Sept. 24, 1946. P. V. KOOS 2,408,074

TELETYPEWRITER SWITCHBOARD

Filed April 30, 1943 6 Sheets-Sheet 1

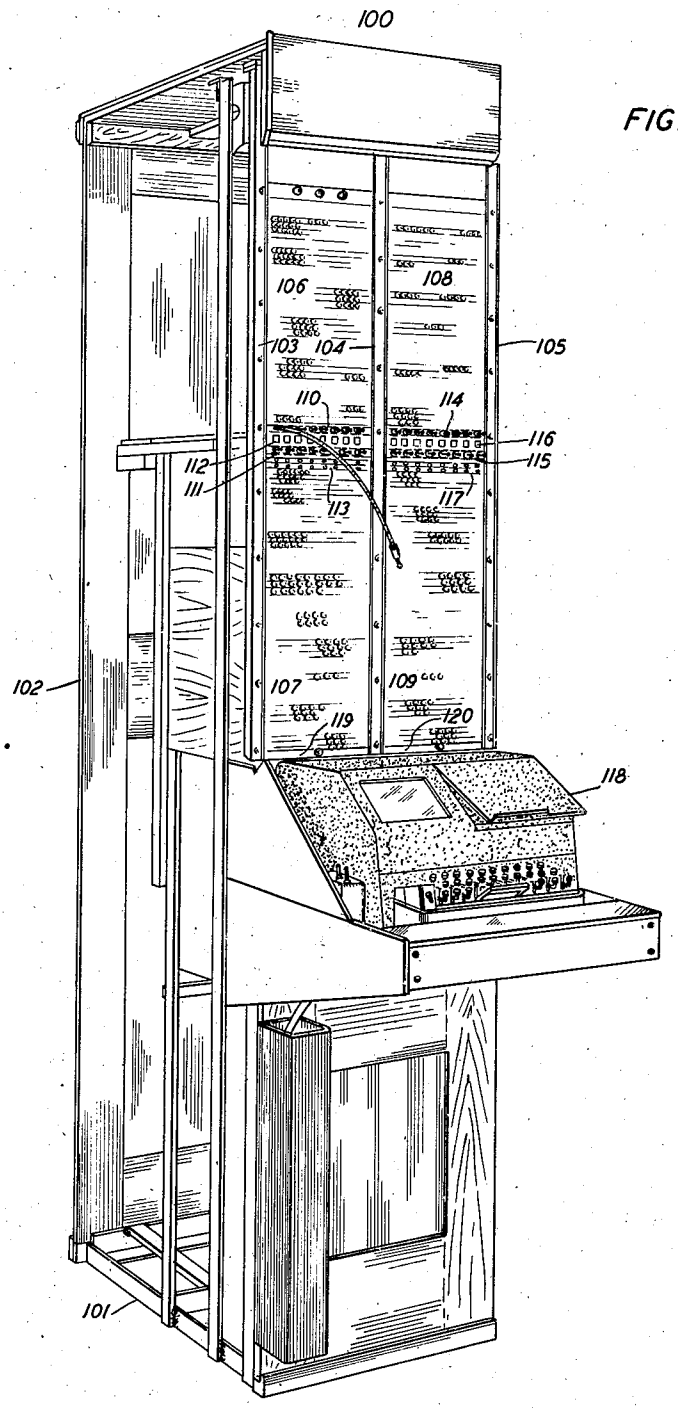


