

SERVICE MANUAL

OTTP:95

TRANSFORMERS TYPES "VW" and "ZW"

Types 'VW' and 'ZW' Multi-Control Transformers, built in 1948, are similar to other Multi-Control transformers in the principle of operation but differ from them in their general appearance and in having a double set of whistle and reversing controls so that two separate layouts can be operated independently by the same transformer.

Type 'VW' transformer, rated at 150 watts, can supply continuously 110 watts, or approximately 8 amperes at the working track voltage. This transformer can be used with power lines of 110-125 volts, 50-60 cycles.

Type 'ZW' transformer, rated at 250 watts, can supply continuously 180 watts at 14 amperes. The 'ZW' transformer can be used with power lines of 110-125 volts 60 cycles only.

As illustrated in the schematic diagram below, these transformers have a fixed secondary winding of 8 volts in series with a variable secondary winding of 12 volts. This makes it possible for each of the four rolling contacts to supply from 8 to 20 volts. The two 5-volt compensating windings are normally

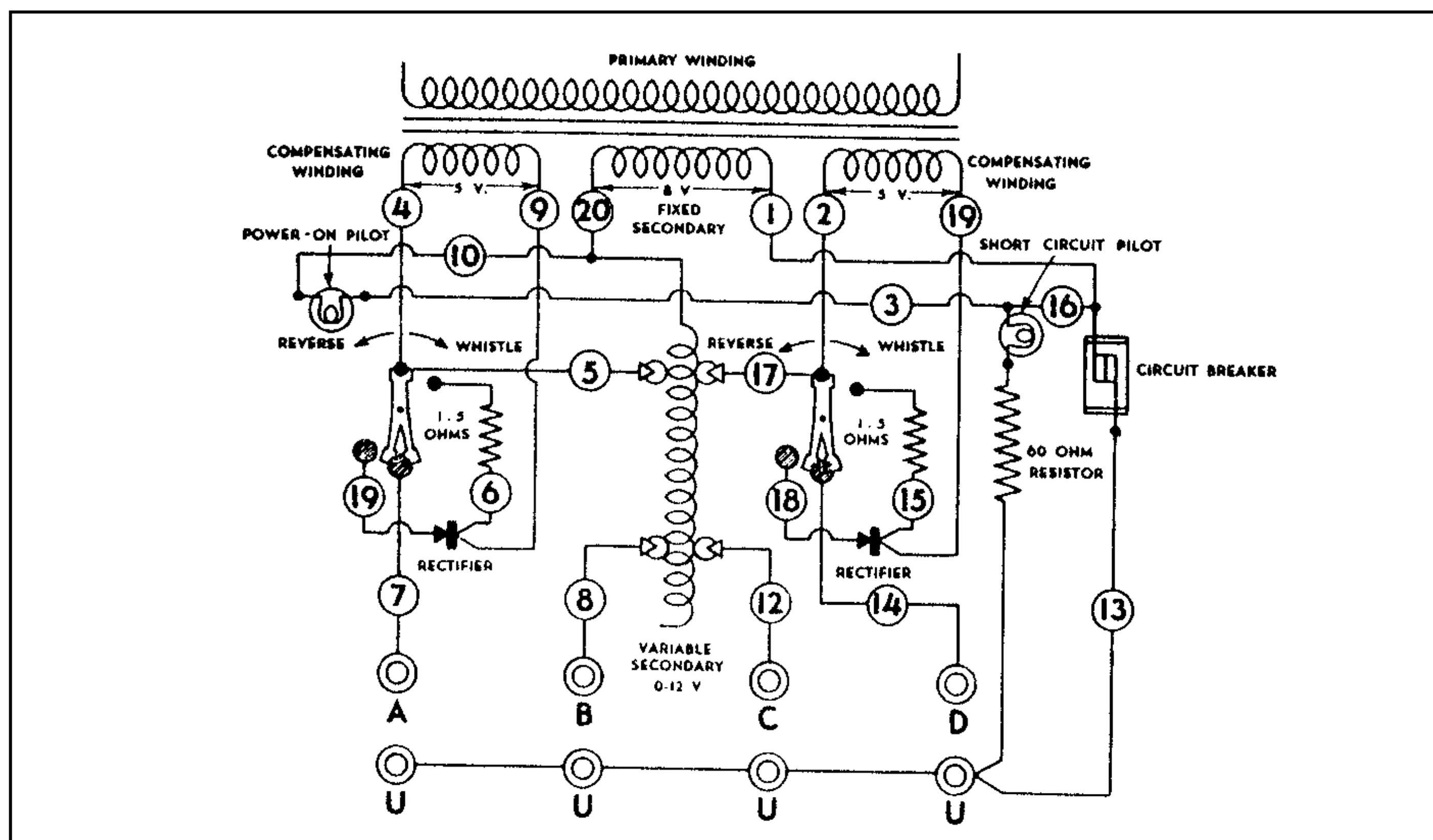
out of the circuit but are switched in series with the circuit whenever the whistle controller is operated to compensate for the voltage drop in the rectifier and the additional load of the whistle motor.

The three fixed secondary windings are wound directly on the primary, while the variable secondary winding is wound separately on a bakelite form and assembled on the opposite leg of the iron core.

The transformers are equipped with a pilot 'power on' light placed across the fixed 8 volts winding, and a 'short circuit' pilot placed across the circuit breaker. The 60-ohm resistor in series with the short circuit pilot limits the voltage placed across that lamp when the circuit breaker opens.

Note: Because circuit breakers of correct value could not be obtained for the 'VW' transformers built in 1948, a length of resistance wire in insulating sleeving was wound around the circuit breaker and served as a heater to decrease its breaking time in case of short circuits.

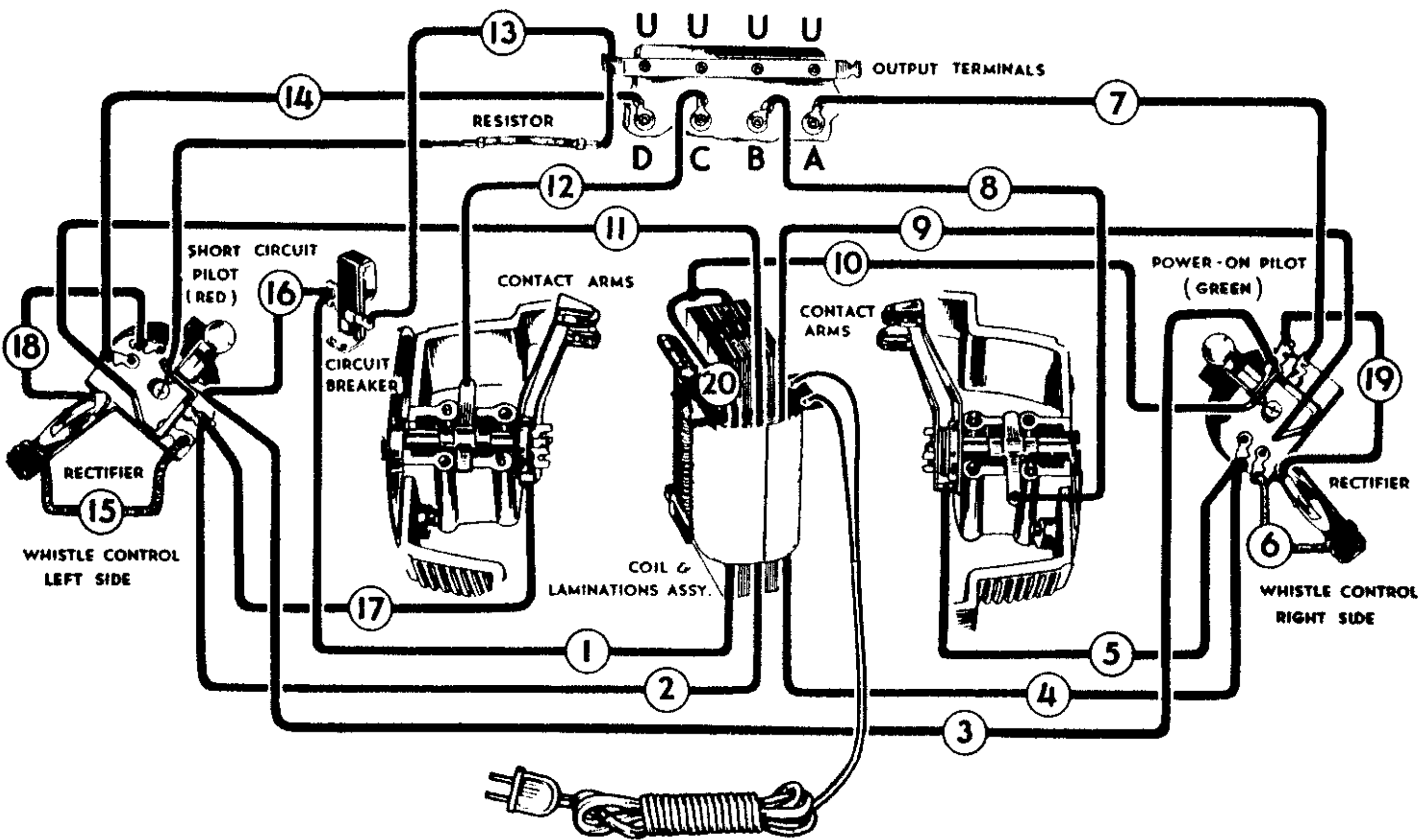
SCHEMATIC WIRING DIAGRAM OF TRANSFORMERS "VW" and "ZW"



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PICTORIAL WIRING DIAGRAM OF TRANSFORMERS "VW" and "ZW"

The 'ZW' Multi-Control transformer differs from the illustrated 'VW' in having a heavier Coil and Lamination Assembly and a different Circuit Breaker. The wiring and arrangement of parts are identical. In the 1948 'VW' transformers Lead No. 13 is a 12' length of special resistance wire which is wound around the circuit breaker and which acts as a heater to decrease the breaking time of the circuit breaker in case of short circuits. The numbers of the leads correspond with the Schematic Wiring Diagram on previous page.



