Jan. 26, 1954

E. P. G. WRIGHT

2,667,542

ELECTRIC CONNECTING DEVICE

Filed Sept. 25, 1951

3 Sheets-Sheet 1

FIG. 1.

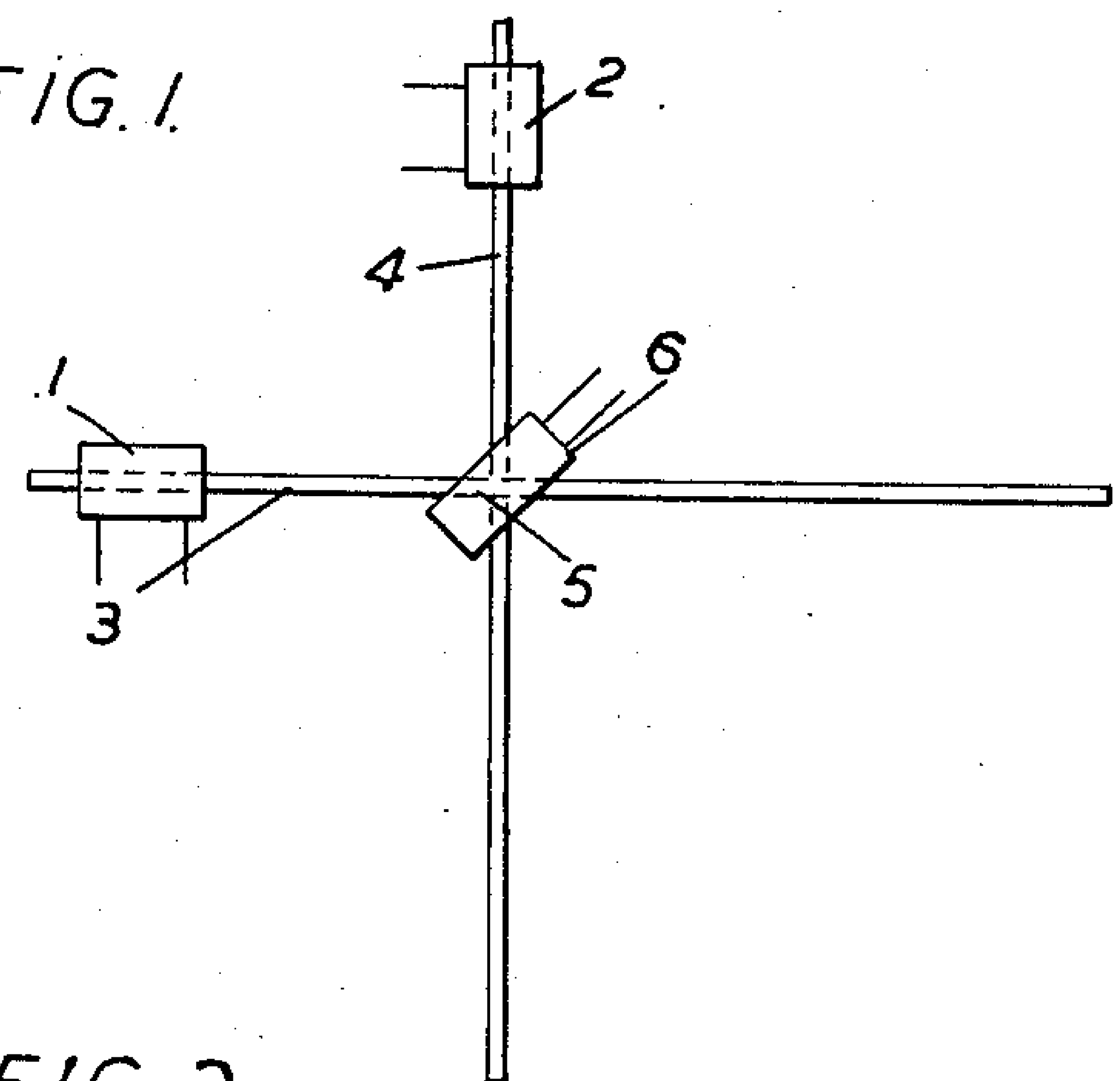

FIG. 2.

