

PHILIPS

VALVE-TESTING APPARATUS

“Cartomatic” III



GM 7633\01

DIRECTIONS FOR USE

DIRECTIONS FOR USE VALVE-TESTING APPARATUS "CARTOMATIC" III

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In correspondence concerning this apparatus please quote the type number and serial number as given on the plate at the back.

DESCRIPTION

Both for the sale of valves and for a quick and efficient testing of valves in various apparatus it is of great importance to have an instrument available with which it is possible to determine quickly whether the valves come up to special requirements.

The Philips "Cartomatic" III has been specially designed for testing radio and amplifier valves. It has been so constructed that it can also be operated by untrained personnel.

The following valve checks can be carried out:

1. Filament breakage;
2. Electrode connections and metallisation (screening) of the valve;
3. Anode current (emission) and thus the quality of the valve.

Short-circuiting can be detected both when the valve is cold and when it is hot. It is quite possible for a valve to have a short-circuit when it is hot but not when it is cold, and vice versa.

The time required for testing a particular valve has been reduced to a minimum by avoiding the necessity of separately adjusting the anode voltage, cathode voltage, etc. required for each valve, which is the case with many valve testers of other types.

With the aid of the punched "Pertinax" measuring card corresponding to each type of valve (fig. 1), the necessary voltages are applied to the valve.

After the valve has been tested — in the manner to be described further on — in the cold state for short-circuiting between the electrodes, the measuring card for that particular type of valve is placed in the slot on the left-hand side of the instrument. Upon the handle being pushed to the left the 88 contact pins of a built-in switching mechanism are moved towards the card. Wherever a hole has been punched in the card a contact pin passes through and makes contact with a corresponding contact spring on the other side of the card. In this way a number of connections are established which automatically give the right value to the supply voltages for the particular valve.

The apparatus can be used in horizontal as well as in vertical position. It is, however, recommended to use the apparatus in the **horizontal** position for testing certain types of directly-heated rectifying valves, such as AZ 41, to prevent sagging of the filament.

The apparatus can be connected to a.c. mains of 40—60 c/s with a voltage of 110, 125, 145, 200, 220 or 245 V. A regulating knob is fitted for correcting any variations in the supply voltage. The power dissipation, unloaded, is about 7 W.

Accessories

With the apparatus are included:

1. a flex for connecting to the mains;
2. a lead for connecting valves with a top or side connection;
3. a metal pin for testing the metallization (used in combination with the top valve connection);
4. a standard series of appr. 50 valve measuring cards, type GM 7632 (series A for European valves or series B for American valves);
5. a standard series of adaptor sockets type GM 7631.

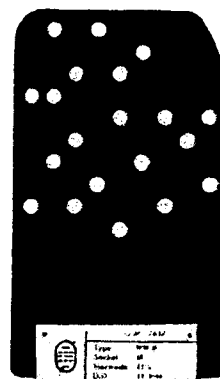


Fig. 1
Measuring card

New valve measuring cards for the "Cartomatic" III (GM 7633/01) can be punched with a perforator which can be ordered under type number GM 7636; a book of instructions is supplied with it. Measuring cards for each of the valve types given in the book of instructions can be made with the aid of the materials supplied in a packet under type number GM 7637 containing:

- a. 100 blank measuring cards,
- b. 100 labels (25 × 4),
- c. 2 booklets of valve diagrams,
- d. 1 roll of cellophane adhesive tape.

INSTALLATION

Adjusting to local mains voltage

If the number visible through the circular opening in the cover plate on the bottom does not correspond to the local mains voltage then an adjustment has to be made. This is done by removing the cover plate, pulling out the voltage adaptor and after turning it to the correct figure pressing it back again, after which the cover plate is replaced.

Earth connection

The terminal marked E should be properly earthed before the "Cartomatic" is connected to the mains.

Connection to mains

The mains lead supplied with the apparatus can be connected to the counter-sunk pin socket on the right-hand side panel.

Replacing defective lamps

The apparatus contains the following lamps:

pilot lamp La_1 (type 8009 N, 6.3 V 0.25 A),
neon lamp La_2 (type 9512, 90 V) and
signal lamp La_3 (type 8009 N, 6.3 V 0.25 A).

To replace these lamps the apparatus has to be taken out of the case, after removing the three fixing screws and the earth terminal on the front (see fig. 2). The neon signal lamp La_2 next to the handle on the right has a bayonet fitting and can be replaced from the outside.

OPERATION

ZERO ADJUSTMENT OF THE METER

Before connecting the apparatus to the mains, the pointer of the meter has to be set to the zero point of the scale with the adjusting screw on the meter glass (mechanical zero adjustment). When the apparatus is then connected to the mains the signal lamp La_1 begins to glow.

INSERTING THE VALVE TO BE TESTED

Valves with a P cap can be inserted directly into the valve socket on the left-hand side of the apparatus. For valves with other caps one has to use the adaptor socket type GM 7631 indicated on the label of the measuring card(s) for the valve in question.

If the valve has a top connection, or the adaptor a side connection, this is to be connected to socket 9 next to the valve holder with the aid of the flex supplied.

TESTING THE VALVE IN THE COLD STATE

This should always be done before testing the valve in a hot state. The handle on the left on the apparatus should be placed in the right-hand position. The indicator lamp La_1 next to the meter shows whether the apparatus is under tension or not.