LEAD NO.	DESCRIPTION
1	NO TUBING
2	BLACK TUBING
4	YELLOW TUBING
6	RESISTANCE WIRE
9	YELLOW TUBING

LEAD NO.	DESCRIPTION
11	BLACK TUBING
13	HEATER WIRE (See note)
15	RESISTANCE WIRE
20	YELLOW TUBING

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PROCEDURE FOR DISASSEMBLING "VW" and "ZW" TRANSFORMERS

1. Remove transformer cover by taking out the 4 recessed screws on top of transformer case. Remove lamps before lifting off the transformer cover.

2. To remove throttle arm assembly simply pull out pin 'A' with a pair of pliers. However, since the pin may be somewhat difficult to replace because of the sharp edges of the contact roller arm, some service men prefer to remove the entire voltage control assembly. This is done by removing the whistle control assembly (See 4), removing the plastic throttle control arm (See 3), and extracting pin at E (See 5).

3. To remove the plastic throttle arm without disassembling the transformer case, screw a #4-40 x 1" machine screw into the opening in the end of the throttle arm dial. This will push the throttle arm dial off its shaft.

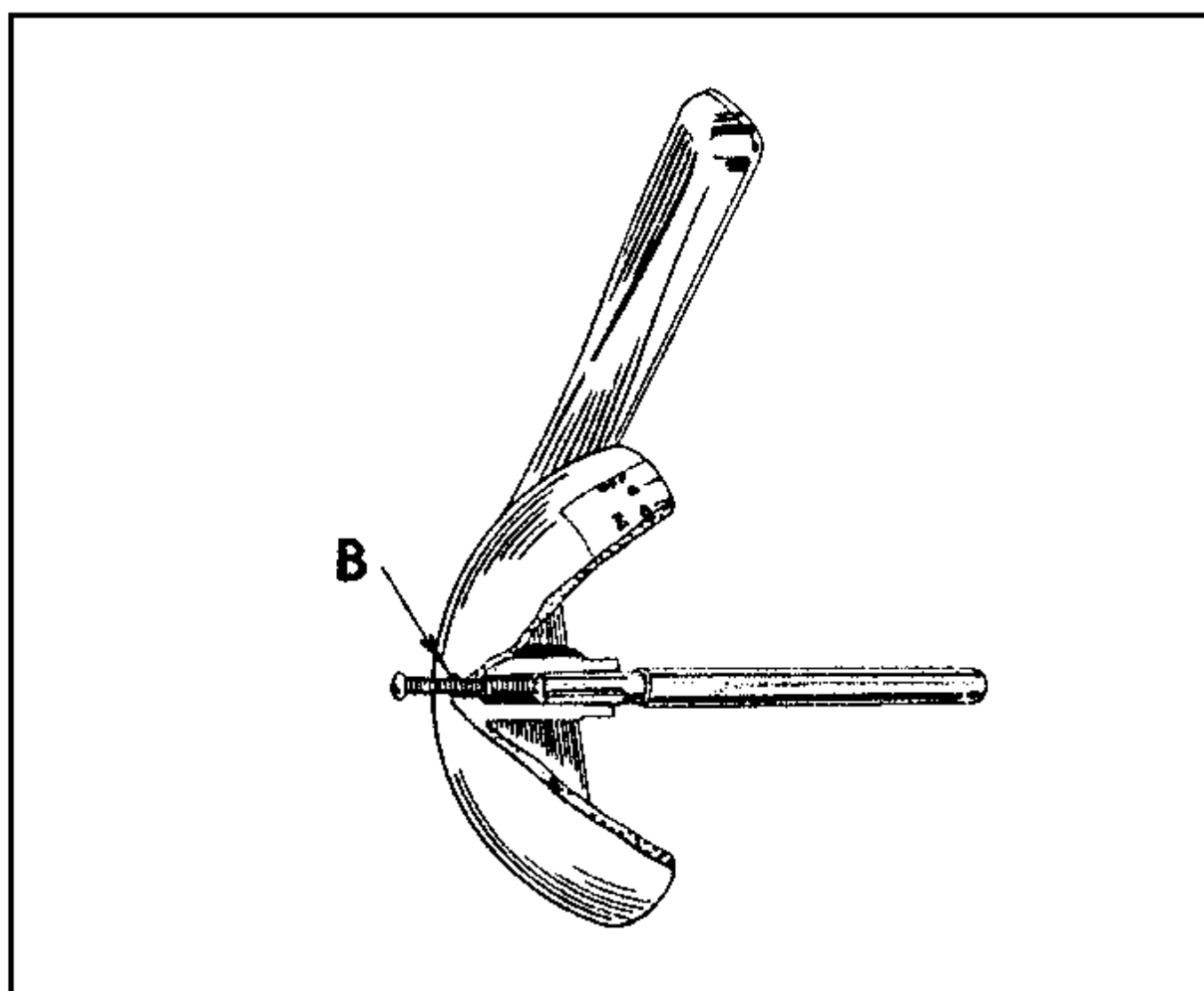


Fig. 1 - Removing Plastic Throttle Arm

4. The whistle controls are held to the transformer case by two #6-32 round head screws at points 'C'. After the screws are removed the right hand control can be lifted off and simply folded back. To lift off the left hand control, however, the yellow lead may have to be unsoldered from the bracket solder lug.

When replacing controls observe their correct position. The semi-circular notches cut in the edge of the fibre pieces should face the rear of the transformer. To distinguish them further

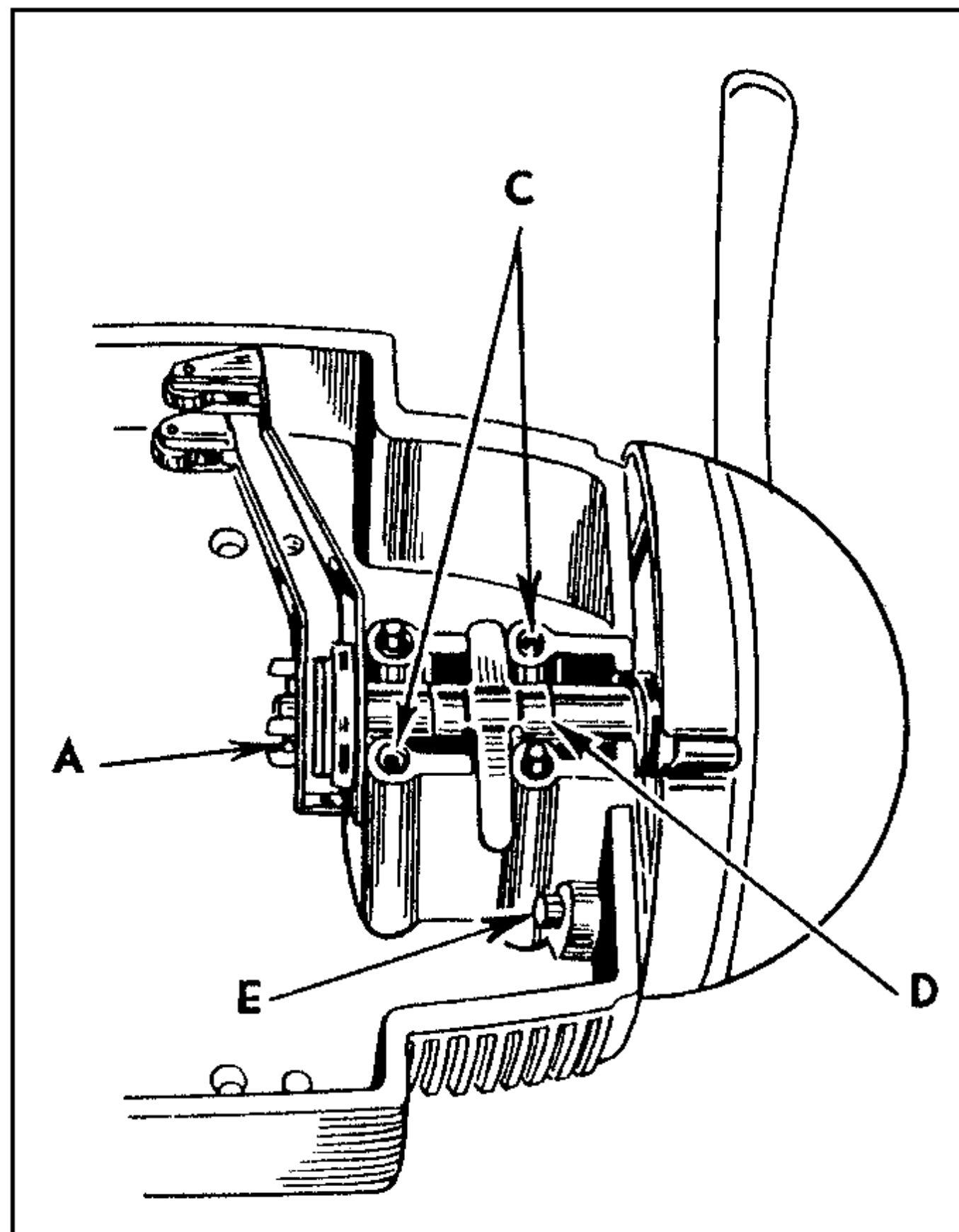


Fig. 2 - Dial and Throttle Arm Voltage Controls

the edge of the right hand fibre piece is stained black while the left hand piece remains white. Don't forget to replace both pieces of insulating paper between the bracket and the fixed voltage dial shaft. Both pieces are necessary for proper pressure on the contact spring 'D.' Note that due to the difference in the right and left hand control assemblies the position of the right and left hand contact springs is reversed.

