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C.D.U./U.D.C.: 621.3.061.001.13 744.423

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

(affiliée à l'Organisation Internationale de Normalisation — ISO)

NORME DE LA CEI

INTERNATIONAL ELECTROTECHNICAL COMMISSION

(affiliated to the International Organization for Standardization — ISO)

IEC STANDARD

Publication 113-4

Première édition — First edition

1975

Schémas, diagrammes, tableaux

Quatrième partie: Recommandations pour l'établissement des schémas des circuits

Diagrams, charts, tables

Part 4: Recommendations for the preparation of circuit diagrams

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STANDARDS AND SAFETY SECTION

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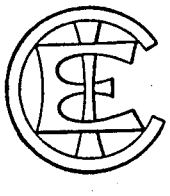

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Bureau Central de la Commission Electrotechnique Internationale

1, rue de Varembé

Genève, Suisse

IEC

VOL.10

Prix Fr. s.
Price S. Fr. **70.50**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

DIAGRAMS, CHARTS, TABLES

Part 4: Recommendations for the preparation of circuit diagrams

FOREWORD

1) The formal decisions or agreements of the IEC on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.

2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.

3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

PREFACE

This recommendation has been prepared by Sub-Committee SC 3B, Preparation of Diagrams, Charts and Tables. Item Designation, of IEC Technical Committee No. 3, Graphical Symbols.

A first draft, prepared by the Secretariat of SC 3B, was discussed at the meeting held in Helsinki in 1971, and a second draft was discussed at the meeting held in Paris in 1972. The draft was submitted to the National Committees for approval under the Six Months' Rule in April 1973.

The following countries voted explicitly in favour of publication of Part 4:

Australia
Austria
Belgium
Denmark
Finland
France
Germany
Italy
Japan
Netherlands
Portugal
Romania
South Africa (Republic of)
Sweden
Switzerland
Turkey
United Kingdom
United States of America

Lines representing conductors on a diagram should be straight with a minimum of cross-overs and changes of direction. Individual circuits should preferably be arranged vertically as shown in Figure 1 or horizontally as shown in Figure 2.

In Figures 1 to 36, T-junctions are shown without a dot. In accordance with IEC Publication 117, Recommended Graphical Symbols, it is equally permissible to draw T-junctions with a dot or a circle. One of the three methods should be used consistently in each diagram or set of diagrams.

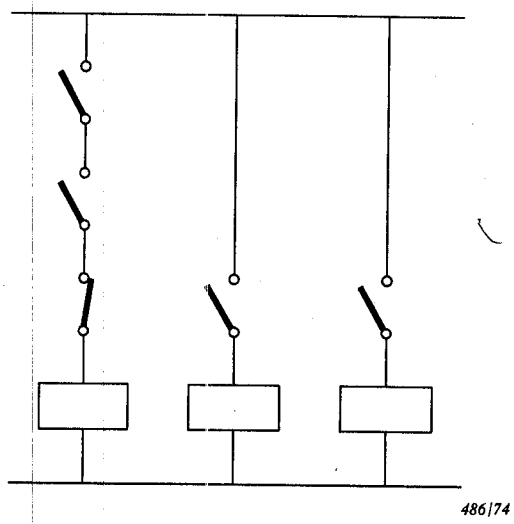


FIGURE 1

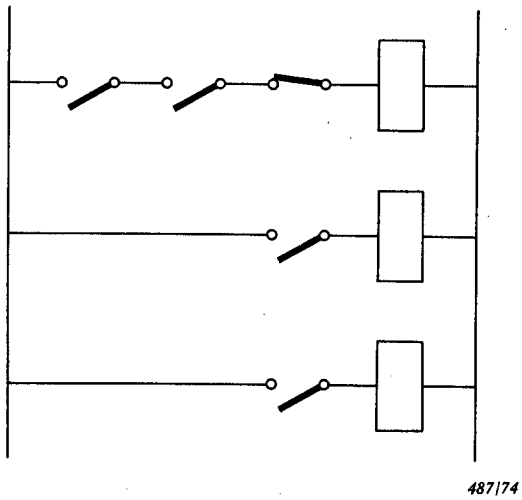


FIGURE 2

4.2 *Functional grouping*

It is recommended that symbols for circuit elements performing a basic function, not necessarily in the same constructional unit, be grouped together. Whenever possible, functional groups should be arranged so that the sequence of events or signal flow are clear, with other elements also arranged to serve this purpose. Circuits should preferably be drawn so that this sequence is shown from left to right or from top to bottom.

5. Arrangement of symbols on diagrams

5.1 *Methods for indicating symbol location*

5.1.1 *Grid reference system*

The grid reference system is described in IEC Publication 113-3. For examples, see:

— Figure 38 (pages 51 and 52), using references with sheet numbers and row designations,

— Figure 39 (page 53), using references with column designations,

— Figures 43 (page 60) and 44 (page 62), using references with rectangular zone designations.

5.1.2 *Tabular system*

Along a horizontal edge of the drawing, the item designations are repeated above or below the corresponding symbols. These item designations are usually arranged in rows, a row for capacitors, a row for resistors, etc. See Figure 47 (page 65). A similar vertical arrangement is also permissible.

5.1.3 *Circuit reference system*

Circuits such as shown in Figures 1 and 2 may be identified by circuit numbers. For example, see Figure 40, page 54.

5.2 *Methods of circuit representation*

The following methods of representation are defined in I E C Publication 113-1:

— assembled representation,
— semi-assembled representation,
— detached representation.

5.2.1 *Assembled representation*

In simple diagrams, it may be satisfactory to show the symbols for the parts of multipart components such as relays, keys, switches, etc., in close proximity. For example, see Figure 3.

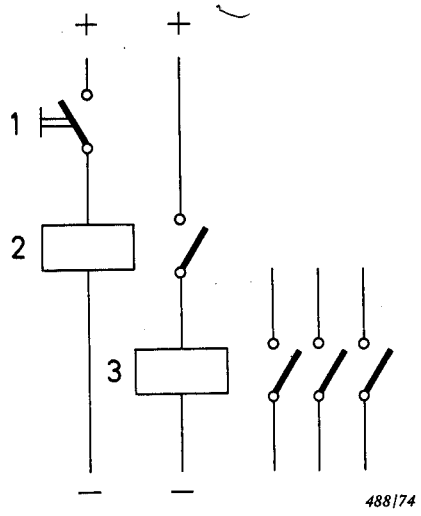


FIGURE 3

5.2.2 *Semi-assembled representation*

Semi-assembled representation with straight mechanical linkage symbols, for example, see Figure 37 (page 50), may result in bends of circuit lines and crossing of lines, and this considerably reduces the clarity of the circuit representation.

To clarify the diagram, it may be necessary to allow crossings, bends and branching of linkage lines. For example, see Figure 14 (page 27) and Figure 38, sheet 2 (page 52).

5.2.3 *Detached representation*

Detached representation, see Figure 39 (page 53), leads to a considerable simplification of drawings, but introduces the problem of indicating which parts belong to the same component. Some recommended methods are described in Sub-clause 5.4.

5.3 *Separation of symbols in detached representation*

When detached representation is used, the symbols for the parts of a multipart component will usually be spread over the circuit diagram.

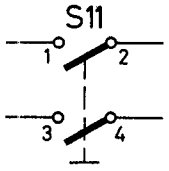
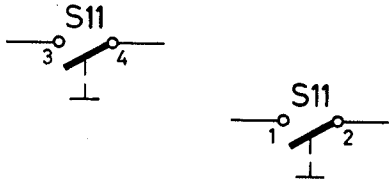
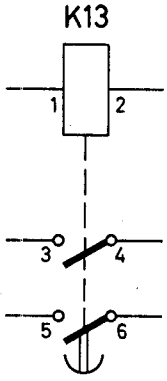
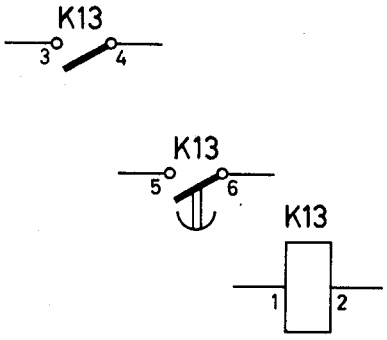
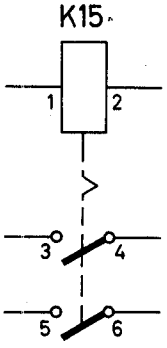
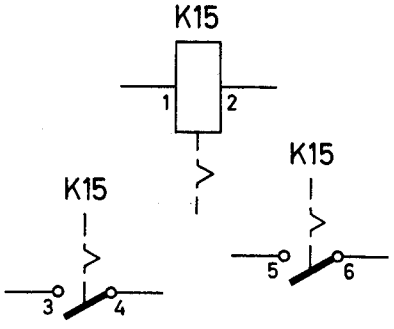
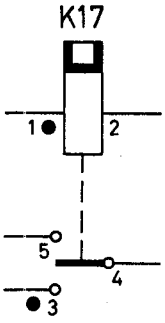
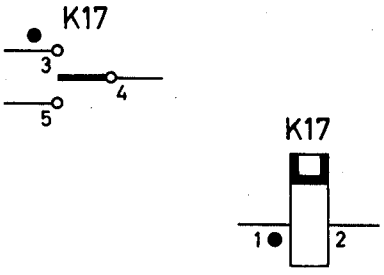
Where necessary, symbols for relays, manually operated switches, etc., are shown with qualifying symbols to describe the operation, e.g. symbols denoting polarization, delay, automatic reset, etc.

The same amount of information should be given in diagrams where detached representation is used. In principle, therefore, the qualifying symbol should be shown associated with each symbol part concerned.

Table I shows some examples of how this can be done.

TABLEAU I
Exemples

TABLE I
Examples

N° No.	Représentation assemblée Assembled representation	Représentation développée Detached representation
1		
2		
3		
4		

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5.4 *Methods of referencing parts in the case of detached representation*

On a diagram in detached representation, the symbol for each part shall be referenced so that:

— it can be seen without ambiguity that all the various parts of any given component in fact belong to that component,

— the location of any given symbol on the diagram can easily be found.

This information may be given by:

a) inset diagrams, or

b) tables.

If it is not possible to place the inset diagrams or tables in line with the corresponding circuits, they may be located elsewhere on the diagram or on a separate sheet. In this case, they should be supplemented by an indication of the location of the operating device.

Note. — Such references may not be necessary in certain simple cases where the addition of the mechanical linkage symbol is sufficient. See for example switch — S1 in Figure 39 (page 53).

5.4.1 *Inset diagrams*

Figure 39 (page 53) gives an example of this method. For each contactor or relay, an inset diagram showing all its coils and contacts is shown below the circuit which contains the coil. For example, in column 7 the diagram for contactor +A4 – K1 appears below the symbol for its coil. The reference at the left of a contact symbol indicates the column where the contact is shown in a circuit. Thus the symbol for contact with terminal markings 21-22 is to be found in column 8 of the diagram.

Similarly, for each contact shown in the circuit diagram a reference to the position of the coil is given. For example for contact +A2 – K3, shown in a circuit near the top of column 6, the reference 5 indicates that coil +A2–K3 can be found in column 5.

Figure 44 (page 62) is an example where all inset diagrams are placed together to the right on the drawing and shown in topographical representation. Topographical representation may be specially suitable for components with complicated contact units where there is no space for terminal markings. The arrangement of the terminals is shown in this example as seen from the wiring side.

Another method of indicating the location of symbols for multipart components is by inset diagrams as shown in Figures 43.1 and 43.2 (page 61).

5.4.2 *Representation by table*

The inset diagrams may be replaced by tables giving the same information. For relays, contactors, etc., Table II is typical and applies to contactor +A4 – K1 in Figure 39.

TABLE II

Make contact	Break contact	Column
1-2		3
3-4		3
5-6		3
13-14		7
	21-22	8
23-24		

Note. — Symbols may be used, instead of words, for column headings. For example, see Figure 40 (page 54).

If there are terminal markings on the component or if they are known by convention, they should be shown in the table. In other cases, an arbitrary identification, e.g. a dot, should be used in the table.

5.5 *Representation of unused elements*

On the final diagrams, prepared after design and development, unused elements, e.g. contacts, windings and terminals, should be shown or referenced.

In semi-assembled representation, the unused elements shown should be linked with the other elements of the same multipart component, e.g. the unused contacts of a relay on the dashed line representing the mechanical coupling. For example, see Figure 37 (page 50).

When detached representation as described in Sub-clause 5.4 is used, the absence of a reference in the inset diagram or table denotes that the element is not used in the equipment. Example, see Figure 39 (page 53) and Table II, contact 23-24 of contactor +A4 – K1.

5.6 *Representation of contacts*

Wherever practicable, consistent orientation of contact symbols for relays, contactors, etc., is recommended. When using detached representation in circuits with complicated contact arrangements, a clear layout of the diagram without crossings has preference over consistency in contact symbol orientation.

All contact symbols shown on one mechanical linkage symbol should have the same direction of movement when actuated by the same actuating device.

For contacts which are not electrically and not manually operated, it is necessary that the circuit diagram should contain an indication of the means of operation. The contact symbol should be drawn in a position consistent with that indication.

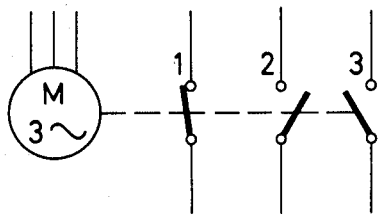
The indication adjacent to a symbol may consist of:

a) *A graph*: Examples of graphs are given in the left hand column of Table III. In these examples, 0 on the vertical axis stands for "contact open" and 1 for "contact closed".

b) *A symbol for the operating device*: For cam-operated devices (chosen as an example of operating devices), the symbols shown in the right-hand column of Table III may be used.

c) *A note, designation or table*: A short text such as shown in Figure 4 may be suitable in some cases.

Example: Motor equipped with centrifugal switch.



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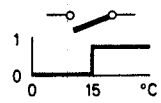
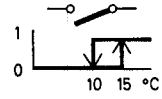
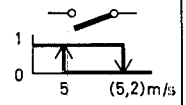
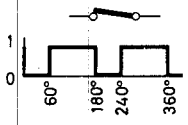
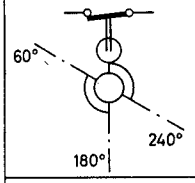
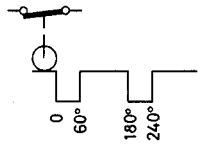
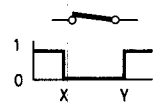
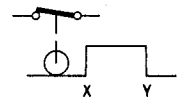
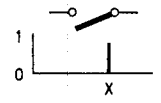
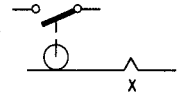
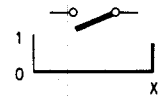
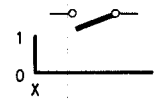
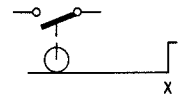
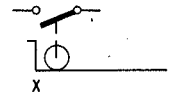
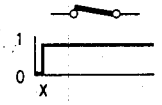
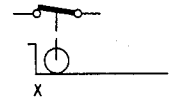
1 = closed in start position, otherwise open
2 = closed at 100 < n < 200 r/min
3 = open at high speed, otherwise closed

FIGURE 4

TABLE III

Example	Description in circuit diagram: by graph	Description in circuit diagram: by cam symbol	Explanation
1			Contact closed at temperatures equal to or exceeding 15 °C
2			Contact closes when temperature increases to 15 °C and then opens when temperature decreases to 10 °C
3			If it is desirable to show that the reset value is only of secondary interest, the reset value is shown in brackets: contact closes when speed decreases to 5 m/s and opens when speed increases to about 5.2 m/s
4		 	Contact closed between 60° and 180° and also between 240° and 360° (0°), otherwise opened
5			Contact opened between position X and position Y, otherwise closed
6			Contact closed only when passing position X
7	 	 	Contact closed only in end position X
8			Contact opened only in end position X

6. Representation of circuits

6.1 *General*

The general principles given in Clause 4 apply to representation of circuits.

6.2 *Representation of supply*

The supply may be represented by:

a) lines as shown in Figures 1 and 2,

b) symbols such as +, —, ~ , etc., as shown in Figure 5,

c) a combination of both, see Figure 6.

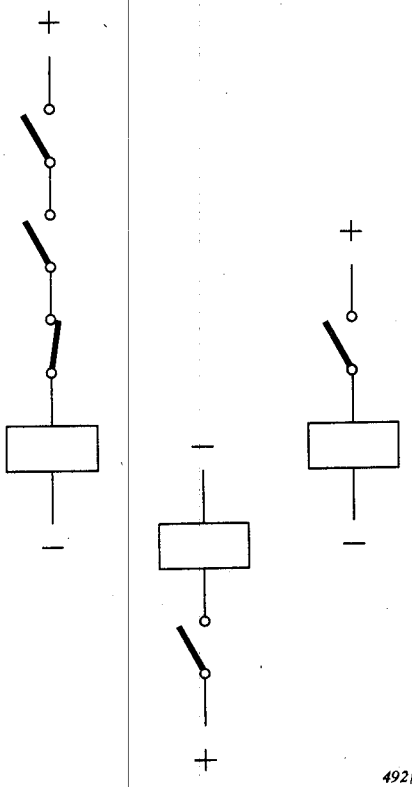


FIGURE 5

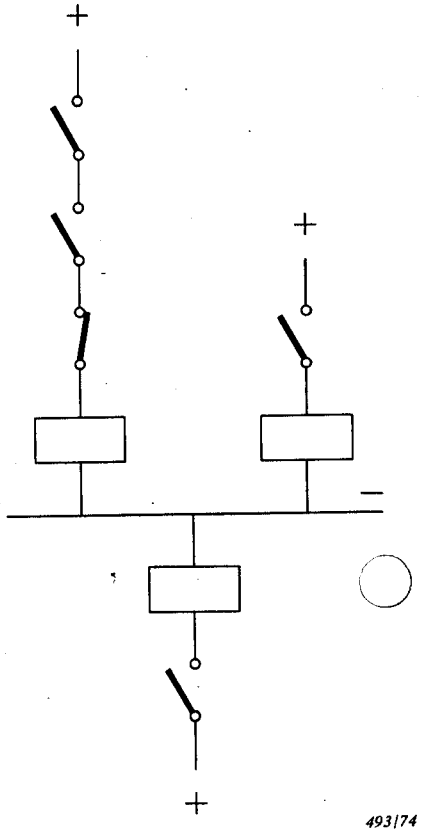


FIGURE 6

The arrangement of d.c. circuits and single-phase circuits on the diagram is made easier and clearer by placing the circuits between supply lines.

