth and encased in heavy tape webbing, finally being dipped and baked. This form of construction renders the coil impervious to the infiltration of conducting dust and moisture. This form of field coil design and treatment is an exclusive Westinghouse feature.

The series parallel shunt field connections obtained in the manner just described produces a field circuit of low inductance which effects a rapid building up of the field flux in the initial portion of the accelerating period and an extremely rapid weakening of the field flux during the balance of the accelerating period. These effects produce extremely smooth and rapid acceleration. Because the series parallel field connection provides for full field at approximately 115 volts, it is evident that excellent dynamic braking will be provided when the shunt coils are energized by the voltage generated by the armature during the dynamic braking period.

Installation of Motor

The motor should be mounted on a solid foundation which preferably should be an integral part of the planer foundation. It should be carefully aligned with the driven shaft and connected to it by means of a well designed flexible coupling. In selecting a coupling, care should be taken to obtain a design that is free from excessive play as any looseness tends to transmit unnecessary shocks to the gearing. While special care has been taken in the design of the equipment herein described, it is obvious that the effect of excessive play in the gearing will tend to amplify any shocks that may exist.

The bearings normally furnished are of the solid sleeve type and are especially constructed to prevent the entrance of abrasive dust that is frequently present in machine shops. Inspection will disclose that a very large bearing surface exists and one that is well suited to the constant reversals and stresses encountered in service. In starting up for the first time it is advisable to remove the large plugs that are located in the top of the bearings to assume that the oil ring is turning freely. These plugs should then be tightly screwed in place. All oiling should be done through the oil-filler gauge located at the side of the bearing housing. Add oil every three months and clean bearings once a year.

Inspect brushes and wipe off the winding every thirty days. Wipe commutator with clean dry rag. Avoid unnecessary sanding of the commutator.

DESCRIPTION OF CONTROLLER

The controller is enclosed in a ventilated sheet steel cabinet which is provided with a door in the front and a removable back so that all the apparatus is accessible.

The starting, braking, and field resistors are mounted on top of the cabinet so that the heat given off will not affect the panel apparatus. The resistors are protected by a ventilated cover which can be readily removed.

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 terminals on the rear of the panel. The conduits should, in all cases where it is possible, be brought through the floor inside the cabinet.

The motor shunt fields are connected in two parallel circuits rated 115 volts with a permanent resistor connected in series to make them good for 230 volts under normal operating conditions. Connecting the fields in parallel decreases the inductance, providing faster acceleration on field weakening and more effective braking on power failure. The permanent resistance is short circuited during the emergency braking by relay contacts FRA.

The coils for the Type HI relays VR and PR are 230 volts coil connected in series. This reduces the voltage to one-half on each coil and the heating to one-quarter. These relays are adjusted to operate at definite voltages and this method of connecting them reduces the change in setting due to heating.

The control scheme uses two steps of acceleration and two steps of dynamic braking in addition to some plugging on automatic operation. The first starting step has a high ohmic resistance and is only in the circuit long enough to reduce the motor torque as the motor goes through zero speed. This eliminates the shock on the gears and provides a smooth reversal. The first step of dynamic braking is used for the purpose of reducing the motor torque at the instant dynamic braking is applied. This eliminates the shock as the backlash in the gearing is taken up.

The coils for the line contactor M, the dynamic braking contactor 1DB, and the directional contactors 1C and 2C or 1R and 2R are connected in series to eliminate all sequencing in the operation. This results in quicker response from the inch buttons and faster reversal on automatic operation.

Emergency braking on power failure is obtained by using the motor counter-voltage to energize the shunt field. The directional contactors are held closed during dynamic braking by the motor counter-voltage. When loss of power occurs, the motor counter-voltage will decrease until the voltage is reached for which the low voltage relay is set to drop out. The low voltage relay VR will open, transferring the motor shunt field circuit from the line to the inside of the line contactor by means of VR's back contacts. The VR make contacts will de-energize relay FR, and AR will be de-energized by FR. AR in turn de-energizes the line and dynamic braking contactors, M and 1DB. The motor is brought to rest in less time than during normal braking because the motor shunt field is stronger due to the back contact FRA shorting the permanent resistor in series with the field. The VR relay will not open immediately on the loss of power. It is held in by the motor counter-voltage until its drop-out setting is reached. The table will stop when the stroke limit switch is operated with less overtravel than on normal operation if it is operated before the VR relay opens.

