A-120 AMPLIFIER

(McINTOSH)

CONTENTS PAGE

1. GENERAL

1.01 This section which describes in detail the electrical and mechanical features of the McIntosh A-120 Amplifier is reissued to include additional installation information.

1.02 This amplifier was designed as a general purpose amplifier. Its principal application is in wired music distribution and paging system service. It can also be used for general monitoring and in similar services to supply audio power to loudspeakers or other equipment. The amplifier may be used on subscriber premises.

1.03 The amplifier contains its own power supply which requires 110 to 130 volts ac (nominally 117V or 125V) 50 to 60 cycles. Assuming proper power line voltage, the power consumption at zero output is 105 watts. At 30 watts continuous output, the power consumption is 155 watts. A power cord is not provided with the amplifier. The amplifier is protected by a 3.2 ampere slow blow fuse. The amplifier chassis should be grounded.

1.04 The A-120 Amplifier may be mounted in a 19-inch relay rack. The amplifier is 19 inches long, extends 10-1/8 inches behind the mounting surface and is 8-3/4 inches high. The amplifier is shown in Figs. 1 and 2. On the front side of the chassis and extending through the cover panel are an "ON-OFF" power switch, a pilot light, the gains controls and fuse.

1.05 The amplifier weighs 38 pounds. The chassis, panel and protective cover are finished in gray hammertone.

2. ELECTRICAL CHARACTERISTICS

2.01 The nominal electrical characteristics of the amplifier are listed in Table 1. The "maximum program level output" listed in Table 1 is given to show the maximum ***voltage*** (program material) which is permissible at this point as it would be indicated by measurement with a standard volume indicator.

2.02 The internal impedances of the McIntosh A-120 Amplifier are shown in Tables 2 and 3. Typical performance characteristics of this amplifier are shown in Fig. 3. An input selector switch is mounted on the chassis of the amplifier and must be positioned properly.

2.03 The damping factor is the ratio of the rated load impedance to the internal output impedance of the amplifier. The damping factor of the McIntosh A-120 Amplifier is 12 or more; thus, the 600-ohm output circuit will present an internal output impedance of 50 ohms or less to the load.