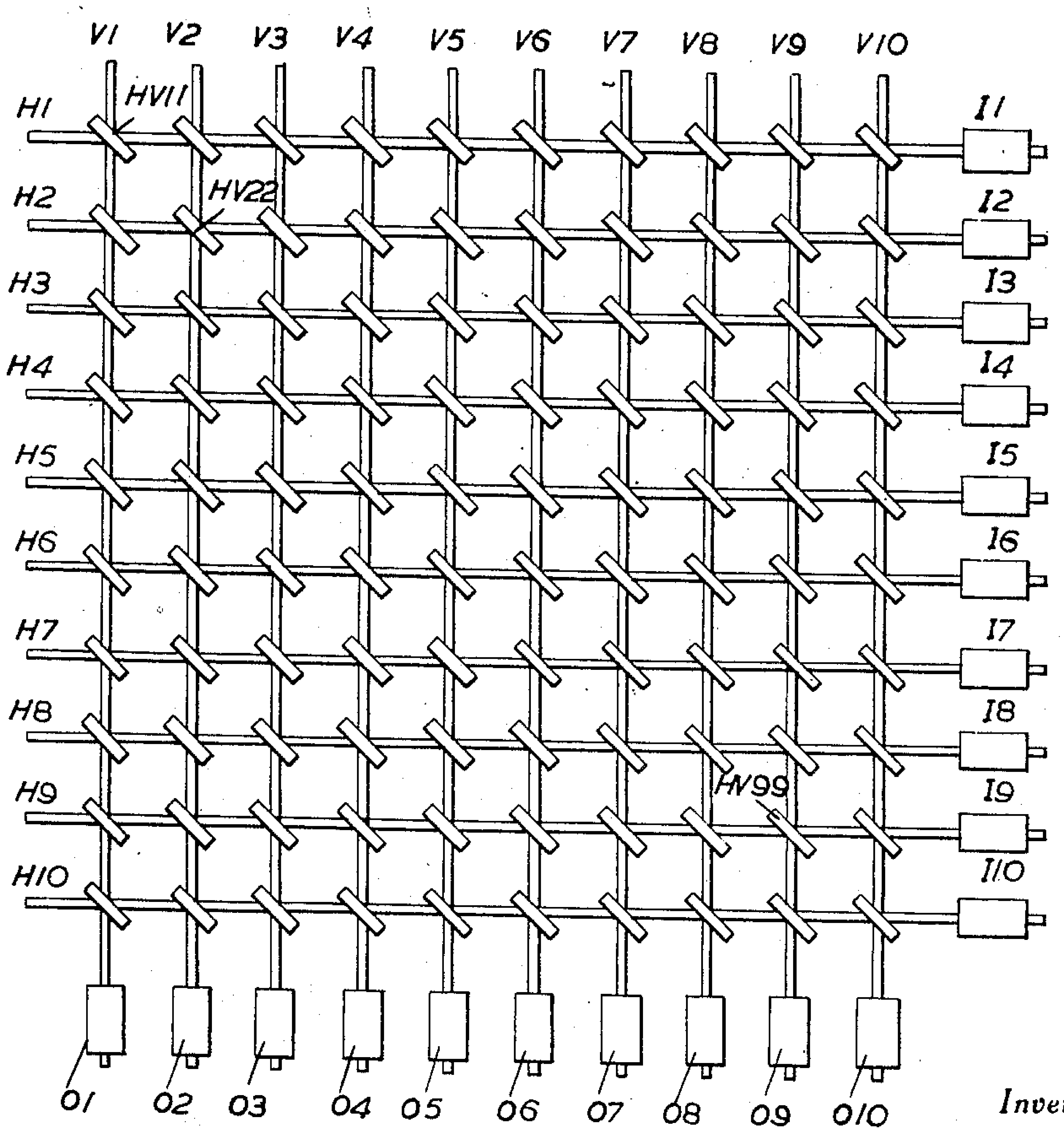

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FIG. 3.

