Oct. 14, 1941. J. SCHMID 2,259,086

SWITCHBOARD PLUG AND JACK STRUCTURE

Filed Jan. 6, 1940 2 Sheets-Sheet 1

FIG. 1

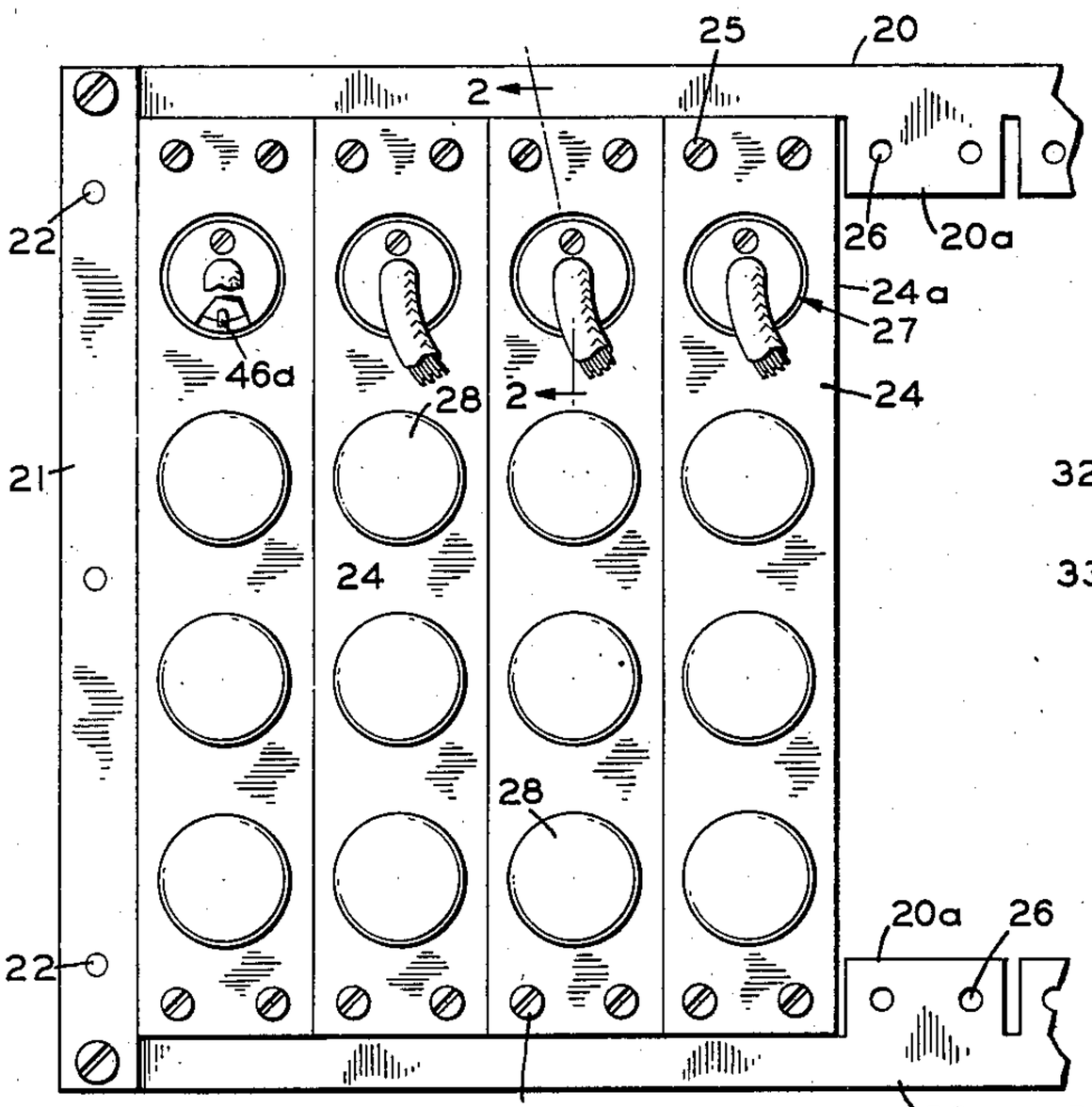


