WIRELESS SET No. 19, MK. II

GENERAL DESCRIPTION

POWER SUPPLIES (Figs. 1004 and 1007)

H.T. Supplies

1. (*a*) The H.T. supplies are obtained from Supply unit No. 1. This supply unit contains a three-commutator rotary transformer, working off the 12 V D.C. input from the accumulator, which supplies 50 mA at 500 V, and 110 mA at 275 V. The unit also contains the necessary R.F. and A.F. filters. Supply unit, Mk. I*, contains additional R.F. filtering.

(*b*) The circuits of the Supply units, Mks. I and I*, are shown in Figs. 1007 and 1004 respectively.

(*c*) The Supply unit No. 1, Mk. III, is used in some cases instead of the Mks. I and I*. (see Tels. F257/7). For description of this supply unit see Tels. F 252/3.

(*d*) The 12 V L.T. is supplied to a rotary transformer, H.T., 55 W, No. 1, through the R.F. filters L16A with C22G (Mk. I*), and L17A with C22D (Mk. I*). These are shunt- and series-wound field windings. The 275 V supply is choke capacity smoothed by L18B and C32A, the reservoir condensers being C4CP. The 500 V supply is smoothed by L18A and C33B, and its reservoir condenser is C33A. In the Mk. I*, additional R.F. filtering for the 12 V L.T. supply is provided by L17B and C22A.

L.T. supplies

2. The valve heaters are supplied from the 12 V accumulator. The details of the valve heater circuits are shown in Fig. 1003.

A SET (Fig. 1002)

GENERAL

3. The set has a frequency range of 2.1—8 Mc/s (142.8—37.5 meters) covered in two bands, 2.1—4.5 Mc/s and 4.5—8 Mc/s. The bands are selected by the wave-change switch S11A.

4. (*a*) The receiver is a superheterodyne, which uses an I.F. of 465 kc/s. The valve stages are described in paras. 7–12.

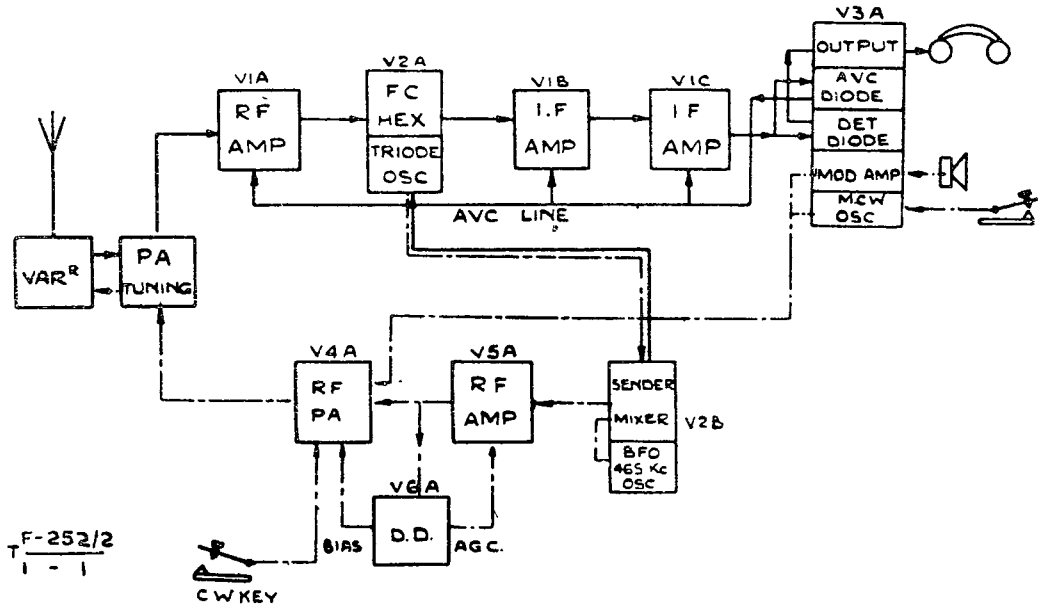
(*b*) Several valves are used both on receive and on send. This arrangement is shown in detail in Fig. 1, from which it can be seen that the frequency of the sender is controlled by the tuning of the receiver L.O. and beat oscillator. There is, therefore, no separate control for selecting the frequency of the sender.

Flick Mechanism

5. The preselector arrangement consists mainly of two circular plates driven from the main condenser spindle. A V cut on the periphery of each plate allows a spring-loaded flick locating arm to engage in the V slot. The two plates are free to move on the main spindle, until locked into the required position by two clamping screws. Each plate can be separately adjusted to the required preselected frequency.

6. The two spring-loaded arms also operate two flags so that a visual indication is given for each preselected frequency. A flick lever is incorporated to give the following facilities :—

(*a*) *Tune.* In this position the flick mechanism is disengaged, and the slow-motion drive (Drive,



Fig, 1.—Block schematic diagram of A set sender-receiver.

slow-motion, No. 14) is then in operation, to allow operator to tune set.

(*b*) *Set.* In this position both the flick and slow-motion mechanisms are engaged to enable the operator to set the tuning dial for flick working.

(*c*) *Flick.* The slow-motion drive is disengaged and the flick mechanism is in operation.

On some sets the Drive, slow-motion, No. 14 (on master oscillator tuning control only) is replaced by Drive, slow-motion, No. 21 (as used on Wireless set No. 19, Mk. III) to enable a lower ratio tuning drive to be obtained (see Tels. F 257/8 for fitting).

RECEIVER

R.F. amplifier

7. The signal from the aerial passes through the aerial tuned circuit (see para. 35), and is fed through C2A to the control grid of the valve V1A. V1A is a variable-μ R.F. pentode, which is used only for R.F. amplification. It is self-biased by R2A and receives A.V.C. bias through the choke L10A. The anode circuit of the valve consists of the primary of the R.F. transformer L22A and B, or L23A and B. The secondary of the transformer is tuned by C9A, and is connected to the control grid of the hexode portion of the frequency changer valve, V2A.

Frequency changer

8. (*a*) The frequency changer valve, V2A, is a triode-hexode. The triode section acts as the local oscillator, working at a frequency 465 kc/s. above the signal frequency. The oscillator circuit comprises the transformer L24A and B or L25A and B, the secondary being tuned by C9B.

(*b*) The triode grid of V2A is connected internally to the injector grid of the hexode section, which acts as the mixer. The hexode anode is coupled, through the I.F. transformer L8A, to the control grid of the first I.F. amplifier, V1B.

(*c*) The triode section of V2A also acts as a part of the sender. This is described in para. 12.