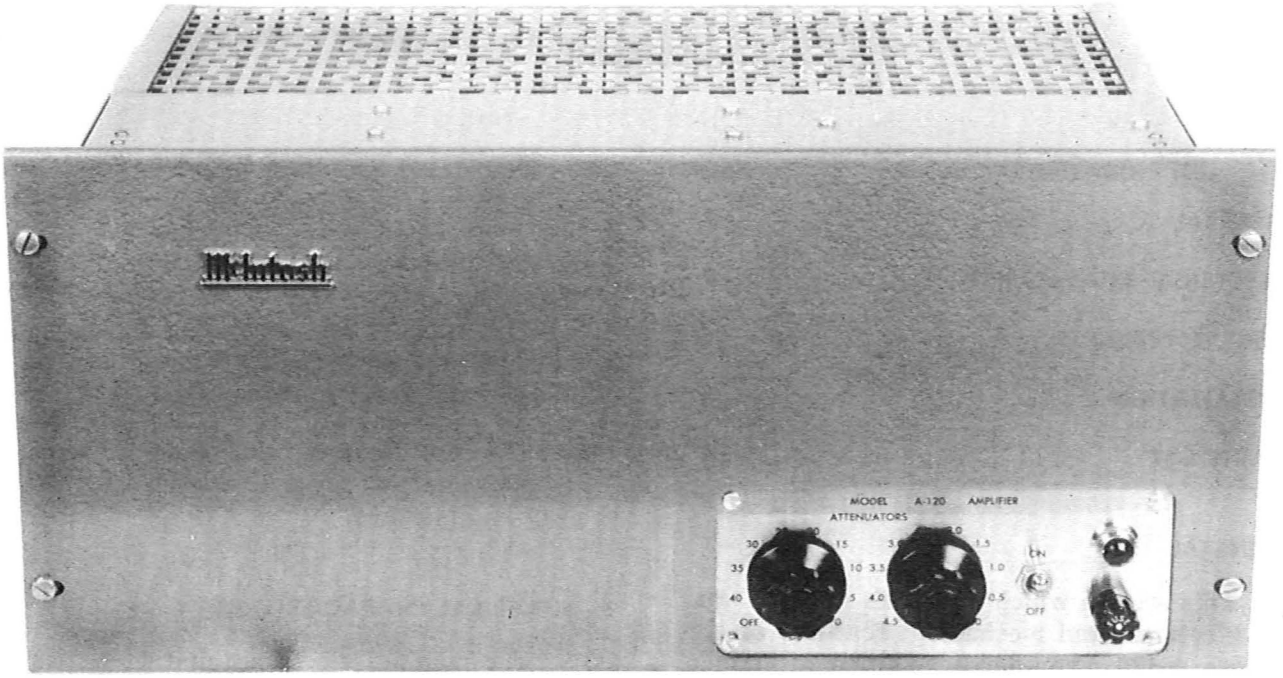

McIntosh
MODEL A-120 AMPLIFIER
ATTENUATORS
OFF
OFF

Fig. 1


McIntosh
Type
TRANSFORMER
McIntosh
Type
TRANSFORMER
12AU7
12BH7
12AX7
6AX7
HUM ADJ.
12AX7
12AX7
12AX7
INPUT SELECTOR
SERIAL NO.
021

Fig. 2

Table 1

CHARACTERISTIC	OUTPUT IMPEDANCE 1-OHM	4-OHM	8-OHM	16-OHM	600-OHM
Maximum program level output	+7vu	+13vu	+16vu	+19vu	+35vu
Maximum gain, 600-ohm input*	51.5db	57.5db	60.5db	63.5db	79.5db
Maximum gain, bridging input*	26.5db	31.5db	34.5db	37.5db	54.5db

* Using 600-ohm transmission measuring sets.

Common to All Arrangements

Maximum gain between 600-ohm impedances	78 db
Maximum gain with 30-ohm input and 600-ohm output	98 db
Maximum input level (600-ohms)	−5 dbm (−15 vu)
Frequency response	±0.1 db, 20 to 20,000 cycles
Maximum power output	30 watts continuous (+44.8 dbm)
Intermodulation distortion	Less than 0.5% if instantaneous peak power is less than 60 watts
Harmonic distortion	Less than 0.5% up to 30 watts output
Damping factor	12 or greater
Ratio of maximum single-frequency signal to unweighted steady noise	75 db or greater for 600-ohm input
Gain control range	44.5 db in 0.5 db steps

Table 2

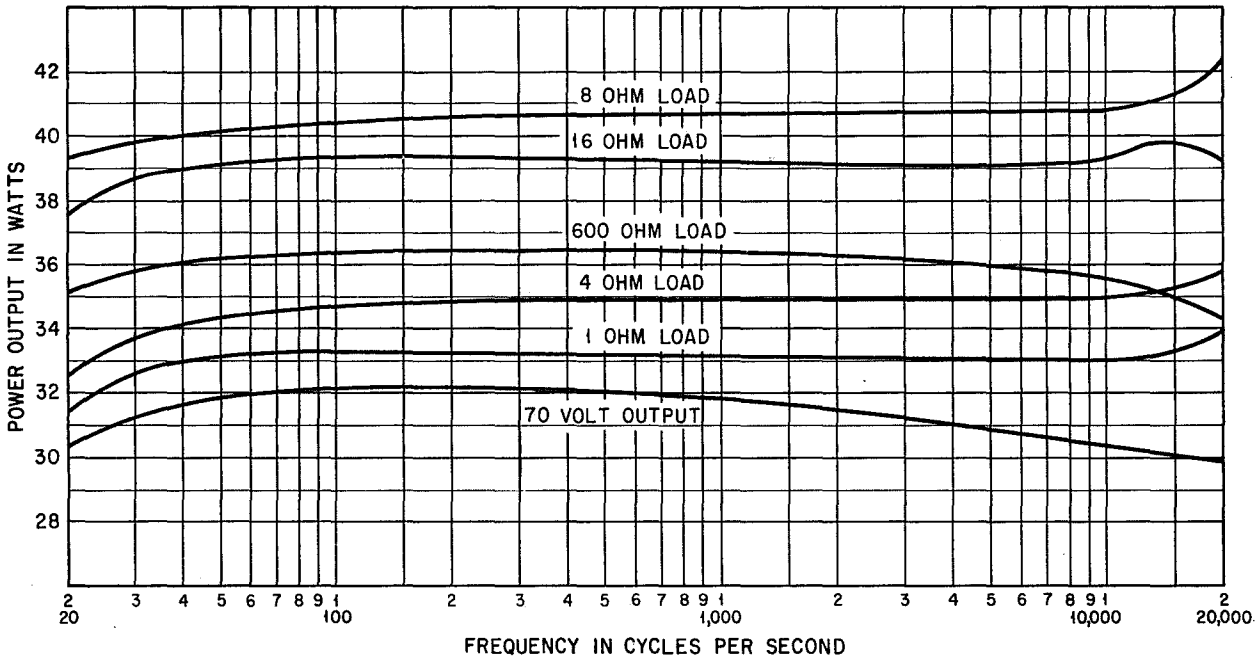
NOMINAL INPUT IMPEDANCE	INPUT IMPEDANCE RANGE	INTERNAL INPUT IMPEDANCE	INPUT SWITCH SETTING	INPUT TERMINALS
30 ohms	15 to 60 ohms	30 ohms, unbalanced	"30Ω"	30, 600 - GND, C-T
600 ohms	300 to 1,200 ohms	600 ohms, balanced	"600Ω"	30, 600 - 600
600 ohms bridging	zero to 20,000 ohms	10,000 ohms, balanced	"BRIDGE"	30, 600 - 600

