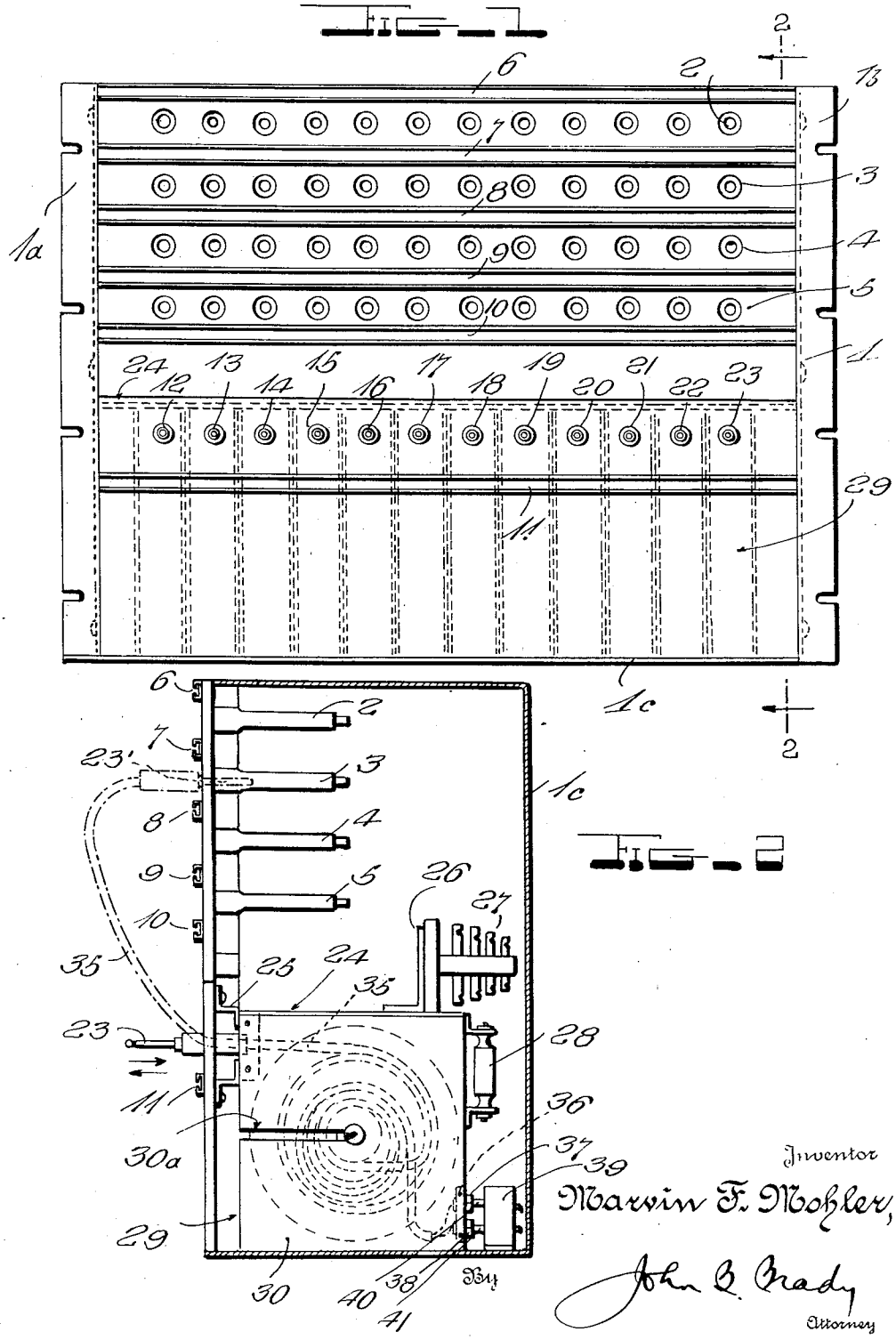
March 30, 1948. M. F. MOHLER 2,438,515

PLUG AND JACK BOX SWITCHING UNIT

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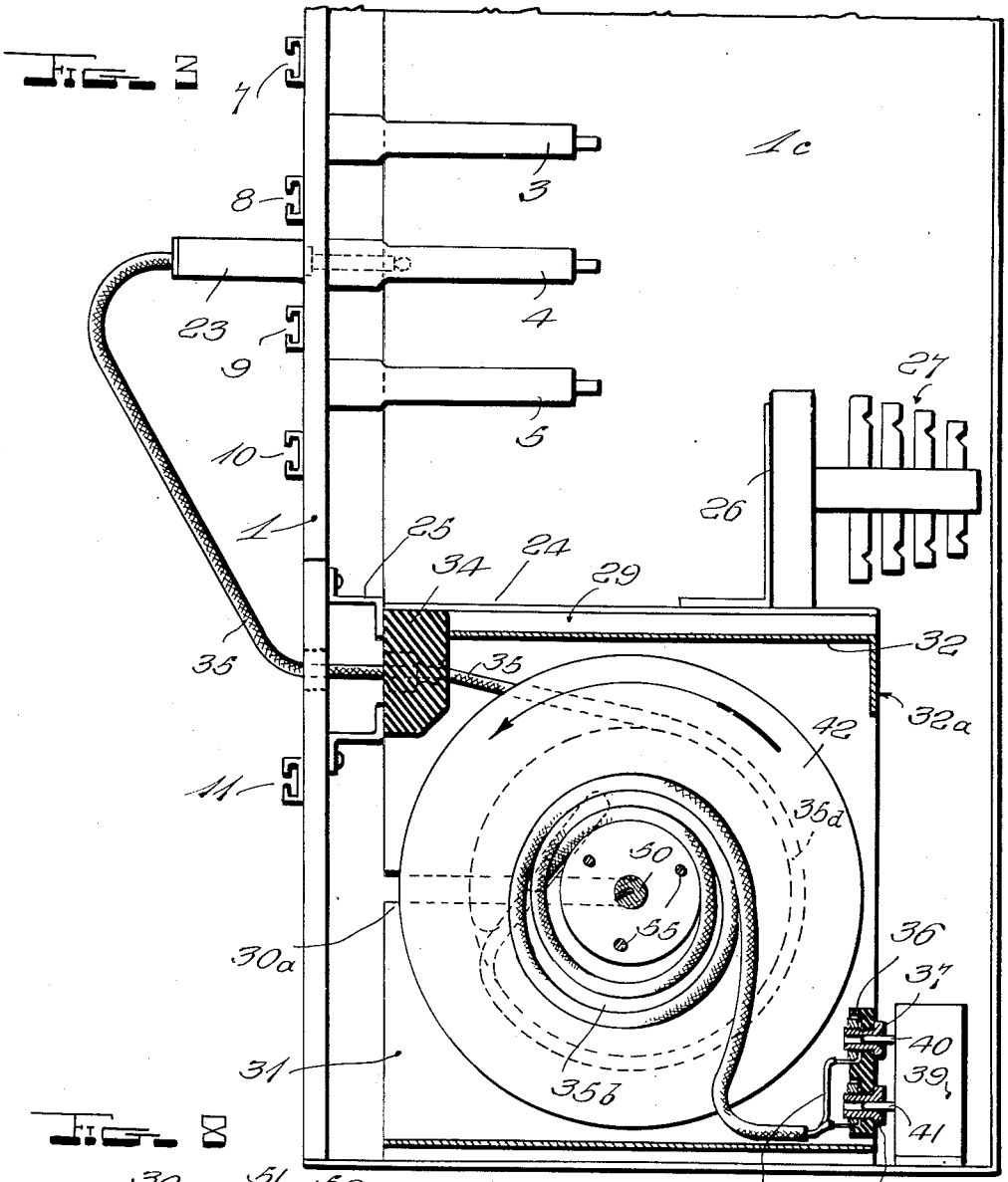


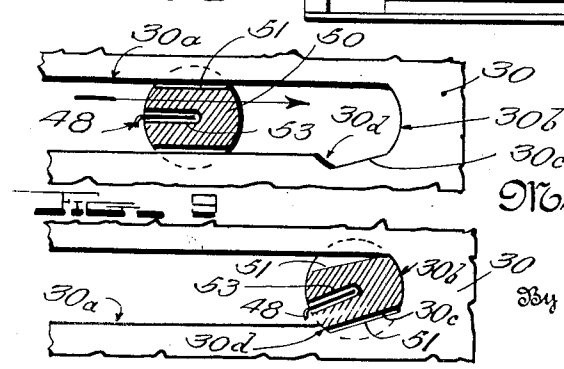
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PLUG AND JACK BOX SWITCHING UNIT

Filed Oct. 9, 1945 5 Sheets-Sheet 2





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March 30, 1948. M. F. MOHLER 2,438,515