First I.F. stage

9. V1B is a variable-μ R.F. pentode, used only for I.F. amplification. The valve is self-biased by R9A, and receives A.V.C. bias through the secondary of L8A. The anode is coupled through the I.F. transformer, L8B, to the control grid of the second I.F. amplifier, V1C.

Second I.F. stage

10. V1C is another variable-μ R.F. pentode, used only for I.F. amplification. The valve is self-biased by R3B, and receives A.V.C. bias through the secondary of L8B. It is coupled through the I.F. transformer, L9A, to the signal detector diode anode of V3A.

Detector, A.V.C. and output stage

11. (*a*) V3A is a double-diode pentode. One diode acts as the signal detector, the other diode as the A.V.C. detector, and the pentode as the A.F. amplifier.

(*b*) The anode of the signal detector diode is directly connected to the live side of the secondary of the I.F. transformer, L9A. The diode load is provided by R7C and R1B. A filter, consisting of R7C, C14A and C15A, serves to keep I.F. signals out of the A.F. amplifier. The A.F. is fed through C17A to the A.F. volume control R13A, which is connected by a screened lead, through a contact of the send-receive relay, to the control grid of the pentode section of V3A.

(*c*) The A.V.C. diode is fed from the signal detector diode through a small coupling condenser C18A. R8A is the diode load, across which a voltage is developed by the flow of rectified current through the A.V.C. diode. This voltage is applied as negative bias, through R8B, to the control grids of the valves V1A, V1B and V1C. R8B and C38A act as a filter, and their values determine the time constant of the circuit.

(*d*) The diode load R8A is connected to earth; this places a negative bias on the anode of the A.V.C. diode equal to the D.C. volts developed across the cathode resistor R10A and R11A, by the cathode current of V3A. Therefore no rectification takes place in the A.V.C. diode until the amplitude of the incoming signal is great enough to overcome this bias, thus delaying the A.V.C.

(*e*) The output stage is the pentode section of V3A, acting as an A.F. amplifier. The input is resistance-coupled by R13A, the L.F. volume control. The anode is coupled by the transformer, T2A, to the headphones.

Note. V3A is also used by the sender, as described in para. 17.

Beat frequency oscillator

12. (*a*) The triode portion of the triode-hexode valve V2B acts as the beat oscillator.

(*b*) For the reception of C.W., the B.F.O. is switched on by the C.W.-R/T switch S7A/6. The pitch of the heterodyne beat note can be adjusted by means of the variable resistance R14A, which varies the beat oscillator frequency by shunting the coupling coil L5B.

(*c*) The B.F.O. is brought into operation when the NET button S3B is pressed, oscillating at the I.F. of 465 kc/s. The inter-electrode capacity of V2B provides coupling with the I.F., via the hexode control grid of V2B, and the triode grid of V2A. In this manner the beat oscillator heterodynes with the I.F., thus enabling the receiver to be tuned accurately to an inaudibly low beat note with the received signal.

SENDER

Master oscillator stage

13. The triode section of the receiver frequency changer valve, V2A, acts as the master oscillator when the set is on send. It oscillates at a frequency 463–7 kc/s above the carrier frequency. It is coupled, through C21A and R42C, to the hexode control grid of the sender frequency changer, V2B.

Sender frequency changer

14. (*a*) V2B is a triode-hexode valve ; the triode section, which is the beat oscillator of the receiver, oscillates at 463–7 kc/s. The output of this oscillator is mixed with the output of the master oscillator in the hexode section of the valve, producing a signal of carrier frequency.

(*b*) The output from the hexode is tuned by the circuits L7A, or L21A, and C9D. The signal is fed through C2C to the control grid of the valve V5A.

Buffer stage (R.F. amplifier)

15. (*a*) V5A is a steep-slope pentode valve, used to amplify the drive voltage to the power amplifier valve, V4A. The output from V5A is tuned by L4A or L6A and C9C, and fed through C2E to the control grid of V4A, and to the anodes of the double-diode valve V6A.

(*b*) One of the diodes of V6A provides a control voltage which is fed back, through R1D and R1E, to the control grid of V5A. This control voltage is delayed to an extent determined by the setting of the variable resistance R43A, the effect being to maintain the drive voltage constant at a pre-determined value applying to the control grid of V4A.

Power amplifier stage

16. (*a*) V4A is a beam tetrode valve which acts as the power amplifier. On R/T and M.C.W., modulation is applied to the control grid of the valve ; keying on C.W. is described in para. 18.

(*b*) On R/T and M.C.W., a negative bias developed by the second diode of V6A is applied to the control grid of V4A. The bias is proportional to the R.F. drive voltage which reaches the diode, and, therefore, to the drive applied to the control grid of V4A.
On C.W. the bias from the diode of V6A is removed, and V4A is self-biased by grid current through R7D.

(*c*) The output of V4A is tuned by L3A and C3A ; and fed from a low-impedance tap on L3A, through the aerial feeder, to the variometer, which tunes the aerial. The R.F. current from the variometer to the aerial is passed through the primary of transformer T1A, the current in the secondary is taken through the rectifier W1A. The D.C. current produced by the rectifier is passed through the R.F. choke L2A, the aerial feeder, the R.F. choke L2B, to the panel meter.

Modulation

17. (*a*) R/T—The pentode section of the valve V3A acts as a modulation amplifier. The input from the microphone comes through the microphone transformer T3A. The output is applied, through C17B and R7G, to the control grid of V4A. Sidetone is taken through the transformer T2A to the headphones.

(*b*) M.C.W.—The valve V3A is made to oscillate by coupling its control grid to the reaction winding on T2A. The anode and screen grid of V3A are keyed through the key jack J1A.

C.W. keying

18. C.W. keying is done, through the key jack J1A, on the H.T. supplies of the following :—the screen grid of V4A, the anode and screen grid of V5A, the anode and screen grids of the hexode section of V2B.

'B' SET (FIG. 1005)

GENERAL

19. The B set is an U.H.F. transceiver, with a frequency range of about 229–241 Mc/s. When switched to receive, it acts as a super-regenerative receiver, using a quench or interruption frequency of between 158 kc/s and 228 kc/s ; when switched to send it acts as an anode-modulated oscillator. A block diagram of the B set is shown in Fig. 2.

