AUTOMATIC TUNING

The past four years have witnessed the widespread adoption of automatic tuning systems by practically every radio receiver manufacturer. The appeal of this feature to the public has been fostered by intensive sales promotion and advertising campaigns which have established it as a necessary adjunct to a modern receiver. It presents to the radio service engineer a unique opportunity for the establishment of closer customer contact since the original setup of selected stations as well as the maintenance of continued satisfactory automatic operation is a function which he alone is technically capable of rendering.

As everyone acquainted with radio receiver details will realize, automatic station selection is not a new development but rather a refinement and perfection of principles which have been in use for several years past. It is interesting to note that the continued progress towards the ideal of simplification of the tuning requirements of radio receivers has been the result of a series of cycles in which improvements in mechanical design have in every case followed and been initiated by the introduction of new radio circuits. In the present case the development of automatic frequency control of superheterodyne oscillators, stabilization of drifts due to temperature and humidity and the expansion of IF amplifier circuits have simplified the design of automatic tuning devices by allowing considerable latitude in the mechanical and electrical precision of selectors.

The present article is a combination of the texts appearing in the 2nd Edition Radio Service Encyclopedia (pages 249-274), and the Automatic Tuning Supplement Number 8 to the 3rd Edition Radio Service Encyclopedia. In each of these articles a system of listing all models in table form with reference to specific portions of the text applying to the particular model was used, and the present article continues this method. The present article has a greater utility not only because of integrated form but also because it combines the basic theory of operation as covered in the 2nd Edition with the specific set-up and service information appearing in the Supplement.

In setting up this reference system it has been necessary to classify the material under nine headings as follows:

Section 1 Mechanically Operated Manual Types
Section 2 Tuned Circuit Substitution Types
Section 3 Motor Operated Types
Section 4 Electric Tuning Motors
Section 5 Station Selector Switches
Section 6 Transfer Devices
Section 7 Silencing Equipment and Operation
Section 8 Station Selector Commutator Devices
Section 9 Special Mechanisms

Some of the sections have subdivisions to cover the many variations of a basic operation and references in the table are made directly to the subdivision in such cases. Two subdivision references are frequently given, one for theory of operation, and the second for specific set-up data.

The column headed "Type" in the reference table actually names variations of the three main types, that is, manually operated, circuit substitution, or motor operated. For instance, it is more informative to refer to a particular system as dual mica, or mica and permeability type rather than to the general classification of tuned circuit substitution.

The column headed, "Number of Buttons," refers to the number of selectors actually used for station reception. Transfer buttons, tone control buttons, etc., are not included in the number shown.

The "Special Descriptions" column refers to portions of the text devoted to transfer devices, audio silencing systems, etc., applicable to models carrying the reference. Altogether there are seven subheadings under the Special Description classification as follows: Button Indexing Adjustment, Tuning Motor, Push-Button Station Selector Switch, Transfer Device-Manual to Automatic, Audio Silencing Circuit and AFC Release During Tune, Station Selecting Commutator Device, and Stop or Lock-In Mechanism.

It should be noted that the method of referring receivers of one manufacturer to those of another manufacturer for illustrative purposes does not indicate that the receivers are identical or even similar; only that the automatic tuning device operation is basically the same.

MANUFACTURER AND MODEL	Type	No. of Buttons	REFERENCE Section	Sub-Division	SPECIAL DESCRIPTION Button Indexing Adj.	Tuning Motor	Push-Button Station Selector Switch	Transfer Device Manual to Automatic	Audio Silencing Circuit and AFC Release During Tune	Station Selecting Commutator Device	Stop or Lock-In Mechanism
AIR KING											
910, 911	Dual Mica	5	2	2A, 2B			5B	6D			
ALLIED											
A9757, A9758	Telephone Dial	12	1	1E	1C4			6B	7D, 7K2		
B10525, B10526	Motor Operated	8	3			4B	5B	6D	7H, 7K4	8C	
B10537, B10538, B10539	Motor Operated	8	3	3B		4B	5B	6D	7H, 7K4	8C	
B10540, B10541, B10542	Telephone Dial	10	1	1C	1C2				7A		1C12
B10580, B10581, B10582	Telephone Dial	12	1	1E	1C4			6B	7D, 7K2		
B10799	Rocker Bar	6	1	1B, 1B1							
E10704	Cam and Lever	4	1	1A, 1A1							
E10705, E10706	Rocker Bar	6	1	1B, 1B1							
E10707, E10708	Rocker Bar	6	1	1B, 1B1							
E10709, E10710	Dual Permeability	7	2	2B							
E10711, E10712	Dual Permeability	7	2	2B							
E10718, E10720	Rocker Bar	6	1	1B, 1B1							
E10721, E10722, E10723	Rocker Bar	6	1	1B, 1B1							
E10726	Dual Permeability	7	2	2B							
E10727	Rocker Bar	6	1	1B, 1B1							
E10728	Dual Permeability	7	2	2B							
E10740	Rocker Arm	4	1	1B, 1B1							
E10741, E10742, E10743	Dual Permeability	6	2	2B							
E10744, E10745	Motor Operated	8	3	3B		4B	5B	6D	7H, 7K4	8C	
E10751	Cam and Lever	5	1	1A2							
E10773, E10774	Dual Permeability	5	2	2B							
E10786, E10788	Rocker Bar	4	1	1B							
E10790, E10794	Rocker Bar	4	1	1B							
E10795	Rocker Bar	5	1	1B							
E10797, E10798, E10799	Dual Permeability	9	2	2B							
E10800	Cam and Lever	4	1	1A1							
E10806	Rocker Bar	6	1	1B1							
E10807, E10808, E10809	Dual Permeability	7	2	2B							
E10810, E10811, E10812	Rocker Bar	6	1	1B1							
E10813, E10814, E10815	Dual Permeability	7	2	2B							
E10825, E10826, E10827	Rocker Bar	6	1	1B1							
E10828, E10829, E10830	Rocker Bar	6	1	1B1							
E10840, E10841, E10842	Cam and Lever	4	1	1A1							
E10850, E10851	Motor Operated	8	3	3B		4B	5B	6D	7H, 7K4	8C	
E10870, E10872, E10874	Dual Permeability	6	2	2B							
E10875, E10876, E10877	Dual Permeability	6	2	2B							
E10880, E10881	Motor Operated	8	3	3B		4B	5B	6D	7H, 7K4	8C	
E10882A to E10887A	Rocker Bar	4	1	1B							
E10890	Cam and Lever	5	1	1A2							
E10893, E10894, E10895	Rocker Bar	4	1	1B1							
E10897, E10898, E10899	Rocker Bar	6	1	1B1							
E10900, E10901, E10902, E10903	Dual Permeability	9	2	2B							
E10905	Dual Permeability	4	2	2B							
E10906, E10907	Rocker Bar	6	1	1B							
E10920	Rocker Bar	4	1	1B							
AUTOMATIC											
855, 892	Permeability & Mica	6	2	2B			5B	6B			
BELMONT											
408A	Cam and Lever	5	1	1A1							
418A	Cam and Lever	6	1	1A1							
501A	Cam and Lever	5	1	1A1							
511A	Cam and Lever	6	1	1A3							
517A, 519A, 520A, 521A	Cam and Lever	6	2	2B							
524A	Cam and Lever	6	1	1A3							
526, 527, 529, 531B	Cam and Lever	5	1	1A1							
553A	Cam and Lever	6	1	1A1							
577A, 577C, 579	Cam and Lever	5	1	1A4							
582, 583A, 611A, 612A	Cam and Lever	6	1	1A1							
632A, 633A, 634A, 635A, 636	Cam and Lever	5	1	1A1							
637A, 638	Cam and Lever	6	1	1A1							
665A	Cam and Lever	6	1	1A3							
676A	Cam and Lever	6	1	1A5							
677	Cam and Lever	6	1	1A4							
678	Cam and Lever	6	1	1A5							
751A	Cam and Lever	6	1	1A6							
761A, 765A	Cam and Lever	6	1	1A3							
767A	Cam and Lever	6	1	1A6							
791A	Cam and Lever	6	1	1A3							
792, 793	Cam and Lever	6	1	1A7							
794	Cam and Lever	6	1	1A8							
796, 797	Cam and Lever	6	1	1A3							
860	Cam and Lever	8	1	1A3					7B		
860A	Cam and Lever	8	1	1A3					7B		
867A	Cam and Lever	6	1	1A6							
1075A, 1075B	Dual Permeability	6	2	2B							
1175	Cam and Lever	8	1	1A3					7B		
1175A	Cam and Lever	8	1	1A3					7B		
BUICK											
980598, 980620	Rack and Pinion	5	9	9D							
CADILLAC											
1433970	Permeability Tuners	5	2	2B							
CHEVROLET											
985283	Motor Operated	8	8	8D							
985425, 985426	Rocker Bar	5	1	1B2							
CLARION											
55A, 57A, 58B	Dual Mica	5	2	2A							
70X	Dual Mica	4	2	2A							
93, 1105	Dual Mica	5	2	2A							

MANUFACTURER AND MODEL	Type	No. of Buttons	REFERENCE Section	REFERENCE Sub-Division	SPECIAL DESCRIPTION Button Indexing Adj.	Tuning Motor	Push-Button Station Selector Switch	Transfer Device Manual to Automatic	Audio Silencing Circuit and AFC Release During Tune	Station Selecting Commutator Device	Stop or Lock-In Mechanism
COLONIAL (Sears-Roebuck)											
4610, 4666, 4686	Telephone Dial	11	1	1C	1C1				7A		1C8
4687	Telephone Dial	11	1	1C	1C1			6A	7A, 7K1		1C8
4786	Telephone Dial	11	1	1C	1C1				7A		1C8
4787	Telephone Dial	11	1	1C	1C1			6A	7A, 7K1		1C8
4791, 4792	Telephone Dial	11	1	1C	1C1				7A		1C8
CONTINENTAL											
5A	Cam and Lever	4	1	1A1							
5B	Rocker Bar	4	1	1B1							
6B, 6C	Motor Operated	6	3	3B		4B	5B	6D	7H, 7K4	8C	
6G	Dual Permeability	6	2	2B							
6K	Rocker Arm	4	1	1B1							
7G, 8A, 8AU	Dual Permeability	6	2	2B							
9G, 11A, 11S, 16R, 16S	Motor Operated	8	3	3B		4B	5B	6D	7H, 7K4	8C	
55	Cam and Lever	5	1	1A2							
CROSLEY											
A158, A168, A169, A258	Rocker Bar	5	1	1B3							
A268, A358	Rocker Bar	5	1	1B3							
418, 428	Rocker Bar	4	1	1B3							
438M, 448	Rocker Bar	5	1	1B3							
458	Rocker Bar	4	1	1B3							
548	Rocker Bar	5	1	1B3							
588, 598	Rocker Bar	4	1	1B3							
617	Motor Operated		3	3A		4C	5D				
628, 638	Rocker Bar	5	1	1B3							
648	Rocker Bar	4	1	1B2							
718, 758, 818	Rocker Bar	5	1	1B3							
828	Rocker Bar	8	1	1B3							
1018	Rocker Bar	5	1	1B3							
1118	Motor Operated	8	3	3B		4C	5A		7G	8D	
1127	Motor Operated		3	3A		4C	5D				
1137, 1227, 1237	Motor Operated	8	3	3B		4C	5A		7G	8D	
5628	Rocker Bar	5	1	1B3							
DELCO											
R667, R669	Delco-Matic	6	9	9B							
R675, R677, R678	Rocker Bar	5	1	1B4							
R1132	Delco-Matic	8	9	9B							
R1134, R1135, R1139	Cam and Lever	5	1	1A1							
R1140	Dual Permeability	5	2	2B							
R1141, R1142, R1143, R1144	Dual Permeability	6	2	2B							
DETROLA											
175, 183, 185	Motor Operated	8	3	3B		4B	5A		7G	8C	
191, 192, 193, 195(C4), 204	Motor Operated	10	3	3B		4B	5A		7G	8C	
209, 210	Dual Permeability	6	2	2B							
220, 221, 222	Rocker Bar	4	1	1B1							
223, 225	Rocker Bar	6	1	1B1							
226, 227	Rocker Bar	4	1	1B1							
228	Rocker Bar	6	1	1B1							
231	Motor Operated	8	3	3B		4B	5A		7G	8C	
233	Rocker Bar	6	1	1B1							
258, 259, 270	Dual Mica	6	2	2A							
ERLA											
11 Tube 3 Band	Flash Tuning	12	1	1E	1C4			6B	7D, 7K2		
11 Tube 3 Band	Telephone Dial	10	1	1C	1C3			6B	7D, 7K2		
76A	Flash Tuning	12	1	1E	1C4			6B	7D, 7K2		
78B, 78BE, 82A, 82AE, 86AE	Telephone Dial	10	1	1C	1C3			6B	7D, 7K2		
91B, 95B	Telephone Dial	10	1	1C	1C3			6B	7D, 7K2		
EMERSON											
AR171, AR173, AR174	Automatic Dial	10	1	1C	1C1						1C11
AR176, AR180, AR185	Automatic Dial	10	1	1C	1C1						1C11
AT170, AT172, AT181	Automatic Dial	10	1	1C	1C1						1C11
AV193, AY194, AY195	Single Adjust. Mica	6	2	2C							
AZ196	Single Adjust. Mica	6	2	2C							
BB208, BB209	Rocker Bar	4	1	1B1							
BD197, BD198	Single Adjust. Mica	6	2	2C							
BQ223, BQ225, BQ228	Instamatic	6	9	9E							
BR224, BR226, BU229	Instamatic	6	9	9E							
BU230, BW231	Instamatic	6	9	9E							
CA208, CA209, CA234	Rocker Bar	4	1	1B1							
FADA											
A66PC, A66T, A76PC	Dual Mica	6	2	2A							
A76T, 6A39	Dual Mica	6	2	2A							
358, 366, 366PT, 368	Flashomatic	6	2								
FAIRBANKS-MORSE											
9AC4, 9AC5		15	1	1C	1C1				7A, 7K1		1C8
12AC6		15	1	1C					7A		
FIRESTONE											
S7407-5	Ratchet Switch	6	2	2D							
1175	Cam and Lever	8	1	1A3							
01009, 01010	Cam and Lever	5	1	1A1							
01029	Cam and Lever	8	1	1A3							
01030	Cam and Lever	6	1	1A1							
015040, 015050, 015060	Rocker Bar	4	1	1B1							
015070	Cam and Lever		1	1A3, 1A8							
015080, 015090	Cam and Lever		1	1A9							
015100, 015110, 015120	Rocker Bar	4	1	1B1							
015130	Rocker Bar	4	1	1B1							
100502	Cam and Lever	6	1	1A4							
FORD											
F1740, 6MF490	Ratchet Switch	5	2	2D							

MANUFACTURER AND MODEL	Type	No. of Buttons	REFERENCE		SPECIAL DESCRIPTION						
			Section	Sub-Division	Button Indexing Adj.	Tuning Motor	Push-Button Station Selector Switch	Transfer Device Manual to Automatic	Audio Silencing Circuit and AFC Release During Tune	Station Selecting Commutator Device	Stop or Lock-In Mechanism
GALVIN											
1938 Auto Models	Spot Tuning	Any No.	1	1D	1C6						
8-60, 8-80	Motor Operated	6	3	3B		4B	5A		7E		1C15
10Y1, 12Y, 12Y1	Motor Operated	19	3	3C	1C2	4C	5C	6C	7G, 7K2		1C13
9-49, 9-69, 15F	Motor Operated	6	9	9G							
16C	Rocker Bar	5	1	1B							
17D, 17DA, 18O, 19B	Rocker Bar	6	1	1B							
20P, 21L, 22S, 24K, 25N	Motor Operated	6	9	9G							
89K1, 89K2, 89K3, 109K1	Motor Operated	6	9	9G							
109K2	Motor Operated	6	9	9G							
GAMBLE-SKOGMO											
A1, A2, A3, A6	Motor Operated	8	9	9C							
527A, 527C	Cam and Lever	5	1	1A1							
C640	Cam and Lever	6	1	1A1							
645	Dual Mica	5	2	2A			5B	6D			
648	Rocker Bar	6	1	1B1							
677	Cam and Lever	6	1	1A4							
678	Cam and Lever	6	1	1A5							
735	Dual Mica	5	2	2A							
761A, 796, 797	Cam and Lever	6	1	1A3							
867A	Cam and Lever	6	1	1A6							
GAROD											
782, 782-1	Prestomatic	6	2	2A			5B	6B			
GENERAL ELECTRIC											
F96	Touch Tuning	6	2	2A			5B	6D			
F107, F109, F137	Motor Operated	13	9	9A		4A	5B	6D	7E, 7K3	8B	
G50	Telephone Dial	8	1	1B2							
G53	Dual Mica	6	2	2A				6B			
G55	Telephone Dial	8	1	1B2							
G56, G61, G64, G66, G68	Dual Mica	6	2	2A				6B			
G69, G75, G76, G78	Dual Mica	6	2	2A				6B			
G85	Dual Mica	8	2	2A				6B			
G86	Dual Mica	6	2	2A				6B			
G95	Motor Operated	13	3	3B							
G97	Dual Mica	6	2	2A				6B			
G99	Dual Mica	8	2	2A				6B			
G105, G106	Motor Operated	13	3	3B							
G655	Dual Mica	6	2	2A				6B			
GA62	Rocker Bar	5	1	1B1							
GD51	Cam and Lever	5	1	1A1							
GD52, GD52A, GD60, GD63	Dual Mica	5	2	2A			5B	6D			
GD610	Cam and Lever	5	1	1A1							
H73, H77, H78, H79, H87	Permeability & Mica	6	2	2A, 2B							
H116, H118	Permeability & Mica	8	2	2A, 2B							
H634, H638, H640	Permeability & Mica	5	2	2A, 2B							
HJ905, HJ908	Permeability & Mica	5	2	2A, 2B							
HJ1005	Permeability & Mica	6	2	2A, 2B							
HJ1205	Permeability & Mica	8	2	2A, 2B							
GENERAL HOUSEHOLD UTILITIES (Grunow)											
585	Teledial	10	1	1C	1C3				7A, 7K1		1C8
588	Teledial	8	1	1C	1C3				7A, 7K1		1C8
589	Teledial	10	1	1C	1C3				7A, 7K1		1C8
622	Teledial	8	1	1C	1C3				7A, 7K1		1C8
623	Teledial	10	1	1C	1C3				7A, 7K1		1C8
624, 632	Teledial	8	1	1C	1C3				7A, 7K1		1C8
633, 1067	Teledial	10	1	1C	1C3				7A, 7K1		1C8
1081, 1091, 1181, 1183, 1185	Teledial	16	1	1C	1C1				7A, 7K1		1C8
1291, 1293	Teledial	15	1	1C	1C1				7A, 7K1		1C8
GILFILLAN											
5T8	Dual Mica	6	2	2A			5B	6D			
13C8-E	Motor Operated	8	3	3B		4B	5B	6A	7H	8C	
HERBERT H. HORN											
11A	Motor Operated	8	3	3B		4B	5B	6D	7H, 7K4	8C	
HOWARD											
210 Adapter, 211 Converter	Dual Mica	8	2	2A			5B	6D			
240, 240-2	Dual Mica	8	2	2A			5B				
318, 318D, 325D, 368A	Dual Mica	8	2	2A			5B	6D			
375	Permeability & Mica	6	2	2A, 2B							
400A, 425A	Motor Operated	8	3	3B		4B	5B	6D	7H		8C
418, 468, 525	Permeability & Mica	6	2	2A, 2B							
HUDSON											
SA40	Solenoid	6	9	9F							
MAGNAVOX											
CR101M, CR108M	Motor Operated	8	3	3B							
CR121	Dual Mica	6	2	2A				6B			
CR122	Motor Operated	8	3	3B							
CR123	Rocker Bar	6	1	1B							
CR124	Dual Mica	6	2	2A				6B			
CR128	Rocker Bar	6	1	1B							
MAJESTIC											
62A	Rocker Bar	4	1	1B1							
639, 639B	Rocker Bar	6	1	1B1							
651-EB	Dual Mica	4	2	2A				6B			
739	Rocker Bar	4	1	1B1							
1056X, 1058X	Dual Permeability	5	2	2B							
1356X, 1656X	Dual Permeability	7	2	2B							
11056	Motor Operated	6	3	3B							
11058	Motor Operated	8	3	3B							
11356	Motor Operated	10	3	3B							
11656	Motor Operated	12	3	3B							

MANUFACTURER AND MODEL	Type	No. of Buttons	REFERENCE Section	REFERENCE Sub-Division	SPECIAL DESCRIPTION Button Indexing Adj.	Tuning Motor	Push-Button Station Selector Switch	Transfer Device Manual to Automatic	Audio Silencing Circuit and AFC Release During Tune	Station Selecting Commutator Device	Stop or Lock-In Mechanism
MIDWEST											
VT16, VT18, VT20	Motor Operated	18	3	3B		4B	5A	6F	7C	8C	
MONTGOMERY-WARD											
62-274, 62-280, 62-282	Cam and Lever	6	1	1A1							
62-284, 62-288, 62-290	Cam and Lever	6	1	1A1							
62-303, 62-321	Motor Operated	8	9	9C							
62-322	Dual Permeability	6	2	2B							
62-323, 62-324	Cam and Lever	6	1	1A3							
62-350	Cam and Lever	4	1	1A1							
62-361	Cam and Lever	6	1	1A1							
62-362	Cam and Lever	6	1	1A3							
62-363, 62-370, 62-390	Dual Permeability	6	2	2B							
62-401, 62-403, 62-422	Dual Permeability	6	2	2B							
62-433	Motor Operated	8	9	9C							
62-434, 62-435	Cam and Lever	6	1	1A3							
62-451	Motor Operated	8	9	9C							
62-453	Cam and Lever	6	1	1A1							
62-459	Cam and Lever	5	1	1A1							
62-463, 62-470, 62-479	Dual Permeability	6	2	2B							
62-490	Dual Permeability	6	2	2B							
62-501, 62-502, 62-504A	Cam and Lever	6	1	1A1							
62-505A, 62-552, 62-553	Cam and Lever	6	1	1A1							
62-554	Cam and Lever	5	1	1A10							
62-558	Cam and Lever	6	1	1A3							
62-601	Cam and Lever	6	1	1A1							
62-650	Dual Permeability	6	2	2B							
62-651, 62-652	Cam and Lever	6	1	1A6							
62-653	Cam and Lever	5	1	1A10							
62-654, 62-655, 62-656	Cam and Lever	6	1	1A6							
62-700	Dual Permeability	6	2	2B							
62-713	Cam and Lever	6	1	1A11							
62-750, 62-751	Cam and Lever	6	1	1A6							
62-900, 62-1100	Dual Permeability	6	2	2B							
62-1558	Cam and Lever	6	1	1A3							
04BR-609A	Cam and Lever	6	1	1A1							
04BR678C	Cam and Lever	6	1	1A5							
93BR462A	Cam and Lever	6	1	1A3							
93BR508, 93BR509	Cam and Lever	4	1	1A1							
93BR560A	Cam and Lever	6	1	1A11							
93BR561A, 93BR563A	Cam and Lever	6	1	1A14							
93BR564A	Cam and Lever	6	1	1A1							
93BR657A	Cam and Lever	6	1	1A11							
93BR658A, 93BR659A	Cam and Lever	6	1	1A14							
93BR660A	Cam and Lever	6	1	1A14							
93BR713A	Cam and Lever	6	1	1A11							
93BR714A, 93BR714B	Cam and Lever	6	1	1A14							
93BR715A, 93BR717A	Cam and Lever	6	1	1A14							
93BR1201A	Cam and Lever	6	1	1A14							
NOBLITT-SPARKS											
6, 68	Dual Mica	6	2	2A							
92	Dual Mica	6	2	2A				6B			
818AT, 828AT, 838AT	Phantom Tuning	10	1	1E	1C4			6A	7E		
1237, 1247, 1247A	Phantom Tuning	6	2	2A			5B	6B			
1427	Phantom Tuning	10	2	2A			5B	6B			
OLDSMOBILE											
982126, 982127	Rocker Bar	6	1	1B2							
PACKARD BELL											
160	Motor Operated	8	3	3B		4B	5B	6E	7H	8C	
PACIFIC (Chicago)											
Converter Unit	Selectro-Matic	6	2	2A			5B	6D			
PACIFIC (Los Angeles)											
37, 37A	Dual Mica	6	2	2A			5B	6D			
PACIFIC											
8AC	Rocker Bar	6	1	1B							
501, 601, 602	Rocker Bar	4	1	1B							
PACKARD											
PA333915	Motor Operated	5	9	9J							
PA351099, PA351100	Ratchet Switch	5	2	2D							
PA351101, PA351102	Ratchet Switch	5	2	2D							
PHILCO											
37-9, 37-10, 37-11, 37-116	Automatic Dial		1	1C	1C1			6A	7A, 7K1		1C8
37-675, 37-690	Automatic Dial		1	1C	1C1			6A	7A, 7K1		1C8
38-1(121), 38-2(121), 38-3(121)	Automatic Dial		1	1C	1C1			6A	7A, 7K1		1C8
38-4(121), 38-7(121), 38-7(124)	Cone-Centric		1	1C	1C3				7A		1C11
38-22	Cone-Centric		1	1C	1C3				7A		1C11
38-116(121), 38-116(125)	Automatic Dial		1	1C	1C1			6A	7A, 7K1		1C8
38-690	Automatic Dial		1	1C	1C1			6A	7A, 7K1		1C8
39-17, 39-18, 39-19	Cam and Lever	6	1	1A1							
39-25, 39-30, 39-35	Permeability & Mica	8	2	2B							
39-36, 39-40, 39-45	Permeability & Mica	8	2	2B							
39-70, 39-75	Cam and Lever	6	1	1A1							
39-85	Permeability & Mica	6	2	2B							
39-117, 39-118, 39-119	Dual Mica	5	2	2A							
40-125, 40-135	Dual Mica	5	2	2A							
40-150, 40-155	Permeability & Mica	7	2	2B							
40-160, 40-165	Permeability & Mica	5	2	2B							
40-180, 40-185, 40-190	Permeability & Mica	7	2	2B							
40-195, 40-200	Permeability & Mica	8	2	2B							
105	Dual Mica	5	2	2A							
108	Permeability & Mica	8	2	2B							

MANUFACTURER AND MODEL	Type	No. of Buttons	REFERENCE Section	REFERENCE Sub-Division	SPECIAL DESCRIPTION Button Indexing Adj.	Tuning Motor	Push-Button Station Selector Switch	Transfer Device Manual to Automatic	Audio Silencing Circuit and AFC Release During Tune	Station Selecting Commutator Device	Stop or Lock-In Mechanism
PONTIAC											
983679, 983680	Rocker Bar	5	1	1B1							
R. C. A.											
HF1	Permeability & Mica.	8	2	2B							
HF2, HF4, HF6, HF8	Motor Operated	8	3	3B							
9M1, 9M2	Rocker Bar	5	1	1B2							
U10, U12, U20	Rocker Bar	6	1	1B2							
U25, U26	Permeability & Mica.	6	2	2B							
U30	Motor Operated	8	2	2B							
U44	Rocker Bar	6	1	1B5							
K50	Rocker Bar	6	1	1B2							
M50	Rocker Bar	5	1	1B1							
T55	Rocker Bar	6	1	1B2							
K60	Rocker Bar	8	1	1B5							
M60	Rocker Bar	5	1	1B1							
T60, T62	Rocker Bar	6	1	1B2							
T64	Rocker Bar	6	1	1B5							
M70	Rocker Bar	5	1	1B1							
K80, K81	Rocker Bar	8	1	1B5							
T80	Rocker Bar	6	1	1B5							
86T6	Permeability & Mica.	6	2	2B							
87K1, 87T2	Permeability & Mica.	6	2	2B			5B	6B			
94X1, 94X2	Dual Mica	6	2	2A							
95T5	Permeability & Mica.	5	2	2B							
95X1	Dual Mica	5	2	2A							
96BK6, 96BT6	Dual Permeability	4	2	2B							
96E	Permeability & Mica.	5	2	2B							
96E2, 96K, 96K2	Permeability & Mica.	6	2	2B							
96T2	Permeability & Mica.	6	2	2B							
96T4, 96T5	Permeability & Mica.	5	2	2B							
96X11, 96X12, 96X13, 96X14	Rocker Bar	5	1	1B2							
97E, 97K, 97KG, 97T	Permeability & Mica.	6	2	2B							
97X	Permeability & Mica.	5	2	2B							
97Y	Permeability & Mica.	6	2	2B							
98K	Motor Operated	8	3	3B							
98K2, 98T, 98T2	Permeability & Mica.	6	2	2B							
99K, 99T	Motor Operated	8	3	3B							
K105	Rocker Bar	8	1	1B5							
U106	Permeability & Mica.	6	2	2B							
U109	Motor Operated	8	3	3B							
U115	Permeability & Mica.	5	2	2B							
U119	Permeability & Mica.	6	2	2B							
U121	Permeability & Mica.	5	2	2B							
U122E	Permeability & Mica.	6	2	2B							
U123	Permeability & Mica.	5	2	2B							
U124, U125	Permeability & Mica.	6	2	2B							
U126	Motor Operated	8	3	3B							
U127E	Permeability & Mica.	5	2	2B							
U128, U129, U130, U132, U134	Motor Operated	8	3	3B							
811K, 812K, 813K, 816K	Motor Operated	8	3	3B		4C	5B	6A	7H, 7K4	8A	
910KG, 911K	Motor Operated	8	3	3B							
RADIO PRODUCTS											
925-16R, 930-16R	Motor Operated	8	3	3B		4B	5B	6D	7H, 7K4	8C	
935-11S, 940-11S	Motor Operated	8	3	3B		4B	5B	6D	7H, 7K4	8C	
Motor Car Conversion Unit	Touch-O-Matic	5	2	2A			5A				
SEARS-ROEBUCK											
4487, 4488, 4587, 4590	Flash Tuning		9	9H							
4610, 4666	Telephone Dial	11	1	1C	1C1				7A		1C8
4667, 4677, 4681	Dual Mica	8	2	2A				6B			
4687	Telephone Dial	11	1	1C	1C1			6A	7A, 7K1		1C8
4688	Moto-Matic	12	9	9B							
4766	Telephone Dial	11	1	1C	1C1				7A		1C8
4767, 4777, 4781	Dual Mica	8	2	2A				6B			
4786	Telephone Dial	11	1	1C	1C1				7A		1C8
4787	Telephone Dial	11	1	1C	1C1			6A	7A, 7K1		1C8
4788	Moto-Matic	12	9	9B							
4791, 4792	Telephone Dial	11	1	1C	1C1				7A		1C8
4798	Dual Mica	8	2	2A				6B			
4799	Moto-Matic	12	9	9B							
6002	Dual Mica	5	2	2A				6B			
6003, 6004	Cam and Lever	8	1	1A12							
6008, 6009, 6016, 6017	Cam and Lever	6	1	1A3, 1A4							
6022	Cam and Lever	6	1	1A3, 1A4							
6025	Rocker Bar	5	1	1B2							
6036, 6038	Cam and Lever	8	1	1A12							
6052, 6053, 6054, 6055	Rocker Bar	4	1	1B1							
6072	Cam and Lever	6	1	1A3, 1A4							
6073	Rocker Bar	4	1	1B1							
6074	Cam and Lever	8	1	1A12							
6102, 6103	Rocker Bar	4	1	1B1							
6104	Rocker Bar	5	1	1B2							
6109, 6110, 6111, 6112	Cam and Lever	6	1	1A1							
6113, 6114, 6115	Cam and Lever	6	1	1A1							
6119, 6120	Rocker Bar	5	1	1B2							
6125	Rocker Bar	5	1	1B1							
6130	Rocker Bar	5	1	1B2							
6133	Cam and Lever	6	1	1A3, 1A4							
6140	Cam and Lever	8	1	1A12							
6151	Rocker Bar	5	1	1B2							
6152, 6153, 6155, 6156	Cam and Lever	8	1	1A13							
6157	Dual Mica	6	2	2A				6B			
6158, 6159	Cam and Lever	8	1	1A13							
6190	Rocker Bar	5	1	1B1							
6208, 6209	Cam and Lever	6	1	1A3, 1A4							
6214, 6218	Rocker Bar	4	1	1B1, 1B2							
6261	Rocker Bar	4	1	1B2							
6262	Rocker Bar	5	1	1B2							

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			Section	Sub-Division	Button Indexing Adj.	Tuning Motor	Push-Button Station Selector Switch	Transfer Device Manual to Automatic	Audio Silencing Circuit and AFC Release During Tune	Station Selecting Commutator Device	Stop or Lock-In Mechanism
SEARS-ROEBUCK—Cont.											
6263, 6264, 6265	Cam and Lever	6	1	1A3, 1A4							
6301	Rocker Bar	5	1	1B1							
6320	Rocker Bar	4	1	1C3							
6321, 6322, 6323, 6324	Rocker Bar	5	1	1B2							
6325, 6335, 6336, 6337	Rocker Bar	6	1	1B2							
6359, 6360, 6361	Rocker Bar	6	1	1B2							
6362, 6363, 6364	Rocker Bar	6	1	1B2							
6407, 6408, 6409	Rocker Bar	4	1	1B3							
6421, 6424	Rocker Bar	5	1	1B2							
6425, 6435, 6436	Rocker Bar	6	1	1B2							
6437, 6438, 6439	Rocker Bar	6	1	1B2							
7215	Dual Mica	5	2	2A, 2B			5B	6D			
7216, 7217, 7218	Moto-Matic	15	9	9B							
7219	Dual Mica	6	2	2A							
7225	Rocker Bar	4	1	1B1							
7227	Dual Mica	4	2	2A, 2B							
7228	Motor Operated	8	3	3B							
7230	Permeability & Mica	6	2	2B							
7235, 7236	Telephone Dial	10	1	1C							
7241, 7241A, 7242, 7242A	Motor Operated	8	3	3B							
7245	Permeability & Mica	6	2	2B							
7250	Dual Mica	4	2	2A, 2B							
7807	Rocker Bar	6	1	1B1							
SENTINEL											
124A, 124AE	Dual Permeability	4	2	2B							
125AE	Dual Permeability	5	2	2B							
127B, 128B, 130B	Rocker Bar	4	1	1B							
138AE, 139UE, 140B, 140BE	Rocker Bar	6	1	1B							
141AE, 143L, 144X, 144XE	Rocker Bar	4	1	1B							
145AE	Dual Permeability	9	2	2B							
149A, 149AE	Rocker Bar	5	1	1B							
158AE	Rocker Bar	6	1	1B							
SONORA											
BA	Cam and Lever	4	1	1A1							
EA, FA	Rocker Bar	6	1	1B1							
GA	Dual Permeability	7	2	2B							
QA	Rocker Bar	6	1	1B1							
RA	Dual Permeability	7	2	2B							
TD	Rocker Bar	6	1	1B1							
TW, TWU, TX, TXF, TY	Rocker Bar	4	1	1B2							
SPARTON											
738	Dual Mica	6	2	2A			5B				
1068	Triple Mica	6	2, 9	2A, 9K			5B	6A			
1078X, 1078X, 1089	Triple Mica	6	2	2A							
1268, 1288	Triple Mica	6	2, 9	2A, 9K			5B	6A			
1288P, 1288LXP	Triple Mica	6	2	2A							
1568	Triple Mica	6	2, 9	2A, 9K			5B	6A			
1588	Triple Mica	6	2	2A							
5018	Dual Mica	6	2	2A			5B				
5218	Triple Mica	6	2, 9	2A, 9K			5B	6A			
5518	Rocker Bar	4	1	1B1							
6218, 7618	Triple Mica	6	2, 9	2A, 9K			5B	6A			
8616	Dual Mica	6	2	2A				6B			
SPIEGEL											
1002, 1003	Rocker Bar	4	1	1B							
1104 to 1107 inclusive	Rocker Bar	6	1	1B							
2058, 2059, 2060, 2061	Motor Operated	8	3	3B							
2064, 2065, 2070	Dual Mica	5	2	2A							
2071, 4014	Dual Mica	5	2	2A							
4054	Motor Operated	8	3	3B							
4064, 4066, 4068, 4076	Dual Mica	5	2	2A							
STEWART-WARNER											
01-52, 01-53, 01-61, 01-61S	Dual Mica	5	2	2A							
01-81	Dual Mica	6	2	2A				6B			
07-63	Rocker Bar	4	1	1B2							
08-52	Dual Mica	5	2	2A							
08-81	Dual Mica	6	2	2A				6B			
010-52, 010-53	Dual Mica	5	2	2A							
91-51	Rocker Bar	4	1	1B2							
91-53	Dual Mica	5	2	2A							
91-61	Dual Mica	6	2	2A				6B			
91-62	Dual Mica	5	2	2A							
91-64	Rocker Bar	5	1	1B6							
91-71, 91-81	Dual Mica	6	2	2A				6B			
91-82	Dual Mica	8	2	2A							
91-111	Motor Operated	8	3	3B							
97-56, 97-56S	Cam and Lever	4	1	1A1							
98-51	Rocker Bar	4	1	1B2							
98-53	Dual Mica	5	2	2A							
98-61	Dual Mica	6	2	2A				6B			
98-62	Dual Mica	5	2	2A							
98-64	Rocker Bar	5	1	1B6							
98-71, 98-81	Dual Mica	6	2	2A				6B			
98-82	Dual Mica	8	2	2A							
98-111	Motor Operated	8	3	3B							
R-184, R-185, R-186	Magic Keyboard	15	9	9B							
910-51	Rocker Bar	4	1	1B2							
910-53	Dual Mica	5	2	2A							
910-61	Dual Mica	6	2	2A				6B			
910-62	Dual Mica	5	2	2A							
910-64	Rocker Bar	5	1	1B6							
910-71, 910-81	Dual Mica	6	2	2A				6B			
910-82	Dual Mica	8	2	2A							
910-111	Motor Operated	8	3	3B							

MANUFACTURER AND MODEL	Type	No. of Buttons	REFERENCE Section	REFERENCE Sub-Division	SPECIAL DESCRIPTION Button Indexing Adj.	Tuning Motor	Push-Button Station Selector Switch	Transfer Device Manual to Automatic	Audio Silencing Circuit and AFC Release During Tune	Station Selecting Commutator Device	Stop or Lock-In Mechanism
STROMBERG-CARLSON											
70, 72, 74	Te-Lek-Tor	8	3	3B		4B	5A	6G	7H	8C	
235, 245	Flash Tuning	6	2	2A			5B	6A			
255L, 260L, 260P	Flash Tuning	7	1	1C	1C5			6A	7F, 7K1		1C9
325, 335, 337	Dual Mica	6	2	2A							
340, 341, 345, 350	Dual Mica	8	2	2A							
360, 370	Motor Operated	8	3	3B							
405, 420	Dual Mica	6	2	2A							
430, 435	Dual Permeability	7	2	2B							
440, 450	Motor Operated	8	3	3B							
455	Dual Mica	6	2	2A							
460, 470	Motor Operated	8	3	3B							
480	Motor Operated	7	3	3B							
TRAV-LER											
436M	Rocker Bar	6	1	1B							
466M	Rocker Bar	4	1	1B							
1938 Automatic Tuning	Adjust. Index	12	1	1C	1C3						1C11
UNITED AMERICAN BOSCH											
850, 860	Motor Operated	14	3	3C	1C2	4B	5C	6A	7F		1C14
WARWICK											
9-46	Rocker Bar	4	1	1B1							
645	Dual Mica	5	2	2A			5B	6D			
WELLS-GARDNER											
A1, A2, A3 (1st Type)	Motor Operated	8	9	9C							
A1, A2, A3 (2nd Type)	Telephone Dial	17	1	1C	1C1				7A		1C8
A4, A5	Telephone Dial	17	1	1C	1C1				7A		1C8
A12, A13, A14, A15, A16	Dual Permeability	6	2	2B							
S2, T2	Dual Permeability	6	2	2B							
6C9	Cam and Lever	5	1	1A10							
WESTERN AIR PATROL											
1337, 1487, 1587	Motor Operated	8	3	3B							
WESTERN AUTO											
D689	Dual Permeability	6	2	2B							
D690	Motor Operated	10	3	3B							
D691	Motor Operated	8	3	3B							
D705, D714	Dual Permeability	6	2	2B							
D717	Cam and Lever	6	1	1A1							
D727	Motor Operated	8	3	3B							
D731	Cam and Lever	4	1	1A1							
D746	Cam and Lever	5	1	1A4							
D747	Cam and Lever	6	1	1A4							
D901	Dual Permeability	6	2	2B							
D910	Rocker Bar	6	1	1B5							
D920	Dual Permeability	6	2	2B							
D921	Rocker Bar	6	1	1B5							
D930	Dual Permeability	6	2	2B							
D941	Cam and Lever	4	1	1A1							
D976, D978	Cam and Lever	6	1	1A5							
1388	Dual Permeability	6	2	2B							
WESTINGHOUSE											
WR264	Permeability & Mica	6	2	2B							
WR332, WR336	Motor Operated		3	3C							
WILCOX-GAY											
A33, A35	Telephone Dial	10	1	1C	1C2				7A		1C12
A36	Telephone Dial	10	1	1C							
A37, A40	Telephone Dial	10	1	1C	1C2				7A		1C12
A41	Telephone Dial	10	1	1C							
A42	Telephone Dial	10	1	1C	1C2				7A		1C12
A48, 7S5	Dual Mica	6	2	2A							
ZENITH											
4B314, 4B317	Dual Permeability	4	2	2B							
5G441, 5G442, 5G461	Permeability & Mica	5	2	2E							
5M294	Permeability & Mica	4	2	2E							
5S319, 5S327, 5S330	Dual Permeability	5	2	2B							
5S338, 5S339, 6B321	Dual Permeability	5	2	2B							
6D413, 6D414, 6D426	Permeability & Mica	4	2	2E							
6D427, 6D446, 6D455	Permeability & Mica	4	2	2E							
6J322, 6J357	Dual Permeability	5	2	2B							
6J436, 6J463	Permeability & Mica	6	2	2E							
6M295	Triple Permeability	5	2	2B							
6M390	Ratchet Switch	5	2	2D							
6P418, 6P419, 6P428	Permeability & Mica	4	2	2E							
6P429, 6P430, 6P447	Permeability & Mica	4	2	2E							
6P448, 6P457, 6R485	Permeability & Mica	4	2	2E							
6S341, 6S362	Dual Permeability	6	2	2B							
6S439, 6S469	Permeability & Mica	5	2	2E							
6S511, 6S527, 6S528	Permeability & Mica	4	2	2E							
6S546, 6S556	Permeability & Mica	5	2	2E							
7J323, 7J368	Triple Permeability	6	2	2B							
7S323, 7S342, 7S343	Dual Permeability	6	2	2B							
7S363, 7S364, 7S366	Dual Permeability	6	2	2B							
7S432, 7S433, 7S434	Permeability & Mica	5	2	2E							
7S449, 7S450, 7S458	Permeability & Mica	5	2	2E							
7S459, 7S460, 7S461	Permeability & Mica	5	2	2E							
7S462, 7S487, 7S488	Permeability & Mica	5	2	2E							
7S490, 7S529, 7S530	Permeability & Mica	5	2	2E							
7S547, 7S557, 7S558	Permeability & Mica	5	2	2E							
7S585	Permeability & Mica	5	2	2E							
8S443, 8S451, 8S463	Permeability & Mica	6	2	2E							
8S531, 8S548, 8S563	Permeability & Mica	6	2	2E							
8S568	Permeability & Mica	6	2	2E							

MANUFACTURER AND MODEL	Type	No. of Buttons	REFERENCE Section	Sub-Division	SPECIAL DESCRIPTION Button Indexing Adj.	Tuning Motor	Push-Button Station Selector Switch	Transfer Device Manual to Automatic	Audio Silencing Circuit and AFC Release During Tune	Station Selecting Commutator Device	Stop or Lock-In Mechanism
ZENITH—Continued											
9S307, 9S324, 9S344	Triple Permeability	8	2	2B							
9S365	Dual Permeability	6	2	2B							
9S367, 9S369	Triple Permeability	8	2	2B							
10S443, 10S452, 10S464	Permeability & Mica.	6	2	2E							
10S470, 10S491, 10S492	Permeability & Mica.	6	2	2E							
10S531, 10S549, 10S566	Permeability & Mica.	6	2	2E							
11S474	Permeability & Mica.	6	2	2E							
12S345, 12S370, 12S371	Triple Permeability	8	2	2B							
12S445, 12S453, 12S471	Permeability & Mica.	8	2	2E							
12S475, 12S494	Dual Perm. & Mica.	8	2	2B							
12S550, 12S568, 12S569	Dual Perm. & Mica.	8	2	2B							
15S308, 15S346	Triple Permeability	8	2	2B							
15S372, 15S373	Triple Permeability	8	2	2B							
15S479, 15S495	Dual Perm. & Mica.	8	2	2B							
1204 (7 Models)	Motor Operated		3	3A			5D				
1501 (6 Models)	Motor Operated		3	3A			5D				
S905 (7 Models)	Motor Operated		3	3A			5D				

SECTION 1

Mechanically Operated Manual Types

The tuning condenser is turned to the desired station reception position by direct mechanical effort of the person operating the receiver. Five general divisions of this type have appeared:

A—Linear (Typewriter key motion).
B—Rocker Bar (Plunger Type).
C—Rotary (Telephone dial motion).
D—Indent (Spot tuning).
E—Flash (Light indicator tuning).