PLUG AND JACK BOX SWITCHING UNIT

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FIG. 4

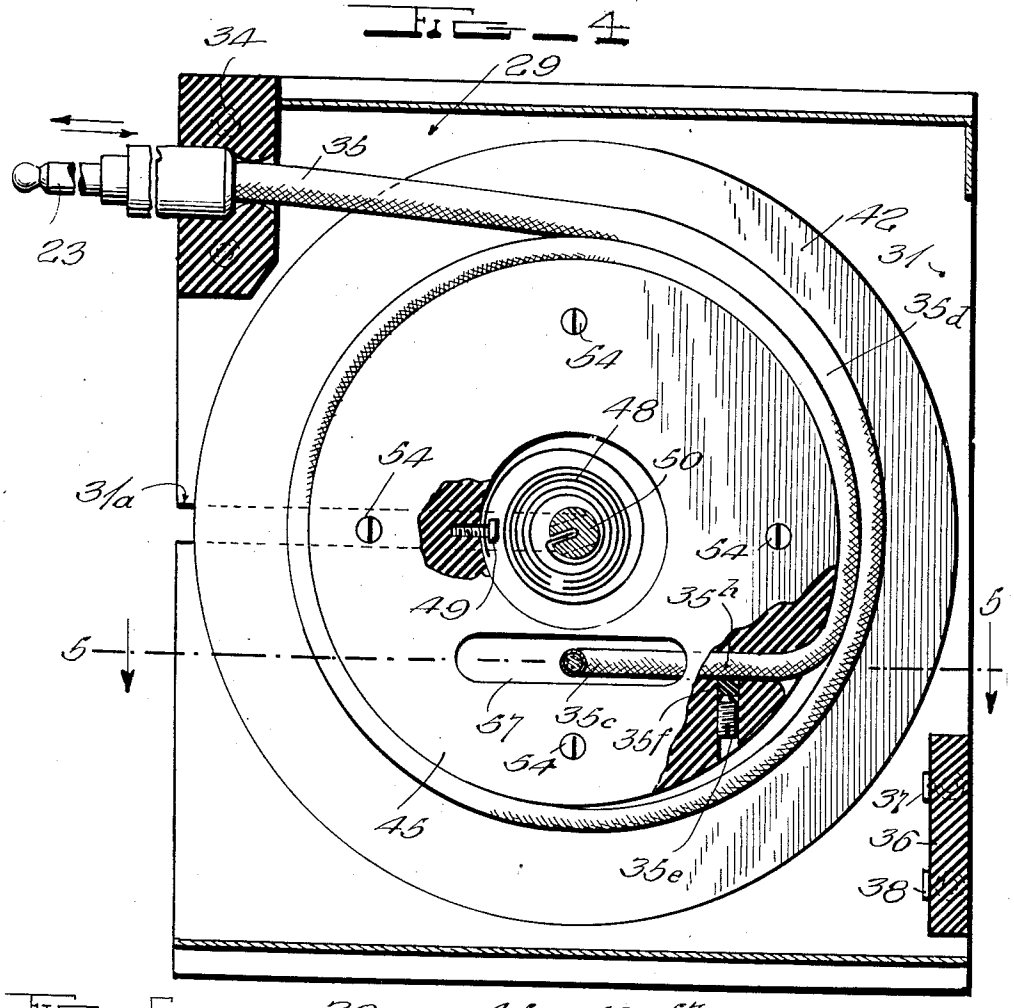


FIG. 5

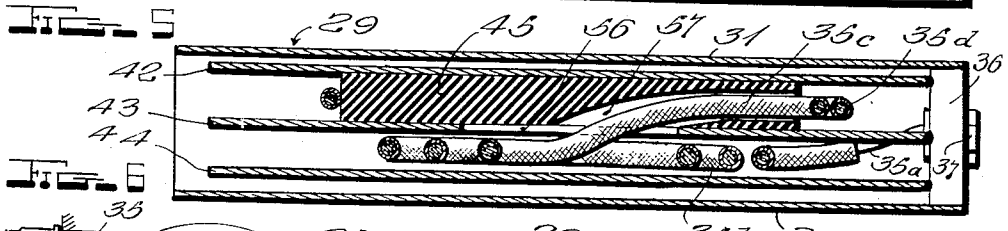


FIG. 6

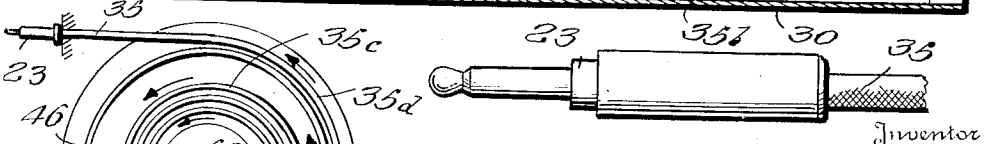