5. To remove fixed voltage dial assembly the stop pin 'E' must first be tapped out from within the transformer case. If you don't have enough room to work take out coil by loosening the 4 hex head screws holding the coil bracket to the bottom of the transformer case. It is not necessary to remove the brackets themselves.

5. To replace carbon rollers on contact arms file off one end of rivet which serves as roller axle and push it out. Do not attempt to straighten the tabs holding the roller bracket or they will crack off.

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UPPER CASE ASSEMBLY

VW-3
ZW-3
\$4.00

GREEN
JEWEL CAP
ZW-23
\$.15
NOT IN ASSEMBLY

JEWEL FERRULE
ZW-22
\$.10

ESCUTCHEON
BONDING FILM
ZW-6
\$.05
To apply, moisten with car-
bon tetrachloride (Carbona)

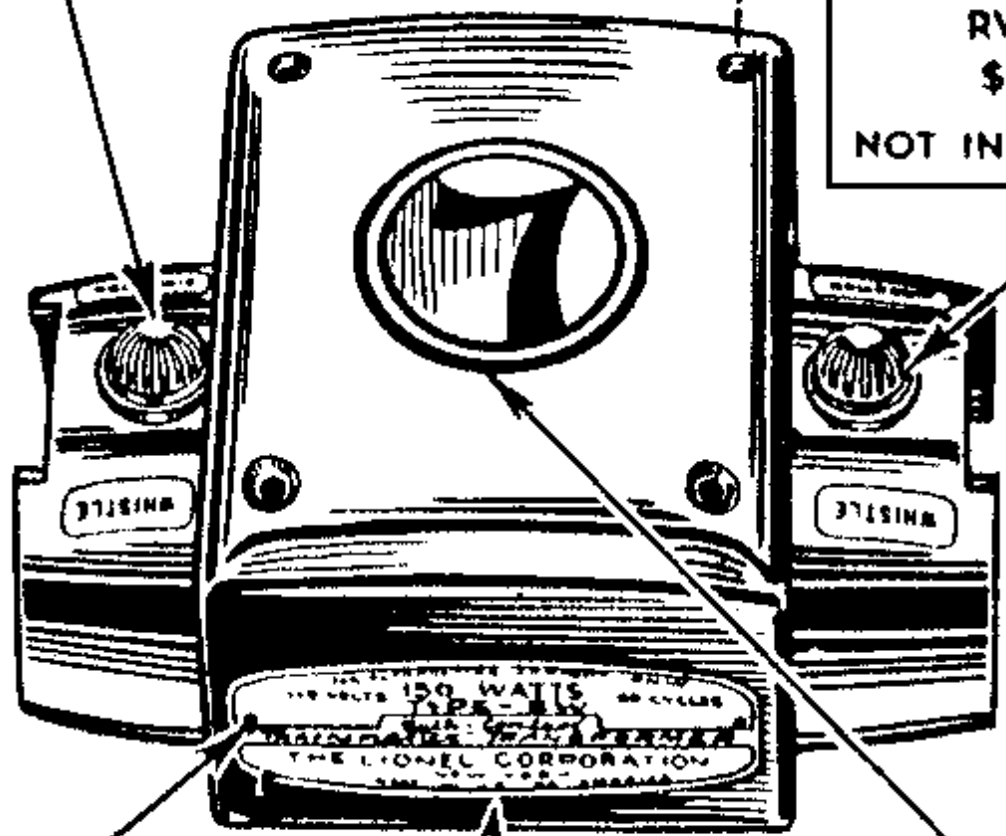
COVER HOLDING SCREW
ZW-120
\$.05
NOT IN ASSEMBLY

RED JEWEL CAP
RW-27
\$.15
NOT IN ASSEMBLY

DRIVE SCREW
35-14
\$.02

NAMEPLATE
VW-21
ZW-21
\$.60

ESCUTCHEON
ZW-20
\$.50



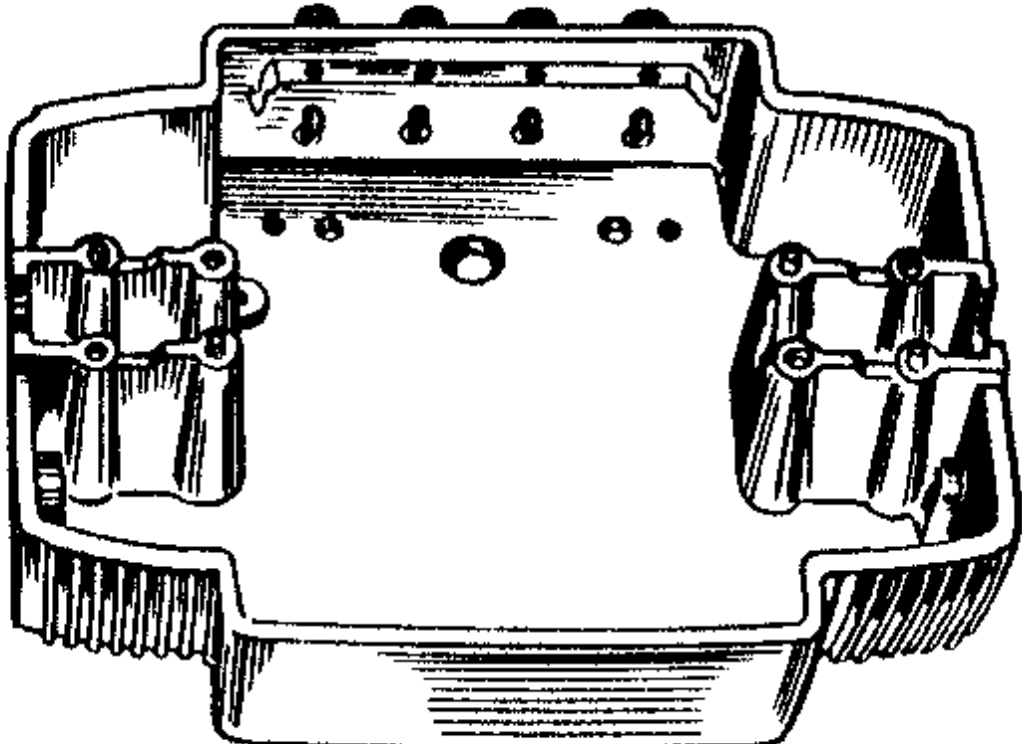
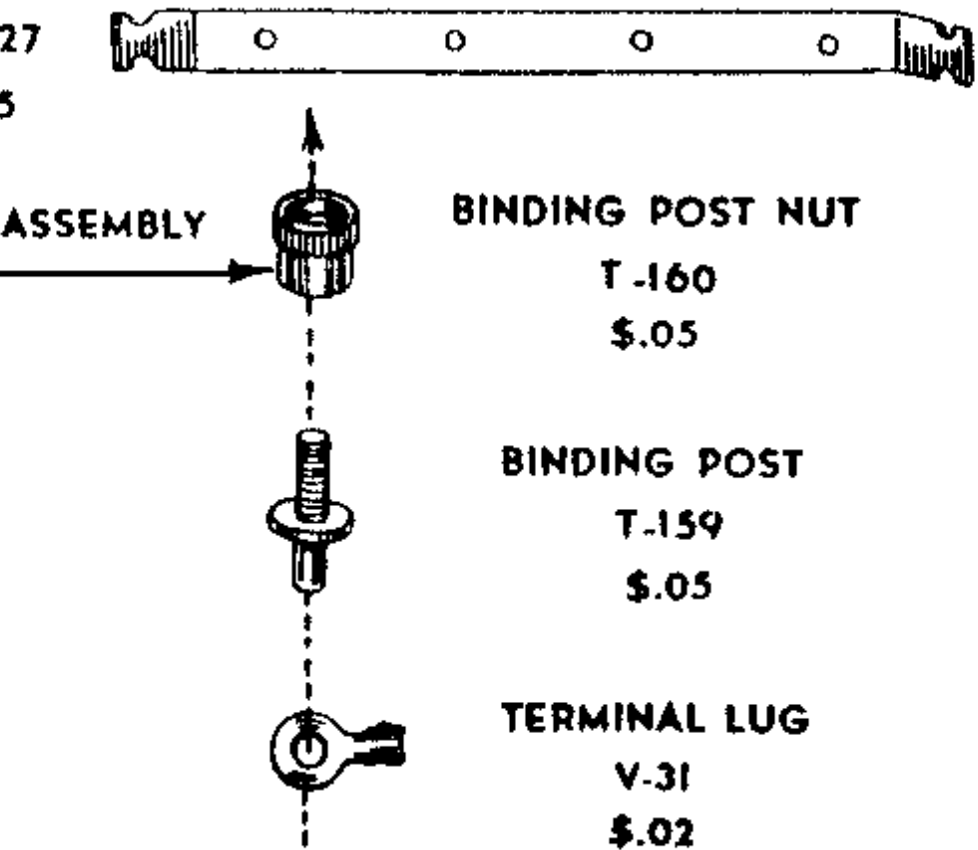
BUS BAR
ZW-27
\$.15