FIG. 1

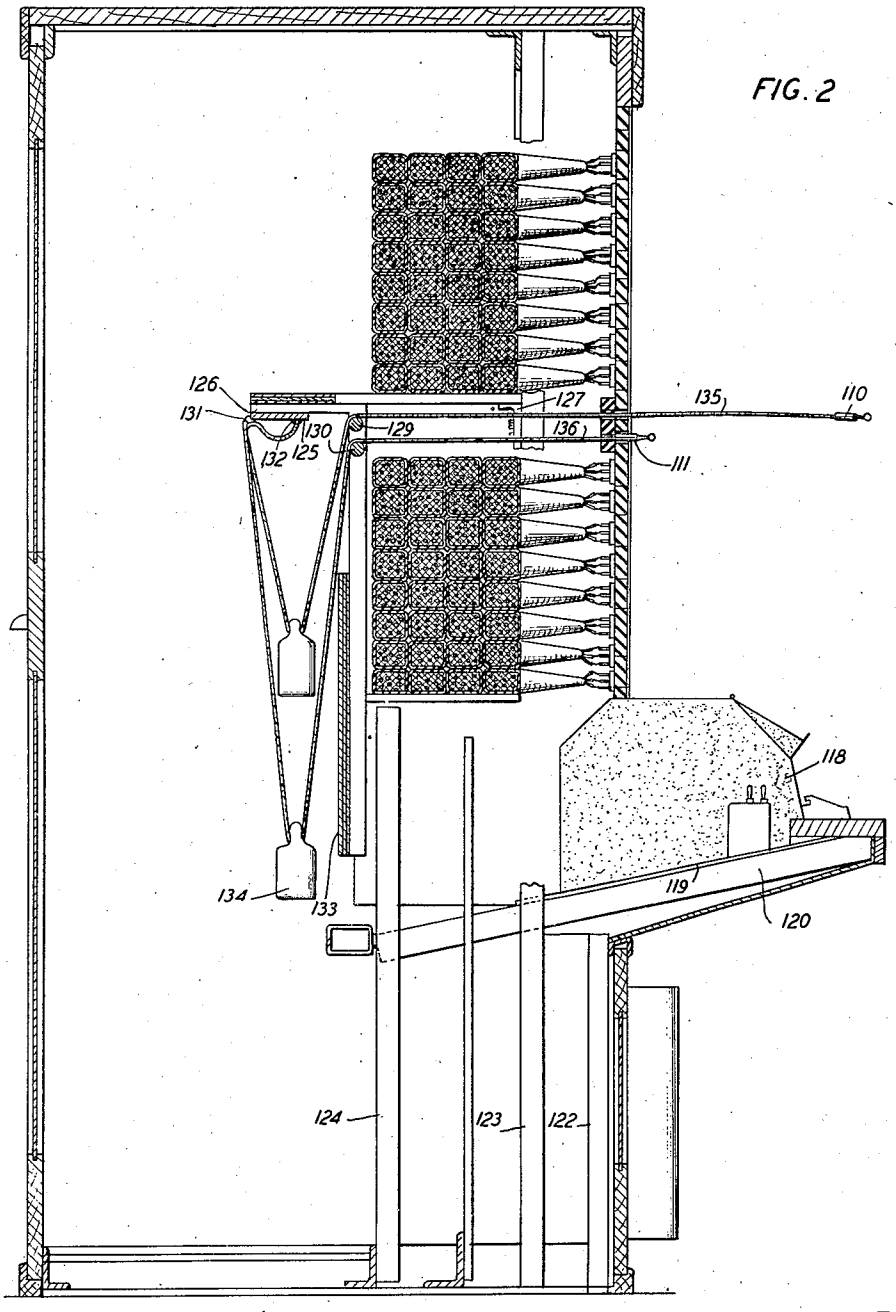
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TELETYPEWRITER SWITCHBOARD