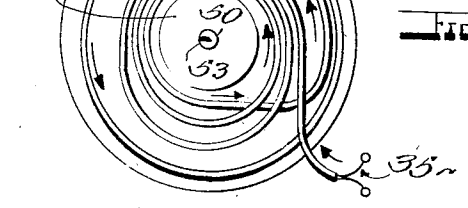


FIG. 7



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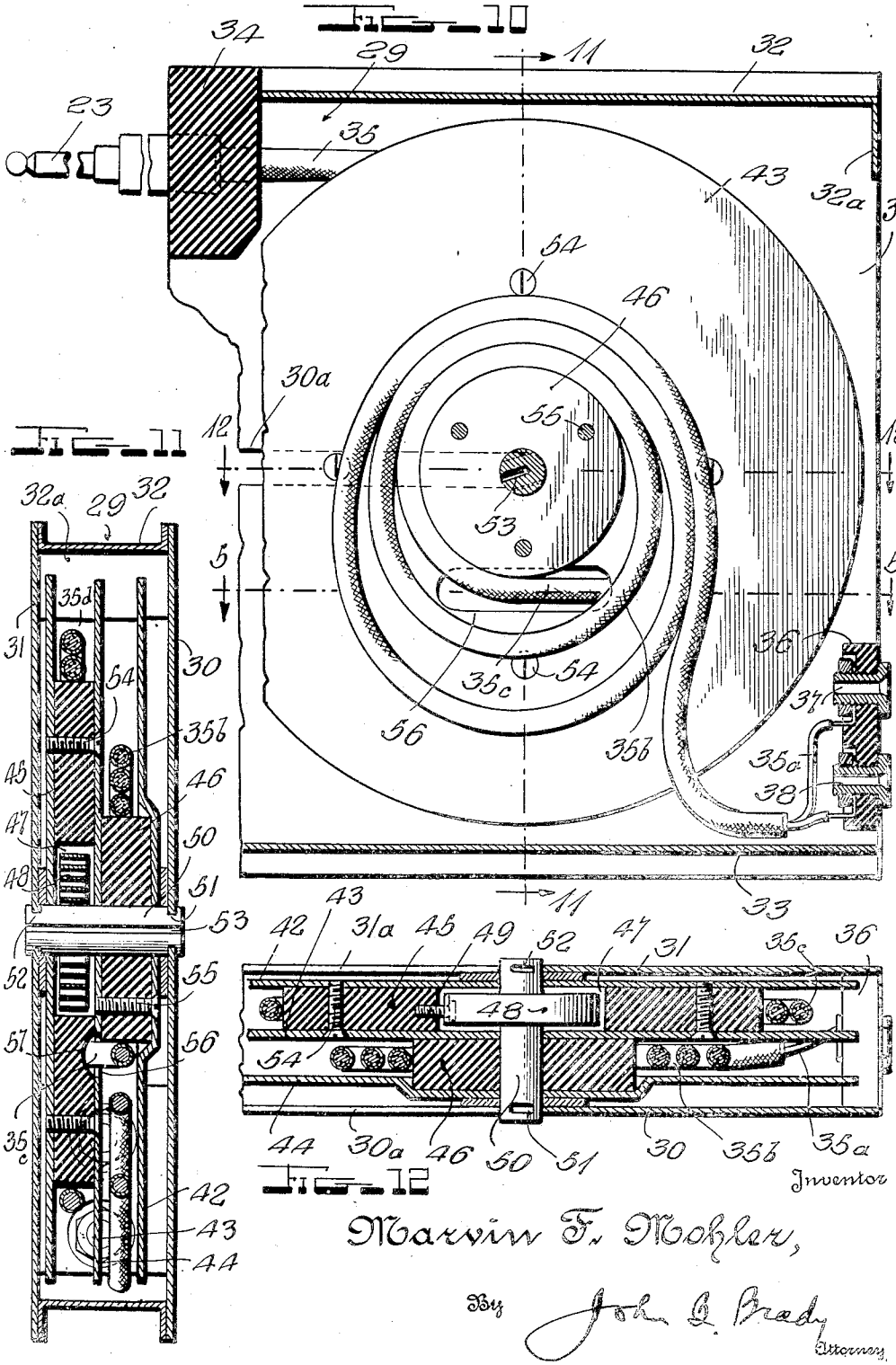
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PLUG AND JACK BOX SWITCHING UNIT