NOT IN ASSEMBLY

BINDING POST NUT
T-160
\$.05

BINDING POST
T-159
\$.05

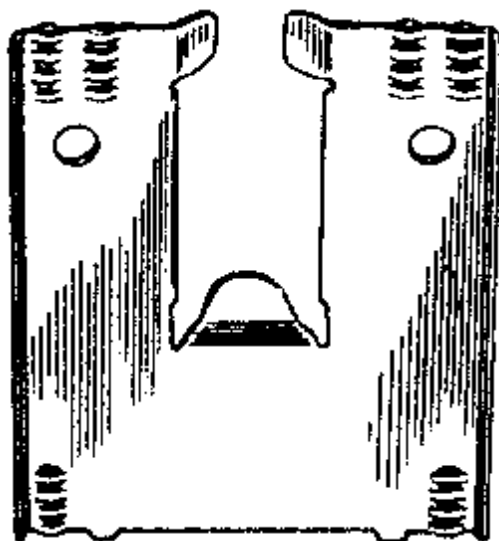
TERMINAL LUG
V-31
\$.02



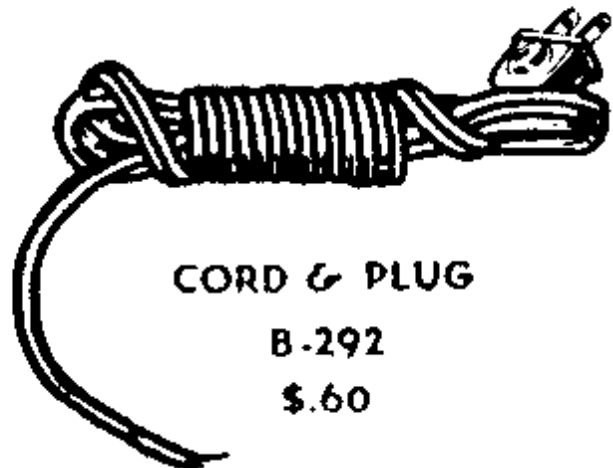
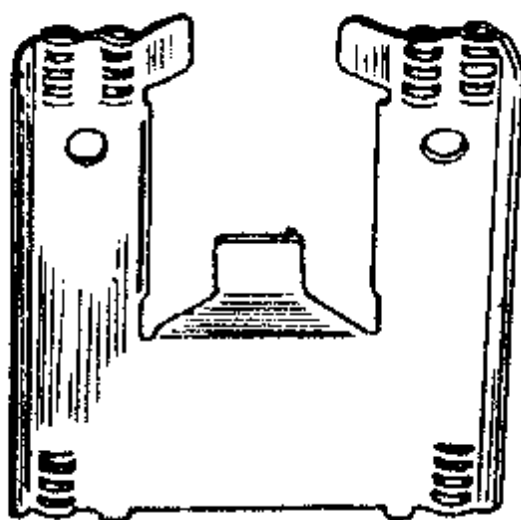
LOWER CASE ASSEMBLY
ZW-25
\$4.00