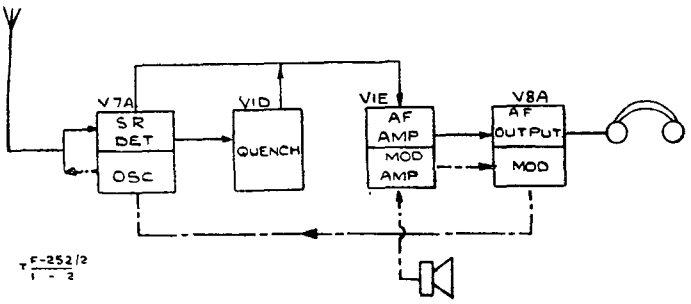


Fig. 2—Block schematic diagram of B set sender-receiver

RECEIVER

Detector stage

20. V7A is an U.H.F. triode which acts as an oscillating detector, and is tuned to the frequency of the incoming carrier by the circuit L11A, and C25A. The oscillation of V7A is periodically interrupted by the application of the output from the quench oscillator V1D. V1D is tuned, by L14A, C28A and C37A, to oscillate at the quench frequency. This arrangement keeps V7A in the most sensitive condition, and the circuit is equivalent to a leaky grid detector with very critically adjusted reaction. The output from the detector is fed through C29A to the volume control R35A, which is connected to the control grid of the first A.F. amplifier, V1E. A filter circuit is provided, comprised of C30A, R6H and C30B, to prevent the quench frequency getting into the A.F. stages.

First A.F. amplifier

21. V1E is a R.F. pentode, used only for A.F. amplification. Its output is fed through C29B and is resistance-coupled by R8D to the control grid of the output valve V8A.

Output stage (second A.F. amplifier)

22. V8A is a beam tetrode power valve, used for A.F. amplification. Its output is coupled by the transformer T5A to the headphones.

SENDER

Modulation amplifier

23. The output from the microphone is taken through the microphone transformer T4A to the control grid of V1E, which acts as the modulation amplifier. The output from the valve is fed through C29B to the control grid of the modulator valve V8A.

Modulator

24. (*a*) The beam tetrode power valve V8A acts as the modulator. The output from the valve is taken through the output transformer T5A to the anode of the oscillator V7A.
(*b*) Negative feed back is taken from the phone winding of T5A and applied to the primary winding of the transformer T4A.
(*c*) Sidetone is taken from T5A to the headphones.

Oscillator

25. The U.H.F. triode valve, V7A, acts as an anode-modulated oscillator, producing the carrier. It receives its H.T. supply through T5A.

SEND-RECEIVE SWITCHING

26. Changing over from receive to send is performed by the pressel switch on the microphone and receiver headgear No. 1. This actuates the relay of the set to which the control unit is switched, relay S5A for A set, relay S5B for B set.

27. Following the circuit through on the A set, it will be seen that when the pressel switch is closed, one side of L19A (the relay energizing coil) is earthed (pin 7, 12 pt. plug). The other side has a standing voltage of 12 V (pin 3, 6 pt. plug). The relay then pulls over, and H.T. is applied to the sender valves (by S5A 2 and 3), and the microphone is put in circuit (by S5A 4) with the microphone amplifier V3A.

28. When using M.C.W. or C.W., send-receive switching is automatically performed by pushing the key plug into the key-jack for send, and half withdrawing it for receive.

INTER-COMMUNICATION AMPLIFIER (FIG. 1006)

29. The inter-communication amplifier is a two-stage A.F. amplifier, which uses negative feed back.

30. The output from the microphone is taken through the transformer, T4B, to the first A.F. amplifying valve V1F. The output from V1F is fed through C29C and resistance-coupled, by R8F, to the control grid of the second A.F. valve, V8B.

31. The output from V8B passes through the transformer T6A to the headphones.

32. Negative feed back is taken from the secondary of T6A and applied to the primary of T4B.

AERIALS AND ASSOCIATED EQUIPMENT

A set rod aerials

33. The A set is designed primarily for use with 8 ft. or 12 ft. rod aerials of the type supplied with the equipment. When short-range communication only is required a single 4 ft. mast section may be used, if the 8 ft. rod aerial is regarded as too conspicuous.

A set horizontal aerials

34. If greater range is required, a horizontal aerial can be used with the set.

A set aerial circuit

35. A common tuned circuit (labelled P.A. TUNING) is used to tune the grid of V1A when receiving, and the anode of V4A when sending. The aerial is tuned to resonance by the variometer L1A, forming a series resonant circuit, which is connected to a low-impedance tapping on the tank coil, L3A, via a low-capacity feeder. The entire aerial circuit within the vehicle is fully screened to reduce interference from other electrical equipment in the vehicle.

B set aerial

36. This is a half-wave rod aerial fed by a feeder which is a multiple of a half wave-length. Only two standard feeders are available. These are cut to correct lengths and must, therefore, on no account be shortened. The feeders with the green band are cut to within a closer tolerance than the older type. The lengths are :—

Aerial leads, No. 2.	4 ft. 2 in.	$1\frac{1}{2}$ wavelengths
,, ,, No. 3	7 ft.	$2\frac{1}{2}$,,

Note. These physical lengths are not the equivalent of the electrical wavelengths. They have been calculated by taking into account the impedance of the feeder and of the coil circuit.

WIRELESS SET No. 19, Mk. II*

37. This is the standard Wireless Set No. 19, Mk. II, modified to operate with Supply unit No. 1, Mk. III, as Supply unit No. 2, which is normally used with Wireless set No. 19, Mk. III. This is done to decrease the battery consumption in certain stations. (See Tels. F257/7).

38. Supply units, No. 1, Mk. III, are described in para. 29 of Tels. F.253/3.

39. Wireless set No. 19, Mk. II*, has the following main changes relative to the Mk. II set :—

(*a*) Plug 6 pt. No. 4 (power input plug). Earth lead to pin 1 removed, and pin 1 joined to connection between pin 7 of plug 12 pt., No. 1, A set send receive relay coil and C.W. jack.
(*b*) Connector 6 pt. No. 4, modified to 6-12 pt., No. 1, by removal of one socket 6 pt. and fitting of a socket 12 pt. to connect with plugs 12 pt., No. 1, on supply unit No. 1, Mk. III (see Tels. F 257/7).