FIG. 3

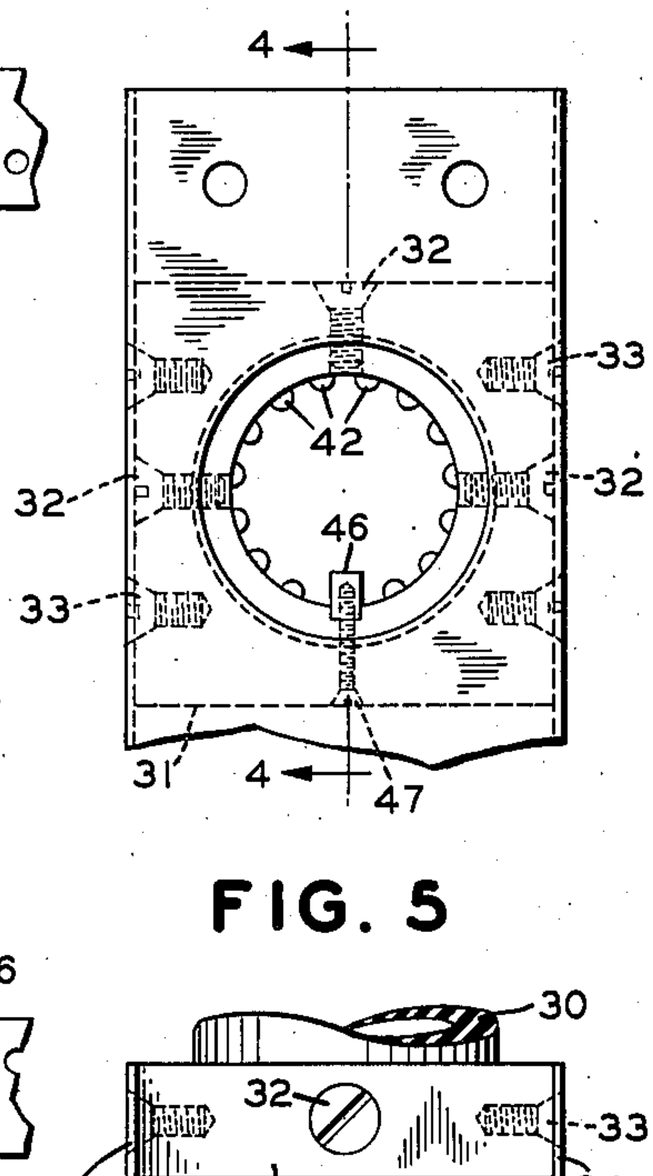


FIG. 5

FIG. 2

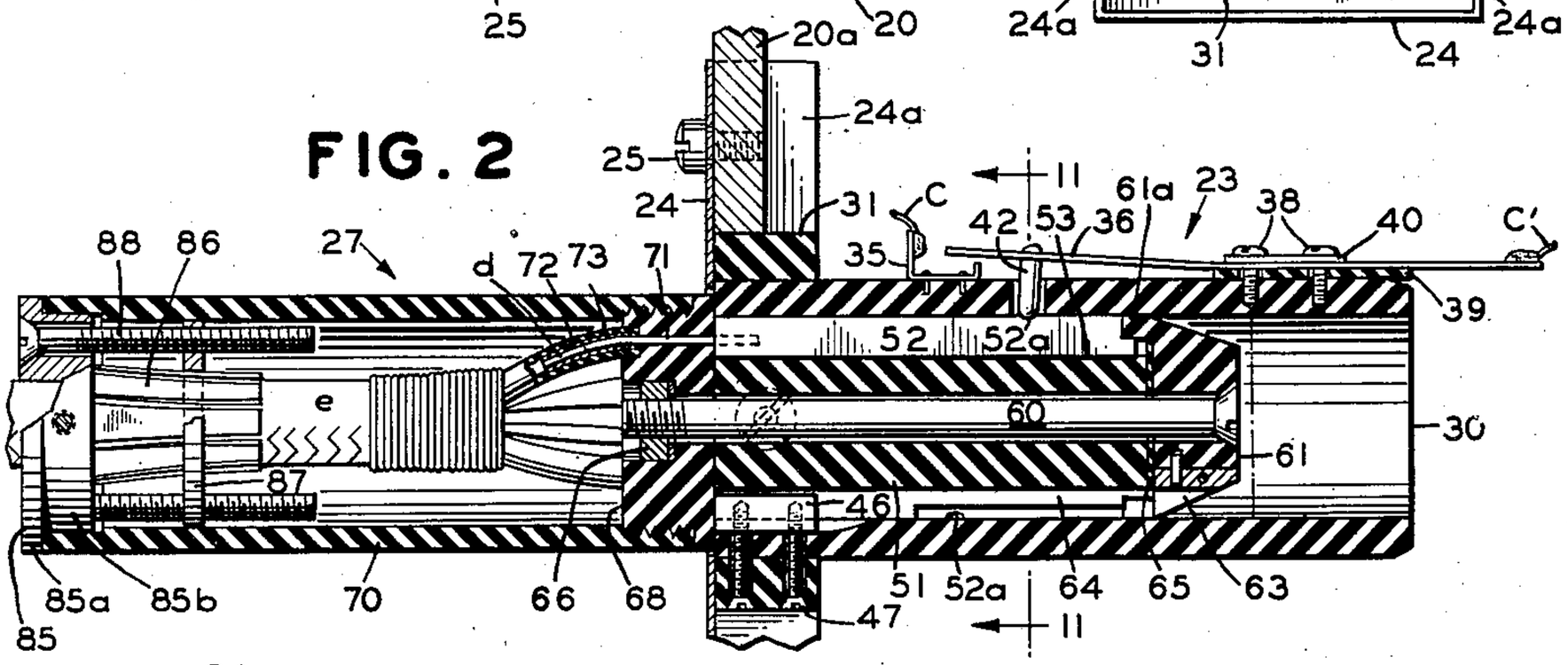
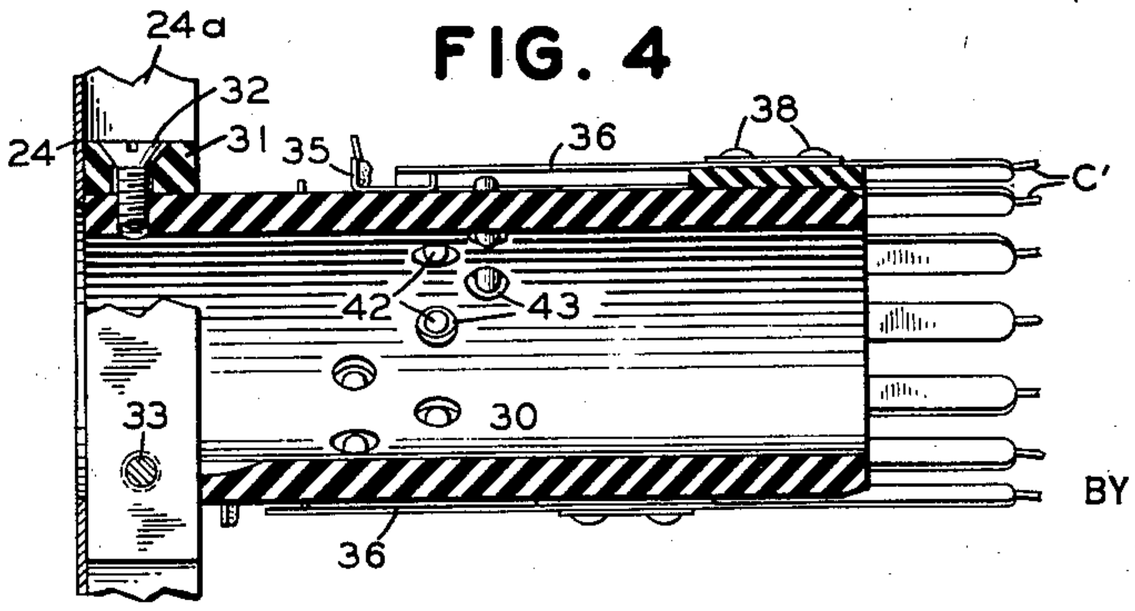