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FIG. 2



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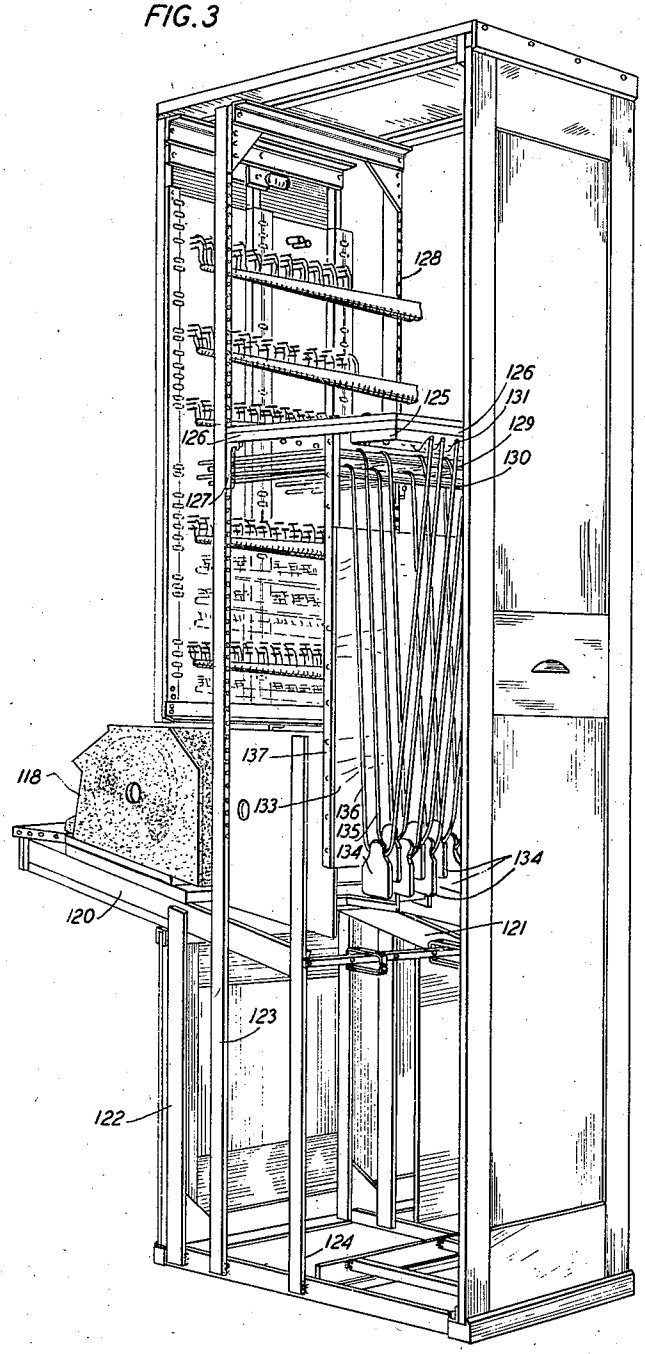
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TELETYPEWRITER SWITCHBOARD