In multi-phase circuits, all the supply lines may be shown together to one side, or above or below the circuit. Symbols for the conductors of three-phase systems should preferably be shown in conventional phase sequence order, starting from the top or from the left of the diagram. Neutral conductors should be shown below or to the right of the phase conductors.

6.3 *Representation of main circuits*

A circuit diagram for the control equipment of a power plant or an industrial plant should also show the main power circuits to such an extent that the study of the function of the control equipment is facilitated. It may often be sufficient to show the main circuits or part of them in single-line representation. In certain cases, however, it may be necessary to use multiline representation, e.g. to show how measuring transformers are connected.

6.4 *Detailed recommendations*

6.4.1 *Alignment of similar items*

Similar elements in circuits drawn vertically are preferably aligned horizontally. Example, Figure 7.

For circuits drawn horizontally similar elements are preferably aligned vertically. Example, Figure 8.

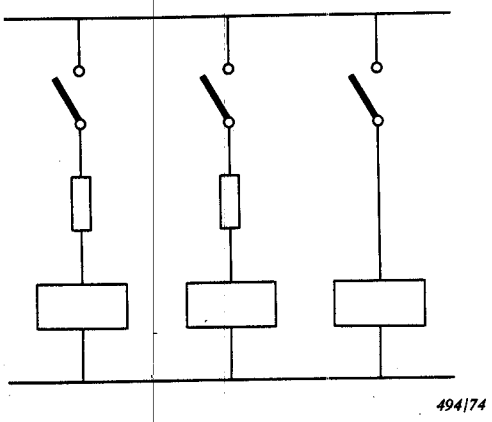


FIGURE 7

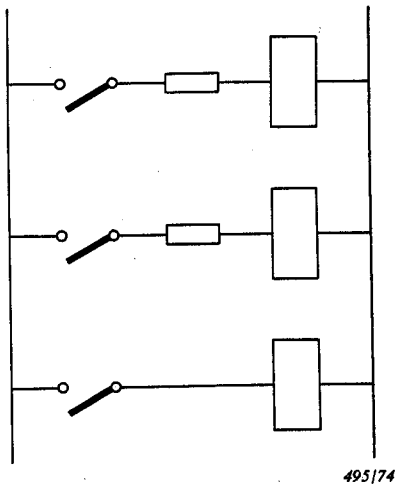


FIGURE 8

6.4.2 *Connection of functionally related elements*

The connections between functionally related elements should be short so that the relationship is made clear. See Figure 9.

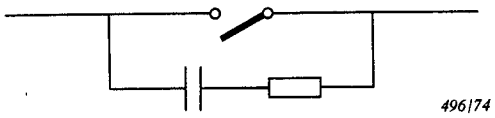


FIGURE 9

Parallel paths of equal importance should be symmetrically displaced with respect to the main path. See Figure 10.

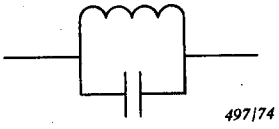


FIGURE 10

6.4.3 *Connecting lines*

a) Long connection lines between parts of the circuit should be avoided.

b) When mechanical functions are closely related to certain electrical functions, linkage of the symbols should be shown, see Figure 11.

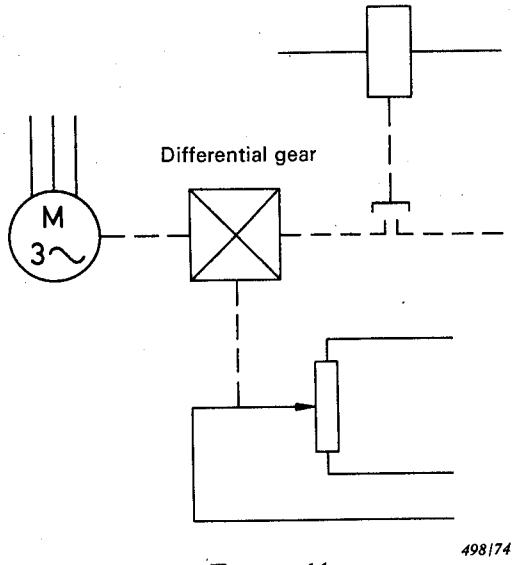


FIGURE 11

6.4.4 *Use of alternative connection symbols*

The symbol for alternative connections (73B of IEC Publication 117) may be used on the circuit diagram to show the connections which have to be made to render the equipment suitable for various alternative applications. The meaning of the numbers must be explained by a note or table on the diagram. See for example Figure 43 (page 60).

Note. — With this technique, it may be convenient to show the symbols for some parts twice; see for example Figure 43, where make contact 1Z.11 appears in zone B5 for alternative applications 4 and 7 and in zone B8 for application 8.

6.4.5 *Crossing and branching*

IEC Publication 117 provides a possibility of showing a connection at a crossing point in the diagram by means of a dot (symbol 70). Crossing points with a dot and those without a dot may not easily be distinguished when using certain reproduction techniques. IEC Publication 117 therefore gives a method of staggering (symbol 69) which avoids ambiguity.

Two lines representing conductors which cross on a diagram should not change direction at this point. The change of direction should therefore occur at a short distance from the crossing point. See Figure 12.

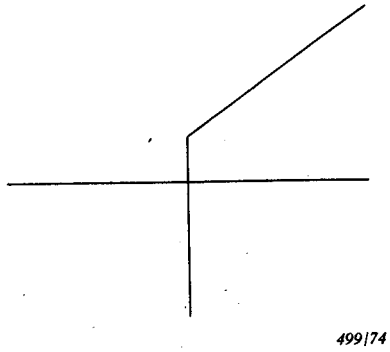


FIGURE 12

Lines representing conductors which are joined together should preferably be drawn at right angles to one another.

6.4.6 *Oblique crossing*

Oblique crossing lines may be used to connect corresponding elements in symmetrical circuits. Example, Figure 13.

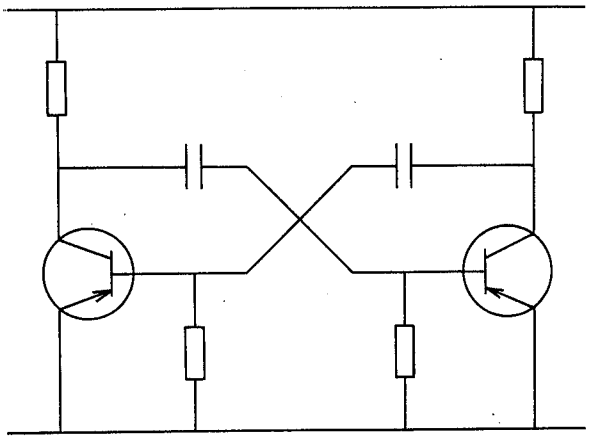


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FIGURE 13

6.4.7 *Boundary lines for functional or constructional units*

When it is desirable in a circuit diagram to show that a part of it represents a functional or constructional unit (e.g. group of apparatus, relay set, etc.), this can be done by a long chain boundary line as in Figure 14. The diagram should be laid out to give maximum clarity, even if this means that the boundary line has an irregular shape.

When such a sub-assembly is not completely represented, it should be identified by a reference number or an annotation. Figure 15 shows the use of a boundary line surrounding a sub-assembly identified by the reference number A2 and that of the diagram 609012.

As circuit diagrams should be drawn according to the general principles in Clause 4, it may happen that a diagram within a boundary line representing a unit contains symbols for parts which do not belong to the unit. Such symbols should then be shown within a boundary line of different type and by adding a designation or a note.

Example: In Figure 16 the outer boundary line shows a unit Q6 consisting of contactor, thermal relay and fuses. Push-buttons S1 and S2 are functionally related items but are not located in unit Q6.

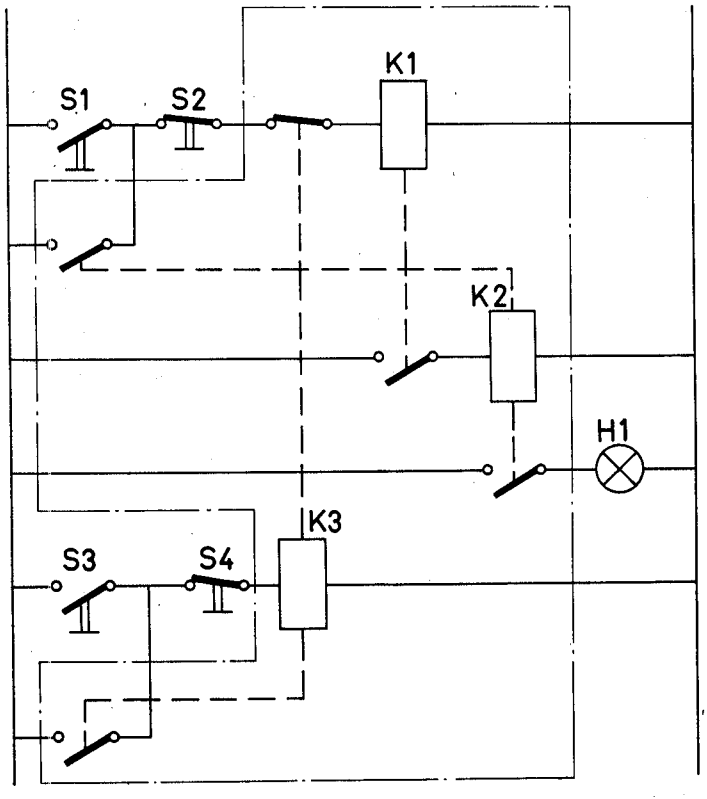

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FIGURE 14

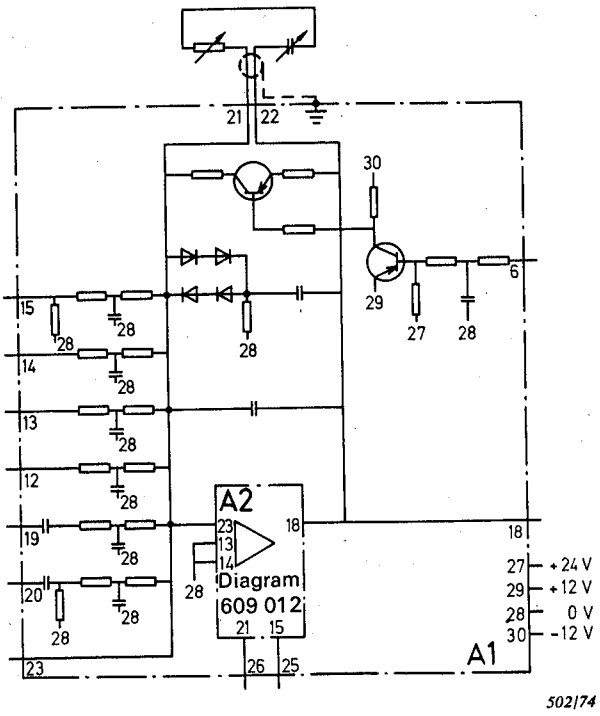


FIGURE 15

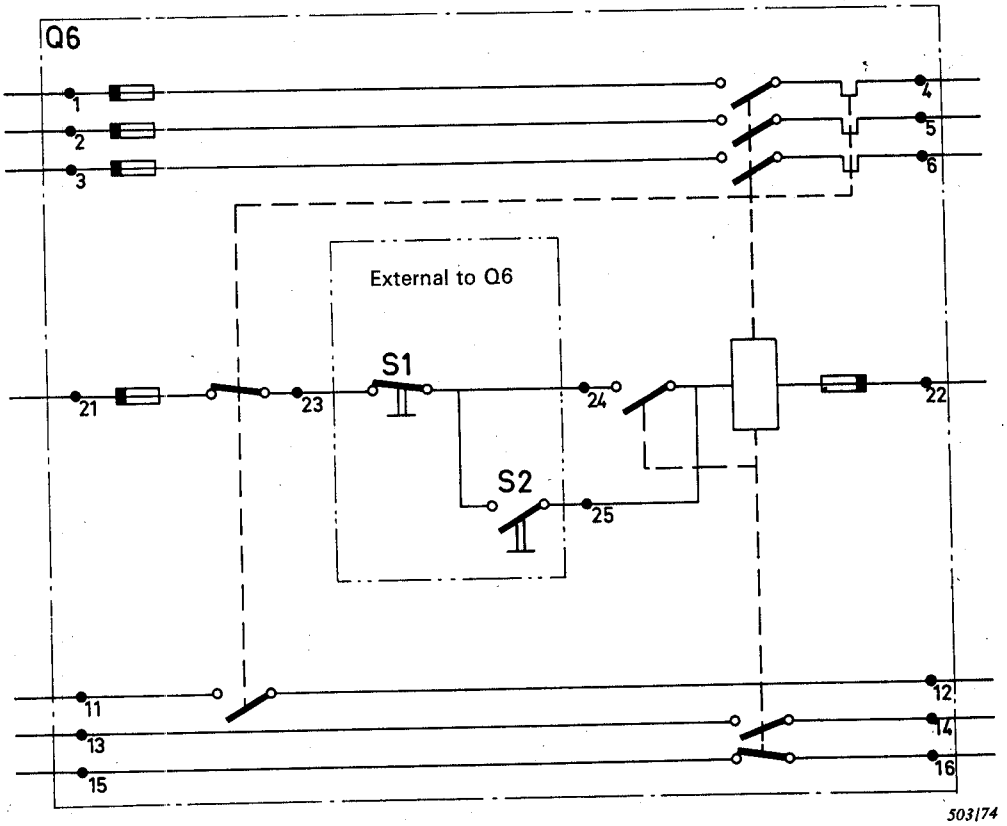


FIGURE 16

6.4.8 *References for interrupted lines*

When a circuit line is interrupted on one sheet and continues on another sheet, references such as diagram number, sheet number and zone location should be shown. For example, see Figure 17.

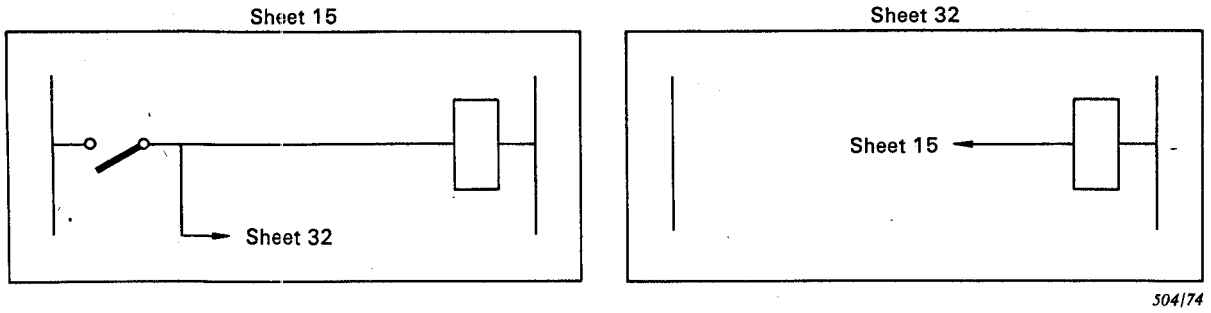


FIGURE 17

If there are several references on the same sheet, they must be distinguished, e.g. by different letters as in Figure 18. The circuit function may also be used, see Figure 43 (page 60).

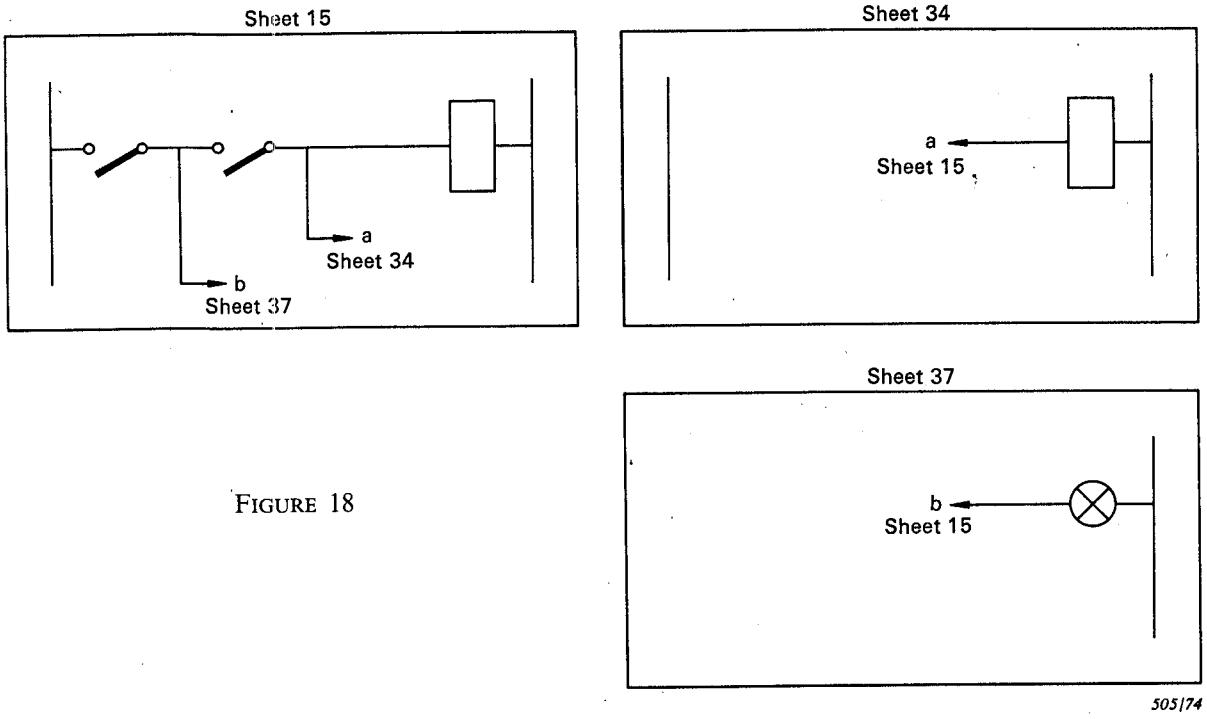


FIGURE 18

6.5 *Simplifications*

6.5.1 *Omitting lines*

References may be used instead of lines for common connections such as supply lines, bonding rails, etc. Figure 15 shows an example of the method where the distribution of the supply voltages (−12 V, 0 V, + 12 V, + 24 V) within unit A1 is represented only by the terminal markings. See also Figure 45 (page 63) where the lines are designated by voltages.