As may be seen from fig. 2, at the bottom of the front panel on the left-hand side there are nine push-buttons, the numbers of which correspond to the numbering of the electrodes shown in the valve diagram (on the measuring card for the respective valve). The simplified circuiting diagram in fig. 3. shows how the short-circuiting test works when the valve is in the cold state. When, for instance, the push-button for the supply lead to the control grid (f) is depressed, this grid receives a strong negative voltage with respect to all the other electrodes. If there is a short-circuit with one or more of the other electrodes the neon lamp La_2 immediately lights up. In this way all the electrodes can be scanned one after the other. In the event of a short-circuit, for instance between control grid and cathode, the neon lamp will light up when pressing in both the button f and the button g.

If the lamp does not light up when pressing in the buttons h or i this indicates a breakage in the filament. When h and i are pushed in simultaneously the lamp La_2 should not light up.

Below an explanation is given of the tests, also summarized in the table on page 12.

Test 1. — Short-circuiting between the filament and one of the other electrodes

Both the push-buttons for the filament connection (see the valve diagram on the label of the corresponding card) have to be pressed in at once. If the signal lamp La_2 above and to the right of the push-buttons should light up this indicates short-circuiting with one of the other electrodes; it begins to glow when there is a shorting resistance less than appr. 1.5 megohms.

Test 2. — Breakage of the filament

This is tested by releasing one of the two filament buttons. If the filament and its connections are in order then the signal lamp La_2 lights up.

Test 3. — Short-circuiting between the other electrodes

Press in one after the other the push-buttons 1 to 9. If there is a shorting resistance less than appr. 1.5 megohms the lamp La_2 begins to glow. If, for instance, the lamp burns both when button 4 is pressed in and also when button 9 is pressed in then this indicates a short-circuit between the electrodes corresponding to the connections 4 and 9 on the valve socket. A momentary flicker does not mean that there is a short circuit, for this may be caused by emis-

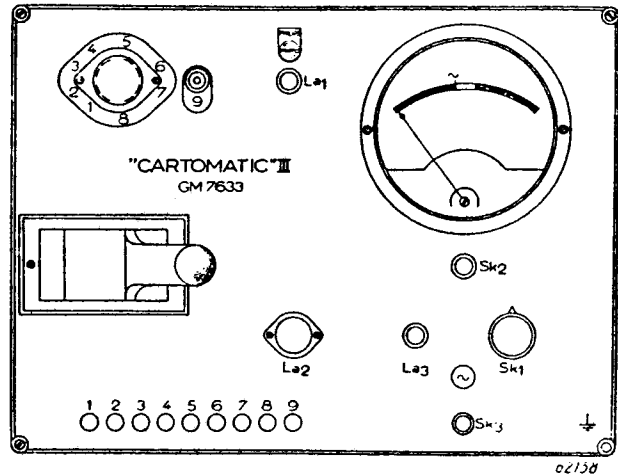


Fig. 2

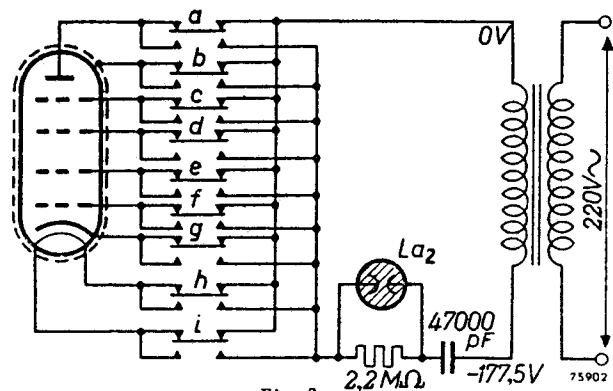


Fig. 3

The circuit diagram for the short-circuit tests if no voltages are applied to the valve (cold condition)

sion from a still hot electrode. The filament buttons need not now be pushed in; in that case the lighting up of the neon lamp La_2 does not indicate short-circuiting but on the contrary that the filament is intact, as already indicated under test 2.

The neon lamp La_2 also lights up when the push-button corresponding to an ic contact (internal connection), is depressed.

Test 4. — Connection between metallization and the contact pin of the valve base

If a metallized valve is being tested which has a top or side connection this has to be temporarily removed, the metallization then being connected to socket 9 on the apparatus with the metal pin and flex for the top connection. When button 9 is then pressed in, or the button corresponding to the metallization (see diagram on the label of the measuring card), then the neon lamp La_2 will light up brightly if the connection is in order. If the lamp does not light up or burns very weakly, then the connection between metallization and the contact pin of the valve base is broken or insufficient. After this test has been completed the lead has to be reconnected to the top or side connection.

TESTING THE VALVE IN THE HOT STATE

If a valve has answered all the above tests satisfactorily it can then be tested in the hot state.

It may occur that if the valve is in cold condition, no short-circuit between the electrodes occurs, whereas this will take place in warm condition. Some of these short-circuits, e.g. between suppressor grid and anode may cause a considerable current in the meter circuit.