COIL SUPPORT STRAP
ZW-159
\$.10

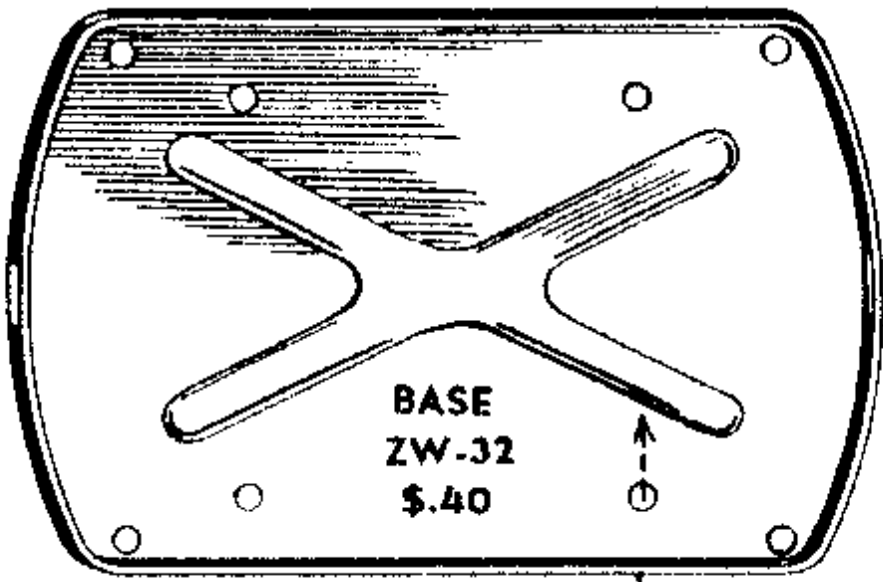
COIL SUPPORT BRACKET
VW-30
\$.50



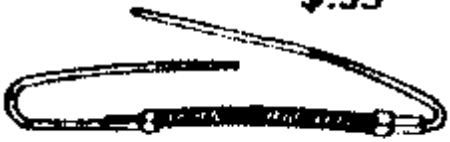
COIL SUPPORT BRACKET
ZW-30
\$.50



CORD & PLUG
B-292
\$.60

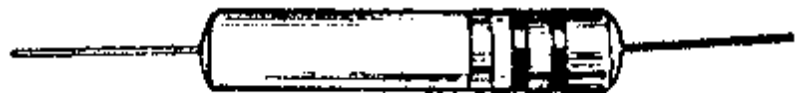


ALTERNATE
RESISTOR
Q-8
\$.35



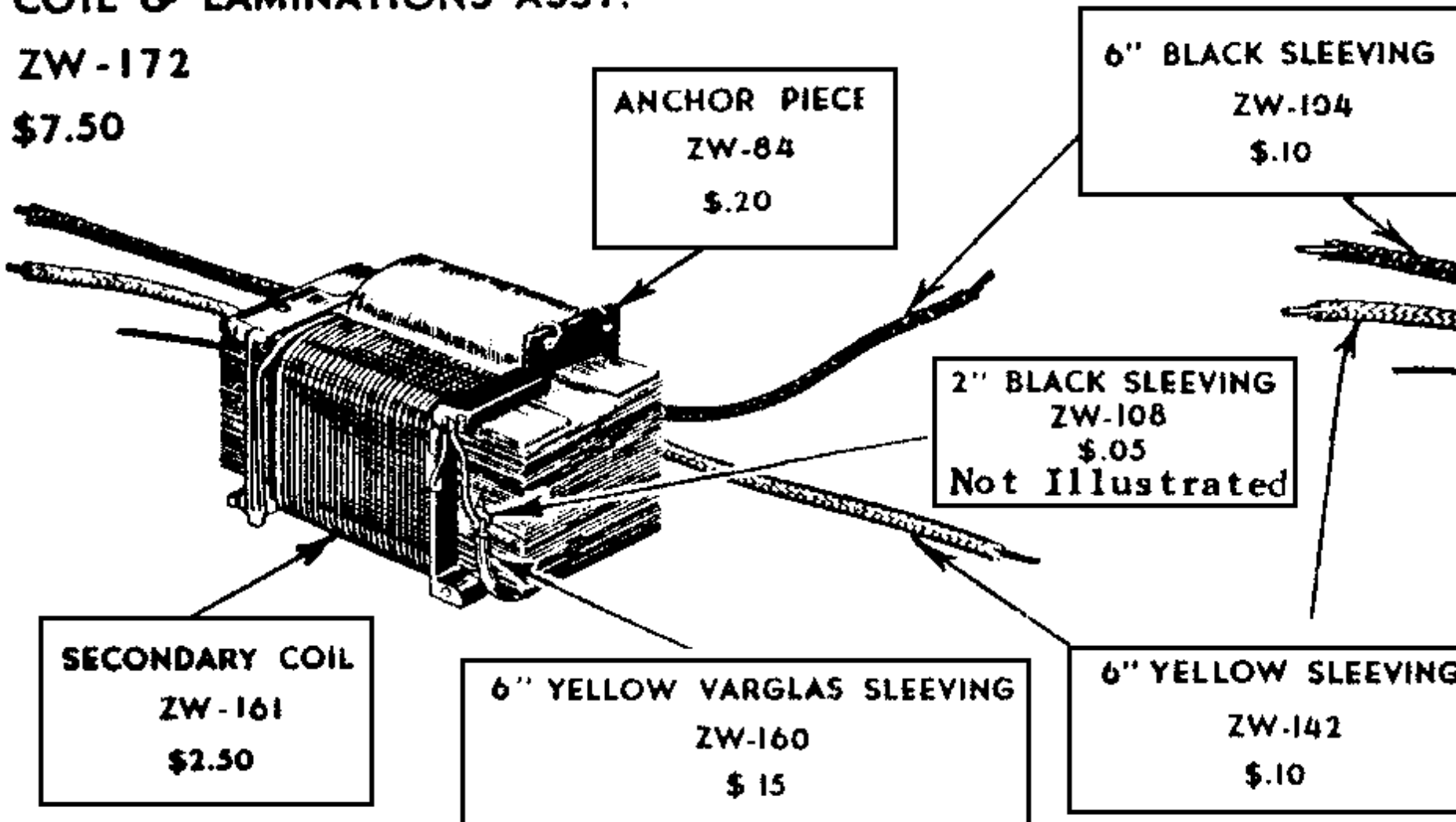
HEX HEAD SCREW
ZW-121
\$.05

RESISTOR
RW-49
\$.35



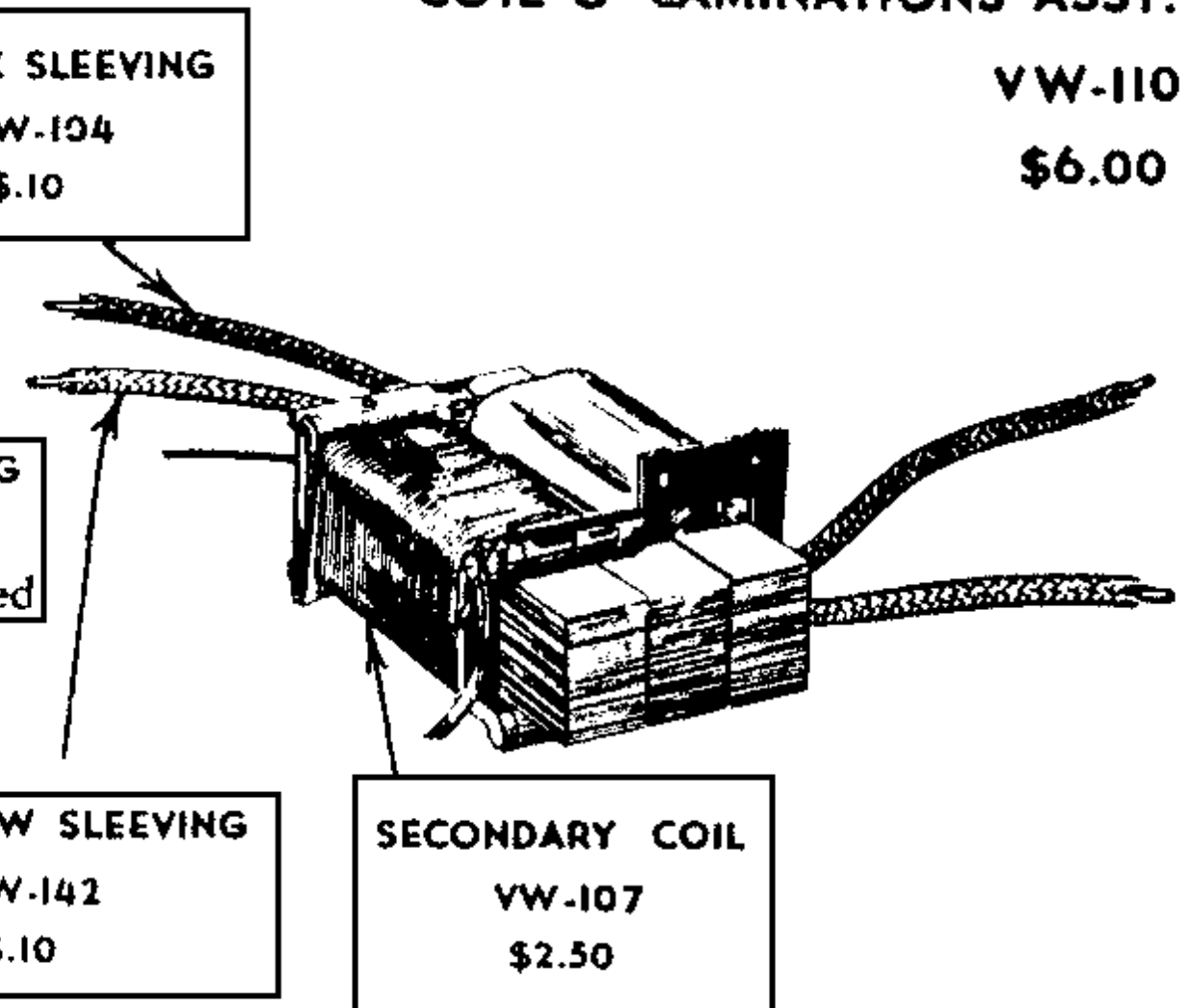
COIL & LAMINATIONS ASSY.

ZW-172
\$7.50



COIL & LAMINATIONS ASSY.

VW-110
\$6.00



Outer Control Dial Assembly and the large Groove Pin, ZW-93, are not included in Control Dial Assembly. VW and ZW assemblies differ from each other in the length and shape of the contact springs. A few of the earliest transformers used a paper tube insulation instead of Insulating Bushing, ZW-157.

OUTER CONTROL DIAL ASSY.