6.5.2 *Multiple connection*

Two or more identical branches of a current path may be represented by one figure and use of the multiple symbol, providing item designations or similar information is associated with the symbol. Examples, see Figures 19 to 22.

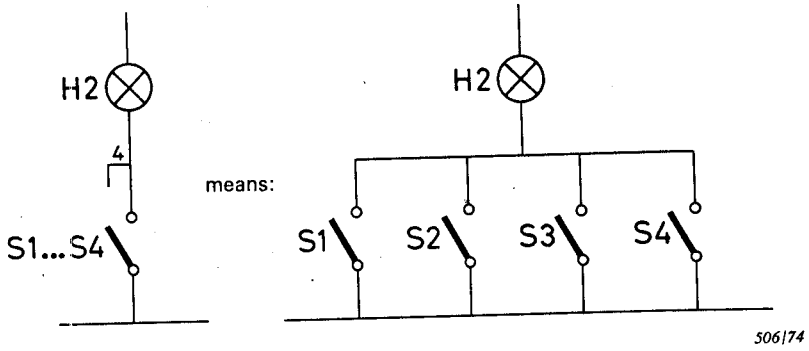


FIGURE 19

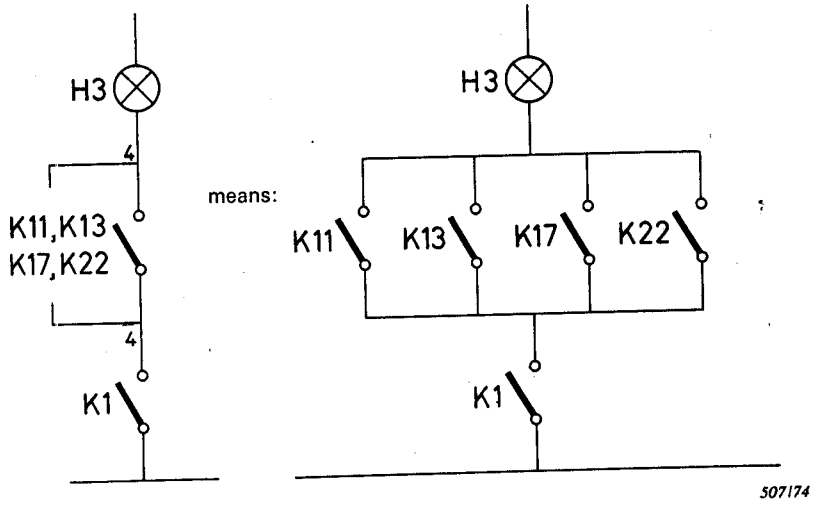


FIGURE 20

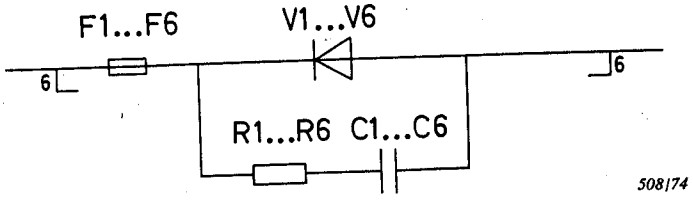


FIG. 21. — Example representing a rectifier equipment consisting of six individually-fused diode circuits in parallel.

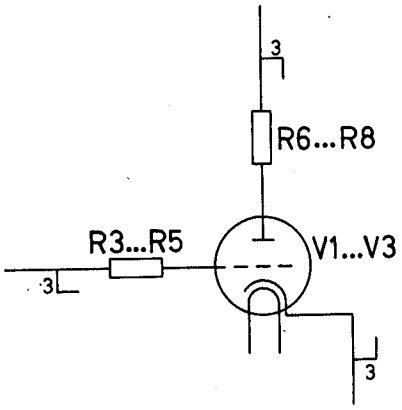


FIG. 22. — Example representing three circuits connected in parallel.

6.5.3 *Simplified representation of constructional units*

The circuit diagram within a boundary line representing a constructional unit may, in certain cases, be simplified, if a reference to a complete diagram of the unit is inscribed.

Such simplification can be applied especially for units where inputs and outputs may be identified, as for power supply devices, amplifiers and changers. For the study of the circuit diagram, in such cases it may be sufficient to show within the boundary line a simple symbol denoting the kind of device and the direction of transmission. For example see Figure 15 (page 29), unit A2.

To identify the inputs and outputs, it may be more appropriate to indicate, within the boundary line, the most important parts of the unit. For example see Figure 23, where the auxiliary circuits of a circuit-breaker (closing and tripping coil, spring-operating motor and some auxiliary contacts for position indication) are identified in a rectangle. A reference to the detailed diagram is given inside the boundary line.

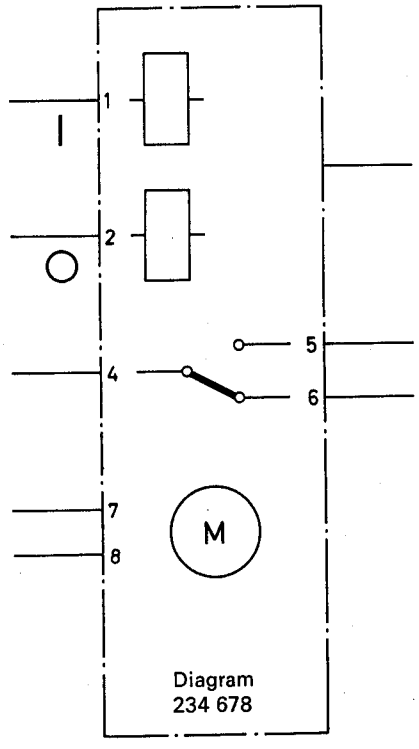
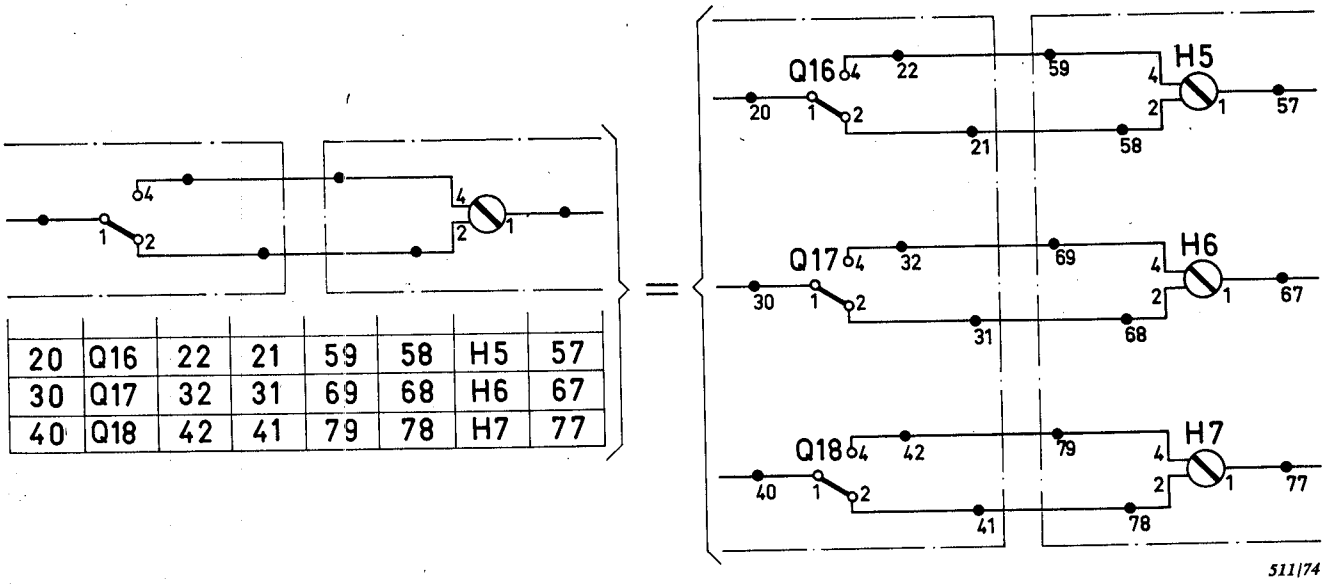


FIGURE 23

6.5.4 *Representation of similar circuits*

Several similar circuits may be represented by one figure showing only those designations which are valid for all circuits. The rest of the designations should then be shown in a table which may be arranged so that the designation can be found directly below the corresponding symbol. Figure 24 shows an example. The simplified representation is shown to the left. For explanation, the complete representation is also shown here (to the right)



20	Q16	22	21	59	58	H5	57
30	Q17	32	31	69	68	H6	67
40	Q18	42	41	79	78	H7	77

FIGURE 24

6.5.5 *Repeating symbols*

It is possible to clarify functional groupings and avoid a number of lines and cross-overs by repeating certain symbols. See for example Figure 46 (page 64), where the earth symbol is repeated several times.

As another example, in detached representation, a change-over contact may be shown twice, once to illustrate the make circuit and once to show the break circuit. In addition, suitable information should be given to ensure that no confusion would result. There should be some location reference showing where the other circuit is to be found. See Figure 25, where G5 and A2 are drawing zone location references.

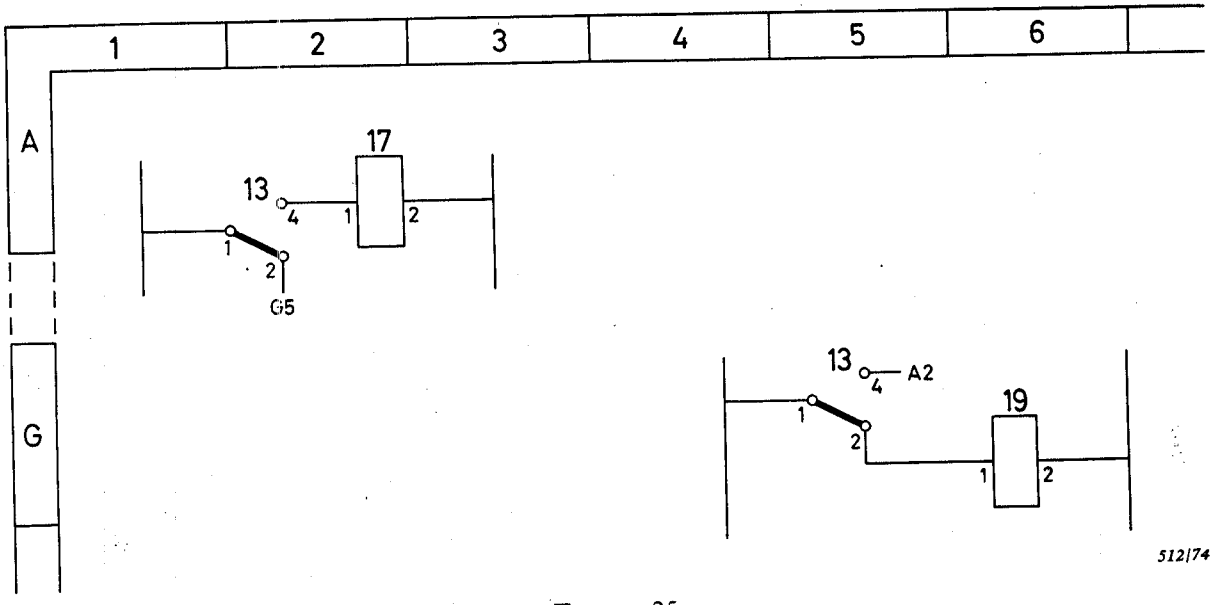


FIGURE 25

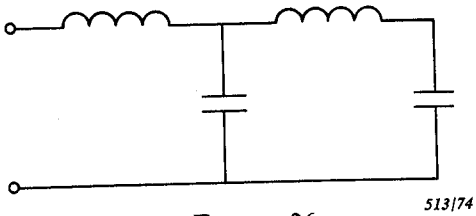
6.6 *Recommended layout for some fundamental circuits*

Circuit diagrams should show in a uniform manner certain fundamental circuit arrangements such as bridges, RC-coupled amplifiers, etc., which occur frequently. Recognition of these fundamental circuits is easier if each has a formalized pattern which is always used to represent the circuit. Additional components should be arranged so that the pattern is not distorted but remains recognizable.

Figures 26 to 36 are recommended layouts for a number of fundamental circuits.

6.6.1 *Terminations*

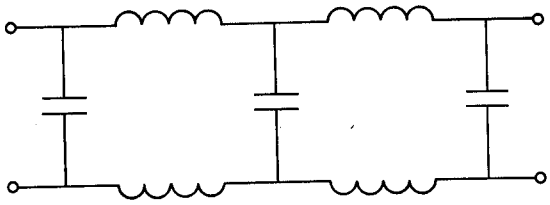
Two-terminal passive networks should be drawn with the terminals at the same end.



513/74

FIGURE 26

Four-terminal passive networks such as filters, smoothing circuits, attenuators and phase-shift networks should be drawn with the terminals at the corners of a rectangle.



514/74

FIGURE 27

6.6.2 *Basic bridge circuits*

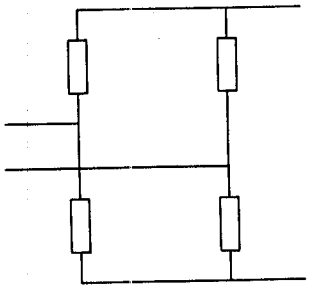


FIGURE 28 515/74

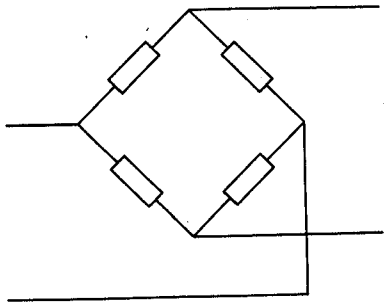


FIGURE 29 516/74

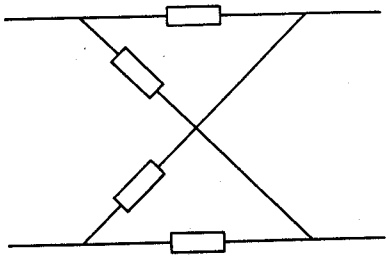


FIGURE 30 517/74

These methods of representation are applicable to other components or groups of components.

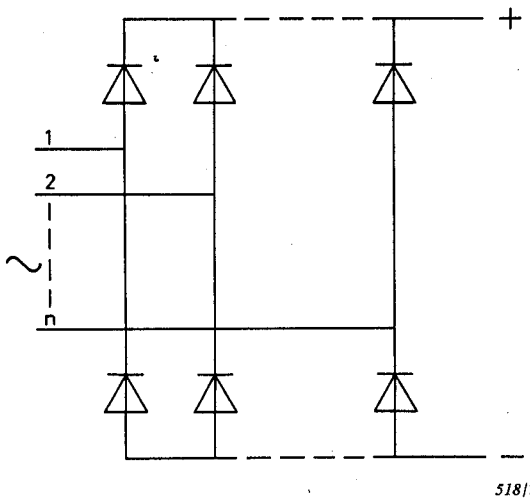


FIG. 31. — Example of an *n*-phase converter circuit.

6.6.3 *RC-coupled amplifying stage (examples with NPN transistor)*

a) Common base (two alternatives)

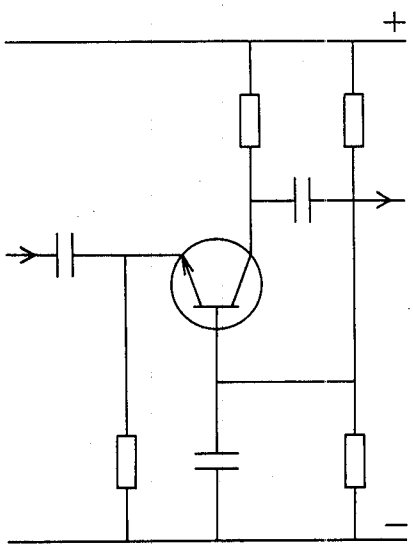


FIGURE 32

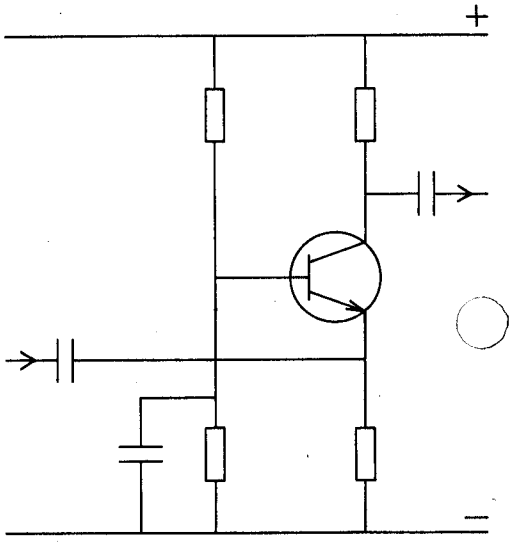


FIGURE 33

b) Common emitter

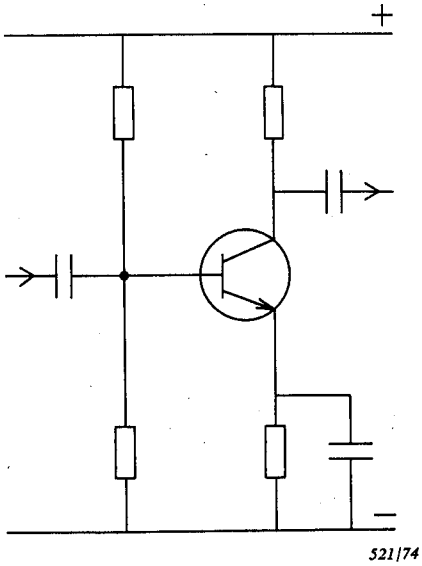


FIGURE 34

c) *Common collector (emitter follower)*

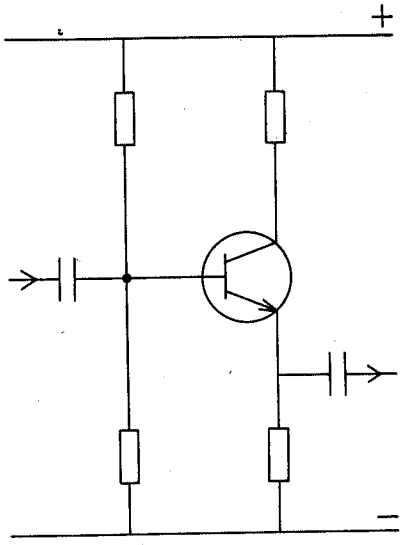


FIGURE 35

6.6.4 *Motor with star-delta starter*

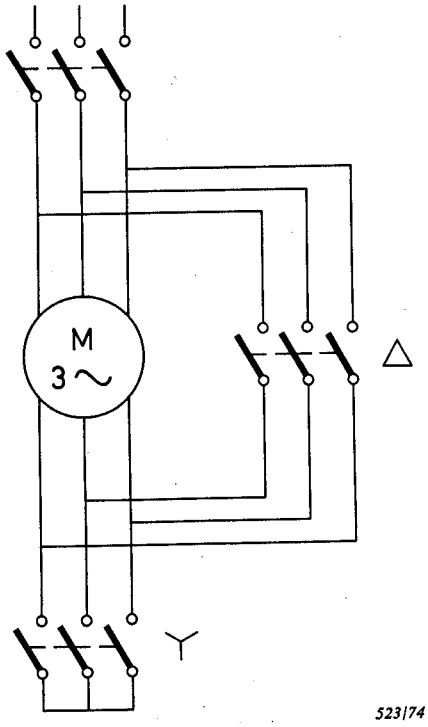


FIGURE 36

7. Markings and designations

The circuit diagram may show item designation and terminal markings for each item. Designations may also be shown for junctions (terminals, junction blocks, plugs, sockets, etc.).