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PLUG AND JACK BOX SWITCHING UNIT

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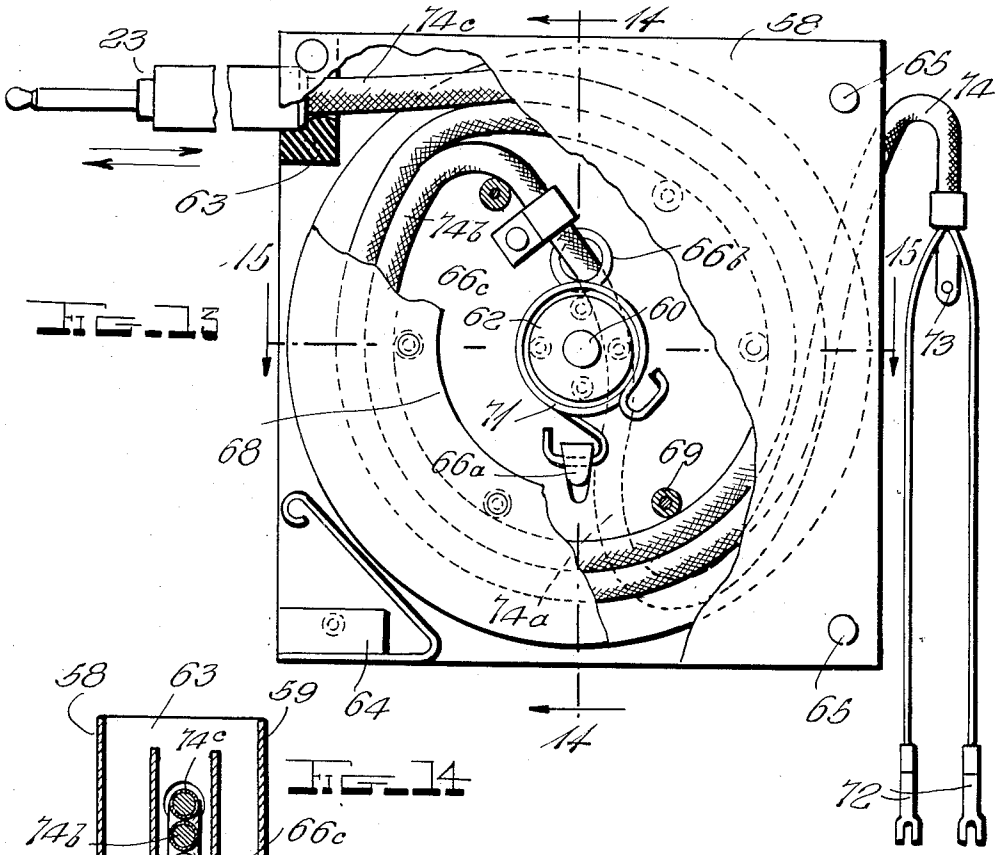


FIG. 3

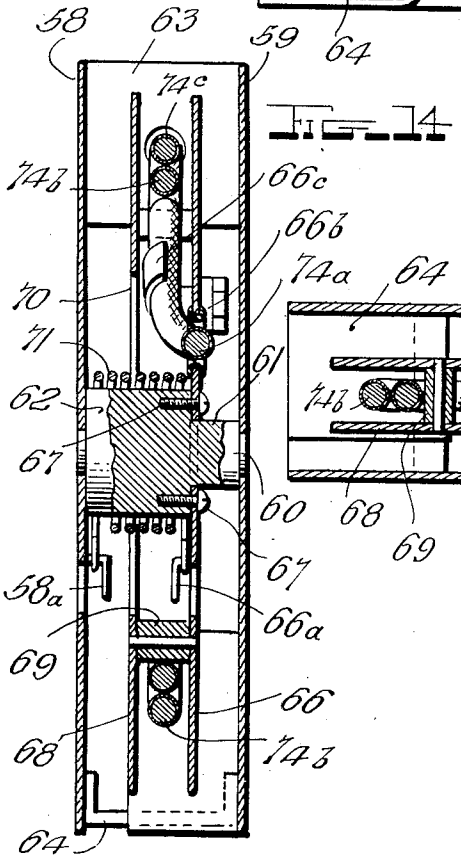


FIG. 4

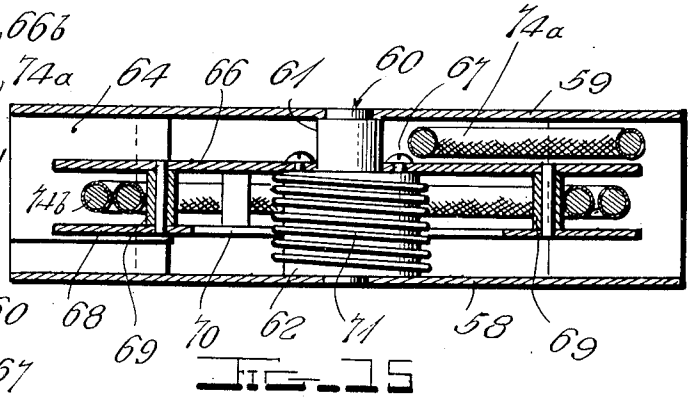


FIG. 5

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Patented Mar. 30, 1948

2,438,515

UNITED STATES PATENT OFFICE

2,438,515

PLUG AND JACK BOX SWITCHING UNIT

Marvin F. Mohler, Arlington, Va.