Fig. 4 shows for example the measurement of the heptode part of an ECH 21, where there is a short-circuit between the suppressor grid and the anode of the heptode part. The current through the meter with shunt in this measurement will be approx. 180 mA, whilst the current required for full deflection in this case is 4 mA. The current through the meter circuit can rise to this high value, because this value, in the case of a short-circuit, is entirely determined by the value of the measuring voltage and the resistance of meter with shunt, and no longer by the emission of the valve. In the above-mentioned case the chance of burning out of the meter is therefore considerable.

The meter is protected by incorporating a signal lamp La_3 in series with the meter circuit, whilst the meter can be short-circuited by means of a push-button switch Sk_2 . Both are found on the text plate under the meter (fig. 2).

If the handle is set to the left, La_3 , in case of a short-circuit, will either light up, or burn out, according to the nature of the short-circuit and the type of valve.

As soon as La_3 lights up the handle should be set to the right in order to avoid burning out of the resistors in the meter circuit.

In order to be able to signalize a short-circuit it is thus necessary to check in advance the functioning of La_3 , in the manner as described below under test 5. If the pilot lamp has been found to be in order and does not light up when the handle is set to the left, then there is no short-circuit and the remaining electrodes can be checked (test 6), after which the emission can be measured by removing the short-circuit of the meter (test 7). The tests mentioned here are carried out in the following way:

Test 5. — Signal lamp La_3

It can at once be seen whether this lamp is in order by pressing in the push-button Sk_3 (marked \sim). During this test the handle remains in the right-hand position. If the lamp does not light up it has to be replaced by a new one.

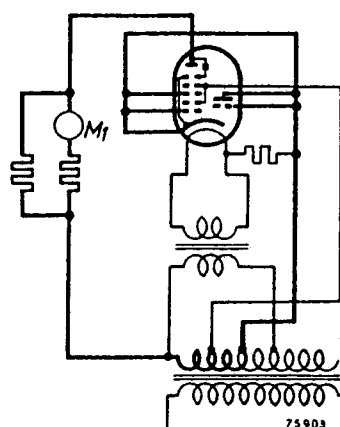


Fig. 4
Short-circuit in the heptode part
of an ECH 21

If it lights up, then the needle of the meter has to be watched to see whether it comes to rest exactly on the last mark of the red section (marked \sim) or not. It is possible that owing to mains voltage variations the measuring voltage is slightly changed. The voltage can be readjusted first with the regulator Sk_1 .

After this proceed to the following test.

Test 6. — Short-circuiting between one of the electrodes

The corresponding card (type GM 7632) is placed in the slot in the left-hand panel and the handle is moved over to the left.

As soon as La_3 (underneath the meter) lights up the handle should be set to the right and the valve has to be rejected.

With the handle to the left the valve under test is provided with the necessary supply voltages.

Should there be more than one card belonging to a particular valve — this is indicated in the second column in the instruction book — then the valve should be tested in the hot state with all these cards. If the card is not inserted far enough into the slot or the text on the label is not facing upward then upon the handle being pushed over to the left the apparatus is automatically switched off, thus precluding the possibility of the apparatus or the valve being damaged. The indicator lamp La_1 (next to the meter) then goes out.

If the card has been inserted in the proper way then the signal lamp La_1 goes on burning as soon as the handle is pushed to the left.

The functioning is illustrated in fig. 5, showing for example the circuit for measuring an ECH 3.

A. First the anode of the valve part to be tested has to be checked for leakage or short-circuiting. This is done by pressing in the button corresponding to this electrode, as indicated on the label of the measuring card under "Electrode" (button 8 in fig. 5).

Numbers in parentheses on the label indicate the anodes of other valve parts for which there are separate measuring cards. If the anode makes a short-circuit with one of the other electrodes then the neon lamp La_2 will glow and in that case no further tests should be carried out. In the case of a complete short-circuit with the anode this will generally have been signaled by La_3 lighting up.

B. If the test has not indicated any short-circuiting of the anode then the buttons corresponding to the other electrodes can be pressed in successively. Should there be a short-circuit, the lamp La_2 will light up.

An exception to this rule are the filament push-buttons when **indirectly-heated** valves are tested. If, on pressing one of these buttons La_2 lights up, this does not necessarily mean that there is a short-circuit. This is, however, sure to be the case if La_2 lights up when **both** filament push-buttons are depressed **simultaneously**. In order to determine which electrode is short-circuiting with the filament, it is necessary to depress, apart from the two filament push-buttons, all the other buttons in turn. La_2 is extinguished as soon as the button of the short-circuiting electrode is depressed. In most cases this will be the cathode. The valve has to be rejected in any case.

Test 7. — Emission

During the previous test the valve had the opportunity to heat up, so that the meter will indicate its emission when push-button Sk_2 (underneath the meter) is depressed, by means of which the short-circuiting of the meter is removed.

If the pointer does not show a deflection this is an indication of one of the following defects:

- a. there is no emission from the valve;
- b. the filament is broken;
- c. the cathode lead is broken;
- d. the anode lead is broken.

In all these cases the valve has to be rejected.

