

# SERVICE MANUAL

## TYPE 'KW' MULTI-CONTROL TRANSFORMER

Lionel Type 'KW' Multi-Control Transformer, first built in 1950, is rated at 190 watts input and is able to supply continuously approximately 140 watts of useful power, or approximately 10 amperes of current, at normal operating voltage. The circuit breaker which protects the principal circuits is set to carry that amperage. The 'KW' transformer is designed for use with 115-volt 60-cycle alternating current power line only.

As illustrated in schematic diagram on Page 2, the secondary of this transformer consists of three separate windings: a fixed 6-volt winding and a 5-volt compensating winding which are wound over the primary and a 14-volt rectangular wire winding placed on the opposite leg of the transformer core. The two carbon contact rollers riding upon the bared surface of the 14-volt winding provide two independently controllable track circuits which may be varied from 6 to 20 volts.

As implied by its 'Multi-Control' designation the 'KW' transformer is equipped with built-in controls for reversing the locomotive and operating the horn and whistle relays. Each of the two track circuits has its own set of controls although the two whistle controls have a common control handle as well as a common rectifier, resistor and compensating winding so that whistles of two trains operating on separate layouts, can be operated selectively, but not simultaneously, by moving the control handle either to the right or to the left.

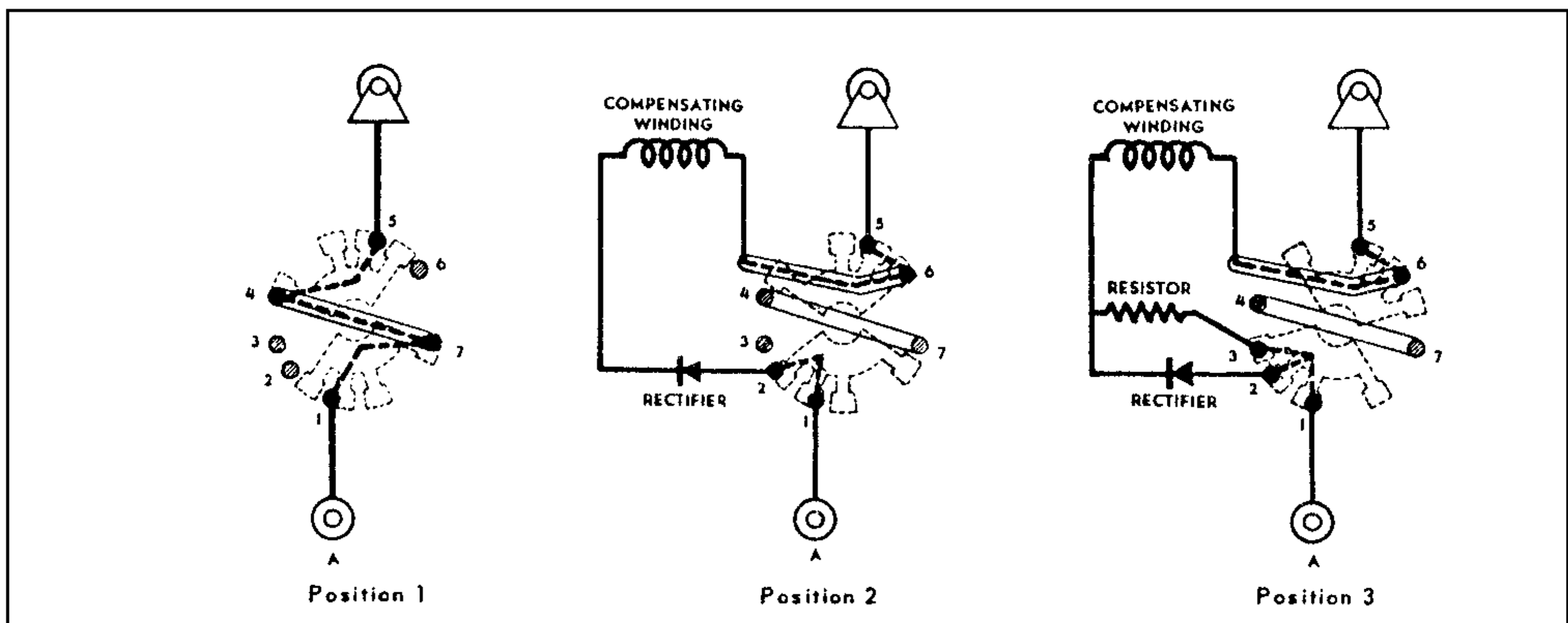
The operation of the whistle control is similar in principle to all other 'Multi-Control' transformers and is described elsewhere. As illustrated below, the normal position of the whistle control switch (Position 1) permits the track current to reach its outlet terminal directly through contacts 5, 4, 7 and 1. Moving the switch clockwise connects the rectifier and the compensating winding in series with the track circuit allowing a momentary high d.c. 'pickup' voltage to reach the track. (Position 2). The contacts are made through rivets 5, 6, 2 and 1. In the final position of the switch (Position 3) a resistor is shunted across the rectifier through contact rivet 3 to provide lower d.c. 'holding' voltage.