For recommendations for item designation, see IEC Publication 113-2, Part 2: Item Designation. For recommendations for terminal markings, see especially IEC Publication 34-8, Rotating Electrical Machines,

Part 8: Terminal Markings and Direction of Rotation of Rotating Machines, and Publication 445, Identification of Apparatus Terminals and General Rules for a Uniform System of Terminal Marking, using an Alphanumeric Notation.

Some recommendations for the location of designations in circuit diagrams are given in Sub-clauses 7.1 and 7.2. Deviations from these recommendations may sometimes be necessary due to lack of space, but the item designation, terminal marking, technical data and supplementary information should be easily distinguished.

7.1 *Item designation*

In semi-assembled representation the item designation for each item is shown only once. This method makes it possible to align each item designation with the appropriate linkage line. The designations may be arranged in columns or rows so that it is possible to show at the top of a column or end of a row a general part of the item designation (e.g. location) according to IEC Publication 113-2. For example see Figure 37 (page 50).

In detached representation the item designation must be shown at each element symbol. For examples see Figures 39 (page 53) and 43 (page 60).

7.2 *Designation of terminals and junctions*

a) For terminals of relays, resistors, etc., generally no terminals symbols (○ or ●) are shown. The designations of terminals are shown at convenient places adjacent to the component symbol.

b) Each junction of a connecting device (terminal board, connector, etc.) intended for connection on site or for testing and fault location is represented by a symbol and given a designation. However, the terminal symbol may be omitted when the junction is shown by the intersection of a connection with a boundary line representing a constructional unit as in Figure 15 (page 29); the designation is then marked alongside the boundary line.

8. Explanatory notes

Brief explanatory notes or tables should be used where the meaning cannot conveniently be conveyed by other means. If informative markings for controls, connectors, etc. appear on an equipment panel, these same markings, preferably framed in an outline for emphasis, should appear adjacent to the graphical symbol for the item in the diagram.

9. Inscription of technical data

Numerical data and explanatory wording such as component information may be placed adjacent to the symbols if desired. It is also permissible to give data, e.g. resistance values, inside rectangular symbols such as those for relay coils. In both cases, suitable space should be left for qualifying symbols.

For some examples, see IEC Publication 117-1, Recommended Graphical Symbols, Part 1: Kind of Current, Distribution Systems, Methods of Connection and Circuit Elements, and Publication 117-2, Part 2: Machines, Transformers, Primary Cells and Accumulators, Transductors and Magnetic Amplifiers, Inductors.

Data as mentioned above may also be given in a separate table.

10. Examples of complete circuit diagrams

Figures 37 to 48.1 are intended to show the application of the recommendations given in Clauses 4 to 9. They are intended only to show the different methods of representation and are not meant as recommendations concerning the equipment.

The examples depict equipment of different kinds. It is, however, not the intention to prescribe that the method of representation, chosen here for a certain kind of equipment, is specific for equipment of this kind.

Item designations which are not in accordance with Tables I and II of IEC Publication 113-2 are used in some examples as permitted by Sub-clause 5.2.1 of that publication. In such cases, the designations used are explained or referenced on the diagram as described in the publication.

Figures 37 to 39 (pages 50 to 53) show three variants of a circuit diagram for the same equipment, a milling machine.

This equipment consists of several sub-assemblies:

A1	sub-assembly for power supply,
A2, A3, A4	sub-assembly for motors M1, M2, M3 respectively,
A5	sub-assembly for auxiliary circuit supply,
C	control station,
M	equipment on the machine.

Those terminal symbols which are not directly attached to component symbols represent terminals of these sub-assemblies.

In Figure 37 (page 50) all the circuits are shown on one sheet, and they are drawn vertically. The figure is an example of semi-assembled representation with straight mechanical linkage symbols. The table to the right shows the item designation for contactors, relays, etc., as well as those of the sub-assemblies where these elements are located.

In Figure 38 (pages 51 and 52) the main circuits are shown on sheet 1, the auxiliary circuits on sheet 2, and all are drawn horizontally. The figure uses a combination of detached and semi-assembled representation. The relationship of the elements belonging to one item is shown partly by the linkage symbol, partly by references. Example: 2/D stands for sheet 2, row D.

In Figure 39 (page 53) all the circuits are shown on one sheet, and they are drawn vertically. Detached representation is used with column references. However, some mechanical linkage symbols, which facilitate understanding and are easy to insert, have been shown. The inset diagrams for contactors and relays are shown at the bottom of the diagram.

In Figure 40 (page 54) a circuit reference system is used. Control circuit numbers are shown at the bottom of the diagram. Circuits for normal power supply are designated 1...4, circuits for emergency power supply 5...7. Circuits for main power 11...13 and 21...23 as referenced in the table are not shown here, as they are of no interest for the explanation of the system.

Figure 41 (page 55) shows the circuit diagram of an equipment for starting a motor in the two directions with automatic braking by counter-current.

This figure is an example of detached representation of a simple item of equipment in which the relationship between the elements of each unit can easily be seen from the item designation alone. It also includes an example of the application of Sub-clause 5.6 to show the functioning of centrifugal switch S2. The symbols for the contacts of drum controller S1 are arranged in line and graphs of the drum are drawn opposite them. Therefore it is unnecessary to supply an inset diagram to aid the clarity of the circuit diagram.

Figure 42 (pages 56 to 59) represents part of the control equipment for a transformer station 50/10 kV.

Due to the size and complexity of the equipment the complete circuit diagram consists of a number of sheets, only four of which are shown here. Sheet 1 depicts the main circuits of a transformer with protective relays and measuring devices, sheet 2 the auxiliary power supply, sheets 3 and 4 the control equipment for the 50 and 10 kV circuit breakers.

Semi-assembled representation is generally used. For each relay all the symbols for its contacts are drawn adjacent to the coil symbol in the circuit diagram.

The contents of each diagram sheet are so obvious that referencing consists only of sheet numbers.

Figure 43 (page 60) represents a group selector of a telephone system. Detached representation is used with row and column references. Figures 43.1 and 43.2 (page 61) show two different layouts of subsidiary "pictorial tables" for the components, i.e. relays 1A, 1C, 1J, etc. For each contact and winding symbol, the co-ordinates (row and column) are given in the tables.

Cette figure représente une partie d'équipement qui peut être utilisée de différentes façons par changement des connexions. Le tableau placé en bas du schéma indique quelles connexions doivent être réalisées pour les usages correspondants de l'équipement. Toutes ces connexions figurent sur le schéma. Par exemple la connexion ———2——— se trouve en A7.

La figure 44 (page 62) qui représente aussi une portion d'équipement téléphonique, est également dessinée en représentation développée. Les schémas annexes relatifs aux relais K1, K2, etc. figurent à droite. La méthode de grille est utilisée pour les références.

La figure 45 (page 63) représente un amplificateur à vidéo fréquence et son sous-ensemble d'alimentation à base de transistors. Dans cet exemple, des données techniques sont incluses pour certains composants tels que résistances, capacités, fusibles.

La figure 46 (page 64) représente une partie de l'étage à fréquence intermédiaire et la détection d'un récepteur imprimant sur page. Pour les filtres F1, F2 et F3 figurent seulement des symboles fonctionnels, mais les références aux schémas annexes, non fournis ici, sont données. Le schéma illustre la simplification prévue au paragraphe 6.5.4 pour des circuits identiques. Dans ce cas, du fait que deux circuits sont seuls concernés, les références des composants pour le deuxième circuit sont seulement indiquées entre parenthèses.

La figure 47 (page 65) est un exemple utilisant la méthode tabulaire de repérage d'emplacement des symboles, voir paragraphe 5.1.2.

La figure 48 (page 66) représente un récepteur radiophonique, l'ensemble fonctionnel A1 est représenté dans une forme simplifiée à l'intérieur d'un encadrement de séparation. La figure 48.1 (page 67) est le schéma détaillé de cet ensemble A1.

This figure represents a piece of equipment which can be used in different ways by changing the connections. The table at the bottom of the diagram indicates the connections which should be made for different usages of the equipment. All these connections are shown in the diagram. For example, connection ———2——— can be found in square A7.

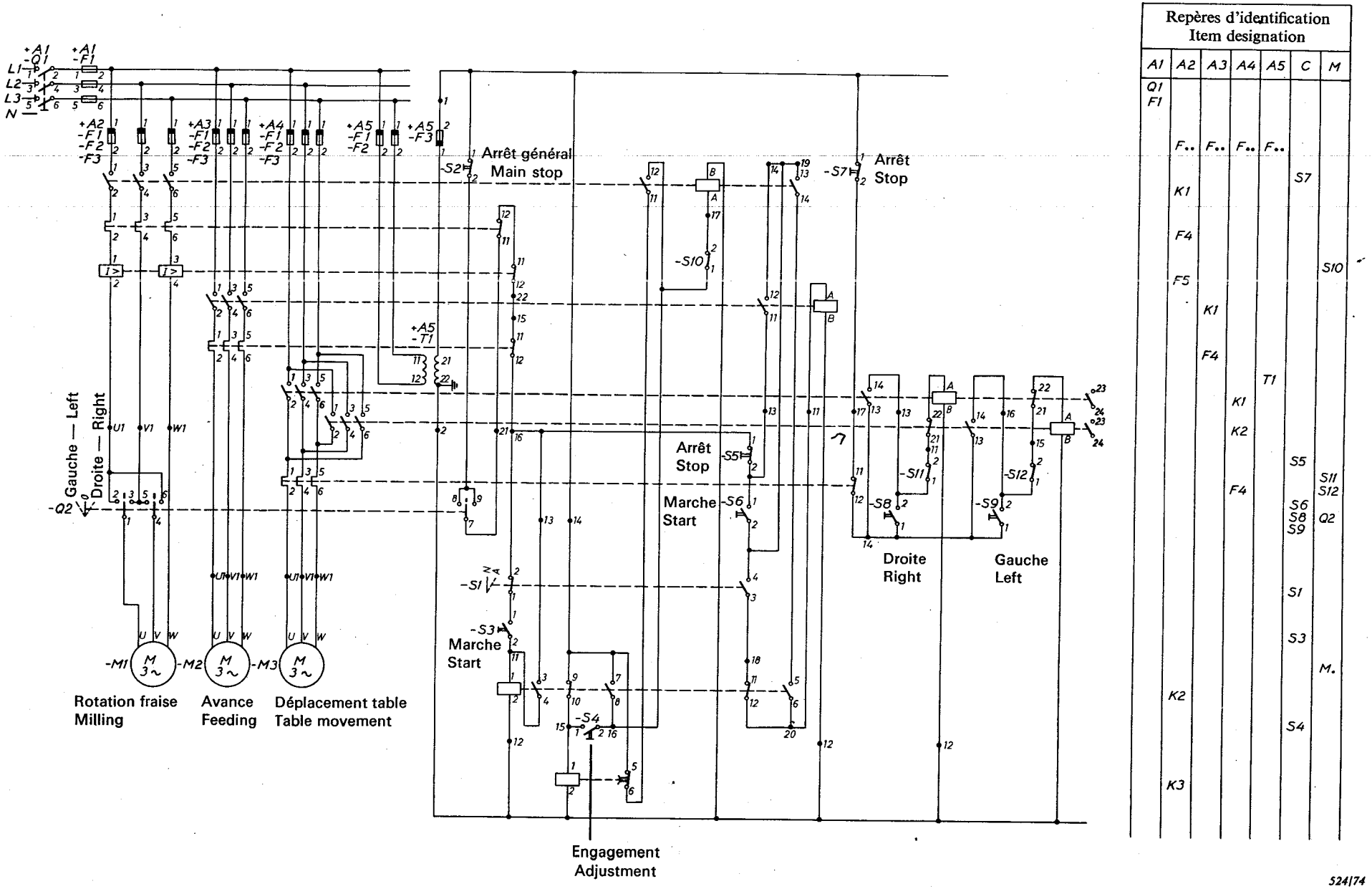
Figure 44 (page 62) representing a piece of telephone equipment is also drawn in detached representation. The inset diagrams for relays K1, K2, etc., are shown on the right. The grid system is used for the referencing.

Figure 45 (page 63) represents a video amplifier and its power supply using transistors. In this example, technical data for components such as resistors, capacitors and fuses is included.

Figure 46 (page 64) is a circuit diagram showing part of the IF stages and detector of a page printing receiver. For filters F1, F2 and F3 only simple block symbols are used, but references to inset diagrams, not shown here, are included. The diagram illustrates the simplifications possible with identical circuits, see Sub-clause 6.5.4. In this case, however, since only two circuits are concerned the component references for the second circuit are merely given in brackets.

Figure 47 (page 65) is an example using the tabular system for symbol location, see Sub-clause 5.1.2.

Figure 48 (page 66) represents an AM broadcast receiver. The functional unit A1 is represented in a simplified form within boundary lines. Figure 48.1 (page 67) is the detailed diagram of this unit A1.



Repères d'identification Item designation						
A1	A2	A3	A4	A5	C	M
Q1						
F1						
	F..	F..	F..	F..		
	K1				S7	
	F4					S10
	F5					
		K1				
		F4				
			K1	T1		
			K2		S5	S11
			F4		S6	S12
					S8	Q2
					S9	
					S1	
					S3	
						M.
	K2				S4	
	K3					

FIGURE 37

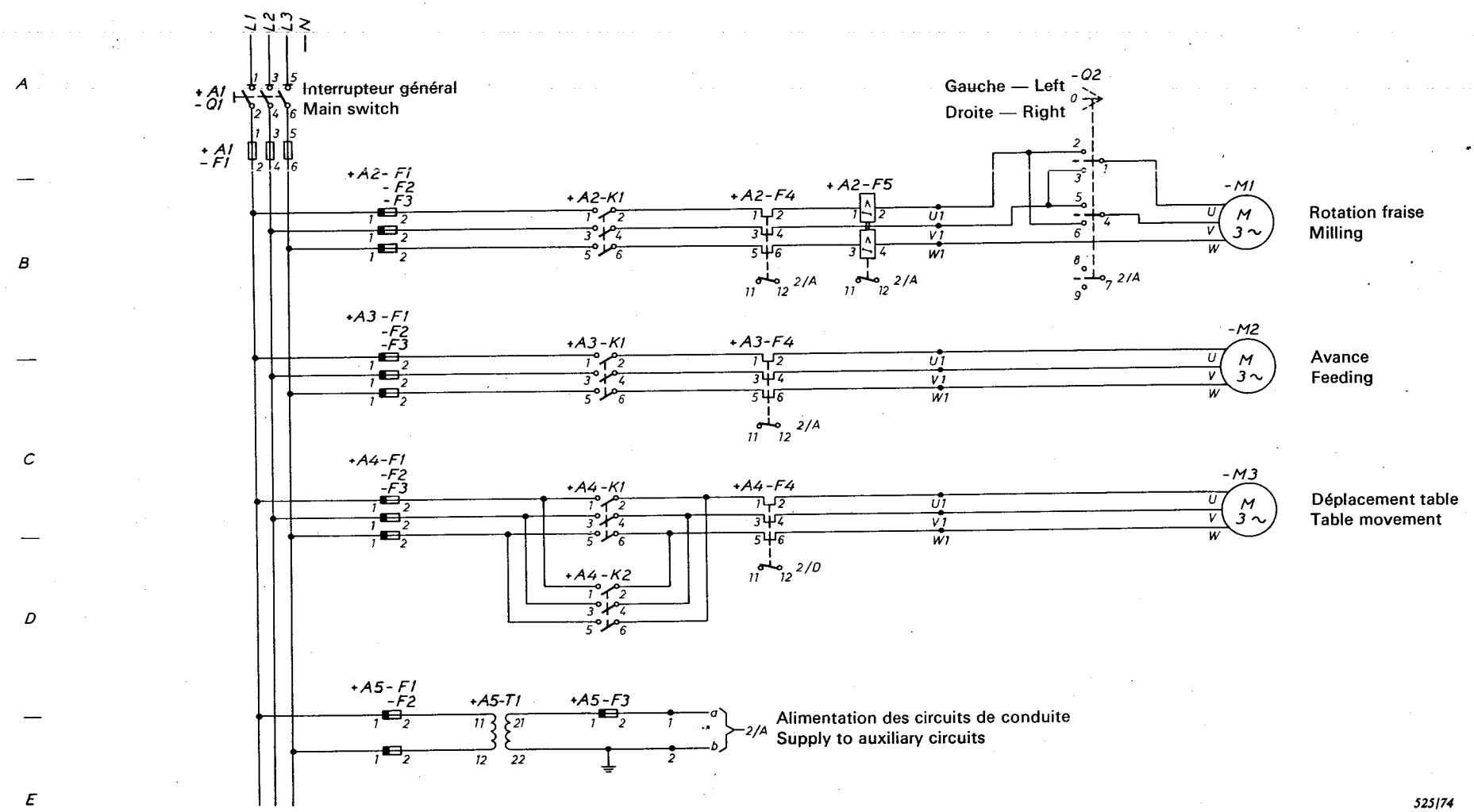


FIG. 38. — Feuille 1 de 2. — Sheet 1 of 2.