A. Linear (Typewriter Key Motion)

Straight line motion of a key in a direction parallel to the tuning panel rotates the gang condenser by means of cams or levers whose position is pre-set to the desired station. Examples: Belmont (Belmonitor), cam and lever types.

B. Rocker Bar (Plunger Type)

Plunger motion operating through push rod, pawl and sector gear rotates gang condenser to pre-set position of desired station. Examples: Crosley, Continental, Howard, etc.

C. Rotary (Telephone Dial Motion)

This type of mechanism which appeared in late 1935 and in 1936 receivers has found widespread use and has been subject to many mechanical refinements. Gearing between dial mechanism and tuning condenser is arranged to allow almost 360° of dial movement.

1. Button or Indexing Adjustment.
   a. By splines or serrations on plunger co-operating with similar shaped grooves in an opening on a die-cast dial plate. Examples: Colonial, Emerson, Fairbanks-Morse, Philco.
   b. By locking nut on threaded plunger shaft.
      (1) Rotary adjustment of location of pin on radius about center of equally spaced buttons. Example: Wilcox-Gay, G. H. U.
      (2) Sliding adjustment in annular slot or series of overlapping slots around periphery of dial. Examples: Erla (Sentinel), Trav-ler, Philco (Cone-centric), G. H. U. (Teledial).
2. Stop or "lock-in" device.
   a. Latch Gate—A spring operated double gate allows depressed station pin to enter from either side but immediately locks after the pin enters to prevent rotation in either direction. Examples: Colonial, Fairbanks-Morse, G. H. U., Philco (Magnetic tuning).
   Note: In most instances the latch gate operates switching of AFC and audio silencing circuits. The latch gate principle is also employed in some motor-tuned systems. See 6A under "Transfer Devices."
   b. Slot in metal plate co-operating with depressed pin. Example: Wilcox-Gay.
   c. Floating Vane Stop—Vane is moved sideways by the depressed pin until it strikes fixed stops. Pin centers at same position when moved from either direction. Examples: Emerson, Trav-ler.

D. Indent (Spot Tuning)

Hardened steel ball is pressed into threaded groove in soft brass cylinder to provide indents to assist manual tune. Example: Galvin (Motorola Spot Tuning).

E. Flash (Light Indicator Tuning)

As set is tuned manually, with audio system silenced, a light flashes to indicate when tune to the desired station has been accomplished. Receiver "muting" is removed as station tune point is reached.

1. Operated by latch gate switching. Example: Stromberg-Carlson (Flash Tuning).
2. Operated by sliding contacts on dial and "muting" relay. Example: Noblitt-Sparks and Erla.

SECTION 1A

Cam and Lever Mechanisms

This device consists of a series of "heart-shaped" cams stacked on a shaft attached directly to the gang condenser. These cams are individually adjustable since they can be unlocked from the drive shaft by a tapered expansion sleeve which is controlled by a screw. Fig. 1 shows a front view of the tuning system. The levers shown at the front of the unit move through a distance of approximately 1¼ inches and in doing this turn the cams until the two lobes of the cam are aligned against the lever. This is the position corresponding to station tune.

Fig. 2 shows the appearance of this type of mechanical tuner from the front of the cabinet.

A typical cam and lever system (exclusive of dial construction) appears in Fig. 3 and operates as follows.

Heart cam "A" is held to the tuning shaft by means of friction washers "B." When a button is depressed, roller "C," on the end of the push-button lever "D," is forced against the heart cam. This causes the cam to turn until the roller reaches its lowest point.

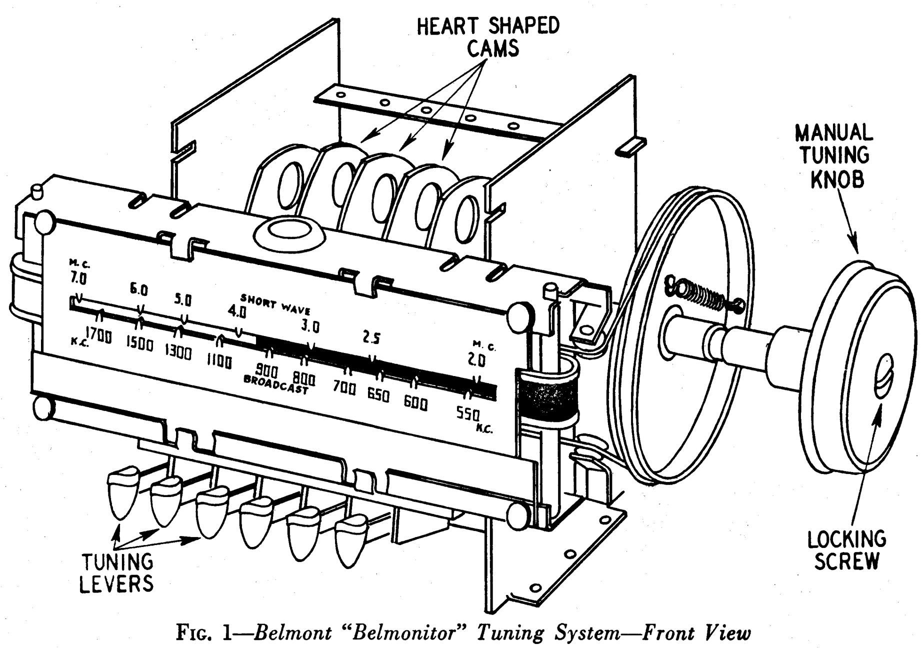


FIG. 1—*Belmont "Belmonitor" Tuning System—Front View*

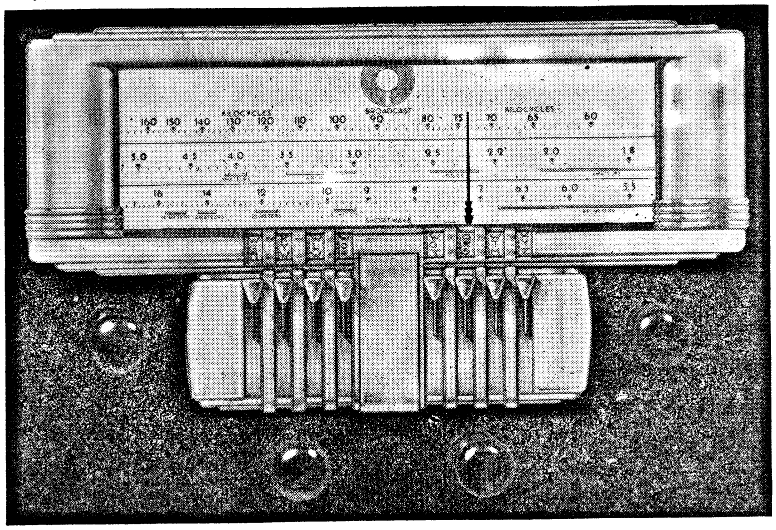


FIG. 2—*Belmont "Belmonitor" Tuner—Front of Cabinet*

To set up this type mechanism, the locking screw "E" is loosened, allowing the heart cams to slip freely between the friction washers. If a button is now depressed its corresponding cam will be turned without affecting any other cam. While holding the button down firmly, tune accurately to the desired station. When all the buttons have been set the locking screw should be tightened. This will hold the cams securely to the tuning shaft. Now, when any button is depressed, its corresponding cam will resume the position to which it was set, turning the gang condenser with it. For the location of the locking screw on various receivers see paragraphs 1A1 through 1A14.

Note 1A1

These receivers have the locking screw located in the center of the tuning knob as shown in Fig. 3. Unlocking is accomplished by turning this screw to the left by means of a small screwdriver or coin. To lock the tuner after the buttons have been set, turn the knob to its extreme clockwise position and tighten the locking screw.

Note 1A2

The lock screw on these receivers is a knurled screw located on the side of the receiver.

Note 1A3

The lock screw may be reached by removing the metal button in the end of the receiver.

Note 1A4

The locking mechanism on these receivers is a wing nut on the side of the dial assembly.

Note 1A5

Push in the tuning knob hard enough to make it latch. Rotate the knob to the left until it cannot be turned farther without forcing.

The knob will turn hard as the unlocking begins, then turn easily until the mechanism is entirely unlocked. To set stations, push in a button and the dial tuning knob at the same time so they will both stay latched in. While pressing firmly on the button, tune in the desired station by means of the tuning knob. Repeat this procedure for the remaining buttons. Before relocking the mechanism, release the latched button by pressing slightly on another button (Some models have a push-button release pin under the button assembly which should be pressed to unlatch the last button). Then latch the tuning knob again and rotate it to the right until it is tight.

Note 1A6

Pull the dial tuning knob all the way out and rotate it to the left to unlock the tuner. While holding a push-button down firmly, press in on the tuning knob and tune accurately to the desired station. Repeat this procedure for the other buttons. Pull the tuning knob all the way out and rotate it to the right until tight to relock.

Note 1A7

Pull out the "Reset" button (the last button to the right) and rotate it to the left until it cannot be turned any farther. Push in one of the buttons.

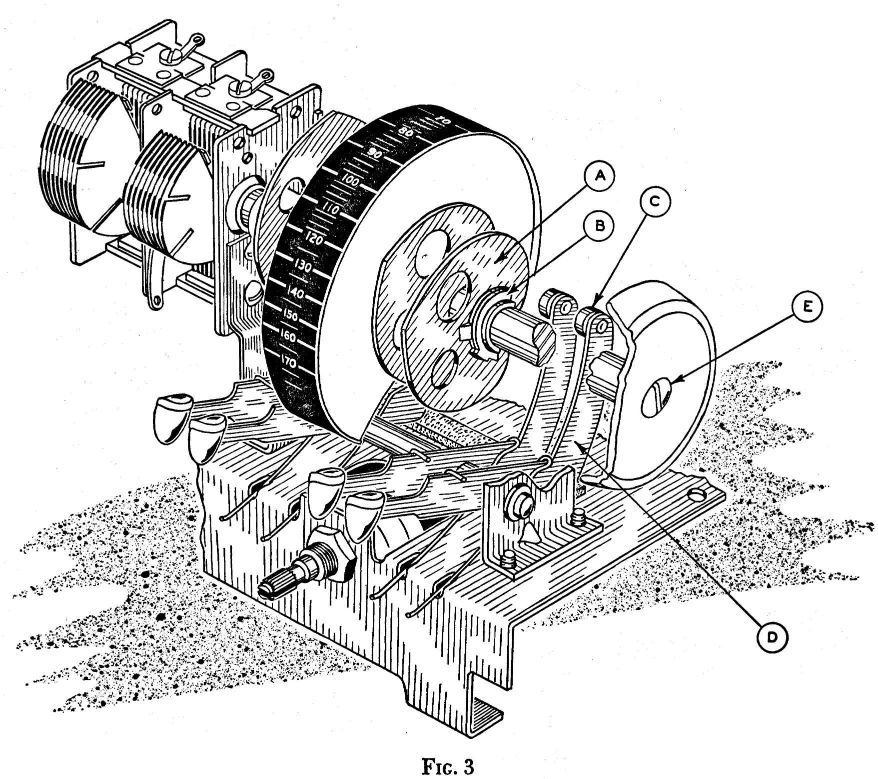


FIG. 3

and at the same time press in on the dial tuning knob, so that both will stay latched in. Then tune the station manually while holding in on the button. Repeat this procedure for the remaining buttons. When all the buttons have been set up, lock the mechanism by pulling the "Reset" button all the way out and rotating it clockwise as far as it will go.

Note 1A8

The locking screw will be found by looking at the back of the cabinet. Rotate the screw by means of the pin through the shaft.

Note 1A9

The locking screw is exposed by removing the push-button escutcheon. Push the tuning knob in and rotate it so that the pointer comes to the left end of the dial. Then with a small screwdriver push in the slotted shaft and turn it counter-clockwise about four turns. Press a button and while holding it in push in the tuning knob. Tune accurately to the desired station.

When all the stations have been set up, use the small screwdriver to push in and turn the slotted shaft clockwise. Do not tighten the shaft too much or the mechanism may be damaged.

Note 1A10

Loosen the locking screw by inserting a small screwdriver into the hole below the tuning unit and turning the screw counter-clockwise as far as it will go. Keep the manual tuning knob depressed with one hand, and with the other push the desired button. Tune in the station with the manual knob. When all the stations have been set up, the last button should be released. If the receiver has an "off" button, the other buttons may be released by pushing slightly on this button, otherwise push very slightly on one of the station buttons, being careful not to disturb its adjustment. Then retighten the lock screw.

Note 1A11

Remove the snap-in button from the dial escutcheon. Insert a screwdriver and unlock the mechanism by pressing in and turning the locking screw to the right. After setting up the buttons by the regular procedure as given at the first of section two, the mechanism may be locked by pressing in and turning the locking screw to the left until tight.

Note 1A12

Remove the volume control and tuning knobs. Remove the snap-in buttons that were covered by these knobs, allowing the escutcheon to be removed. Replace the tuning knob. Push in the knob and rotate it until the pointer comes to the left end of the dial. A slotted shaft will be found between the push-buttons and the tuning knob. Unlock the mechanism by turning this shaft as far to the left as it will go without forcing. To re-lock the mechanism, first turn the dial pointer to the right end of the scale. Then turn the slotted shaft as far as it will go clockwise.

Note 1A13

The escutcheon is held in place by four screws, otherwise the procedure is the same as that given in paragraph 1A12.

Note 1A14

Remove the snap-in button from the dial escutcheon. Insert a screwdriver and unlock the mechanism by pressing in and turning the locking screw as far as it will go to the left. After setting up the buttons by the regular procedure as given at the first of section two, the mechanism may be locked by pressing in and turning the locking screw to the right until tight.

SECTION 1B

Rocker Bar Mechanisms

The rocker bar type mechanical push-button tuner is one of the most popular of tuners. Illustrations 4 and 5 show two of the most frequently used variations of this general type. Fig. 4 illustrates a four button tuner of the type which can be set up without tools of any kind. Locking and unlocking adjustments are accomplished merely by twisting the button itself. Fig. 5 illustrates a five button tuner of the type having a separate lock screw exposed by removing the push-button.

Parts of the two tuners are lettered alike to show their similarity. "E" is the push rod to which the button "F" is attached. Pushing pawl "B," held in place by locking screw "D" and locking shoe "G," turns rocker bar "A" to a position corresponding to the setting of the pawl "B." Return spring "C" ordinarily keeps the pushing pawl away from the rocker bar. A sector gear, part of which is shown as "H" in Fig. 1, rotates the gang condenser to a position corresponding to the setting of the push-button mechanism. To set up this type mechanism, the locking screw "D" is first loosened enough to relieve the tension of shoe "G" on the pushing pawl "B." Then, when the button is depressed, the pushing pawl automatically aligns itself with the rocker bar. When the locking screw is again tightened the pawl will be held in position. Depressing the button will then cause the rocker bar to resume the same position it had when the button was locked.

Specific instructions for the several variations of this tuner are given in paragraphs 1B1 to 1B6 immediately following. Remember that the push-buttons will return the bar to the exact positions it had during set-up, so be sure you tune in the station as accurately as possible during the set-up operation.

Note 1B1

Turn the push-button counter-clockwise about 1 turn. (See Fig. 4.)

Depress the button as far as it will go, and while holding it in this position, tune manually to the desired station. Tighten the button while it is in this position.

Note 1B2

When the push-buttons are removed a screw will be found by the side of each push rod (See Fig. 5). This screw should be loosened. Push the rod in firmly by means of the screwdriver in the screw slot. While holding it in this position tune accurately to the desired station. Tighten the screw before releasing it.

Note 1B3

The locking screws will be exposed by removing the station tabs from the buttons. Insert a small screwdriver into the exposed hole and loosen the screw. Push the button all the way down and tune in the desired station. Then, while holding the button in securely, tighten the screw.

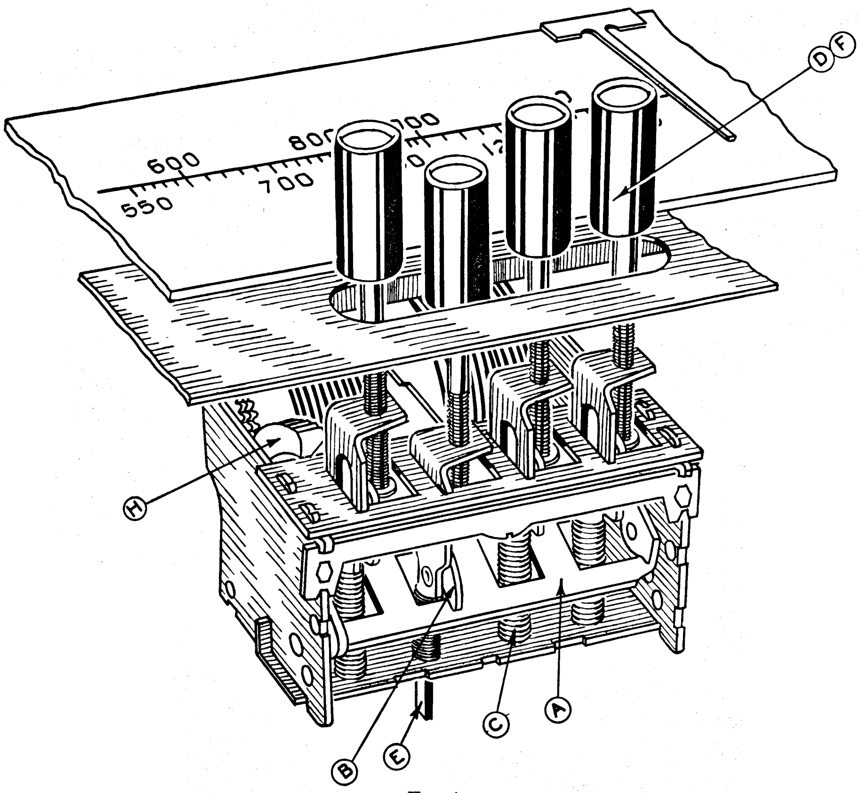


Fig. 4

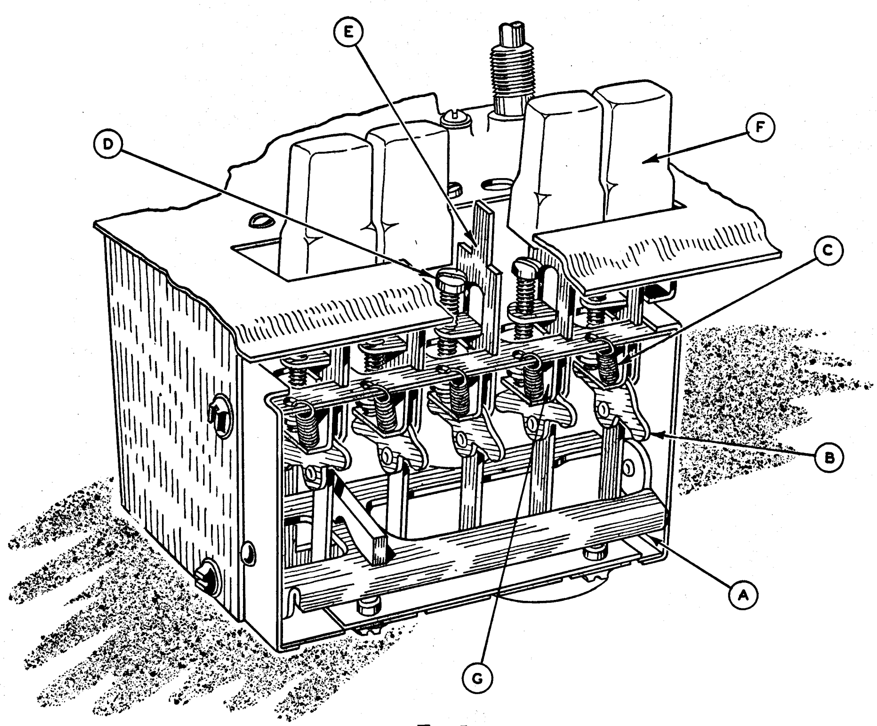


Fig. 5

Note 1B4

Remove the push-button trim plate by prying gently with a screwdriver. Press a button on which a station is to be set up. With the button held in firmly, insert a screwdriver into the hole to the right of the button and loosen the set screw. Then, with the button held down firmly, tune in the desired station. When the station is accurately tuned in, tighten the set screw and remove the screwdriver before releasing the button.

Note 1B5

Remove the station marker tabs. Reach through the station marker recesses with a small screwdriver and loosen the push-button rods. With a push-button rod held in firmly with the screwdriver, tune manually to the desired station. Then tighten the screw. Do not turn the screw more than a quarter turn after it begins to grip.

Note 1B6

Remove the push-button escutcheon. A screw will be found by the side of each button. Loosen this screw and push the push-button rod in firmly. Tune manually to the desired station. Then tighten the screw and release the button.

SECTION 1C

Mechanical Station Button or Indexing Adjustment

In all of the mechanically operated manual types and a few of the motor driven types the station selecting button itself provides the adjustment of the indexing pin which arrests rotation of the gang condenser at the proper point for station tune. In most models the pin or lever is attached to the opposite end of the push-button plunger and is held away from the dial mechanism by a coiled or flat spring. The series of button plungers are usually attached to a dial plate which in turn drives the gang condenser through a gear train so proportioned as to allow almost 360° of dial plate rotation. This constitutes the familiar "telephone" dial type of drive mechanism. As the plunger is depressed and the dial rotated in the same operation the indexing pin moves forward and is arrested in its rotary motion by some type of stop or lock-in device (See Section 1C7). The precise position at which the condenser rotation stops is adjustable, by one of the following methods described, to allow set-up of the receiver to a group of desired stations after which the adjustment is locked in place.

Note 1C1

The splined, serrated or straight knurl type of indexing adjustment has probably been employed in more of the manually tuned sets than any other type. Its action can be understood from a study of Figs. 6, 7, and 8. The grooves on the plunger slide freely in co-operating grooves in the dial plate so that the plunger may be readily pushed into the opening in the dial plate but may not be rotated unless unlocked in some manner for adjustment.

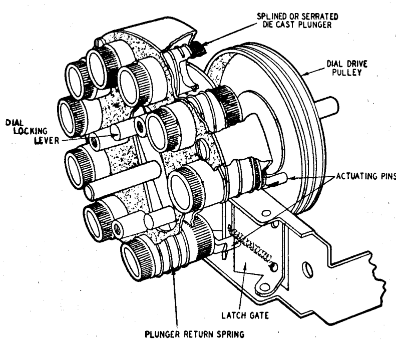


FIG. 6—*Colonial Indexing Adjustment*

COLONIAL—Fig. 6 shows by means of a line drawing cutaway view the action of the Colonial indexing adjustment. The dial locking lever when rotated a few degrees toward the left unlocks the mechanism and allows the die cast plungers to be pushed in until the serrated portion clears the grooves in the aperture of the dial plate. When this is done the plungers may be rotated so that the actuating pin can be correctly located for station tune. A reverse rotation of the locking lever prevents subsequent motion of the plunger beyond the serrations.

EMERSON—Fig. 7 shows a similar serrated type of adjustment. In this case the outer ornamental dial plate is removed during set-up operations. Its place is taken by a thin metal disc held in place by the knurled face nut. This disc has a single semi-circular notch in its periphery which may be adjusted to allow any one button to be moved forward while holding the rest of the buttons in place. Thus a button under the action of its spring will move forward sufficiently to allows its serration to clear those of the housing after which it may be rotated so that the button pin is in the correct position for station tune.

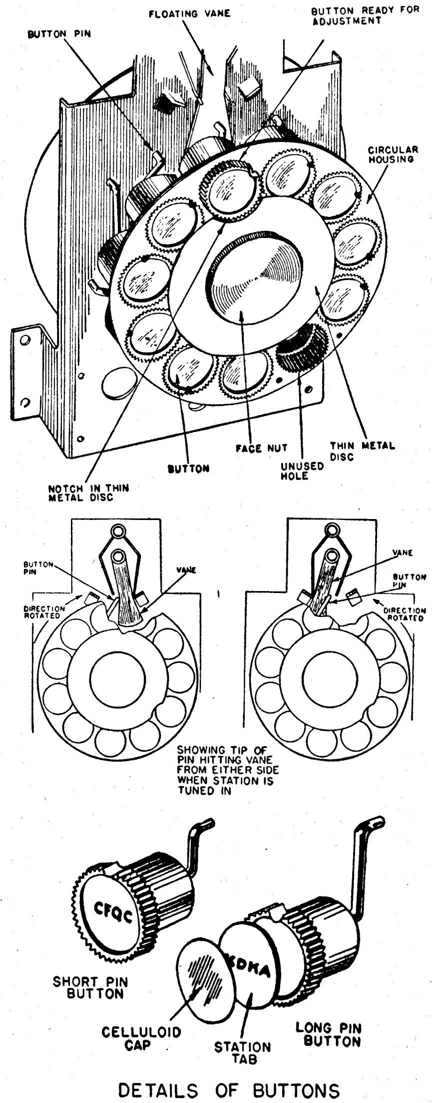


FIG. 7—*Emerson Indexing Adjustment*

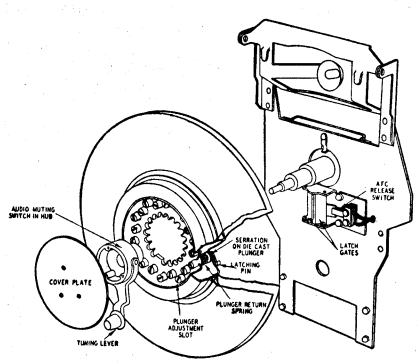


FIG. 8—*Philco Automatic Dial*

PHILCO—Fig. 8 shows a line drawing of the details of the Philco Automatic Dial. A diecast plunger similar to those previously described operates in grooves in the rear of the housing. The method of adjustment differs from the foregoing in that the plunger may readily be moved from one groove to another after the front plate has been removed by depressing it against the action of its spring until the serrations clear the opening in the rear of the housing. This may be done with a screwdriver since the head of the plunger has a slot to receive the screwdriver.

Similar mechanisms employing serrated plungers may be found in the mechanical models of Fairbanks-Morse, General Household Utilities, and Wells-Gardner.

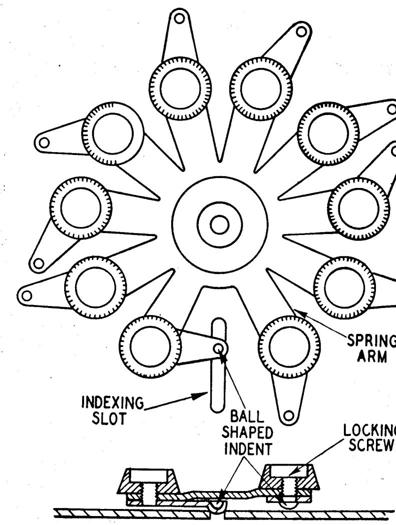


FIG. 9—*Wilcox-Gay Automatic Dial Assembly*

Note 1C2

An alternate method of locking the station selecting button is by means of threaded lock nuts on the plunger shaft.

WILCOX-GAY—Fig. 9 shows one of the simplest of automatic dial assemblies. The station buttons are located at the ends of radial flat spring members which are so shaped as to hold the button away from contact with a slotted plate on the front of the receiver. These radial members are attached to the dial drive shaft. Each of the buttons carries a cam at whose end is a ball-shaped depression which engages a fixed slot in a stationary plate attached to the chassis. The cam may be unlocked and allowed to rotate around the button center by unscrewing the button itself which acts as a lock nut.

The Galvin, G. H. U., United American Bosch, and Westinghouse motor-driven systems employ the lock nut principle of adjusting station plungers.

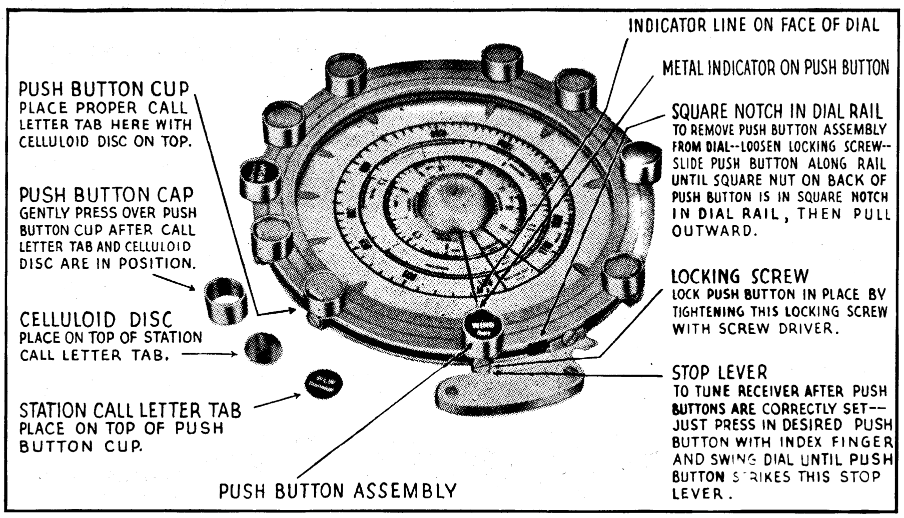


FIG. 10—*Erla-Sentinel Push-Button Dial*

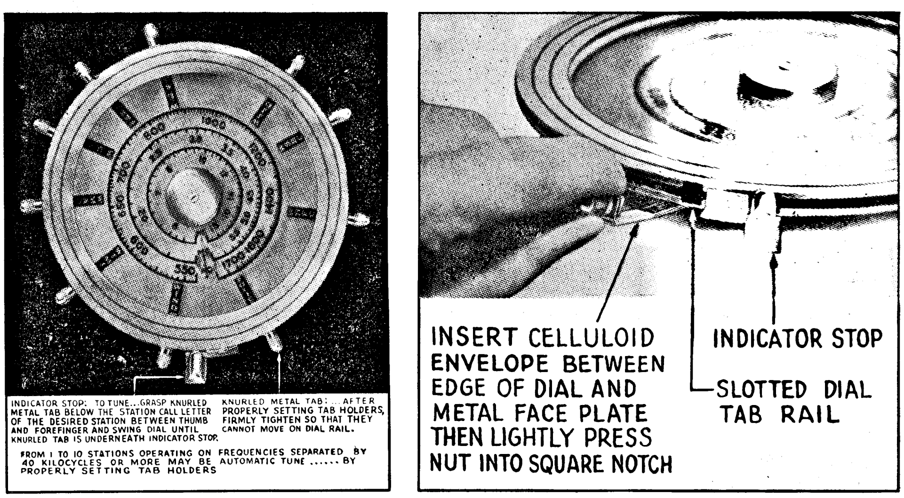


FIG. 11—*Erla-Sentinel "Automatic Tune Wheel" Dial*

Note 1C3

This method of pre-setting the position of the station button plungers employs the screw locking principle of Note 1C2 in combination with annular shaped slots in the dial plate concentric with the dial center.

ERLA—The Erla "Push-Button Dial" and "Automatic Tune Wheel" dial have the station plungers and tabs locked in a slot around the outer rim of the dial as shown in Figs. 10 and 11 by means of a lock nut sliding within the dial rail.

PHILCO—The "Cone-centric" tuning system employs small metal cones which are locked in place in a circular slot as shown in line drawing 12. Two small holes near the apex of the cone allow the insertion of a special tool through the hollow center of the tuning knob. This permits the cones to be loosened, moved along the slot and tightened in the desired position in a single operation as the dial is adjusted to tune on a desired station. Subsequent selection of the station is accomplished with accuracy by centering the conical depression of the tuning arm over the desired station cone.

TRAV-LER—Figs. 13 and 13A illustrate the simple use of the annular slot and lock nut for setting of button positions. In this case stations may be set even on adjacent channels since the buttons are arranged on two radii with an overlap of range.

Note 1C4

In the flash tuning systems of Erla and Noblitt-Sparks the station indicator adjustments operate in annular slots in a fixed member or plate while an electrical contactor is carried by the moving dial mechanism causing an indicator light to flash as each of the desired stations are successively tuned in. Audio silencing which is operative between stations is removed as the contacts are made. Audio silencing details of these systems are covered more fully in Section 7.

NOBLITT-SPARKS—Figs. 14 and 14A show rear and front views of the "Phan-

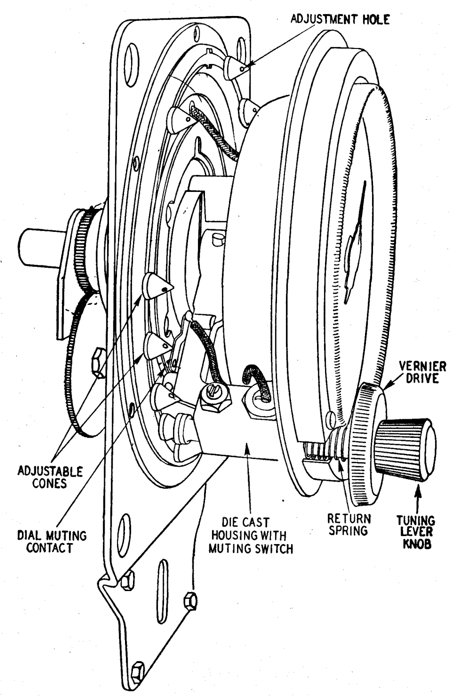


FIG. 12—*Philco "Cone-centric" Tuning Mechanism*

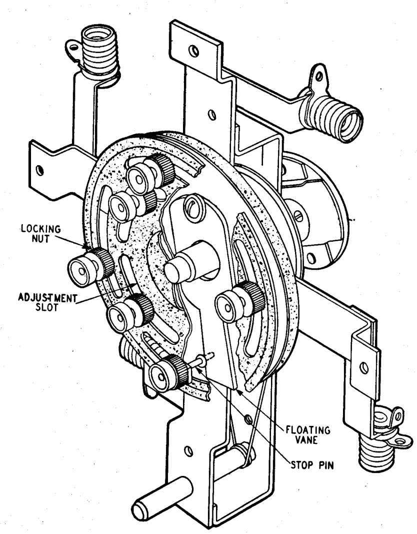


FIG. 13—*Trav-ler Annular Slot and Lock-Nut System*

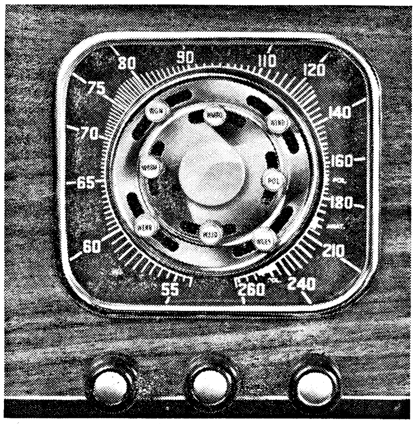


FIG. 13A—*Trav-ler Dial*

tom" tuning dial of the Arvin models which employ the flash tuning principle. Contacts are movable along the annular slots shown and as the station positions are successively passed in manually tuning the receiver the lights in panels along either side of the dial indicate the station to which the receiver is tuned. Adjustment of position of the contactors is accomplished by unlocking them by means of their screw thread and subsequently relocking them in the required positions.

ERLA—The Erla Flash Tuning dial employs a similar system except that station tabs are employed which are set along a circular guide rail at the edge of the dial. Rapid and Flash tuning are accomplished by a lever which operates independently from the conventional rotary vernier tuning knob.

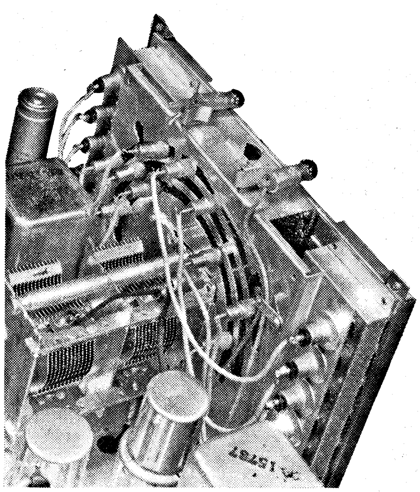


FIG. 14—*Noblitt-Sparks (Arvin) "Phantom Tuning"—Rear View*

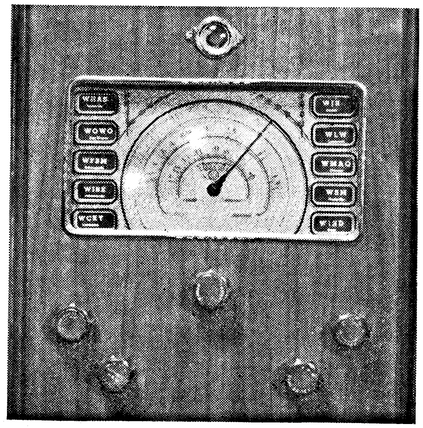


FIG. 14A—*Noblitt-Sparks (Arvin) "Phantom Tuning"—Front of Dial*

Note 1C5

An alternative system of "Flash" tuning of novel design is that offered by Stromberg-Carlson. This system employs a series of thin discs or contactors which operate in conjunction with an electrical gate as shown in Figs. 15 and 15A. When the large knurled clamping nut is released, a contactor disc may be located in the center of the electrical gate while a station is tuned manually. The knurled nut is then tightened while the contactor clamping frame is held rigidly to prevent accidental rotation of either the gang condenser or the contactor disc. The contactor discs are insulated from the frame and individually connected to station indicator lamps one of which is illuminated as each contactor disc centers in the electrical gate. Audio silencing and AFC release functions are performed by contacts in the electrical gate (See Section 7).

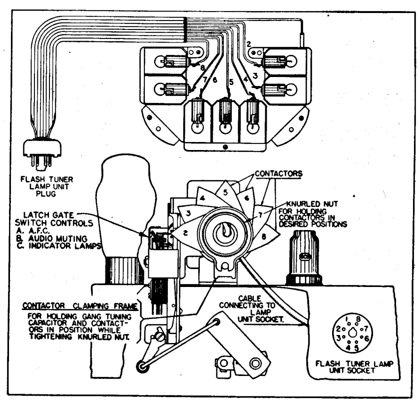


FIG. 15—*Stromberg-Carlson "Flash-Tuning" System*

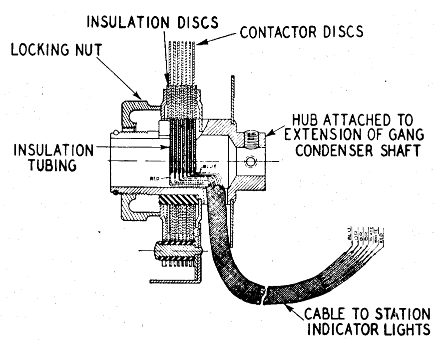


FIG. 15A—*Stromberg-Carlson "Flash-Tuning" System*

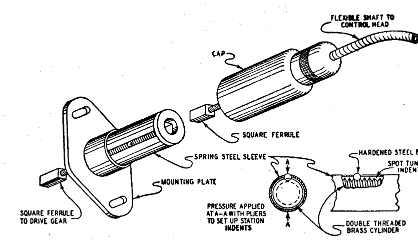


FIG. 16—*Galvin (Motorola) "Spot Tuning" Mechanism*

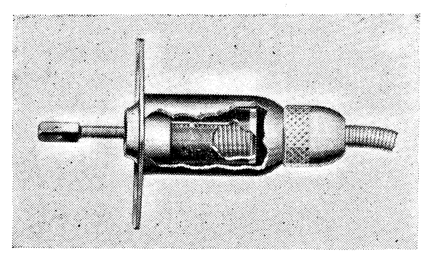


FIG. 16A—*Galvin (Motorola) "Spot Tuning"—Exterior*

Note 1C6

A unique application of mechanical automatic station selection to motor car receivers has been made available in several Motorola models. This device, known as "Spot Tuning," is illustrated in Figs. 16 and 16A. It consists of a compact mechanism in a cylindrical housing attached to the exterior of the motor car receiver by means of the mounting plate. It constitutes a link in the driving system between the flexible shaft from the control head and the gang condenser driving gear system. Since it is connected directly adjacent to the gang condenser it is not subject to back-lash difficulties. Its operation is as follows: A soft brass cylinder carries a double V thread and is surrounded by a spring steel sleeve of cylindrical form having a longitudinal slot. This slot serves as a guide to retain a hardened steel ball in one of the threads. As the flexible shaft is rotated in tuning the receiver the steel ball is caused to "walk" along the thread. If after a station is accurately tuned to resonance, pressure is applied to the steel ball and sleeve at points AA (See Fig. 16) with a pair of gas-pliers, an indent is produced in the brass cylinder which subsequently will act as a mechanical indexing point for automatic tuning. In this manner all of the desired automatic station points are set up in turn. In the event that an error is made in the location of one of these points, use can be made of the other thread in the double-threaded cylinder by rotating the tuning condenser to the end of this range at which point the steel ball will drop into the next thread channel and present a new, clear groove for station set-up. Alternatively the double thread may be employed for two separate sets of automatic station selections as in two separate localities between which the car owner frequently travels.