Two 'Reverse' buttons are provided for interrupting either of the two track circuits in order to activate the locomotive-reversing E-Unit.

### SERVICE HINTS

Because the aluminum coil brackets tend to become work-hardened, the tabs which hold down the coil and lamination assembly may break off after repeated bending and straightening. In this case it is possible to repair the damage without replacing the entire bracket by holding down the lamination stack with a No. 6-32 x 1" round head machine screw screwed into the side of the bracket. The hole for the screw should be located on the side of the bracket 1-8/8" below the top. (See illustration on Page 4)

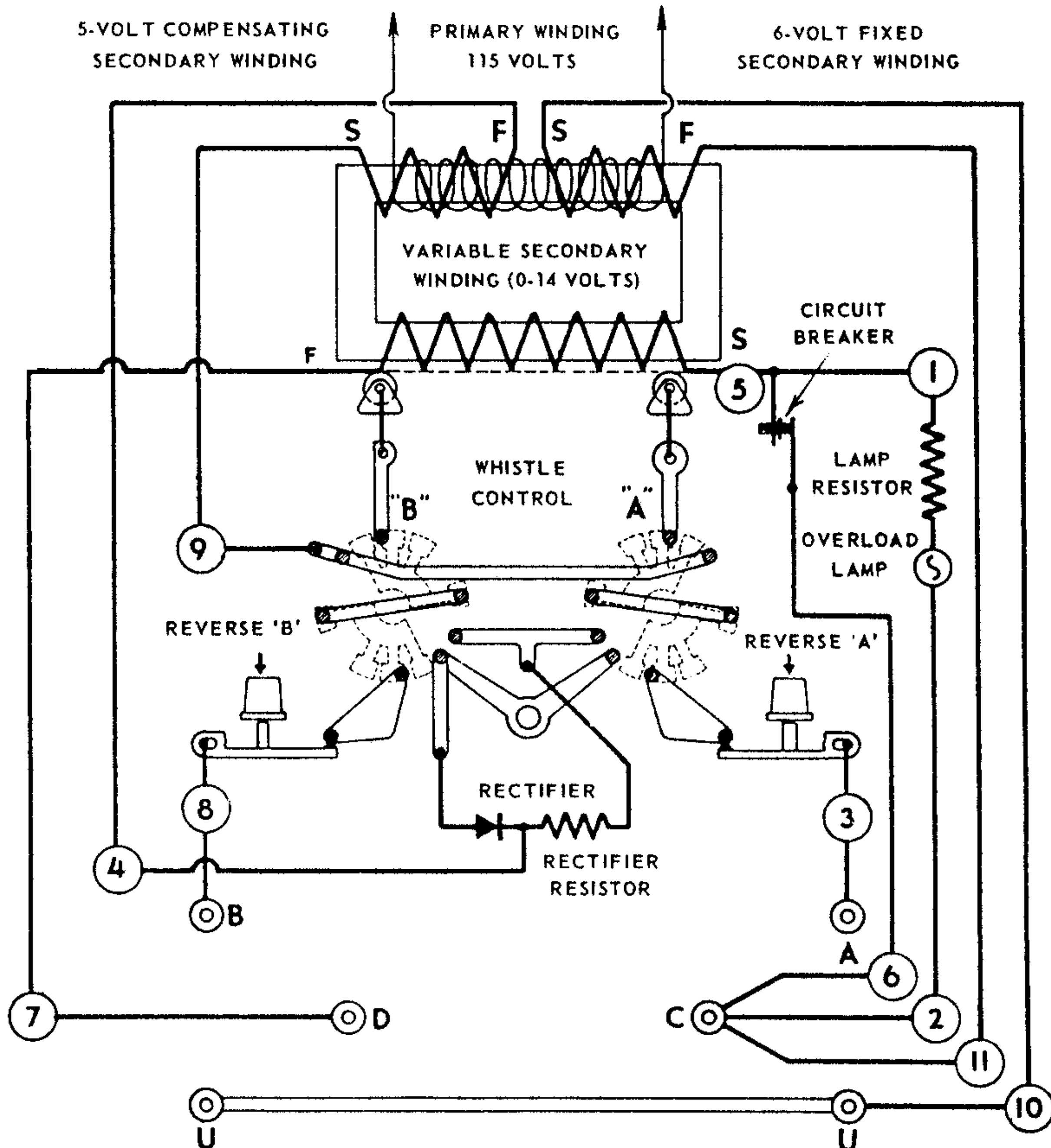
### OPERATION OF 'KW' WHISTLE CONTROLLER