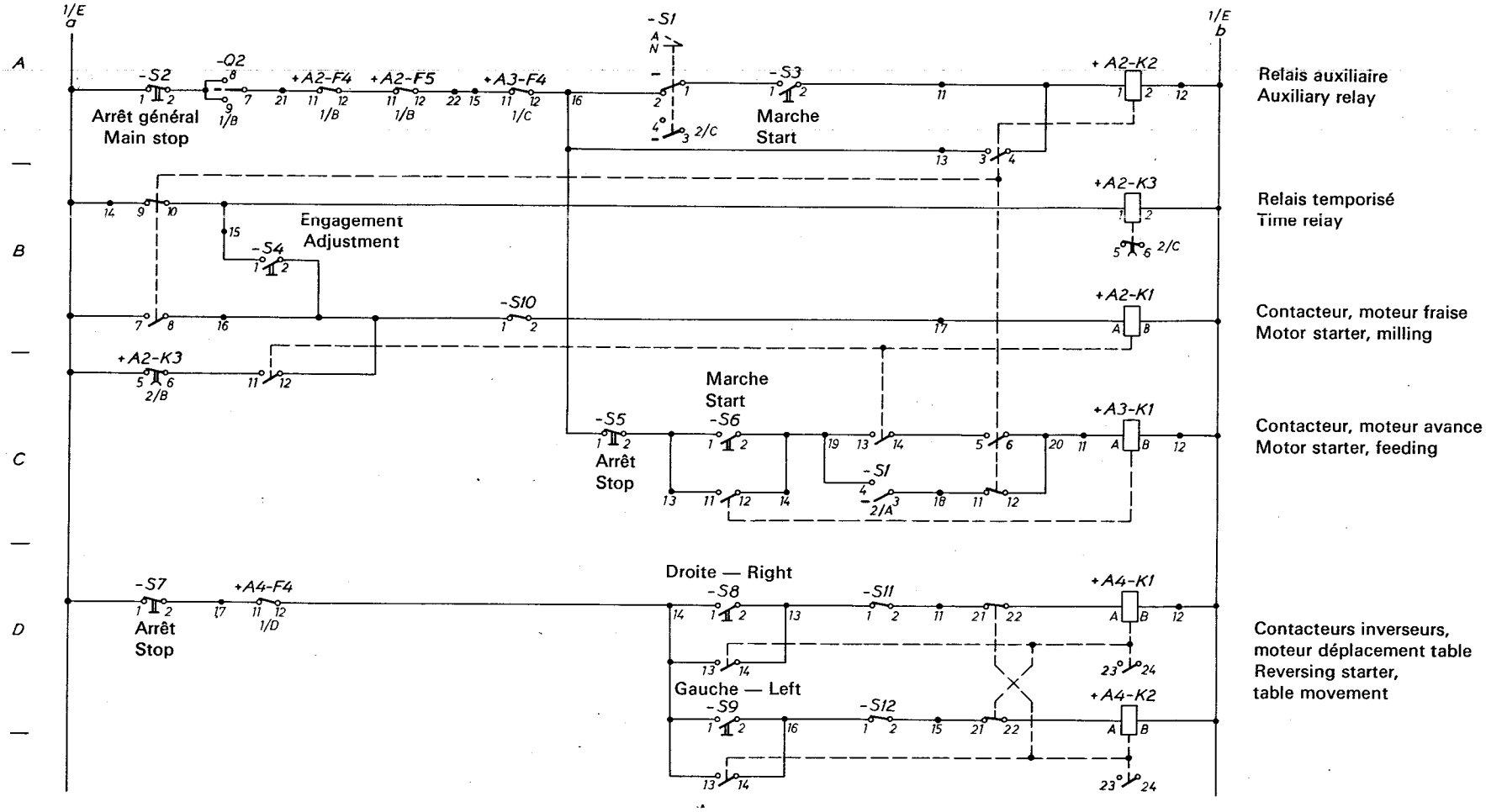


FIG. 38. — Feuille 2 de 2. — Sheet 2 of 2.

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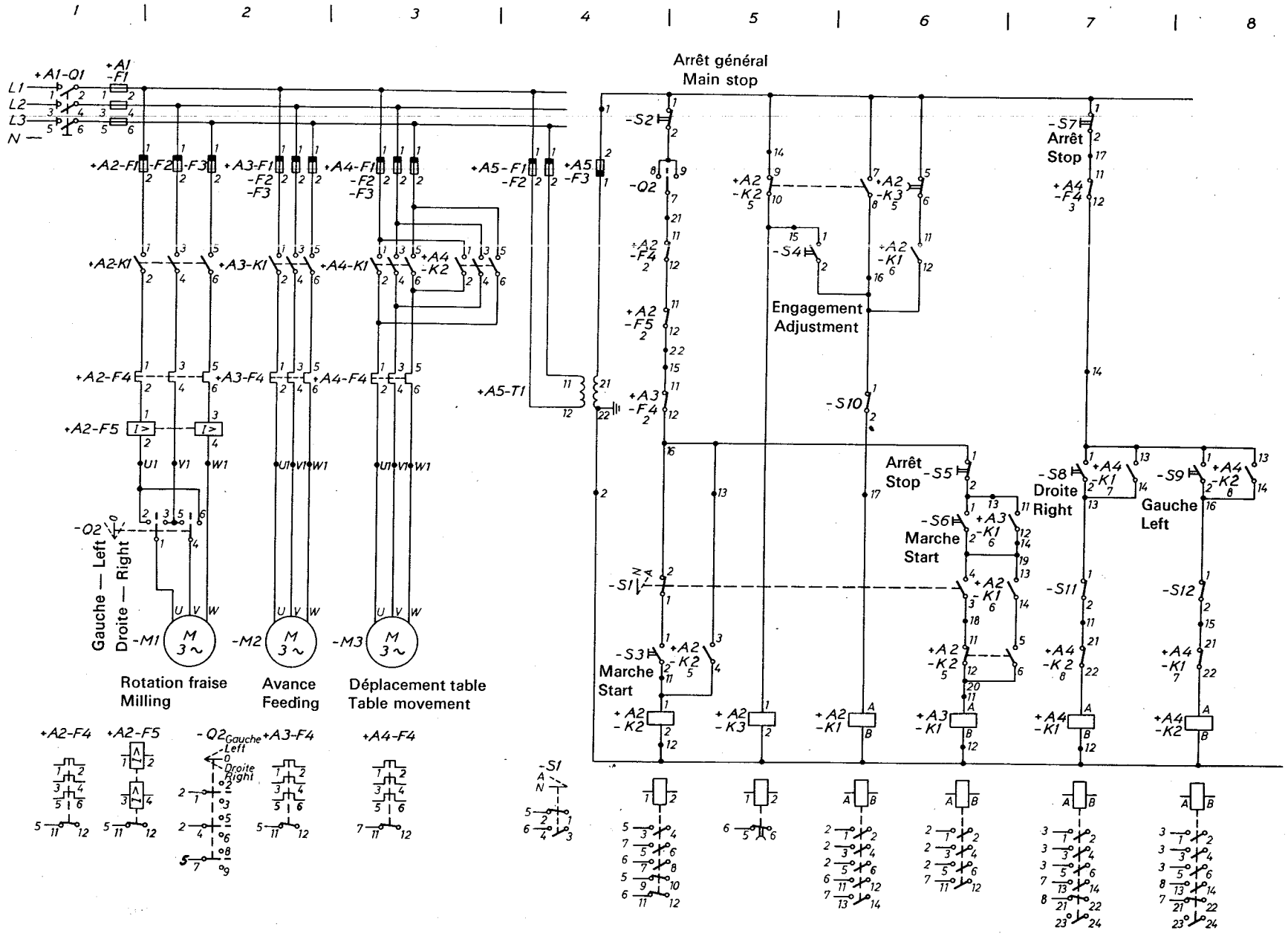
Arrêt général
Main stop
Engagement
Adjustment
Arrêt
Stop
Marche
Start
Droite
Right
Gauche
Left
Gauche — Left
Droite — Right
Rotation fraise
Milling
Avance
Feeding
Déplacement table
Table movement
527174

FIGURE 39

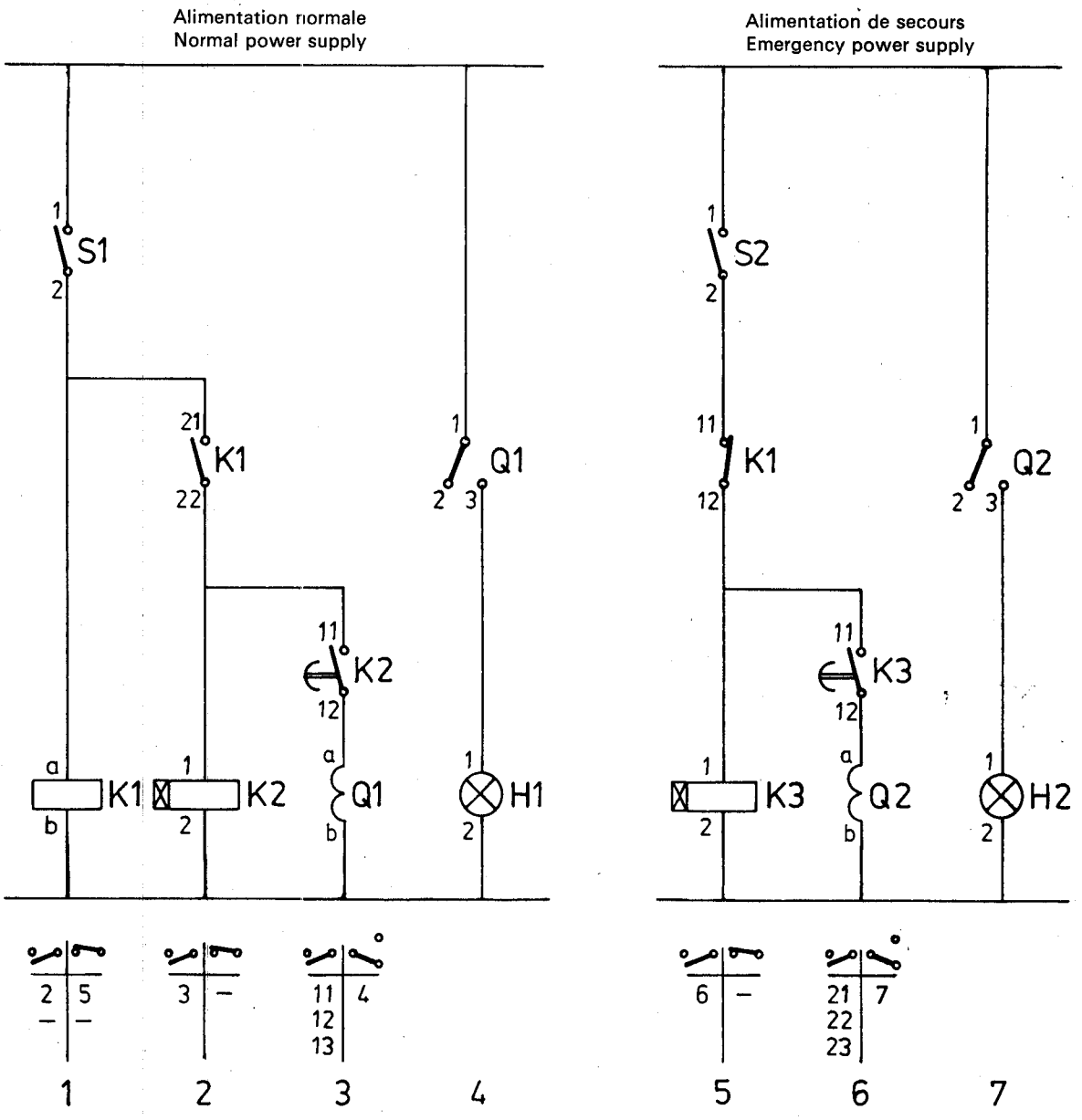
Alimentation normale
Normal power supply
Alimentation de secours
Emergency power supply
S1
S2
K1
K2
K3
Q1
Q2
H1
H2
1
2
3
4
5
6
7
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FIGURE 40

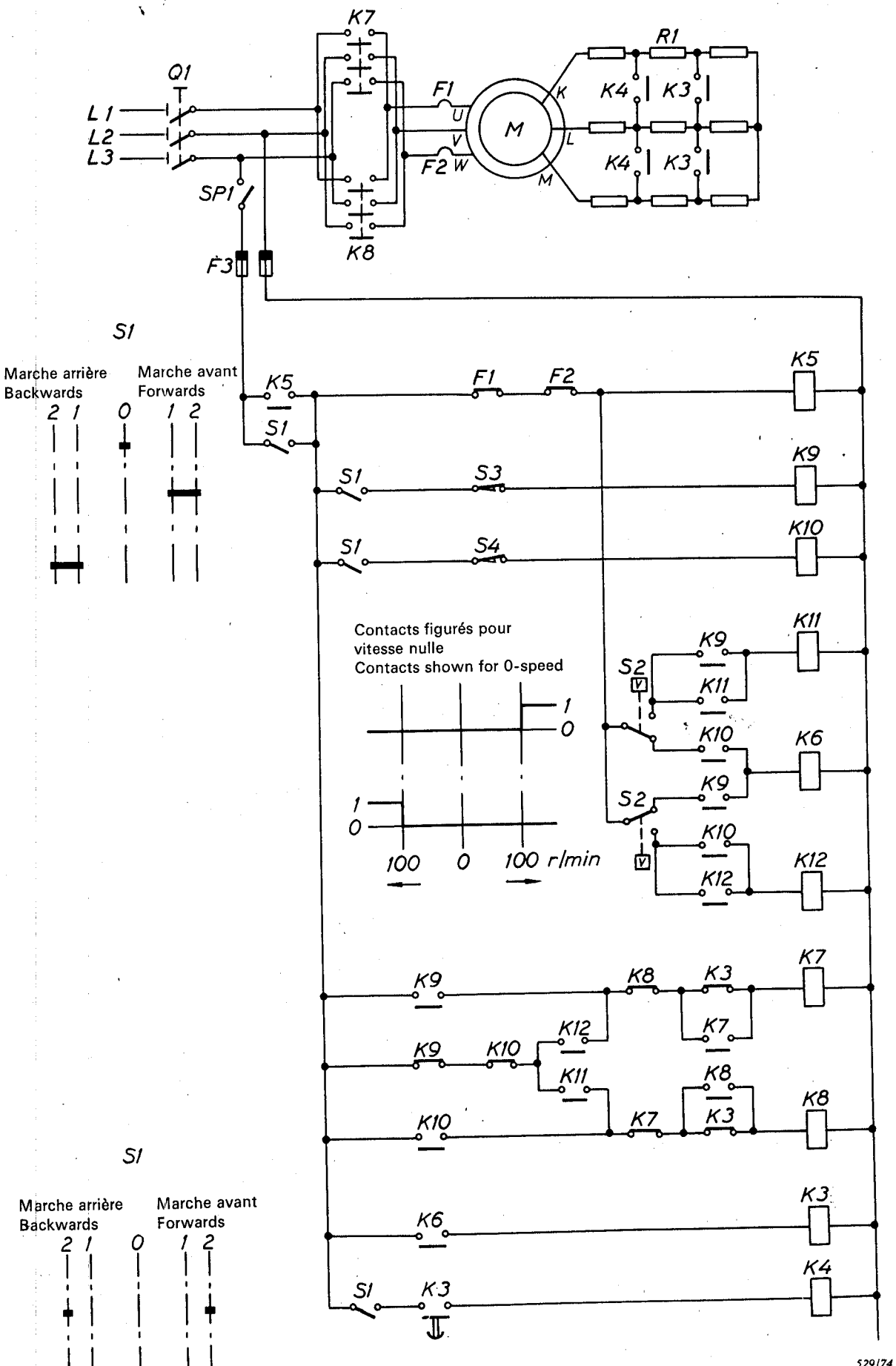
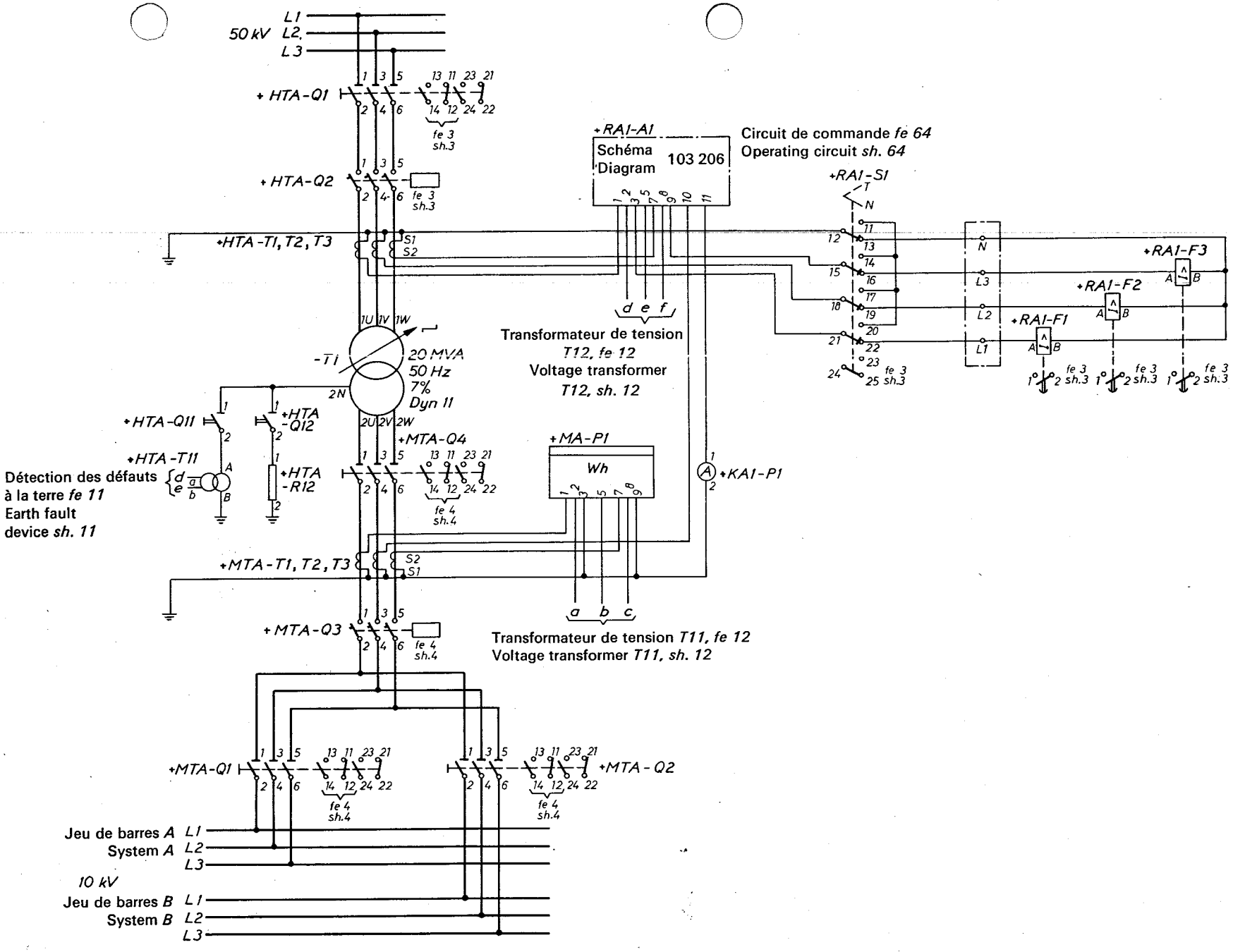

K7
R1
Q1
T
F1
K4
K3
L1
L2
L3
U
V
W
M
K
L
M
F2
SP1
K8
F3
S1
Marche arrière
Backwards
Marche avant
Forwards
2 1 0 1 2
K5
F1
F2
S1
S3
S4
K9
K10
K11
K6
K12
Contacts figurés pour
vitesse nulle
Contacts shown for 0-speed
S2
1
0
100 0 100 r/min
K8
K7
K3
K4
529174

FIGURE 41



Transformateur
Transformer *T1*

Régulateur de tension
Voltage regulator

Protection contre les surintensités
Over-current protection

Comptage d'énergie
Power consumption

530174

FIG. 42. — Feuille 1 de 4. — Sheet 1 of 4.