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FIG. 3



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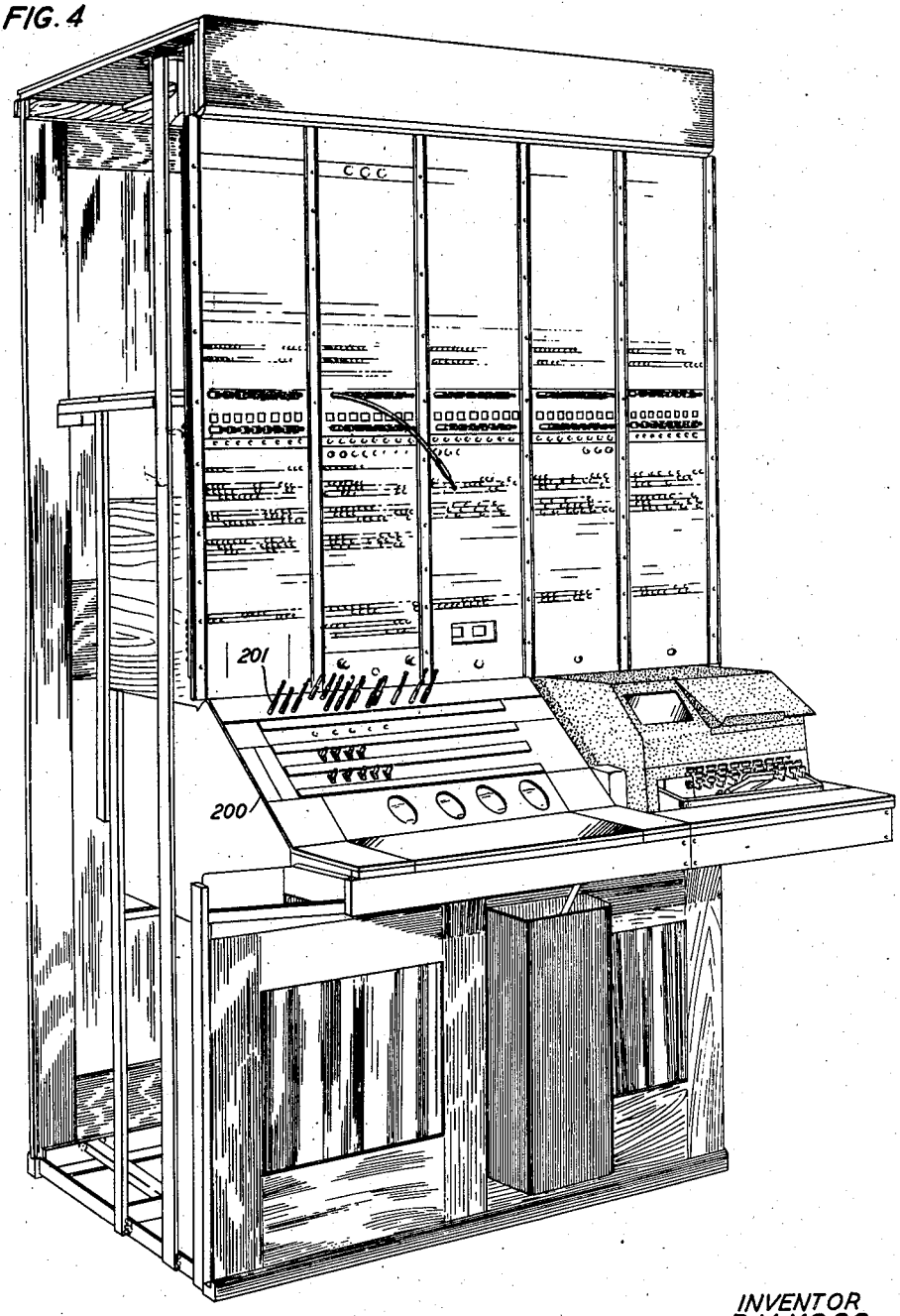
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TELETYPEWRITER SWITCHBOARD