L.H. ZW-99
R.H. ZW-96
\$.75

CONTROL DIAL ASSY. RIGHT HAND

VW-49

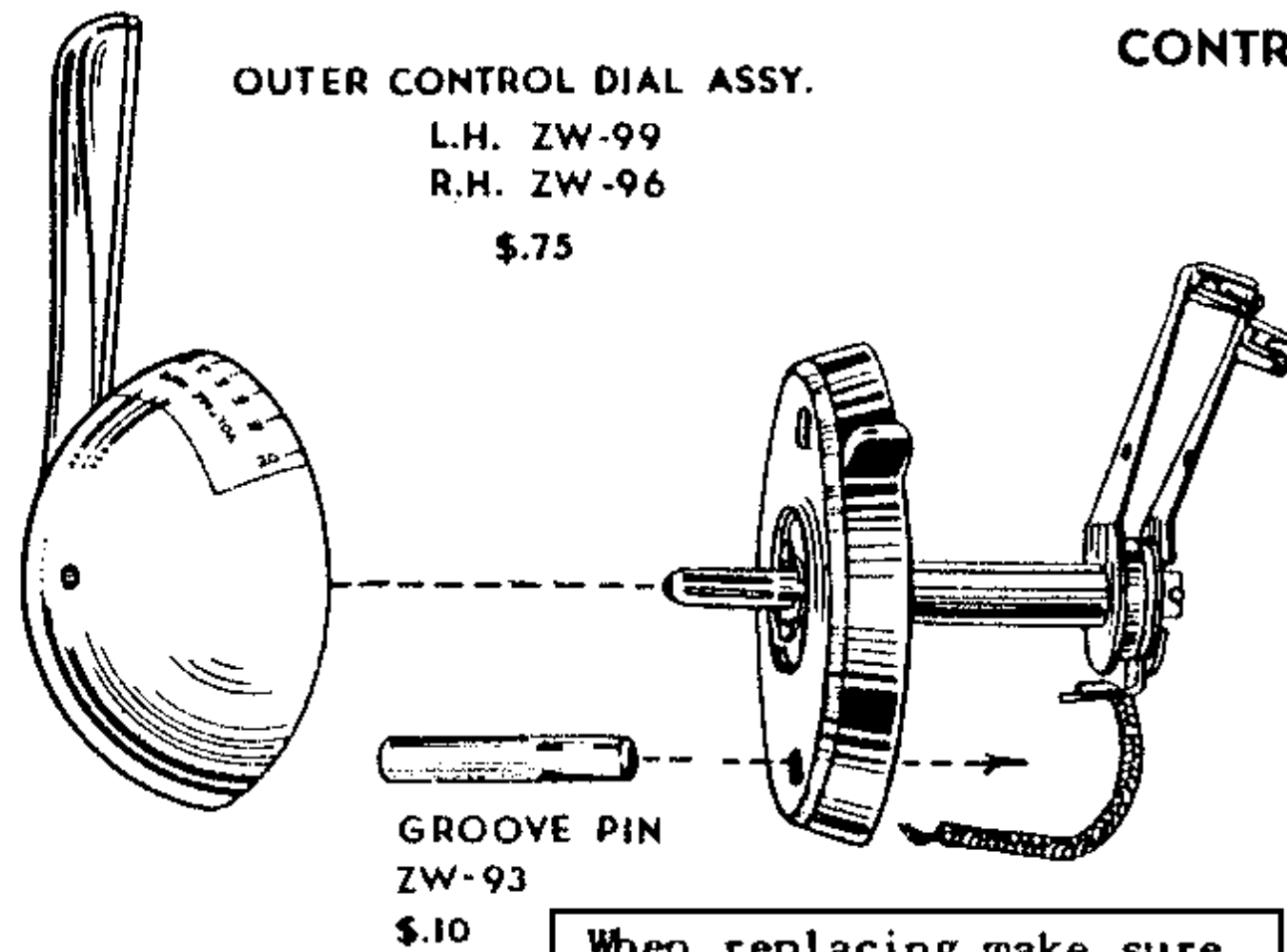
ZW-49

LEFT HAND

VW-60

ZW-60

\$2.50

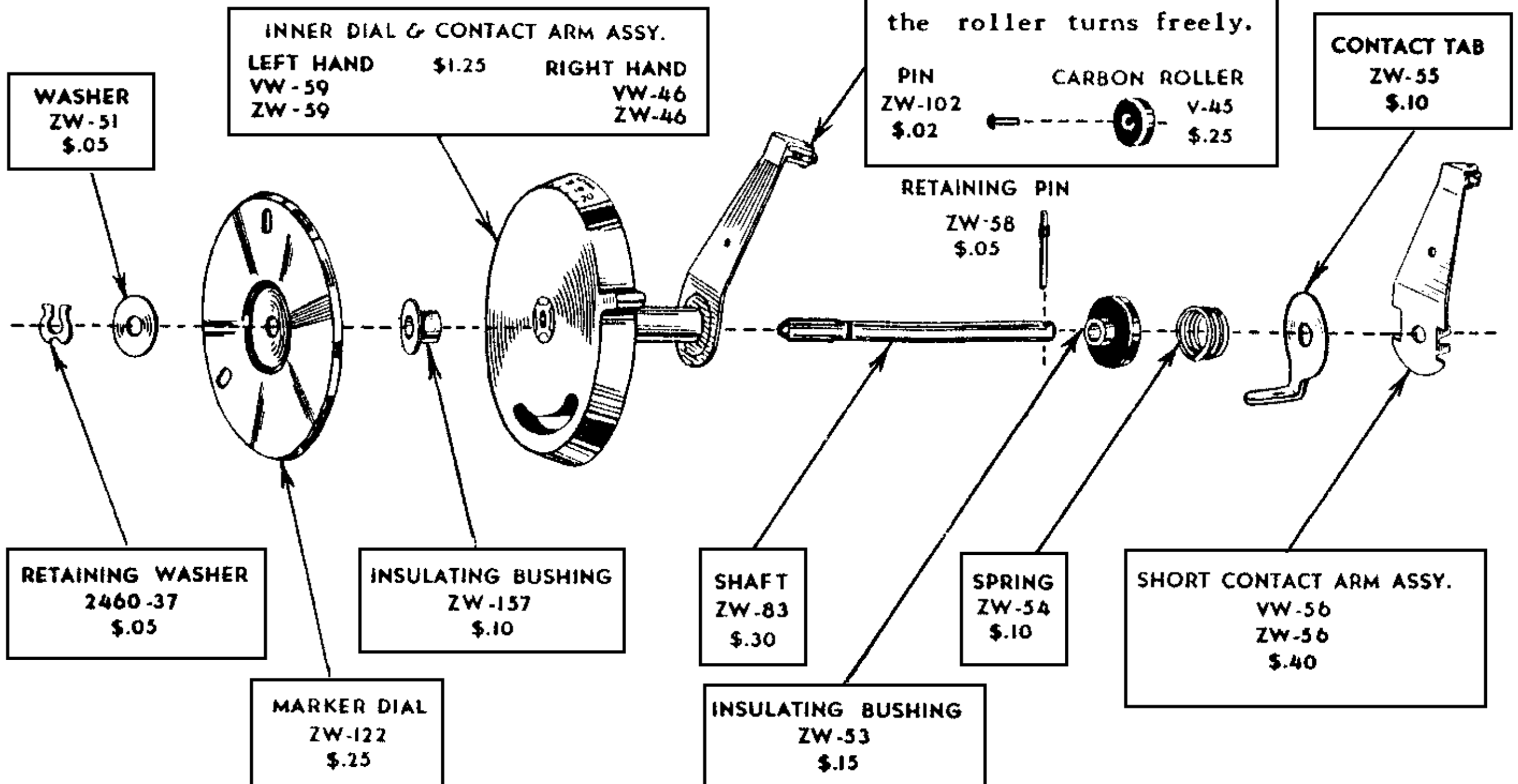


When replacing make sure the roller turns freely.