Application October 9, 1945, Serial No. 621,335

10 Claims. (Cl. 179—95)

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My invention relates broadly to switching systems and more particularly to an arrangement of plug and jack box for telegraph and telephone communication systems.

One of the objects of my invention is to provide a construction of plug and jack box for communication systems which is compact in construction and adaptable for interconnecting a multiplicity of electrical circuits and electrical equipments in which the electrical conductors which connect with the plugs are maintained at all times under spring tension.

Another object of my invention is to provide a compact assembly of plug and jack box for communication circuits.

Electrical conductors which connect to the plugs are wound upon spring tensioned reels for storing the conductors ready for instant withdrawal in establishing connection between the plug and an associated jack.

A still further object of my invention is to provide a construction of plug and jack box in which a multiplicity of reels carrying flexible electrical conductors stored thereon may be independently and removably connected in a communication circuit and the conductor carried by the reel unreeled for establishing connection between a plug connected thereto and a coacting jack.

A further object of my invention is to provide a construction of reel carrier for a multiple flexible conductor for permitting extension and retraction of the conductor from the reel in effecting the establishment of an electrical current through the conductor.

Still another object of my invention is to provide a construction of spring-tensioned two-section reel carrying a flexible multiple electrical conductor which is adapted to be stored on the reel or withdrawn therefrom for establishing a temporary electrical circuit which when discontinued provides for the winding of the conductor upon the reel for storage thereon.

Still another object of my invention is to provide a construction of multiple section reel having a means for receiving and storing different portions of a multiple electrical conductor thereon, one portion of which extends to a detachable connection to a communication circuit and the other portion of which extends to a detachable plug and jack arrangement whereby slack in the conductor may be stored upon the reel intermediate the detachable end connections of the conductor preparatory for rotation of the reel and withdrawal of the conductor from time to time.

Other and further objects of my invention reside in a construction of plug and jack box having separable reel structors therein adapted to be renewed from time to time, except as set forth more fully in the specification hereinafter following by reference to the accompanying drawings, in which:

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Figure 1 is a front elevational view of a plug and jack box embodying my invention; Fig. 2 is a vertical sectional view through the plug and jack box of Fig. 1 taken substantially on line 2—2 of Fig. 1; Fig. 3 is an enlarged fragmentary sectional view of the removable reel employed in the plug and jack box of my invention and illustrating the separable character of one of the reel units and the manner in which the flexible multiple conductor is raised above the smaller section of the reel; Fig. 4 is an enlarged vertical view taken through one of the reel units with parts broken away and illustrated in section and showing the manner in which the flexible conductor is stored on the larger section of the reel; Fig. 5 is a horizontal sectional view taken substantially on line 5—5 of Fig. 4; Fig. 6 is a schematic and theoretical view illustrating the manner in which sufficient slack is maintained in the flexible conductor stored upon the rotatable reel to allow the conductor to be withdrawn for establishing connection between the plug and a selected jack in the plug and jack box; Fig. 7 is an elevational view of the plug which is carried with the flexible conductor stored on the reel; Fig. 8 is a fragmentary sectional view illustrating the manner in which the detachable reel is moved into interlocking arrangement with the removable reel carrying frame structure; Fig. 9 is a view similar to the view shown in Fig. 8 but illustrating the interlock which is effected between the removable reel and the removable reel carrying frame; Fig. 10 is a fragmentary enlarged sectional view illustrating the manner in which the flexible conductor extends from one portion of the rotatable reel to the other portion thereof; Fig. 11 is a vertical sectional view taken substantially on line 11—11 of Fig. 10; Fig. 12 is a horizontal sectional view taken substantially on line 12—12 of Fig. 10; Fig. 13 is a side elevational view partially broken away and shown in section illustrating the manner of storing the flexible conductor on a modified form of separable reel embodying my invention; Fig. 14 is a vertical sectional view taken on line 14—14 of Fig. 3; and Fig. 15 is a horizontal sectional view taken substantially on line 15—15 of Fig. 13.

My invention is directed to a construction of multiple circuit plug and jack box for use in

establishing selective connections as required between line wire circuits and terminal equipment such as telephones or printing telegraph apparatus. I provide an enclosed metallic housing comprising a unit which contains a multiplicity of horizontal rows of jacks and multiplicity of separable rotatable reels. The reels are maintained in independent frames which are detachably connectable with circuit terminals of a communication system. Each reel is independently removable from the separable frame structure which serves to mount the reel and by the coaction of the reel and the associated frame structure, the reel may be locked in position within the frame carrying structure in such manner that accidental withdrawal therefrom under the normal forces imparted to the reel when withdrawing the flexible conductor therefrom, is prevented. The reels are each formed in two sections and the flexible conductor stored thereon, one portion of the conductor extending to the separable detachable connections of the reel supporting frame with the communication circuits and the other portion of the conductor extending to the plug which is adapted to establishing detachable connection with a selected coacting jack. In both portions of the conductor adequate slack is provided to allow the limited rotation of the reel necessary for withdrawing the conductor therefrom. Adequate insulation is provided between the reel and the associated supporting frame and the electrical circuits with which the conductor coordinates. Spring means are provided for tensioning the reel whereby the reel normally tends to wrap the flexible conductor on the reel for storing the conductor thereon ready for instant withdrawal in establishing connection between the plug connected thereto and a coacting selected jack.