Table 3

NOMINAL OUTPUT IMPEDANCE	LOAD IMPEDANCE RANGE	STRAP TERMINALS	OUTPUT TERMINALS
1 ohm	0.5 to 2 ohms	C - COM, 1 - 4	COM - 1
4 ohms	2 to 6 ohms	1 - C	COM - 4
8 ohms	6 to 12 ohms	1 - C	COM - 8
16 ohms	12 to 32 ohms	1 - C	COM - 16
600 ohms	300 to 1200 ohms	-	600 - 600
70 Volt Circuit	150 ohms or more	-	C-T - 600

Note: Low impedance (1 to 16 ohms) windings may be operated with one side grounded. The 600-ohm winding must not be grounded except at its center tap.

McINTOSH AMPLIFIER A120
POWER OUTPUT AT 0.5 % DISTORTION



DISTORTION VS POWER OUTPUT

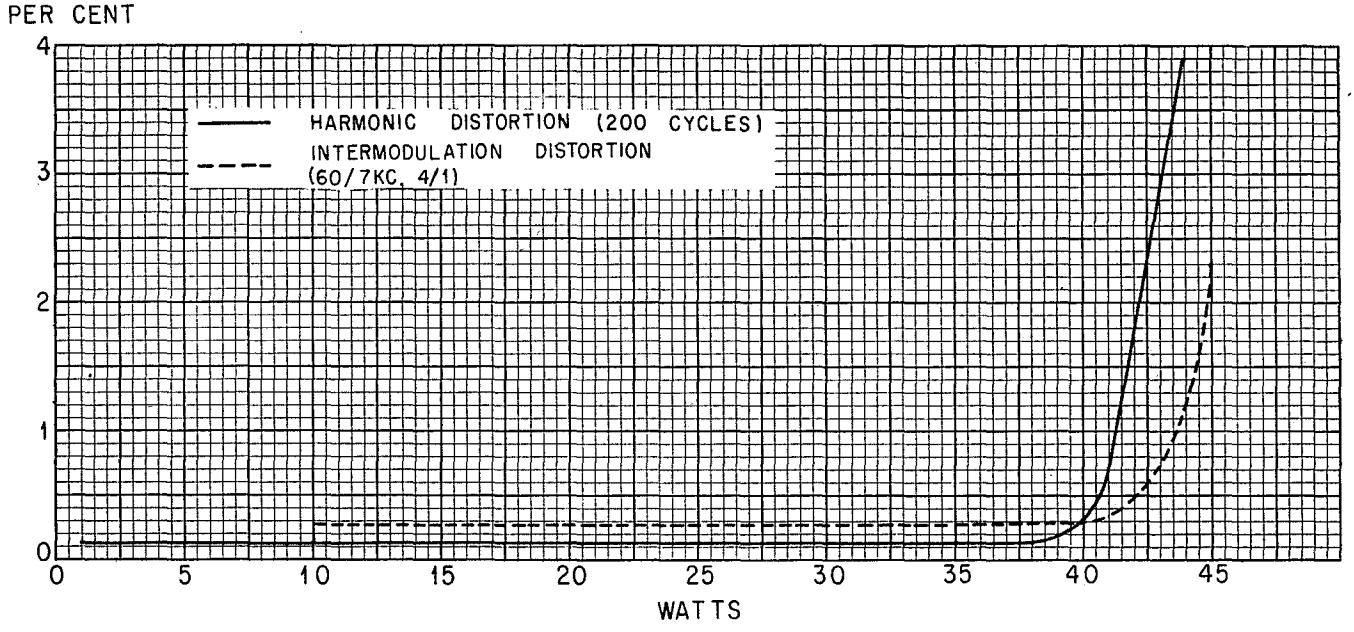


Fig. 3

3. CIRCUIT FEATURES

3.01 The schematic diagram of the A-120 Amplifier is shown in Fig. 4. Commercial tubes with the exception of the rectifier* and output tubes** are furnished with the amplifier. Since either W. E. Co. or commercial tubes may be used for the rectifier and power output tubes, they are not furnished with the amplifier and must be ordered separately. The tube complement is listed in Table 4. ←

Table 4 ←

NO. USED	W. E. CO.	COMMERCIAL
4		12AX7
1		12AU7
1		12BH7
1		6BX7
2	**350B	**6550
1	*422A	*5U4GB

Basic Amplifier Circuit

3.02 Ten electron tubes are used in the amplifier. Eight of the tubes are used in the transmission path. One serves as a high voltage rectifier and one is used for voltage control. The signal enters the amplifier at the input terminals. It passes to the input selector switch and then to the input transformer. Following the transformer, the signal is amplified by V1, a 12AX7 which has its two triode sections connected in cascade. The output of V1 connects to V2, a 12AX7 which is connected with its two triode sections in parallel in a cathode follower arrangement. Output from V2 divides into two paths; one path is connected to a feedback network involving switch sections on the input selector switch. The network is used to apply negative feedback to the input cathode of V1. The second path from the cathode of V2 is connected to the attenuator switches. The first attenuator switch varies the amplifier gain in ten steps of 0.5 db each. The second attenuator changes the gain in nine steps of 5.0 db each. The second attenuator is also provided with an "off" position.

3.03 The attenuator output connects to one section of V3, a 12AX7 which is arranged as a voltage amplifier. The output of this section of V3 feeds V4, a 12AU7 phase inverter. The two triode sections of V4 are connected in a cathode coupled arrangement. The push-pull output of V4 goes to V5, a 12BH7 push-pull voltage amplifier and from V5 to V6, a 12AX7 which uses a feedback arrangement in its place