Mechanical Stop or Lock-in Mechanism

Note 1C7

All of the indexing pin arrangements described in Notes 1C1-1C6 operate in conjunction with some type of stop or latch mechanism. As the dial is rotated with an indexing pin extended a fixed stop must be provided to arrest the motion of the pin at the desired tune point. In many cases this stop also functions to remove the automatic frequency control bias momentarily and thus allow control to be regained on the desired station. Stop mechanisms are employed on all of the mechanically operated manual types and also on a few of the motor driven types in which case they replace the electrical commutation device normally used.

Note 1C8

One of the most popular types of lock-in mechanisms is the latch gate, illustrated in Figs. 6 and 8, page 151. This consists of a pair of hinged gates normally held closed by a spring mechanism. As the extended plunger pin approaches the gate it strikes one of the pair of plates causing it to move inward until the pin passes the edge of the plate. As soon as the pin has passed the edge of the plate, the latter returns to its closed position. At this point the pin strikes the edge of the opposite open plate and is thus locked from rotation in either direction. Fig. 6 shows one of the plungers with its pin engaged in the latch gate.

Examples of use of the latch gate are: Colonial, Fairbanks-Morse, G. H. U., Philco, and Wells-Gardner.

Note 1C9

In the Stromberg-Carlson "Flash Tuning" receiver the latch gate, whose contactor mechanism was described in Note 1C5, the gate mechanism does not latch the end of the contactor disc against further rotation but merely arrests motion by interposing additional friction as shown in Fig. 15. This detent principle which indicates the point of tune without preventing further rotation is also employed in the Motorola "Spot Tuning" as described in Note 1C6.

Note 1C10

The Philco "Cone-centric" latching principle is a novel method of assuring accuracy of location of the tuning drive. The approximate location of desired local stations are printed upon the dial (a separate dial scale is available for each of the principal sales centers of the country). By means of the station indication the dial is quickly turned to the approximate location of the station. Upon depressing the tuning lever it will be found that a conical shaped end of the lever will center itself over the cone which has been accurately located by the dealer or service engineer as indicated in Note 1C3 and Fig. 12.

Note 1C11

A method of station stop which permits of very simple construction employs a floating vane operating between fixed stops.

EMERSON—The Automatic Dial mechanism illustrated in Fig. 7 clearly delineates the action of the floating vane stop. The stop is so shaped that the center of the pin will be located on a line drawn vertically through the center of the dial when the pin pushes the vane against either stop. In other words the shape of the vane and its thickness are such that independent of the position of the pin it will be centrally located when approaching the stop from either direction. Note—In using this type of mechanism the operator should be instructed to withdraw the finger from the button directly and thus prevent motion of the dial away from the stop since the vane arrests motion in one direction only.

TRAV-LER—The Trav-ler mechanism is similar to the Emerson type previously described with the exception that the stop occurs on the tuning hub rather than on two symmetrically spaced stops as in the former mechanism. This will be evident from an inspection of Fig. 13.

Note 1C12

A simple positive lock-in mechanism is employed in the Wilcox-Gay receiver whose button adjustment has been described in Note 1C2 and illustrated in Fig. 9. The end of the cams attached to the button have a hemispherical detent which drops into a vertical slot when the dial is rotated toward the index or bottom position. When this occurs, further motion in either direction is not possible. Upon removing the finger from the button, the spring arm to which the button and cam are attached withdraws the detent from the notch.

Note 1C13

The Motorola "Electric Automatic Tuner" of the motor-driven type, shown in Fig. 17, employs a method of locking a depressed station button which is very similar to that used in some of the ladder type push-button switches. The button plunger has a groove and shoulder running around its circumference. This serves to lock a button "in," when it is pressed. The button is held by a locking plate which drops behind this shoulder. The locking mechanism consists of three flat plates, the center of which is the locking plate. The three plates have a series of round holes through which the button plungers extend. The center or locking plate is under spring tension with respect to the other two which tends to keep the holes out of line. When a button is pressed the shoulder on the plunger forces the holes into alignment which releases any previously held button and locks the button selected into place. A rotating mechanism carrying a slotted latch gate, locks upon the stop arm of the button, forming a mechanical stop. At the same time the electrical circuits of the motor are opened by jack spring contacts within the slotted latch gate.

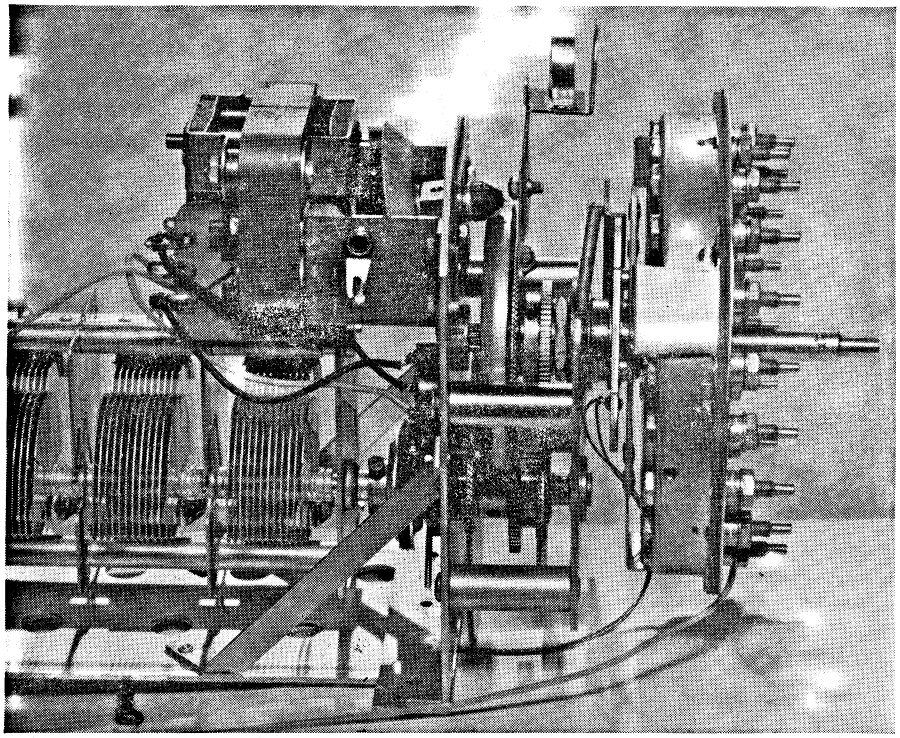


FIG. 17—*Galvin (Motorola) Electric Automatic Tuner*

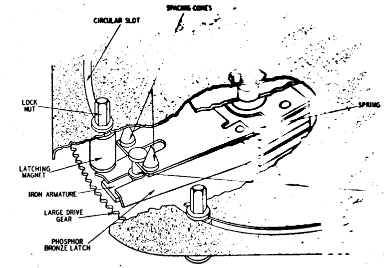


FIG. 18—*Galvin (Motorola) "Press-Button Tuning" System*

Note 1C14

In the United American Bosch and Westinghouse receivers the latch gate is carried on a rotating member driven by the tuning dial. This latch locks upon the end of the tuning lever of a depressed button in a manner similar to that described in Note 1C13.

Note 1C15

The Motorola "Press-Button Tuning" magnetic latch differs in so many respects from other latching systems as to merit special consideration. Its operation is illustrated in Figs. 18 and 19, and circuit diagram 20. In Fig. 18 is shown a cutaway drawing of the magnetic latching system as used in the Motorola motor-tuned motor car receivers. A moving latch system attached to a large drive gear is caused to stop and lock at desired station tune positions by selectively energized magnets. The magnets are mounted by means of threaded studs in a circular slot with their pole faces directly above the path of an iron armature. A phosphor bronze member, fashioned as a two-prong fork is interposed between the armature and the magnet pole face. The spacing of this bronze latch and the armature from the pole faces of the magnets is accurately held by means of the spacing post and spacing cones shown in Fig. 18. Reference to the sequence diagram shown in Fig. 19 and the schematic circuit of Fig. 20 will assist in clarifying the operation of the device. "A" of Fig. 19 shows a cross-section view of the magnet, locknut, armature and bronze latch gate. This view represents the condition before the tuning cycle is initiated. Pressing a desired station button (See Fig. 20) closes the switch by first connecting a desired latching magnet to the plus A supply followed by the completion of the A supply through the reversing switch and tuning motor. As the motor starts driving the large gear which carries the armature and latch bar, the armature approaches the position of the desired station locking magnet as shown in "B" of Fig. 19. The magnet attracts the armature. As the armature carries with it the latching spring, this is depressed and drops over the pole face of the magnet. "C" of Fig. 19 shows the condition which exists as the armature is held against the magnet pole face with two sides of the fork firmly pressed against the pole face and preventing further rotation of the armature and consequently of the gang condenser. When the operator's finger is withdrawn from the push button the motor contacts break, thus preventing further rotation of the gang condenser. Then the magnet supply circuit is

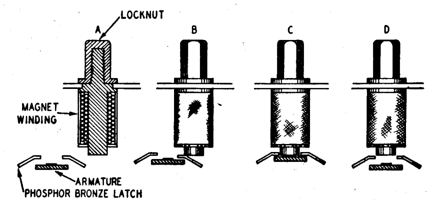


FIG. 19—*Galvin (Motorola) "Press-Button Tuning"—Action Diagram*

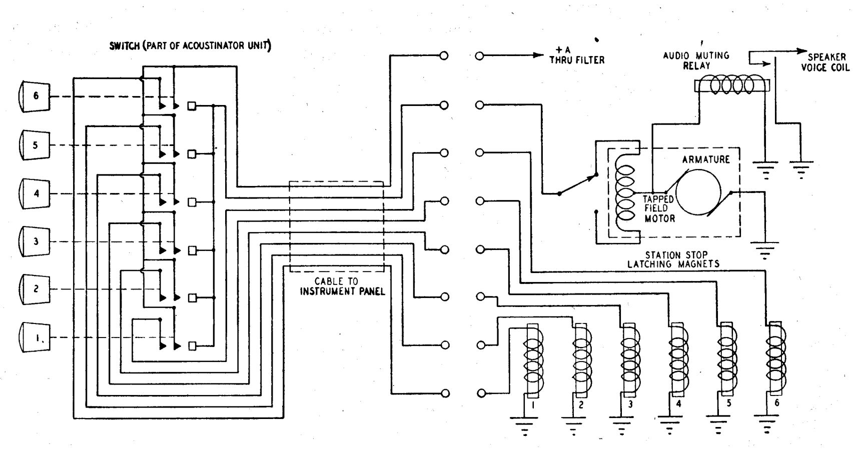


FIG. 20—*Galvin (Motorola) "Press-Button Tuning"—Circuit Diagram*

broken, allowing both the armature and latch spring to be pulled away from the magnet as shown in "D" of Fig. 19. This leaves the system clear and ready to move, on the next station-selecting impulse. Details of motor reversal and audio muting relay action will be covered more completely in their respective sections.

SECTION 2

Tuned Circuit Substitution Types

These systems usually employ one of three switch constructions for selecting the pre-calibrated tuned circuits which are substituted for the usual variable condenser tuned input and oscillator circuits. First is the latching or ladder type push-button switch, second the rotary type similar to the waveband change types, and third, the ratchet mechanism switch.

Several types of pre-set circuits have been used, namely, mica trimming condensers, permeability tuned coils, and combinations of mica trimming and permeability tuned units.

In addition to the selection of the pre-tuned circuits, some form of transfer switching from automatic to manual tuning must be provided on all automatically tuned receivers with the exception of those models which operate on selected broadcast stations only and do not have a gang tuning condenser. Probably the most popular methods of accomplishing this changeover are by inclusion of the transfer switch in the push-button selector unit, or the addition of an extra position on the wave change switch.

Immediately following is a brief outline of the various systems employing trimmer condenser tuning.

1. Ground side switching with push-button switch.
   The low potential or ground side of the trimmers are connected to the switch.
   a. Two trimmer circuits (no RF stage). Examples: Garod, Howard, Pacific Radio (Chicago), Wilcox-Gay.
   b. Three trimmer circuits (RF stage, detector input and oscillator). Examples: Noblitt-Sparks, Sparks-Withington.
2. High side switching with push-button switch.
   The push-button switch is connected on the high potential or grid side of the RF circuit. This allows transfer switching to gang tuning by one button of the switch.
   a. With transfer switching by other means than selector switch. Examples: Pacific Radio (Los Angeles), Stromberg-Carlson.
   b. With transfer switching on push-button station selector switch. Examples: Air King, Erla, General Electric, Warwick.
3. No gang condenser—selected broadcast only. Examples: Howard, Sparton, Wilcox-Gay.
4. Rotary type station selector switch. Examples: Fada, Radio Products (Motor Car Touch-O-Matic).

SECTION 2A

Description of Condenser Tuned System

A typical condenser substitution system is shown in pictorial fashion in Fig. 21, with the schematic diagram of the rear wave switch section shown in Fig. 22. The various parts are separated in these illustrations in such a manner as to show the operation to advantage and do not necessarily represent the actual placement of the parts in a receiver.

The circuit illustrated is that of a two-band receiver with both push-button and continuous tuning on the broadcast band. The wave change switch has been given an extra or extreme counter-clockwise position to transfer the circuit connections from manual to automatic tuning. In this position the switch terminal connected to the gang condenser stator is open and the grid, broadcast secondary and push-button selected trimmer condenser are all connected in parallel. The upper bank of condensers serve to tune the oscillator grid circuit, while the lower bank of condensers are used to tune the detector input circuit. The circuit illustrates ground side switching with the high potential side of the trimmer condensers connected in parallel. In this case the shoe holders of the sliding contact shoes on the push-button switch are made of metal and serve to connect the low potential sides of the selected condensers to frame or ground as shown in the schematic diagram of Fig. 22.

SECTION 2B

Description of Permeability Tuned Systems

Fig. 23 shows the schematic wiring diagram of a model employing a combination of compression tuned (trimmer) input circuits and iron core tuned oscillator circuits. Fig. 23A shows an "under-chassis" view of this receiver. As in the previous diagram a position of the wave change switch has been used to transfer from manual to automatic operation. The portions of the circuit used in automatic tuning have been shown by darker lines than the remainder of the diagram. The iron core trimmed coils are individually connected in parallel with an auxiliary secondary coil coupled to the broadcast oscillator plate winding. This coil tuned by condenser C is resonant to a frequency below the broadcast band so that when it is paralleled by the iron core winding the frequency is increased to the desired point in the band. The condenser is of special construction and utilizes a ceramic dielectric which has a negative temperature coefficient to compensate the positive temperature drift of coil and tube.

The introduction of the dual permeability tuner made possible a tuned circuit substitution type push-button tuner requiring only one adjustment for set-up. Tracking between the oscillator and the antenna is permanently fixed at the factory and rarely requires adjustment in the field.

Fig. 24 illustrates a typical dual permeability tuned coil. In order to show clearly all the parts of the coil it is shown both phantom and cutaway.

Coils "D" are wound on a fiber tube "G." To facilitate tracking, the coil nearest the front is made the oscillator coil.

Brass stud "F" carries the iron cores "A," causing both to be moved simultaneously when a station is being set up. The cores are held a fixed distance apart by spring "B" and spacing nut

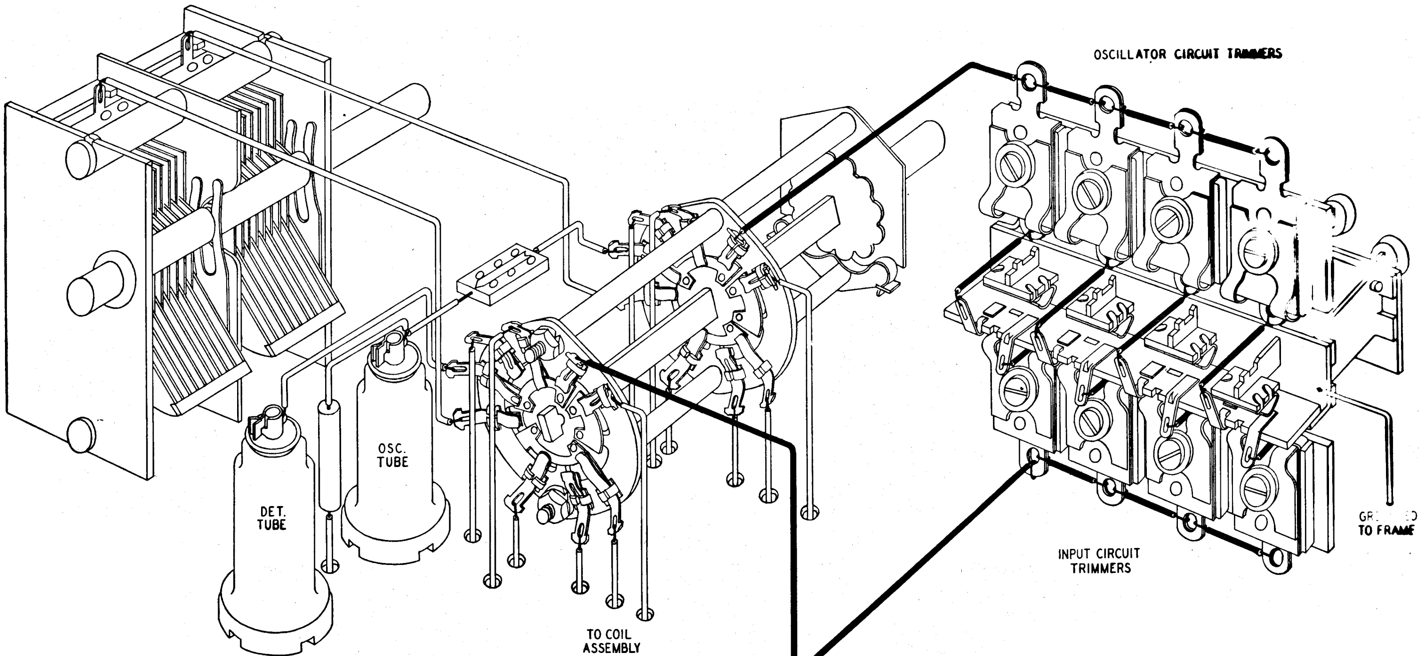


FIG. 21—*Typical Condenser Substitution Tuning System*

"E." The input coil is tracked with the oscillator by varying the position of spacing nut "E," while holding stud "F." This tracking adjustment need not be made unless you have reason to believe that the position of the nut has changed. If the cores are moved too close together, another seemingly correct adjustment may be obtained at certain frequencies. However, as soon as the adjustment stud is moved to tune a different station, the coils will be out of track. To guard against this possibility bakelite spacing sleeve "C" is placed between the cores.

Since the method of adjustment of this type tuner should be obvious in all cases, no specific instructions will be given. Those receivers which use a Colpitts oscillator circuit may show some interaction in the adjustments of the buttons. This is because the capacitance between the coil and its core is placed across one section of the tuning capacitance. The effect of one adjustment on the others will be slight, but sometimes it will be noticeable. It will be wise, therefore, to check the adjustment of each button after set-up is completed in order to be sure that the tuning has not changed.

In order to get the advantage of a tuned R. F. stage, one of several expedients may be used. Two of the

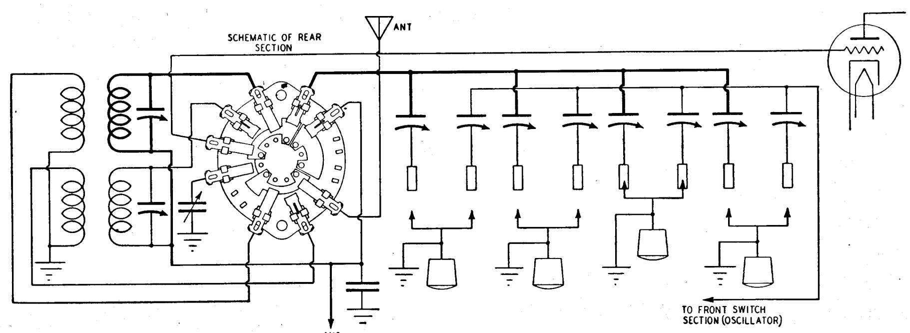


FIG. 22—*Schematic Diagram of Rear Switch Section of Fig. 21*

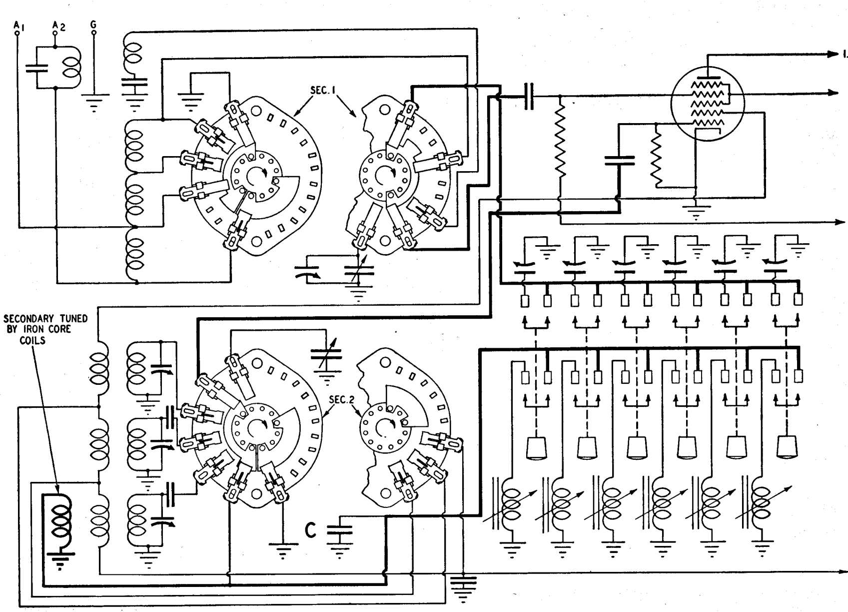


FIG. 23—*Iron Core Tuned System (R.C.A.)*

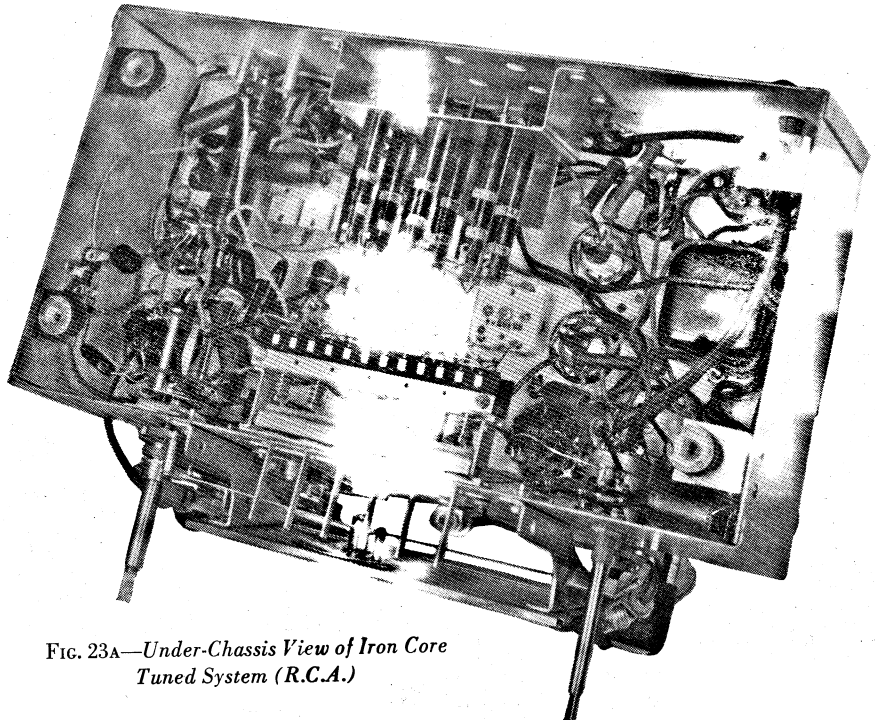


FIG. 23A—*Under-Chassis View of Iron Core Tuned System (R.C.A.)*

most popular are the ones using mica tuned antenna circuits with permeability tuned interstage and oscillator circuits, and the ones using triple permeability tuning. An interesting tuner using triple permeability tuning with magnetic switching is shown in Fig. 25. Switching from manual to push-button tuning is accomplished automatically when any station button is depressed. Those receivers using dual permeability tuners with mica trimmers in the R. F. stage require two adjustments. The station is first tuned accurately by means of the permeability tuner. Then the less critical antenna stage is adjusted by means of the corresponding mica trimmer.

SECTION 2C

Emerson Miracle Tuner

The schematic diagram of the Emerson Miracle Tuning unit is shown in Fig. 26. The oscillator is tuned by means of variable mica trimmers, while the input is broadly peaked to the range of each button by means of fixed mica condensers. To set up stations on this and similar tuners only one adjustment is required, that of the oscillator trimmer. The input circuit will be in tune for any station within range of the button.

SECTION 2D

Ratchet Switch Mechanisms

A number of automobile receivers use a single push-button, which must be pressed several times to tune desired stations. Fig. 27 illustrates a typical solenoid operated ratchet switch as used in many of these receivers. As will be seen by inspection of the drawing, the switch is moved forward one position each time the solenoid is energized.

Fig. 28 is a partial schematic of a Colonial receiver (Firestone S7407-5) showing the use of this type switch. Separate dial lights for each station light up to indicate which station is being received. This receiver uses an untuned transformer between the R.F. stage and the mixer so that only two tuning elements are required. The antenna is tuned by a set of mica trimmers, while the oscillator is adjusted by means of permeability tuned coils.

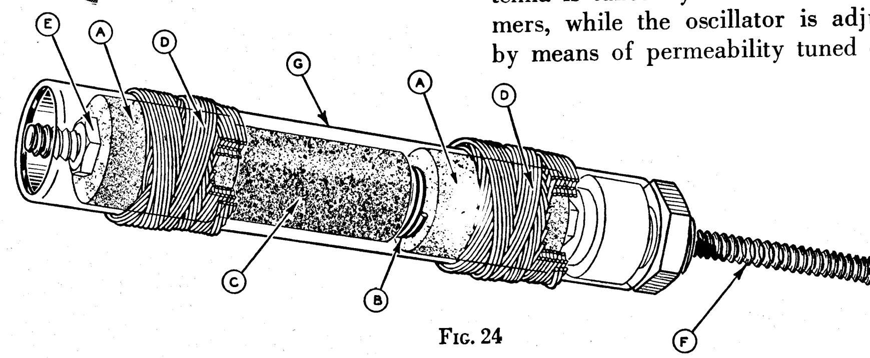


FIG. 24

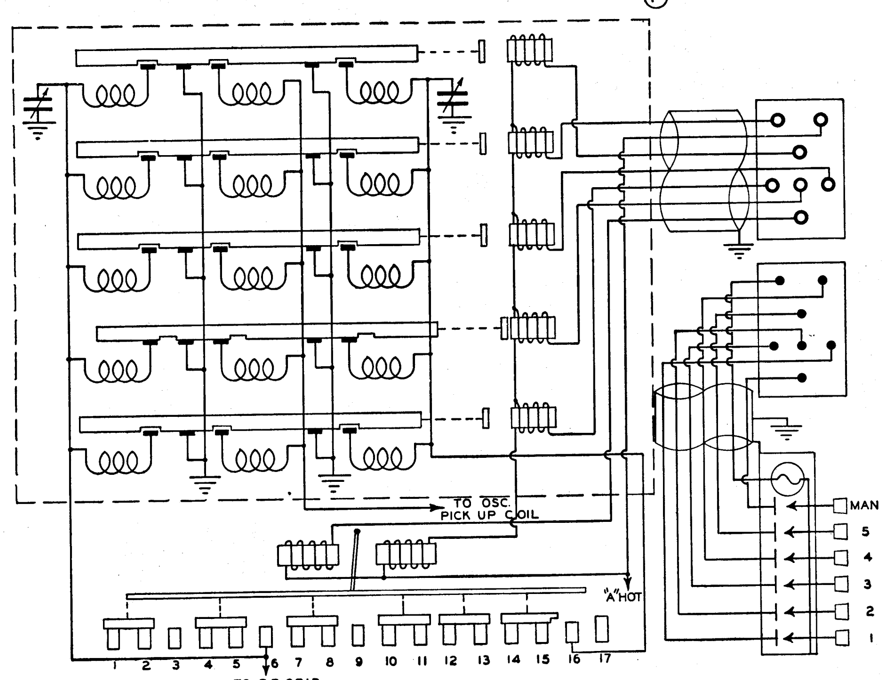


FIG. 25

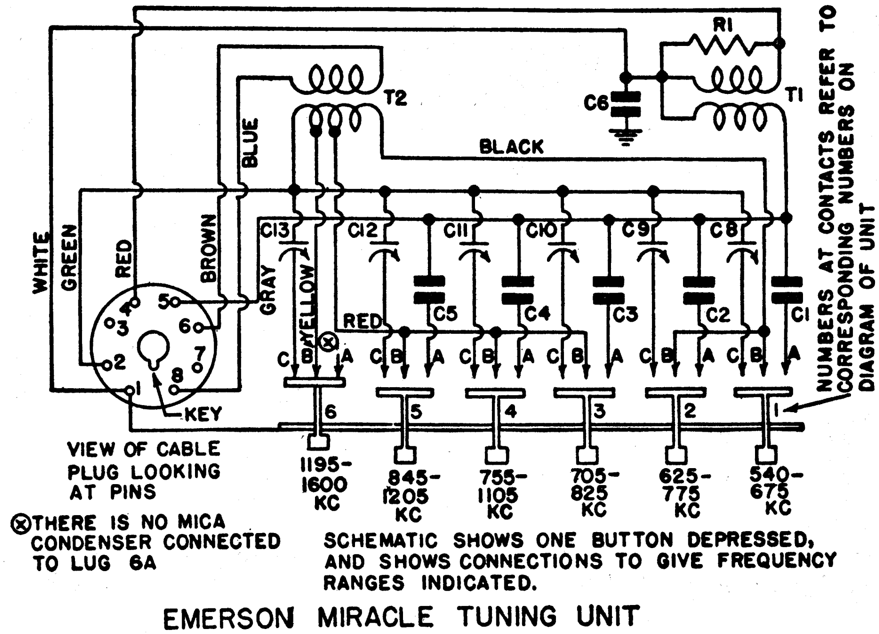


Fig. 26

Instead of the separate dial lights used as indicators in the Colonial receiver, many receivers use a rotary dial to indicate the position of the switch. This dial may be operated by the dial mechanism, as is the Motorola illustrated in Fig. 29, or it may be operated by a separate solenoid mechanism.

To set up this type tuner, first push the button until the mechanism reaches the manual position, and tune in the desired station manually. Then push the button until the desired switch position is reached and turn the oscillator adjustment corresponding to that position until the same station is tuned in. Peak the input stage trimmer for best response, and set-up for that position is completed. Repeat this same procedure for the remaining switch positions.

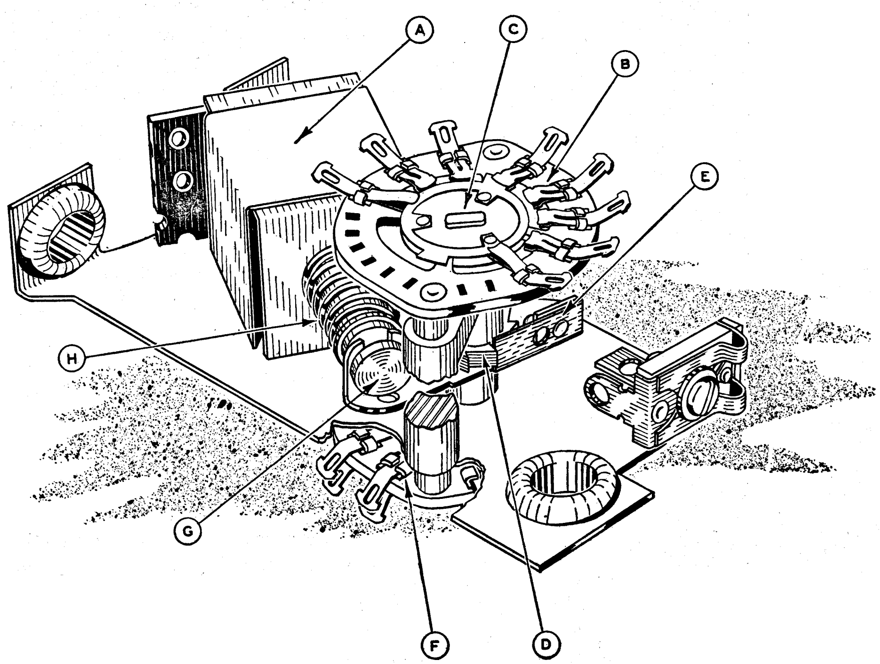


Fig. 27

SECTION 2E

Zenith Permeability and Mica

The oscillator adjustment on these receivers is the center, or screw adjustment. The input stage is controlled by the nut. Fig. 30 illustrates these adjustments and the special adjusting wrench. The button ranges are as follows:

BUTTON	RANGE
1	550 to 950 KC
2	600 to 1100 KC
3	650 to 1200 KC
4	730 to 1390 KC
5	900 to 1550 KC

SECTION 3

Motor Operated Types

The rotation of the variable gang tuning condenser to a position corresponding to a desired station tuning point is accomplished by means of an electric motor. The system usually includes: an electric tuning motor, a station selector switch or group of selector buttons, a selecting commutator or other device for stopping the motor at the desired point, an audio silencing and AFC release circuit operating during the tuning cycle and a transfer device to change from manual to automatic tune. Each of these functions will be covered more completely under individual headings. Motor tuning methods may be broadly divided into three main groups:

A—Motor drive by scanning switch.

B—Electrical push-button switch with selecting commutator.

C—Mechanically interlocked station plunger and selecting mechanism.

A. Motor Drive by Scanning Switch

A scanning or motor reversing switch is operated by a knob concentric with the manual tuning knob. The operation of the motor brings the tuning condenser position close to the desired point after which the tuning operation is completed manually. Examples: Crosley and Zenith.

B. Electrical Push-Button Switch with Selecting Commutator

The selecting commutator or stop device is mechanically connected to the

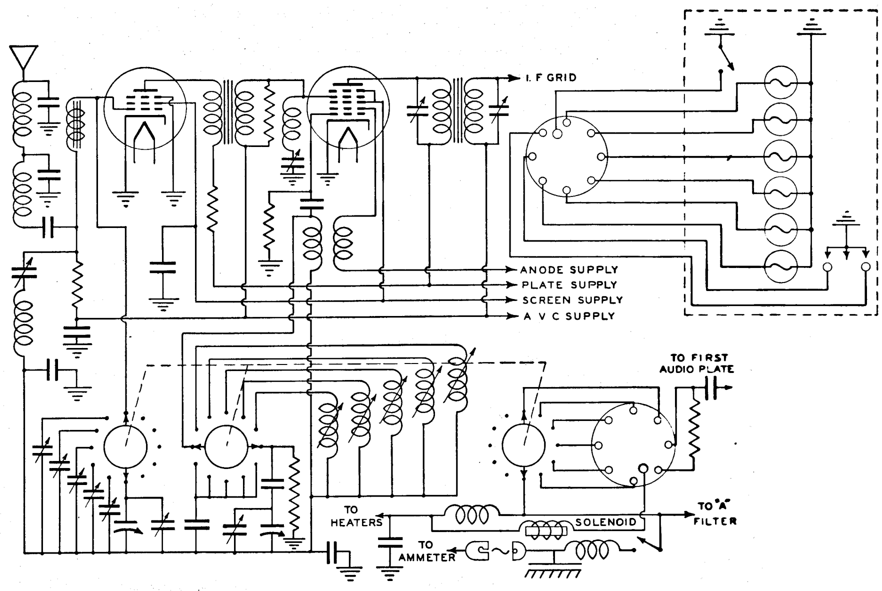


Fig. 28

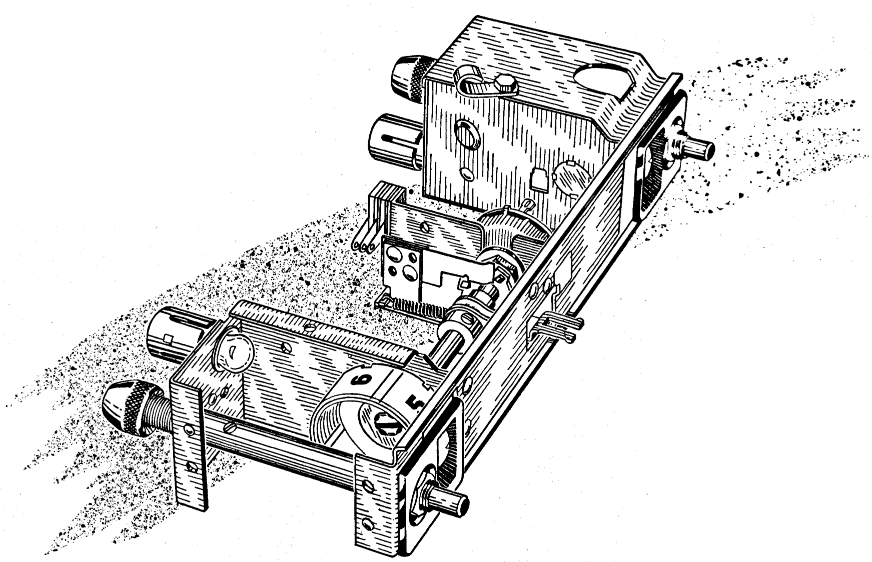


Fig. 29

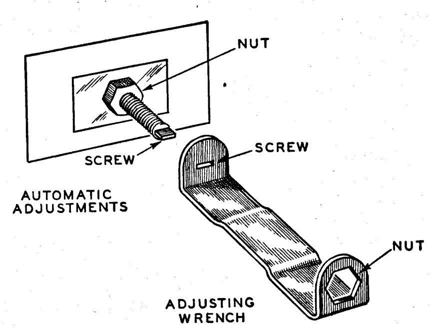


Fig. 30

gang condenser and electrically connected to the station selector switch and motor. Examples: Crosley, Detrola, General Electric, Gilfillan, Galvin (Motor car set), Midwest, Packard Bell, Pacific Radio, Radio Products, Stromberg-Carlson.

C. Mechanically Interlocked Station Plunger and Selecting Mechanism

The selecting buttons and the stop device are combined in one unit with some type of mechanical latching at the instant of stop. This type may be pre-set for stations from the front of the receiver since the stop devices are part of the dial mechanism.

1. Circular arrangement of fixed buttons which lock rotation by latching. Examples: Galvin (Motorola household sets), United American Bosch, Westinghouse.
2. Straight line arrangement of fixed buttons with mechanical interlock to disc or cam selectors. Examples:

Stewart-Warner, Wells-Gardner.

As indicated in the main outline, motor tuned systems in general include:

1. An electric tuning motor.
2. A selecting commutator.
3. An audio silencing and AFC release device.

A typically motor tuned system is illustrated pictorially in Fig. 31, with its corresponding schematic wiring diagram in Fig. 32. A description of this system will serve to familiarize the reader with motor tuned operation. Variations from this typical system are covered in the notes listed in the Reference Table.

The tuning motor drives the variable gang condenser through a train of gears to which the motor is mechanically coupled by a quick-acting clutch.