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FIG. 4



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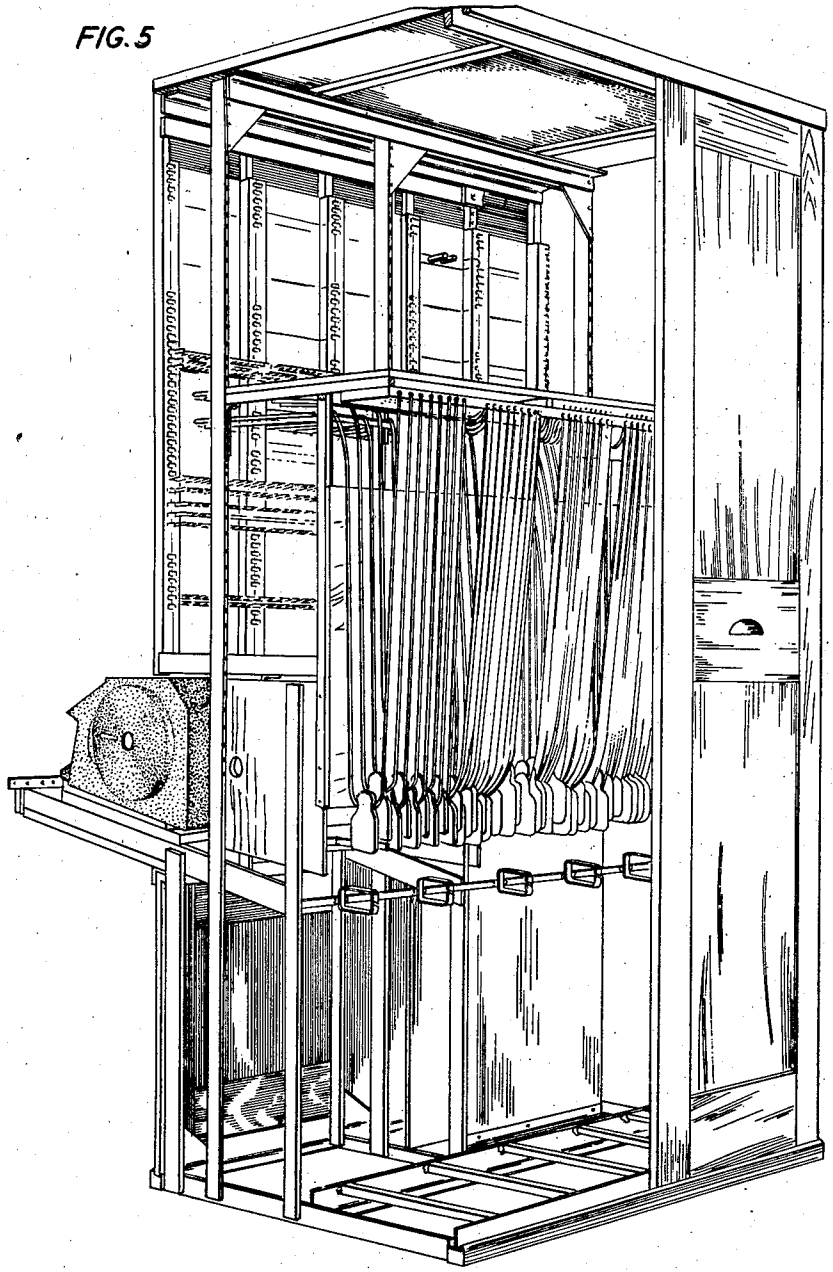
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TELETYPEWRITER SWITCHBOARD