FIG. 4



INVENTOR
J. SCHMID
BY
ATTORNEY

Oct. 14, 1941. J. SCHMID 2,259,086

SWITCHBOARD PLUG AND JACK STRUCTURE

Filed Jan. 6, 1940 2 Sheets-Sheet 2

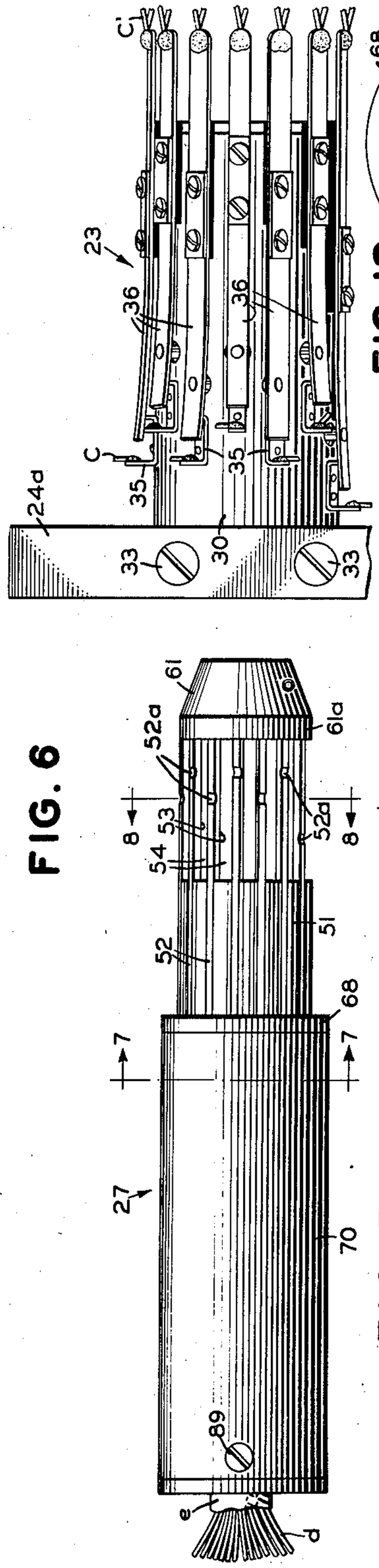


FIG. 6

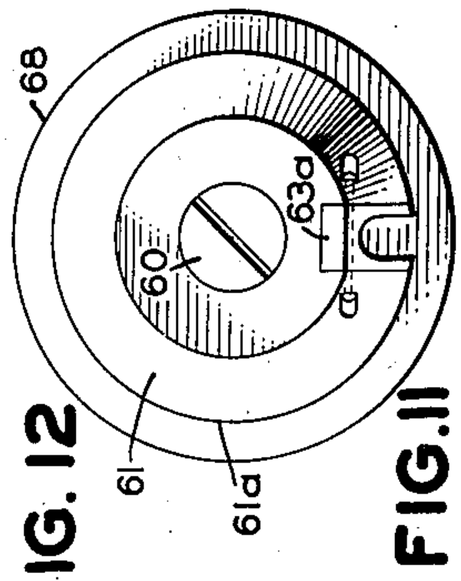


FIG. 12

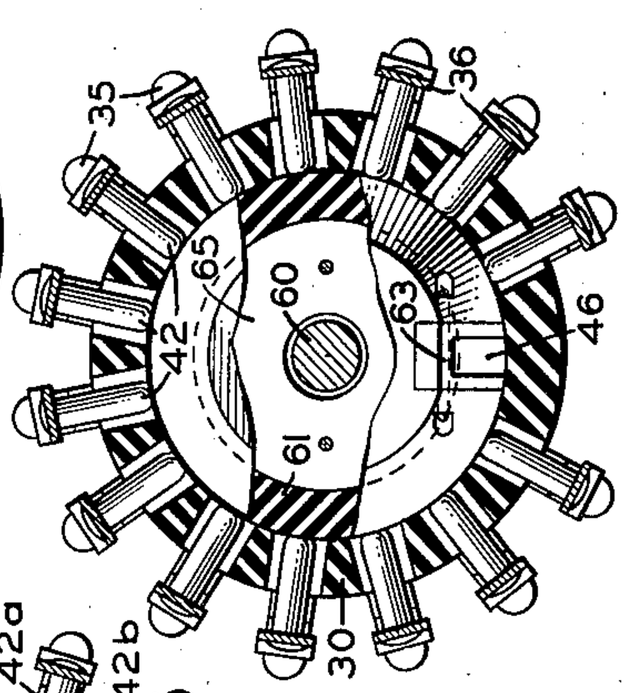


FIG. 11

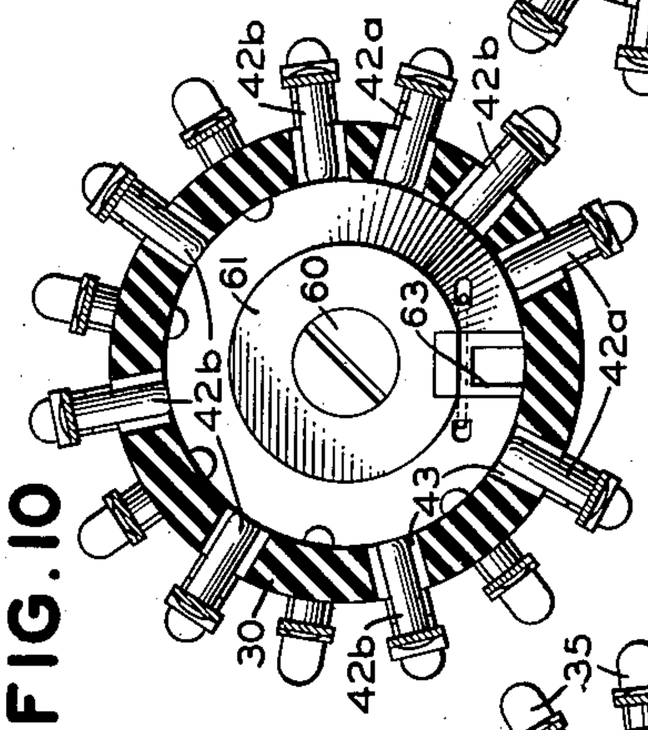


FIG. 10

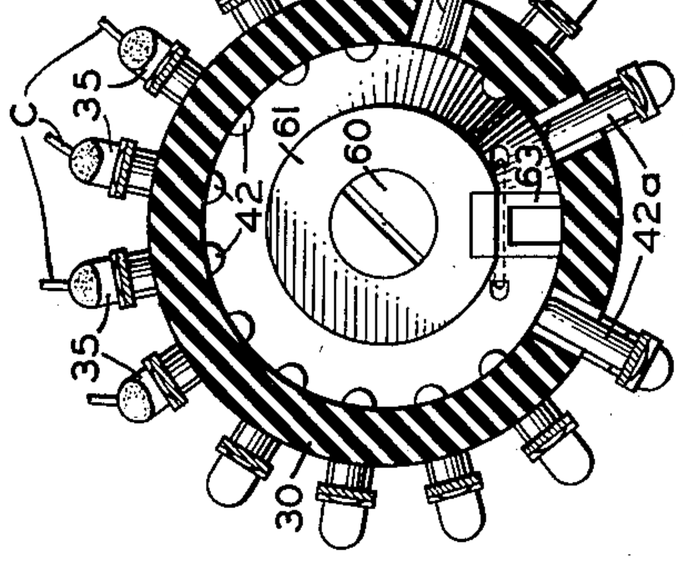