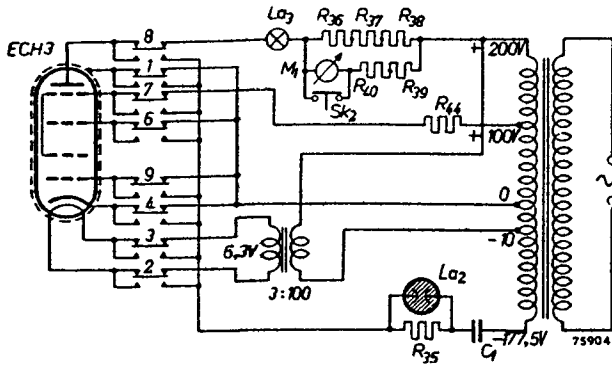


Fig. 5

Circuit diagram for the short-circuit tests when voltages are supplied to the valve (warm condition)

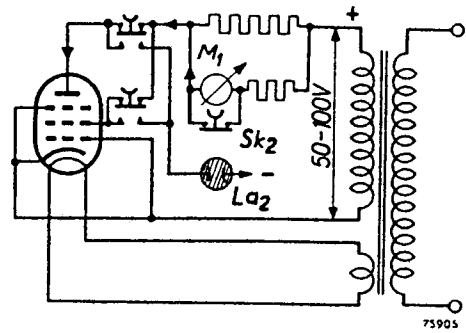


Fig. 6

Screen grid and anode interconnected (for simplification only two push-buttons are shown)

Test 8. — Faulty connection of one of the electrodes

When, besides Sk_2 , also the button corresponding to the anode, is depressed, the indicator will fall back to zero.

An exception are those tubes where during measurement the screen grid of the valve part under test, is connected to the anode. This can be seen on the measuring card of the appertaining valve part. If, as is the case with most valves containing a screen grid, the hole G_s of group IV has been punched in the column for the screen grid of the valve part to be examined (see also manual), this means that during the measurement the screen grid is indeed separately supplied with a voltage (see e.g. fig. 5). If no hole G_s has been punched, this means that during measurement the screen grid is connected to the anode (fig. 6). In that case a hole A has been punched both with the anode as with the screen grid (see e.g. in the manual the EF 39, KL 1, KL 2, KL 5, UF 8, UL 1 etc.).

If now the button corresponding to the anode is pressed, the screen grid will function as anode and the meter will continue to show a deflection (Sk_2 is depressed). If this is not the case, the screen-grid connection is faulty.

The meter will likewise fail to give a deflection, if besides Sk_2 both the button of the anode and the one of the screen grid are pressed, or if only the screen-grid button (together with Sk_2) is pressed.

After this test the other electrodes are tested for faulty connections by subsequently depressing the corresponding buttons (each time also press Sk_2). The indicator should then always fall back to zero. If the meter fails to fall back, this is an indication that the connection between the electrode in question and the valve base is faulty and the valve has to be rejected. The filament need not be checked any further for faulty connection, since this would already have been found during test 7 (no emission).

Test 9. — Quality

After a certain valve part has been tested for short-circuiting and faulty connections the quality of that part of the valve can be tested.

If, with the button Sk_2 pressed in, the pointer moves into the red section then the quality of the valve is unsatisfactory. If the pointer remains in the white section then the quality is doubtful. If the pointer moves across into the blue section then the valve is of sufficient quality for that part to which the measuring card in use relates. After this test the handle is swung over into the right-hand position and the card replaced by the next one, if there should be another belonging to this valve. Testing in the hot state is then carried out in the same way for the respective valve parts.

If in the quality tests the pointer should move for all cards into the blue section then the valve quality is satisfactory, but if in one of the tests it should enter the red section then the valve has to be rejected.

The meter deflection is a measure for the anode current and hence for the emission.

Owing to the rectifying action of the valve, the anode current consists of semi-sinusoidal pulses. The meter indicates a direct current equal to $0.28 \times I_{max}$, where I_{max} is the amplitude of the current passing through the meter; the factor 0.28 has been established experimentally.

The relation between the emission and the mutual conductance of a valve can best be understood with reference to the I_a-V_g characteristic, two of which are given by way of example in fig. 7.

When the anode current at $V = 0$ has dropped from I_{a1} to I_{a2} , the mutual conductance is reduced proportionately, as is clearly to be seen in the illustration. In this case the starting point P of the anode current is the same for both characteristics.

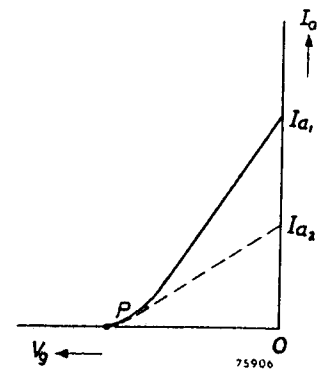


Fig. 7

I_a-V_g characteristics

PERFORATING THE MEASURING CARDS

The book of instructions, supplied with the perforator, contains data on a large number of European and American valves. If a valve has to be measured for which no data are given in the book, these data will be supplied upon request. The data of new valves that may be introduced in the future will be supplied in due course.