The inch buttons are independent of the stroke limit switches permitting the movement of the table beyond the limit switches. The table is inched at the full field speed of the motor.

INSTRUCTIONS FOR STARTING AND ADJUSTING EQUIPMENT

The wiring to all the apparatus should be checked very carefully to make certain it agrees with the wiring diagram.

With the power off, the contactors and relays should be operated by hand to insure that they operate freely and make good contact. The interlocks should also be checked to see that they make positive contact.

The operation can be checked against the sequence table. If the motor operates in the reverse direction from that indicated by the marking on the pushbutton station reverse the connections of the armature leads A1 and A2 at the motor.

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 adjustments can be checked with a voltmeter as described below.

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The plugging relay PR is set to drop out at approximately 125 volts. Connect a voltmeter from inside the line contactor at S2 to N. Put a piece of paper in between the first dynamic braking contactor 1DB contacts. Operate the planer at slow speed in the cut direction, allowing for a long overtravel after the limit switch is operated. Note that when the limit switch is operated the voltage will decrease slowly until the plugging relay opens when it will drop rapidly to zero.

The low voltage relay VR is set to drop out at 160 to 175 volts. Connect a voltmeter across the line inside the disconnect or safety switch. Operate the planer on a long stroke at a fairly high speed. Open the safety switch while there is considerable travel to the limit switch. Note that the voltage will decrease slowly until the low voltage relay opens when it will drop rapidly to zero.

To raise the drop-out setting of either the PR or VR relays, increase the spring tension. Plugging the motor at too high a voltage will cause poor motor commutation and may result in flashing the motor. The emergency braking can be improved by raising the drop-out voltage of the VR relay. The relay should never be set lower than 160 volts. Care must be taken not to set the VR relay drop-out so high that dips in voltage will cause it to drop out.

The voltage settings given above are for cold coils.

OPERATION OF THE CONTROLLER

The apparatus is shown on the wiring diagram in the de-energized position. Closing the line disconnect or safety switch will cause the VR and FR relays to be energized through the break interlocks on contactors 1DB and 2DB. Relays VR and FR close, completing the circuit to the motor shunt field through contacts FR and form their own holding circuit through contact FR, VR and resistor A. The controller is now ready to operate.

Inching Operation

Pressing the "Inch Cut" button energizes contactor coils M, 1DB, 1C and 2C. The contactors pick-up, connecting the motor to the line in series with both steps of the starting resistor. An interlock on contactor M energizes the first accelerating contactor 1A, which in closing cuts out the high resistance step. The motor continues to run with the second or low resistance step in the circuit until the button is released. When the button is released contactors M and 1DB are de-energized and drop out. The motor armature is disconnected from the line and connected to the dynamic braking resistor. Contactor 2DB is energized and short circuits the high resistance step of the dynamic braking resistor. The motor is quickly brought to rest.

Pressing the "Inch Return" button causes the same sequence except the directional contactors 1R and 2R are energized instead of 1C and 2C.

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 set-up relay AR, which closes, forming its own holding circuit and completing the circuit to contactor coils M, 1DB, 1C, and 2C. The motor armature is connected to the line in series with the starting resistor. Relay SR is energized and closes its make contacts. An interlock on contactor M energizes the accelerating contactor 1A, which closes, shorting out the high resistance step. An interlock on 1A energizes the second accelerating contactor, 2A, which closes, shorting out all the resistance in series with the motor armature. Contactor FW, being de-energized, opens its contacts, inserting the cut rheostat in series with the motor shunt field. The motor is now running in the cut direction at the cut speed selected at the rheostat.

Near the end of the cut stroke the cut limit switch is operated by the dog on the table. Contactors M and 1DB are de-energized, disconnecting the motor from the line and applying the dynamic braking circuit with all the resistor in the circuit. Contactors 2DB and FW are energized by the voltage drop across the braking resistors. On closing, contactor 2DB shorts out the high resistance step of braking resistance, while contactor FW shorts out the field rheostat, applying full field to the motor.

The plugging relay, PR, drops out at a definite setting of counter-voltage, dropping out the directional contactors, 1C and 2C. This permits the contactors, M, 1DB, 1R and 2R to close, connecting the motor armature to the line in the reverse direction with all the starting resistor in series, plugging it to a stop and causing it to run in the return direction.