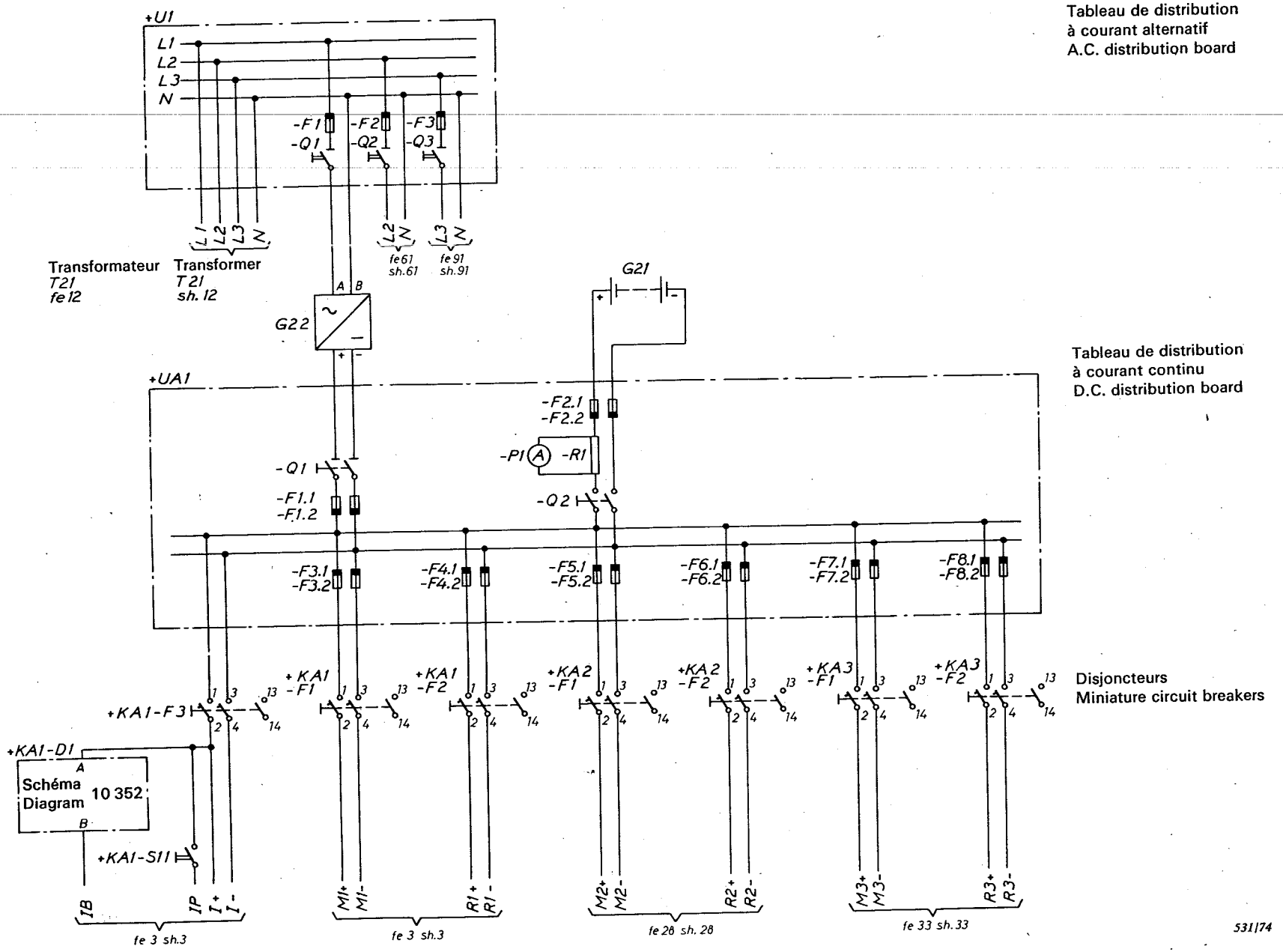
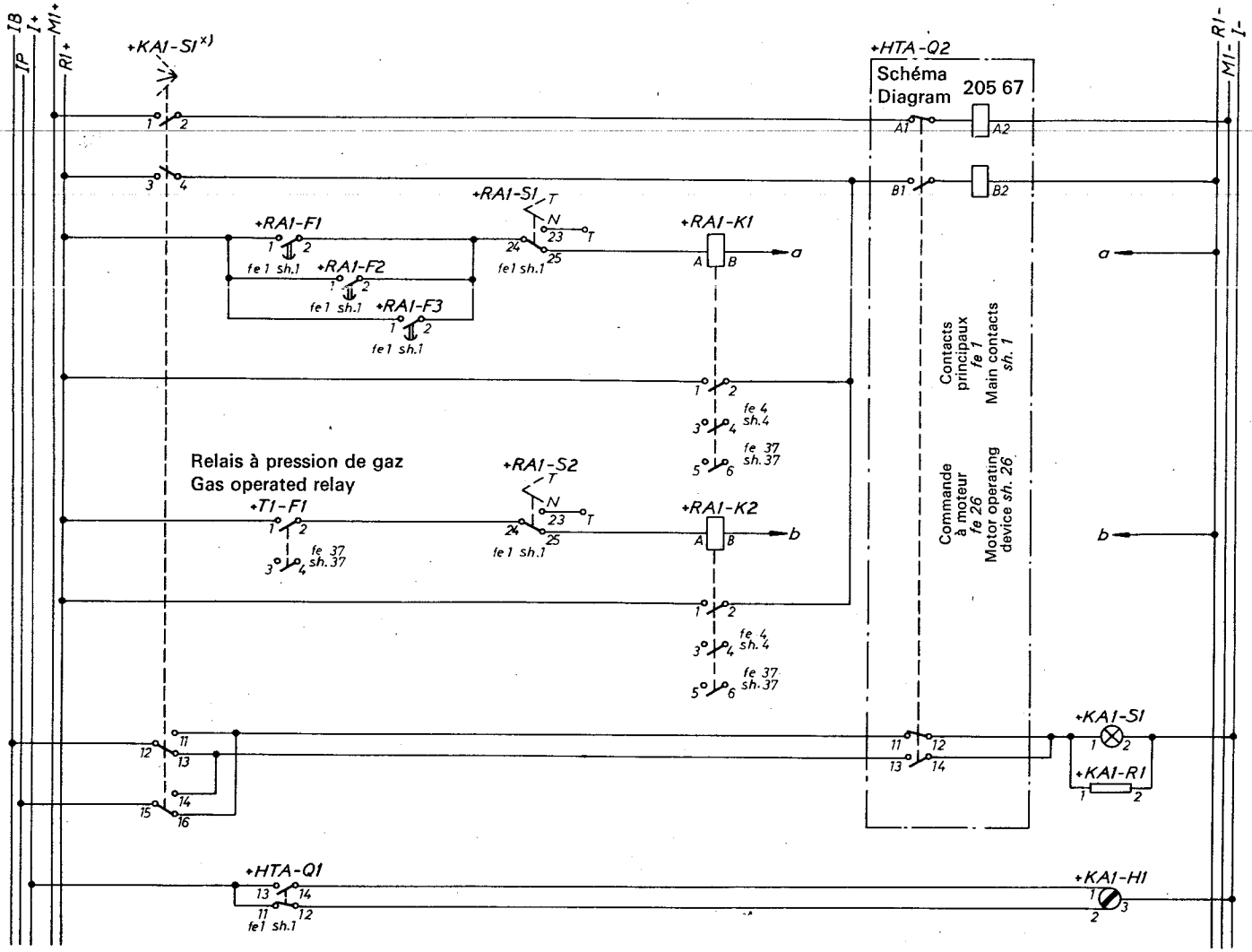


FIG. 42. — Feuille 2 de 4. — Sheet 2 of 4.

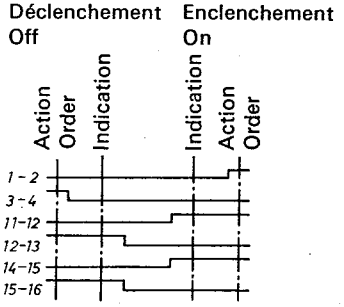


Disjoncteur 50 kV
du transformateur *T1*
50 kV circuit breaker
for transformer *T1*

Bobine d'enclenchement
Closing coil

Bobine de déclenchement
Tripping coil

x) *+KA1-S1*
Commutateur de commande
et de signalisation de position
Discrepancy switch



Lampe de signalisation
du commutateur
Lamp in discrepancy switch

Indicateur de position
du sectionneur 50 kV
Position indicator
for 50 kV isolator

FIG. 42. — Feuille 3 de 4. — Sheet 3 of 4.

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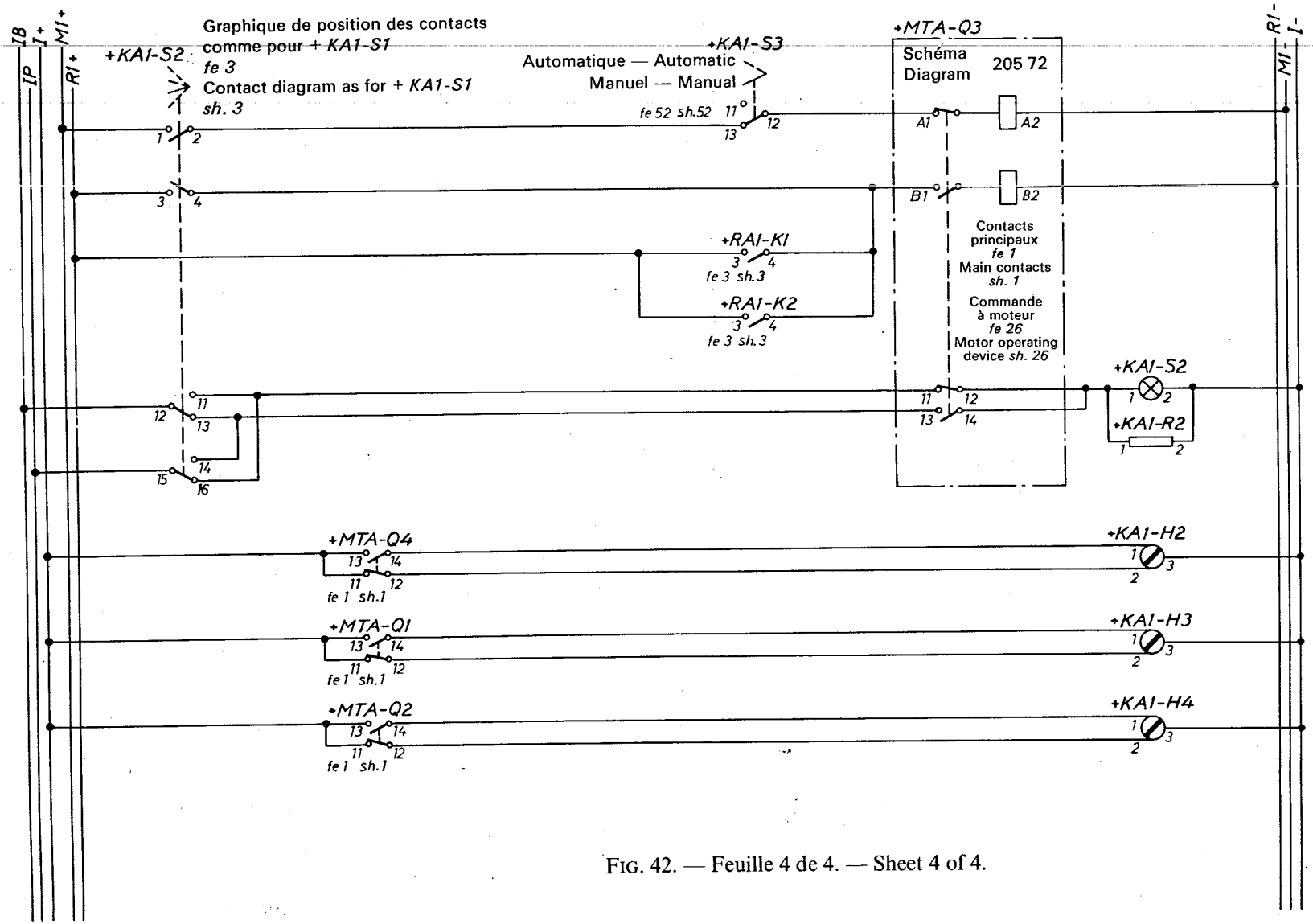

Disjoncteur 10 kV
du transformateur *T1*
10 kV circuit breaker
for transformer *T1*

Bobine d'enclenchement
Closing coil

Bobine de déclenchement
Tripping coil

Lampe de signalisation
du commutateur
Lamp in discrepancy switch

Indicateurs de position:
Position indicators:

Sectionneur 10 kV
du transformateur *T1*
10 kV isolator
for transformer *T1*

Sectionneur 10 kV
sur le jeu de barres A
10 kV isolator for system A

Sectionneur 10 kV
sur jeu de barres B
10 kV isolator for system B

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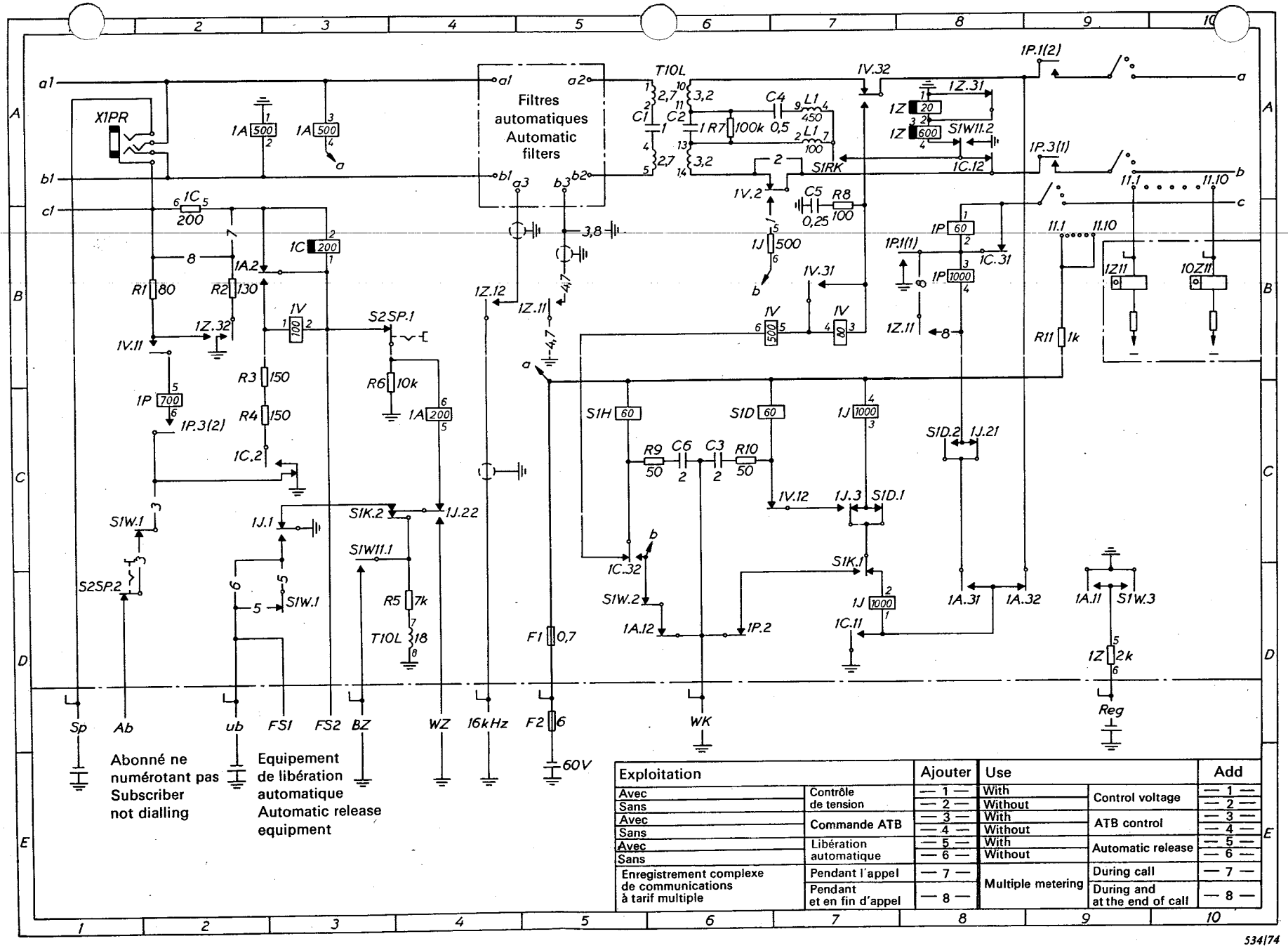
FIG. 42. — Feuille 4 de 4. — Sheet 4 of 4.