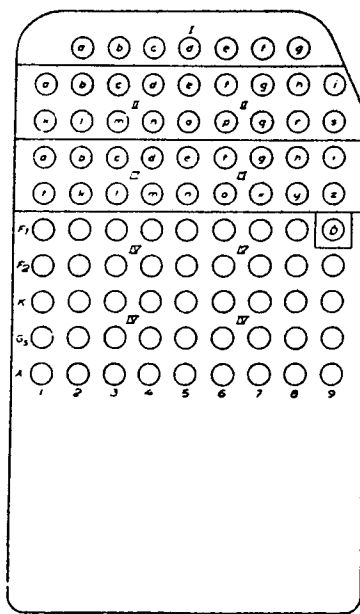


Fig. 8

Non-perforated measuring card

The figures 8 and 9 show a non-perforated measuring card and the punch used for perforating the cards.

The circles on the measuring card are arranged in four groups, I, II, III and IV. With group I the rejection limit is determined. Group II serves for getting the right voltages on the anode and screen grid. With group III the right filament voltage is determined, whilst with group IV the necessary connections to the valve base are chosen.

For a large number of valves the book of instructions shows exactly where holes have to be punched in the various groups. As an example we give below the data contained in the book for the valve type ECH 3.

For this valve two measuring cards are required, because it has two anodes (5 and 8).

Columns I, II, III and IV correspond to the groups of circles I, II, III and IV on the card. The letters in these columns indicate where a hole has to be punched in the card. The number under the column S indicates the valve diagram belonging to the particular type of valve. These diagrams

are no larger than a postage stamp and can be torn out of the book of valve diagrams. Where a socket adaptor has to be used, this is indicated in the next column. When the

Type	Socket	Electr.	I	II	III	IV									S	GM 7631/	d.d.
						1	2	3	4	5	6	7	8	9			
ECH 3	P	5	acde	dh	agn-xyz	K	F ₁	F ₂	K	A	K	K	K	K	527	--	
		8	abe	afm	agn-xyz	K	F ₁	F ₂	K	K	K	G _s	A	K	527	--	

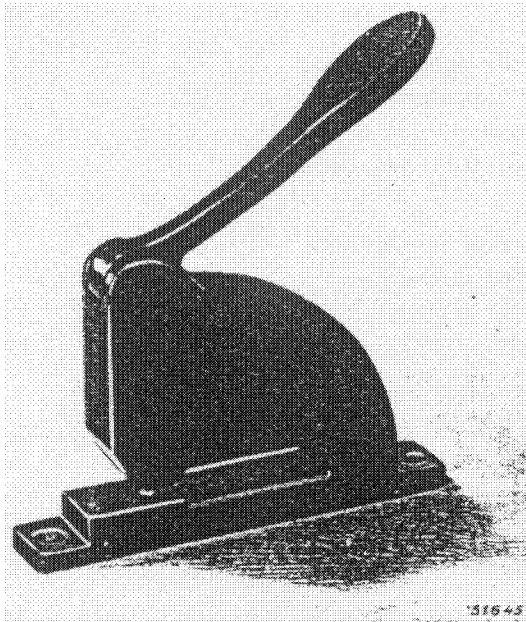


Fig. 9
The perforator

cards have been perforated according to the instructions given, a label is filled in as follows (fig. 10):

Type: ECH 3
Socket (adaptor): *)
Electrode: 5 (8)

In this case electrode 5 is connected as an anode.

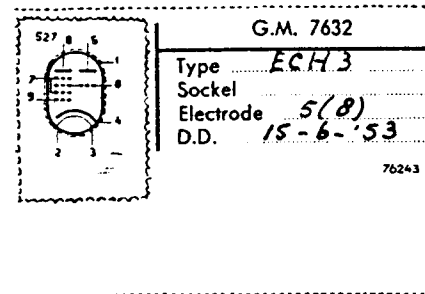


Fig. 10
Label for measuring card

The figure (8) means that a second measuring card belongs to this valve; on this second card one fills in after the word "Electrode": 8 (5). Finally, in the space provided, the date is filled in on which the card was made. The valve type is again written in the open space at the bottom. After the valve diagram has been pasted on in the square on the left the label is folded in half round the bottom of the card, with the printed part on the printed side of the card, and secured with the adhesive tape. The card is then ready for use. The measuring cards made in this way can be filed in a box so that one can immediately lay hand on them when required.

*) e.g. for type AZ 41: GM 7631/65.