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FIG. 5



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TELETYPEWRITER SWITCHBOARD

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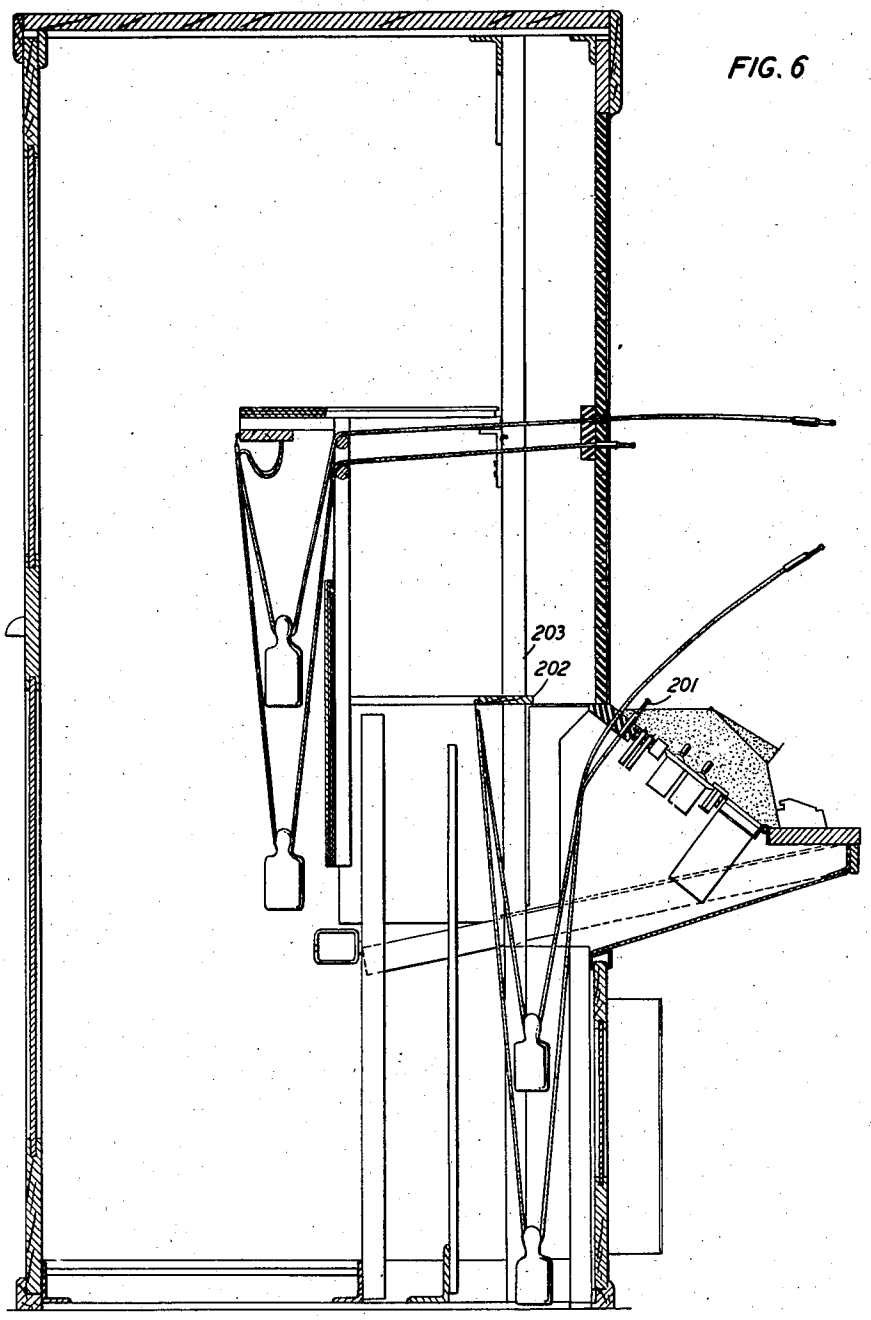


FIG. 6

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Patented Sept. 24, 1946 2,408,074

UNITED STATES PATENT OFFICE

2,408,074

TELETYPEWRITER SWITCHBOARD

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Application April 30, 1943, Serial No. 485,136

17 Claims. (Cl. 178—75)

1

This application continues subject-matter disclosed and claimed in my copending application Serial No. 302,837, filed November 4, 1939, and the benefit of the filing date of that application is claimed for all purposes under whatever provisions of law are applicable.

This invention relates to communication switchboards by means of which communication circuits are flexibly extended and particularly to teletypewriter switchboards used in flexibly interconnecting calling and called teletypewriter subscribers' stations or in flexibly extending teletypewriter communication circuits to and from distant switchboards in tandem.

An object of the invention is the improvement of communication switchboards.

A more particular object of the invention is the improvement of teletypewriter switchboards.

Since the introduction into the communication industry of teletypewriter switching systems, considerable effort has been expended toward evolving a desirable teletypewriter switchboard. The satisfactory disposition of the teletypewriter instrument itself with respect to the switchboard is a problem which has long engaged the attention of inventors and designers.

One of the principal difficulties encountered was the excessive amount of space required by the teletypewriter. As is well known by those familiar with the art, a teletypewriter is a piece of apparatus which requires considerable mounting space. This reduces the space within reach of an operator which is available for jacks, etc. A number of solutions were suggested, none of which was entirely satisfactory. When the teletypewriters are mounted, as they sometimes are, on movable tables below the switchboard operating shelf, the level of the operating shelf must be in an elevated position to provide both for the height of the teletypewriter and a kneewell for the operator below the teletypewriter table. Further, this limits the height of the jack field which an operator can reach. There is another serious objection to this arrangement in that the table legs supporting the platform on which the teletypewriter is mounted become obstructions, limiting movement beneath the key-shelf.