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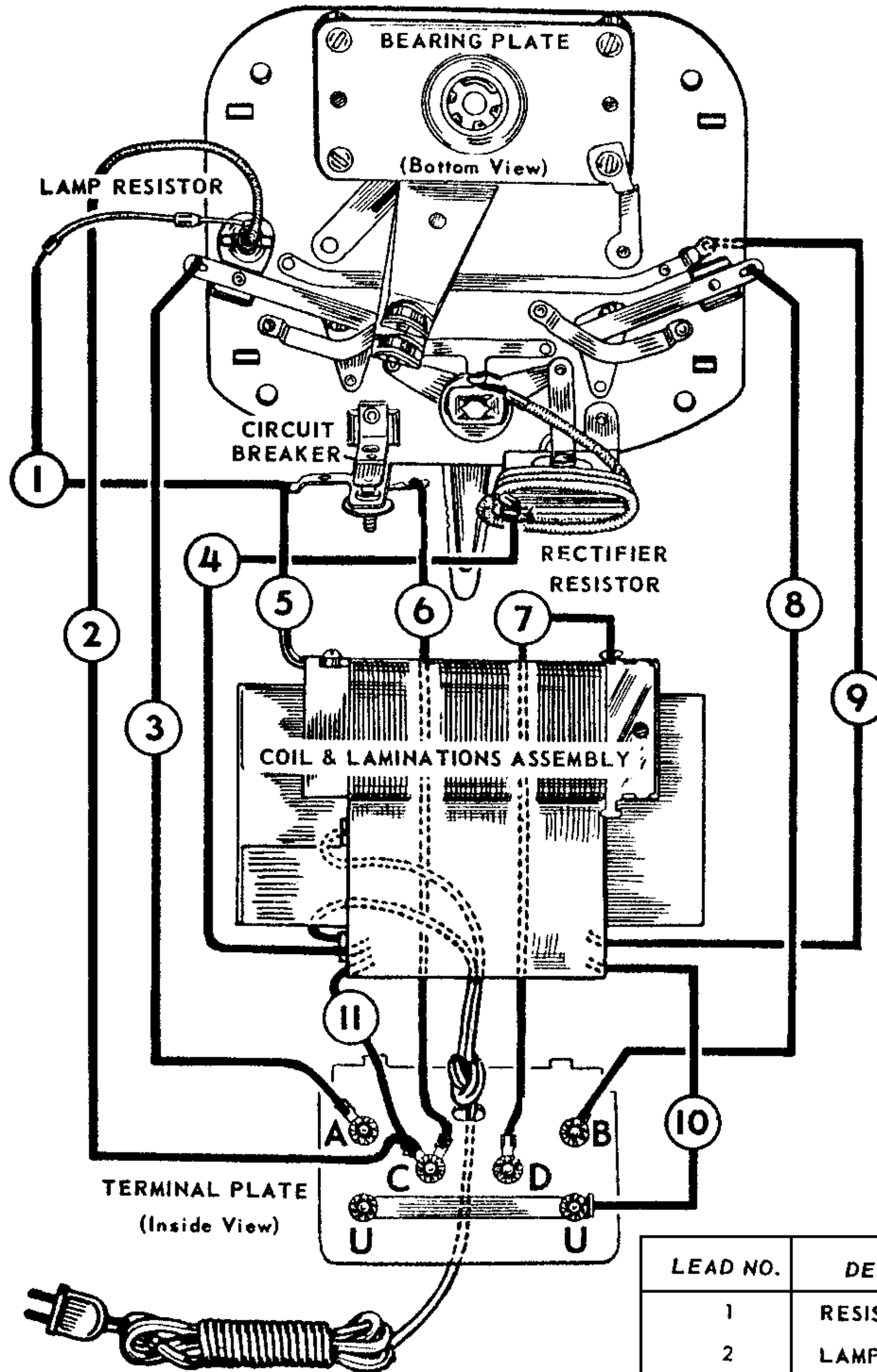
SCHMATIC WIRING DIAGRAM OF 'KW' TRANSFORMER