One of the outstanding advantages of the construction of my invention is the circuit continuity which is maintained from the communication circuit through the rotatable storage reel to the plug and jack. The same conductor which establishes connection with the communication circuit continues all the way to the detachable plug. The reel functions as a storage device or accumulator of the flexible conductor intermediate the terminal ends thereof and care is taken to provide sufficient slack for each of the connecting portions of the conductor where the conductor is substantially fixed in a selected portion intermediate the two sections of the rotatable reel. An equally outstanding advantage of the construction of my invention resides in the fact that all of the customary roller weights heretofore used for maintaining cords in telephone switchboards taut, are eliminated. The yieldable characteristics of the reel mechanism of my invention are such that the flexible conductor is properly tensioned and maintained in compact storage at all times. This arrangement greatly increases the adaptability of the switching unit of my invention for use on mobile units such as ships or other movable bodies employing communication circuits where swinging of the roller weights hereinbefore referred to becomes a hazard to the equipment under conditions of vibration of the mobile body. The plug and jack system of my invention has proven practical and efficient in the maintenance of the continuity of selected circuits and does not contain the inherent defects existent in the use of imperfect slidable contact devices.

Referring to the drawings in more detail, reference character 1 designates a panel structure which extends across the front of a frame which may be provided with detachable brackets 1*a* and 1*b* suitably slotted for attachment to a rack structure for supporting the frame which carries the switching unit. A housing 1*c* engages the rear of the frame structure enclosing the equipment mounted behind the panel structure 1. I provide a desired number of rows of jacks on the panel structure 1 such as represented by reference characters 2, 3, 4 and 5. Four rows of jacks have been illustrated but it will be understood that any desirable number of rows of jacks may be installed. Designator strips 6, 7, 8, 9, 10 and 11 extend horizontally with respect to panel 1 and adapted to receive indicator cards designating the circuits served by the several jacks and the circuits served by the two conductor plugs which I have represented at 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22 and 23. The plugs are each normally projectable from the front of the panel structure 1 as represented in Fig. 2 ready to be instantly withdrawn from their horizontally projecting portions to establish a selected electrical connection with a coacting jack.

The frame structure of the switching unit includes a horizontally extending shelf 24 providing mounting means for bracket 26 which supports the terminal block 27 through which connections are distributed to the several cords and the jacks in the rows of jacks 2, 3, 4 and 5. The shelf 24 extends to a position immediately behind the horizontally extending guide bracket 25 which extends transversely of the frame structure which serves as an abutment for the individual removable reel units. The shelf 24 also serves as a supporting means for the dummy resistance 28 which may be used in connection with the testing circuits incidental to the operation of the switching unit of my invention.

The separable removable reel units are represented generally at 29. Each reel unit is constituted by a frame structure consisting of side plates 30 and 31 interconnected by a top section 32 and a bottom section 33. The top section is turned downwardly as represented at 32*a*. Intermediate the side plates 30 and 31 I provided a block of insulation material 34 which is apertured to serve as a guide for the flexible multiple conductor 35, which as it passes from the reel to the plug 23 frictionally engages the interwalls of the aperture in block 34.

In the diagonally opposite corners of the frame structure which houses the rotatable reel I provide a panel of insulation material represented at 36 extending between the side walls 30 and 31 and supporting the socket terminals 37 and 38 adapted to establish frictional wiping connection with the horizontally extending pin terminals 40 and 41 which project from the terminal panel 39 transversely disposed within the frame structure of the switching unit. The line circuits connect to the terminals which connect to the pin terminals 40 and 41 on panel 39, enabling connection to be made with the line circuit upon insertion of the reel frame and the engagement of a pair of pin terminals by a pair of socket members carried by a removable reel frame structure.

Within each of the reel frame structures I provide a rotatable reel formed by three parallel extending confining plates 42, 43 and 44. These plates are secured in relation to hub members of insulation material represented at 45 and 46. It will be observed that hub 46 is substantially one-half the diameter of hub 45. Plate 43 is fas-

tened to plate 44 by means of screws 54 which extend through the hub of insulation material 45. Plate 42 is secured to plate 43 through insulated hub 46 by means of screws 55.

A central cut-out 47 is provided in insulated hub 45 for housing a spiral tension spring 48. The spiral spring 48 is fastened at the end 49 thereof to the inside face of the cut-out portion 47 in hub 45. The other end of the spiral tension spring 48 is inserted in the transversely extending groove 53 disposed radially in one side of shaft 50. Shaft 50 is supported at opposite ends in the side plates 30 and 31 by means of slots 51 and 52 which extend normal to the axis of the shaft 50 adjacently the ends thereof. The slots 51 and 52 of shaft 50 engage the slots 30*a* and 31*a* in side plates 30 and 31 in the manner shown more clearly in Figs. 8 and 9. The reel structure as thus described is removable and replaceable through the open slots 30*a* and 31*a* in the side plates 30 and 31 for repair or renewal of parts and for facilitating replacement of flexible conductor cords in maintenance of the equipment.