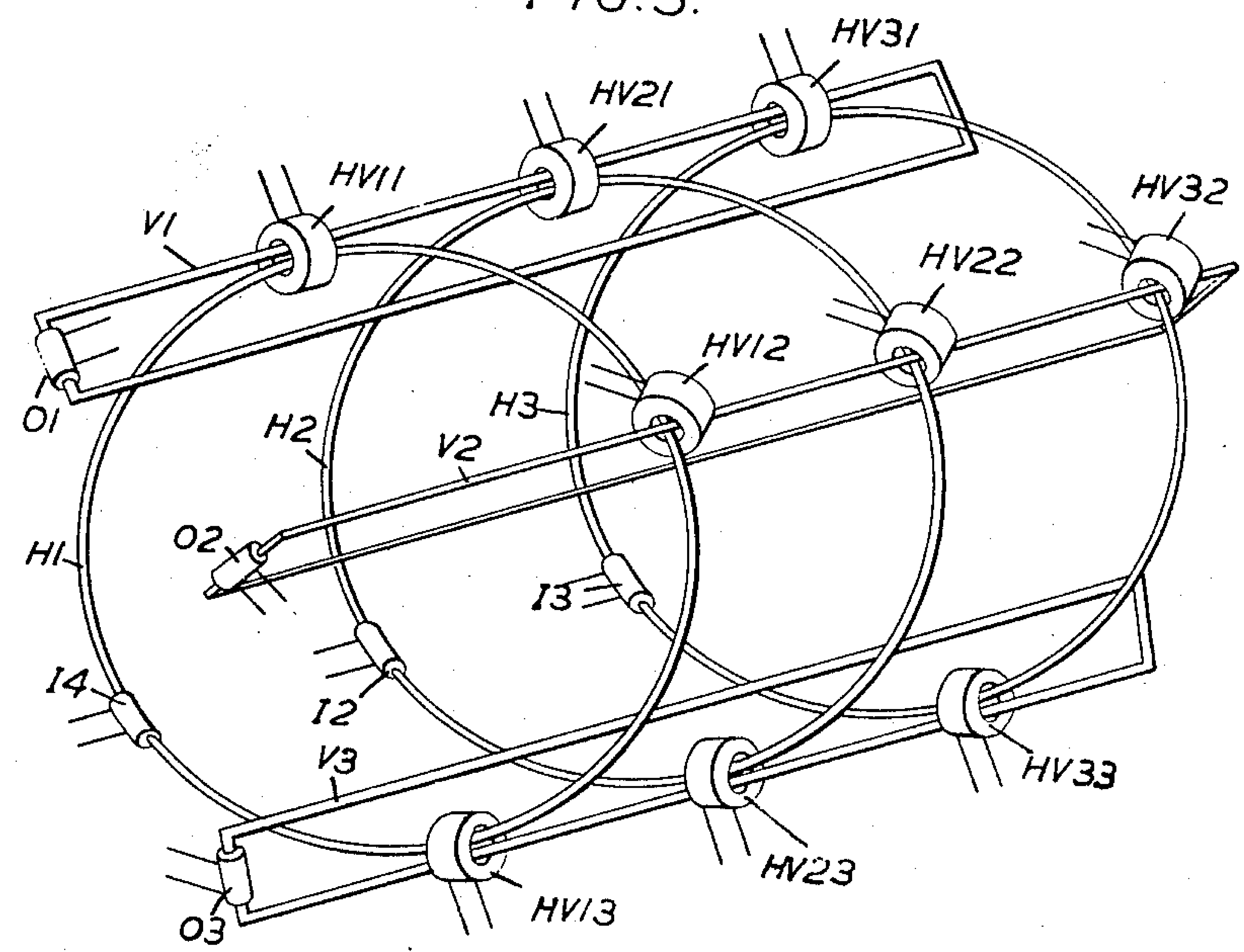

FIG. 4.