Exploitation		Ajouter	Use		Add
Avec	Contrôle de tension	— 1 —	With	Control voltage	— 1 —
Sans		— 2 —	Without		— 2 —
Avec	Commande ATB	— 3 —	With	ATB control	— 3 —
Sans		— 4 —	Without		— 4 —
Avec	Libération automatique	— 5 —	With	Automatic release	— 5 —
Sans		— 6 —	Without		— 6 —
Enregistrement complexe de communications à tarif multiple	Pendant l'appel	— 7 —	Multiple metering	During call	— 7 —
	Pendant et en fin d'appel	— 8 —		During and at the end of call	— 8 —

FIGURE 43

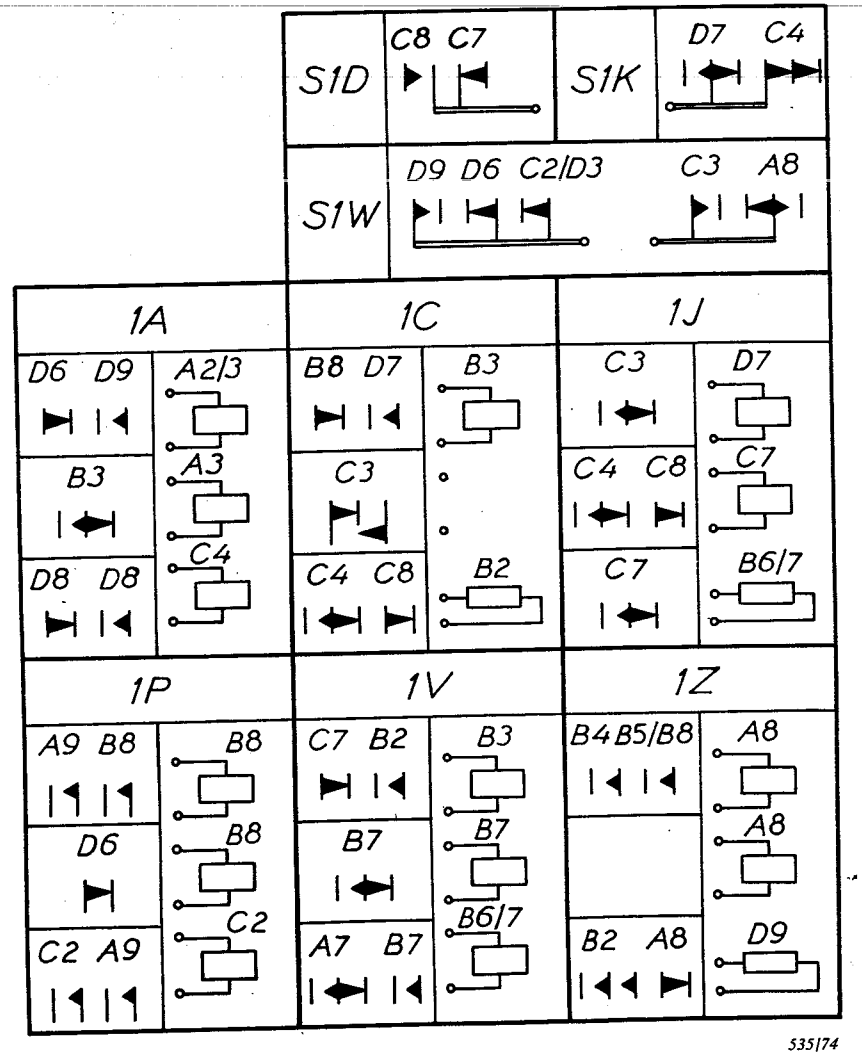


FIGURE 43.1

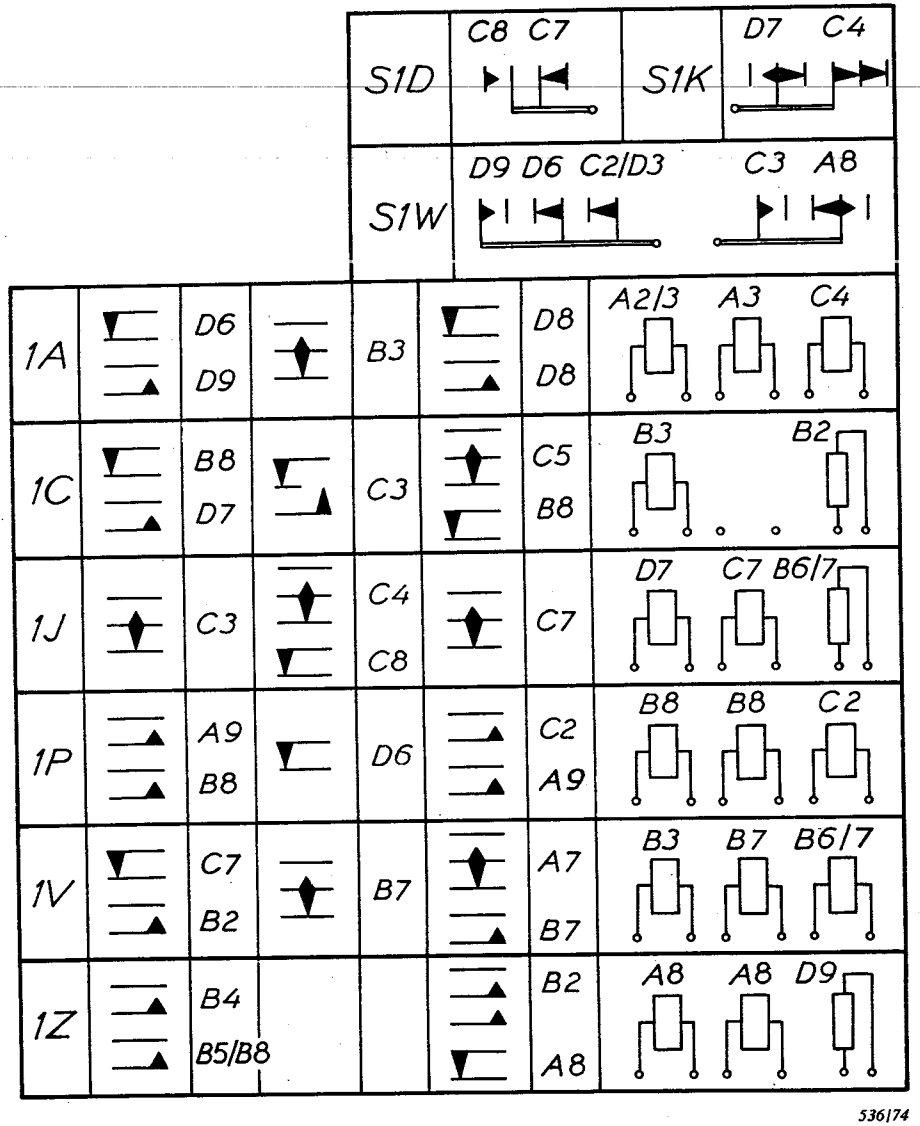


FIGURE 43.2

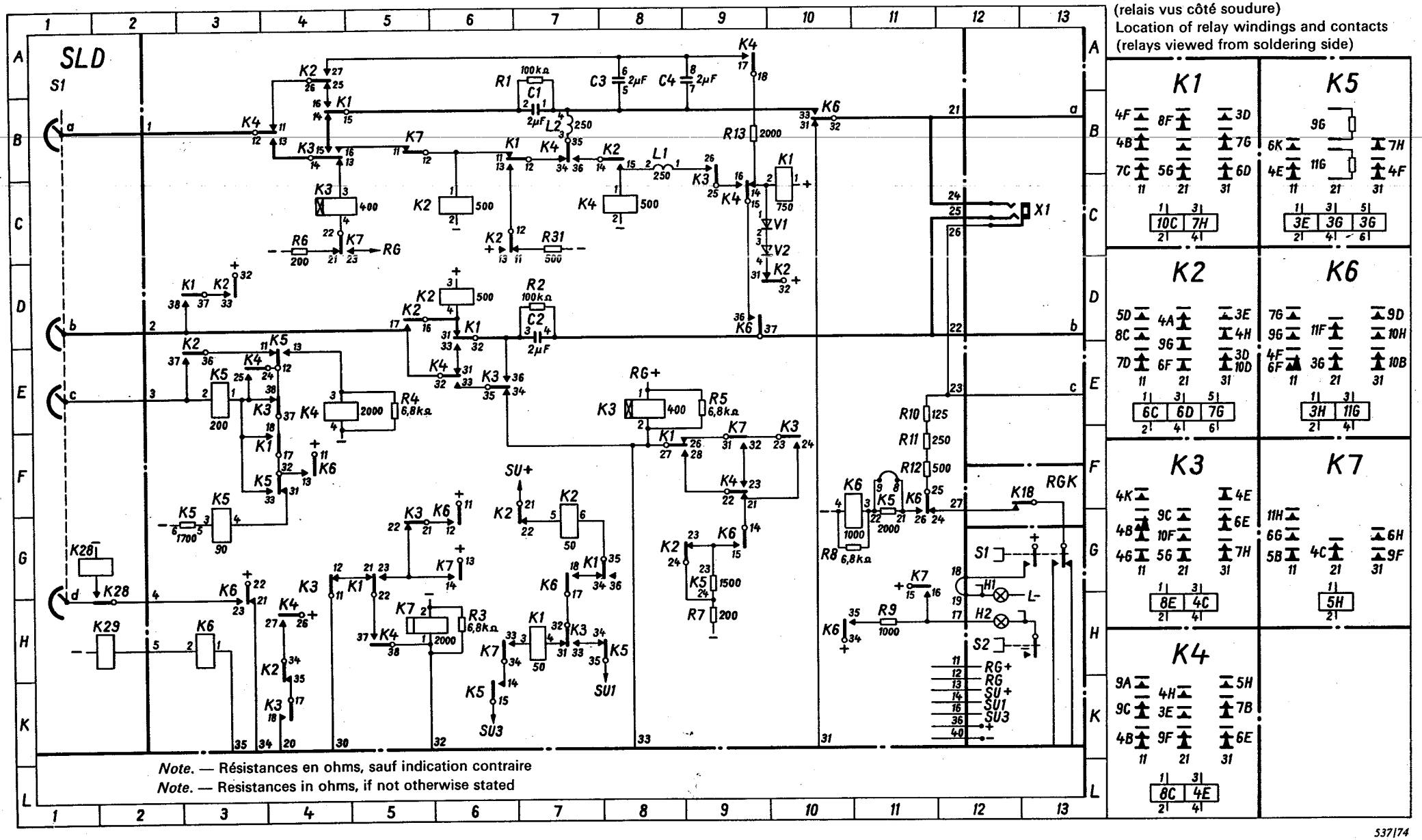
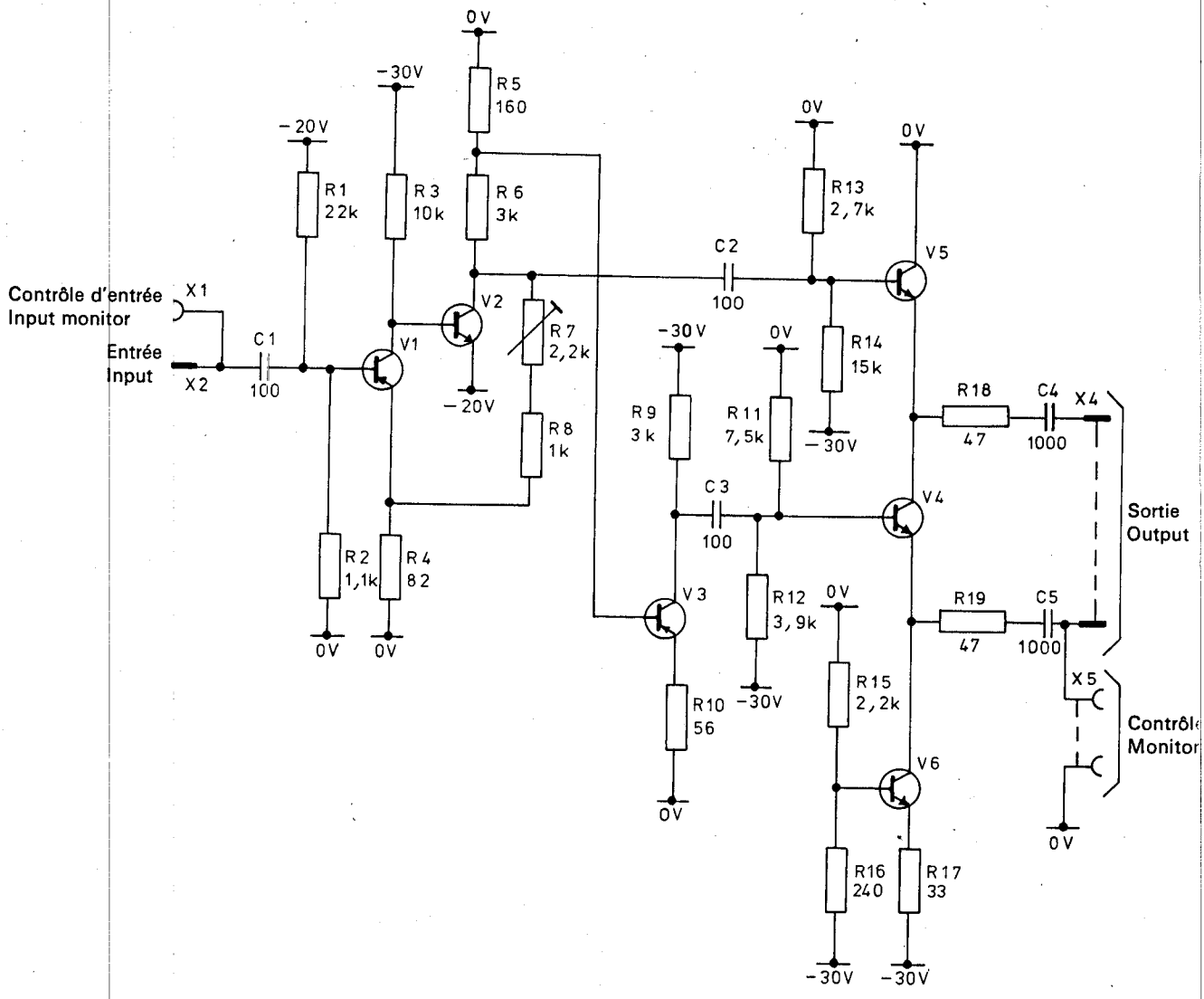

SLD
S1
Note. — Résistances en ohms, sauf indication contraire
Note. — Resistances in ohms, if not otherwise stated
Emplacement des enroulements
et des contacts des relais
(relais vus côté soudure)
Location of relay windings and contacts
(relays viewed from soldering side)
K1
K5
K2
K6
K3
K7
K4
537174

FIGURE 44


0V
-30V
R5
160
-20V
R1
22k
R3
10k
R6
3k
0V
0V
R13
2,7k
C2
100
V5
Contrôle d'entrée
Input monitor
X1
Entrée
Input
X2
C1
100
V1
V2
R7
2,2k
-20V
R8
1k
-30V
0V
R14
15k
R18
47
C4
1000
X4
R9
3k
R11
7,5k
-30V
C3
100
V4
Sortie
Output
R2
1,1k
R4
82
0V
0V
V3
R12
3,9k
0V
R19
47
C5
1000
X5
R10
56
-30V
R15
2,2k
V6
0V
0V
R16
240
R17
33
-30V
-30V
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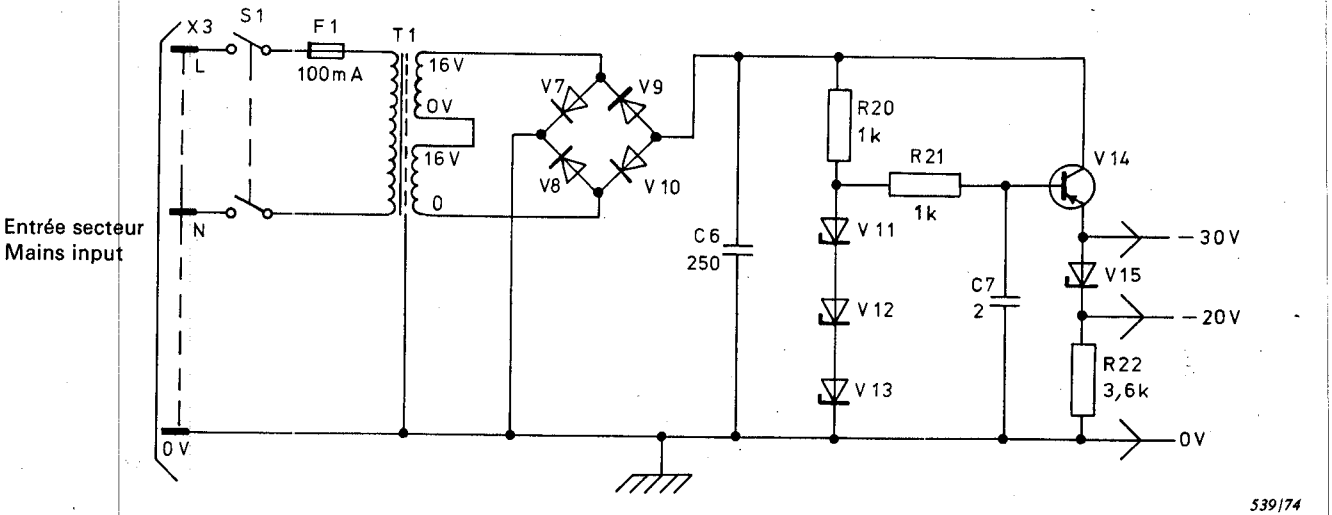
X3
L
S1
F1
100mA
T1
16V
0V
16V
0
V7
V9
V8
V10
R20
1k
R21
1k
V14
Entrée secteur
Mains input
N
C6
250
V11
V12
V13
C7
2
-30V
V15
-20V
R22
3,6k
0V
0V
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FIGURE 45