The spiral spring 48 is normally so tensioned that there is a constant tendency for the reel to revolve in a clockwise direction for winding and storing multiconductor upon the reel. The reel is conditioned to provide for the continuous rewinding of the conductor onto the reel when the conductor is withdrawn from the reel to insert the plug which is connected therewith into an associated jack. This tendency to continuously rewind the conductor is by initially applying a tool such as the end of a screwdriver in the open end of the groove 53 and twisting the shaft 50 in a clockwise direction. As thus wound or tensioned, the reel is ready to be inserted in the carrier or frame. The reel thus tensioned or wound is inserted in the carrier as represented in Fig. 8 where the slotted portions 51 and 52 of shaft 50 slide in the slots 30*a* and 31*a*. When the reel reaches the limits of its insertion into the frame structure the screwdriver or tool is removed from the open end of the slot 53 of shaft 50 allowing the shaft to twist into the position illustrated in Fig. 9. In Figs. 8 and 9 it will be observed that the end of the slot 30*a* in side wall 30 is shaped in a very special manner. That is, the end of slot 30*a* is arcuate in shape as represented in 30*b*, terminating in a chordal portion 30*c*, which finally terminates in an abrupt notch 30*d*, connecting to the other side of slot 30*a*. Notch 30*d* forms an abutment for one edge of slotted portion 51 of shaft 50 as shown in Fig. 9. The diagonally opposite edge of shaft 50 at the opposite slot 51 therein abuts against the opposed edge of slot 30*a*, thus latching the reel with the torsional energy stored therein in a central position within the frame structure which carries the reel. Under these conditions it will be apparent that when the multiple conductor flexible cord 35 is drawn outwardly, the spiral spring 48 operates to resist such withdrawal and to exert a continuous tendency to retract the cord 35 as soon as released at the front of the panel after the plug 23 thereon has been disengaged from a selected jack.

In order to insure a continuous electrical circuit through the spring mounted reel I provide a cut-out 56 in plate 43 and an aligned cut-out 57 in hub 45 which provides for the passage of the conductor 35 from the terminals 35*a* thereof which connect to the socket members 37 and 38 and the wrapping of the conductor as represented at 35*b* in a loose manner around hub 46, the cross over from one section of the reel to the other at 35*c* between hubs 45 and 46 and the snug wrapping of the conductor at 35*d* around hub 45. As represented at 35*e* I provide a set screw which is screw-threaded into an orifice in the hub 45 against a block of insulation material 35*f* which grips the conductor at 35*h* thus establishing a fix for the conductor at a point intermediate that portion of the conductor which is carried by that portion of the reel constituted by hub 45 as compared to that portion of the conductor which is carried by hub 46 by that portion of the reel constituted by hub 46.

In the modified form of the reel of my invention I have shown the removable reel structure as mounted within side plates 58 and 59 extending on opposite sides of a rotatably journaled shaft member 60, having hub portions of different diameters represented at 61 and 62. The side plates 58 and 59 are spaced by a block of insulation material shown at 63 at one corner of the frame structure and a spacing bracket 64 is provided in an opposite corner of the frame structure and there are spacing bolts 65 in the other corners of the frame structure for providing a rigid substantial unit which is readily removable and replaceable with respect to the cabinet structure of the switching unit.

The conductor carrying and storing reel comprises side plates 66 and 68 which are centrally disposed within the frame of the removable and replaceable unit. Securing screws 67 pass through a central portion of plate 66 and support plate 66 with respect to hub section 62 of shaft 60. A multiplicity of spacer members 69 are arranged at spaced intervals between the side plates 66 and 68 of the reel to provide for the winding of the flexible multiple conductor cord 74, the interturns 74*b* of which are supported directly by the spacer members 69.

The side plate 68 of the reel is apertured at 70 to allow for the passage of torsion coil spring 71, having one end fastened to lug 58*a* on the interface of plate 58. The other end of the torsioned coil spring 71 is hooked to lug 66*a* on side plate 66 of the reel. The torsion coil spring 71 thus constantly tends to rotate the reel in a clockwise direction for storing the flexible multiple conductor 74 thereon.

The flexible multiple conductor 74 is provided with terminal lugs 72 which may be readily connected to terminals on a terminal board extending transversely through the switching unit. A tie member 73 is provided for fastening the conductor 74 to the terminal board to which lug 72 connects or to any other suitable position in the frame of the switching unit for relieving mechanical strain on the flexible conductor. The flexible conductor 74 extends in a slack loop at 74*a* through a grommet of insulation material represented at 66*b* in the side 66 of the reel. Adjacent the passage of the conductor 74*a* to a position within the rotatable reel I provide a cable clamp 66*c* which constitutes a fix for the cable intermediate the slack loop 74*a* thereof and the turns 74*b* thereof. Thus as the reel is revolved in a counterclockwise direction for withdrawing the conductor at 74*c* through the apertured block 63 of insulation material the turns of the conductor at 74*b* are rolled off of the reel enabling plug 23 to be plugged into any selected jack in the row of jacks at the front of the switching unit.

In either form of reel structure it will be observed that a fix is provided intermediate slacked storage portions of the multiple conductor cord

so that upon rotation of the reel the opposite portions of the conductor have sufficient effective length to provide for the projection of the actuated cords for establishing an electrical connection and the retraction thereof when a connection is released.

In the installation and use of the switching unit of my invention there are no swinging or displaceable weights associated with the flexible cords. On the contrary, the flexible cords are maintained taut and stored in the reel units ready to be withdrawn selectively for establishing a connection with a selected jack and retracted when the connection to the selected jack is no longer required. Disassembly of the switching unit for maintenance and repair is extremely simple and replacement of the individual reel units may be rapidly made at the time that one of the separable reel units may be required for repair.

While I have described my invention in certain of its preferred embodiments I realize that modifications may be made and I intend no limitations upon my invention other than may be imposed by the scope of the appended claims.