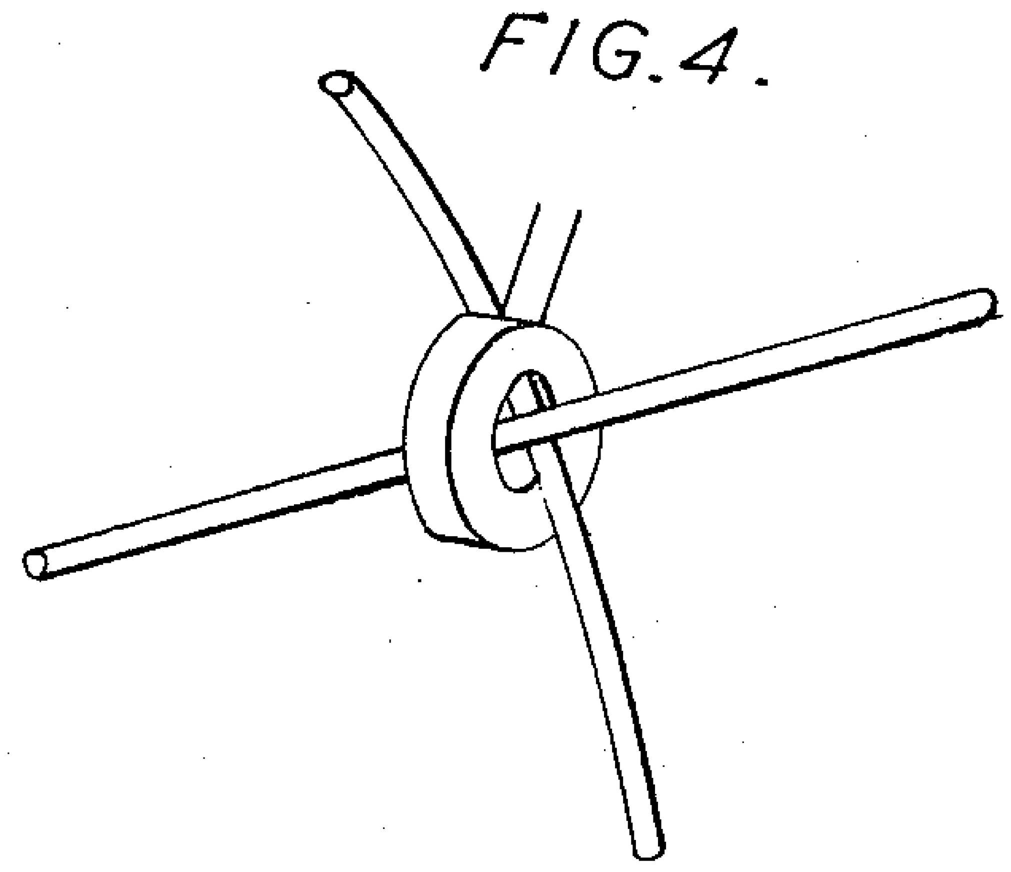

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FIG.5.