When the motor is not energized the armature is positioned slightly out of the center of the magnetic field. It is held in this position by a flat phosphor-bronze spring which also acts as part of a jack spring switch assembly. When the windings of the motor are energized the rotor is drawn into the magnetic field, closing the separated parts of the clutch and actuating the jack spring switch. The clutch performs a dual function in that it relieves the driving system of the load of the motor during manual tuning and it allows the motor to coast to a stop, permitting instant cessation of gang condenser rotation when the selecting commutator opens the motor circuit. The selecting commutator is directly coupled to an extension of the variable gang condenser shaft by means of a universal coupling. In the case illustrated it consists of a series of metal discs which are electrically connected to the shaft and are driven by means of cupped friction washers. In the periphery of each disc is a short insulated section which serves to open a circuit when the disc has revolved to such a point that a contacting finger is resting upon the insulation. These discs may be rotated with respect to their

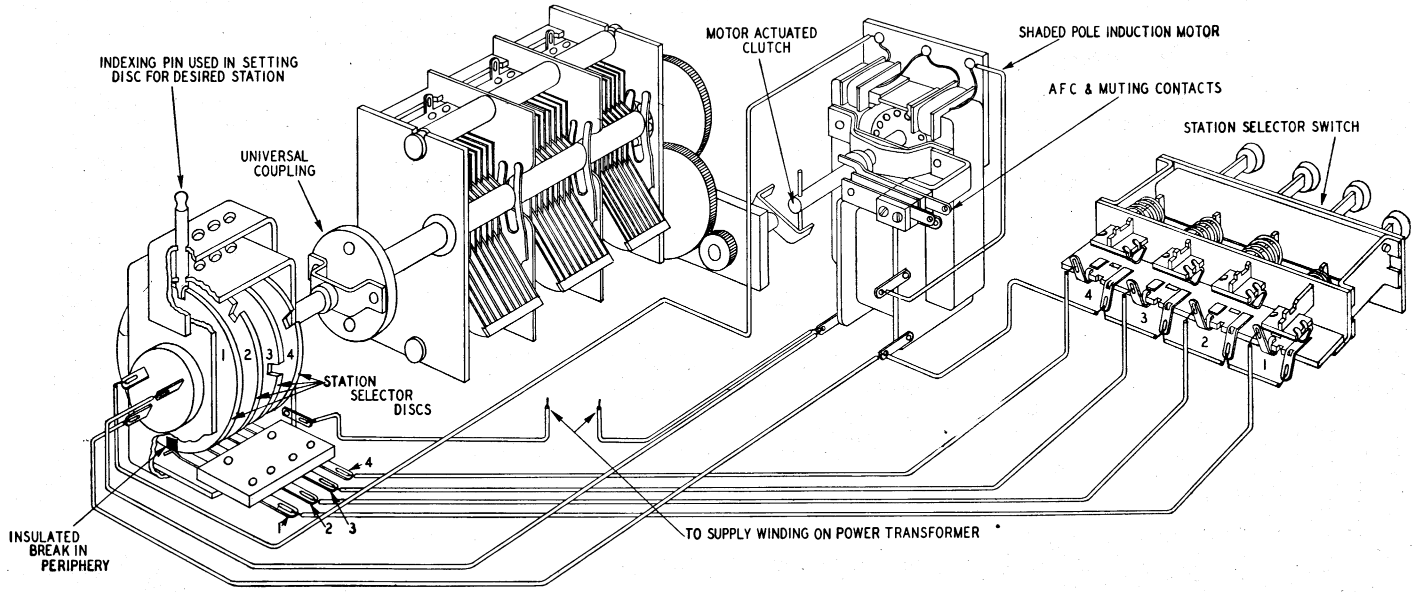


Fig. 31—*Typical Motor-Tuned Automatic Station Selector System*

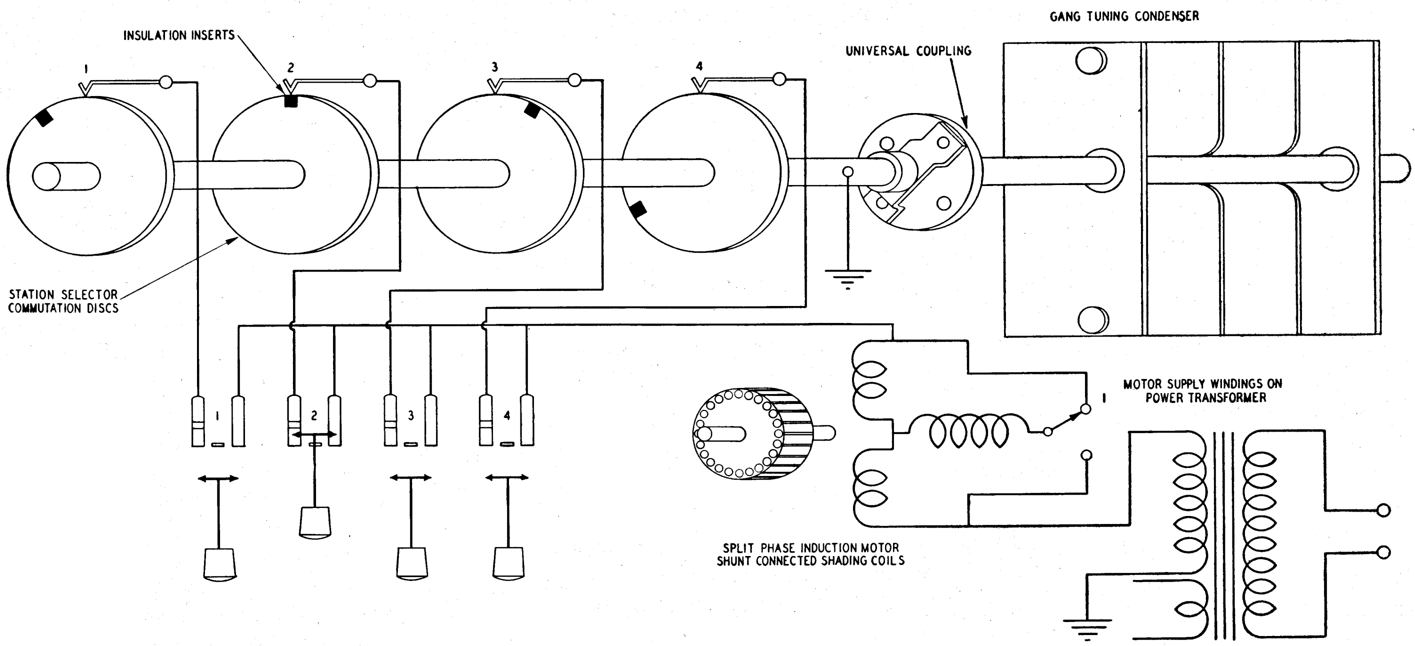


Fig. 32—*Schematic Diagram of Typical Motor-Tuned System*

drive shaft to allow them to be set to positions corresponding to desired station tuning points. This is done by locking the disc against rotation with an indexing pin while the station is tuned in manually. Since this single circuit disc cannot select the direction of rotation of the tuning motor, a motor reversing switch is attached to the commutator shaft and serves to reverse the motor at the end of gang condenser rotation in the event that the desired station tuning point has not been reached before this occurs.

Selection of the desired station is accomplished by depressing a button of the station selector switch. A single circuit switch is actuated by each button respectively wired to the contactor fingers of the station selecting commutator aforementioned. Since the push-button plungers engage a common latch bar (as described in Section 5) a circuit will be held closed until released by the choice of another button. The circuit is completed from ground through a commutator disc and its respective push-button switch, the motor, reversing switch and motor supply winding on the power transformer. Thus when a station selector button is pressed the motor will continue to run until the station selecting disc opens the circuit at the correct station tuning point. During the time that the motor is running the jack spring switch on the motor clutch has silenced the audio system of the receiver and released the automatic frequency control from operation. The necessity of these two functions will be described in greater detail in Section 7.

Several variations of this basic system exist which are not readily described in the listing. These will be described separately.

SECTION 4

Electric Tuning Motors

An analysis of the motors in use for the control of automatic tuned radio receivers discloses three main types which in turn have several sub-classes.

1. Induction motors
   - A. Split phase
     1. Phase splitting by the use of a capacitor.
     2. Phase splitting by difference in inductance or impedance of windings.
   - B. Shaded pole
     1. Pole shading coils in parallel with main field winding.
     2. Pole shading coils in series with main field winding.
2. Series wound commutator type or "Universal."
3. Impulse type.

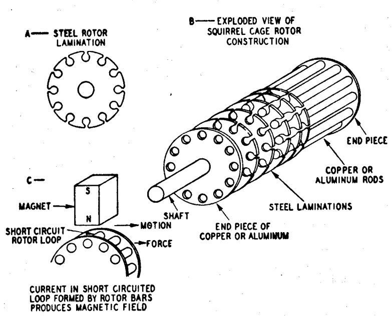


FIG. 33A-B-C—*"Squirrel Cage" Rotor Assembly*

SECTION 4A

Inductance Motors

Since induction motors use the same type of rotor assembly known as "squirrel cage" and operate by means of a rotating magnetic field, it seems advisable to start by an explanation of the manner in which a "squirrel cage" rotor follows a rotating magnetic field.

The "squirrel cage" rotor consists of a stack of round laminations stamped from thin sheets of a similar grade of iron as that found in power and audio transformers. These laminations have a central hole to fit the rotor shaft and a series of equally spaced holes around their periphery as shown in Fig. 33A. Round copper rods are inserted in each of these outer holes and extend beyond the cylindrical stack. Copper laminations are placed over the ends and the rods staked and soldered to them so that each bar or rod is short circuited to all of the others at each end. An exploded view of such a rotor assembly is shown in Fig. 33B. While for the sake of simplicity the rods have been shown parallel to the shaft in Fig. 33, in many designs they will be found to be "skewed" or at an angle to the shaft. When this rotor assembly is threaded by a changing magnetic field the current generated in the short circuited loops will produce a magnetic field of its own which will magnetize the portion of the stack of laminations lying within the short circuited loop.

For a simple explanation of the manner in which such a rotor assembly will follow a moving magnetic field refer to Fig. 33C. As the magnet is moved, its magnetic flux cuts the shorted loop and gives rise to an induced current by transformer action. Reference to Lenz's law of the direction of induced electric currents in any standard text will amplify this explanation. The current in the shorted loop causes a magnetic field which reacts on the field from the moving magnet so as to tend to force the loop to follow the magnet. The shorted loop can never attain the speed of the moving magnet, for if it were to do this there would be no relative motion between the two and therefore no cutting of flux to produce current. The loop current would become zero and no torque would be developed which would immediately result in the loop speed dropping to below that of the magnet. The velocity of rotation of the magnetic fields of all of the tuning motors in use is 3600 revolutions per minute. The speed of the rotor depends upon the load or amount of work which the magnetic field is called upon to perform and may be as high as 3000 revolutions per minute although it is usually much less than that.

In the motors under discussion, the effect of the moving magnet previously discussed is produced by the movement of magnetic flux across the pole faces of a field structure. The field consists of a stack of laminations with pole faces extending toward the rotor and encircling it. The poles are so spaced that when they are alternately energized by the alternating current flowing through their windings the effect of a rotating magnetic field is produced.

The split phase motor shown in Fig. 34 produces a rotating field of the time-phase type. Considering opposite windings 1 and 3 which are directly connected to the A.C. supply as reaching maximum magnetic flux at a given time, it can readily be seen that windings 2 and 4 whose current flows through the impedance "Z" must reach their maximum flux at some other time. Their impedance "Z" may be a resistance, inductance or capacitance. If it is an inductance or capacitance the phase angle may approach 90°. In this case the magnetic flux at pole 1 would be passing through zero as the magnetic flux at pole 2 is reaching its maximum. This sequence continues to follow around from pole 2 to pole 3 and thus a rotating magnetic field is produced. The rotor will follow this field with a slip or time lag depending upon the load. Such a motor possesses its maximum torque as the phase relations between the two field systems approaches 90°. It can be made very close to this ideal in the capacitor type motor. An example of the capacitor type motor is shown in sche-

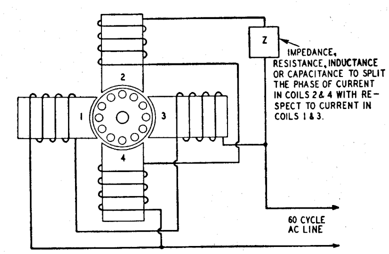


FIG. 34—*Split Phase Motor Wiring Diagram*

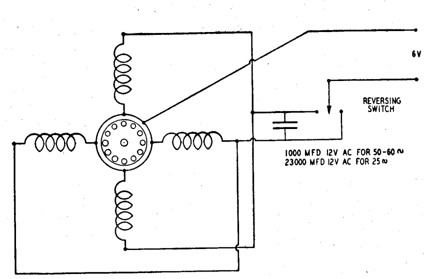


FIG. 35—*General Electric Capacitor Motor—Wiring Diagram*

matic Fig. 35 and Fig. 36. This motor manufactured by the General Electric Company is used in their "Touch Tuning" models described on page 184. Reversal of direction is obtained by shifting the phase splitting capacitor from one set of field windings to the other. Its characteristics are identical for either direction of rotation.

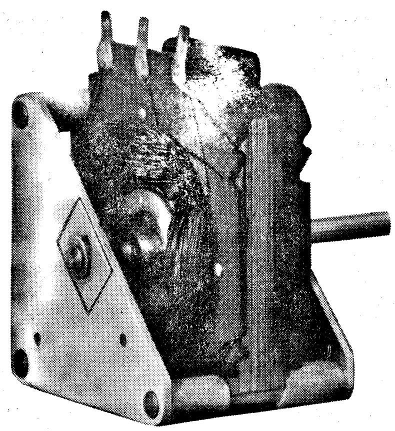


Fig. 36—*General Electric Capacitor Split-Phase Motor*

Another method of producing a rotating magnetic field is by means of pole shading. Fig. 37 illustrates this principle in diagram A. It will be seen that the tip of each field pole is notched and carries an additional winding. The windings on either pole may be alternately short circuited as in Fig. 37B. When the main field pole is building up in flux density some of the lines of force cut the shorted turns of the shading winding and cause current to flow in them. This current produces a magnetic field which tends to oppose the action of being generated and therefore does not allow the tip of the pole to become magnetized as quickly as the main pole of which it is a part. On the diminishing part of the half cycle these shorted turns are again being threaded by the collapsing flux and consequently oppose this action also with the result that the magnetism does not die out in the shaded tip at the same time that it does in the main field but lasts a short time longer. This difference in time between the main field flux and the tip causes a rotating field across the face of the pole which in turn causes the rotor to move. The direction of rotation depends upon which tip of the main field is being shaded. The direction of rotation is always from the main field pole towards the shaded portion since the flux in the shaded portion always lags the main flux. Motors produced by Alliance and Barber-Coleman are of this type.

If the pole tip windings are connected to the same source of alternating current as the field, a rotating magnetic field is produced in practically the same manner as that described for the split phase motor. In this case the phase displacement to produce the time shift of magnetic flux is due to the difference in impedance of the pole tip winding which

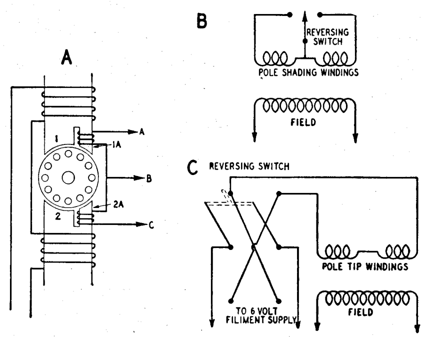


Fig. 37A-B-C—*Pole Shading Operation*

usually is wound with a far different number of turns and hence a different inductance. The torque produced by this type of connection is greater than for the pole shading type since windings on both poles are active in producing rotation.

Another version of the split phase type which depends for its operation on the difference of impedance of simultaneously operating coils energizes its reactive winding by connecting it from a center tap on the field winding across either half of the field depending upon the direction of rotation desired. Examples of this type of induction motor are to be found in models offered by Delco, Robbins-Meyer and Speedway. See schematic Figs. 61, 70, and 80.

A type of shaded pole induction motor developed by the Utah Products Company is illustrated in diagram Figs. 38 and 39. This motor is furnished complete with built-in integral automatic clutch permitting instant stop of driven load when power is cut off; a built-in thermostatic cut-out switch for protection if operated continuously on overload and an AFC-muting switch operated by end thrust of the rotor shaft. Speed reduction gearing with approximately 35:1 ratio is furnished as shown in Fig. 39 so that the drive system of the receiver may operate by belt connection to the pulley shown on the large shaft with the shaft itself acting as the manual drive. In using this for manual drive the clutch is automatically disengaged relieving the load of the motor.

In this motor the wiring and placement of shaded poles makes possible reversal of direction by means of a single-pole double-throw switch. Unlike the pole shading types previously described which used only two poles with shaded

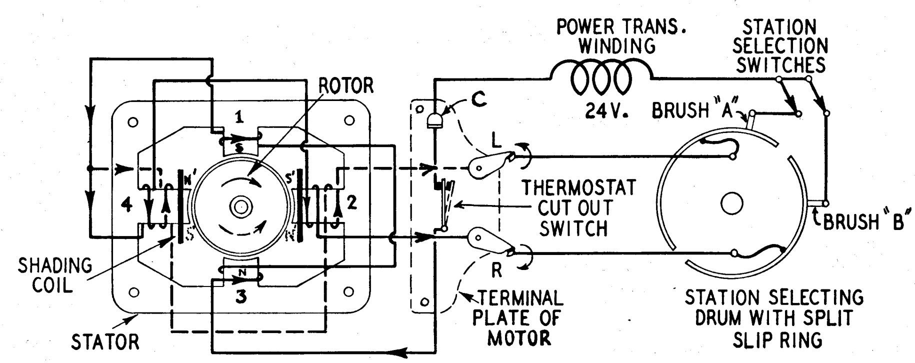


Fig. 38—*Shaded Pole Induction Motor (Utah)—Wiring Diagram*

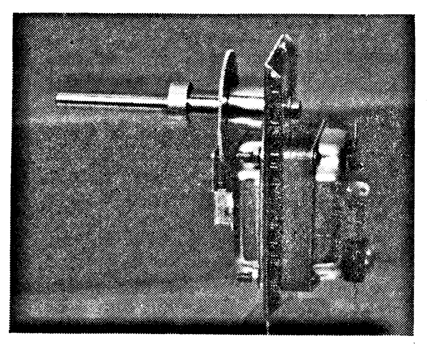


Fig. 39—*Exterior View—Utah Shaded Pole Induction Motor*

tips, this motor places the shaded sections on two additional poles midway between the unshaded sections as indicated in the figure. The pole shading is accomplished by the use of heavy copper shading "coils" which are in reality large single short circuited turns. The shading poles each have two separate sets of magnetizing coils of opposite polarity which are alternately connected with the winding on the unshaded poles by a "T" circuit. Thus either set of windings on the shaded sections may be used in series with the unshaded section.

To explain the operation of reversing this motor, assume that the external circuit is closed so as to apply current to the common terminal "C" and the directional terminal "R" (right). At a given instant assume the current to flow in the direction shown by the arrows. The current passing through coils 1 and 3 will make the corresponding unshaded pole section have polarities "S" and "N," respectively. Continuing through the windings on pole sections 2 and 4 as indicated by solid lines, magnetic polarities "S¹" and "N¹," respectively are produced, which due to the shading rings of solid copper reach maximum intensity after unshaded sections 1 and 3.

Thus the maximum flux of polarity "S" occurs first at pole section 1 and then later at pole section 2. The "N" flux simultaneously shifts from pole section 3 to 4. This causes the rotor to turn in a clockwise direction as indicated by the solid curved arrow on the rotor.

To run the motor in the other direction, the electrical connection is made to terminal "L" (left) instead of "R" (right). At a given instant, pole sections 1 and 3 will be "S" and "N" polarity as before but by following the dotted line windings now used on pole sections 2 and 3 it will be seen that their polarities are now reversed, being "N¹" and "S¹" respectively, as shown in the dotted letters. The maximum flux now shifts from pole section 1 to 4, turning the rotor counter-clockwise, as shown by the dotted curved arrow.

The motor is rated for continuous operation at 12 volts although it may be safely overloaded several hundred per-cent for the short intervals of time involved in tuning a radio receiver since it is protected by the thermostatic cut-out. Its performance characteristic at various percentages of rated load are shown in the graph of Fig. 40.

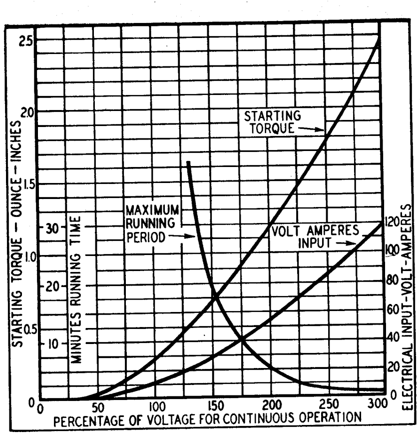


Fig. 40—*Performance Characteristics of Utah Shaded Pole Induction Motor*

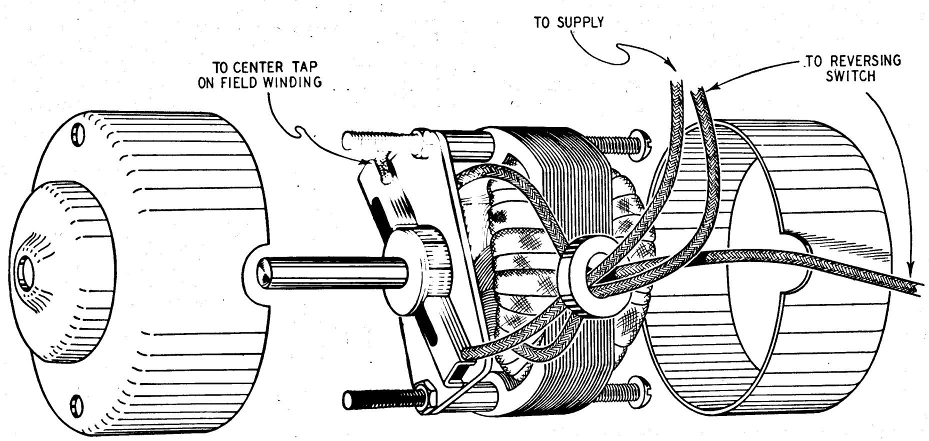


Fig. 41—*Delco Universal Tuning Motor—Assembly*

SECTION 4B

Series Wound Commutator Type or "Universal"

The wound armature series connected universal motor is such a well known device as to require no detailed explanation. This type of motor ordinarily requires a double-pole double-throw switch for reversal of direction. In the types developed for the present requirements of automatic tuning a change in construction and wiring has permitted a simpler type of reversal switching. Fig. 41 shows the Delco Products 3-wire construction whose wiring diagram is shown in Fig. 42. By dividing the field winding into two parts the direction of the magnetic field of the armature with respect to the field may be reversed by the use of a single-pole double-throw switch.

This type of motor is adaptable to either the operation of A.C. household receivers or 6-volt D.C. motor car sets. Schematic diagrams of receivers employing this type of motor are shown in Fig. 20 and Fig. 76.

SECTION 4C

Impulse Type Motors

In this type of motor the rotation is not continuous but is intermittent as determined by a series of pulses. An electro-magnet operating on low voltage alternating current is used to obtain rectilinear motion from a hinged pole shoe normally held away from the magnet by a spring. The operation of such a motor can be understood by reference to Fig. 43, a line drawing of the Crosley "Dynatrol." On the motor shaft are two drums around which are wrapped flexible belts having cork friction surfaces cemented to that portion of the belt which surrounds the drum. One end of the belt is connected to the armature and the other end to an adjustable

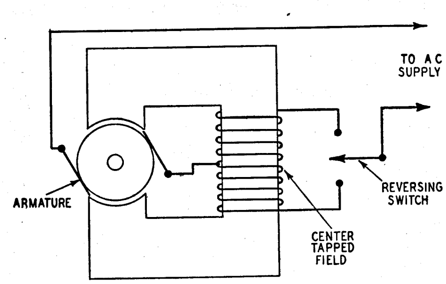


Fig. 42—*Delco Motor Wiring Diagram*

screw supported by a rubber grommet. The action of the belt in producing rotation is as follows: First, as the armature is attracted towards the magnet the belt becomes tightened and the cork friction surface wraps tightly on the smooth surface of the drum. Second, the further motion of the armature causes the belt to move a short distance until the rubber grommet and stretch of the belt prevent further motion. This slight motion advances the drum a fraction of a revolution. This entire action has occurred during the first quarter cycle of the sixty cycle alternating current. As the armature leaves the pole face under

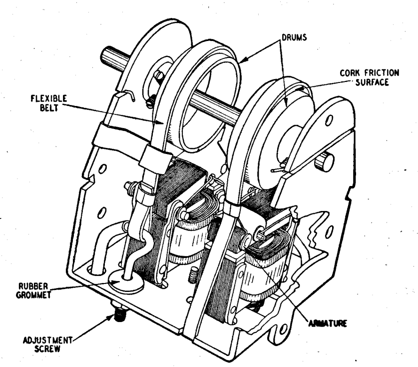


FIG. 43—*Crosley "Dynatrol" Tuning Motor*

the action of its restoring spring during the decay of voltage the relieved pressure on the belt releases the cork friction surface from the drum. The inertia of the moving drum and friction of the system prevents reverse rotation as the belt tension is released. During the second half cycle this sequence of "grab, turn, and release" is repeated and so on at a rate of one hundred and twenty times per second. In this manner due to the frequency of operation the drum appears to move continuously as long as an alternating voltage is impressed on the coil. A duplicate system is used for operation in the reverse direction. The two operate independently of one another since no friction exists between the cork surface and the drum except when the magnet is energized. Close adjustment of armature motion and tension are required. This type of motor develops a surprising amount of torque due to the short motion of each cycle of operation acting through the lever arm of the radius of the drum.

SECTION 5

Station Selector Switches

Station selection switches are used as a method of accomplishing desired station tune in all of the receivers of the tuned circuit substitution type and in all but a few of the motor operated types. In general the push-button type of switch has met with widest acceptance although a few models employ rotary selector switches of the familiar wave band type. The push-button idea has also been used in combination with the stop mechanism in a few receivers (see Notes 1C13, 1C14, and 5C).

Push-button switches may be classified into two main groups: (Momentary) in which the button does not lock down but is held down by the operator until the tuning cycle has been completed and, (Latching) in which the button locks in position and remains locked until released by the act of depressing another button.

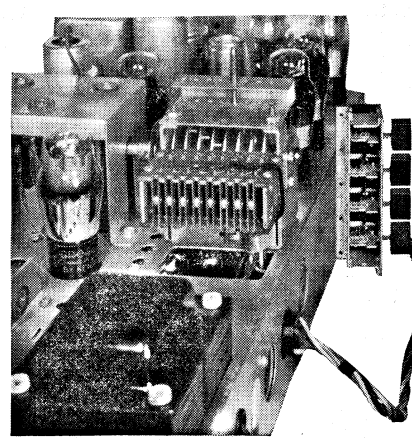


FIG. 44—*Crosley "Prestotune" Showing Station Selecting Commutator and Push-Button Switch*

Note 5A

The momentary type of push-button selector switch is employed in many receivers because of the facility with which it lends itself to remote control operation. Since buttons are not locked in place, the contacts of the remote switch may be connected in parallel with those of the switch at the receiver without any conflict of operation or the necessity of unlocking the switch at the receiver before making a remote selection. The necessity of holding the button depressed until the tuning cycle has been completed, a seeming disadvantage of this type of switching, has been rendered less objectionable by speeding up the duration of the tuning cycle to the point that action is almost instantaneous.

CROSLEY—The Crosley "Prestotune" models use two switch groups of four units each. One is shown in Fig. 44. The switch is similar in construction to that shown in Fig. 53, but with the latch bar removed to make each unit independent and non-latching.

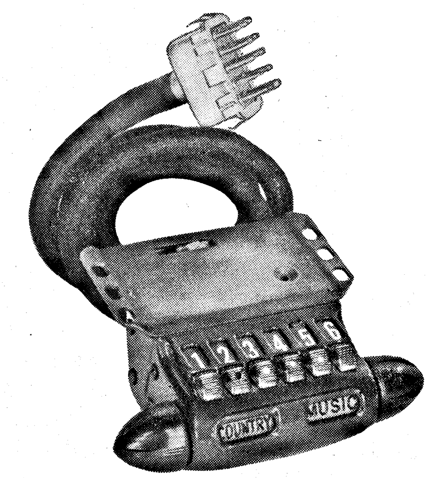


FIG. 45—*Galvin (Motorola) Combined Push-Button Switch and "Acoustinator"*

DETROLA—The Detrola "Electric Automatic Tuning" models use the momentary type single circuit push-button switch. A split ring commutation device directs the motor as covered in Section 8. Certain models have provision for remote control by parallel connection of an additional switch of the same type.

GALVIN—The "Press-Button" motor car radio control system, whose latching system was described in Note 1C15, employs a momentary type switch as an integral part of the "Acoustinator" unit. This unit may be mounted below the instrument panel or on the steering column. Illustrated in Fig. 45 is the push-button "Acoustinator" unit with its six illuminated station buttons. The unit is equipped with an extension cord to which is attached a twelve pin plug for connection to the radio receiver. The wiring of the push-button circuits is shown in Fig. 20. Each button actuates three contacts which are connected together in the sequence described in Note 1C15. The contacts themselves are of silver riveted to phosphor-bronze springs. The motor circuit contacts are of generous size to break the current of the stalled motor (approximately 10 amperes).

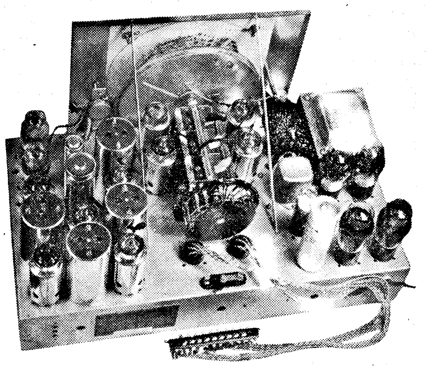


FIG. 46—*Midwest "Motorized Automatic" Showing Push-Button and Selector Commutator Details*

MIDWEST—The Midwest "Motorized Automatic" receivers are controlled by a push-button switch of the momentary type which also operates the audio silencing circuit. The circuit connections of this switch are shown in Fig. 76. The switch is mounted on the top of the cabinet and is connected to the receiver by cables and plugs as shown in Fig. 46. The momentary type push-button switch shown behind the receiver has ten buttons of which nine are used for station selection and the tenth to turn the receiver off. Pressing any station button turns the receiver on by means of an A.C. line switch mounted in such a fashion that a pin on the dial engages the actuator of the switch as the tuning motor starts rotating the dial. A "keep alive" motor transformer is connected to the A.C. line at all times and draws a small no-load exciting current. This transformer allows the push-button switch to be used for complete control since the motor is at all times ready to receive an impulse which will select a desired station and turn the receiver on in the same operation. The "off" button turns the condenser to one end, thus tripping the line switch and turning the receiver off.

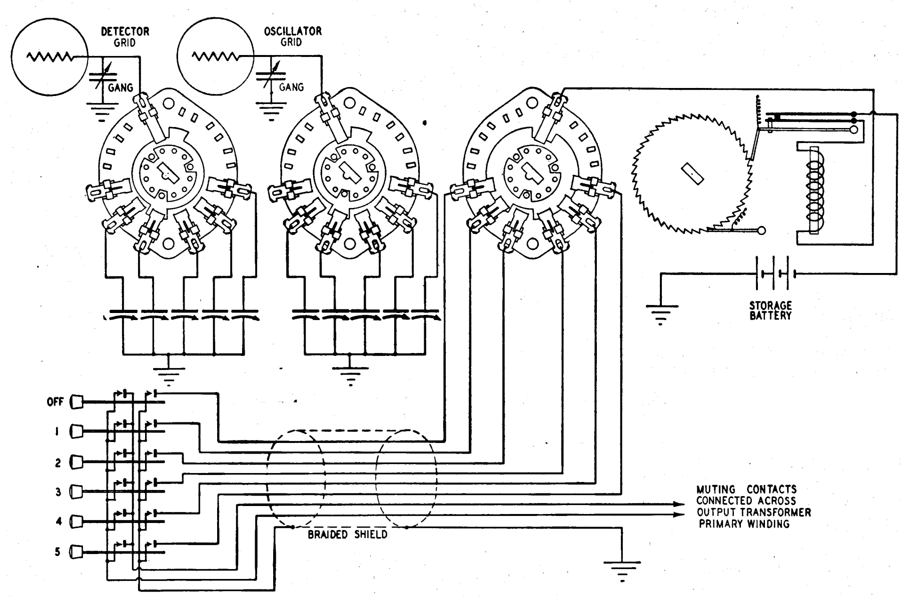
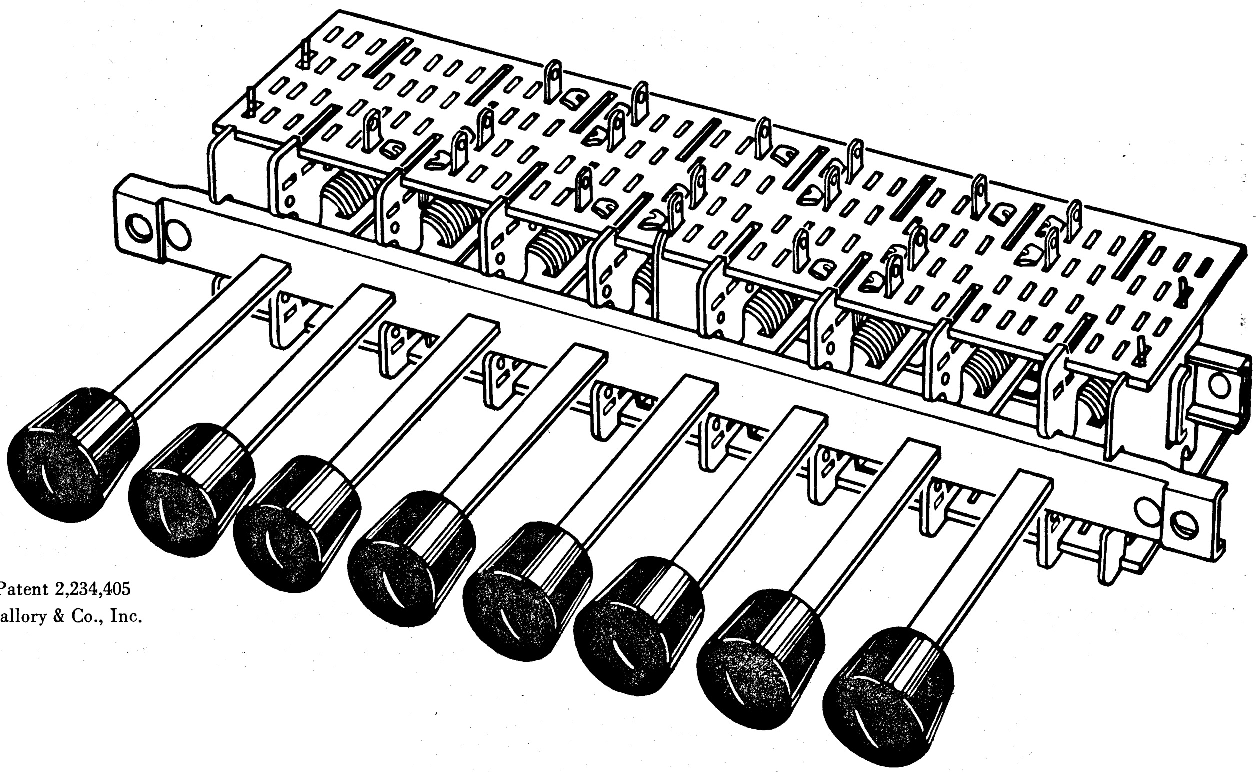


FIG. 47—*Admiral "Touch-O-Matic" Motor Car Conversion Unit—Circuit Diagram*

RADIO PRODUCTS CO.—The Admiral "Touch-O-Matic" conversion unit for motor car radio receivers employs a momentary type push-button switch in combination with a stepping system for the remote selection of tuned circuit elements. This unit shown in schematic diagram Fig. 47 may be attached to any two gang motor car radio receiver and allow the selection of five favorite stations by means of a push-button box attached to the steering column and connected to the unit at the receiver by means of a shielded cable. The push-button box as shown in the diagram contains six switch units. The first of these units is used for the purpose of transfer to the normal manual control. Each button serves to close two circuits when depressed. The first of these circuits shorts the moving coil of the loud speaker or the output transformer primary winding thus silencing the receiver during the tuning cycle. The second switch selects a circuit for one of the desired station selections. The operation of the conversion unit follows: A multi-section wave change switch is rotated by a stepping device in which a toothed wheel is advanced by a magnetic armature with breaker points similar in action to an electric door bell. As long as the circuit is complete through this device it will continue to vibrate and move the toothed wheel one notch or tooth at each vibration. The first section of the switch is used to stop this motion at the desired points. How this is accomplished will be obvious from an inspection of the circuit shown in Fig. 47. It will be noticed that two circuit opening notches diametrically opposite one another as well as two rotor projections on each of the trimmer selector switches corresponding with the notches on the circuit opening section make it unnecessary for the rotor to revolve more than one hundred and eighty degrees to select any station. The two trimmer selector switches are connected in parallel with the oscillator and input sections of the gang condenser respectively. The gang condenser is turned to its minimum stop when using the automatic station buttons. Thus the "off" button accomplishes transfer by opening these two circuits.

STROMBERG-CARLSON—The 70 series "Te-Lek-Tor" remote control "key" box contains twenty momentary type push buttons for complete control of the receiver. In addition to the selection of eight preset stations, the unit has push-button control of on and off functions, the increase or decrease of volume, scanning or continuous tune to higher or lower channels, automatic operation of the automatic record-playing phonograph and selection of four speakers. These operations are accomplished by the use of separate motors for the tuning and volume control operations and relays for the control of off-on and radio-to-phonograph switching.



U. S. Patent 2,234,405
P. R. Mallory & Co., Inc.

Fig. 48

Note 5B

Under this note are classified all of the latching or ladder type push-button switches. In general, this type of switch can perform all the functions of a rotary switch, with one important additional advantage—switching can be accomplished in any desired sequence. Fig. 48 shows the front view of a Mallory MC manufacturers original equipment type, or 2100 jobber type switch. MC switches can be built with a maximum of 32 terminals per plunger, to perform such applications as circuit closing, circuit opening, and circuit transfer, with either shorting (make before break) or non-shorting (break before make) operation, both between terminals, and between successively operated plungers.

Fig. 49 illustrates the simplest contact action—namely, depressing a button closes one or more individual circuits. The practical application of this is shown in Fig. 50 where the circuit closing principle has been applied to push-button tuning.

The shorting, or make-before-break sequence is always used for push-button tuning. A break-before-make or non-shorting action would be undesirable in this type of circuit, since momentarily opening the grid circuit would result in a voltage surge and would cause a loud thumping noise in the loud speaker.

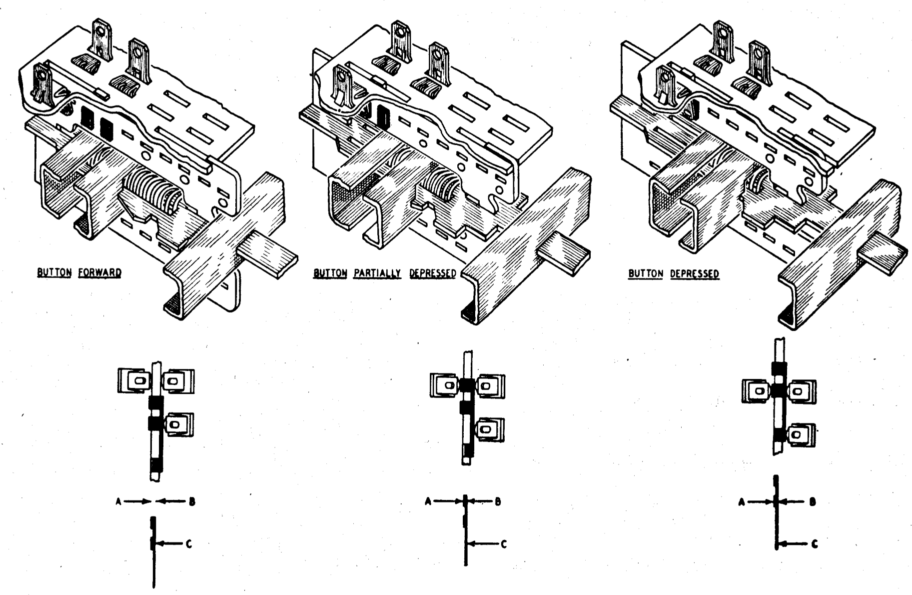


Fig. 49—*Switch Action—Depressing Knob Connects Together Three Contacts on Each of the Independent (Upper and Lower) Switch Sections*

TYPICAL APPLICATION

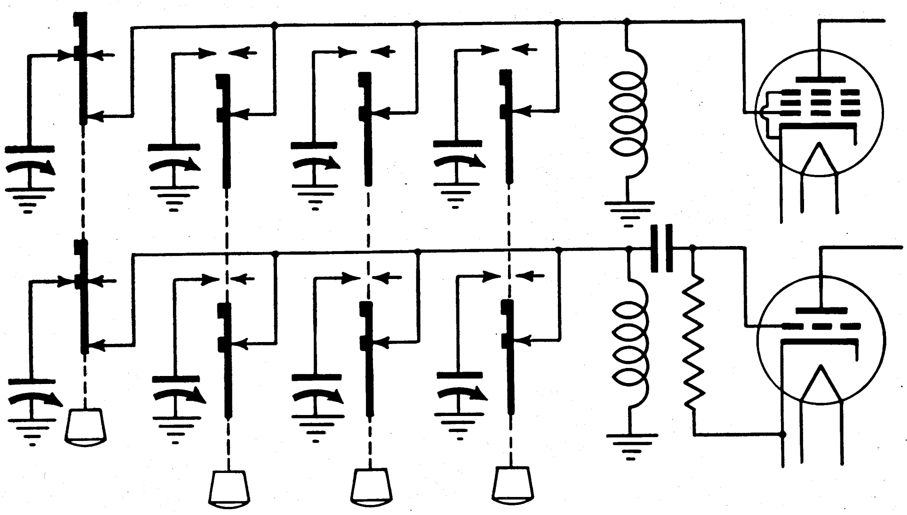


FIG. 50—*Radio Receiver Station Selector Circuit. Shorting (make-before-break) Action Insures Quietness—No Popping Noise in the Loudspeaker from the Operation of the Switch. Mallory Type 2160 Multiple Push-Button Switches Have Many Other Applications for Circuit Closing.*

An interesting sidelight on the ladder switch is its application to radio test equipment. By building such a switch with a definite non-shorting action (break-before-make) these switches can be used for ammeter of milliammeter insertion, or for voltmeter switching, and when so used provide greater convenience than can be obtained from rotary switches in that measurements can be made in any desired order, without the necessity of connecting the meters to circuits where readings are not desired, as would occur when turning a rotary switch, from one position to another.

Fig. 53A shows the contact action of an MC switch built for non-shorting, or break-before-make operation. Fig. 53B shows a typical application in test equipment.

Note: Standard stock types of MC switches may be purchased for constructional purposes. These stock types are available as follows:

(a) Circuit closing—shorting action. Depressing button connects together two independent groups of three terminals.

4 button size Mallory Type 2164
6 button size Mallory Type 2166
8 button size Mallory Type 2168

(b) Circuit transfer, shorting type. Depressing button transfers two circuits, viz. double pole, double throw.

4 button size Mallory Type 2184
6 button size Mallory Type 2186
8 button size Mallory Type 2188

(c) Circuit transfer, non-shorting type, same as 2160 series, except that a definite break-before-make operation is provided. For test equipment applications:

4 button size Mallory Type 2194
6 button size Mallory Type 2196
8 button size Mallory Type 2198

Fig. 53B. Meter Switching Circuit—This circuit permits the instant insertion of a current reading meter into any one of the various circuits, at the same time maintaining "through" connections on the balance of the circuits.

Voltmeter Switching—The Type 2190 switch is adapted for connecting a single voltmeter across a number of independent circuits. The connections are similar to Fig. 53B except that the terminals marked "A" are unused, and the interconnecting wires shown between them are omitted.

NOTE: The switching action of the Type 2190 switches is identical to the Type 2180 except that it is non-shorting both between contacts on the same plunger and other plungers.