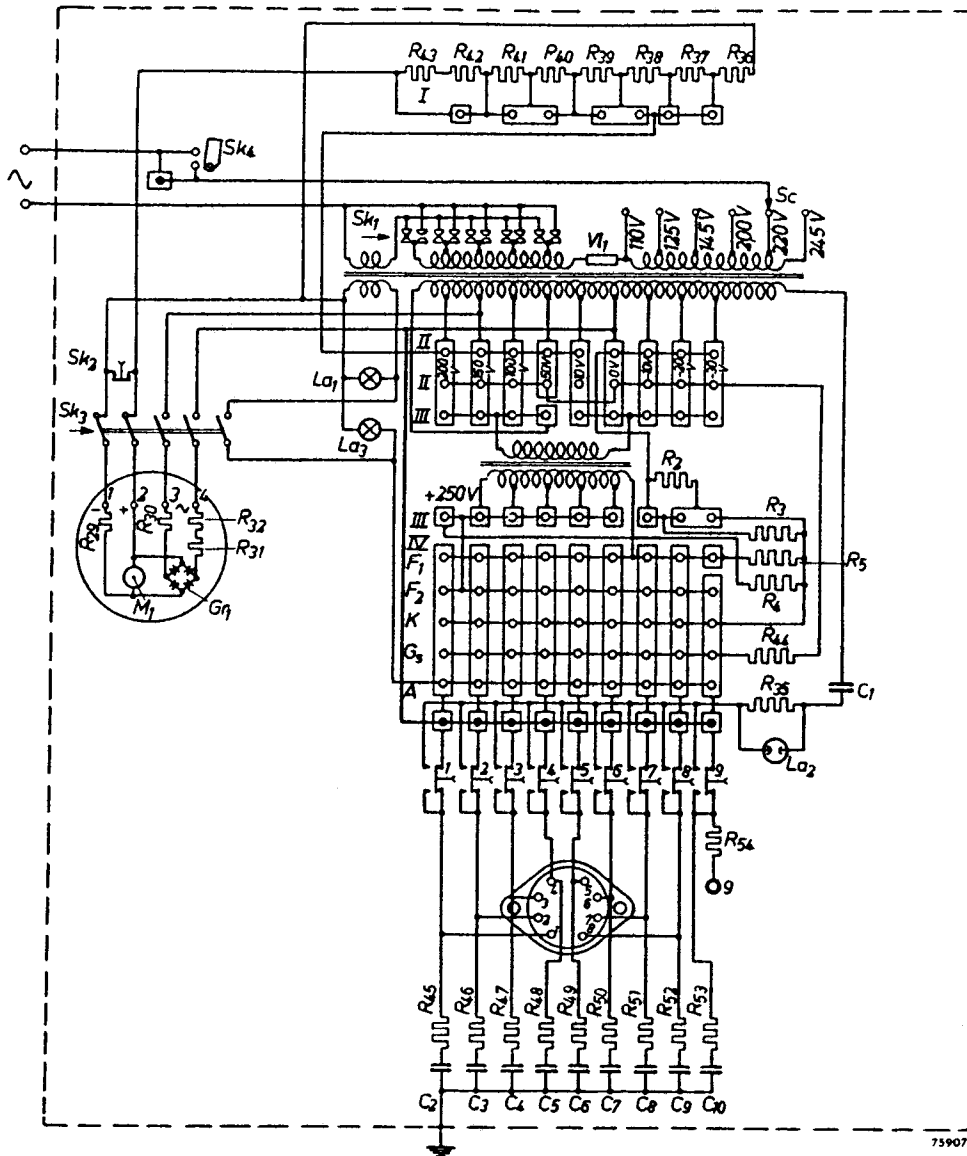


Fig. 11

Circuit diagram of the "Cartomatic" III (subject to slight modifications).
At the indicated point the circuit is connected to the casing.

ELECTRICAL DATA

RESISTORS

R ₂	6000	ohms
R ₃	3000	ohms
R ₄	30	ohms
R ₅	30	ohms
R ₂₉	490	ohms
R ₃₀	390,000	ohms
R ₃₁	27,000—75,000	ohms
R ₃₂	360,000	ohms
R ₃₅	2.2	megohms
R ₃₆	75	ohms
R ₃₇	225	ohms

R ₃₈	900	ohms
R ₃₉	1800	ohms
R ₄₀	3600	ohms
R ₄₁	7200	ohms
R ₄₂	7200	ohms
R ₄₃	7200	ohms
R ₄₄	2 × 20,000	ohms (parallel)
R ₄₅ until and incl. R ₅₃	100	ohms
R ₅₄	15	ohms

CONDENSORS

C ₁	47,000	pF
C ₂ until and incl. C ₁₀	270	pF

LAMPS

La ₁ (type 8009 N)	6.3 V 0.25 A
La ₂ (type 9512)	90 V
La ₃ (type 8009 N)	6.3 V 0.25 A