Table 1—Circuit component references for Wireless Set No. 19, Mk. II

Circuit reference	*Component*
	INDUCTANCES
L1A	Aerial tuning variometer
L2A and B	R.F. choke (17.3 μH)
L3A	Power amplifier tuning inductance
L4A	Drive anode tuning inductance, H.F.
*L5A	I.F. oscillator inductance
*L5B	I.F. oscillator coupler
L6A	Drive anode tuning inductance, L.F.
L7A	Sender F.C. anode tuning inductance, H.F.
L8A and B	1st and 2nd I.F. transformers
L9A	3rd I.F. transformer
L10A	Receiver R.F. choke
L11A	V.H.F. tuning inductance
L12A	B aerial choke
L13A	B cathode choke
L14A	Quench tuning coil
L15A	Quench anode choke
L16A	L.T. filter choke (.03 pH)
L17A and B	L.T. filter choke
L18A and B	H.T. filter chokes
L19A and B	Relay, energizing coils
L20A	Buzzer, energizing coil
L21A	Sender F.C. anode tuning inductance, L.F.
*L22A	Receiver R.F. tuning inductance, H.F.
*L22B	Receiver R.F. coupler, H.F.
*L23A	Receiver R.F. tuning inductance, L.F.
*L23B	Receiver R.F. coupler, L.F.
*L24A	R.F. oscillator inductance, H.F.
*L24B	R.F. oscillator coupler, H.F.
*L25A	R.F. oscillator inductance, L.F.
*L25B	R.F. oscillator coupler, L.F.
L26A	B aerial coil
	TRANSFORMERS
T1A	Aerial current, meter transformer
T2A	Receiver, output transformer, A set
T3A	Microphone transformer, A set
T4A	Microphone transformer, B set
T4B	Microphone transformer, I–C
*T5A	Output transformer, B set
*T6A	Output transformer, I–C
T7A and B	Power microphone transformer
	SWITCHES
S1A–D	Six-pole, 3-way control switch
S2A–C	Pressel switch in hand microphone
S3A–B	Press button switch
S4A and B	Press button switch on power microphone
S5A and B	Relays, send-receive
S6A	Two-pole, on-off power switch
S7A	Nine-pole, 3-way M.C.W., C.W., R/T switch
S8A	Two-pole, 6-way meter switch
S9A	Single-pole, on-off toggle switch
S10A	Double-pole, on-off toggle switch
S11A	Twelve-pole, 2-way wave-change switch

*Not separately demandable.

Circuit reference	*Component*
	VALVES
V1A–F	6K7G R.F. pentode, variable-μ
V2A and B	6K8G triode-hexode, frequency changer
V3A	6B8G double-diode pentode
V4A	ATS25(807) beam power tetrode
V5A	ARP35(EF50) R.F. pentode
V6A	ARDD5(EB34) double diode
V7A	CV6(V.H.F.) tetrode
V8A and B	6V6G(ARP32) beam power tetrode
	PLUGS
PL.1A–C	6pt. Pye plug
PL.2A	12pt. Pye plug
PL.3A–E	5pt. snatch plug
PL.4A–C	Feeder plug
	SOCKETS
So.1A–C	6pt. Pye socket
So.2A	12pt. Pye socket
So.3A–G	5pt. socket
So.4A and B	Feeder socket, A set and variometer
So.5A	Feeder socket, B set
	JACKS
J1A	Key jack, A set
	KEYS
K1A	Key and plug assembly
	RECTIFIERS
W1A	Type A 50962 Westector
W2A	Selenium disc type
	FUSES
F1A–C	Fuses, 250 mA, power supply
	LAMPS
Pl.–A–C.	Lamp, 12 V, pilot and signal

CONDENSERS

Circuit reference	*Capacity in μF*	*Tolerance*	*Rating in V*
C1A	.004	±15%	
C2A–E	.0001	±10%	
C3A	.00054	Max. variable condenser	
C4A–F, H, I, K–O, Q–X, AP–CP	.1		600
C5A	.01	±10%	350
C6A	.00006	± 2%	
C7A and B	.00003	±10%	
C8A	.0032	± 2%	
C9A–D		Four-section variable condenser	
C10A (+C35A)	.00003	Max. trimmer condenser	
C10B and C	.00003	Max. trimmer condenser	
C10D–F	.00003	Max. trimmer condenser	
C11A	.00075	Max. trimmer condenser	

Circuit reference	*Capacity in μF*	*Tolerance*	*Rating in V*
C12A	.0016	± 2%	
C13A–F	.00014	± 2%	
C14A and B	.0001	±20%	
C15A–H and J–M	.0005	±20%	
C16A and B	12.0	Electrolytic	50
C17A–D	.002		450
C18A	.00002	±10%	
C19A	.00009	± 2%	
C20A and B	.002	±15%	
C21A and B	.000005	±20%	
C22A–D	.025		450
C23A	.05		450
C24A	.001		5k
C25A		Split-stator variable condenser	
C26A	.001	±25%	
C27A	.00002	±20%	
C28A	.0007	± 5%	
C29A–C	.01		350
C30A and B	.001	±15%	
C31A–C	2.0	Electrolytic	350
C32A	32.0	Electrolytic	450
C33A and B	.1		1.5k
C34A	.00008	Max. trimmer condenser	
C35A(+C10A)	.000015	Max. trimmer condenser	
C35B	.000015	Max. trimmer condenser	
C36A	.01	±10%	
C37A	.0005	± 2%	
C38A	.1		1k

RESISTORS

	Value in Ω	*Tolerance*	*Rating in W*
R1A–F	470k	±20%	$\frac{1}{4}$
R2A–F	220	±10%	$\frac{1}{4}$
R3A and B	270	±10%	$\frac{1}{4}$
R4A and D	22k	±10%	$\frac{1}{2}$
R5A–E	2.2k	±10%	$\frac{1}{4}$
R6B, D and F–H	47k	±10%	$\frac{1}{4}$
R7A–D, G–H, J–L	100k	±20%	$\frac{1}{4}$
R8A, B.D. and F	1 M	±20%	$\frac{1}{4}$
R9A–E	1k	±10%	$\frac{1}{4}$
R10A and C	470	±10%	$\frac{1}{4}$
R11A and B	3.3k	±10%	$\frac{1}{4}$
R12A	68k	±10%	$\frac{1}{4}$
R13A	1 M		Vol. control
R14A	6		Variable
R15A and B	220k	±20%	$\frac{1}{4}$
R16A	0.5	± .5%	$\frac{1}{4}$
R17A	3.9k	±10%	$\frac{1}{4}$
R18A–C	270k	±20%	$\frac{1}{4}$
R19A and B	82k	±10%	$\frac{1}{4}$
R20A and B	100	±10%	$\frac{1}{4}$
R21A–C	27k	±10%	$\frac{1}{4}$
R22A	47	±10%	$\frac{1}{4}$

Circuit schematic reference	*Value in Ω*	*Tolerance*	*Rating in W*
R23B–E	22k	±10%	¼
R24A	1.200k	± 5%	½
R25A	1.200k	± 5%	1
R26A	29.5k	± 2%	½
R27A			
R28A	27	±10%	¼
R29A	20k		Semi-adjustable
R30A	30	± 5%	½
R31A	2.2k	±10%	½
R32A	15k	±10%	¼
R33A	27k	±10%	½
R34A–C	47k	±10%	½
R35A	100k		Vol. control
R36A	39k	±10%	¼
R37A	390	±10%	¼
R38A	65	± 5%	1
R39A and B	820	±10%	¼
R40A–C	20	±10%	½
R41A and B	2	±10%	18
R42A–C	10k	±10%	¼
R43A	100k		Variable control
R44A	39k	±10%	½
R45A and B	22k	±10%	1