Heretofore in the case of manually operated teletypewriter switchboards in which cords and plugs were used in establishing connections and which included jack pile-ups with their openings arranged in a vertical bank, wherever plug-ended communication cords have been mounted above a teletypewriter in the same vertical tier, the plugs have been mounted in a plug-shelf which

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projected in front of the vertical face of the board. The plug-shelves have generally been horizontal, but in some designs they have been inclined upwardly toward the jack field in the vertical face of the board. In both of these arrangements wherever teletypewriters have been located in the same vertical tier in which plug-ended communication cords and a jack field were also located, so as to provide all of the essential operating equipment used in establishing interconnections in the same single operator's position, the teletypewriter has been mounted on a separate table which has been arranged to be moved into position under the plug-shelf.

As a result of mounting the teletypewriter on a table and locating it beneath the plug-shelf, vertical space in the board was required to accommodate the teletypewriter, the plug-shelf and the protruding plugs. An operator seated before the board in front of the teletypewriter had to reach over the plug-shelf in making connections of the jack field. This adversely affected operation in two ways. First, it reduced the area available for jacks within reach of the operator. Second, it slowed up operation of the board as the jack field was so far removed from the operator. Both of these adverse factors, in turn, made it necessary where such arrangements were used in large teletypewriter central switching stations to provide more switchboard positions and more operators to handle a given load than would be the case if it were possible to eliminate the protruding plug-shelf.

The operating difficulties presented by the necessity for providing plug-ended cords mounted on a plug-shelf, a teletypewriter and a vertical bank of jacks, all in the same operating position in a teletypewriter switchboard have been accepted as inescapable by the industry. The upper portion of a modern communication switchboard is devoted almost entirely to the accommodation of a vertical jack bank and the cabling and wiring of the jack bank. In such switchboards the space in the rear of the jacks is literally full of this cabling and wiring. The jack field in the front of the upper portion of the board and the cabling and wiring serving the jack field behind the jacks both extend from a level a little above the top of the plugs in the plug-shelf to a height determined by the limits of an average operator's reach.

It has heretofore always been accepted in the communications industry that there were but two positions in which the cords and plugs could possibly be located in manual cord operated com-

munication switchboards having vertical jack banks, namely, below the jack field or above the jack field, and that of these two possible positions only the one below the jack field, where the cords and plugs have heretofore almost invariably been located, has been considered feasible. There are a number of reasons for this. First, it is necessary to provide sufficient slack in the cords so that connections may be made. Space must, therefore, be provided for the slack. The slack obviously cannot hang down in the space among the jack cabling and wiring which completely fill the space immediately behind the jack field. So it was heretofore considered impossible to locate the plugs and cords in such a manner that the cords hung down behind the jacks.

Plugs have heretofore been located above a jack field in certain of the oldest telephone boards which were operated by operators standing before the board. Where this has been done, the cords have been extended upwardly above the switchboard and run through sheaves attached to an open superstructure above the switchboard to prevent interference with the jack cabling and wiring. Plugs have also been located at the top of trouble positions, etc., and cords have been permitted to depend directly from plugs so located in positions in which there was no jack wiring. It would not be practical to arrange the plugs and cords used in establishing connections between subscribers in a modern switchboard in this manner or in any manner which involved locating the plugs, used in extending circuits between stations, at the top of the board, as an operator seated before the board would be required to reach above the top of the jack field for a plug on making each connection and such operation would be too slow.

Communication plugs and cords in all modern manual switchboards operated by an operator seated before the board, which switchboards include a vertical jack field, therefore, have heretofore been located below the jacks and the jack wiring. The plugs, as heretofore explained, are arranged to protrude through a shelf which is generally horizontal but which at times is arranged to incline upwardly toward the jack field. In all cases the shelf has been located beneath the jack field. The cords hung down from the plug, seated in the plug-shelf, passing through movable weighted sheaves or cord weights which serve to withdraw the plug and reseat it in the plug-shelf when it is released after use by the operator. The rear end of the cord is attached to a cord-shelf where its flexible conductors are terminated for interconnection to the relay and signaling equipment. The cord-shelf has been mounted heretofore behind the plug-shelf in a fixed position at approximately the same level as the plug-shelf.