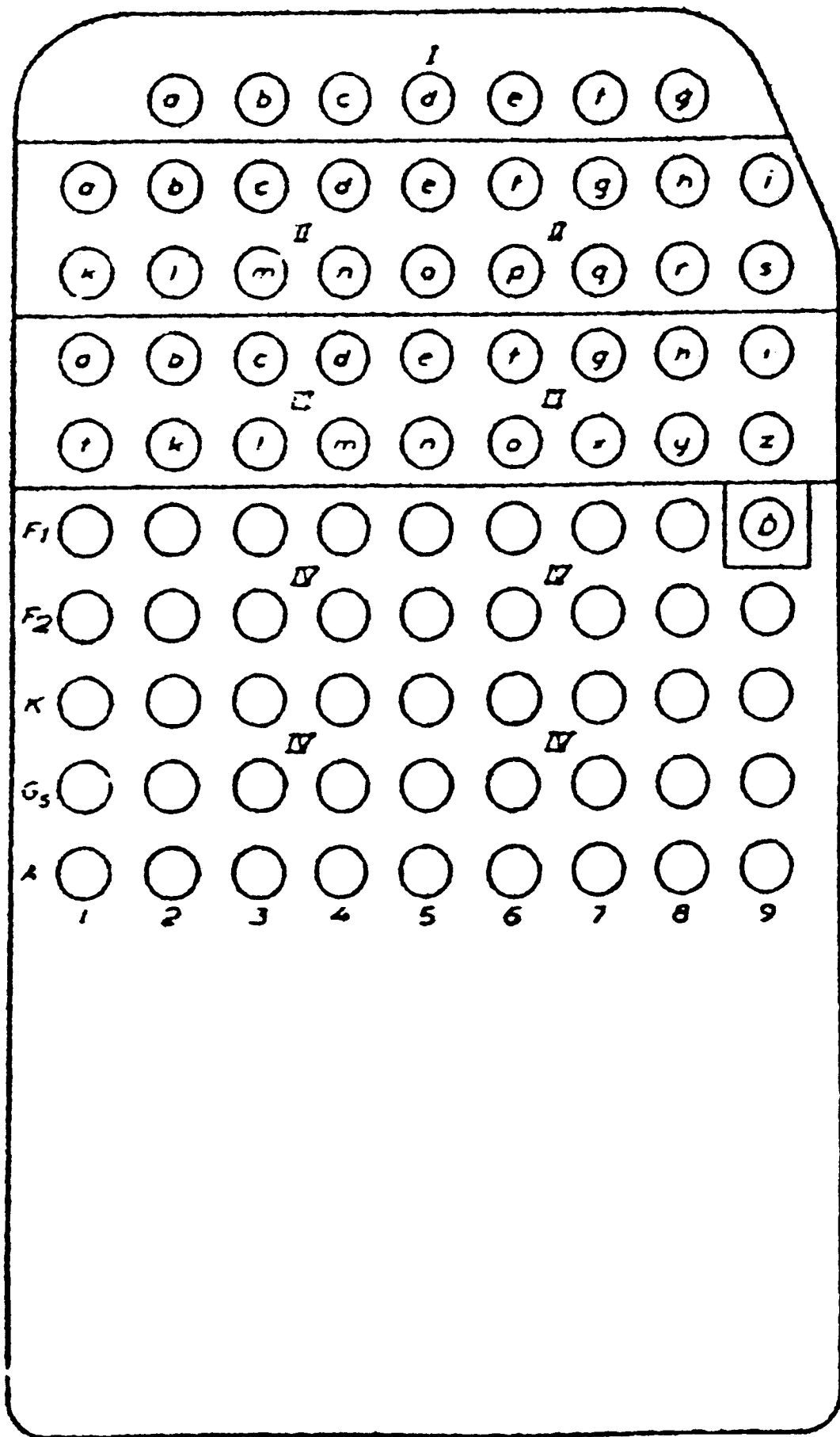
VALVE-TESTING TABLE

Test	Manipulation	Lamp lighting up?			Meter pointer deflecting?	Conclusions
		La ₁	La ₂	La ₃		
Cold state (without card)	Handle to the right	a. no b. yes				a. App. dead b. Apply test 1
1. Shorting between filament and one of the other electrodes	Press in both filament buttons		a. yes b. no			a. Reject (shorting) b. Apply test 2
2. Breakage of filament	Release one of the filament buttons		a. no b. yes			a. Reject (breakage) b. Filament in order, apply test 3
3. Shorting between the other electrodes	Press in the other buttons successively		a. yes ¹⁾ b. no			a. Reject (shorting) b. Apply test 4 or test 5
4. Connection between metallization and contact pin of valve base	Connect metallization to socket 9 and press in one of the two corresponding buttons		a. no b. yes			a. Reject (breakage) b. Reconnect lead with top or side connection and apply test 5
5. Signal lamp La ₃	Press in Sk ₃			a. no b. yes		a. La ₃ defective b. With Sk ₃ , adjust pointer to last mark in red section (~); then apply tests with hot valve
Hot state (with card) Only if 1, 2 and 3 are in order	Slide in the card (text plate upward) and turn handle to the left	a. no b. yes		c. yes d. no		a. No voltage, check whether card has been inserted properly bc. Reject (shorting), immediately turn handle to right, do not test further bd. Carry out test 6
6. Shorting between the electrodes A. Leakage or shorting between anode and one of the electrodes B. Short-circuit of the other electrodes	Press in anode button Press in the other buttons in succession		a. yes b. no a. yes ¹⁾ b. no			a. Reject; do not test further b. Carry out test 6 B a. Reject (short-circuiting) b. Carry out test 7
7. Emission	Press in Sk ₂ (underneath the meter)				a. no b. yes	a. Reject (no emission; anode or cathode lead broken) b. Carry out test 8
8. Interruption of one of the other electrodes	Press in the corresponding buttons (together with Sk ₂) successively (filament buttons excepted)				a. yes ²⁾ b. no	a. Reject (interruption) b. Proceed to quality test (9) for the part of the valve under test when all electrodes are in order
9. Quality	Press in Sk ₂				a. in red section b. in white section c. in blue section	a. Reject; quality unsatisfactory b. Quality doubtful ³⁾ c. Quality good ³⁾

¹⁾ La₂ also lights up when the button corresponding with an ic-contact (internal connection) is pressed in.