circuits. The output of V6 is arranged as a push-pull cathode follower to drive the grids of the two output tubes, type 350B's or 6550's. The 350B or 6550 tubes operate push-pull as class AB_1 power amplifiers using the McIntosh unity coupled output circuit. In this unity coupled arrangement, the output tubes are loaded in both their plate and cathode circuits. Very low distortion is obtained by using this circuit. The output transformer is equipped with various secondary windings and taps to provide the output impedances which are available at the output terminal strip. The output transformer has a separate secondary winding which is used to supply negative feedback voltage. This feedback voltage is fed to the cathode circuit of the first section of V3.

3.04 V7, a type 6BX7 dual triode, is used in a series tube regulator circuit to provide screen voltage for the amplifier output tubes, and plate voltage for V3, V5 and V6. The second section of V3 is used as a voltage regulator amplifier in connection with the V7 so as to regulate the output voltage delivered at the cathode of V7. The bias power supply, which employs a half-wave selenium rectifier and delivers bias for the output tubes and V4, also provides the reference voltage for the voltage regulator circuit involving the second section of V3 and V7.

3.05 The high voltage supply uses either a 422A or 5U4GB full-wave rectifier tube. The plate supply filter system uses resistances and capacitances. All tube filaments are connected to the power transformer. Separate windings are provided for the filaments of V7 and V10. A hum balancing control (R66) is provided in the filament circuit of the amplifying stages to allow balancing of output hum to a minimum.

4. INSTALLATION

4.01 In general, the A-120 Amplifier will operate satisfactorily at normal ambient room temperatures. Continuous operation in locations of high ambient temperature (over 100°F) is not recommended.

4.02 Several A-120 Amplifiers may be mounted in a relay rack or equipment cabinet without forced ventilation provided 100° F room temperature is not exceeded. At least 100 square inches of open area should be provided both above the top amplifier and below the bottom amplifier in an enclosed cabinet. The recommended minimum spacing between cabinet-mounted amplifiers (electron tubes horizontal) is as follows:

NUMBER OF AMPLIFIERS	MINIMUM SPACING
2	5-1/4"
3	7"
4 or 5	8-3/4"

4.03 The amplifier should be mounted so that the electron tubes are toward what is normally the "wiring" side of the frame. The cover mat and external controls will then be on the "apparatus" side of the frame.