Numbers of leads correspond to those on the pictorial wiring diagram on the opposite page. Letters S and F indicate the start and finish of each winding. Note that the circuit breaker does not protect binding post combinations A-B, B-D and C-U.

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## PICTORIAL WIRING DIAGRAM OF 'KW' TRANSFORMER

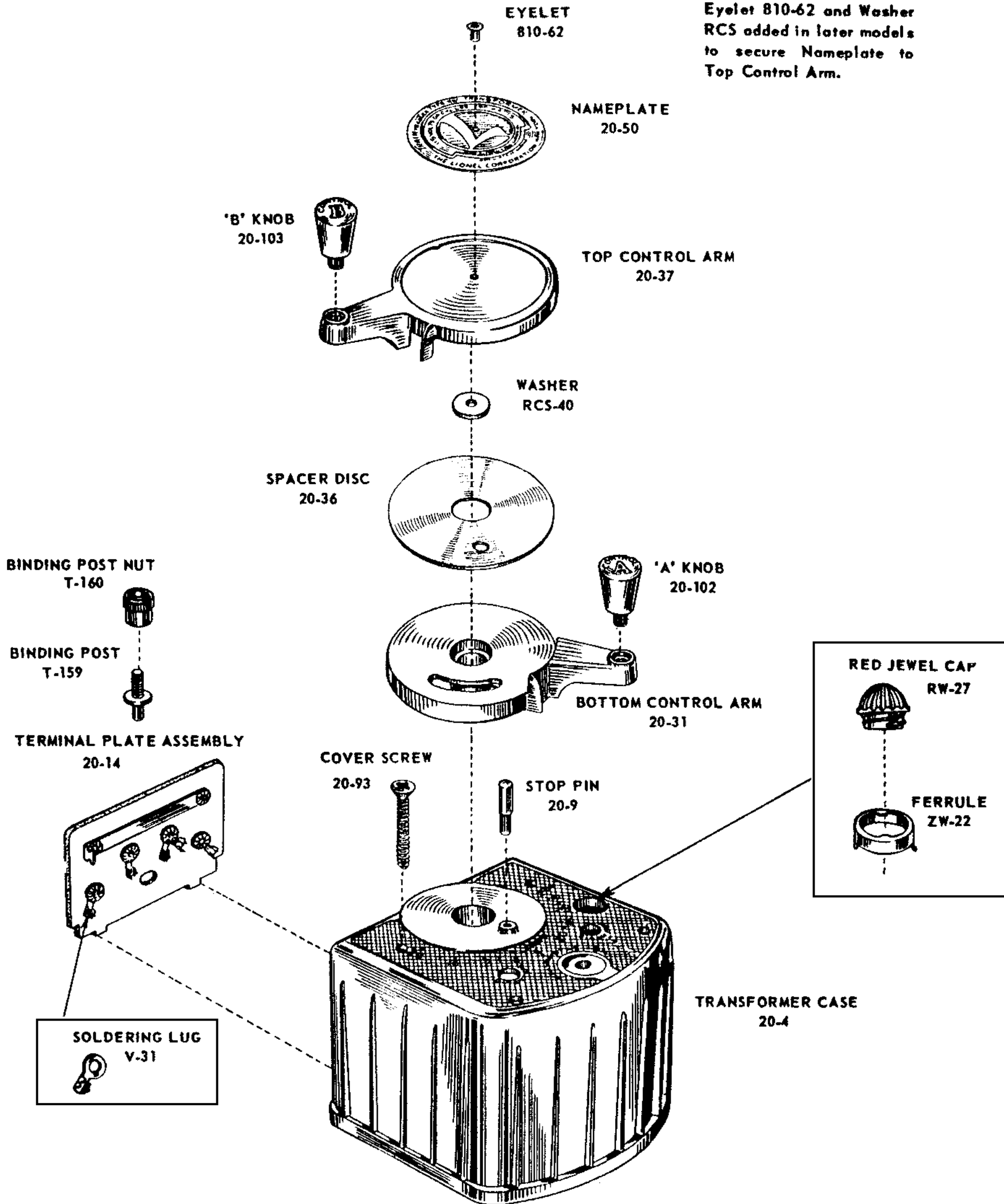