PIN ZW-102 \$.02

CARBON ROLLER V-45 \$.25

CONTACT TAB ZW-55 \$.10



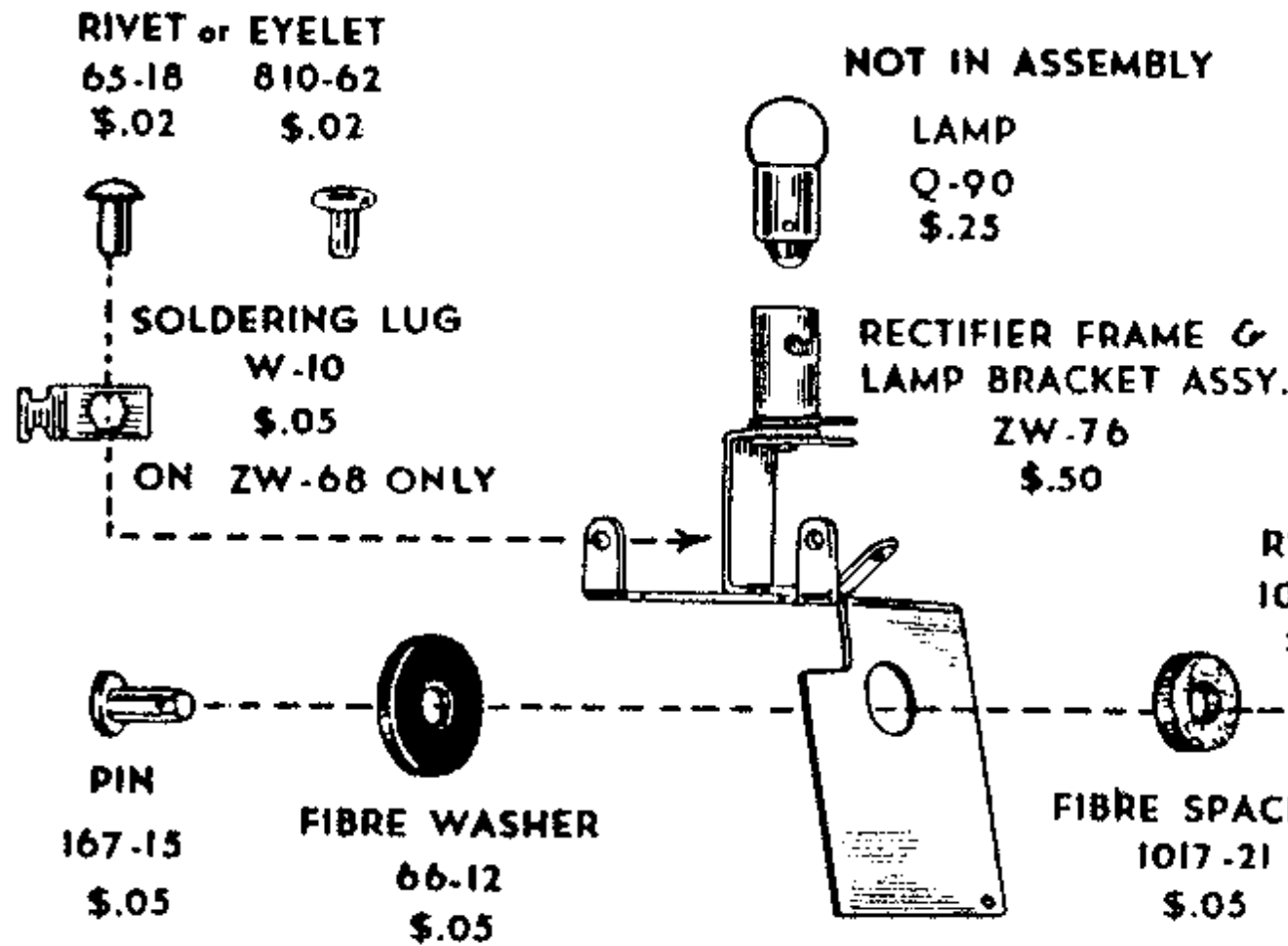
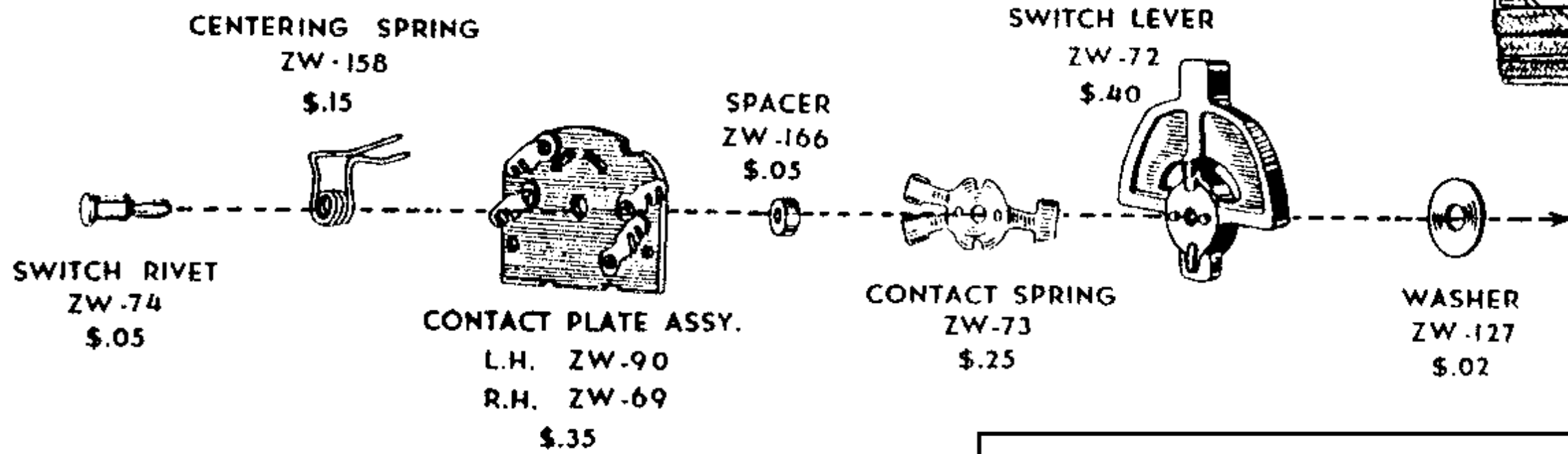
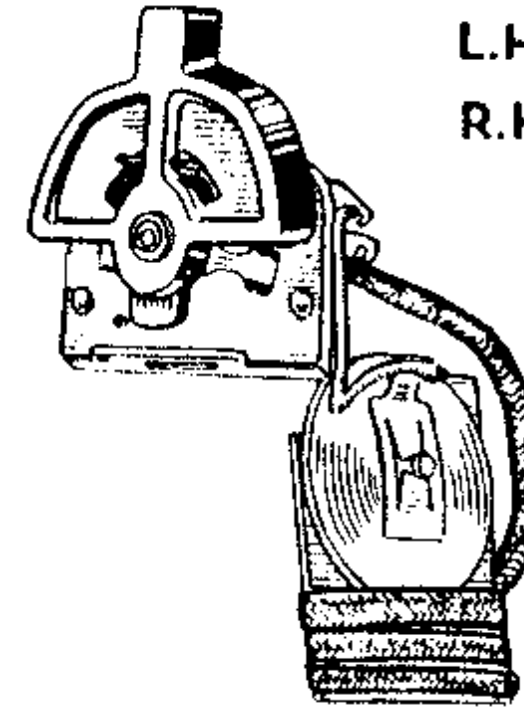
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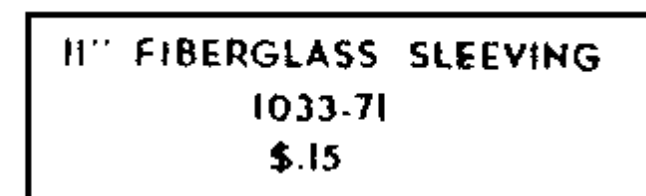
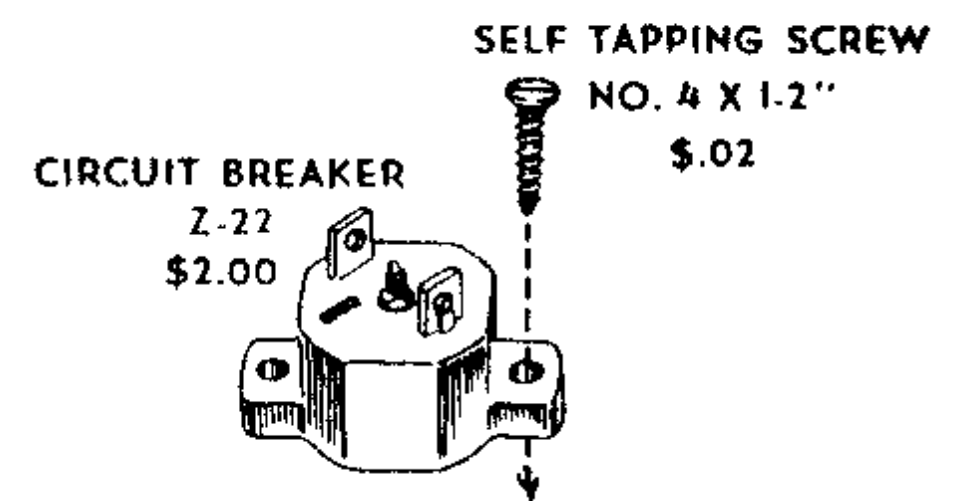
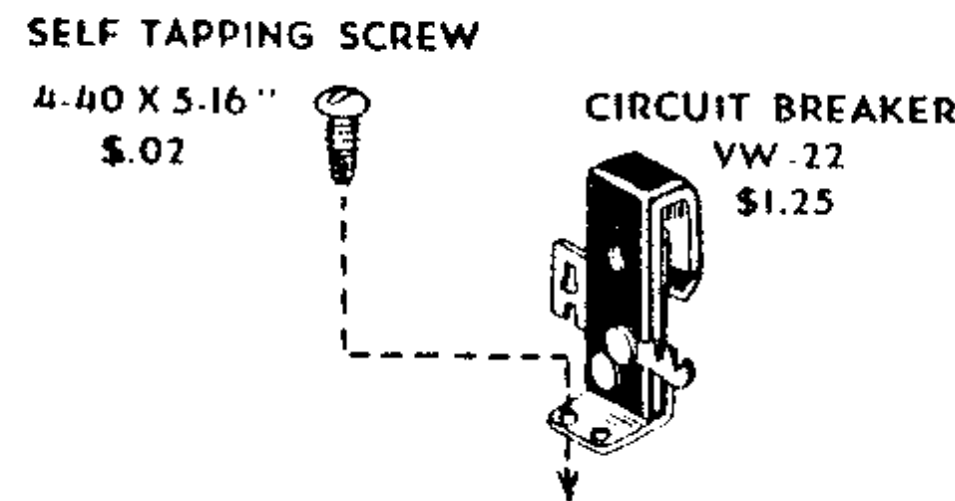
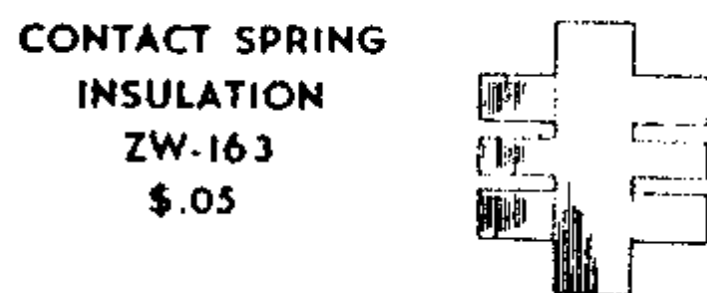
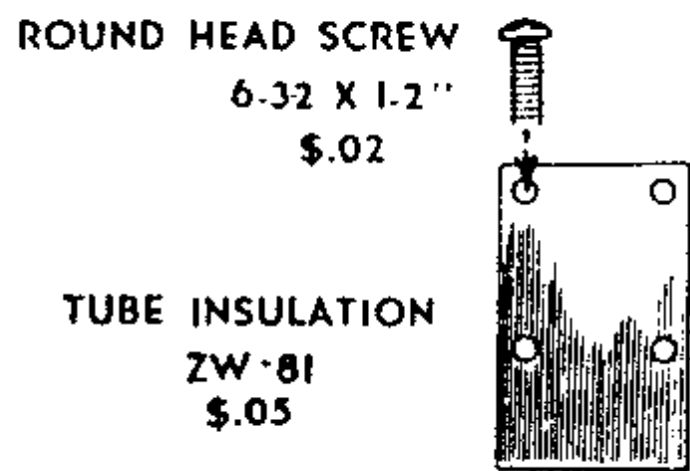
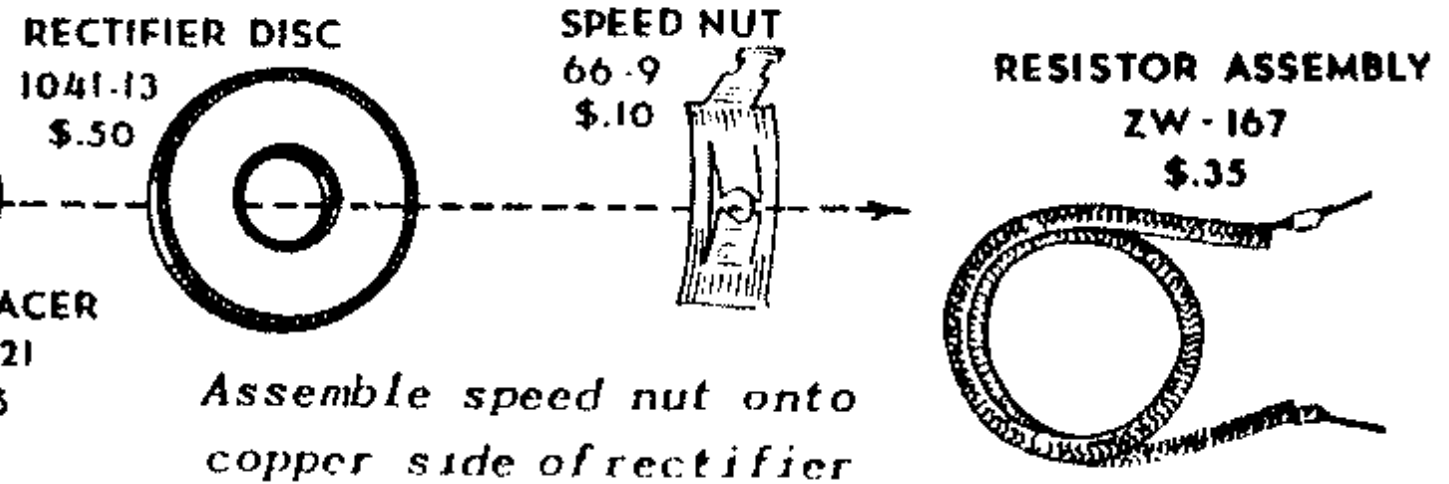
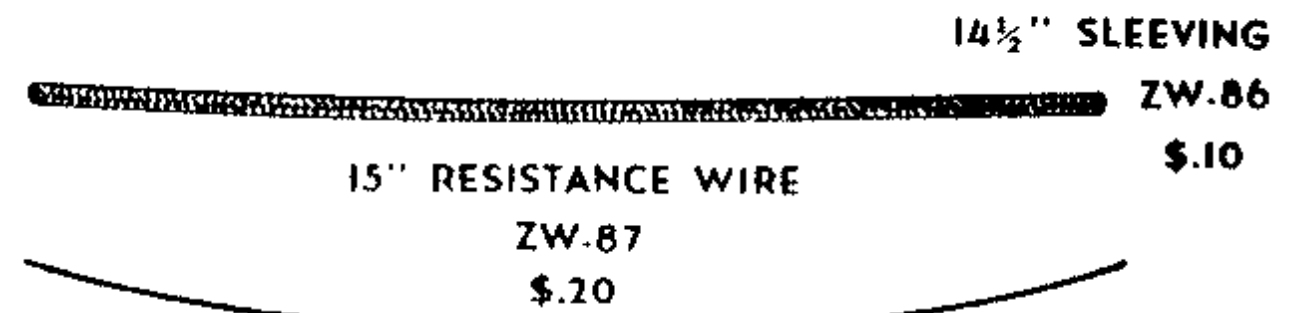
Right and left hand Reversing Unit Assemblies differ from each other in the location of contacts on the Contact Plate Assembly. For easier identification the edges of right hand contact plates are blackened while the edges of the left hand contact plates remain 'natural.'