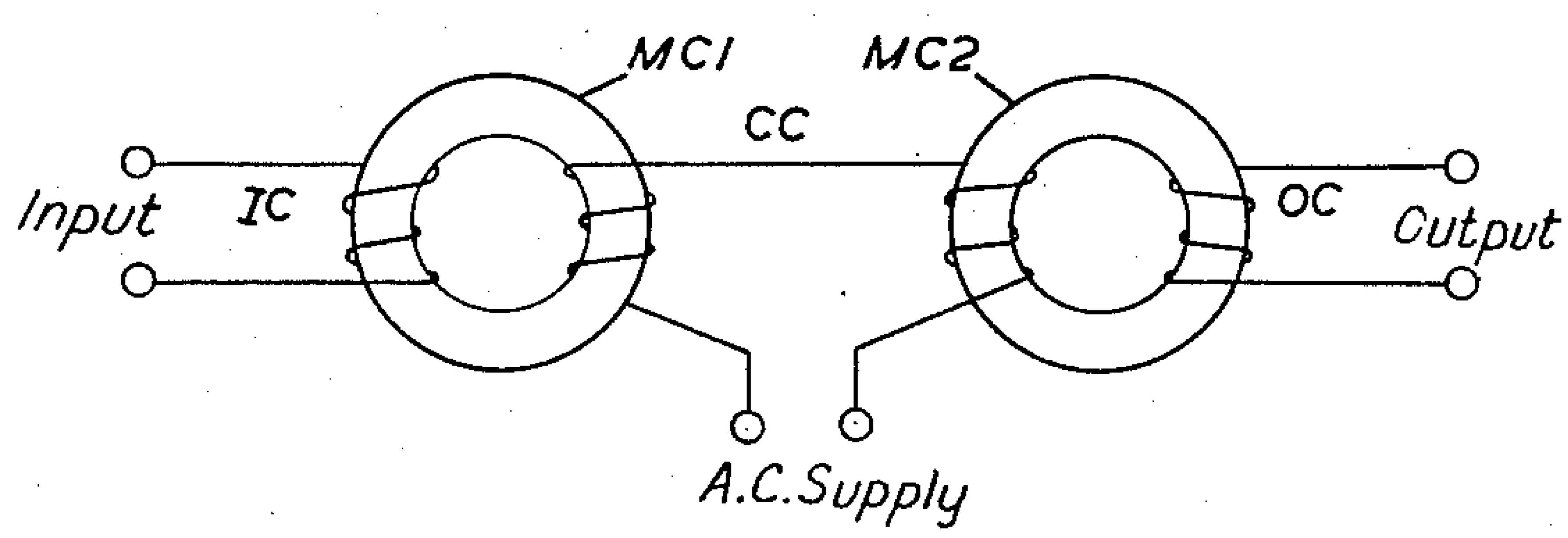
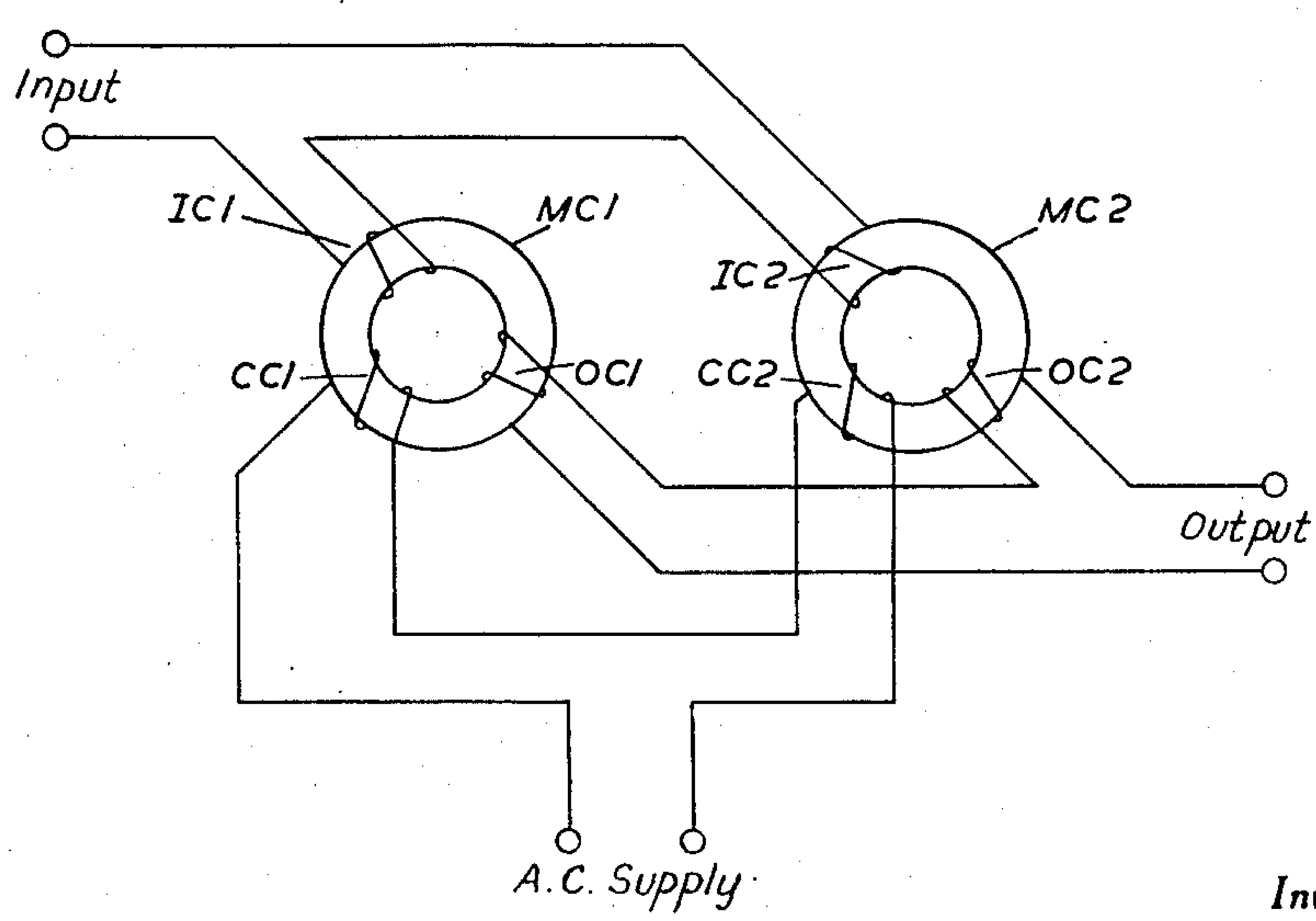


FIG.6.