LEAD NO.	DESCRIPTION
1	RESISTOR LEAD
2	LAMP LEAD
4	YELLOW TUBING
5	RECTANGULAR WIRE
9	YELLOW TUBING
10	BLACK TUBING
11	BLACK TUBING

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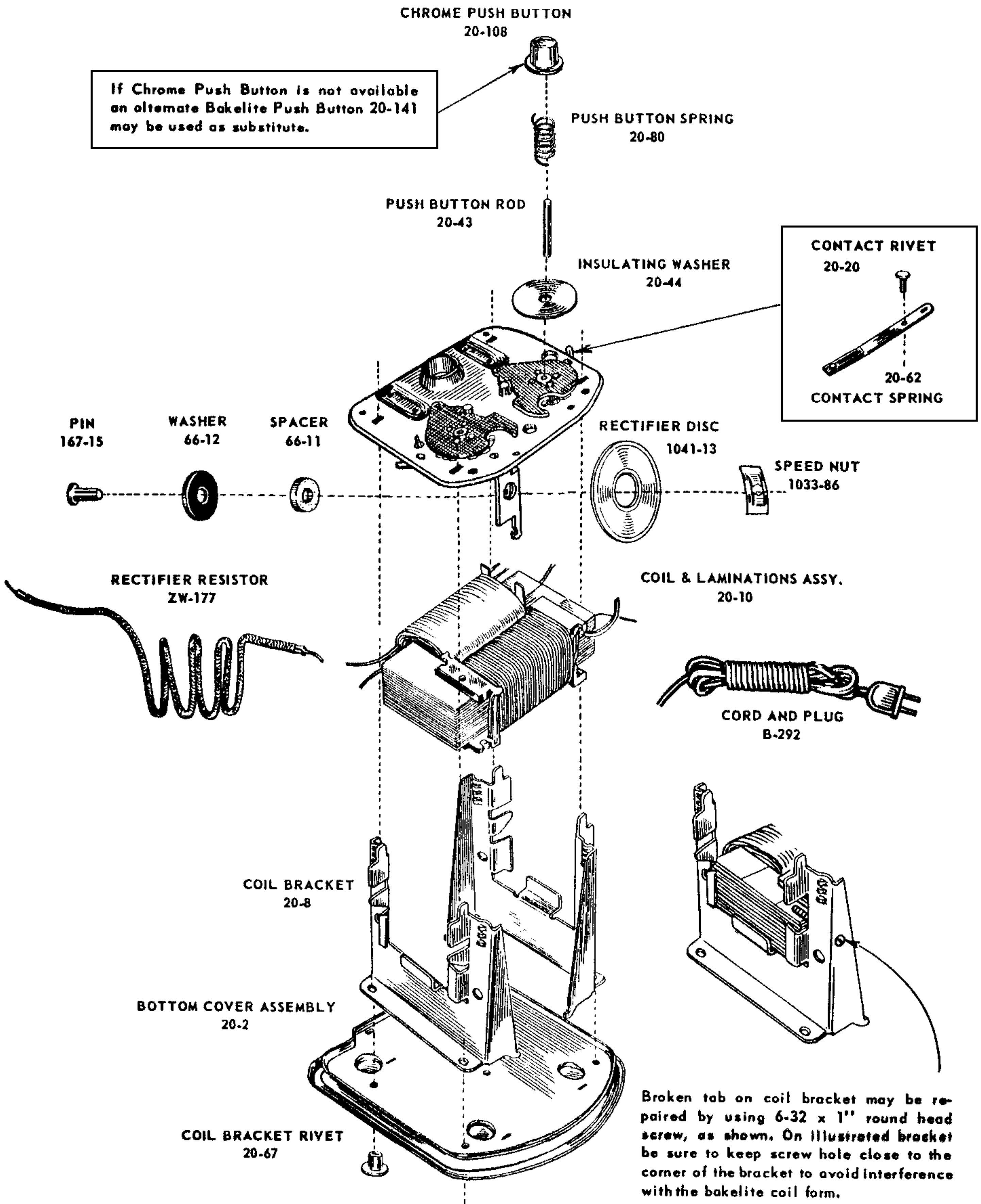
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Eyelet 810-62 and Washer RCS added in later models to secure Nameplate to Top Control Arm.