What I claim and desire to secure by Letters Patent of the United States is as follows:

1. A switching unit comprising a multiplicity of two circuit jacks, a multiplicity of coacting cords and two circuit plugs connected therewith and insertable into and removable from said jacks for establishing connection between said two circuit plugs and said two circuit jacks and spring actuated two section reels for storing said cords on both sections thereof, and spring means within one of the sections of said reel for tensioning said cords and reeling all surplusage of said cords onto both of the sections of said two section reels preparatory to an unreeling operation.

2. A switching unit comprising a multiplicity of two circuit jacks, a multiplicity of spring actuated two section reels, a removable frame structure for each of said reels including terminal connectors carried by said frame structures and coacting terminals connected with coextensive circuit systems, a flexible cord connector looped around one of the sections of said spring actuated two section reels and electrically connected at one end with said terminal connectors and looped around the other of the sections of said two section reel and terminating in a plug connector at the other end, said two section spring actuated reels normally maintaining said flexible cord connectors wound upon each of the sections of said two section reels subject to an unwinding operation, said plugs being insertable within a selected jack against the tension of said spring actuated two section reels.

3. A switching unit comprising a plug and jack box containing a removable and replaceable frame structure having terminals thereon registerable with fixed coacting circuit terminals, a spring actuated two section reel including a tensioned coil spring and a flexible connecting cord looped upon one of the sections of said two section reel, connections between one end of said cord and said fixed coacting circuit terminals, said connecting cord being looped around the other of said sections adjacent the other end thereof and a plug connected with the last-mentioned end of said flexible connecting cord and operative to be drawn outwardly from said frame structure against the tension of said spring actuated two section reel.

4. In a plug and jack switching unit, a frame

structure, a two section reel journaled in said frame structure, spring means for tensioning said two section reel, a flexible conductor electrically connected to a terminal position on said frame and looped through a multiple number of turns about one of the sections of said two sections reel, said conductor passing between the sections of said two section reel and being looped around the other of said sections adjacent the other end thereof a plug connected with said conductor at the last mentioned end thereof, said conductor being wound upon each of the sections of said two section reel in a direction opposite the direction of the effective tension of said spring means whereby withdrawal of said conductor from said two section reel tends to wind said spring for increasing the effective tension thereof for continuously urging said conductor to a return storage position on said two section reel.

5. A switching unit comprising a multiplicity of multi-circuit jacks, a cabinet structure, circuit terminals terminating in said cabinet structure, a frame insertable into and removable from said cabinet structure with circuit terminals on said frame coacting with the circuit terminals in said cabinet structure for establishing an electrical circuit therebetween, a reel journaled in said frame, spring means for actuating said reel, a flexible electrical connector having its terminals connected with the circuit terminals on said frame at one end and having a plug connector on the other end, said reel having a central vertical partition therein dividing said reel into two portions, one of which receives a multiplicity of turns of said flexible electrical connector leading to said circuit terminals on said frame and the other of which receives a multiplicity of turns of said connector leading to the plug, whereby as said plug is withdrawn the turns of said connector wind upon the first mentioned portion of said reel and unwind from the last mentioned portion of said reel.

6. In a plug and jack switching unit a frame structure, a reel journaled in said frame structure, said reel having a pair of vertical sections, a flexible conductor electrically connected at one end with a terminal position on said frame structure and looped through each of the sections of said reel, with a multiple number of turns of said conductor stored on one section of said reel with substantial slack therein and connected with said terminal position and a multiple number of turns of said conductor stored upon the other section of said reel and terminating in a plug, and spring means for resisting the unwinding of said conductor from the last mentioned section of said reel.

7. In a plug and jack switching unit, a frame structure, a reel journaled on said frame structure, coil spring means for tensioning said reel with respect to said frame structure for normally maintaining said structure in a predetermined position, a flexible conductor fixed in a substantially central position on said reel structure and having wrapped turns on either end thereof coiled about said reel structure and terminating at one end at fixed terminals and at the other end in a plug, said conductor, when withdrawn from said reel operating to resist the tension imparted thereto by the spring means of said reel.

8. A plug and jack switching unit comprising a cabinet structure, a terminal board in said cabinet structure, a multiplicity of terminals on said terminal board, a plurality of reel supporting frames insertable into or movable from said cabi-

net structure, said frames each carrying contactors thereon operative to establish detachable connection with the terminals on said terminal board, a rotatable reel journaled in each of said insertable and removable reel supporting frames, a flexible electric conductor centrally fixed to each of said reels, one end of said conductor being connected with said contactors and the other end of said conductor being connected with a plug, and means for latching each of said reels in said reel-supporting frames for preventing withdrawal of said reel-supporting frames from said cabinet structure when a pulling force is applied to the plug on said flexible conductor for unwinding said conductor from said reel.

9. In a plug and jack switching unit a cabinet structure, terminal members carried by said cabinet structure, a multiplicity of reel frame members insertable into and withdrawable from said cabinet structure, each of said reel frame members having contactors thereon selectively connectable with aligned terminals carried by said cabinet structure, a reel journaled in each of said reel frame structures, a flexible conductor looped around each of said reels, said conductor being fixed intermediate the ends thereof to the associated reel with one end of said conductor coiled about the associated reel and electrically connected with said contactors and the other end of said conductor looped about said reel and

terminating in a plug and spring means for tensioning each of said reels for normally winding the conductor on said reels.

10. In a plug and jack switching unit, a cabinet structure, terminal members on said cabinet structure, a multiplicity of reel frame structures having contact members thereon detachably engageable with the terminal members on said cabinet structure, a multiple section reel journaled in each of said reel frame structures, spring means for tensioning each of said reels, a plug member, a flexible conductor extending through the sections of said reel and having turns thereof wrapped on each section of said multiple section reel and having one end electrically connected with the contact members on the reel frame structure and the other end connected with said plug member.

MARVIN F. MOHLER.

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