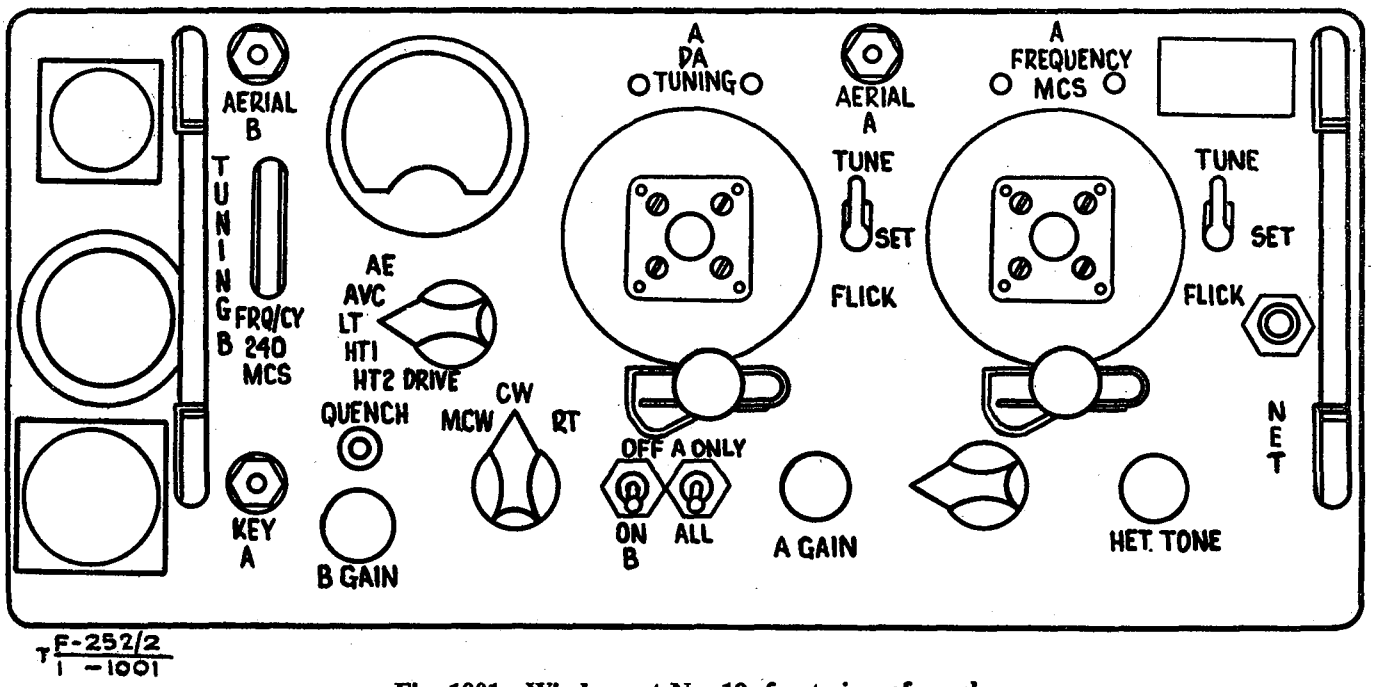


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Fig. 1001—Wireless set No. 19, front view of panel

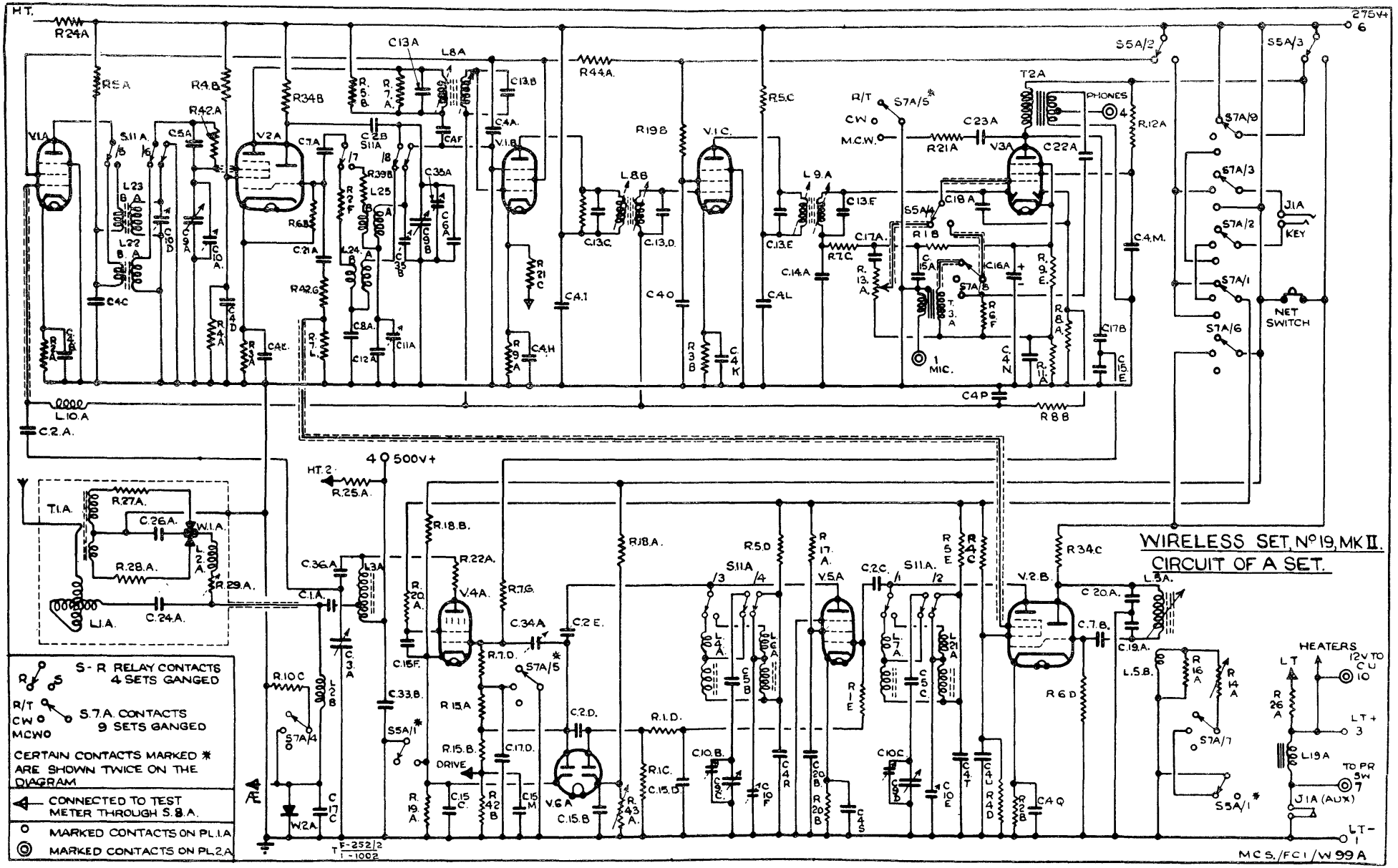
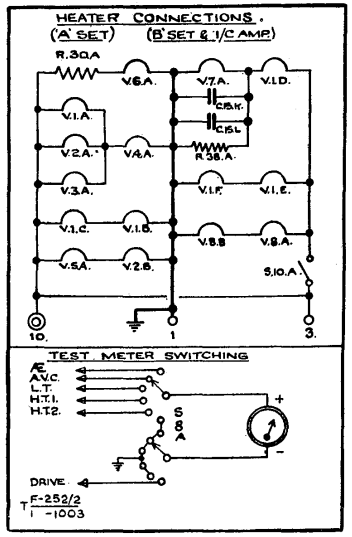