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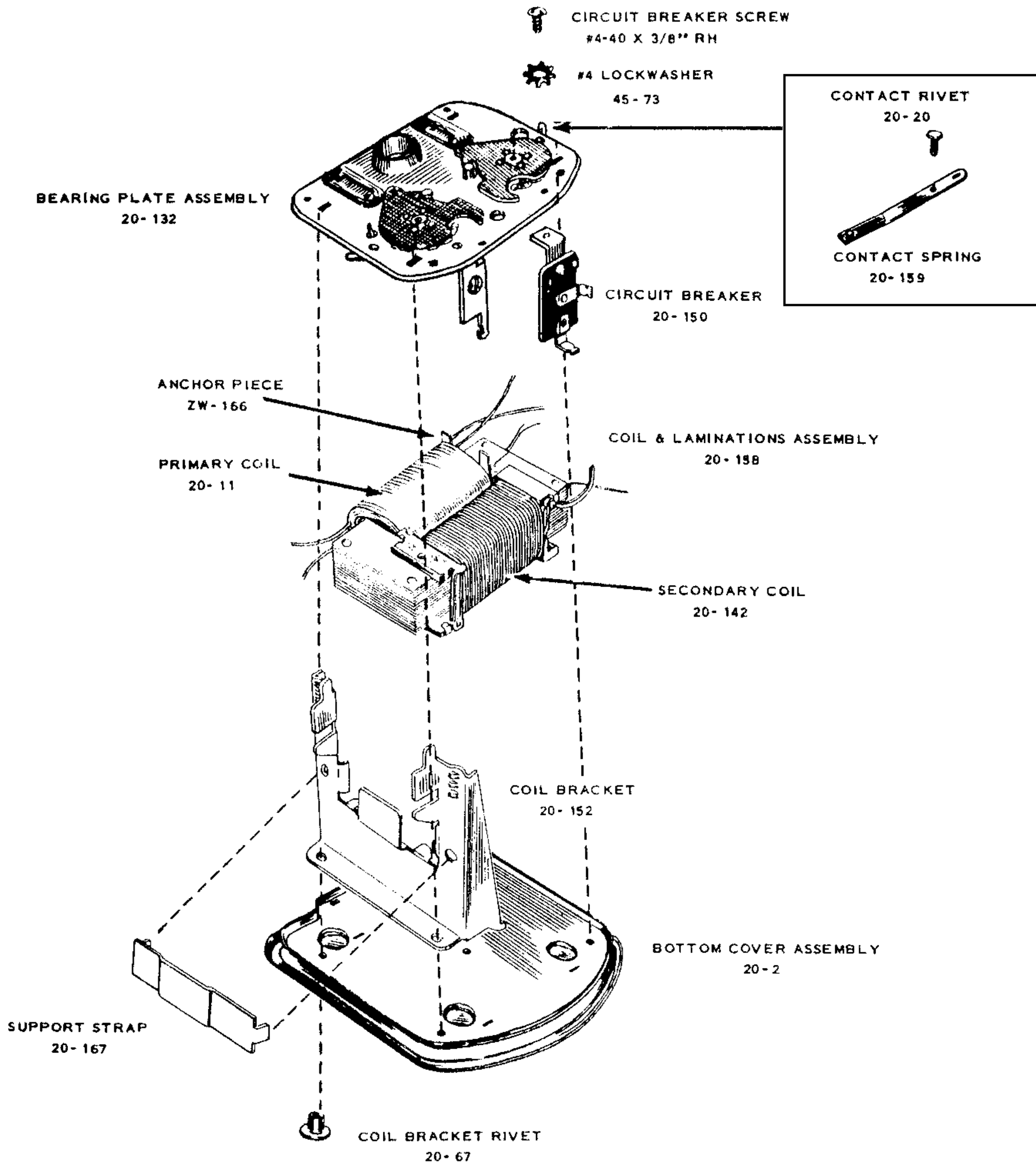