4.04 The protective cover provided for the amplifier is perforated to allow adequate circulation of air. This cover should be removed, however, when the amplifier is mounted in an enclosed cabinet.

4.05 The ac supply can be brought into the amplifier either through conduit or by means of a flexible appliance cord. The neutral conductor should be connected to either the "115V" or "125V" terminal. The ungrounded conductor should be connected to the "COM" power terminal. Power conductors should enter the amplifier from the right side as it is viewed from the front or cover mat side.

4.06 The amplifier output circuit should enter the same side of the amplifier as the power conductors. The input circuit should enter the amplifier chassis from the opposite (left) side.

4.07 A good building ground should be connected to the amplifier chassis. All wiring shields should be electrically continuous and grounded only at the amplier. In central office installations, type BF shielded wire or equivalent may be used for wiring the input and 600-ohm output circuits. Type SK wire may be used on customer premises.

5. PARTS LIST

5.01 The various component parts of the McIntosh A-120 Amplifier are listed in Table 5.

Table 5

Parts List for McIntosh A-120 Amplifier

CAPACITORS	MFD	VOLTS
C1	.022	400
C2	.47	200
C3	20	250
C4	.033	400
C5	.1	400
C6	100	12
C7	.068	400
C8	8	250
C9	100	12
C10	470 mmfd	500
C11	.22	400
C12	.047	600
C13	.047	600
C14	.25	600
C15	.25	600
C16	.47	400
C17	.47	400
C18	8	500
C19	20	475
C20	40	475
C21	40	475
C22	60	475
C23	40	475
C24	.25	600

TABLE 5 (Contd)

RESISTORS	OHMS	WATTS (ALL 1/2W EXCEPT AS NOTED)	TOLERANCE (%) (ALL 5% EXCEPT AS NOTED)
R1	4.7K		
R2	4.7K		
R3	1K		
R4	47K		10
R5	4.7K	1	
R6	3.3K		10
R7	1M		10
R8	100K		(low noise)
R9	330K		10
R10	100K		10
R11	22K		
R12	220K		10
R13	390		
R14	120K		
R15	100K		
R16	4.3K		
R17	3.9K		
R18	3.9K		
R19	3.9K		
R20	3.9K		
R21	3.6K		
R22	3.6K		
R23	3.6K		
R24	3.3K		
R25	1K		
R26	750		
R27	1.3K		
R28	2.4K		
R29	4.3K		
R30	7.5K		
R31	13K		
R32	24K		
R33	43K		
R34	22K		10
R35	100K		10
R36	3.3K		10
R37	68		
R38	2.2K		
R39	120K		10
R40	270K	1	
R41	2.2M		10
R42	18K	1	10
R43	27K	1	
R44	30K	1	
R45	180K		10
R46	180K		10
*R47	100K Potentiometer		
R48	1.2K		10
R49	820K		

TABLE 5 (Contd)

RESISTORS	OHMS	WATTS (ALL 1/2W EXCEPT AS NOTED)	TOLERANCE (%) (ALL 5% EXCEPT AS NOTED)
R50	1M		10
R51	1M		10
R52	12K	2	Matched pair
R53	12K	2	to 1%
R54	180K		
R55	120K		
R56	200K	1	
R57	200K	1	
R58	1.2M		10
R59	1.2M		10
R60	220K		10
R61	220K		10
R62	27K		10
R63	10K	2	10
R64	150	10	10
R65	68K		
R66	250 Potentiometer		
R67	220K	1	10
R68	220K	1	10
R69	2	1	10
R70	2	1	10
R71	56K		10
R72	6.8K		10
R73	6.8K		10
R74	1K		
*R75	100K Potentiometer		