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Patented Jan. 26, 1954

2,667,542

UNITED STATES PATENT OFFICE

2,667,542

ELECTRIC CONNECTING DEVICE

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Application September 25, 1951, Serial No. 248,196

Claims priority, application Great Britain September 26, 1950

7 Claims. (Cl. 179—27.54)

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This invention relates to static switching devices, and consist broadly in means for making an electrical connection by static coupling.

While the invention is applicable to coupling between a single pair of circuits it is also applicable to switches in which alternative connection possibilities exist between different pairs of a number of circuits, for instance, switches of the type used in telecommunication switching systems, and it is particularly suitable for application to co-ordinate switches, in connection with which the invention will be described.

It is an object of the present invention to provide such a switch in which any one of a plurality of input circuits can be coupled to any one of a plurality of output circuits without any direct metallic connection being established between the circuits coupled together.

The invention will now be described with reference to the accompanying drawings, in which;

Fig. 1 is a diagrammatic representation of means according to the present invention for establishing a connection between a single input circuit and a single output circuit;

Fig. 2 is a flattened-out diagrammatic representation of a multi-switch according to the present invention;

Fig. 3 is a perspective diagrammatic representation of a multi-switch according to the present invention;

Fig. 4 is an enlarged fragmentary view of part of Fig. 3; and

Figs. 5 and 6 show modifications of the means shown in Fig. 1.

In Fig. 1, **1** is an input speech coil and **2** is an output speech coil. The input coil **1** is wound on a core formed by part of a loop **3** of a magnetic material having a very low value of remanence. Therefore any current variations due to an A. C. flow in the coil **1** will produce a varying magnetic flux in its core. Although this core is in the form of closed loop **3** it is shown as a straight bar for convenience of representation. The output speech coil **2** is wound on a similar loop **4** of magnetic material, also shown as a straight bar.

The loops **3** and **4** are so arranged that they are adjacent at point **5**, at any desired angle, although parallelism is considered to give optimum results. A coil **6** is mounted on the two loops in such a way that it embraces the loops at point **5**.

If the coil **1** is energised with an alternating current in the speech range the varying magnetic flux induced thereby in the loop **3**, part of which

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forms an iron core for coil **1**, will have some influence on the magnetic state of loop **4** since the loops are in close proximity at the crossover point **5**. However, under normal conditions the magnitude of this transfer of magnetism is so small as to be practically negligible. It has been found that if the coil **5** which embraces the loops **3** and **4** at the crossover point **5** is energised with radio frequency current, preferably in the range 20 kc./s. to 200 kc./s., the magnetic transfer is greatly facilitated. The frequency of the coupling current may be within quite wide limits, the limit being set by the magnitude of the A. C. circuit impedance. In fact, the magnitude of the effect becomes so great that there is produced in the loop **4** a varying magnetic flux whose amplitude is almost equal to the amplitude of the varying magnetic flux in the "input" loop **3**. This varying flux in loop **4** will, in the normal manner, induce into the "output" coil **2** a varying current whose amplitude will almost equal the amplitude of the original current flowing in the coil **1**.

Therefore it is possible to establish a connection between input and output circuits without any direct metallic connection.

Fig. 2 shows a co-ordinate multi-switch according to the present invention in which loops H**1** to H**10** (shown as straight bars) bear input coils I**1** to I**10** respectively and loops V**1** to V**10** (shown as straight bars) bear output coils O**1** to O**10** respectively. Each crossing point between one of loops H**1** to H**10** and one of loops V**1** to V**10** is embraced by a coil such as HV**11** or HV**99**. A speech path can be established between any input coil and any output coil by applying the radio frequency to the coil embracing the crossing point of the loops on which the desired input and output coils are wound. Thus, for example, to establish connection for speech between coil I**2**, wound on loop H**2**, and coil O2, wound on loop V2, the coil HV**22** is energised with R. F. by switching means not shown. Magnetic transfer between these loops will then become almost complete, so that the speech circuit has become effectively extended through the switch.