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## TYPE "KW" TRANSFORMER REVISION

Type "KW" transformers manufactured since 1957 were made with riveted lamination stacks which required a change in the dimensions of the coils and of the coil brackets.

Replacement of the older coils with new coils requires the use of new brackets as well. The new components and their assembly are illustrated below.



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## REPLACEMENT PARTS FOR TRANSFORMER TYPE "KW" (Revised)

<u>Part No.</u>	<u>Bin</u>	<u>Description</u>	<u>List Price</u>	<u>Part No.</u>	<u>Bin</u>	<u>Description</u>	<u>List Price</u>
20-2	N-34	Bottom Cover Assem.	1.50	20-150	O-56	Circuit Breaker	1.50
20-4	F-1	Case	4.00	22-65	J-64	Rivet	.02
20-8	Obs.	Coil Bracket		45-73	A-61	#4 Lockwasher	.02
20-9	O-79	Stop Pin	.05	51-300	LC	Lamp	.20
20-10	Obs.	Coil Assem.		61-22	A-61	Lamp Contact	.02
20-11		Primary Coil	3.50	66-11	H-97	Spacer	.05
20-14	O-66	Terminal Plate	1.00	66-12	H-97	Washer	.02
20-19	N-43	Retainer Plate	.20	167-15	J-91	Rectifier Pin	.05
20-20	O-78	Contact Rivet	.02	810-62	Sub. 22-65	Eyelet	
20-22	Sub. 20-150	Circuit Breaker		1011-24	N-11	Control	.50
20-27	N-43	Outer Shaft	.30	1033-86	O-99	Speednut	.05
20-28	O-35	Inner Shaft	.30	1041-13	N-73	Rectifier Disc	.75
20-29	Sub. 20-157	Retaining Eyelet		B-292	N-44	Cord & Plug	1.00
20-31	N-14	Bottom Control Arm	.75	R-91	N-55	Lamp Spring	.05
20-36	O-55	Spacer Disc	.20	Q-90	Sub. 51-300	Lamp	
20-37	N-43	Top Control Arm	.75	R-92	N-55	Lamp Socket	.25
20-43	O-65	Push Button Rod	.10	RCS-40	H-93	Washer	.05
20-44	O-75	Insulating Washer	.05	RW-27	N-95	Red Jewel Cap	.20
20-45	Sub. ZW-183	Lamp Resistor		T-159	N-98	Binding Post	.10
20-49	O-75	Rivet	.02	T-160	N-98	Binding Post Nut	.10
20-50	O-75	Nameplate	.75	V-31		Solder Lug	.05
20-62	Sub. 20-159	Contact Spring		V-45	Sub. 20-137	Carbon Roller	
20-63	O-67	"A" Switch Assem.	1.00	ZW-22	O-82	Ferrule	.20
20-66	O-67	"B" Switch Assem.	1.00	ZW-102	O-64	Roller Pin	.02
20-67	O-65	Coil Bracket Rivet	.05	ZW-166	O-84	Anchor Piece	.05
20-69	O-65	Switch Rivet	.05	ZW-177	O-94	Rectifier Resistor	.35
20-70	O-65	Switch Shaft	.30	ZW-183	O-68	Lamp Resistor	.35
20-71	O-75	Washer	.05	20-152	O-46	Coil Bracket	.60
20-72	O-95	Speed Nut	.05	20-157		Retaining Eyelet	.20
20-73	O-85	Switch Spring	.10	20-158	O-14	Coil & Laminations	12.00
20-80	O-55	Push Button Spring	.05	20-159		Contact Spring	.10
20-82	O-85	Long Arm	.75	20-167		Support Strap	.20
20-83	O-78	Short Arm	.75				
20-93	O-95	Cover Screw	.05				
20-102	O-44	"A" Knob	.30				
20-103	O-65	"B" Knob	.30				
20-108	O-95	Chrome Push Button	.15				
20-131	O-65	Compression Spring	.15				
20-132	Sub. 20-140	Bearing Plate Assem.					
20-137		Carbon Roller	.25				
20-138	O-65	Nut (Circuit Breaker)	.05				
20-140		Bearing Plate Assem	4.25				
20-142		Secondary Coil	6.00				