FIG. 9

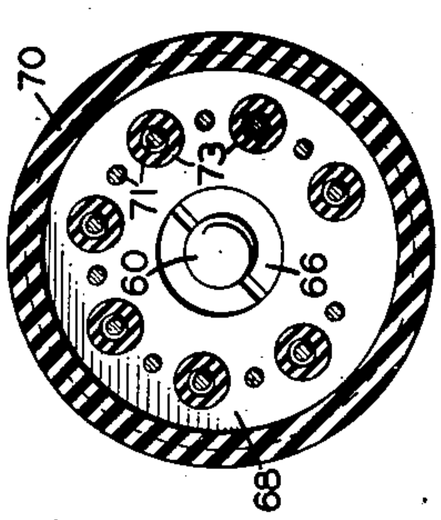


FIG. 7

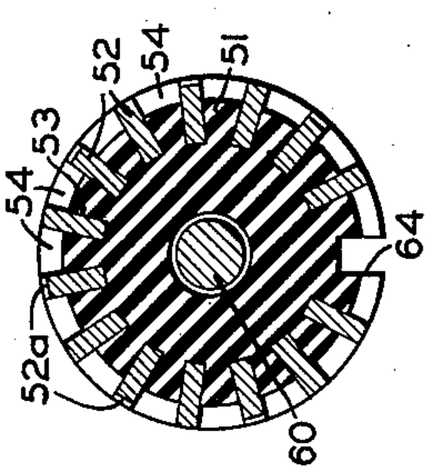


FIG. 8

INVENTOR
J. SCHMID
BY
ATTORNEY

Patented Oct. 14, 1941 2,259,086

UNITED STATES PATENT OFFICE

2,259,086

SWITCHBOARD PLUG AND JACK STRUCTURE

Joseph Schmid, New York, N. Y., assignor to The Western Union Telegraph Company, New York, N. Y., a corporation of New York