Fig. 1002—Circuit diagram of A set



1003—Heater connections and test meter switching

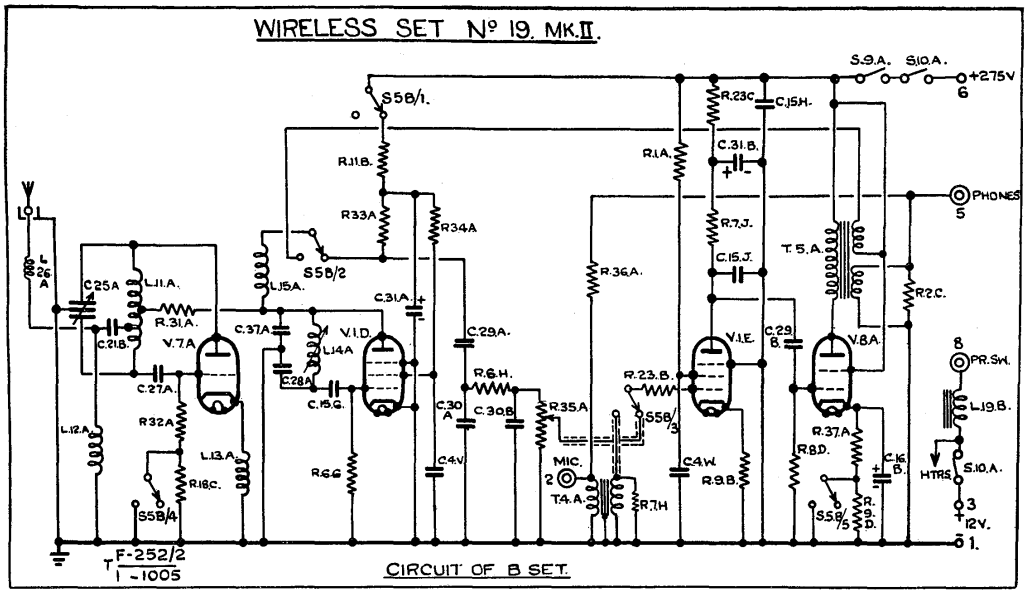


Fig. 1005—Circuit diagram of B set

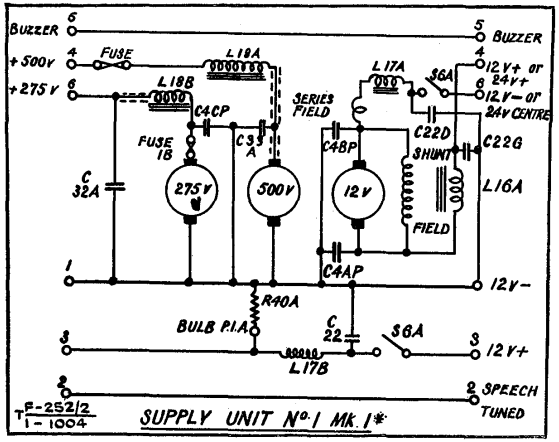


Fig. 1004—Circuit diagram of supply unit No. 1, Mk. I*