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<u>Part Number</u>	<u>Location</u>	<u>Unit Price</u>	<u>Min. Quan.</u>	<u>Description</u>
20-2	N-34	1.50		Bottom Cover Assem.
20-4	F-1 Top	4.00		Case
20-8	Obsolete			Coil Bracket
20-9	O-79	.05	12	Stop Pin
20-10	Obsolete			Coil & Laminations Assem.
20-14	O-66	1.00		Terminal Plate Assem.
20-19	N-43	.20		Retainer Plate
20-20	O-78	.02	25	Contact Rivet
20-22	Sub. 20-150			Circuit Breaker
20-27	N-43	.30		Outer Shaft
20-28	O-35	.30		Inner Shaft
20-29	O-75	.05	12	Large Retaining Ring
20-31	N-14	.75		Bottom Control Arm
20-36	O-55	.20		Spacer Disc
20-37	N-39	.75		Top Control Arm
20-43	O-65	.10	6	Push Button Rod
20-44	O-75	.05	12	Insulating Washer
20-45	Sub. ZW-183			Resistor (Circuit Breaker)
20-49	O-75	.02	25	Rivet
20-50	O-75	.75		Nameplate
20-62	O-75	.10	6	Contact Spring
20-63	O-67	1.00		"A" Switch Assem.
20-66	O-67	1.00		"B" Switch Assem.
20-67	O-65	.05	12	Coil Bracket Rivet
20-69	O-65	.05	12	Switch Rivet
20-70	O-65	.30		Switch Shaft
20-71	O-75	.05	12	Washer
20-73	O-85	.10	6	Switch Spring
20-80	O-55	.05		Push Button Spring
20-82	O-85	.75		Long Contact Arm Assem.
20-83	O-78	.75		Short Contact Arm Assem.
20-93	O-95	.05	12	Cover Screw
20-102	O-44	.30		"A" Knob
20-103	O-65	.30		"B" Knob
20-108	O-95	.15	6	Chrome Push Button
20-131	O-65	.15	6	Compression Spring
20-132	N-23	4.25		Bearing Plate Assem.
20-138	O-65	.05	12	Tension Nut (Circuit Breaker)

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<u>Part Number</u>	<u>Location</u>	<u>Unit Price</u>	<u>Min. Quan.</u>	<u>Description</u>
20-150	O-56	1.50	2	Circuit Breaker
51-300	LC	.20	10	Lamp
61-22	A-61	.05	25	Eyelet & Washer
66-11	H-97	.05	12	Spacer
66-12	H-97	.02	12	Washer
167-15	J-91	.05	10	Rectifier Pin
810-62	N-51	.05	12	Eyelet
1011-24	N-11	.50		Red Control Handle
1033-86	O-99	.05	12	Speednut
1041-13	N-73	.75	6	Rectifier Disc
B-292	N-44	1.00		Cord & Plug
R-91	N-55	.05	12	Lamp Spring
R-92	N-55	.25		Lamp Socket
RCS-40	H-93	.05	12	Washer
RW-27	N-95	.20		Red Jewel Cap
T-159	N-98	.10	6	Binding Post
T-160	N-98	.10	6	Binding Post Nut
V-31		.05	12	Solder Lug
V-45	N-98	.25		Carbon Roller
ZW-22	O-82	.20		Ferrule
ZW-102	O-64	.02	25	Roller Pin
ZW-177	O-94	.35		Rectifier Resistor Wire
6/32 x 3/8"	Q-62	.02	25	RH Screw (Plate)