The sequence of the accelerating relays and contactors is the same in the return direction as in the cut direction, and so is the reversing cycle.

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

Motor

Check the alignment of the motor with the driven shaft.

Make sure that sufficient oil is in the motor bearings.

Make sure that the oil rings in the motor bearings are free to turn.

Check the location of the bearing bracket to see that it is located in the same position as when shipped. Poor commutation will result if the brushes are off neutral.

Inspect the brushes to see that they move freely in the brush holders.

Inspect the interior of the motor removing any foreign matter which may have entered.

Inspect all connections being sure that they are tight and that no loose ends are touching the frame or other terminals.

Controller

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

Inspect all contactors and relays to insure that they operate freely without friction.

The electrical interlocks should be checked and adjusted if necessary to insure they make positive contact.

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

The arc horns, arc boxes, contacts and shunts should be given particular attention. Contacts and arc boxes that are badly burned should be cleaned or replaced. The contacts may be cleaned with a cloth which has been 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.

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

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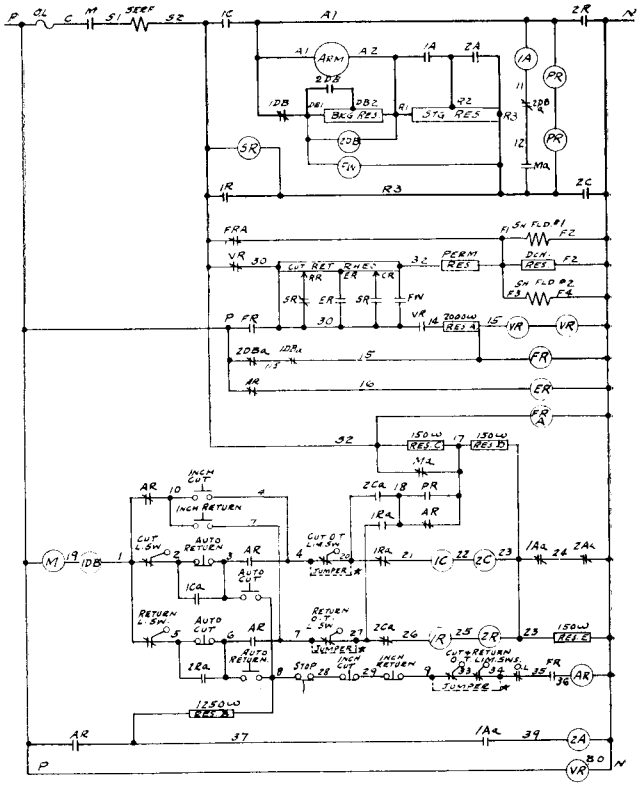

FIG. 1

Contactors	No Voltage	Auto Cut → Accel.			Auto Cut → Run	Auto Cut → Dynamic Braking			Auto Return → Accel.			Auto Return → Run	Auto Return → Dynamic Braking			Emergency Braking → Cut				Emergency Braking → Return			
M		Ø	Ø	Ø	Ø				Ø	Ø	Ø	Ø				Ø				Ø			
1 & 2C		Ø	Ø	Ø	Ø	Ø	Ø	Ø								Ø	Ø	Ø	Ø				
1 & 2R									Ø	Ø	Ø	Ø	Ø	Ø	Ø					Ø	Ø	Ø	Ø
1A			Ø	Ø	Ø					Ø	Ø	Ø				Ø				Ø			
2A				Ø	Ø						Ø	Ø				Ø				Ø			
1DB	●					●	●	●					●	●	●		●	●	●		●	●	●
2DB							Ø	Ø						Ø	Ø			Ø	Ø			Ø	Ø
PR			Ø	Ø	Ø	Ø	Ø	Ø		Ø	Ø	Ø		Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
FW		Ø	Ø	Ø		Ø	Ø	Ø	Ø	Ø	Ø			Ø	Ø	Ø	Ø	Ø	Ø		Ø	Ø	Ø
SR		Ø	Ø	Ø	Ø	Ø	Ø	Ø								Ø	Ø	Ø	Ø				
AR		Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø				Ø			
VR		Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø								
FR		Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø								
FRA	●															●	●	●	●	●	●	●	●
ER																	Ø	Ø	Ø		Ø	Ø	Ø

FIG. 2

Ø Indicates magnetically closed contacts.
● Indicates spring closed contacts. During inching contactor 2A remains open and relay FW remains closed.

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