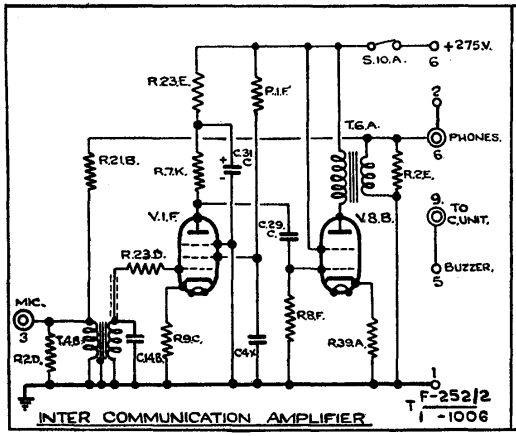


Fig. 1006—Circuit diagram of intercommunication amplifier

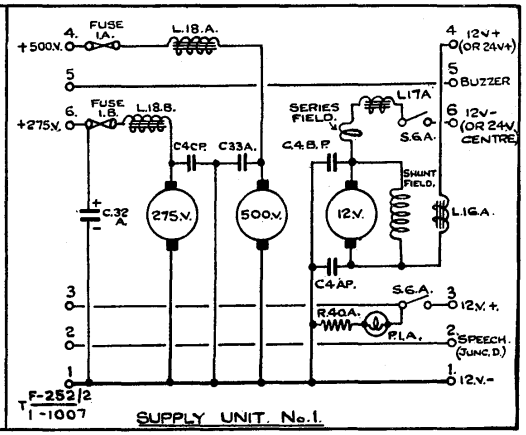


Fig. 1007—Circuit diagram of supply unit No. 1, Mk. I

END

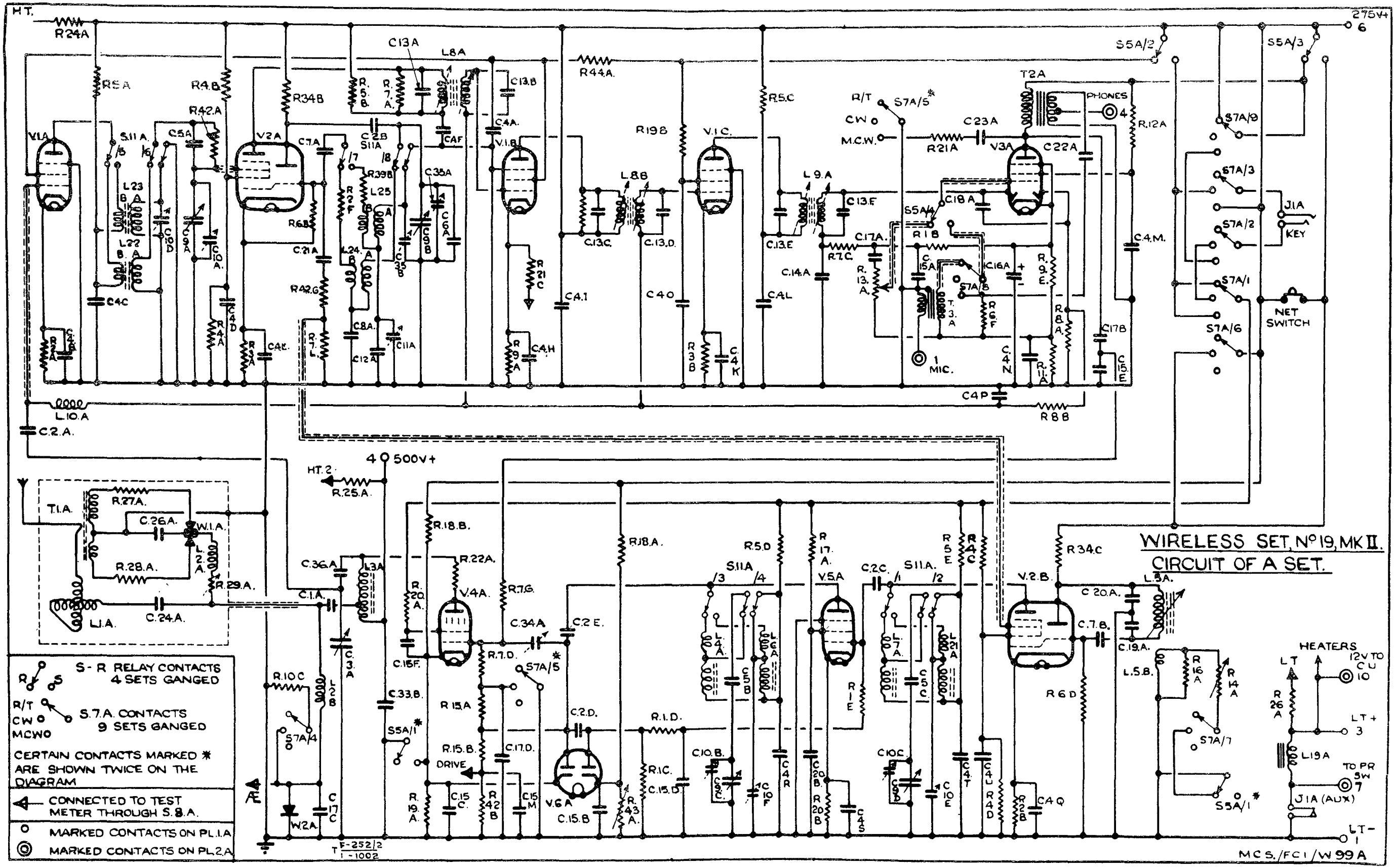
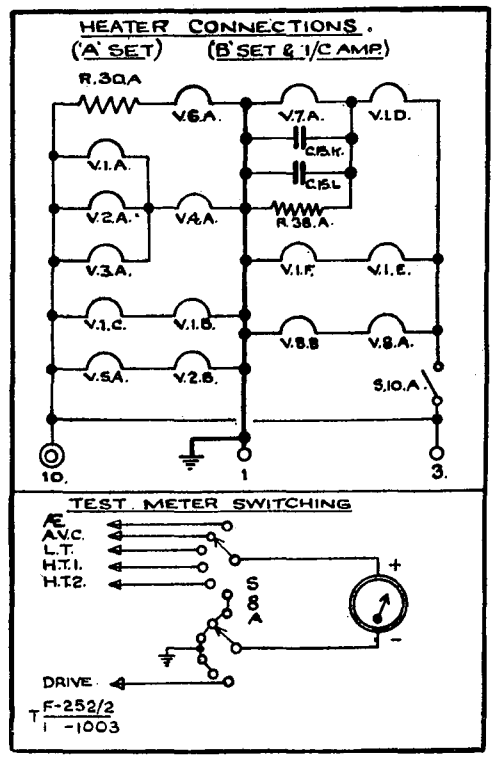