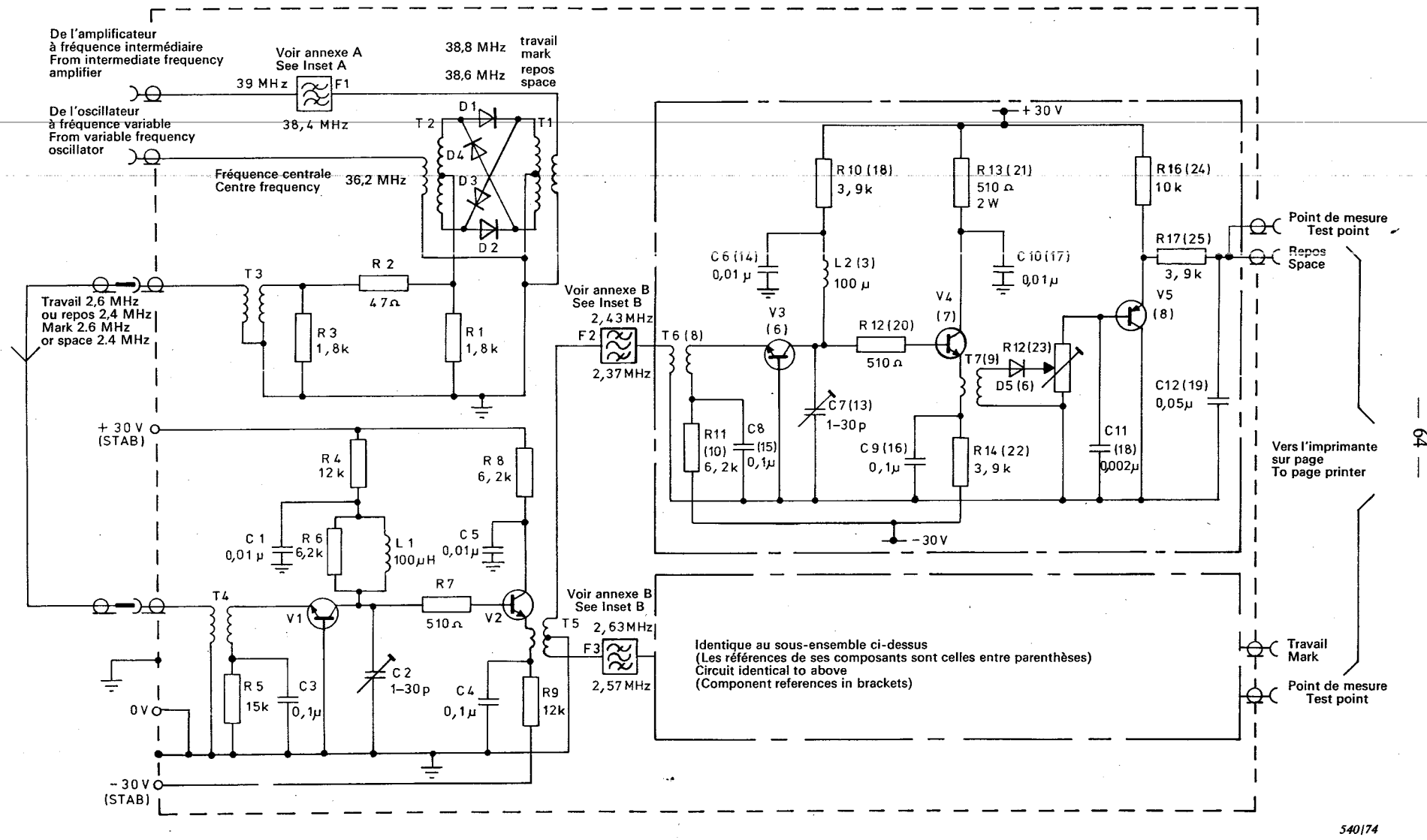
De l'amplificateur
à fréquence intermédiaire
From intermediate frequency
amplifier
Voir annexe A
See Inset A
39 MHz
F1
38,4 MHz
38,8 MHz
travail
mark
38,6 MHz
repos
space
De l'oscillateur
à fréquence variable
From variable frequency
oscillator
Fréquence centrale
Centre frequency
36,2 MHz
D1
D2
D3
D4
T1
T2
T3
R2
47Ω
R3
1,8k
R1
1,8k
Travail 2,6 MHz
ou repos 2,4 MHz
Mark 2.6 MHz
or space 2.4 MHz
+30V
(STAB)
R4
12k
R8
6,2k
C1
0,01µ
R6
6,2k
L1
100µH
C5
0,01µ
R7
510Ω
T4
V1
V2
T5
C2
1-30p
C3
0,1µ
C4
0,1µ
R5
15k
R9
12k
0V
-30V
(STAB)
Voir annexe B
See Inset B
2,43MHz
F2
2,37MHz
T6 (8)
V3
(6)
C6 (14)
0,01µ
L2 (3)
100µ
R10 (18)
3,9k
R13 (21)
510Ω
2W
C10 (17)
0,01µ
R16 (24)
10k
R17 (25)
3,9k
V4
(7)
V5
(8)
R12 (20)
510Ω
T7 (9)
R12 (23)
D5 (6)
C12 (19)
0,05µ
R11
(10)
6,2k
C8
(15)
0,1µ
C7 (13)
1-30p
C9 (16)
0,1µ
R14 (22)
3,9k
C11
(18)
0,002µ
+30V
-30V
Point de mesure
Test point
Repos
Space
Vers l'imprimante
sur page
To page printer
Voir annexe B
See Inset B
2,63MHz
F3
2,57MHz
Identique au sous-ensemble ci-dessus
(Les références de ses composants sont celles entre parenthèses)
Circuit identical to above
(Component references in brackets)
Travail
Mark
Point de mesure
Test point
540174

FIGURE 46

Condensateurs Capacitors	C1 C2 C3 C4 C6 C5 C7
Résistances Resistors	R1 R2 R3 R4-R6 R22 R23 R7 R8 R9-R11 R24 R25 R26 R27-R28 R13 R30 R32 R14-R16 R31 R17 R18 R33 R21 R34 R35 R19 R20
Divers Miscellaneous	V1 V2 V3 V15 V4 V10 V16 V5 V11 V17 V12 V18 V13 V6 V14 V7 K1 K1 V19 V8 K1

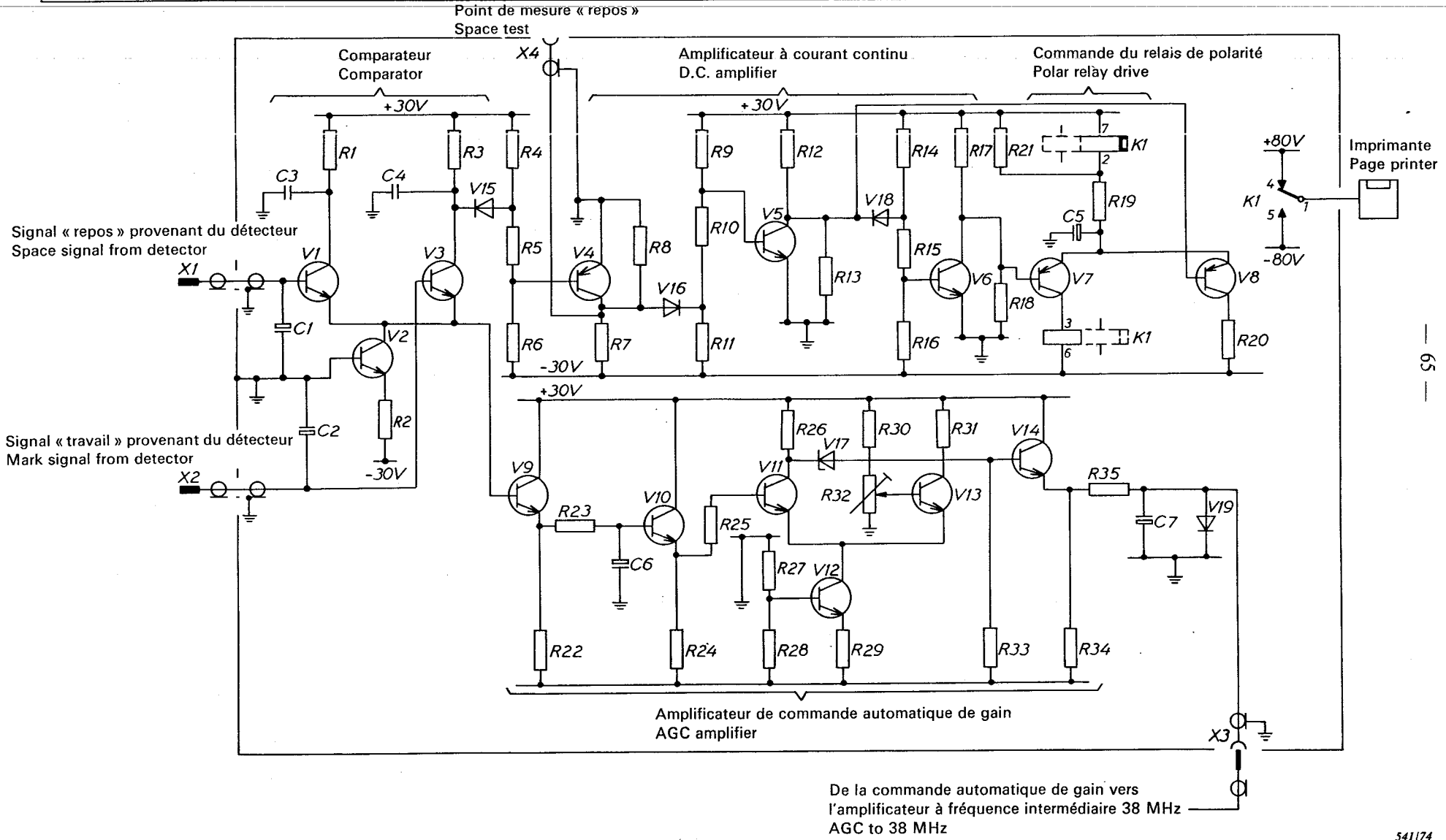

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FIGURE 47

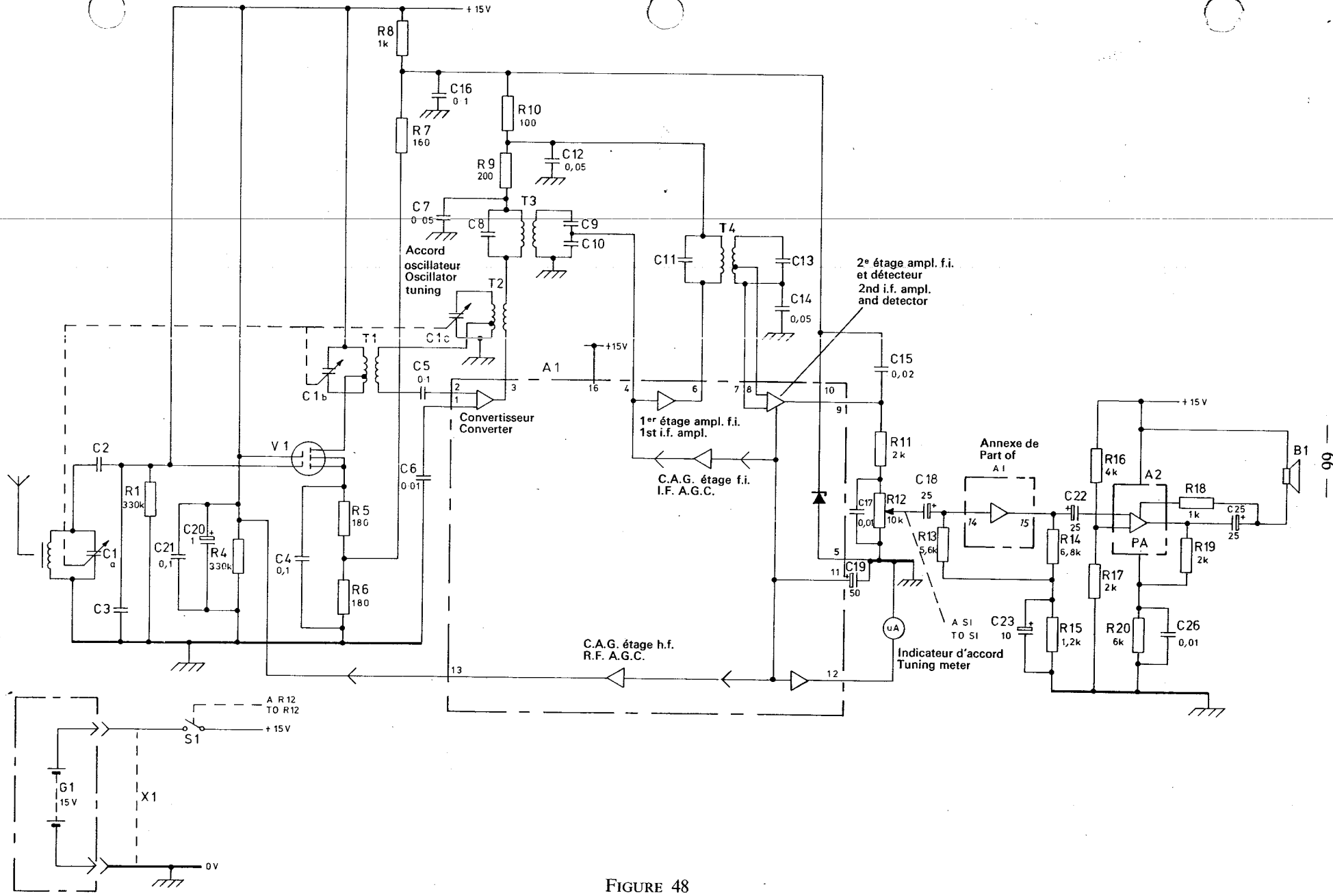

FIGURE 48

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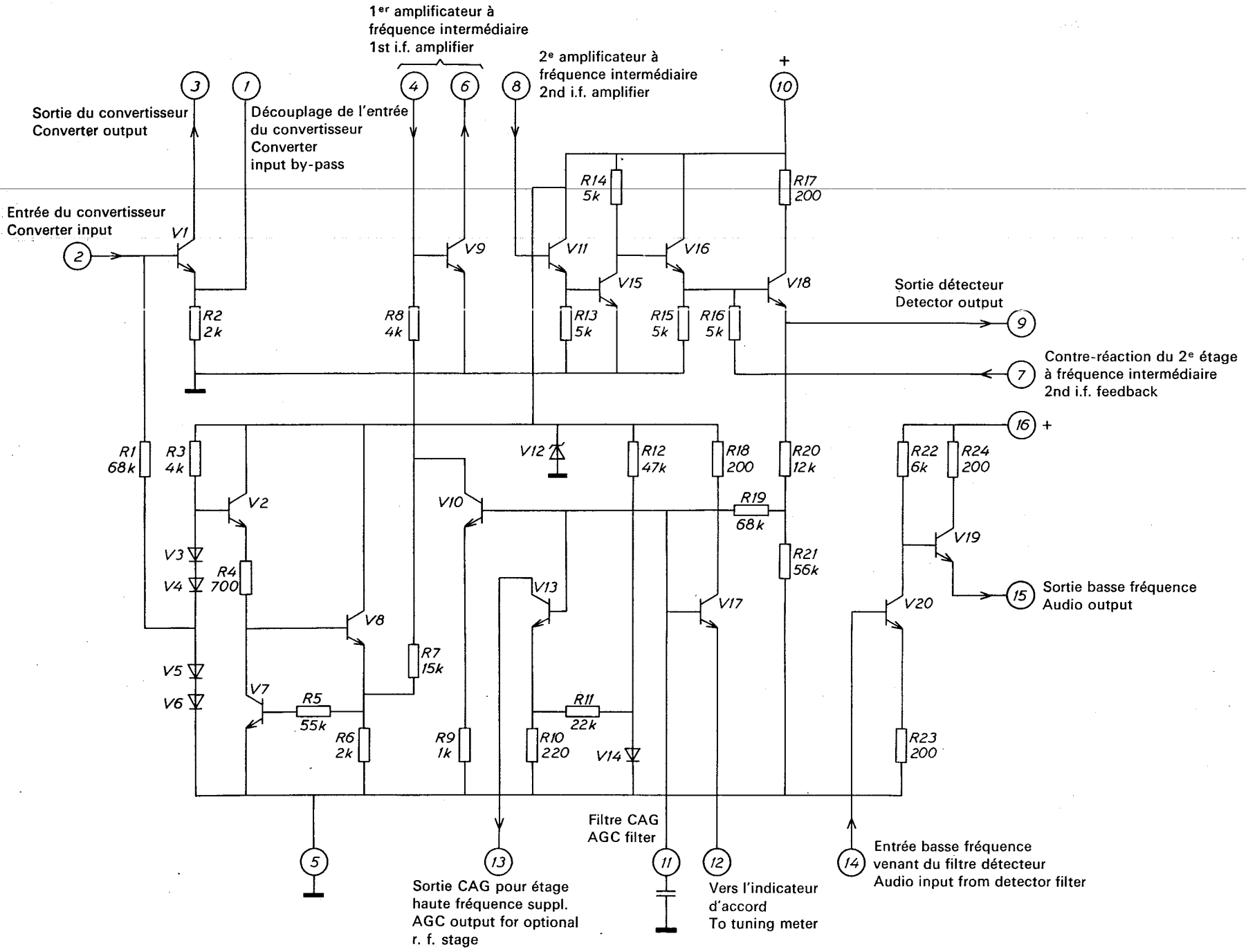
1er amplificateur à fréquence intermédiaire
1st i.f. amplifier
2e amplificateur à fréquence intermédiaire
2nd i.f. amplifier
Sortie du convertisseur
Converter output
Découplage de l'entrée du convertisseur
Converter input by-pass
Entrée du convertisseur
Converter input
Sortie détecteur
Detector output
Contre-réaction du 2e étage à fréquence intermédiaire
2nd i.f. feedback
Sortie basse fréquence
Audio output
Filtre CAG
AGC filter
Sortie CAG pour étage haute fréquence suppl.
AGC output for optional r. f. stage
Vers l'indicateur d'accord
To tuning meter
Entrée basse fréquence venant du filtre détecteur
Audio input from detector filter
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FIGURE 48.1