Application January 6, 1940, Serial No. 312,679

8 Claims. (Cl. 178—75)

This invention relates generally to a multiple circuit plug and jack structure, and more particularly to a switchboard plug and jack adapted for connecting or switching a plurality of telegraph or other communication circuits.

Various types of switchboard plug and jack structures have heretofore been employed in telephone and telegraph systems, but they have exhibited various disadvantages, among which are that if the structures were sufficiently small and compact to be practical, not sufficient clearance was obtainable between adjacent terminals both on the plug and jack, particularly when a relatively large number of circuits were to be controlled thereby, so that dirt, pieces of wire, solder, and other foreign substances that are apt to be present at various times were likely to cause grounds, short-circuits, or crosses between adjacent circuits. Also, the prior art devices have in general been difficult to inspect and repair, especially when in their operative positions in the switchboard, and have been subject to undue wear and misalignment of the contact elements so that high resistance or loose connections frequently have resulted.

An object of the present invention is to obviate various of the disadvantages heretofore present, and to provide a plug and jack structure which is compact and yet is sufficiently rugged to stand rough handling in service, and which is capable of carrying relatively heavy currents, and in which the various connecting parts and terminals more readily are available for inspection, repair or replacement purposes.

Another object is a plug and jack structure which may handle a relatively large number of circuits and which may be assembled from a relatively small number of like parts.

A further object is a plug and jack structure of the character described which may be built or assembled with a minimum of skill on the part of workers during the manufacture thereof, and in which larger tolerances are permissible without adversely affecting the high standard of performance required.

Still another object is a jack structure of the character disclosed which may be mounted more readily, and in which the jacks are readily interchangeable in a switchboard structure.

Other and further advantages of the invention will be apparent from the following description of the apparatus, taken in connection with the accompanying drawings, in which:

Fig. 1 is a view of a telegraph switchboard employing plug and jack structures constructed in accordance with the invention;

Fig. 2 is a longitudinal sectional view of one of the plugs inserted into a jack in circuit connecting position, taken along the line 2—2 of Fig. 1;

Fig. 3 is a front view of one of the jacks of Figs. 1 and 2, with the plug removed from the jack;

Fig. 4 is a longitudinal section, taken along the line 4—4 of Fig. 3;

Fig. 5 is a fragmentary top view of the jack, showing certain details of the switchboard panel structure;

Fig. 6 is a view of the plug and jack, with the plug removed from the jack;

Fig. 7 is a cross-section taken along the line 7—7 of Fig. 6, showing certain details of the plug structure;

Fig. 8 is a cross-section taken along the line 8—8 of Fig. 6;

Figs. 9 and 10 are views showing various groups of contacts of the jack structure as they are progressively moved outwardly by the plug when it is inserted into the jack;

Fig. 11 is a cross-section taken along the line 11—11 of Fig. 2, showing the positions of the jack contacts when the plug is fully inserted; and

Fig. 12 is a fragmentary view of a plug having a different form of keyway therein.

Referring now to Fig. 1 of the drawings, there is shown a telegraph switchboard structure comprising upper and lower supporting iron strips 20 secured in place by vertical iron strips 21, one of which vertical strips is shown in the figure. The vertical strips are secured to a switchboard supporting framework in any suitable manner, as by screws or bolts which pass through the holes 22 in the vertical strips. Each of the laterally extending strips 20 has a series of tongues 20*a*, the upper and lower aligned tongues providing mounting means for the channel-shaped jack mounting strips 24, Figs. 1 and 5, which are secured to the tongues 20*a* by means of machine screws 25, Figs. 1 and 2, that pass through holes 26 in the tongues and are screw-threaded into the tongues.

As hereinafter described in detail, the jacks 23 are mounted in openings 24*a* in the faces of the channel-shaped members 24, each of the strips being adapted to mount four jacks, so that the portion of the switchboard assembly shown provides room for sixteen jacks. In the figure, only the upper openings 24*a* of the strips are shown as having jacks mounted therein, these jacks having their complementary switchboard plugs 27 inserted therein in operating position. The other three openings of each of the mounting strips 24 are covered by removable blank caps 28 which may be removably secured in the openings 24*a* by a forcefit or by spring tongues or any other suitable manner. The switchboard may thus be built up to accommodate any desired number of working circuits, and also provides ample room for future expansion.

Figs. 2 to 6 show various details of the jack structure and mounting means therefor, and

Figs. 2 and 6 also show various details of the plug structure.