Fig. 1002—Circuit diagram of A set



1003—Heater connections and test meter switching

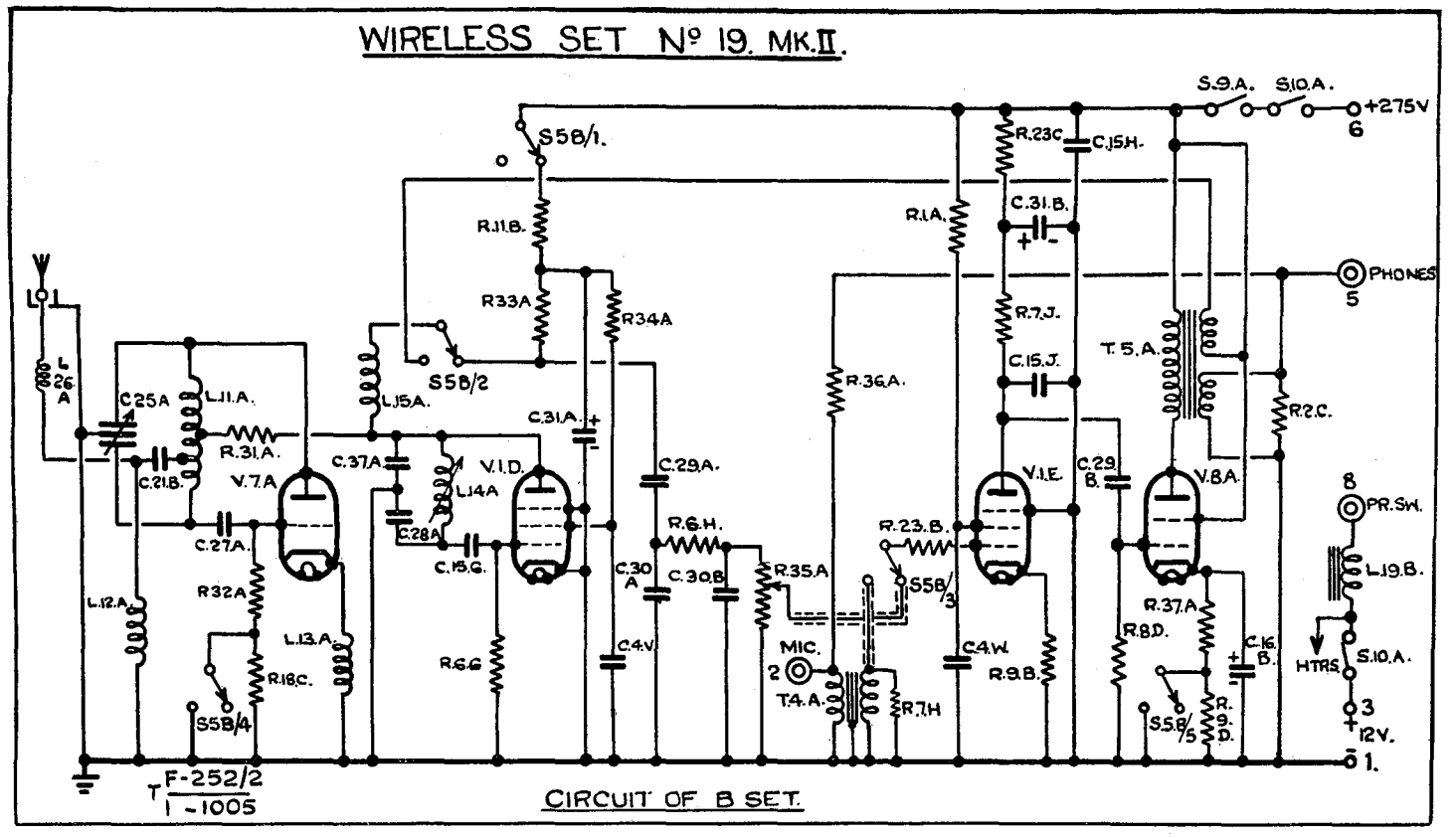


Fig. 1005—Circuit diagram of B set

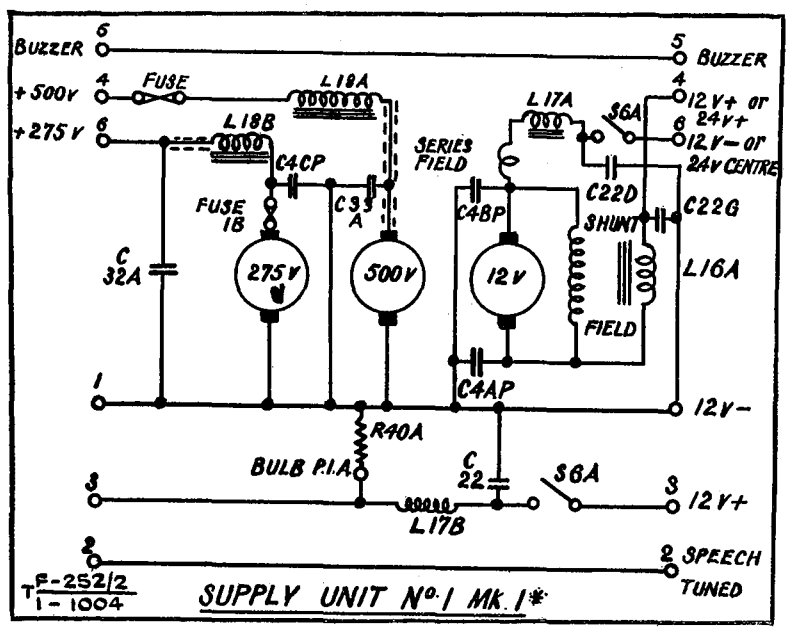


Fig. 1004—Circuit diagram of supply unit No. 1, Mk. I*

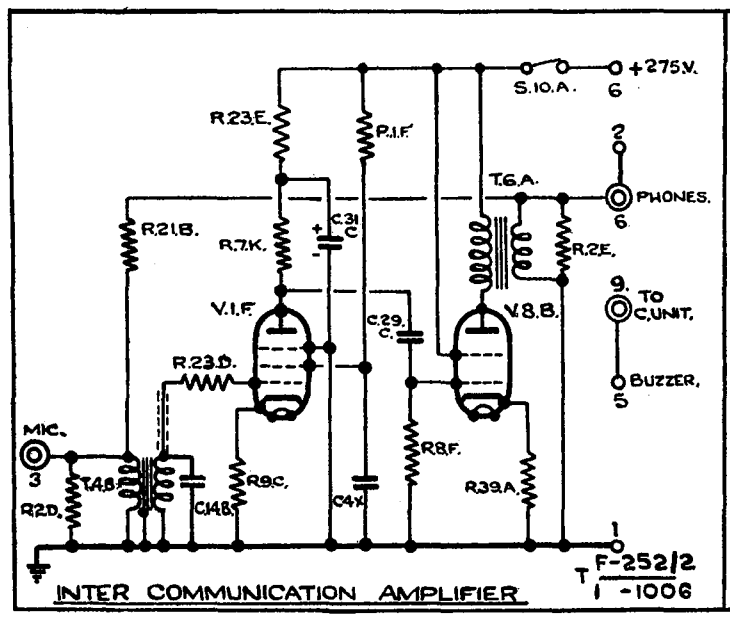


Fig. 1006—Circuit diagram of intercommunication amplifier

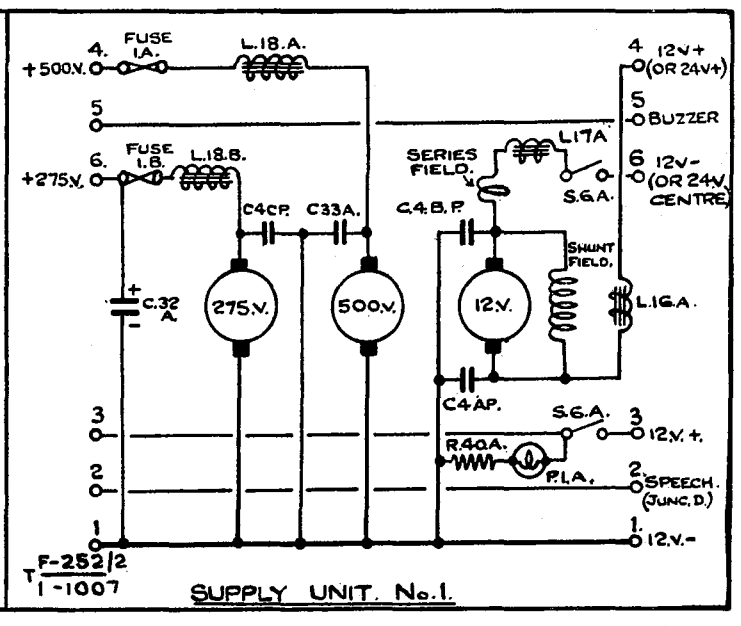


Fig. 1007—Circuit diagram of supply unit No. 1, Mk. I

END