Several of the tuned circuit substitution type receivers employ a switch in which the trimmer condensers are an integral part of the switch design. The switch structure is arranged to provide shielding between the circuits. An example of the use of such a switch is that employed in the Sparton "Selectronne,"

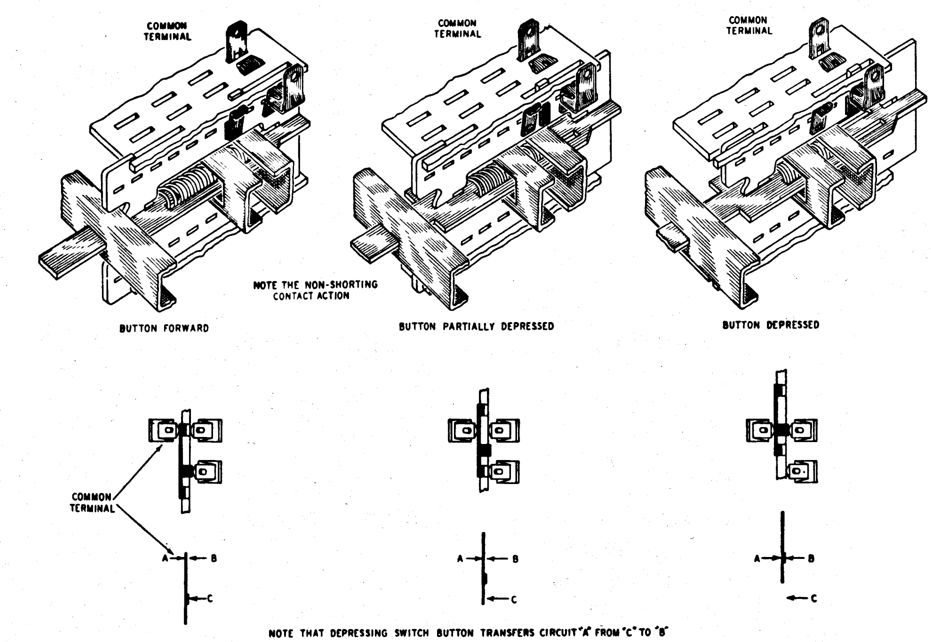


FIG. 51—*A Terminal Arrangement Frequently Used in Push-Button Tuning Provides a Circuit Transfer or Series Action. Fig. 51 Shows the Contact Arrangement, Fig. 52 Shows Its Application in a Typical Circuit.*

TYPICAL APPLICATION

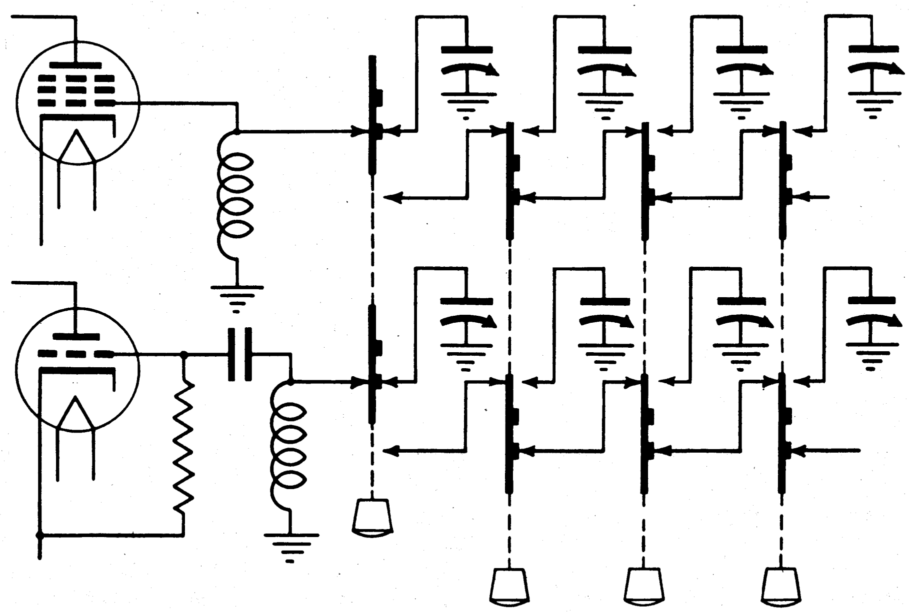


FIG. 52—*Radio Receiver Station Selection. Transfer Type Circuit.*

NOTE: *Button No. 1 transfers tuning to the gang condenser. Other buttons used for station selection.*

Series Operation Principle with Mallory MC Switch

illustrated in Fig. 63. A shielding box with partitions as indicated by dotted lines separates the individual groups of trimmers. Shielded cables of a low capacity type connect these trimmer groups to the input, detector, and oscillator transfer switches as described in Note 6A.

A somewhat different latch assembly is a feature of the "Selectromatic" unit shown in Figs. 54A and 54B. This unit which is intended for use in converting existing two gang receivers to push-button operation employs a side acting bar for holding and releasing the plungers. This design is similar to the one in use in apartment house telephone systems. The plungers are turned from round rod stock and have cone-shaped locking grooves which co-operate with round holes in the latch bar. The latch bar is forced to one side by a spring which causes its hole to overlap the edge of the cone, thus preventing the cone from returning to its released position. When a plunger is depressed, its cone aligns the hole in the latch bar causing the latch bar to move sideways. As the cone moves through the hole in the bar, the bar is in such a position that any previously held plunger cone will pass through it thereby releasing the previously selected circuit. In use the individual sections of this switch are paralleled across units of the gang condenser. When the release button is pressed these circuits are opened allowing the receiver to be tuned manually by the gang condenser. When using the automatic unit the gang condenser is turned to its minimum capacity stop.

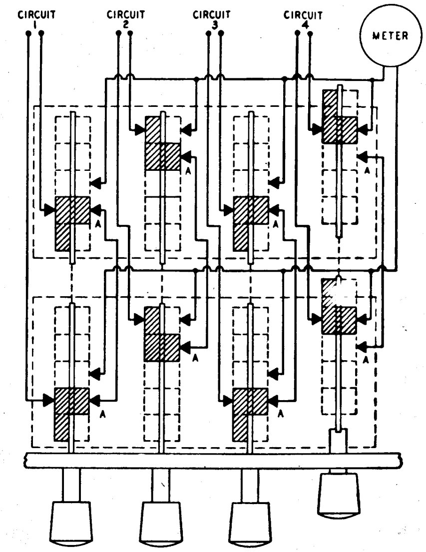


FIG. 53B

The Howard push-button switch is used as shown in Fig. 55 in a separate conversion unit as described in Note 6D and Fig. 74. A feature of this switch is the use of silver-plated steel wire loops for terminals. These loops are connected to ground by the actuated plunger which itself is silver-plated. Since the unit contains its own converter tube it consti-

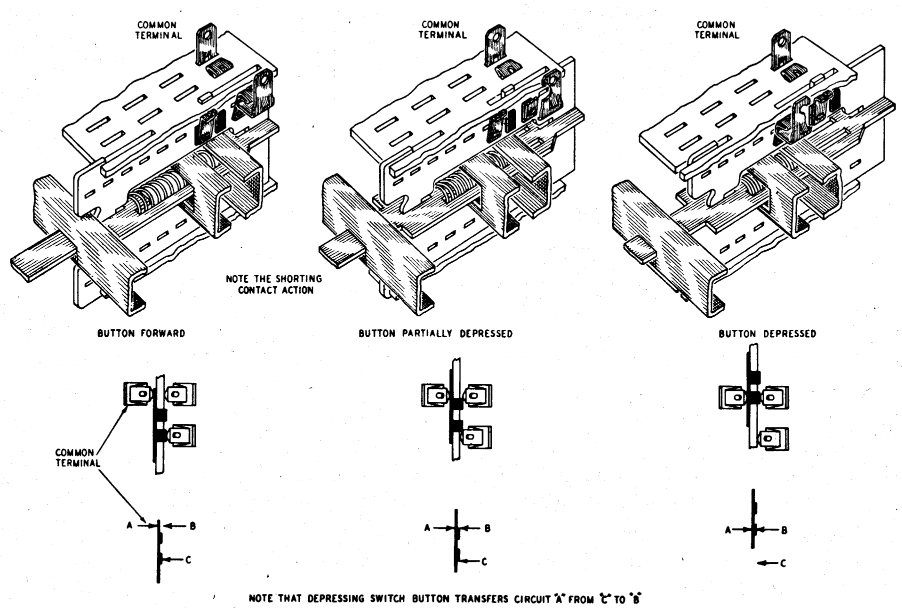


FIG. 53A

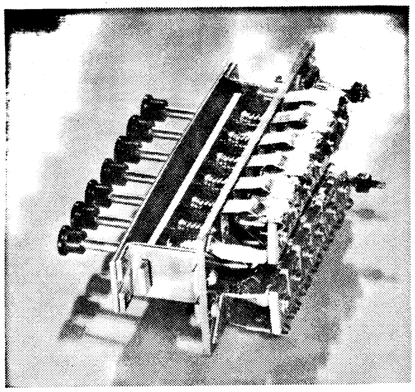


Fig. 54a—*Pacific "Selectromatic" Unit—View from Top*

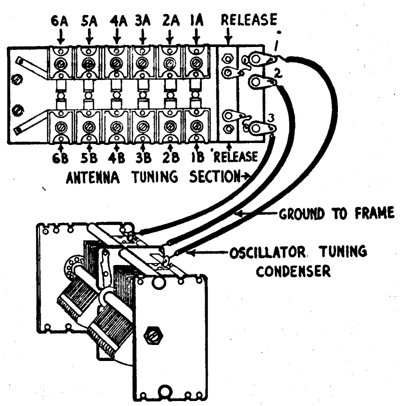


Fig. 54b—*Pacific "Selectromatic" Unit—Wiring Diagram*

tutes the entire pre-amplifier oscillator and detector of a superheterodyne. The addition of a rectifier and filter makes possible in the type 211 converter a unit which may be used for remote control purposes with the radio receiver to which it is attached tuned to a frequency below the broadcast band (540 kc.) and acting as an I.F. amplifier.

Air King—Trimmer condenser switching is employed with the series or "L" terminal. This allows one of the push-button positions to be used for the selection of the gang condenser. See Fig. 71A and Note 6D.

Automatic Electric—Iron core tuning is employed in the oscillator circuit of several models with switching accomplished on the ground side of the circuit. Note 6B and Fig. 66 cover the details of circuit connections.

Erla—The series operating or "L" terminal circuit is used as illustrated in Fig. 71A. Transfer switching to gang condenser is accomplished on the push-button switch. A feature of this circuit is the use of fixed condensers having a negative drift of capacitance with temperature to compensate for the positive drift tendency of the trimmers, coil, and tubes.

Garod—The Garod "Prestomatic" receivers employ ground side switching for the connection of dual trimmers. See Fig. 69.

General Electric—General Electric receivers employ two distinct types of latching switches in touch tuning models of the motor-driven and capacitor substitution varieties. The motor-driven model actuates "jack spring pile-up" switching as described on page 184. The trimmer condenser models use a latching type switch as shown in Fig. 73. This switch employs wave band type terminals with contactor shoes carried by strips of thin bakelite. Connection is made to the high potential side of the circuit. Further details of the switching as regards the transfer button are described in Note 6D, page 176.

Gilfillan Bros.—Models of this company employ latching switches in both motor driven and trimmer substitution types. The motor-driven model incorporates a novel feature in the push-button switch as shown in Fig. 59. This comprises the use of two buttons at the center of the switch which are non-latching but which have a release cam so that the act of depressing either of them releases any previously latched plunger. These buttons are used for continuous scanning in either direction as shown and are employed when it is desired to rapidly tune across the broadcast band for the purpose of selecting a desired type of program. One of the buttons is connected to run the motor in the clockwise direction and the other to run it in the opposite or counter-clockwise direction. Skillful manipulation of these plungers enables them to be used in lieu of the manual tuning knob.

In the automatic "Touch Tuning" models, condenser substitution is employed with transfer switching in one of the push-button units as described in Note 6D.

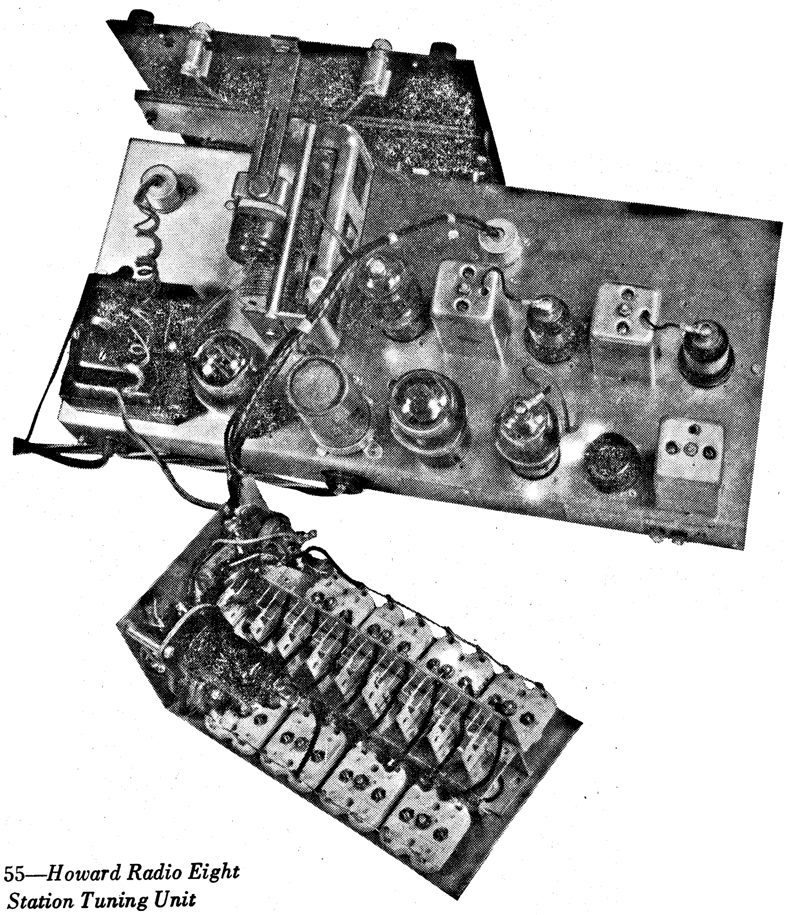


Fig. 55—*Howard Radio Eight Station Tuning Unit*

HERBERT HORN—Herbert Horn motor-driven models employ a circuit similar to that shown in Fig. 75.

HOWARD—The motor-driven models use a latching type push-button switch with series connection (see Fig. 71). The transfer switch opens this series circuit to prevent operation of the motor while on manual tuning.

Tuned circuit substitution models employ a separate converter tube as described and illustrated in Figs. 74 and 55.

NOBLITT-SPARKS—In these receivers a double row construction switch similar to that illustrated in Fig. 48 is employed to connect three sets of trimmer condensers. A shield is interposed between the switch terminals to prevent couplings between circuits which might result in instability. The method of mounting the trimmer condensers and connecting them to the switch terminals is shown in Figs. 56, 56A, 57, and 57A. In this switch the sliding contactor shoe is grounded and switching is performed between the low or rotor side of the trimmers and the frame or ground. Transfer from manual to automatic tuning is performed by the wave change switch whose counterclockwise position transfers coil circuits to trimmer tuning as described in Note 6B.

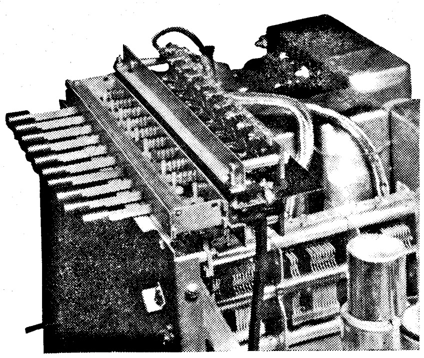


FIG. 56—*Noblitt-Sparks (Arvin) Ten-Station Selector Switch—Top View*

PACIFIC RADIO (Chicago)—The "Selectromatic" tuning unit has been described.

PACIFIC (Los Angeles)—Several models employ condenser substitution with the push-button switch in the high side of the circuit. The first or gang tuning position connects the gang condenser in the same manner in which the other positions select trimmers. A transfer position to manual tuning is used on the wave band switch.

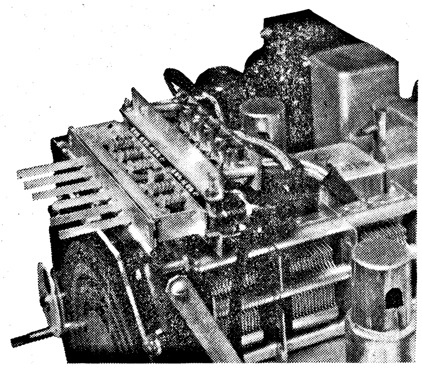


FIG. 56A—*Noblitt-Sparks (Arvin) Six-Station Selector Switch—Top View*

PACKARD-BELL—The Packard-Bell "Automatic Tuning" motor-driven model uses a series connected switch with two non-latching buttons for scanning operation as discussed above.

RADIO PRODUCTS — "Touch-O-Matic" tuning models of the Admiral line use a series-connected "L" terminal switch whose wiring is shown in Fig. 75. Operation of the "off" or transfer button is described in Note 6D.

SPARKS-WITHINGTON—The Sparton "Selectronne" switching unit serves to ground three independent sets of trimmers as shown in Fig. 63, and described in the introduction to this section.

WARWICK—The Warwick push-button switch combines series and parallel connections on separate sides on the same unit as shown in Fig. 72.

WILCOX-GAY—Models A48 and 7S5 which feature the choice of six selected stations without gang condenser tuning, use an insulated shoe construction in which the contact arm connects three terminals together. One of these terminals is the grid, another the coil and a third the selected trimmer. By using a tap on the coil it is possible to restrict the range of the trimmers without restricting frequency coverage of the re-

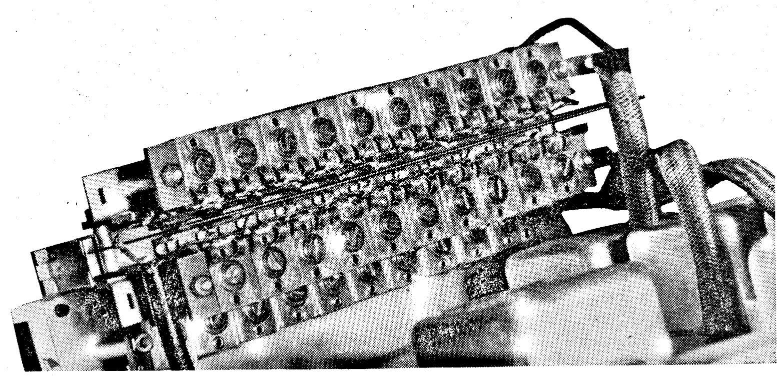


FIG. 57—*Noblitt-Sparks (Arvin) Ten-Station Selector Switch—Rear View*

R.C.A.—"Electric Tuning" motor-driven models make use of a latching type switch. The circuit connections are shown in Fig. 61. An optional feature of the system is the use of a switch similar to that incorporated in the receiver as a remote tuning unit. Shift to remote operation is controlled by a transfer switch as shown in the circuit.

The "Automatic Electric Tuning" models use condenser tuned input circuits and iron core trimmed oscillator circuits as shown in Fig. 23, page 157. The switch, of double row construction, is of the high side connection type.

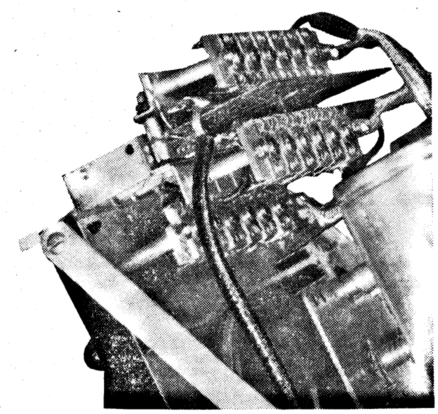


FIG. 57A—*Noblitt-Sparks (Arvin) Six-Station Selector Switch—Rear View* ceiver. In a particular locality in which it might be desired to have more than the usual number of selected stations toward one end of the broadcast band, a simple shift of these coil connections could be made by the service engineer.

Note 5C

As noted in the introduction a few of the motor-driven receivers employ electro-mechanical latching of a station button which also acts as a station stop position. These buttons are latched in place in a fashion similar to that described under Note 5B although they are not strictly push-button switches.

GALVIN—"Electric Automatic Radio" models described in Note 1C13 and illustrated in Fig. 17, combine the functions of a latching push-button with an electrical station stop.

UNITED AMERICAN BOSCH — Several automatic tuning models employ a button latching principle in connection with the station stop mechanism.

Note 5D

Certain Crosley and Zenith receivers use a motor drive to assist manual tune and rapidly turn the tuning mechanism to the desired station reception point. The tuning operation is then completed with the manual tuning knob. The switch controlling the motor in this case has its shaft concentric with that of the manual tuning shaft and the switch is of the center spring return type. Rotation of the switch knob toward the right causes the motor to turn in that direction. Conversely the motion of the knob to the left produces motor rotation in the opposite direction. Figs. 81 and 82 illustrate this method of control.

Note 5E

In the Fada "Flashomatic" models a rotary selector switch is used as shown in Fig. 68 to connect pre-set trimmer condensers and indicate the station tuned by lighting an individual dial lamp.

SECTION 6

Transfer Devices and Circuits From Manual To Automatic Tuning

The circuits, switches, and mechanical devices employed to transfer operation from manual or continuous tuning to automatic tuning display more variation and are inter-related with more diverse circuit functions than any of the other elements of automatic tuning. The transfer operation in some receivers is handled by a separate switch, in others by a separate position on the wave band switch and in still another group by the use of one of the switches of the push-button selector switch. In many receivers a number of functions are performed by the transfer switch such as the removal of automatic frequency control operation when in the manual position, addition of transfer to phonograph operation, or removal of audio muting. The circuit diagrams used in illustrations of transfer switching will in some cases also serve to illustrate details to be covered under the headings of push-button station selector switches, audio silencing and AFC release.

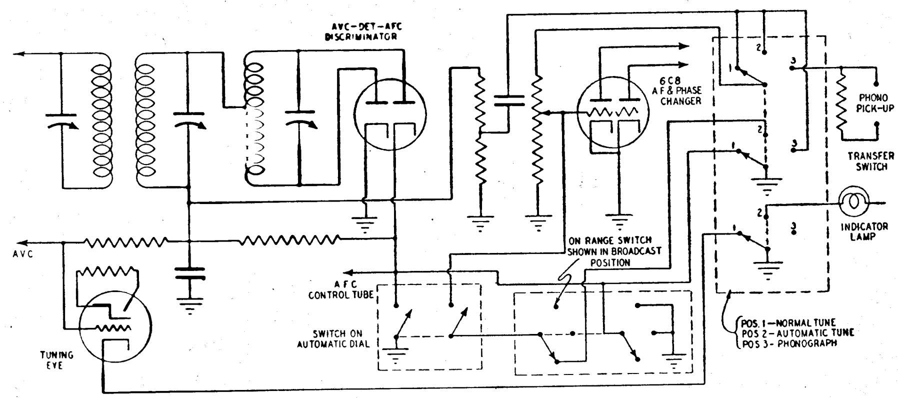


FIG. 58—*Colonial (Sears-Silvertone) Transfer Switching Diagram*

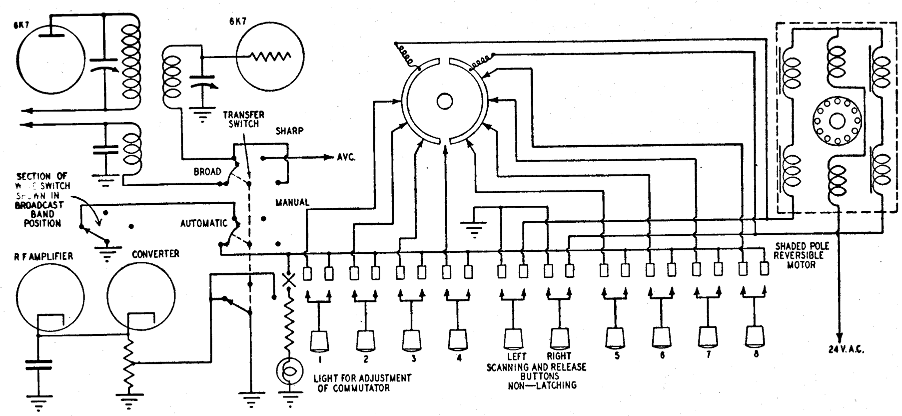


FIG. 59—*Gilfillan Bros.—Transfer Switching and Selectivity Control*

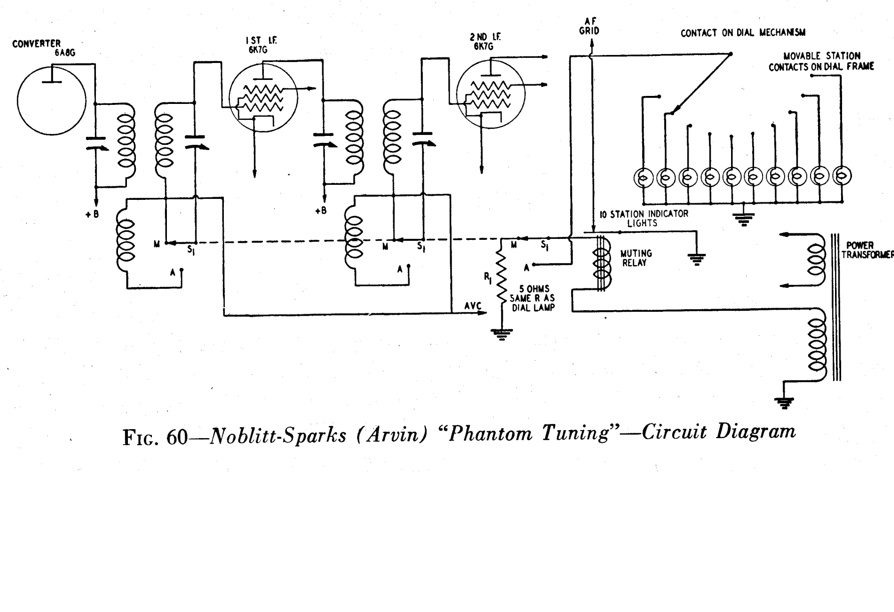


FIG. 60—*Noblitt-Sparks (Arvin) "Phantom Tuning"—Circuit Diagram*

Note 6A

The use of a separate transfer switch for changing from manual to automatic tuning is found in receivers of all three classifications of automatic tuning. The transfer switch is found to handle RF, AF, motor or dial lighting circuits and in many cases, combinations of these circuits.

COLONIAL—Fig. 58 shows the interconnection between three separate switching groups employed in some of the Colonial (Sears-Silvertone) receivers. The three-point switch shown at the right in Fig. 58 provides for normal or manual tuning in its first position, automatic tuning in its second position and phonograph operation in its third position. It consists of three separate sections. The upper group serve to connect the audio grid to either the detector or the phonograph pick-up. The middle group interconnects with the wave band and dial switches to provide the release of AFC and audio muting when in the broadcast manual position, using these functions in the automatic position and the short circuit of the detector output when in phonograph operation. The lower switch serves to connect an indicator lamp while in the automatic tuning position. The wave band switch carries contacts which disconnect the AFC system on both of the short wave positions as well as rendering the audio muting circuits inoperative in short wave positions.

GILFILLAN BROS.—This model (circuit diagram shown in Fig. 59) combines the operation of transfer with that of selectivity control. The three-position switch when in its counter-clockwise position provides for automatic tuning by completing the motor supply circuit and at the same time operates on the coupling of the IF transformer to broaden its response. In the center position the receiver is used for manual tuning with the IF coupling adjusted for sharp response, the motor circuit open and the sensitivity of RF amplifier and converter altered by change in bias. The third or clockwise position provides for manual operation with broad response of the IF amplifier. In this position the bias has been returned to the same condition as in position one but the motor circuit is open to prevent the use of the automatic tuning function. An addition-

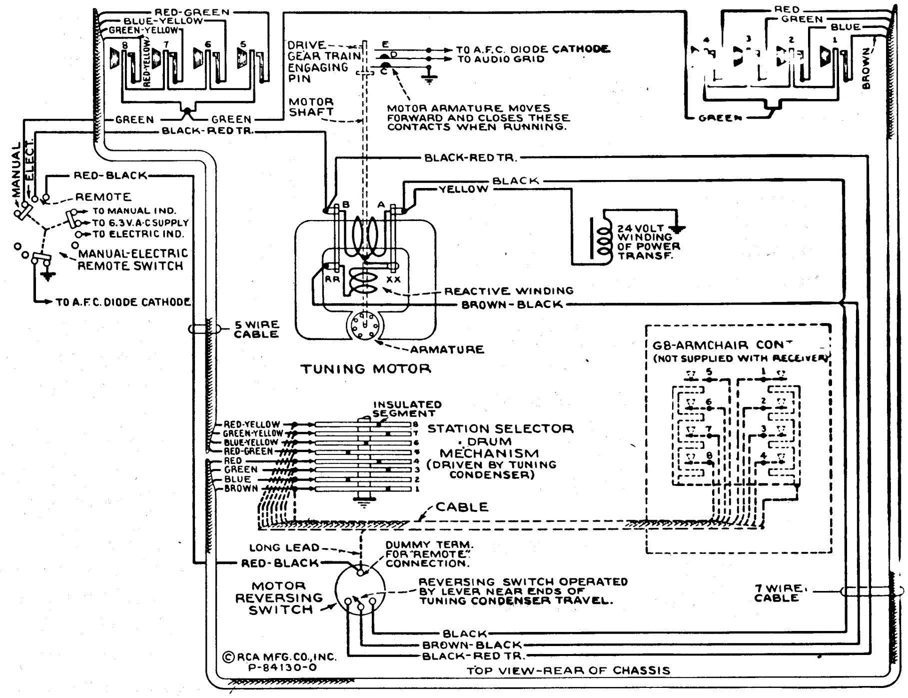


FIG. 61—*R.C.A. Motor-Tuning System—Wiring Diagram*

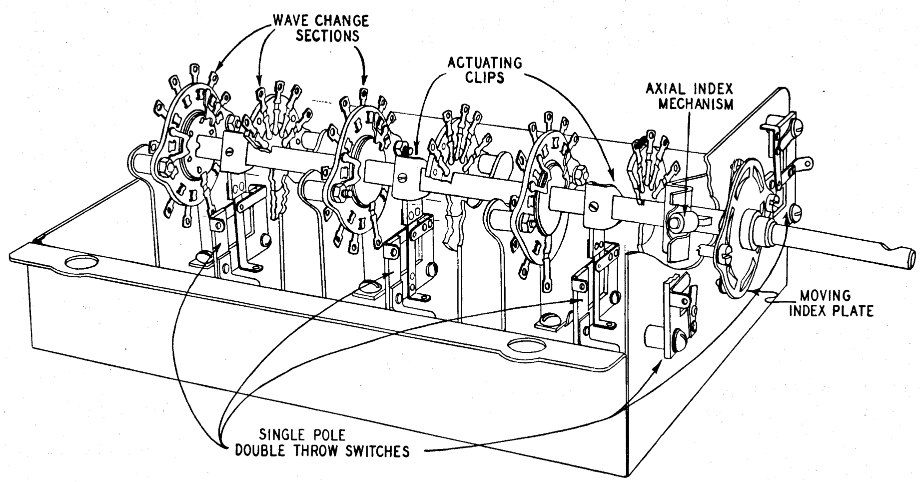


FIG. 62—*Sparton "Selectronne"—Transfer Switch Assembly*

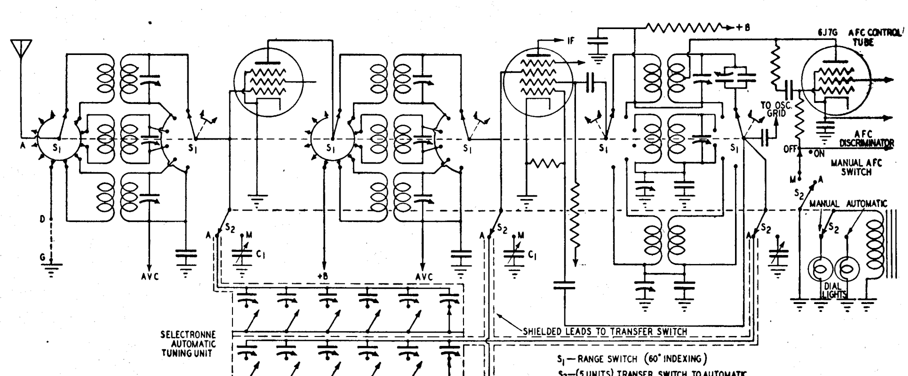


FIG. 63—*Sparton "Selectronne"—Schematic Wiring Diagram*

al interconnection of the motor circuit through the broadcast position of the band switch prevents the use of automatic tuning when the switch is in either of the short wave positions.

NOBLITT-SPARKS—Fig. 60 shows the use of the transfer switch in connection with a band-widening circuit and a relay controlled muting circuit. This latter circuit is covered in greater detail in section 7. When on the manual tuning position, both intermediate frequency stages are in the narrow or sharp position and the muting relay is held open. In automatic tuning both IF stages have increased coupling for broad response and audio muting is controlled by station contacts on the dial. The use of broad response in the automatic tuning position obviates the necessity of automatic frequency control.

Note—the change from sharp to broad tuning when in the automatic position is used in a number of makes of receivers on the theory that automatic selection is used for high level or local programs only. In this case it is not only desirable to have high fidelity response but also broad tuning to cover slight inaccuracies incidental to automatic tuning.

PHILCO—In Philco models employing the "automatic dial tuning system" transfer from automatic to manual tuning is accomplished by a two-pole switch which grounds both AFC discriminator cathodes when in manual tuning to render the automatic frequency control system inoperative.

R.C.A.—In R.C.A. receivers of the motor-tuned type the transfer switch serves the additional function of selecting either automatic operation at the receiver or at a remote point. Indicator lights for manual or electric tuning are selected by the transfer switch as is also the removal of AFC control while on the manual position (see Fig. 61).

SPARKS-WITHINGTON—The transfer switch of the Sparton "Selectronne" is of a very novel construction since it makes use of axial movement of the wave band switch shaft. This is accomplished by mounting the individual switch sections of the wave band switch to partitions of a subassembly in such a manner that the rotor staff of the switch can be moved longitudinally to operate a series of five single-pole double-throw switches. This transfer switch assembly is shown pictorially in Fig. 62 with the schematic wiring diagram in Fig. 63.

The three switch sections mounted adjacent to the wave band sections are used to transfer the grids of the RF, detector, and oscillator tubes to either the gang condenser for manual tuning or to their respective sections of the push-button capacitor group for automatic tuning. The two switches shown on the front plate of the unit are used to operate the AFC and dial light circuits. An advantage of this type of switch lies in the low capacitance of the transfer switches to ground and their close proximity to the desired switching points.

STROMBERG-CARLSON—The "Electric Flash Tuning" models employ a transfer switch of unique design which embodies some of the functions usually associated with wave band switches. In fact the switch is constructed with wave band or rotary selector type terminals although it is of sliding construction as shown in Fig. 64. Because of its construction it has been termed a "shuttlecock" switch. Circuit diagram Fig. 65 shows that the switch is not only used to change from the gang tuning condenser to preselected trimmer units but also to drop the RF amplifier stage when on the push-button position. The switch is mounted directly on the side of the gang condenser thereby assuring short interconnecting leads and a minimum of capacitance to ground due to the relatively great separation of the switch terminals from each other and ground.

The functions of dial light switching and release of automatic frequency control on manual positions are additional functions handled by the switch. The switch is moved between its two positions by a mechanical link connecting a knob on the tuning panel with the stud in the moving member. Coils L1 and L2 reduce the effective inductance of input and oscillator tuning coils when on the push-button position to accommodate the high minimum capacitance of the push-button bank and allow tuning to the high frequency and police stations. Note—The inclusion of what would normally be considered wave band switching functions on the transfer switch are an indication of the trend toward push-button wave band switching.

Note 6B

Transfer from manual to automatic tuning is often accomplished by providing an extra position on the wave band switch. This method is frequently found in receivers of the Tuned Circuit Substitution Types. It provides a ready means of removing the minimum capacitance of the push-button condenser group when on the manual or continuous tuning position. In some of the motor tuned types the use of additional contacts on the wave change switch provides the function of limiting automatic operation to the broadcast band by breaking the motor supply circuit when the band switch is in any of the short wave positions. The use of the band switch for transfer has been briefly indicated in the description of typical substitution tuned systems on page 157 and illustrated in Figs. 21, 22, and 23, page 157.

AUTOMATIC RADIO—In several of the Automatic Radio models an unusual switching sequence is provided to change from a conventional variable condenser-tuned circuit to a combination of trimmer and iron core tuning on the automatic position. Fig. 66 shows the use of a three-position wave change switch consisting of six single-pole three-position units. When in the automatic tuning position the detector input is transferred to a separate antenna coupling coil tuned by individual trimmer units. On this same position a novel oscillator circuit is in use employing a separate tube (type 76) connected as a Colpitts or capacitance feedback type. The Colpitts is ideally adapted to iron core trimmed circuits since it does not require the use of feedback coupling coils and allows the switching of the iron trimmed coil units by a simple single-pole grounded switch.

ERLA (SENTINEL)—The Erla "Flash Tuning" and "Automatic Tune Wheel Dial" models employ circuits on the band switch to control the lamp circuit, audio silencing and AFC release as shown in circuit diagram Fig. 67. Audio silencing and AFC details are unusual in that a bias change of the RF and IF amplifiers are used (see Section 7).

FADA—Fig. 68 shows the use of a wave band switch for the dual functions of transfer to automatic tune and IF band widening when on the automatic posi-

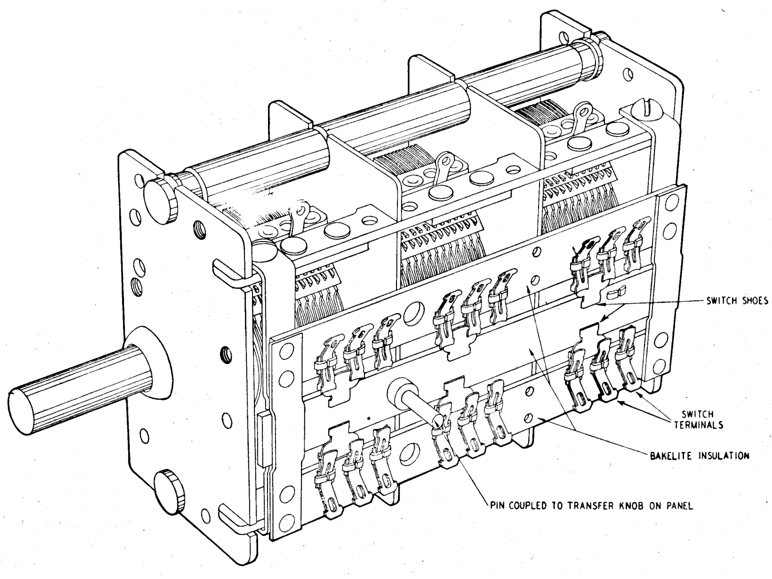


FIG. 64—*Stromberg-Carlson "Electric Flash Tuning"—Shuttlecock Transfer Switch Assembly*

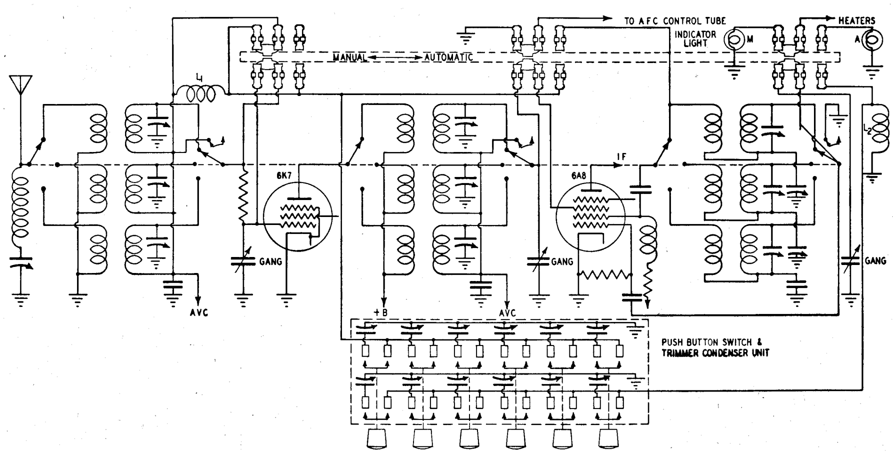


FIG. 65—*Stromberg-Carlson "Electric Flash Tuning"—Circuit Diagram*

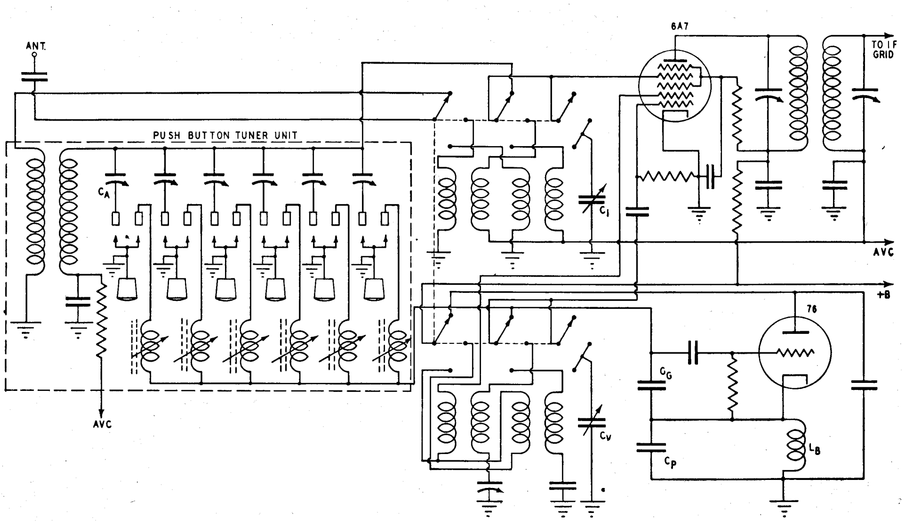


FIG. 66—*Automatic Radio Iron Core System—Circuit Diagram*

tion. An auxiliary switch is provided to narrow the IF band width during the alignment of the pre-set station trimmers. This precaution assures accuracy of adjustment and compensation for slight drift of tune in use since the receiver is always set for wide band reception when in the automatic tuning position.

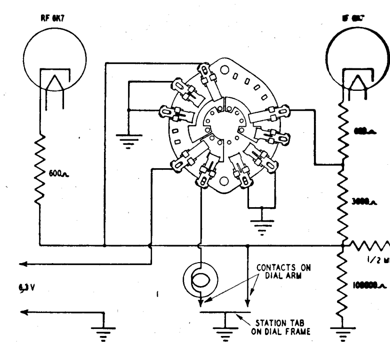


FIG. 67—*Erla-Sentinel Muting and AFC Release Circuit Diagram*

GAROD—A simple switching sequence is used on the wave band switch of the Garod "Prestomatic" receivers to connect the circuits for pre-set trimmer tuning as shown in the schematic wiring diagram of Fig. 69.

NOBLITT-SPARKS—Several models of the Arvin line employ wave band transfer switching to trimmer tuned circuits. The first or counter-clockwise position of the band switch is used to connect the broadcast coils to the pre-set trimmer units by a switching arrangement similar to that shown in Fig. 22, page 157.

R.C.A.—The schematic diagram of an "Automatic Electric Tuning" model with iron core trimmed oscillator circuits is illustrated in Fig. 23, page 157. In this diagram the wave band switch which consists of two sections has been shown pictorially to clarify the various switching positions. It is shown in position No. 1, or automatic tune, with the circuits in use shown in heavy lines. It will be noted that in the next position of the switch the units of the gang condenser will be connected and the input trimmer condensers and iron core oscillator units disconnected.