In the embodiment illustrated, the jack comprises a cylindrical shell **30** of Bakelite, hard rubber, or other suitable material, the front end of the shell being mounted in a close-fitting circular opening in a plug **31** of suitable insulating material, Figs. 2 to 4, and firmly secured thereto by three machine screws **32** that pass through the plug **31** and are screw-threaded into the front end of the shell **30**, the ends of the screws stopping short of the inner surface of the shell. Each plug **31** is firmly secured to its jack mounting strip **24** by four machine screws **33**, Figs. 3, 5 and 6, that pass through holes in the two sides or flanges **24***a* of the mounting strip and are screw-threaded into the plug **31**, the plug fitting snugly between the two flanges **24***a*.

Referring again to Figs. 2, 4 and 6 of the drawings, the shell **30** of the jack has mounted, on its outer cylindrical surface, a series of similar contact spring assemblies, each such assembly comprising a fixed U-shaped contact member **35**, secured, as by pins in the manner shown in Fig. 2, to the body of the shell **30**. The contact has an upturned portion or lug at one end for receiving a conductor *c* soldered thereto, and at its other end has an upturned portion or lug adapted to close a circuit when its associated spring contact **36** is in contact with the lug, as shown in Figs. 4 and 6. Each contact spring **36** is rigidly mounted on the shell **30** by means of two machine screws **38** that pass through holes in the spring and thread into the shell **30**. A spacing strip **39** of insulation is interposed between the spring and shell to suitably space the spring therefrom, and a small strip **40** of metal prevents injury to or breakage of the spring when flexed, and also provides a stiffening piece for the spring. The rear end of each contact spring **36**, which extends beyond the rear end of the shell **30**, provides means for soldering a conductor *c'* to the spring, which conductor forms a portion of the circuit controlled by the plug and jack. Passing through and rigidly secured to the front end of each contact spring, in any suitable manner, as by riveting or spinning over an end thereof, is a generally cylindrical contact member **42**. Each of the members **42** extends, through a circular opening **43** in the wall of the shell **30**, into the interior of the shell to make contact with the plug when it is inserted, sufficient clearance being provided to enable the member **42** to move freely within the opening as its spring **36** is actuated.

In the particular jack illustrated, fourteen spring contact assemblies are provided, so that fourteen circuits may be controlled thereby, although it will be understood that the number of contact assemblies will vary depending upon the number and nature of the circuits employed. The various circuits may comprise, for example, different channels of a multiplex system, together with auxiliary circuits associated therewith, or may comprise various other kinds of circuits which may or may not be thus closely interrelated. Also, as shown, the circuits controlled by each jack normally are closed when no plug is inserted in the jack so that the circuits will not inadvertently be left open at the jacks, and the contacts **42** and associated springs **36** may be staggered longitudinally of the shell **30** so as to form three groups of contact controlling assemblies, whereby when the plug is inserted these groups are switched successively to the circuits of the plug. Such an arrangement enables the conditioning or operation of certain apparatus before other apparatus in the circuits is conditioned or operated, thereby providing a desired sequence of operations of the equipment controlled by the plug and jack. By staggering the contact springs **36** and their associated fixed contacts **35** in the manner shown, there is also provided a greater clearance between adjacent contacts and thus minimizes the possibility of short-circuits, crosses or grounds, and facilitates soldering the external connections *c* to the lugs of the contacts **35**. A metal key **46**, shown in Figs. 2 and 3, is inserted in a slot in the inner front end of the sleeve **30** and is secured thereto by two machine screws **47** which pass through the plug **31**. This key co-acts with a keyway in the plug structure so that the plug can only be inserted when it is in a predetermined position with respect to the jack, and thus insure proper connection of the respective circuits.

Referring to Figs. 2 and 6, the plug **27** comprises a substantially solid cylindrical core **51** of Bakelite or other suitable insulating material, having longitudinal slots **53** cut or otherwise formed in the outer peripheral surface, which slots receive and hold bars **52**, preferably of Phosphor bronze, that provide means for connecting the plug circuits to the various contact members **42** of the jack, in the manner shown in Fig. 2. The bars **52** have indented or recessed portions **52***a* into which the contacts **42** fit when the plug is fully inserted in the jack. Between the slots **53**, and intermediate the contact bars **52**, the plug body has slotted portions **54** to enable the contact members **42** to fit in the portions **52***a* of the bars **52**, the portions **54** also forming the sides of the slots **53** and providing supporting means for the sides of the various bars. The bars may be slightly wedge-shaped, with the narrower edges of the bars received in the slots **53**, so as to firmly wedge the bars in place and also to provide greater clearance between adjacent bars at the surfaces **54** of the plug body **51**, as shown in Fig. 6, the outer edges of the bars **52** are flush with the outer perimeter of the body **51**.

The tip end of the plug body has secured thereto, by a machine screw **60** and nut **66**, a tapered end piece **61** of suitable insulating material, the member **61** serving to guide the plug into the jack. The member **61** has formed thereon a flanged portion **61***a* which, as shown in Fig. 2, fits closely over reduced end portions **52***a* of the bars **52** and thus securely clamps the forward end of each of the bars in proper position. The metal tip **63**, which is secured in a recess in the member **61**, as by the pins shown in Fig. 2, has a recessed portion therein that provides a keyway which slides over the key **46** of the jack when the plug is inserted therein. A slotted portion **64** in the underside of the core **51** forms a continuation of the keyway so that the key **46** and the keyway formed by the portions **63** and **64** coact to insure that the plug will be inserted in proper position relative to the jack and that the plug will not turn in the jack after it is inserted therein. Preferably, and as shown, an insulating washer **65** is interposed between the tip member **61** and the jack body **51**.