REVERSING UNIT ASSY.

L.H. ZW-89
R.H. ZW-68
\$2.50



Resistance Wire ZW-87 and Sleeving ZW-86 were later replaced by Resistor Assembly ZW-167.



As explained on Page 1 of this section, the Heating Wire W-106 in its Sleeving 1033-71 is wrapped around the VW-22 Circuit Breaker to decrease its breaking time.

LIONEL SERVICE MANUAL

"ZW" TRANSFORMER

<u>Part Number</u>	<u>Location</u>	<u>Unit Price</u>	<u>Min. Quan.</u>	<u>Description</u>
51-300	LC	.20	10	Lamp
66-9	H-36	.10	12	Speednut
66-12	H-97	.05	12	Fibre Washer
167-15	J-91	.05	10	Rectifier Pin
1017-21	N-71	.05	12	Spacer
1041-13	N-73	.75	6	Rectifier Disc
2460-37	L-53	.05	12	Retaining Ring
B-292	N-44	1.00		Cord & Plug
RW-27	N-95	.20		Red Jewel Cap
ST-159	N-98	.10	6	Binding Post
ST-160	N-98	.10	6	Binding Post Nut
V-31		.05	10	Solder Lug
V-45	N-98	.25		Carbon Roller
ZW-22	O-82	.20		Jewel Ferrule
ZW-23	O-82	.20		Green Jewel Cap
ZW-25	H-68	5.00		Lower Case Assem.
ZW-27	O-82	.20		Bus Bar
ZW-32	O-92	1.00		Base
ZW-49	O-58	3.00		Inner Control Dial RH
ZW-53	O-53	.15	4	Insulating Bushing
ZW-54	O-53	.10		Spring
ZW-55	O-53	.10	6	Contact Tab
ZW-56	O-63	.40		Contact Arm (Short)
ZW-60	O-63	3.00		Inner Control Dial LH
ZW-68	O-73	4.00		Reversing Unit Assem. RH
ZW-72	O-73	.40		Switch Lever
ZW-73	O-73	.40		Contact Spring
ZW-74	O-83	.05	12	Switch Rivet
ZW-80	O-83	.10	6	Spring Contact
ZW-81	O-68	.05	12	Insulation
ZW-83	O-13	.30		Shaft
ZW-89	O-45	4.00		Reversing Unit Assem. LH
ZW-93	O-68	.10	6	Dial Stop Pin
ZW-96	O-54	1.00		Outer Control Dial RH
ZW-99	O-54	1.00		Outer Control Dial LH
ZW-102	O-64	.02	25	Roller Pin
ZW-120	O-64	.05	12	Upper Case Screw

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PS-ZW

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<u>Part Number</u>	<u>Location</u>	<u>Unit Price</u>	<u>Min. Quan.</u>	<u>Description</u>
ZW-121	O-64	.05	12	Screw (Base Plate)
ZW-122	O-64	.30		Marker Dial
ZW-157	O-74	.10	6	Insulating Bushing
ZW-158	O-74	.20		Centering Spring
ZW-166	O-84	.05	12	Spacer
ZW-167	O-94	.50		Resistance Wire Assem.
ZW-182	O-42	5.00		Upper Case Assem.
ZW-183	O-68	.35		Resistor
ZW-189	P-69	1.00		Nameplate
ZW-191	O-41	.50		Coil Support Bracket
ZW-199	O-68	.05	12	Speednut (Nameplate)
ZW-200	O-54	1.50		Circuit Breaker
ZW-201	G-19	15.00		Coil & Laminations Assem.
6 x 1/4"	Q-63	.02	25	RHST "Z" Screw (Circuit Breaker)

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"VW" & "ZW" TRANSFORMERS

Part Number	Location	Min. Quan.	Unit Price	Description
35-14	N-51	.02	25	Drive Stud
51-300	LC	.20	10	Lamp
65-18	N-51	.02	25	Rivet
66-9	H-36	.10	12	Speednut
66-12	H-97	.02	12	Fibre Washer
167-15	J-91	.05	10	Pin
810-62	N-51	.05	12	Eyelet
1017-21	N-71	.05	12	Fibre Spacer
1033-71	N-92	.15	4	11" Fiberglass Sleeving
1041-13	N-73	.75	6	Rectifier Disc
VW-107	Obsolete			Secondary Coil
W-10	O-72	.05	12	Solder Lug
Z-22	O-48	2.50		Circuit Breaker
ZW-3	J-4 Top	4.00		Upper Case Assem.
ZW-6	O-82	.05	12	Escutcheon Bonding Film
ZW-20	O-82	.50		Escutcheon
ZW-21	O-82	.60		Nameplate
ZW-22	O-82	.20		Jewel Ferrule
ZW-23	O-82	.20		Green Jewel Cap
ZW-25	H-68	5.00		Lower Case Assem.
2460-37	L-53	.05	12	Retaining Washer
B-292	N-44	1.00		Cord & Plug
Q-8	Obsolete			Resistor
RW-27	N-95	.20		Red Jewel Cap
RW-49	N-88	.50		Resistor
T-159	N-98	.10	6	Binding Post
T-160	N-98	.10	6	Binding Post Nut
V-31				Terminal Lug
V-45	N-98	.25		Carbon Roller
VW-3	O-41	4.00		Upper Case Assem.
VW-21	Obsolete			Nameplate
VW-22	O-72	1.25		Circuit Breaker
VW-30	Obsolete			Coil Support Bracket
VW-35	N-42	7.50		Coil & Laminations Assem.
VW-46	O-44	1.25		Inner Dial & Contact Arm RH
VW-49	Obsolete			Control Dial Assem. RH
VW-56	O-48	.40		Short Contact Arm Assem.
VW-59	O-48	2.50		Inner Dial & Contact Arm LH
VW-60	O-52	2.50		Control Dial Assem. LH
VW-106	O-52	.50		Heating Wire
ZW-27	O-82	.20		Bus Bar
ZW-30	O-92	.50		Coil Support Bracket
ZW-32	O-92	1.00		Base
ZW-35	O-11	7.50		Coil & Laminations Assem.

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Part Number	Location	Unit Price	Min. Quan.	Description
ZW-46		2.50		Inner Dial & Contact Arm RH
ZW-49	O-58	3.00		Contact Dial Assem. RH
ZW-51	O-58	.05	12	Washer
ZW-53	O-53	.15	4	Insulating Bushing
ZW-54	O-53	.10	6	Spring
ZW-55	O-53	.10	6	Contact Tab
ZW-56	O-63	.40		Short Contact Arm
ZW-58	O-53	.05	12	Retaining Pin
ZW-59	O-36	1.25		Inner Dial & Contact Arm LH
ZW-60	O-63	3.00		Control Dial Assem. LH
ZW-68	O-73	4.00		Reversing Unit Assem. RH
ZW-69	O-83	.35		Contact Plate Assem. RH
ZW-72	O-73	.40		Switch Lever
ZW-73	O-73	.40		Contact Spring
ZW-74	O-83	.05	12	Switch Rivet
ZW-76	O-83	.50		Rectifier Frame &
ZW-80	O-83	.10	6	Spring Contact Lamp Bracket Assem.
ZW-81	O-68	.05	12	Tube Insulation
ZW-83	O-13	.30		Shaft
ZW-84	O-68	.20		Anchor Piece
ZW-86	Sub. ZW-167			Sleeving
ZW-87	Sub. ZW-167			Resistance Wire
ZW-89	O-45	4.00		Reversing Unit Assem. LH
ZW-90	O-68	.35		Contact Plate Assem. LH
ZW-93	O-68	.10	6	Dial Stop Pin
ZW-96	O-54	1.00		Outer Control Dial Assem. RH
ZW-99	O-54	1.00		Outer Control Dial Assem. LH
ZW-102	O-64	.02	25	Roller Pin
ZW-108	O-64	.05	12	2" Black Sleeving
ZW-120	O-64	.05	12	Cover Screw
ZW-121	O-64	.05	12	Hex Head Screw (Base)
ZW-122	O-64	.30		Marker Dial
ZW-127	O-84	.02	25	Washer
ZW-157	O-74	.10	6	Insulating Bushing
ZW-158	O-74	.20		Centering Spring
ZW-159	O-84	.10	6	Coil Support Strap
ZW-161	O-84	2.50		Secondary Coil
ZW-163	O-94	.05	12	Contact Spring Insulation
ZW-166	O-84	.05	12	Spacer
ZW-167	O-94	.50		Resistor Assem.
ZW-177	O-94	.35		Resistor Assem.
4 x 1/2"		.02	25	BHST Screw
4 x 5/16"	Q-53	.02	25	RHST "Z" Screw
6 x 1/4"		.02	25	RHST "Z" Screw
6/32 x 3/8"		.02	25	RH Type "S" Screw
6/32 x 1/2"		.02	25	RH Screw
4-40 x 5/16"		.02	25	RHST "Z" Screw