Note 6C

In the Motorola electric automatic tuner whose latching system was described in Note 1C13, transfer to manual tune is assigned to one of the push-buttons known as a release button. This release button operates a series of jack spring contacts which open the motor circuit, release or cut-out the AFC and open the audio muting. Thus when this button is depressed any of the latch buttons are released and circuits set up for manual tuning. This circuit is shown in Fig. 70.

Note 6D

A popular method of transfer from manual to automatic tuning in both the motor and tuned circuit substitution types is the utilization of one of the buttons of the push button station selector switch. This type of switch will be covered in greater detail in section 5. In the majority of cases the switch is of the latching or ladder type. The latch locks a button in place and releases any previously selected button. When the transfer switch is part of such a unit the receiver will be held in the manual tune position until it is desired to operate it automatically. In this case the selection of a particular station button transfers operation by the single motion of depressing the button rather than by two operations as would be necessary in all of the transfer devices previously described with the exception of Note 6C, which may be regarded as similar to the type under discussion.

In tuned circuit substitution receivers, push-button switch contacts are connected directly to the trimmer condensers and are part of the radio frequency circuits of the receiver. Two methods have been used for transfer as illustrated in Figs. 71A and 71B. In Fig. 71A a group of L-shaped terminals are used to produce a series switching sequence. When button one is depressed the grid and coil circuit is connected to gang condenser "G." When any other button is selected the gang condenser is disconnected and a pre-set trimmer condenser "T" tunes the coil. Fig. 71B shows a similar type of transfer switching with the exception that the trimmers are connected to a common bus when a station button is depressed. Figs. 72 and 72A illustrate the use of both of the above switching circuits in the same receiver.

Receivers introduced by Air King, Erla, Pacific (Los Angeles), and Warwick employ transfer switching of this type.

The manual button of this class of receivers may be regarded as an additional selected station button since the gang condenser may be set to a desired station other than those of the selected push button group.

General Electric—The General Electric "Touch-Tuning" Model F96, features a push-button switch in which the manual tune or transfer button com-

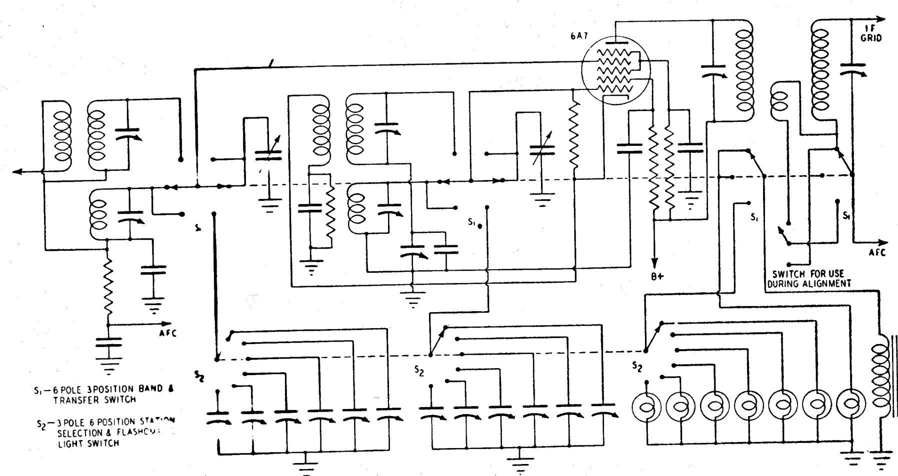


Fig. 68—*Fada Automatic Tuning—Schematic Wiring Diagram*

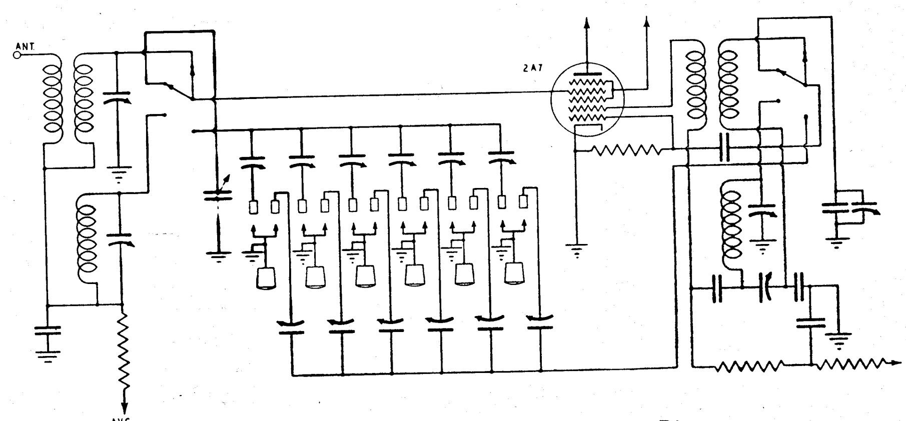


Fig. 69—*Garod "Prestomatic"—Schematic Wiring Diagram*

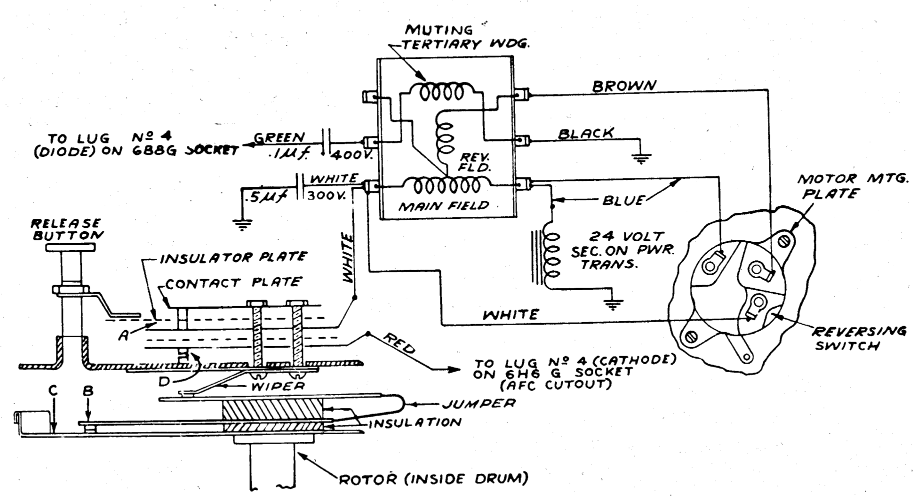


Fig. 70—*Galvin (Motorola) Electric Automatic Tuning—Wiring Diagram*

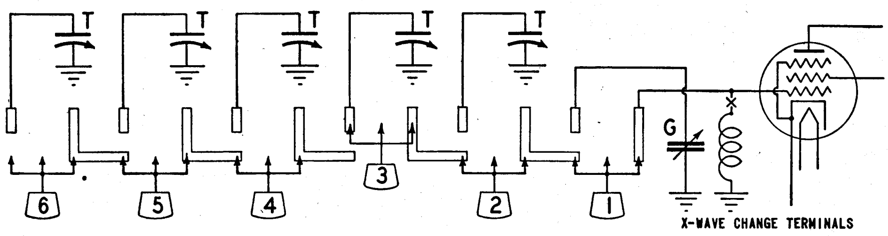


Fig. 71a—*"L"-shaped Terminals Used to Produce Series Switching Sequence*

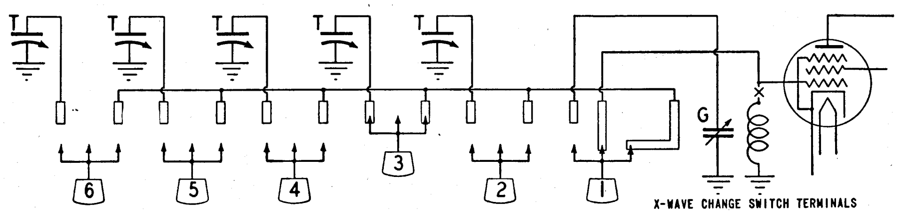


Fig. 71b—*Transfer Switching with Trimmers Connected to a Common Bus Bar When a Station Button Is Depressed*

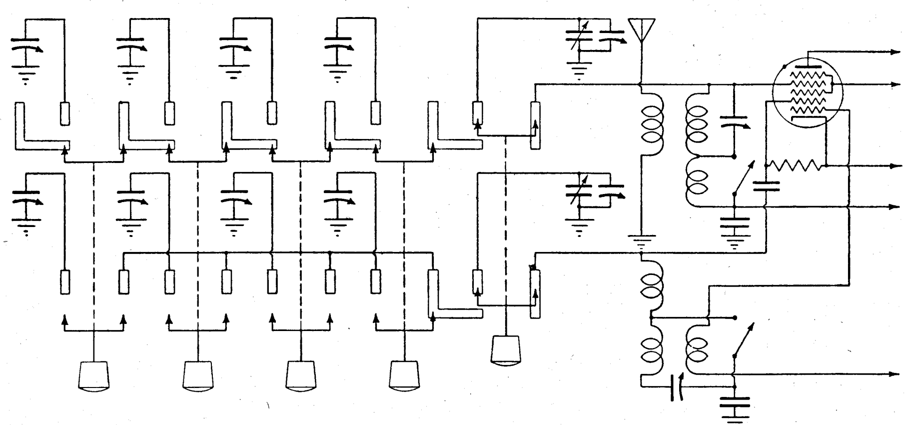


Fig. 72—*Warwick Transfer Switching as Illustrated in Figs. 71a and 71b*

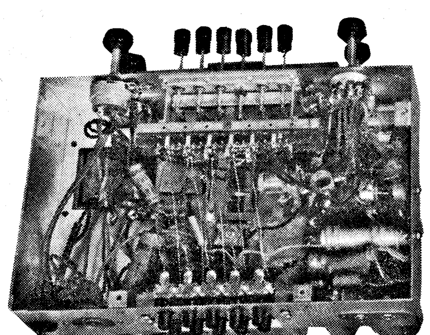


Fig. 72a—*Warwick Under-Chassis View*

bines a group of functions. Reference to schematic diagram Fig. 73 shows a similar switching sequence to that described in Note 6A and Fig. 65. Four separate units are actuated by the manual plunger which in common with the switches attached to the other plungers employ wave band type terminals. S1 and S2 serve to transfer the antenna circuit from the RF tube to the converter when on the push-button position. At the same time the pre-selected trimmer is substituted for the gang condenser unit. This operation drops the RF stage when on push-button tuning. Switch S3 serves the dual function of grounding the interconnecting link between switches S1 and S2 when the RF stage is operative on manual tuning and changing the receiver sensitivity by grounding a tap on the bias resistor of an IF tube when on the push-button position. Switch S4 transfers the oscillator grid circuit from gang condenser to pre-set trimmer condensers.

Gilfillan Bros.—The Automatic "Touch-Tuning" Model 5T8 selects the gang condenser as the first position of the push-button switch in the same manner in which the trimmer condensers are selected. This is possible since the receiver is designed to operate on the broadcast band only.

Howard—Howard Radio models employing trimmer type station selection make use of a separate converter tube for the automatic tuning input and oscillator circuits. This allows the complete automatic unit to be plugged into receptacles on the chassis so that a model may be available with or without automatic tuning with no other change. It also permits the selector switch to have grounded contactor shoes since transfer switching may be accomplished in the B supply circuit as shown in Fig. 74. Other versions of this type of unit convert older type receivers to automatic tuning and employ a transfer switch which operates in the cathode circuit.

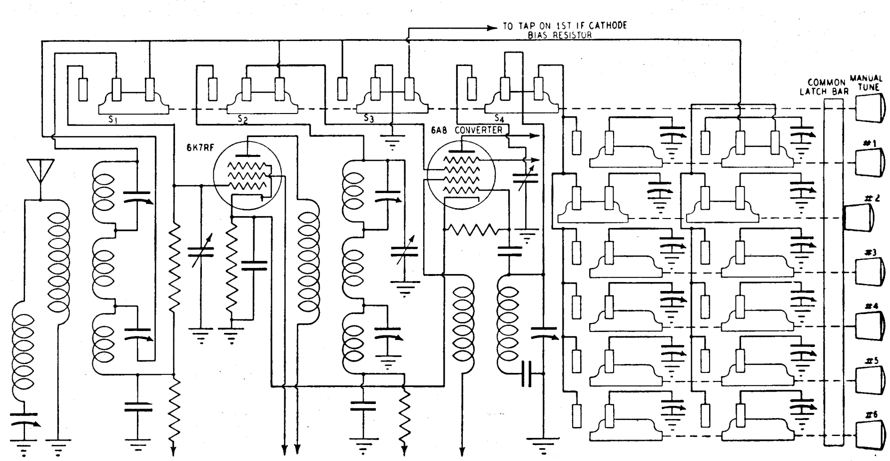


Fig. 73—*General Electric "Touch-Tuning"—Circuit Diagram*

PACIFIC (Chicago)—The Pacific "Selectro-matic" conversion unit is so designed that its input and oscillator trimmer units may be connected in parallel with the respective gang condenser sections. The gang condenser is set at its minimum capacitance during automatic operation. Transfer to manual tuning is accomplished by the simple expedient of opening the common bus to each of the trimmer banks by a double-pole single-throw switch controlled by the transfer button.

Several motor-driven models use transfer switching buttons in the push-button group. Examples are: General Electric, Herbert Horn, Howard Radio, and Radio Products.

GENERAL ELECTRIC—The General Electric motor-driven "Touch-Tuning" models make use of a latching type push-button switch with jack spring type contacts. Because of the rather involved switching a description of this system has been reserved for special consideration on page 184. The schematic wiring diagram showing the manual transfer wiring is illustrated in Fig. 78, page 179.

HOWARD—The Howard "Motor Automatic" models 400A and 425A provide manual tuning transfer by the simple expedient of opening the motor circuit with an off button which interrupts the series connected switching sequence.

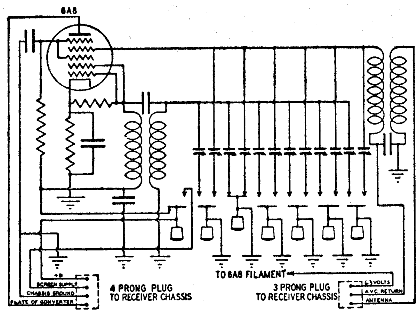


FIG. 74—*Howard Automatic Tuning Circuit Diagram*

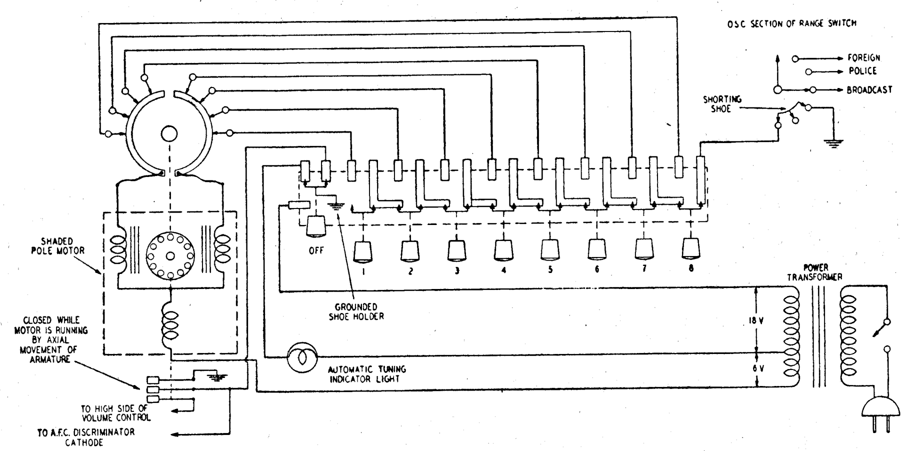


FIG. 75—*Admiral "Touch-O-Matic" Circuit Diagram*

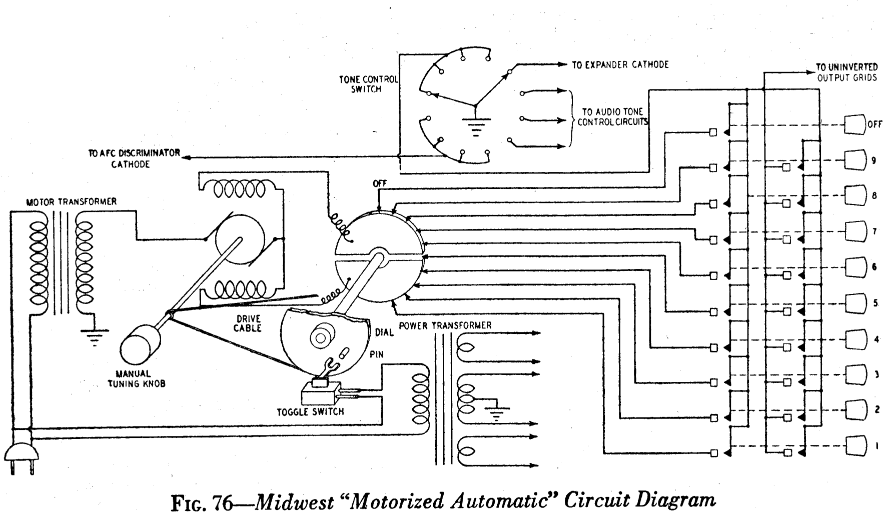


FIG. 76—*Midwest "Motorized Automatic" Circuit Diagram*

RADIO PRODUCTS—The Admiral "Touch-O-Matic" circuit, Fig. 75, combines several circuit operations on its transfer button shown on the left hand end of the group and labeled OFF. In the released or automatic tuning position the grounded contactor shoe connects the motor supply circuit to ground and allows automatic operations by depressing any one of the eight series-connected push-button circuits. In the actuated position this transfer button removes AFC by grounding the discriminator cathode and also connects the motor circuit to a lower voltage through an indicator light whose function will be described in section 8. When this off button is pressed it will unlatch any station button thereby breaking the series circuit to the motor. The Tiffany Tone Model IIA manufactured by Herbert H. Horn employs a similar transfer and motor circuit.

Note 6E

In Packard-Bell motor-tuned receivers two of the buttons of the push-button bank are made non-latching. The shape of the cams on the plungers are such that the latch bar is released when they are depressed thus unlocking any previously selected button. The circuit connections of these plungers are such as to allow their use for "scanning" or motor operation for continuous tuning. A secondary use is that of releasing the push-button control when manual tuning is desired.

Note 6F

The Midwest "Motorized Automatic" circuit diagram shown in Fig. 76, makes use of the tone control switch for the combined functions of tone control, transfer to manual tuning and release of AFC while in the manual tuning position. It is an eight-position switch. The first four positions provide for motor tuning with four selections of audio tone control, including volume expansion on one of the positions, and audio muting on all positions. The next four positions open the audio muting and motor supply circuits and provide for the same four tone control selections with the tuning controlled manually.

Note 6G

Stromberg-Carlson "Te-Lek-Tor" remote control systems as employed in the 70 series receivers make use of a mechanical clutch for shifting control from manual to automatic operation. The entire motor drive unit with its controlling commutator is declutched from an extension of the gang tuning condenser shaft by axial movement of the fidelity control knob. In manual tuning the mechanical drag of the motor drive system is removed by this clutching system.

SECTION 7

Audio Silencing During the Automatic Tuning Cycle

In practically all of the mechanical and motor-tuned systems provision is made for silencing or muting the audio system of the receiver as the tuning mechanism is being changed from one station selection to another. This is necessary since, if it were not done, a bedlam of annoying sounds would issue from the receiver as tuning progressively passed intervening broadcast channels. The methods employed from a circuit or electrical operation standpoint may be divided generally into six types:

1. Short circuiting the moving coil of the dynamic speaker or the output transformer primary.
2. Short circuiting the output of the audio diode detector to ground.
3. Grounding to chassis frame of an audio grid whose circuit is normally returned to ground.
4. Grounding the uninverted grid of a phase inverter driving system.
5. Biasing an audio tube to cut off by the application of high negative bias.
6. Applying high negative bias to the RF converter and IF amplifier tubes to reduce the receiver sensitivity.

The methods of accomplishing the muting operation have been varied and will be covered in detail in the following notes.

Note 7A

In the manually operated mechanical dials of the rotary or "telephone" type muting of the audio system is usually accomplished by the use of a metal ring of annular shape insulated from frame ground and connected to the point in the audio system which it is desired to ground. When the plungers are depressed in station selection a flange or other portion of the plunger strikes this ring and holds the ring grounded until the plunger returns to its normal position as the operator's finger is removed from it. Examples of this type of mechanism are to be found in the Fairbanks-Morse, G. H. U., Wells-Gardner and Wilcox-Gay receivers.

Similar types of dial operated muting devices with detail variations are to be found in the Colonial and Philco "Automatic Tuning Dials."

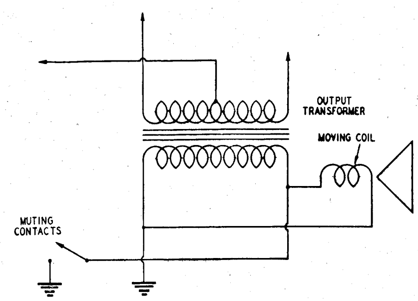


Fig. 77—*Belmont "Belmonitor" Audio Silencing Unit—Circuit*

PHILCO "AUTOMATIC DIAL"—An audio silencing switch is housed within the hub of the automatic station tuning lever. This switch is normally held open by the spring which returns the lever to its unoperated position. In making a station selection the switch closes as the lever is pressed downward upon the desired plunger (see Fig. 8, page 151).

PHILCO "CONE-CENTRIC"—Two muting circuits are connected in series to provide for manual tuning without muting and automatic selection with audio muting by selected position of the tuning lever handle. Within the diecast housing (see Fig. 12, page 152), is an insulated switch operated by axial position of the knob. This switch is connected in series with the contact on the dial disc. If either of these switches are open the receiver audio system is operative. In the manual tuning position of the knob the switch in the housing is open. In the automatic tuning position both switches are closed until the knob is pressed upon the desired cone. As this is done a lever is operated which lifts the contactor from the dial segment.

Note 7B

The Belmont lever actuated system (see page 147), accomplishes audio silencing during tune by short circuit of the speaker moving coil by means of contacts actuated by the tuning levers (Fig. 77).

Note 7C

The Midwest "Motorized Automatic" models in which the motor drive system is controlled by momentary contact push-buttons without the latching feature are silenced during tune by a pair of contacts on each button which grounds the uninverted driver grids during the tuning cycle as shown in schematic drawing Fig. 76.

Note 7D

The Erla "Flash Tuning Dial" carries a pair of contacts on a moving dial arm which light an indicator light and at the same time return the bias of the RF and IF amplifiers to normal. During the tun-

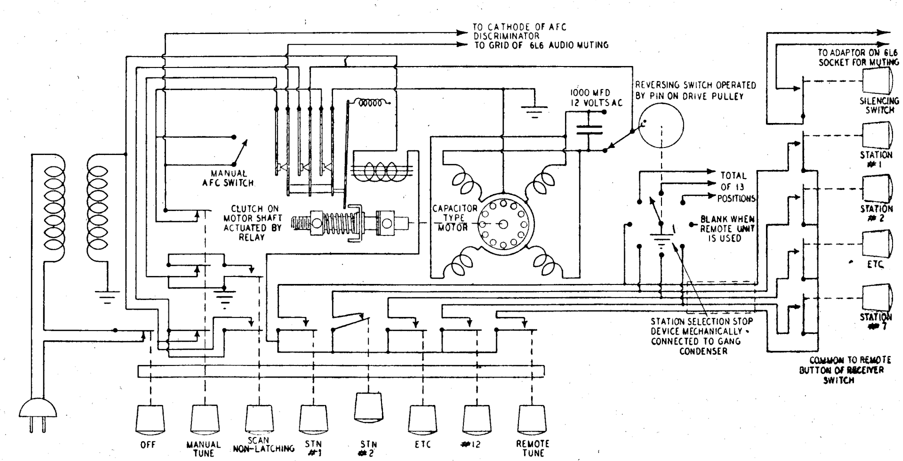


Fig. 78—*General Electric Motor-Driven "Touch-Tuning"—Circuit Diagram*

ing cycle these amplifiers have been subjected to high negative bias which renders them inoperative (Fig. 67).

Note 7E

In a number of receivers the audio silencing or muting is accomplished by the use of a magnetic relay. This is of advantage from a design standpoint when it is desired to perform the muting at a remote point as in automobile receivers or when muting is removed as a pair of contacts or circuits close rather than open. Receivers of Galvin, Noblitt-Sparks and General Electric employ muting relays.

GALVIN MOTOROLA "PRESS-BUTTON TUNING"—Fig. 20 shows the use of a relay whose contacts are connected in parallel with the speaker moving coil. The contacts are closed whenever the tuning motor is running since the relay is operated by a voltage drop across the motor armature. This circuit eliminates the necessity of extra wires in the cable between the receiver and the push-button switch.

NOBLITT-SPARKS — The Noblitt-Sparks schematic diagram Fig. 60 illustrates the use of a closed circuit to hold a muting relay circuit open. When using the automatic tuning feature, with the transfer switch on position "A," a circuit is established through the muting relay, and the selected station dial light when the movable contact on the dial (see Fig. 14) reaches the desired fixed contact. When this occurs the muting relay opens the circuit which has been silencing the audio system. With the transfer switch in position "M" for manual tune a circuit is established through the contacts of the switch and a resistor of the same value as one of the indicator lamps. This circuit continues to hold the muting relay open as long as the receiver is being used for conventional manual tuning.

GENERAL ELECTRIC—In the General Electric "Touch Tuning" motor-driven models a relay is made to serve as a control element for a number of functions. One of these is the release of audio muting as shown in Fig. 78. The details of this circuit are described on page 179.

Note 7F

In Bosch and Westinghouse models employing motor-driven electric tuning, muting is accomplished by a pair of contacts associated with a moving latch which locks on a station plunger pin. The circuit is unusual in that muting is secured by biasing the converter tube to a condition of non-operation. Muting is removed by shorting the resistor whose drop is furnishing this bias. The Stromberg-Carlson "Flash Tuning" models also employ muting contacts operating within the latch gate. (See Fig. 65.)

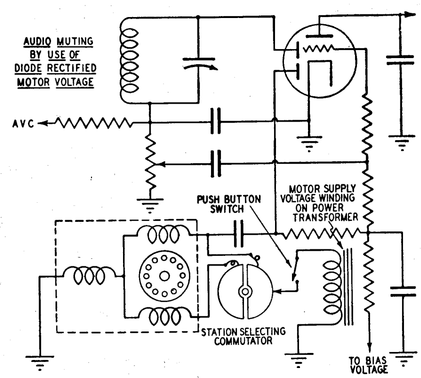


FIG. 79—*Detrola Audio Silencing Unit—Circuit Diagram*

priate resistor network. In this manner as long as the motor is running the receiver output will be silenced. The instant that the motor stops, as controlled by the selecting commutator, the audio bias returns to normal and the receiver is once more operative. Examples of the use of this circuit are to be found in the receivers of Crosley, Detrola, and Galvin. Typical circuits are found in schematic diagrams, Figs. 79 and 80. The former illustrates the use of what would normally be an unused diode plate to furnish a voltage with which to bias to cut-off the grid section of a high mu. diode-triode. Fig. 80 shows a further extension of the use of rectified motor voltage since in this case the RF and IF amplifier is rendered inoperative by high bias as well as the audio system. Thus during the tuning cycle the automatic frequency control system does not function due to absence of signal and is allowed to regain control when the amplifier once more becomes sensitive as the bias returns to normal.

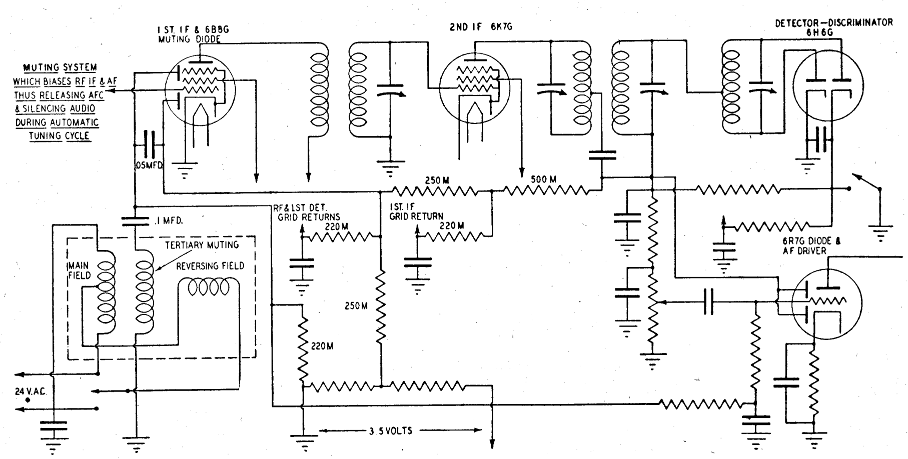


FIG. 80—*Galvin (Motorola) Audio Silencing—Circuit Diagram*

Note 7G

An effective and ingenious method of securing audio silencing in receivers employing low voltage A.C. tuning motors is by the rectification of the motor voltage to furnish a D.C. bias voltage with which to cut off the plate current of an audio tube. The voltage drop across the motor winding or across an auxiliary winding coupled to the motor field is applied to a diode plate and the resulting rectified voltage drop fed to a tube in the audio system through an appro-

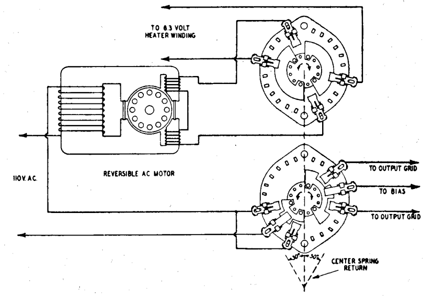


FIG. 81—*Zenith Electric Automatic Tuning Wiring Diagram*

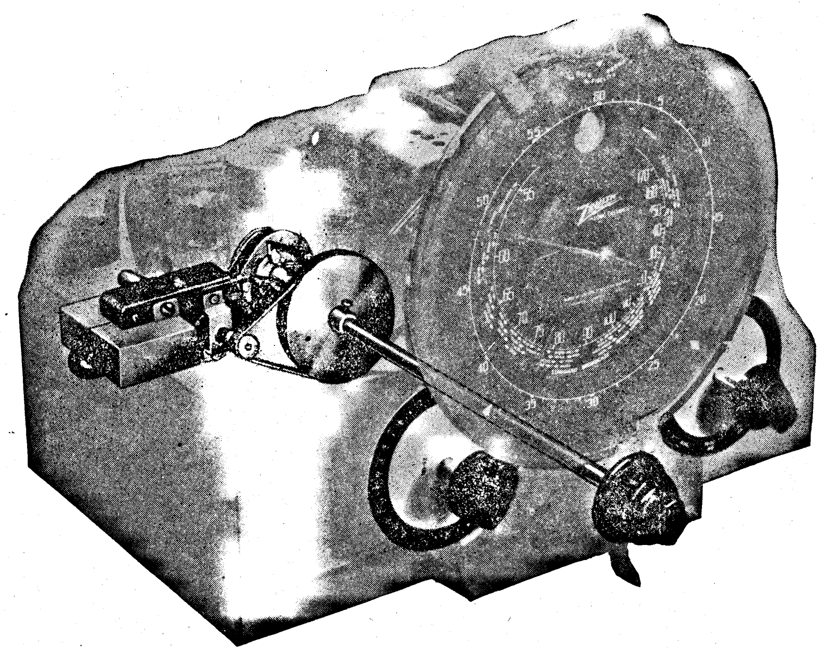


FIG. 82—*Zenith Motor Drive—Phantom View*

Note 7H

One of the earliest methods of silencing the audio system of motor-driven sets was the use of jack spring switches operated by axial movement of the motor shaft. This action has been explained in the short description of the operation of a typical motor-driven system on page 160, and will be illustrated in the section on motors. Figs. 31, 61, and 75, pages 161, 173, and 178, illustrate the action of this type of switch.

Note 7J

The scanning system of rapid tuning employing electric motor drive to be found in Zenith "Electric Automatic Tuning" models is accompanied by the silencing of the audio system with a group of contacts on the center return spring switch which controls the motor. These contacts short the input to the audio grids during the tuning cycle as shown in Figs. 81 and 82.

Note 7K

Automatic Frequency Control Release During Tune

As has been frequently mentioned in preceding sections practically all automatic tuning systems employ the automatic frequency control principle. It has been the use of this principle which has made selected station automatic control possible. A description of the operation of automatic frequency control will be found in section 11 of this book. The necessity for providing some means of rendering the AFC system inoperative during the automatic tuning cycle is obvious from a consideration of its action as the tuning knob is moved. Depending on the width of control as determined by the design of the discriminator system a strong local station will continue to hold the AFC for a few channels beyond its point of tune, thus preventing the system to "lock" on the stations of any of the intervening channels. This makes it necessary either to remove AFC action during the automatic tuning cycle or to remove it for an instant as tune is established on a desired station. It is also desirable to render the AFC system inoperative during manual tuning for the same reason. In general four methods have been applied to accomplish AFC release.

Note 7K1

In the mechanically operated manual types and in a few of the motor-driven types, which make use of the latch gate principle of stopping the motion by locking, on a plunger controlled pin, use has been made of this latch gate to control a switch whose function is to short to ground the AFC voltage for an instant before the pin locks in the gate. This type of action is possible since the sides of the gate move inward under the pressure of the pin and return to their normal positions to constitute a lock when the pin has passed the edge of the gate. Figs. 8 and 15, pages 151 and 153, will serve to illustrate this action. This switch attached to the latch gate is often connected in parallel with contacts on the transfer switch so that AFC action may be removed when manual control of tuning is desired. Such a connection is shown in Figs. 58 and 70, pages 172 and 176. In the Stromberg-Carlson "Flash Tuning" models removal of AFC is accomplished by a mechanical link of the transfer control to the latch gate switch as shown in Fig. 15, page 153.

Note 7K2

The use of high negative bias on amplifier tubes to render the receiver insensitive during the automatic tuning cycle is described in Notes 7D and 7G. This accomplishes the desired result since the signal voltage at the discriminator is below the threshold of action even for strong local signals. Bias is returned to normal at the completion of the tuning cycle. Fig. 67, page 175, and Fig. 80, page 180, illustrate this action.

Note 7K3

Relay contacts control the AFC circuits in the General Electric motor-driven "Touch Tuning" receivers. See description, page 184.

Note 7K4

AFC circuit control by movement of the motor drive shaft has been mentioned in the description of the motor-driven system on page 159 as well as in Note 7H. Illustrations of such a switch are found in Fig. 31, page 161, Fig. 61, page 173, and Fig. 75, page 178.

SECTION 8

Station Selecting Commutator Devices

The motor-driven models which make use of electrical push-button switches all have some type of selective device driven by the gang condenser for the purpose of stopping the motor system at the correct point for station tune. With the exception of General Electric "Touch Tuning" these devices open the motor circuit to stop the tuning operation. The General Electric system is different in this regard since a contact is made rather than broken to cause the system to stop. This is described on page 184.

In general these electrical station stop devices may be divided in two classes: 1. A single-pole type which does not select direction of rotation of the motor and may therefore run to one end of the tuning range and throw a reversing switch before stopping on the desired station. 2. A single-pole double-throw type which by its position determines the correct direction of rotation of the tuning motor and therefore requires no reversing switch. Several mechanical designs of widely different appearance have been developed, of which the most common is the split ring type although the multiple disc type as described in the introduction in connection with a typical motor-tuned system has been used in the receivers of some of the larger manufacturers.

Note 8A

The single-grounded disc selecting device is shown in Figs. 31, 61, and 83. As previously described this commutator is set by locking the disc against rotation by means of the selector adjusting key while the receiver is manually tuned to the desired station. Friction washers between the discs allow the commutator to rotate while the disc remains locked. After the adjusting pin is withdrawn the disc will remain in correct relative position to the shaft by which it is driven through the friction discs.

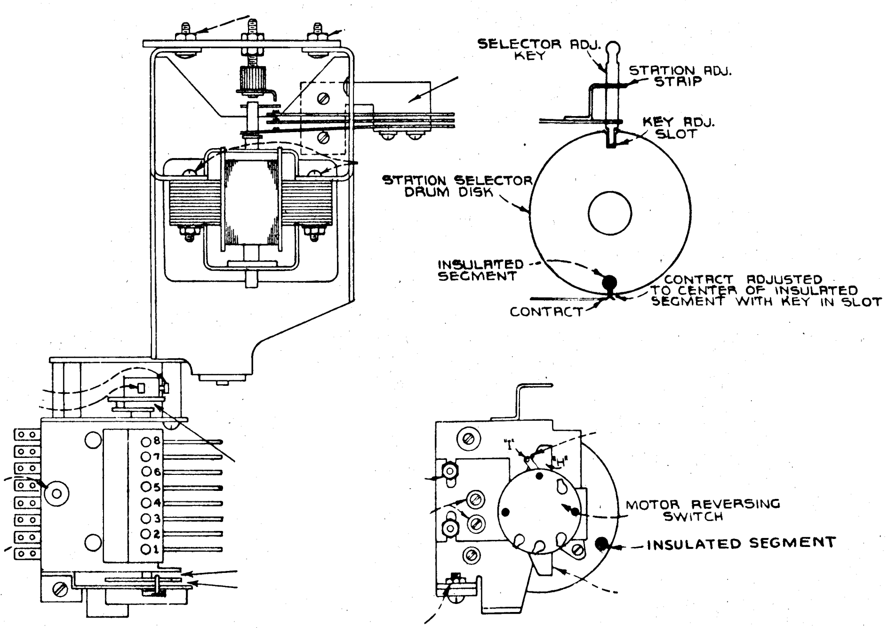


FIG. 83—*R.C.A. Motor and Commutator Details*

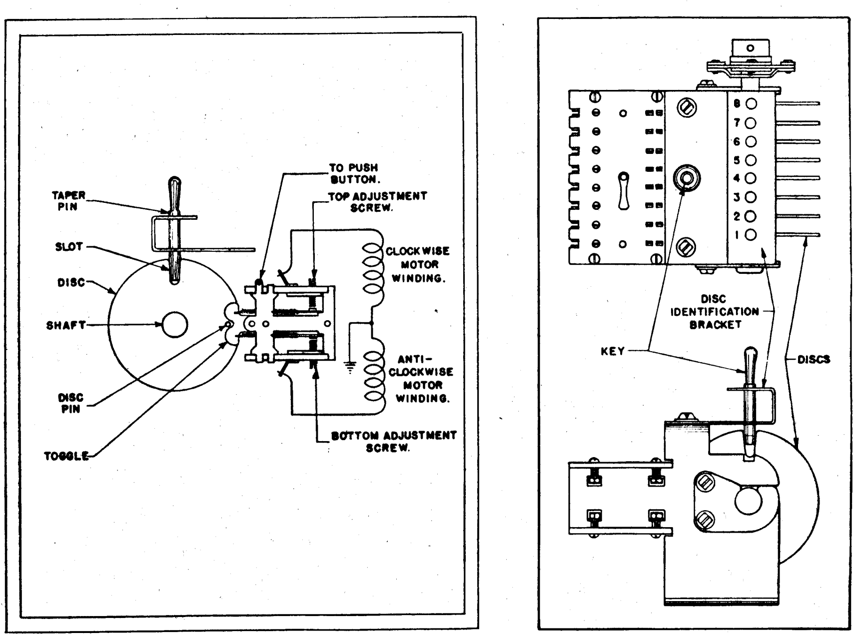


FIG. 84—*Crosley "Prestotune" Commutator Details*

Note 8B

As previously mentioned the General Electric commutating device reverses the usual procedure and makes contact of a moving grounded arm to movable insulated points for station selection. See description of G.E. "Touch Tuning" system, page 184.

Note 8C

The split disc commutator may be considered as a single-pole double-throw switch. The single pole is the selected contact point which can rest upon either one of two rings or discs or upon an insulated break between them. The motor will start to run in such a direction as to move the disc or ring towards the break. Figs. 59, 75, 76, 46, illustrate this principle. An interesting phenomenon occurs in some of these sets as the break reaches the selected contact: inertia of the system may cause over-drive past the insulated break so that contact is established with the other disc or ring. This causes the motor to start in the opposite direction and several oscillations of motion may occur about the position of the insulated break. The accuracy of this type of commutator depends upon the width of the break, speed of the system and shape of the contact.

An interesting feature has been added to a number of the receivers employing this type of commutator in the form of an indicating light for assistance of correct station set-up. The Detrola, Gilfillan and Radio Products receivers employ this light. Since the circuit connections for the operation of this light differ slightly in the models of these companies an individual brief description follows.

DETROLA—The Detrola tuning system employs a selector drum type of mechanism in which the two rings mentioned take the form of half cylinders and the contacts are pins which may be shifted around the periphery of these cylinders in two parallel slots. This arrangement allows two stations on adjacent channels to be selected by using pins on the separate slots for the desired stations. A lamp is connected between the ground and a flexible lead which may be held upon the selector pin being adjusted. While it is so held the station is accurately tuned manually and the pin moved until the light is extinguished. This indicates that the pin is resting on the insulated section of the commutator which is the correct point for automatic operation when selecting that station.

GILFILLAN BROS.—Reference to Fig. 59, page 172, will illustrate the operation of the adjustment light in connection with the commutator setting. A switch at the point marked X is provided to connect the light with its protective resistor between the common bus and the frame. With the transfer switch in the manual-sharp position, a station is tuned in by means of the usual manual tuning drive. The contactor point closest to the break is chosen for this station and with the indicator light switch closed and the station selector switch button latched in place, this selector point is moved until the light is extinguished. Suppose that the station desired was placed on button number 4 (Fig. 59). It will be noted that when number 4 button is locked in place, the circuit from the 24-volt source, tuning motor, commutator, and resistor light to ground is broken at the commutator. The resistor and light reduces the current sufficiently so that there is no tendency of the motor to rotate while this adjustment is being made.

RADIO PRODUCTS—In adjusting the Radio Products Admiral "Touch-O-Matic" system illustrated in Fig. 75, the following sequence is observed: The "off" button and the desired station button are simultaneously locked in. Under these conditions the automatic tuning indicator light is connected in series with the voltage supply to the motor from a 6-volt tap on the 24-volt supply winding. The voltage supply to the motor through the indicator light is insufficient to permit rotation of the motor, and the receiver may be controlled manually. If, when adjusted for exact resonance with the desired station, the indicator lamp is extinguished this indicates that the required contactor is resting on the insulated break of the station selecting commutator. If this is not the case and the light still glows, adjustment of the position of the contact point on the commutator can readily be made. A check of the correctness of commutator setting can be obtained at any time by locking in the required button and the "off" button. During the adjustment cycle described above the automatic frequency control system has been rendered inoperative by contacts controlled by the "off" button.