The other end of the plug body **51** has secured thereto, by the machine screw **60** and the nut **66**, Fig. 2, a cap **68** of insulating material, the cap having holes drilled or otherwise formed therein through which short conductors **71** pass,

these conductors being brazed, soldered or otherwise secured to the ends of the bars 52. Flexible conductors *d*, Fig. 2, which are covered with braid or other suitable insulating material, are connected to the conductors 71 by means of conducting sleeve members 72, the conductors *d* and 71 being received within the sleeves 72 and soldered or otherwise secured thereto. For convenience, the conducting sleeve 72 may be split longitudinally to facilitate entry of the solder around the conductors. Insulating sleeves 73 cover the members 72. As shown in Figs. 2 and 7, the holes in the cap 68, through which the conductors 71 pass, have alternate ones with enlarged recessed portions so as to receive the ends of the insulating sleeves 73 within these recessed portions, thereby to increase the leakage path between adjacent conductors. Member 68 has an exteriorly threaded portion, by means of which is secured thereto a hollow cylindrical shell 70 of insulation through which the conductors *d* pass, this shell also forming a handle for the plug. Usually, and as shown, the conductors *d* are formed into a cord or cable *e*, the number of conductors corresponding to the number of bars 52 which are used in the plug.

The end of the handle or shell 70 is closed by a circular collar 85 of brass or other suitable material, the collar having a flanged portion 85*a* that abuts against the end of the shell 70, and a reduced portion 85*b* that fits within the end of the shell 70. The collar also has projecting therefrom a plurality of spring tongue members 86, these tongue members surrounding the opening in the collar through which the cord *e* passes. The tongue members are arranged so that they taper inwardly and a collar 87 encircles the tongue members with a fairly close fit, so that as the member is moved towards the member 85, by means of the machine screws 88 which thread into the collar, the tongue members 86 will be forced inwardly to firmly clamp the cord *e* and thus prevent any pull from being exerted on the conductors *d* when the plug is in service. The member 85 is secured to the shell 70 by means of machine screws 89, Fig. 6, which pass through the shell and are screw-threaded into the reduced portion 85*b* of the collar.

Figs. 9, 10 and 11 show how the several groups of contacts on the jack are successively connected to the plug as it is inserted in the jack. In Fig. 9 the entry of the plug has operated the group of contacts 42*a*; as the plug is further inserted the group of contacts 42*b* are also operated, as shown in Fig. 10; and in Fig. 11 the plug has been fully inserted and all of the contacts 42 have been operated. As hereinbefore stated, this effects any desired sequence of operations of the equipment controlled by the plug and jack. The number of the several groups, and the number of contacts in each of such groups, may obviously be varied to provide any desired control or sequence of operations.

Fig. 12 shows a modified form of plug in which the metal tip or keyway 63*a* has an arcuate opening, instead of the rectangular opening in the member 63 shown in Figs. 2 and 9 to 11. This prevents the plug of Fig. 12 from being inserted into a jack having a rectangular key 46, such as shown in Fig. 2. However, a plug having a rectangular tip or keyway 63 can be inserted in a jack having an arcuate key 46*a*, such as the jack shown in the upper left hand portion of Fig. 1. The arrangement is of especial importance in the use of patching cords having a plug at each end, since it prevents connecting circuits together which are not intended or adapted to be so connected, but permits ready connection of circuits which are adapted to work together, merely by using plugs on either end of each patching cord having the differently formed tips or keyways 63 and 63*a*.

While there are shown and described herein certain preferred embodiments of the invention, many other and varied forms and uses will occur to those versed in the art without departing from the invention, and the invention is, therefore, not limited except as indicated by the terms and scope of the appended claims.

I claim:

1. Switchboard plug and jack structure comprising a supporting framework, a jack comprising a shell having one end thereof secured to the supporting framework and forming the front opening of the jack for receiving a plug, a plurality of circuit-controlling contact members mounted on the outer surface of said jack shell and spaced around the periphery of said shell, said shell having apertured portions therein adjacent to said contact members, said contact members having contact elements projecting through said apertured portions into the interior of said shell and movable within said apertured portions, a plug comprising a body of insulating material adapted to be inserted in said jack shell, said plug body having a plurality of longitudinally extending slots in the outer surface thereof and spaced around the periphery of said body, conducting bars disposed in said slots and means for securing said bars in place, the spacing of said bars around the periphery of the plug body corresponding to the spacing of the contact elements around the periphery of said jack shell whereby when the plug is inserted a predetermined distance into the jack the various conducting bars will engage the various contact elements, respectively, to connect circuits through the plug and jack.

2. Switchboard plug and jack structure comprising a supporting framework, a jack comprising a hollow cylindrical shell having one end thereof secured to the supporting framework and forming the front opening of the jack for receiving a plug, a plurality of circuit-controlling contact members mounted on the outer surface of said jack shell and spaced around the periphery of said shell, said shell having apertured portions therein adjacent to said contact members, said contact members having contact elements projecting through said apertured portions into the interior of said shell and movable within said apertured portions, a plug comprising a cylindrical body of insulating material adapted to be inserted in said jack shell, said plug body having a plurality of longitudinally extending slots in the outer surface thereof and spaced around the periphery of said body, conducting bars disposed in said slots and means for securing said bars in place, the spacing of said bars around the periphery of the plug body corresponding to the spacing of the contact elements around the periphery of said jack shell whereby when the plug is inserted a predetermined distance into the jack the various conducting bars will engage the various contact elements, respectively, to connect circuits through the plug and jack, and coacting means on the plug and jack structure preventing turning of the plug when inserted in the jack.