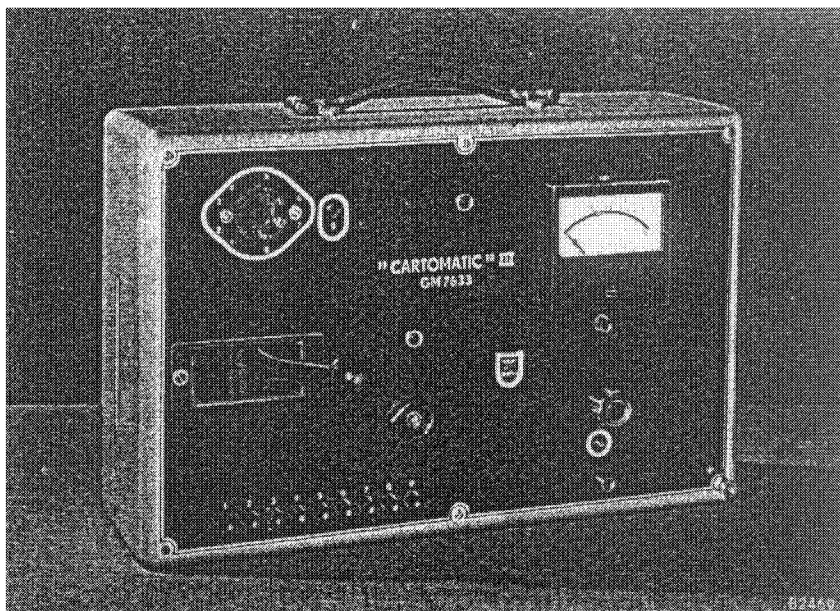
²⁾ See exceptions for some tubes (page 5) of which the screen grid has been connected with the anode.

³⁾ If the quality of the respective part of the valve is good or doubtful the test in the hot state can also be carried out with the next card, if any, for the corresponding part.



49623

Fig. 8



BUIZENCONTROLEAPPARAAT „CARTOMATIC“ III GM 7633/02

De bediening van dit apparaat is gelijk aan die van de GM 7633/01.
Het uiterlijk is gewijzigd; de desbetreffende figuren in de gebruiksaanwijzing voor de GM 7633/01 dienen te worden vervangen door de hierbij afgedrukte.
De meegeleverde standaardserie buizenmeetkaarten is niet meer gesplitst in een serie A en een serie B, zodat thans onder typenummer GM 7632 ongeveer 80 meetkaarten voor Amerikaanse en Europese buizen worden geleverd.

VALVE-TESTING APPARATUS "CARTOMATIC" III GM 7633/02

Operation of this apparatus is identical to that of the GM 7633/01.
The appearance has undergone some changes; the relevant figures in the Directions for Use of the GM 7633/01 will have to be replaced by those printed here.
The standard series of valve-measuring cards supplied with the apparatus is no longer divided into an A and a B series, so that now under type number GM 7632 approximately 80 measuring cards for American and European valves are supplied.

LAMPEMETRE "CARTOMATIC" III GM 7633/02

Le maniement de cet appareil est le même que celui du GM 7633/01.
L'extérieur a été modifié; les figures y relatives dans le mode d'emploi du GM 7633/01 doivent être remplacées par celles imprimées ici.
La série standard des cartes pour la mesure de tubes, série qui est livrée avec l'appareil, n'est plus constituée par les séries A et B. A présent, elle comprend, 80 cartes de mesure environ (numéro de type GM 7632) pour des tubes américains et européens.

RÖHRENPRÜFGERÄT „CARTOMATIC“ III

GM 7633/02

Die Bedienung dieses Geräts ist gleich der des GM 7633/01.

Das Äussere ist geändert worden; die diesbezüglichen Abbildungen in der Gebrauchsanweisung des GM 7633/01 sind durch die hier abgedruckten zu ersetzen.

Die mitgelieferten Normalserie Röhrenprüfkarten ist nicht mehr in eine Serie A und eine Serie B unterteilt, so dass unter der Typennummer GM 7632 etwa 80 Röhrenprüfkarten für amerikanische und europäische Röhren geliefert werden.

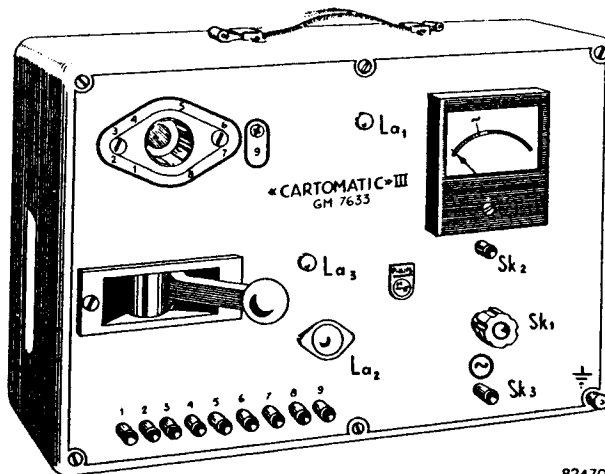
COMPROBADOR DE VALVULAS "CARTOMATIC" III

GM 7633/02

El manejo de este comprobador de válvulas es idéntico al del GM 7633/01.

El aspecto exterior del aparato ha sido modificado; las figuras correspondientes del modo de empleo del GM 7633/01 deben ser sustituidas por las que se adjuntan.

La serie normal de fichas de medida de válvulas que se entrega con cada comprobador ya no está subdividida en dos grupos A y B, sino que ahora se suministran, bajo el número de tipo GM 7632, unas ochenta fichas de medida para válvulas americanas y europeas.



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