Note 8D

The Crosley "Prestotune" household receivers and Chevrolet motor car radio sets employ a combination of disc and toggle switch action as illustrated in Figs. 44, 84, and 85. Referring to Fig. 84 it will be noted that the discs are similar as regards station set-up to the type described in Note 8A. It will be noted, however, that instead of an insulated break, the disc itself carries no electrical connection, but has a pin fastened to its periphery which engages a toggle. This toggle throws a single-pole double-throw switch in one direction or the other, depending on the direction of motion of the disc. As the station is selected and the discs all start to rotate the pins of the unwanted station discs will throw their respective toggles as they pass them, in such a direction that when they are subsequently chosen the switches will have been thrown in the proper manner to start rotation towards the desired station. It will be noted that adjustment screws are provided to limit the throw of the toggle switch. Careful adjustment of these screws makes it possible for the spacing of contacts to compensate for back-lash of the driving system. In the Chevrolet commutator shown in Fig. 85 the contact arm and toggle are combined in one "T"-shaped piece. A screw at each position permits adjustment of the angular width of the break.

SECTION 9

Special Description of Receivers Not Included In General Outline

Certain receivers differ in so many respects from those listed and described in the various preceding sections that it appeared advisable to describe their operation separately. These include the General Electric motor-driven "Touch Tuning" system, the Stewart-Warner "Magic Keyboard," the Wells-Gardner "Electric Drive," Buick Sonomatic, Emerson Instamatic, Hudson Feathertouch Tuner, Motorola Electric Automatic Tuner, Flash Tuning, and Packard 333915.

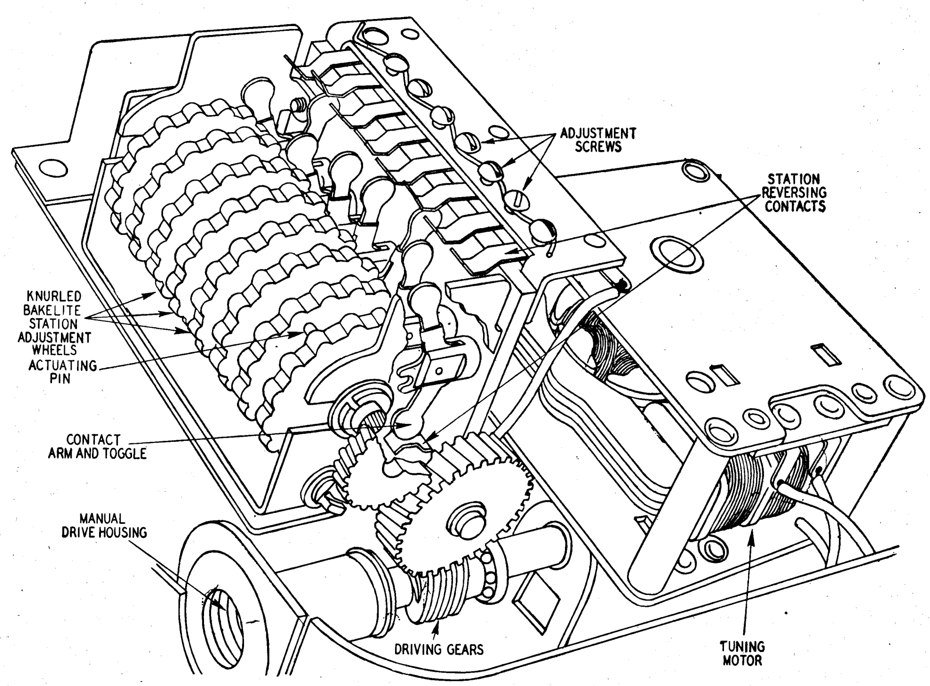


FIG. 85—*Chevrolet Station Selecting Commutator*

SECTION 9A

General Electric Motor Operated "Touch Tuner"

The General Electric "Touch Tuning" system involves the application of so many features not found in the other receivers described that a complete explanation of the operation of the system has been reserved for special consideration. Some of the individual components have been mentioned briefly in the sections devoted to them with reference to this note.

Sixteen push-buttons in a latching type switch control the operation with provision for an eight-button remote unit as an additional accessory if desired.

Of these sixteen buttons, thirteen are used for station selection, one for scanning, one for transfer to manual operation, and the last to turn the receiver off.

Referring to schematic diagram 78 it will be noted that the off button controls an A.C. line switch. This turns the receiver on whenever any of the other buttons of the switch are pressed since the line switch is in its "on" position when its plunger is released or out. To turn the receiver off it is merely necessary to press this button.

The heart of the control system is a combination relay and mechanical stop. This is shown at the center of the diagram. The armature of this relay engages a two-fingered friction clutch which acts as the connecting link between the split phase capacitor type motor and the gang condenser driving system. When the relay closes the end of the armature causes an instant stop of the drive system in addition to opening three circuits by means of contacts on six jack springs as shown.

The first pair of contacts control the release of automatic frequency control, the second pair of contacts control the motor current and the remaining pair of contacts control the audio silencing circuit.

The relay winding is energized when the station commutator on the gang condenser shaft makes contact with the adjustable contact pin to which the desired station button is connected.

Pressing the manual button releases any depressed button. Thus the relay coil circuit is opened and the relay field coil cannot be energized. When the manual button is locked in, the motor circuit is open, and the grounding of output grids and AFC circuit removed. This allows a separate manual AFC switch to be used at will when the manual button is in.

With the receiver set for manual operation depression of the scan button closes the motor circuit by shunting the open motor contacts of the manual switch allowing continuous motor operation and dial travel. As the motor drives to the limits of the dial on either end, the reversing switch operating at the end of travel is automatically thrown, causing reversal of motor rotation. Since the scan button is non-latching, it does not unlock the manual tune button as it is depressed. The audio system is silenced by a pair of contacts on the scan button which avoids reception of unwanted stations or inter-station noise when this button is used.

Since the system stops on contact, the connection of the remote control unit is somewhat different than in systems of the open circuit type. One of the receiver station selector buttons is chosen as the remote tune transfer button. The remote tune switch is connected with the lead which would normally run from this button to the commutator now serving the purpose of a common connection in the remote switch. In this way the remote button serves to connect the remote switches to the relay coil and allow parallel operation of seven positions at the remote point with any seven selections at the receiver. The eighth button at the remote point is used to silence the receiver whenever desired for such occasions as answering the phone.

SECTION 9B

Stewart-Warner "Magic Keyboard"

This mechanism combines mechanical and electrical features to produce a system requiring no transfer means to change from manual to automatic tuning other than the act of turning the tuning knob for manual operation or depressing a button for automatic operation. An additional feature not found in other systems is the dual use of the tuning knob for mechanically unlocking the station set-up cams.

Fig. 86 is a photograph of the "Magic Keyboard" unit.

The Mystic Mechanism with the Magic Keyboard is an electrically driven device for automatically tuning the receiver to any one of fifteen preselected frequencies. The receiver can be tuned either automatically or manually without the need of turning a switch.

The operating mechanism of this tuning device consists of fifteen sets each of keys; station selector cams and pawls. In addition it has two multi-contact control switches.

The back switch, mounted on the rear of the tuner, has four sets of contacts. From front to rear, they are:

1. *Reversing:* for reversing the direction of motor rotation.
2. *Power:* for opening and closing the motor power supply line.
3. *Mute:* for killing the audio system to prevent noises during automatic tuning.
4. *AFC:* for cutting out AFC during automatic tuning.

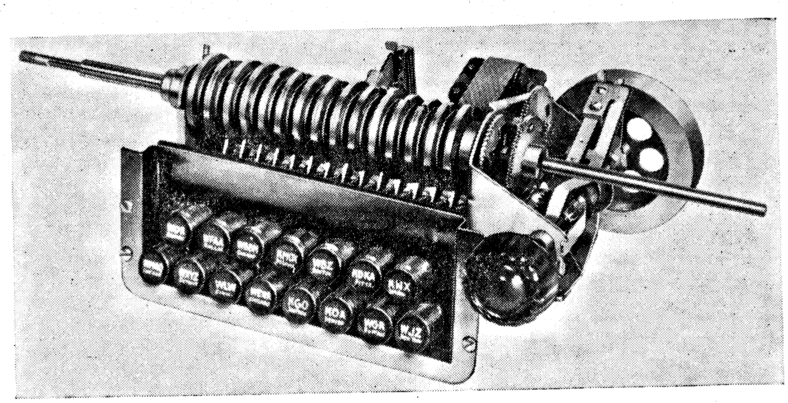
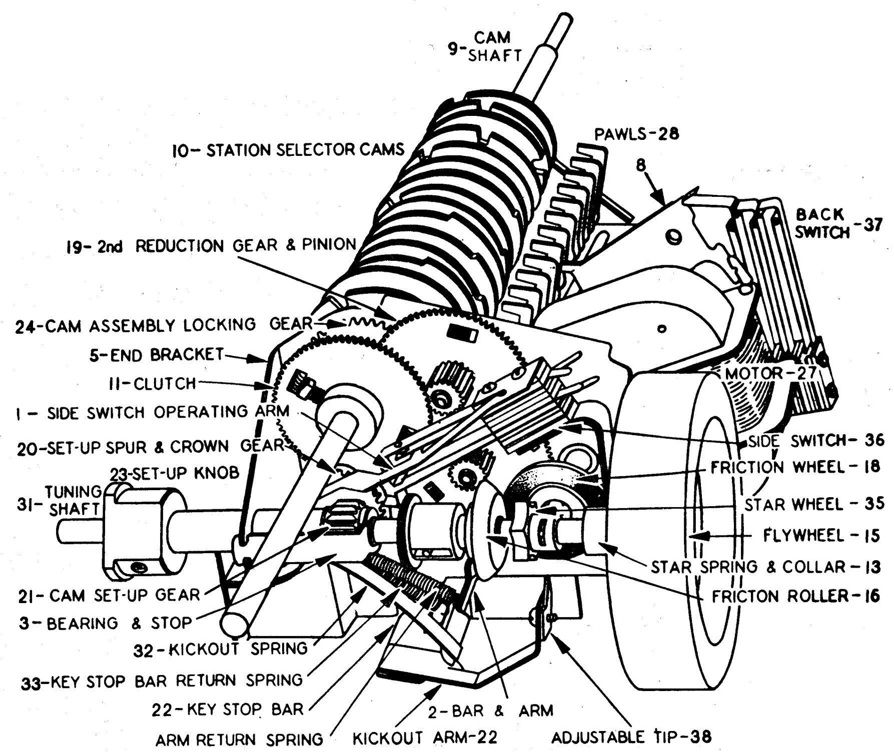


FIG. 86—*Stewart-Warner "Magic Keyboard"*



LEFT END VIEW OF MECHANISM

Fig. 87

The side switch, mounted on the right end of the tuner, has two sets of contacts. From the top down, they are:

1. *AFC:* for cutting out AFC during manual tuning and during setting up.
2. *Power:* for opening and closing the motor and automatic light power supply line.

With the tuner in the manual tuning position all switch contacts are in the position shown in Fig. 89. As a button is pressed in, its pawl is pulled against a station selector cam. It will be noted that these cams have two different heights, that is, a high and a low side. If the pawl comes to rest against the high side of the cam, the reversing contacts on the back switch are closed to the front for one direction of motor rotation. If the pawl comes to rest against the low side of the cam, the reversing contacts close to the back for the other direction of motor rotation. The direction of rotation will always be such as to bring the notch on the cam around to the pawl by the shortest route.

Regardless of whether the pawl rests against the high or low side of the station selector cam, the bakelite cam will close the Power, Mute and AFC contacts on the back switch. After these and the reversing contacts have closed, the power contacts on the side switch close and cause the motor to run.

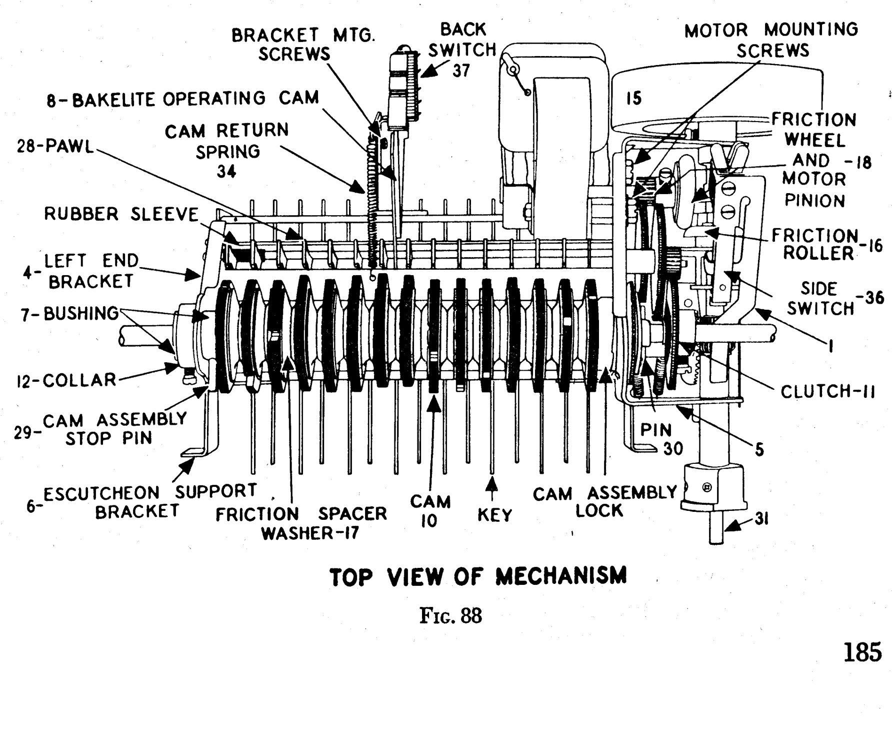
The motor drives the mechanism to the proper position for the desired station. Then the pawl falls into the notch on the selector cam and causes the bakelite cam to set the back switch contacts in new positions. The Power contacts open, shutting off the motor. The Mute contacts open allowing the signal to come in. The AFC contacts open and AFC puts the finishing touch to the automatic tuning operation.

A friction clutch in the gear train, driving the cam shaft, acts as a buffer and absorbs the shock of the sudden stop when the pawl falls into the notch on station selector cam.

During automatic tuning the manual tuning shaft is disengaged by moving the friction roller. This roller is slid away from engagement with a friction wheel as a button is pushed in. The arm that does this, also allows a kickout arm to engage a star wheel. To tune manually, a slight rotary movement of the tuning shaft causes the star wheel to force down the kickout arm. This releases the depressed button and slides back the friction roller into engagement with the friction wheel for manual tuning.

The flywheel on the back end of the tuning shaft provides a "spinner" action while tuning manually.

The station selector cams are prevented from turning on their shaft by an expansion and contraction type locking mechanism. The assembly is locked when the device is expanded or unmeshed as shown in Fig. 90B. Unlocking is accomplished by pulling out the set-up knob and turning it clockwise until a click is heard. This contracts the



TOP VIEW OF MECHANISM

Fig. 88

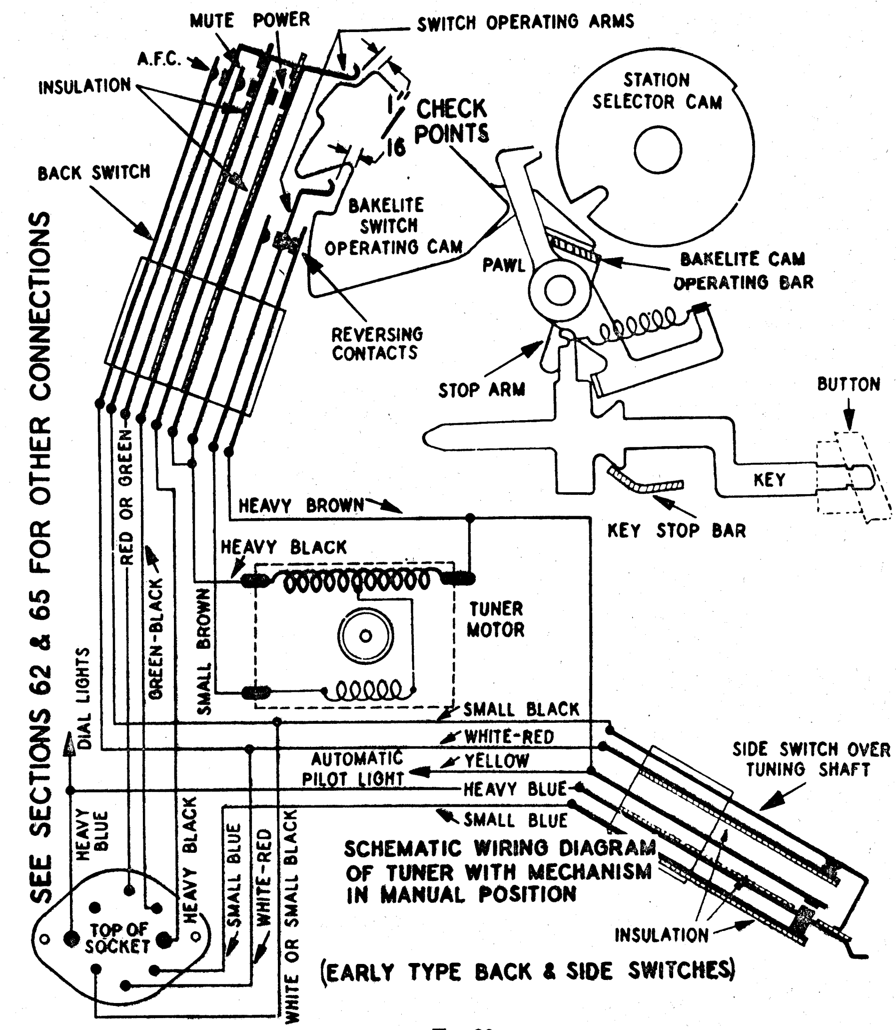


Fig. 89

locking mechanism and allows the selector cams to turn on the shaft for setting up.

Pawls

If a Pawl does not fall completely into the notch on the station selector cam, check the setting of the back switch. It is probable that the Power contacts are opening too soon. Notice that in order to fall into the notch, the pawl must work against the bar carrying the bakelite cam. Anything that makes this bar operate hard should be corrected. See that the end of the pawl and notch on the station selector cam are smooth and free from burrs. Then try closing up the Power contacts on the back switch a little more, but only after checking the above points. This may be done by bending the Power blade so the Power contacts are closer together. *Do not change the outline of the pawl or cam notch.*

Setting Up

The following points must be observed during the setting up and use of the automatic mechanism if best results are to be obtained.

On some models the tone control broadens the tuning when in the treble position, maximum clockwise, therefore this position positively must not be used *during set-up.*

a. Use a *good* antenna.

b. Allow the set to warm up for twenty minutes before setting it up.

c. Set up the buttons from left to right, that is, the right hand buttons should be the last to be set up.

d. Avoid setting buttons on weak or fading signals.

e. Tune carefully when setting up.

f. After a button is set up, do not push that button again until the mechanism is locked. To do so will spoil the setting of that button.

g. Lock up tight. Continue to force the set-up knob in a counter-clockwise direction even after it seems to reach a definite stop. If you do not use force, the settings of the buttons may change.

Setting Up Procedure

In brief, the setting up procedure is as follows:

a. Pull off the tuning knob. This reveals the set-up knob (Fig. 87). Pull the set-up knob out. Unlock the mechanism by turning the set-up knob clockwise until a slight click is heard.

b. Push in a button. After the pointer has stopped moving, grasp the set-up knob and tune in the station to which the button is to be set.

c. Push in another button. After the pointer has stopped moving, again grasp the set-up knob and tune in the station to which this button is to be set.

d. Continue to push in buttons and tune in the stations until as many are set up as desired. Then release the last button set up, by pushing the set-up knob part way in.

e. Pull the set-up knob back out. Lock up the cam assembly by turning the set-up knob counter-clockwise as far as it will go. Continue to force the set-up knob in a counter-clockwise direction even after it seems to reach a definite stop. If you do not use force, the settings of the buttons may change.

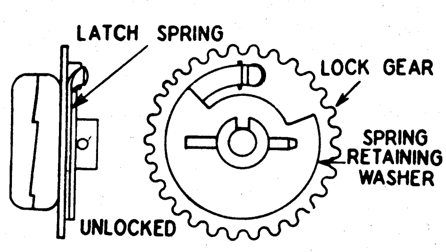
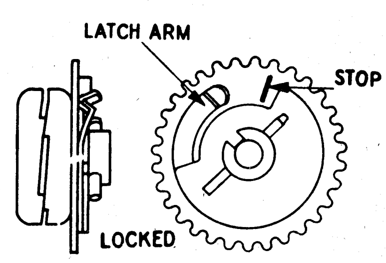


Fig. 90A



CAM ASSEMBLY LOCK

Fig. 90B

f. Push in the set-up knob and replace the tuning knob.

In case of complaint that a button set for some frequency, does not tune to that point within 10 K.C., or more, after locking up, it usually develops that the station selector cam has inadvertently been moved before it was locked. This may come about by turning the set-up knob slightly when releasing the button, preparatory to locking the mechanism. Another possibility, if the back switch is not adjusted properly, is that by pushing a second button the motor will start before the pawl falls clear of the first cam, thus causing this cam to be shifted slightly before it is locked in place.

A short may occur in the unit due to the tuning shaft bearing stop (Fig. 87) getting out of place. It then catches on the set-up gear. When the gear is turned counter-clockwise it forces the bearing stop against the hot blade of the side switch. Solder the bearing stop in place.

SECTION 9C

Wells-Gardner "Electric Drive"

The Wells-Gardner "Electric Drive" is a combination of mechanical and electrical interlocks which allows station "set-up" from the front of the receiver. The station stop mechanism consists of a series of discs which are geared to the condenser drive system and are encircled by brake shoes having notches which co-operate with stop levers as shown in the sequence of drawings of Fig. 91.

Above each station tuning button is a setting button used only when it is desired to change the pre-set tuning choice. The station tuning buttons are interlocked by means of a side-acting latch in such a manner that the act of depressing a station button will move the latch and release any previously held button. This side-acting latch or locking plate is also actuated by the manual-electric transfer control.

Fig. 91A shows the system of rocker arms and stops in position corresponding to a released plunger. It will be seen that all parts of the stop system are clear of the brake shoe and will allow its free rotation. Fig. 91B shows the tuning button depressed with the stop lever bearing against the outer periphery of the brake shoe. The ball on the end of the switch lever is depressing the switch plunger causing the motor to run. The motor will run the system until the stop lever drops into the notch and allows the switch lever ball to leave the switch, thus stopping the motor with the setting disc firmly locked in place, as shown in Fig. 91C.

Fig. 91D shows the manner in which the setting disc is released from the brake drum to allow it to be set at the correct point for station tune. The station is tuned in manually with the system as shown in Fig. 91D. The brake drum turns freely within the setting disc until it is clamped in place by the cams on the drum release and auxiliary lever, as the setting button is withdrawn. Study of the position of the various parts as shown in Fig. 91 will disclose the sequence of operation.

Audio silencing is obtained by a switch operated by axial movement of the motor shaft.

SECTION 9D

Buick Sonomatic

The push-button tuning mechanism of the Buick Sonomatic Model 980620 is illustrated in Fig. 92. One button is removed to show the lock screw.

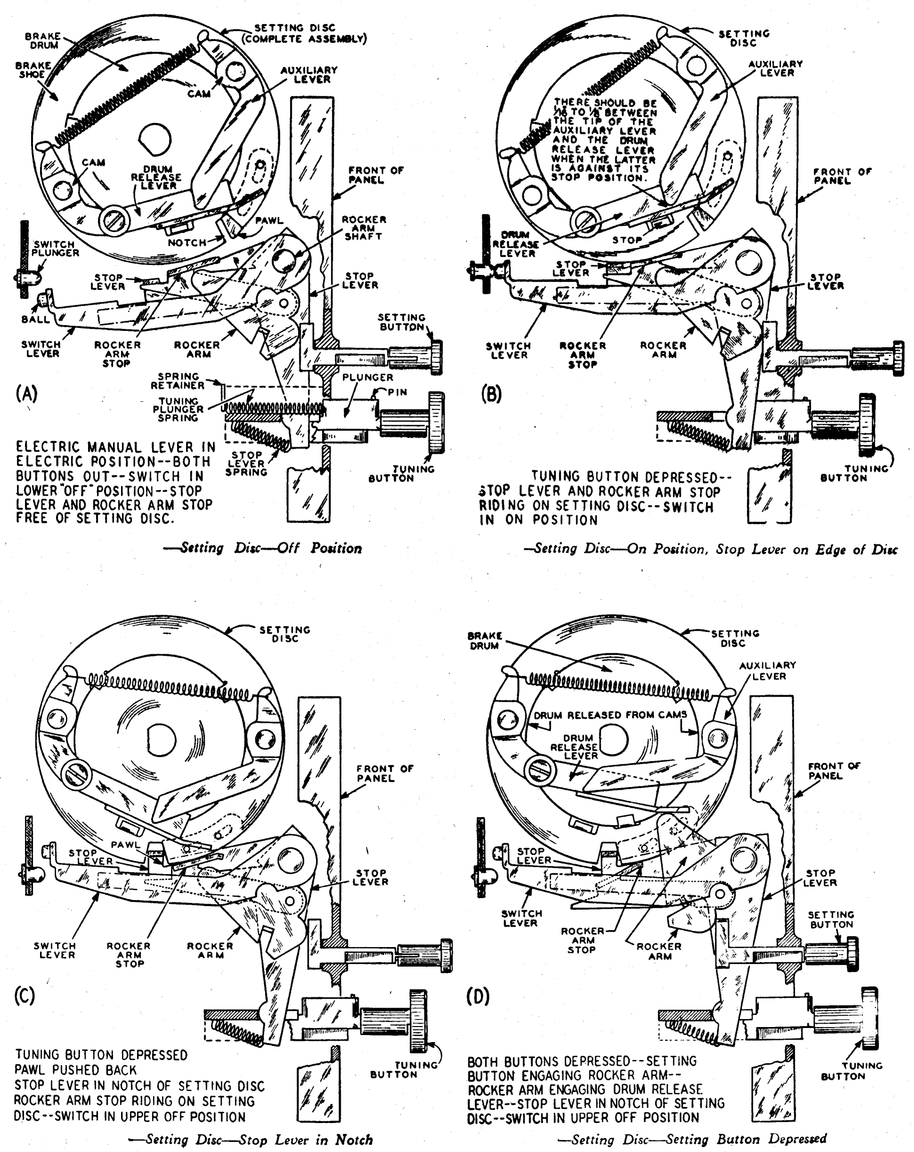


FIG. 91—*Wells-Gardner "Electric Drive" Details*

It is important that this set be connected to a six-volt battery before any attempt is made to operate the tuner. Magnetic clutch "E" (Fig. 92) must operate to remove the load of the manual tuning system before the push-buttons will operate.

In set-up and operation this tuner is very similar to the rocker bar types. Pushing pawl "F" pushes against the pair of racks "D" to turn pinion "C" to the desired position. Pinion "C" is connected directly to the dial mechanism and geared to the condenser side of the magnetic clutch "E." The switch contacts which operate the clutch are closed by the very slightest touch of a button.

To set up stations on this receiver proceed as follows:

First remove the push-button by pulling the button spring to the right and pulling straight out on the button. Then loosen lock screw "A" with a coin or screwdriver. Carefully tune in the desired station by means of the manual control, then push the loosened screw in as far as possible and retighten.

SECTION 9E

Emerson Instamatic

The six push-buttons provide a choice of six favorite broadcast stations for Miracle Instamatic Tuning. Adjustments for any particular station must be made by means of the small cross-slotted button immediately below the chosen push-button. The following procedure must be carefully observed in making these adjustments:

Insert the line plug in the electrical outlet. Turn the receiver on by rotating the tone control knob clockwise until the switch is heard to click and then rotate this knob to the extreme clockwise position. Wait about a minute for the tubes to warm up. Turn the wave-band switch to the broadcast position, clockwise. Turn the volume control clockwise to about half of its full rotation.

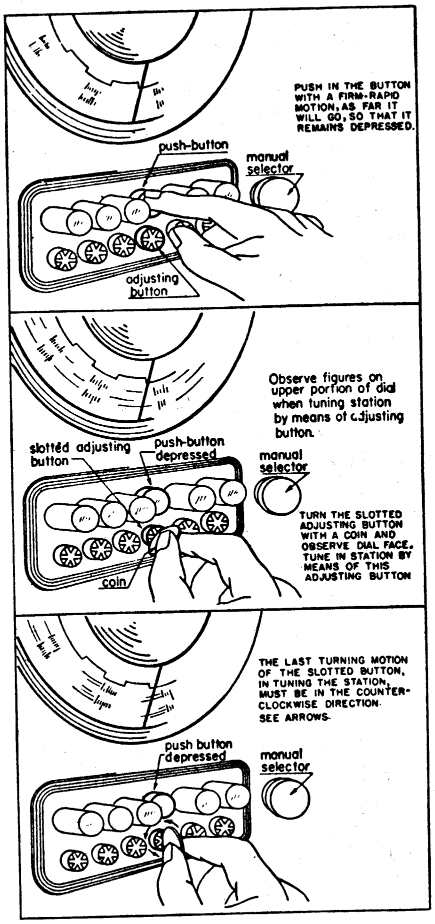


Fig. 93

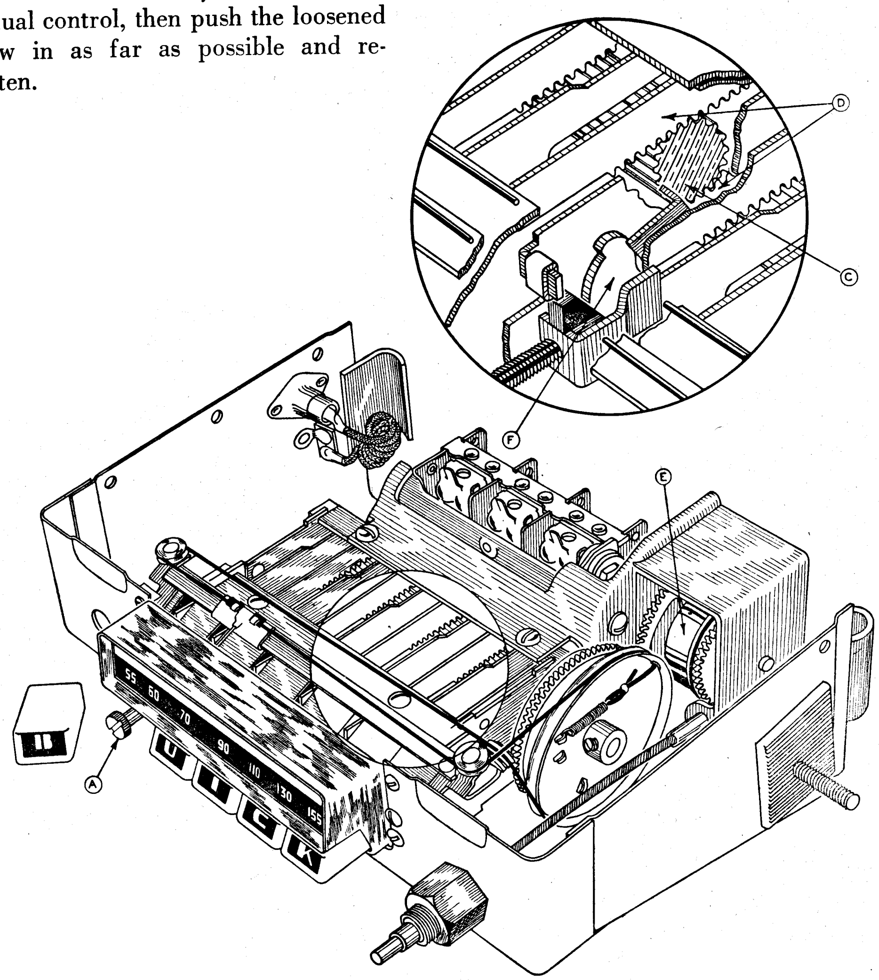


Fig. 92

Push in the manual selector knob (second from right). When pushing in the selector knob or one of the push-buttons best results are obtained by using a firm rapid action.

With the selector knob depressed tune in the desired station. Rotate the selector knob until the mark on the dial face corresponding approximately to the frequency of the station appears at the black indicator line on the conical escutcheon window. Identify the station and note the approximate position of the dial face.

Push in the button to be adjusted for this station. (See Fig. 93.)

Insert a small thin coin in one of the slots of the adjusting button immediately below the push-button. Turn the adjusting button until the mark on the dial face corresponding approximately to the frequency of the station again appears at the black indicator line on the conical escutcheon window. Once the station is heard, tune it in carefully

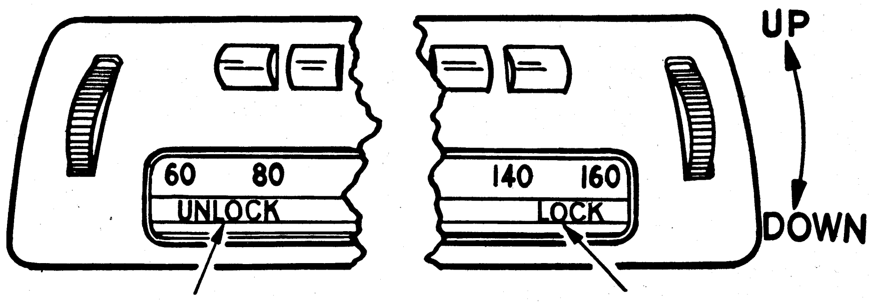


FIG. 94

TO UNLOCK: Turn Manual Tuning Control down about 70 to 100 strokes after word UNLOCK appears. Turn until control turns hard after turning easily. Never force control after this point is reached.

TO LOCK: Turn Manual Tuning Control up about 70 to 100 strokes after word LOCK appears. Turn until control turns hard after turning easily. Never force control after this point is reached.

by turning the adjusting button back and forth slowly. From the standpoint of performance it is of paramount importance to tune in the station accurately. (See Fig. 93.)

It is very important, when tuning in a station by means of the adjusting button, that the last turning motion of the adjusting button be in the counterclockwise direction, as indicated in Fig. 93.

Check the results by moving the dial face, using the selector knob, to a different position and then pushing in the button. The station should be received clearly and with maximum volume.

Adjust the remaining buttons, one at a time, following the procedure outlined above.

SECTION 9F

Hudson Feathertouch Tuner

IMPORTANT PRECAUTION: In order to assure perfect results you must observe all instructions. One very important precaution during set-up is to never touch a button already set while control unit is unlocked. For example, if some buttons are set and while working on the remainder you accidentally touch one already set, the setting on this button will change. This will necessitate resetting of the button accidentally touched.

How to Set Up Push-Buttons

(a) Operate set for about ten minutes before setting up buttons.

(b) *To Unlock Tuning Mechanism:* Rotate right (tuning) control downwards until word *Unlock* shows at the left side of dial. Continue to turn until wheel tightens. (70 to 100 strokes will be required.) A more complete description of this procedure is given below under the heading "Unlocking Tuning Mechanism."

(c) Tune in desired station with (tuning) control.

(d) Hold down the button selected and move tuning control up and down, leaving it in position where tone is deepest. Release button.

(e) Follow same procedure for other buttons. IMPORTANT: After setting any button, it must not be touched until after mechanism has been locked as in (f). Otherwise it is necessary to reset it as in (c) and (d).

(f) *To Lock Tuning Mechanism:* Rotate tuning control upwards until word LOCK appears at right side of dial. Continue to turn until wheel tightens (70 to 100 strokes will be required). A complete description of the locking operation is also given below.

(g) Insert station call letter tab in front of each button. The tabs are inserted by flexing them and allowing them to snap into place in the buttons.

Setting Up Early Radios

Some of the earliest radios produced require a slightly different set-up procedure than given above. This same procedure can be used on later sets though it is not necessary.

After unlocking the tuning mechanism, proceed as follows for each button:

1. Tune station in manually.
2. Now hold the manual tuning control and push the button to be set up *several times.*
3. After pushing and releasing button several times, hold button down and again tune station carefully by turning manual tuning control back and forth slightly.
4. Repeat for other buttons.

The essential difference between this procedure and the one given above is that the button is pushed and released several times in quick succession after desired station is tuned in but before final tuning adjustment is made.

Unlocking Tuning Mechanism

In setting up this mechanism, you must understand the action of the control during locking and unlocking.

The unlocking operation begins *after* the tuning control is turned to the point where the word *unlock* appears. To complete the unlocking operation, the tuning control must be turned quite a bit *after* this point is reached. When unlocking begins, the tuning control may turn quite hard, but then it begins to turn quite easily. You must continue to turn it downwards until it again turns hard. Because of the high gear ratio, it may require 18 to 24 complete turns of the tuning control to reach this point. Since you can turn this control only a quarter of a turn at a time, it may require 70 to 100 strokes of the finger on the control to completely unlock the mechanism. The tuning control will *not* reach a definite stop when the mechanism is unlocked. However, when the control turns easily for quite a while, then turns harder, the unlocked position is reached. In this position the tuning control will spring back when you take your finger off after turning it. At this point, the tuning indicator will function if you turn the tuning control back (up). *Important: When this position is reached, do not force the tuning control further down.*

Locking Tuning Mechanism

The locking action begins when you continue to turn the tuning control upwards after the word *lock* appears.

The action is much the same as described under *unlocking* and it will require as many turns of the tuning control to lock the mechanism as were needed to unlock it.

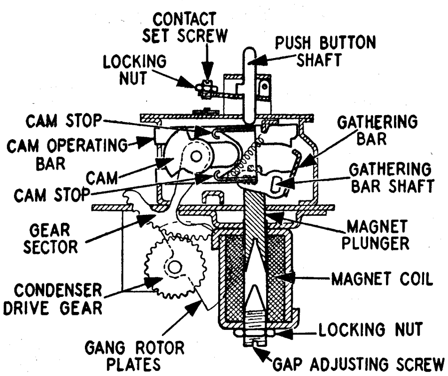


FIG. 95—*Magnet Plunger in "OUT" Position*

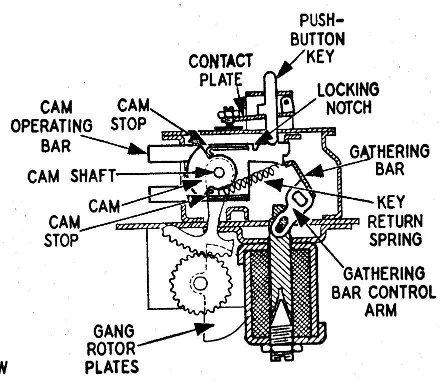


FIG. 96—*Magnet Plunger in "IN" Position*

Refer to Fig. 95 and Fig. 96. When a push-button is depressed, it makes mechanical contact with the cam operating bar located under it, and depresses the bar so that the gathering bar can make contact with it. At the same time, the key forces the contact plate downward, making electrical contact through the contact screw. When the contact screw makes contact, it energizes the winding of the magnet assembly causing the plunger to be drawn completely into the magnet as shown in Fig. 96. The plunger is mechanically coupled to the gathering bar and gathering bar shaft, so that when the plunger is drawn into the magnet, it causes the gathering bar to be forced ahead. The gathering bar engages the cam operating bar which is depressed by the push-button key and drives it forward as shown in Fig. 96. This position of the cam operating bar is indicated by the ends of the cam operating bar extending from the mechanism frame (see Fig. 98). When the cam operating bar moves forward, the cam stops attached to the bar engage the cam, rotating it until it is in the position indicated in Fig. 96. The rotation of the cam causes the cam shaft and gear segment to rotate likewise, rotating the gang condenser to a position corresponding to the station to which this particular key is set.

How the "Locking-Up" Mechanism Works

The cam shaft assembly consists primarily of a shaft on which five cams are alternately spaced between friction collars. On the clutch end of this bar is a short threaded section upon which screws the collar which is part of the clutch and clutch spring assembly. When the cams are locked, this threaded collar is turned upon the threaded section of this cam shaft, exerting pressure upon the cams and friction collars, thus locking them securely in position. When the cams are unlocked, this threaded collar is turned so as to unscrew it and exert a minimum of pressure on the cams and friction collars. The only pressure then exerted upon the cams to hold them in position is that exerted by a spring washer near the threaded end of the shaft. Thus the cams are held so they cannot move of their own accord, but are still loose enough to permit them to be set to correspond to the desired station.

The threaded collar is connected through the clutch to the manual tuning control, permitting adjustment of the cams from outside the tuning unit.

Operation of Clutch and De-Clutch Arm

The clutch mechanism of this tuner (see Fig. 98) functions every time a push-button is depressed. Its purpose is to de-couple the manual tuning control and its associated gears from the automatic portion of the tuner when tuning electrically. The clutch is a dual unit, providing positive mechanical coupling between the manual tuning gears and the cam shaft, and it also has a leather friction disc which operates in conjunction with the positive coupling element to remove excessive backlash when tuning mechanically.

When the plunger is drawn into the magnet, turning the gathering bar shaft, the cam attached to the shaft (Fig. 98) moves downward on the riser of the de-clutch arm, releasing the pressure on the de-clutch arm, which bears against the inside section of the clutch. When this pressure is released, the clutch return spring contracts, separating the two halves of the clutch, thus disengaging the manual tuning gears.

When the push-button is again released, allowing the plunger to be withdrawn from the magnet, the cam on the gathering bar shaft moves upward on the de-clutch arm riser, again exerting pressure on the de-clutch arm, and in turn on the clutch, thus engaging the two clutch sections, and making manual tuning possible.

Set Tunes Improperly

If the set fails to tune in stations properly, first check the set-up of the various buttons. If the set-up is incorrect, the set will tune consistently to the same point, and this condition can be remedied by resetting the buttons.

If the set will not tune in stations, although the plunger tends to move, make sure the Bristo headed set screws in the retaining collar are tight. This is the collar which is almost touched by the condenser drive gear sector when the condenser plates are unmeshed. A loose set screw may strike the unit frame, causing the plunger to stick in either the IN or OUT position.