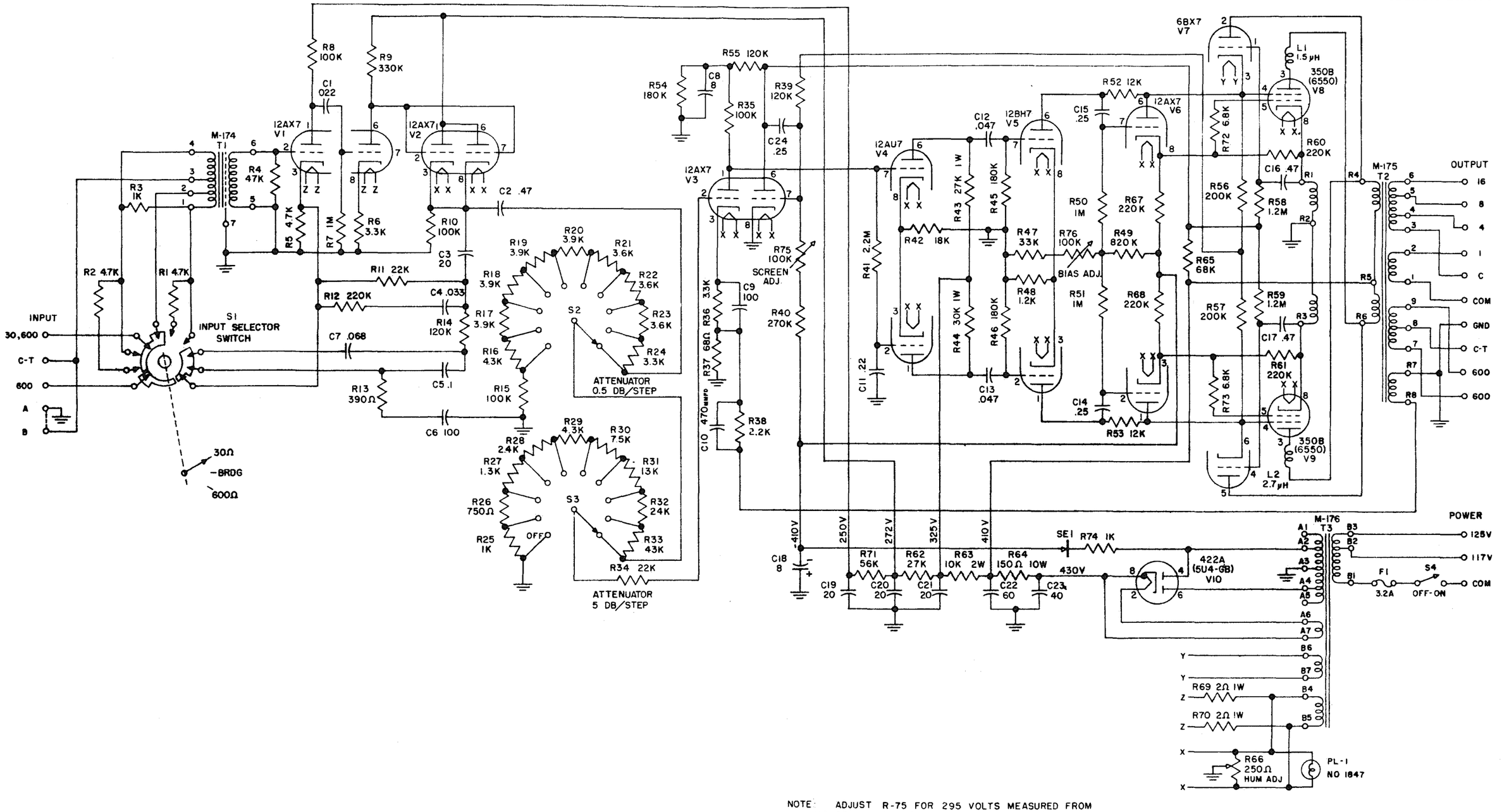
TRANSFORMERS

T1	Input Transformer	McIntosh Type M-174
T2	Output Transformer	McIntosh Type M-175
T3	Power Transformer	McIntosh Type M-176

MISCELLANEOUS

L1	Choke, 2.7 microhenry
L2	Choke, 1.5 microhenry
SE1	Selenium rectifier, 10 MADC, 28 plate
F1	Fuse, 3.2 A slow blow
S1	Input selector switch, 4P3T
S2	Attenuator switch, 0.5 db per step, 1P 10T
S3	Attenuator switch, 5 db per step, 1P 10T
S4	Power switch, SPST

* Indicates factory adjustments



NOTE: ADJUST R-75 FOR 295 VOLTS MEASURED FROM V8 OR V9 PIN 4 (SCREEN GRID) TO GROUND.

ADJUST R-76 FOR -29 VOLTS MEASURED FROM V8 OR V9 PIN 5 (CONTROL GRID) TO GROUND.

Fig. 4 – Schematic Diagram McIntosh Amplifier Model A-120