3. Switchboard plug and jack structure comprising a supporting framework, a jack compris-

ing a shell having one end thereof secured to the supporting framework and forming the front opening of the jack for receiving a plug, a plurality of circuit-controlling spring contact members mounted on the outer surface of said jack shell and spaced around the periphery of said shell, said shell having apertured portions therein adjacent to said contact members, said contact members having contact elements projecting through said apertured portions into the interior of said shell and movable within said apertured portions, said spring contact members normally urging said contact elements inwardly, a plug comprising a body of insulating material adapted to be inserted in said jack shell, said plug body having a plurality of longitudinally extending slots in the outer surface thereof and spaced around the periphery of said body, conducting bars disposed in said slots and means for securing said bars in place, the spacing of said bars around the periphery of the plug body corresponding to the spacing of the contact elements around the periphery of said jack shell whereby when the plug is inserted a predetermined distance into the jack the various conducting bars will engage the various contact elements, respectively, to connect circuits through the plug and jack.

4. Switchboard plug and jack structure comprising a supporting framework, a jack comprising a shell having one end thereof secured to the supporting framework and forming the front opening of the jack for receiving a plug, a plurality of circuit-controlling contact members mounted on the outer surface of said jack shell and spaced around the periphery of said shell, said contact members being spaced longitudinally of the shell to provide different groups of these members, said shell having apertured portions therein adjacent to said contact members, said contact members having contact elements projecting through said apertured portions into the interior of said shell and movable within said apertured portions, a plug comprising a body of insulating material adapted to be inserted in said jack shell, said plug body having a plurality of longitudinally extending slots in the outer surface thereof and spaced around the periphery of said body, conducting bars disposed in said slots and means for securing said bars in place, the spacing of said bars around the periphery of the plug body corresponding to the spacing of the contact elements around the periphery of said jack shell whereby when the plug is inserted a predetermined distance into the jack the various conducting bars will engage the various contact elements, respectively, to connect circuits through the plug and jack, the conducting bars successively engaging the said different groups of circuit-controlling contact members as the plug is inserted to obtain a desired sequence of operations.

5. Switchboard plug and jack structure comprising a supporting framework, a jack comprising a hollow cylindrical shell of insulating material, said shell having one end thereof secured to the supporting framework and forming the front opening of the jack for receiving a plug, a plurality of circuit-controlling contact members mounted on the outer surface of said jack shell and spaced around the periphery of said shell, said shell having apertured portions therein adjacent to said contact members, said contact members having contact elements projecting through said apertured portions into the interior of said shell and movable within said apertured portions, a plug comprising a body of insulating material adapted to be inserted in said jack shell, said plug body having a plurality of longitudinally extending slots in the outer surface thereof and spaced around the periphery of said body, conducting bars disposed in said slots and means for securing said bars in place, the spacing of said bars around the periphery of the plug body corresponding to the spacing of the contact elements around the periphery of said jack shell whereby when the plug is inserted a predetermined distance into the jack the various conducting bars will engage the various contact elements, respectively, to connect circuits through the plug and jack.

6. Switchboard jack structure comprising a shell having one end thereof forming the front opening of the jack for receiving a plug with contact members thereon, a plurality of circuit-controlling contact members mounted on the outer surface of said jack shell and spaced around the periphery of said shell, said shell having apertured portions therein adjacent to said contact members, said contact members having contact elements projecting through said apertured portions so as to form protruding contacts in the interior of said shell and movable within said apertured portions by the contact members on said plug when the latter is inserted into the jack.

7. Switchboard plug structure comprising a body of insulating material adapted to be inserted in a jack having contact elements mounted so as to form protruding contacts in the interior of said jack, said plug body having a plurality of longitudinally extending slots in the outer surface thereof and spaced around the periphery of said body, conducting bars disposed in said slots and means for securing said bars in place, the spacing of said bars around the periphery of the plug body corresponding to the spacing of the contact elements of said jack whereby when the plug is inserted into the jack the various conducting bars will engage the various jack contact elements, respectively, to connect circuits through the plug and jack, said conducting bars having recessed portions in the surfaces thereof for receiving said contact elements when the plug is inserted into the jack.

8. Switchboard plug structure comprising a body of insulating material adapted to be inserted in a jack having contact elements, said plug body having a plurality of longitudinally extending slots in the outer surface thereof and spaced around the periphery of said body, conducting bars disposed in said slots and means for securing said bars in place, the spacing of said bars around the periphery of the plug body corresponding to the spacing of the contact elements of said jack whereby when the plug is inserted into the jack the various conducting bars will engage the various jack contact elements, respectively, to connect circuits through the plug and jack, said plug having an insulating member secured to one end thereof, said insulating member having openings therethrough, conductors passing through said openings and connected respectively to said conducting bars, insulating sleeves around said conductors, alternate ones of said openings having recessed portions for receiving the ends of said insulating sleeves thereby to increase the leakage path between adjacent ones of said conductors.

JOSEPH SCHMID.