If the set fails to tune properly, and the dial stops at different points when approaching the station from opposite ends of the dial the mechanism may not be properly locked up (see "Locking Tuning Mechanisms"). The next step is to check for binding of the

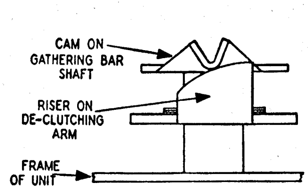


FIG. 97A
Correct Position of Cam on Riser

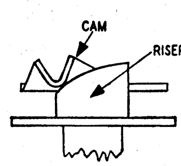


FIG. 97B
Position of Cam Too Low

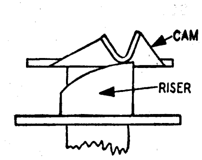


FIG. 97C
Position of Cam Too High

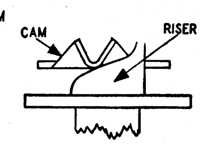


FIG. 97D
Correct Position of Cam on Alternate Type Riser

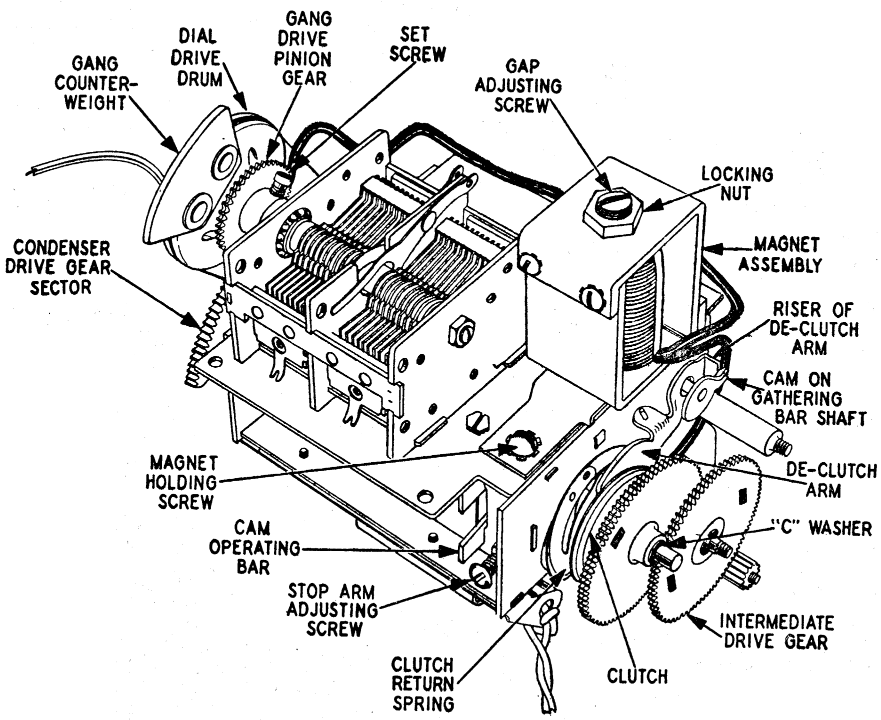


FIG. 98

mechanism (see section on "Binding"). This trouble also may occur if the pulling force of the magnet is not great enough. This may occur when the battery voltage is low (below 5 volts). It may also be due to too large a gap between the plunger and the pole piece of the magnet assembly. On later sets the gap can be adjusted as described in paragraphs 5 and 6 of "Replacing Magnet Coil Assembly." The adjustable magnet assemblies are identified by the Gap Adjusting Screw and Locking Nut shown in Fig. 98.

In the early type of magnet assemblies the gap is not adjustable. If one of these magnets is found to have insufficient pull, the remedy is installation of the new type magnet assembly. However, before replacing a magnet assembly, make sure that improper tuning is not due to low battery voltage or the other causes mentioned above.

Mechanism Where Tuning Control Fails to Reach Stop During Unlocking

This is probably due to the shearing off of the "C" washer on the clutch end of the cam shaft (see Fig. 98). On the earlier mechanisms, this "C" washer holding the clutch and gear assembly to the shaft was made of a fairly soft steel. Occasionally these washers may shear off if the customer continues turning the tuning wheel after the mechanism has become completely unlocked. This continued turning forces the gear and clutch assembly against the "C" washer, shearing it off completely. Replace this washer with the new hardened washer. This can be done without removing the tuning unit from the case. First lock the mechanism, then remove the nuts holding the triangular plate on the clutch end of the tuner. Unhook the plunger return spring so that no pressure will be exerted by the clutch. The washer can now be removed and a new washer installed.

On all early sets, replace this "C" washer even if the old one is still all right.

Shearing or partial shearing of this washer may cause slipping of the clutch or sticking of the plunger in the OUT position.

If a bronze washer is present between the "C" washer and the gear, remove it and discard it. If a steel washer is present, it must be left in place. On early mechanisms, a $\frac{1}{32}''$ steel washer was used in this position and it must be left in place.

Binding

If the radio tunes improperly, check for binding in the dial and tuning mechanisms. Below are enumerated some of the reasons for binding:

Rubbing Light Diffusion Plate: Two types of light diffusion plates were used, the new type being riveted to the cover, while the old type is mounted on the unit itself (see Fig. 99). If the new type light diffusion plate, which is mounted in the cover of the control head, rubs against the dial scale due to warping of the celluloid, cut this plate as shown by the shading in Fig. 99. This can be done without removing the shield from the cover. In some early units, this diffusion plate was mounted on the unit itself. In this case, enlarge the notch fitting over the dial lamp wire as shown in Fig. 99. Exercise care when enlarging the notch, as the celluloid is quite brittle and may break. Then cement the diffusion plate to the front of the contact plate assembly so that the shield rests flat against this metal plate.

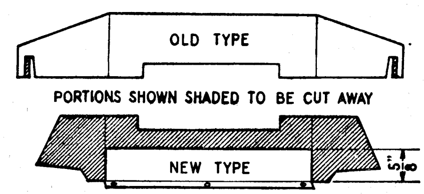


FIG. 99—*Illustration Showing Method of Cutting Light Diffusion Plate*

Ends of Drum Rubbing Brackets: The dial drum should have a slight amount of end play. If it doesn't, it may be binding. This may be due to improper placement of the volume control mounting bracket. To correct this difficulty loosen the two screws holding this bracket and move it slightly farther away from the drum.

Similar binding may also be due to a loose end cap on the dial drum. In this case, force the cap back on the drum and punch-mark the cap to hold it in place on the dial drum.

In a few cases it may be found that dial end bearing is out of line or slightly off center. The bearing can generally be bent slightly to restore it to its proper position. If this cannot be done, replace the dial scale assembly.

Binding of the drum on the mounting brackets may be due to the fact that the control units fitted too tightly in early cars. This causes the escutcheon to be forced sideways, thus pressing on the tuning controls, which may move the dial drum brackets. This binding can generally be eliminated by bending the brackets slightly outward.

Similar difficulties will be encountered if the control head is not properly installed. When mounting the head, tighten the wing nuts evenly, so the control head will not have a tendency to bind against the dash opening, which would push the escutcheon against the controls.

Drive Pulley Striking Antenna Coil Shield: Check to see that the dial drive pulley is properly located on condenser shaft. Its bushing should touch the condenser pinion gear.

Also, the antenna coil shield can may be moved slightly away from the drum by loosening the two nuts holding down the can.

It may also be possible to move the entire tuning unit slightly away from the shield can. Loosen the four screws holding down the unit and shift it.

Chassis Wiring Improperly Placed: If the leads from the on-off switch and other leads in the vicinity of the "A" filter assembly are not properly located, they may interfere with free motion of the dial cord or the condenser drive gear sector. Dress these leads so that they cannot touch these moving parts.

Binding Between Sector and Pinion Gears: Excessive friction between these gears can be reduced by changing the position of the pinion gear so that the set screw indicated in Fig. 10 points upward when the gang is completely closed. This draws the pinion gear slightly farther away from the gear sector, reducing the pressure between them.

Counter-Weight Strikes Case: Should the gang counter-weight strike the wrap-around case, loosen the four screws holding the tuning mechanism to the chassis and shift the tuning mechanism slightly so counter-weight clears case. Keep in mind that the case side may be pulled in slightly when the cover is put on. If the case is warped inward, bend it slightly outward till counter-weight does not strike it.

Slipping Clutch (Backlash)

A slipping clutch is indicated by excessive backlash during manual tuning. First check to see that the correct plunger return spring is used.

The correct type of spring may be determined from the following table giving the dimensions of the three types of springs which have been used.

	No. of Turns	Length of Body	Overall Length	Outside Diam.
Correct Spring...	36	7/8"	1 3/8"	7/32"
Light Spring.	34 or more	5/8"	1 1/4"	3/16"
Heavy Spring.	24	13/16"	1 5/8"	9/32"

If the unit has the light or heavy spring, replace it with correct one. When changing springs, it is also desirable to replace the magnet assembly if it does not have the Locking Nut and Gap Adjusting Screw shown in Fig. 10. However, this is only necessary when there is insufficient pull of the solenoid to operate the mechanism.

Next check the position of the cam on the end of the gathering bar shaft (copper plated shaft) with relation to the riser of the de-clutch arm *while the plunger is out.* See Fig. 98 and Fig. 97A. The cam should be halfway up the curved portion of the riser as shown in Fig. 97A.

If the cam is not halfway up the riser while plunger is out, as shown in Fig. 97A loosen the two Bristo set screws in the retaining collar on the other end of the gathering bar shaft and move the retaining collar on the shaft until the cam is properly positioned on the riser. A special set screw wrench is needed to fit the Bristo set screws.

In all cases where slipping clutches are reported, check to see that there is no excessive friction in the gang condenser, dial or gang condenser drive gears. See section on "Binding."

Sticking Magnet Plungers

If the automatic tuning mechanism does not operate, but manual tuning is possible, the plunger may be stuck in the OUT position (see Fig. 95). If manual tuning control turns easily but does not tune stations, the plunger may be stuck in the IN position (see Fig. 96). A loose set screw on the retaining collar on the gathering bar shaft may strike the frame and cause the plunger to stick, so check the set screws first.

If the plunger sticks when the plunger is all the way in, it is sticking against the conical pole piece of the magnet assembly.

On the later sets, the gap between the plunger and the pole piece is adjustable. Adjustable magnets are identified by the gap adjusting screw and locking nut on the end of the magnet assembly (see Fig. 98). In these sets, loosen the locking nut on the rear of the magnet and turn the gap adjusting screw outward (counter-clockwise) one-half turn, and re-tighten the locking nut. If this sticking occurs in early units, replace the magnet with the newer type assembly. Read the paragraph "Replacing Magnet Coil Assembly" for instructions for replacing and adjusting the magnet assembly.

The plunger may stick in the OUT position, if the "C" washer on the clutch end of the cam shaft (Fig. 98) is totally or partially sheared off. Check this washer, and if found defective, replace with the hardened type of washer. A faulty "C" washer allows the plunger to come out too far, and also allows the cam to reach a position too high on the de-clutch arm riser (see Fig. 97C).

After checking the "C" washer, check the adjustment of the cam on the riser, as explained under "Slipping Clutch."

If the cam is too far up on the riser (see Fig. 97C) it lets the plunger come out of the magnet too far and this may cause sticking. If the cam is not far enough up on the riser (see Fig. 97B) the clutch may slip.

If the position of the cam is correct as shown in Fig. 97A, but the plunger still sticks, loosen the two screws holding down the magnet and shift it slightly until the plunger moves freely, then retighten the screws. If this does not clear up the difficulty, replace the entire magnet assembly.

Replacing Magnet Coil Assembly

To replace a magnet coil assembly, proceed as follows:

1. Remove top and bottom covers of tuning unit. Unsolder red and black magnet wires from points to which they connect.
2. Take out two round headed screws holding magnet to mounting plate.
3. Lift off old magnet assembly and install new assembly.
4. When replacing this magnet assembly, before tightening the screws holding down the unit, check to see that the plunger moves freely inside the magnet coil. If it has a

tendency to bind, shift the position of the magnet slightly until the plunger moves freely, then tighten down the holding screws.

5. It is now necessary to set the large adjusting screw on the top of the new magnet. Loosen the nut and turn the screw out several turns. Now push down one of the push-button shafts next to the drum dial. Then with a screwdriver, push the plunger into the magnet as far as it will go.
6. While holding the plunger in *very tightly*, you can now release the push-button shaft and turn the magnet adjusting screw in, until you feel the screw striking the plunger. When this happens, back the screw out one complete turn and retighten the locking nut. *This adjustment must be made very carefully, since if the threads are tight it is difficult to notice the exact point where the screw strikes the plunger.*

Important: To get proper adjustment, a push-button shaft must be depressed before pushing in the plunger so that the plunger operates the tuning mechanism as indicated by one of the cam operating bars extending from the frame (Fig. 98). If the above adjustment is done while the power is on the unit, the plunger will pull in by itself as soon as you depress one of the push-button shafts. It is then merely necessary to hold the plunger in tightly with a screwdriver and *release the push-button shaft.* The adjustment can then be made.

Stop Arm Adjusting Screw

The function of this screw (Fig. 98) is to prevent damage to the gang condenser plates when the rotor plates are fully opened. This screw is adjusted so that the stop arm on the cam shaft will strike it just before the gang condenser plates open so far as to strike the stationary plates. Set this screw so the stop arm will strike it when the rotor plates are approximately 1/8" from the stator plates. Then tighten the locking nut so as to hold the screw in this position.

There is also a fixed stop whose purpose it is to stop the condenser plates just before they strike the fixed plates when the plates are fully meshed. This fixed stop is part of the frame assembly. When the gang condenser or any of its associated parts are replaced or otherwise adjusted, before tightening the set screws holding the condenser drive pinion gear to the shaft, set the rotor plates so that their upper edges are flush with the top edges of the stator plates. Then turn the condenser drive gear segment until the stop arm on the cam shaft strikes the fixed stop on the frame, then tighten the set screws. When this adjustment is properly made, and when the stop arm adjusting screw is correctly set, no strain is put on the rotor plates of the condenser in either the open or closed position of the gang condenser.

Adjustment of Contact Screw

The contact screw, once properly set, seldom requires readjustment. Improper adjustment may be identified by the following symptoms:

Contact Screw Too Far In: When a push-button key is depressed, the magnet will operate, but the cam operating bar may not be pushed through as shown in Fig. 98.

Contact Screw Too Far Out: This may permit the push-button key to exert too much pressure on the cam operating bar and cause it to stick.

Chattering of the mechanism may be caused when the screw is either too far in or too far out. Adjust the screw until the unit operates properly when any one of the push-buttons is depressed.

Position of Gang Condenser Counter-Weight

Refer to Fig 98. The purpose of the counter-weight shown in this illustration is to counter balance the weight of the gang condenser. When the weight is in correct position the edge of the weight nearest the set screw is approximately straight up and down with the gang condenser fully meshed. When replacing the dial drive drum, always check to see that this weight is in the position described above, or the tuning unit may not operate satisfactorily.

SECTION 9G

Motorola Electric Automatic Tuner

NOTE

All seven tuners are identical in construction, except for the condenser gang.

E5T has a 3-gang condenser and is used in Models 9-49 and 9-69.

E6T has a 2-gang condenser and is used in Models 15-F, 20-P, 21-L, 22-S, 24-K, and 25-N.

E7T has a special high frequency condenser gang and is used in Police Cruiser Model P-69-14.

E11T has a 3-gang condenser and is used in Model 500.

E12T has a 3-gang condenser and is used in Model 700.

E13T has a 2-gang condenser and is used in Models 34K6 and 34K7.

E14T has a 3-gang condenser and is used in Model 550.

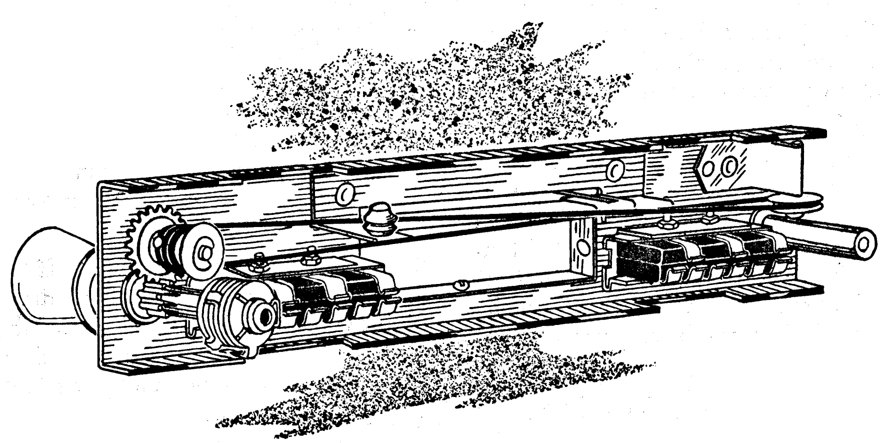


Fig. 100

Motor Does Not Run

1. *Motor Contacts in Control Head Not Closing.* Open the control head and inspect the motor contacts. If the gap is too great, contact will not be made when the button is pressed. Adjust by bending carefully.

2. *Poor Contact at Push-Button Plug.* Inspect the contacts between the plug and the receptacle on the chassis.

3. *Open Circuit in Motor.* Check all connections to motor and check motor winding for continuity.

4. *Motor Brushes Not Making Contact.* Check contact between brushes and commutator. Clean dirty commutator with carbon tetrachloride.

5. *Low Battery Voltage.* A weak or defective battery in the car would not deliver sufficient voltage to run the motor.

6. *Flexible Tuning Shaft Binds.* Binding in the flexible tuning shaft places an additional load on the motor. If this load is too great, it will prevent the motor from turning the mechanism.

7. *Magnet Fails to Release.* If the magnet which has previously been energized, fails to release the latch bar for any reason, the motor cannot turn the mechanism.

Mechanism Runs Sluggishly

1. *Low Battery Voltage.* A weak or defective battery will not deliver sufficient voltage to turn the motor at normal speed.

2. *High Resistance Contact in Control Head.* High resistance at the push-button contacts will cause a voltage drop which will prevent the motor from turning at normal speed.

3. *Poor Contact Between Push-Button Plug and Receptacle.* This will also result in voltage drop, and lessened motor power.

4. *Binding in Tuning Shaft.* Binding in the flexible tuning shaft will place an additional load on the motor which can slow it down considerably. Install tuning shaft with minimum amount of bending and check alignment where the tuning shaft enters the receiver housing.

5. *Gears Not Properly Meshed.* Check all gears in assembly for binding due to improper meshing.

6. *Defective Motor.*—Replace.

Motor Fails to Reverse

1. *Reversing Switch Not Properly Adjusted.* See instructions on page 195.

2. *Open Circuit in Motor.* If one side of motor circuit is open, motor will run in one direction only.

3. *Open Magnet Winding.* An open magnet will not pull latch down; consequently will not cause motor switch to reverse.

4. *Latch Bar Spring Too Tight.* If the latch bars operate under too much tension the magnet may not be able to pull the latch down.

Fails to Retain Original Setting

1. *Latch Rings Not Locked Securely.* The locking screw must be pulled down securely, otherwise, the shock of the sudden stopping will tend to slide the rings away from the original setting.

2. *Original Setting Not Accurate.* Resetting of magnets may be necessary after several days' use, during which time the mechanism goes through a "shaking down" process.

3. *Electrical Drift.* This is usually the result of a great change in temperature. Automatic compensation is provided in the circuit to take care of the normal operating temperature range. Before making original setting, turn the set on and permit it to play long enough to arrive at a constant operating temperature. In zero weather do not expect the set to tune "on the nose" until after a constant temperature has been reached. In severe cases of electrical drift occurring at normal operating temperature, change the compensating condenser.

Impossible to Set Up Stations

1. *Too Much Tension on Locking Levers.* When the automatic locking screw is loose, the station rings should move freely. If the levers still hold the station rings partially locked, the screws which hold the levers in position should be loosened one-quarter to one-half turn.

2. *Latch Rings "Out of Range."* If the loosened latch rings slip on the drum until the notch falls out of reach of the latch bar, they can be brought back to position by following exactly the "setting procedure" outlined on page 195.

3. *Die Cast Rings "Out of Round."* Install new rings.

4. *Die Cast Hub Expanded.* This usually causes the two outside rings to bind. Can be corrected by filing hub.

Fails to Stop at Station

1. *Open Magnet Winding.* Check for continuity and replace if necessary.

2. *Magnet Contact in Control Head Not Closing.* Inspect contacts. Adjust or clean if necessary.

3. *Latch Bar Defective.* Inspect latch bar to make sure that it has not been damaged. Replace latch bar, if required.

4. *Poor Contact at Push-Button Plug.* A poor contact here means a voltage drop which reduces the pulling power of the magnet.

5. *Improper Spacing of Magnet.* Check the spacing between the latch bar armature and the magnet pole. When the tip of the latch bar is seated all the way down in the notch in the latch ring, the armature should not quite touch the magnet pole. A hair line of light should be visible between them.

6. *Latch Rings Not Locked Securely.* If the latch rings are very loose the motor will continue to turn the gang until the plates are completely meshed.

Latch Bar Sticks in Notch

1. *Manual Tuning Shaft Binds.* Binding in the tuning control shaft causes the latch bar to press hard against one side of the notch and may prevent it from releasing as the magnet is deenergized.

2. *Latch Bar Spring Weak.* Check latch bar tension spring to make sure it is pulling away from the magnet with sufficient force. Spring tension is adjustable.

3. *Magnet Contact in Control Head Stuck.* Check the magnet switch in the control head to make sure it breaks contact when pressure is released on the button. Check for frozen contact points, or for sticking button.

4. *Armature Rivet Worn.* There is a brass rivet at the tip of the armature, to prevent the armature freezing to the magnet. If this rivet is worn down, permitting the steel armature to actually touch the magnet pole, it may freeze in that position.

5. *Burr on Tip of Latch.* Latch tip should be smooth and shiny.

6. *Binding in Latch Bearings.* Latch must move freely but not sloppily.

7. *Latch Tips Not Centered on Latch Rings.* Latch tips must not rub bakelite guide rings. The latch bar bearing shaft is adjustable.

8. *Friction Clutch Too Tight.* A tension washer between the motor pinion and the brass pinion collar acts as a friction clutch to absorb the shock of stopping the motor quickly when a station is tuned. If the tension is too tight, the torque of the stopped motor will hold the latch bar tip in the notch.

9. *Motor Brushes Too Tight.* Too much friction between the motor brushes and the commutator will cause the same thing.

Setting Stations

NOTE: Before setting any station, let the set warm up for not less than ten minutes. If you wish you can "set" the automatic tuner on the service bench before installing the radio in the car. Use a short aerial and peak the antenna trimmer to it. Then readjust the antenna trimmer after the installation in the car.

IMPORTANT—You will note that the 9-contact plug on the end of the control head cable has one pin that is shorter than the others. For the "setting up" procedure, this plug should be inserted in its receptacle on the receiver only half way. This will cause all of the magnet terminals to be connected, but will not permit the tuning motor to run during the adjustment, since the short pin will not make contact, thereby holding the motor circuit open. The motor should not run at any time during the "setting up" procedure.

1. From the set of call letter tabs provided, detach the proper ones for the six stations. The station tabs should then be inserted in the space provided in the face of station tuning buttons. Cover the tab with a small rectangular piece of celluloid. Both tabs and celluloids snap into position.

2. Loosen the *Automatic Locking Screw.* This screw should be turned counter-clockwise four or five revolutions—far enough to assure plenty of looseness.

3. Turn the dial all the way to the low frequency end (535 K.C.)

4. Press the first button and hold it down. A faint "click" should be heard, indicating that the tuning magnet has attracted the latch bar.

5. Holding the magnet energized, turn the dial manually all the way to the high frequency end (1550 K.C.) and then all the way back to the low frequency end (535 K.C.)

6. Still pressing on the button, tune in the station to be set on that button.

7. Proceed to set the remaining five stations. For each station follow steps 3, 4, 5, and 6, as outlined above. *At no time in the setting up procedure should the Tuning Motor be permitted to run.*

8. Tighten the automatic locking screw very securely. Do not hold the tuning knob while locking the automatic, but allow the mechanism to turn to its natural stop.

9. Push the plug all the way into the receptacle on the receiver housing so the short motor pin will also make contact.

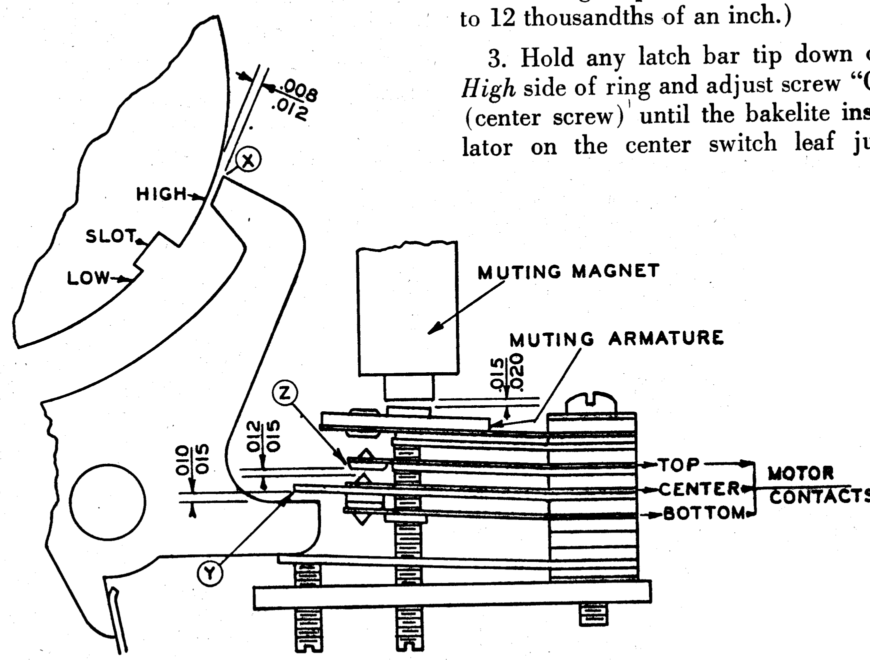
Reversing Switch

NOTE: Four adjusting screws extend upward through the switch mounting plate, three of them in line, and one set off by itself. (See Fig. 101.)

1. Turn the rotor assembly until the *High* sides of all latch rings rest opposite the latch tips.

2. Turn screw "A" in until all latch bar tips touch *High* side of ring and then turn the screw back one-half turn. (Spacing between latch tip and high side of ring at point "X" should be 8 to 12 thousandths of an inch.)

3. Hold any latch bar tip down on *High* side of ring and adjust screw "C" (center screw) until the bakelite insulator on the center switch leaf just



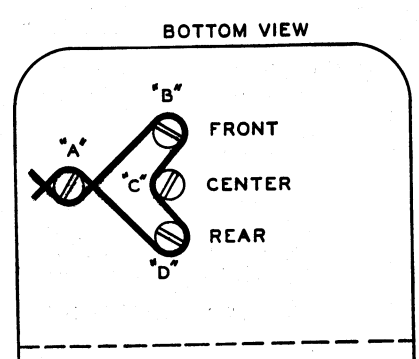


FIG. 101

barely misses touching the heel of the latch bar at point "Y." (Check adjustment by pressing other latch bars. The depressed latch bar must not lift the center contact even slightly.)

4. With latch bar at rest position adjust screw "B" (front screw) until top motor contact is lifted from center contact by 12 to 15 thousandths of an inch at point "Z." (15 thousandths = 1/64".)

5. Turn rotor until *Low* side of ring rests under latch tip. Press any latch bar down and make sure switch actually reverses. (Bottom contact must break and top contact make sufficiently to lift the top switch leaf slightly from the bakelite spacer.)

6. Turn screw "D" (rear screw) until muting relay armature rests 15 to 20 thousandths of an inch from the magnet pole. (Too close spacing will cause intermittent muting due to vibration.) (15 thousandths = 1/64".)

To Remove Latch Bar Assembly

1. Back up on front switch adjustment screw (A) until latch tips rest outside the diameter of the bakelite ring separators.

2. Remove comb shaped latch tension spring. (E) Fig. 102.

3. Remove the hex-head machine screw which extends through the small angle bracket into the brass latch bar bearing shaft underneath the tuner.

4. Pull out latch and shaft assembly. (F)

NOTE: To re-assemble, reverse the above procedure, and take particular care that:

1. Latch bar tips center on latch rings. They should not rub bakelite ring separators. (Spacing is adjustable through elongated hole in small bracket under tuner.)

2. When readjusting screw (A), turn it all the way in until latch tips touch high side of rings; then back screw up one-half turn. (See reversing switch adjustment on page 195.

To Remove Latch Ring Assembly

1. Back up on switch adjustment screw (A) until latch tips rest outside the diameter of the bakelite ring separators.

2. Remove locking screw. (G)

3. Remove the three locking levers. (H)

4. Lift the locking nut off the end of the rotor shaft.

5. Carefully loosen the three screws (J) which hold the ring assembly to the rotor hub, and remove all rings and separators as a unit, being careful to keep the three screws in position through the assembly.

NOTE: To reassemble, reverse the above procedure. Work carefully—do not let the rings and separators get off the screws.

To Replace Defective Latch Ring

1. Remove the entire latch ring assembly from the rotor hub. (See instructions above.)

2. Lay assembly on flat surface with screw heads down.

3. Remove rings, separators, and brass spacing collars, one at a time, until the defective ring is exposed.

NOTE: Reassemble parts one at a time, being careful that rings, separators, and spacers are in the correct position.

CAUTION: Be careful to replace rings in original position. Turning the ring over will reverse the position of the notch and will result in faulty tuning.

To Remove Defective Hub and Gear

1. Remove the entire latch ring assembly from the rotor hub. (See instructions above.)

Fig. 102

A. Switch Adjustment Screw
B. Switch Adjustment Screw
C. Switch Adjustment Screw
D. Switch Adjustment Screw
E. Latch Spring (6 finger)
F. Latch Assembly Complete
G. Automatic Locking Screw
H. Clamping Lever
J. Ring Assembly Screw
K. Idler Gear Assembly
L. Motor Pinion
M. Pinion Collar
N. Tuning Motor
P. Relay Magnet Assembly
R. Reversing Switch
S. Manual Drive Shaft
T. Tuning Magnet

2. Loosen the four Bristo set screws in the rotor hub.

3. Loosen the one Bristo set screw in the bakelite flexible shaft coupling.

4. Pull the rotor hub off the gang shaft. The manual tuning gear and coupling will have to be removed at the same time. The brass collar on the motor shaft may also need to be removed.

NOTE: When installing a new hub, turn the gang to full mesh and the hub gear against its stop before tightening set screws.

SECTION 9H

Flash Tuning

The Flash Tuning mechanism consists essentially of the toothed disc at

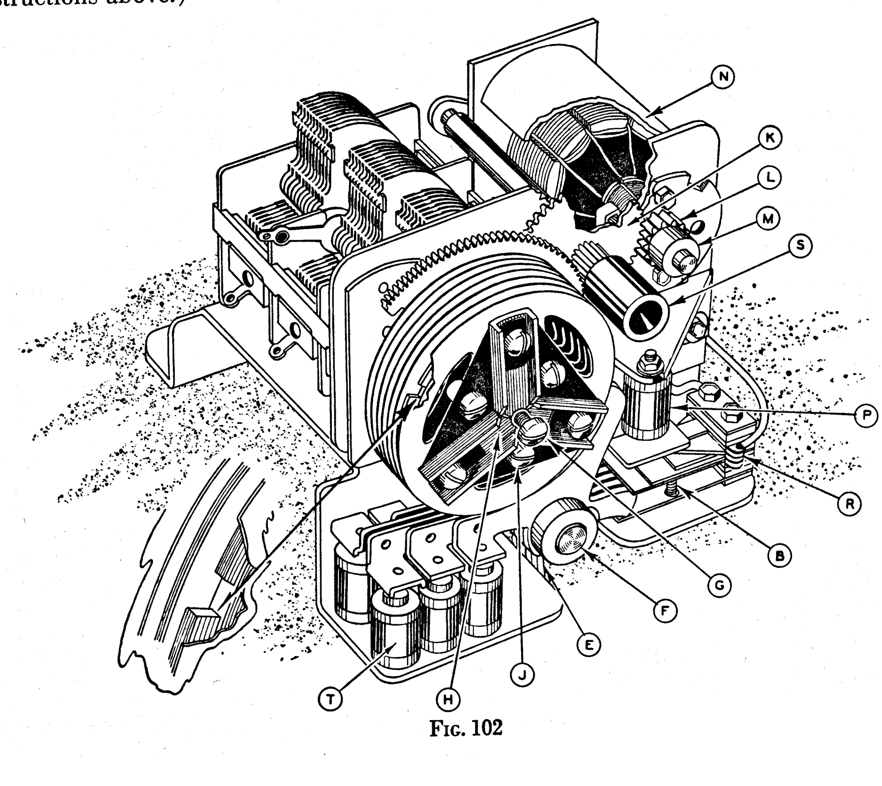


FIG. 102

the rear of the variable condenser and the relay. The function of the toothed disc is to operate the relay when the variable condenser is turned to the various pre-selected stations. The relay contacts close the Flash Tuning light circuit, illuminating the station's call letters. At the same time they remove the high negative bias which blocks off the audio, keeping the receiver silent until the pre-selected station is tuned in.

The relay coil normally is energized. It is short circuited by the bent up tooth of the disc contacting the movable arm. This is why the Flash Tuning light flashes for a second or so when the receiver is first turned on—the rectifier has not heated sufficiently to furnish current to energize the relay.

Turn the Flash Tuning and Selectivity Switch knob to the "SHARP" position. Then tune in the first station on your list of selected stations.

Leaving your station tuned in, go to the rear of the radio. You will see a semi-circular toothed disc, as illustrated in Fig. 103. There is also a flat spring arm, with a small rounded projection near its end, that moves over the teeth of this semi-circular disc as the Station Selector knob is turned. Still leaving your station tuned in, carefully note which tooth on the semi-circular disc is directly under the rounded projection of the spring arm. Mark this tooth with a pencil. Note that there is a double row of teeth and either the tooth that faces you or the tooth that faces the front of the radio may be bent up, depending upon which one is nearer the rounded projection of the spring arm. After you have marked the tooth, turn off the radio. Then tune away from the station (with the Station Selector knob, not the movable arm) and bend this marked tooth straight up, using the slotted end of the tool provided. See Fig. 103. It is important that the slot of the tool fit as far down as possible on the tooth before bending. This is necessary so that the complete tooth will be bent up instead of just part of the tooth. When this is properly done, the projection of the spring arm will touch the bent up tooth when the toothed disc is rotated by turning the Station Selector knob.

Turn the radio on again and tune in the next station on your list of selected stations. Mark the tooth that now is under the projection of the spring arm when this station is tuned in. Turn off the radio, tune away from the station so that the spring arm will not be in the way and bend up this marked tooth, using the tool provided. Proceed in the same manner for each of the other stations on your selected list. Turn off the radio each time before bending up the tooth. Otherwise a slight spark may occur, although there is no danger of shock. When properly done, the spring arm will touch each of the teeth that has been bent up but will not touch any of the other teeth, as the Station Selector knob is turned. Since the mechanism will already be set up on teeth close to the ones you will want to use, these old teeth must be bent back down.

Turn the Flash Tuning and Selectivity Switch knob to the "FLASH" position. Now again tune in the first station on your selected list. As its position is reached, the bent up tooth will touch the spring arm and a light will flash on the dial at a position opposite the end of the dial pointer.

SECTION 9J

Packard 333915

First turn the receiver on and allow it to operate for twenty minutes before making these adjustments.

Press in the "DIAL" button and hold it in until the tuning motor stops, indicating that your receiver is now connected for manual tuning.

Using the tuning knob, tune in the station whose call letters appear on the extreme left hand button (Button No. 1, Fig. 104). This is done so you can identify the station by its program.

Remove the front cover on the receiver case. Two slots are provided at each side of the case so that the cover can be pried off easily. CAUTION: If cover is pried off with a screwdriver, do not push screwdriver too far into case. After the cover has been removed, you will note two rows of adjusting screws in the receiver (See Fig. 104).

Press in the button bearing the call letters of the station you have just tuned in manually (Button No. 1 on extreme left). Hold this button in until the tuning motor stops running. Then, using a screwdriver, adjust the screw marked 1A (in the receiver case) until the station you were just listening to is heard again.

Adjust the screw marked 1B for maximum volume. Repeat adjustment of 1A, making sure you set it to the point where the tone is the deepest, also where hiss and noise are at a minimum. *These adjustments must be made very carefully to assure good reception.*

The set-up for this station is complete and you can proceed to set up the next station which you have labelled on the push-buttons. Proceed as follows:

(a) Press in "DIAL" button, and hold it in until tuning motor stops.

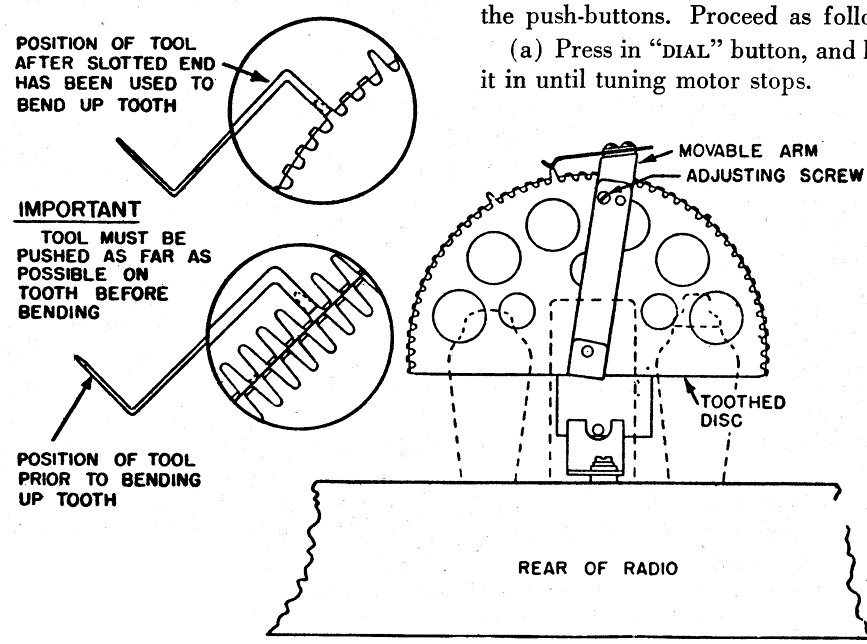


FIG. 103

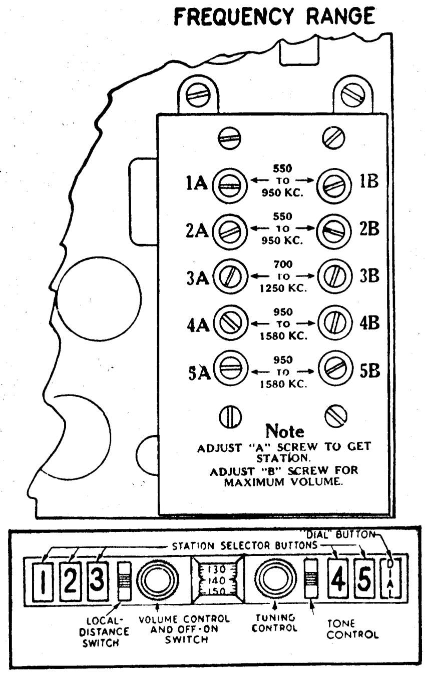


Fig. 104

(b) Using the tuning knob, tune in the station whose call letters appear on the second button from the left (Button No. 2, Fig. 104) and note the program being received.

(c) Press in Button No. 2.

(d) Adjust screw No. 2A until desired station is again tuned in.

(e) Adjust screw No. 2B for maximum volume. Repeat adjustment of 2A, adjusting it for deepest tone.

(f) This completes the set-up of the second button.

(g) The other buttons can be set up in a similar manner.

After all the stations have been set up, it is a good policy to recheck the settings of all the trimmers, to make certain that they are adjusted as accurately as possible for deepest tone and minimum noise. Then replace the cover on the receiver case.

SECTION 9K

Sparton Selectronne

Using a small screwdriver or other tool that will fit the slot in the end of the button, push the button in as far as it will go and turn to the right or left until the dial pointer has moved to the desired station frequency. Be sure the button is pushed all the way in, and the station is tuned accurately. Repeat this procedure for each of the five remaining buttons. Check all buttons by pushing them in, one at a time, to determine whether the desired stations are tuned properly.

Suggestions for Servicing Automatic Tuned Receivers

The purpose of this presentation of the subject of automatic tuning has been to give the service engineer a broad and comprehensive review of the various systems in use and their inter-relation.

Several general suggestions are offered as applicable to all makes of receivers and worthy of consideration:

1. Make certain that the alignment of IF and RF circuits is precise since quality of reception and satisfactory signal to noise ratio are dependent on precision of resonance. This is especially true in models which are not equipped with automatic frequency control.

If band widening circuits are employed in the IF amplifier it is highly desirable to use visual means of alignment. Some receivers have band widening on the automatic position and not on the manual position. In these it is highly desirable to observe whether the band widens without shifting of the center of tune when changing from manual to automatic positions by the transfer means. The electric tuning eye of the receiver is not always an accurate indication of this condition since the sensitivity of the amplifier may be changed by the band widening circuits. A cathode ray oscilloscope alignment method should be used whenever possible.

Although at first thought it might not seem strictly necessary to have the radio frequency circuits accurately tracked when employing AFC, a moment's consideration will show that the operation is impaired by mistracking. The AFC control of the oscillator only assures that the IF signal is of proper frequency. If the RF amplifier is off tune very seriously, the quality, sensitivity, and signal-to-noise ratio will be impaired. Adjacent channel interference may be objectionably high with a mistuned RF system in an AFC set.

2. In making a choice of the stations to be pretuned it is important to select only those which are sufficiently above the noise level as to furnish satisfactory entertainment at all times. An interesting bit of owner psychology is involved in the consequences of improper choice of stations. The purchaser of a new automatic tuned radio receiver is not acquainted with the phenomena of drift of tune due to temperature, mechanical aging of parts, humidity drift, frequency drift due to voltage instability, etc. Nor is he apt to be sympathetic with the vagaries of fading signals and adjacent channel "monkey chatter." When his new receiver fails to produce pure and unadulterated music as every automatic push-button is pressed, he feels that he is not receiving his money's worth of radio performance or that the receiver has been improperly adjusted. Even a demonstration that no better reception of the particular station is possible by manual tune is apt to be too late to be convincing.

3. Allow the receiver to operate for at least fifteen minutes before making the station selector adjustments. This will allow the radio chassis to assume normal operating temperature with voltages at their final values. During this period the oscillator frequency gradually drifts as tuned circuit elements and tubes warm up, and their component parts expand. This precaution is particularly true with respect to the tuned circuit substitution types of receivers not equipped with AFC. As mentioned previously, certain parts of the receiver cause the oscillator to have a positive drift of frequency with increasing temperature and other parts cause the frequency to decrease with increasing temperature. These two effects unfortunately are not balanced. In some of the recent receivers as well as the band spread types, compensation is provided. In spite of this feature, it is wise to allow a reasonable warm-up time to elapse before making final adjustments.

4. Make a check-up trip to the customer after a few days have elapsed to correct any drift tendencies which may have made themselves evident due to mechanical and long-time aging effects. After this second adjustment most receivers will have reached a final condition of operation which will continue to give satisfactory performance. By providing a periodic check-up service, the customer will learn that he can expect continued satisfaction from his automatically-tuned radio receiver.