Selection of the coil required to establish the desired speech path connection can be performed by any known method of selection, one such as by using combinations of cold cathode gaseous discharge tubes or conventional relay systems. Supervisory and control signals which are normally passed through the switching circuit over a third wire can be converted into V. F. signals and then sent in well-known manner over the speech circuit. Alternatively, a separate switching circuit of any desired type can be provided to cater for the third wire.

Fig. 3 shows in perspective a diagrammatical view of a multi-switch according to the invention having three input coils I1, I2 and I3 wound on three loops H1, H2 and H3 respectively. Three output coils O1, O2 and O3 are wound on three loops V1, V2 and V3 respectively. These loops, as before, are formed of a magnetic material having a low value of remanence. The crossing points between loops are embraced by coils HV11 to HV33.

Fig. 4 is a considerably enlarged view of one of the crossing points of the switch of Fig. 3.

In the switch according to Figs. 3 and 4, a speech path between any input coil and any output coil can be established by energising with R. F. the coil embracing the junction point of the loops on which the desired input and output coils are mounted.

The switch shown in Fig. 2 is preferably arranged in the manner shown in Fig. 3, i. e. with the ten V loops disposed radially on the ten H loops which are axially aligned. The coupler coils can be arranged to embrace both wires of the V loops if the windings are suitably phased as the flux in the legs of the V loop will then be in opposition. The coils wound on the V loops may if desired be used as input coils, in which case the coils wound on the H loops would obviously be output coils.

Another arrangement is shown in Fig. 5 in which input and output coils IC, OC are mounted on magnetic cores MC1, MC2 having no particular physical relation. A coupling coil CC is wound partly on one core, partly on the other. When coil CC is fed with alternating current, for example of supersonic frequency, voice frequency currents applied to coil IC are transferred to coil OC.

The A. C. supply may be applied in any known manner to allow coupling between input and output circuits.

With the arrangement shown in Fig. 5 there will nevertheless be a loss due to the fact that certain of the input energy will be dissipated in the coupling coil. This can be overcome by a combination of opposing coils as shown in Fig. 6.

Two series input coils IC1, IC2 are oppositely wound on two magnetic cores MC1, MC2 having no particular physical relation. Two output coils OC1, OC2, are also oppositely wound on the two cores, while the cores also carry two similarly wound coupling coils CC1, 2 to which alternating current preferably of supersonic frequency is applied.

While the principles of the invention have been described above in connection with specific embodiments and particular modifications thereof, it is to be clearly understood that this de-

scription is made by way of example and not as a limitation on the scope of the invention.

What I claim is:

1. A device for transferring communication currents from one transmission circuit to another, comprising two magnetic loops, respectively encircled over portions of their lengths with coils forming parts of said two transmission circuits, one coil forming an input circuit and the other coil forming an output circuit, and a third coil encircling portions of both said magnetic loops.

2. A device, as claimed in claim 1, comprising means for applying high frequency current to said third coil.

3. A device, as claimed in claim 2, comprising two sets of alternating current magnetic loops, all of which carry coils, and "third" coils encircling the corresponding magnetic loops of every possible pairing of coils of the two sets, whereby alternating frequency current can be transferred from any one alternating current coil of one set to any one alternating current coil of the other set.

4. A device, as claimed in claim 1, comprising one magnetic loop associated with a plurality of other magnetic loops and an equal plurality of "third coils", each encircling said one loop and one of the other loops.

5. A device, as claimed in claim 4, and in which each third coil is in two portions, separately wound, one on each of the two magnetic loops associated with said third coil.

6. A device, as claimed in claim 1, in which each transmission circuit comprises two coils oppositely wound one on each of said magnetic loops and in which said coupling coil comprises two parts similarly wound one on each of said magnetic loops.

7. A device for transferring communication currents from one transmission circuit to another, comprising two magnetic loops, respectively encircled over portions of their lengths with coils forming parts of said two transmission circuits, one coil forming an input circuit and the other coil forming an output circuit, and a third coil encircling portions of both said magnetic loops, said third coil being in two portions, separately wound, one on each of the two magnetic loops.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,187,115	Ellwood et al.	Jan. 16, 1940
2,446,033	Wellings	July 27, 1948
2,510,061	Branson et al.	June 6, 1950
2,580,082	Dimond	Dec. 25, 1951