The space in the modern manual cord operated communication switchboard immediately behind the operator's kneewell is almost entirely reserved for the cords and cord weights. The cord weights serve not only to withdraw the cords after disconnection but also to maintain the cords reasonably taut and to keep the tangling of the cords to a minimum. Due to the slapping about of the cord weights, particularly when cords are being withdrawn by the weights, it is not possible to mount any equipment in the space reserved for the cord slack. No other electrical equipment is mounted in this space as it would be susceptible to injury and would tend to increase tangling. Even when the space reserved for the slack is kept completely free of equipment, it is not possible to completely eliminate cord tangling which is still a serious problem arising most frequently when adjacent cords are being withdrawn simultaneously.

Because of these and other considerations, from the time when teletypewriter switchboards were first designed up to the present time, the cords were located in their usual position below the jack field. No entirely satisfactory manner of accommodating a vertical jack field, a teletypewriter and cords in the same vertical tier in a teletypewriter switchboard has heretofore been devised. The difficulty was that the most desirable position for the location of the teletypewriter was immediately below the vertical jack bank. The plug-shelf, plugs and cords occupied this position. Locating the plug-shelf between the jack field and the teletypewriter was wasteful of available jack space within reach of an operator and resulted in a reduced number of available jacks.

In certain teletypewriter switchboard designs the teletypewriter was mounted on a horizontal shelf in the switchboard to one side or the other of the plug-shelf. As a result of this an operator seated in the normal operating position in front of the teletypewriter had to reach over to the right or left to an adjoining plug-shelf to obtain a cord in making a connection which, of course, slowed up operation. Other arrangements included mounting the teletypewriter on tables in such a position that the teletypewriter keyboard was at right angles to the face of the switchboard and there have been designs in which the teletypewriter was located on a table in front of and parallel to the face of the switchboard and spaced from the switchboard so that an operator turned her back to the board when operating the teletypewriter. The disadvantage of such operation is obvious.

Manual teletypewriter switchboards as a result have been slow in operation. This, as heretofore mentioned, has increased the number of operators and operating switchboard positions required to handle a given load, which is reflected in the cost of the service. In conjunction with other factors, such as the necessity of an interchange of teletyped communication between the various switching points when establishing connections, the relatively much slower rate of establishing connections in a manual teletypewriter system than in manual telephone systems has given impetus to the development of the much more expensive mechanical teletypewriter switching systems while investment in such expensive systems is economically hazardous considering the relatively small demand for teletypewriter switching service.

The invention herein solves the problem of the mounting of a teletypewriter and plug-ended cords together with a vertical jack bank in the same vertical tier in a teletypewriter switchboard in a manner which (1) eliminates the plug-shelf in front of the board, (2) increases the number of jacks within reach of an operator seated before the board, (3) prevents mechanical interference between the teletypewriter, the jack wiring and the cords and cord weights, (4) increases the number of connections which it is possible to handle in a given time and (5) reduces the work expended in operating the board to a minimum.

One of the most important aspects of the invention, is a new design of teletypewriter switch-

board to accommodate a teletypewriter below a vertical pile-up of jacks so that the teletypewriter is mounted on supports which are integral with the switchboard framework in such manner that the top of the teletypewriter is in close proximity with the bottom of the vertical jack pile-up and the plug-ended cords are arranged so that the plugs protrude horizontally through openings approximately in the middle of the space ordinarily reserved for jacks and within short reach of the operator and the cords and cord weights are arranged so that there is no interference between the cords and cord weights and either the wiring and cabling which serve the jacks or the teletypewriter, the rear of which is let into the board immediately below the jack wiring.

One of the important features of the invention is the arrangement of cords and plugs, a vertical jack bank and a teletypewriter in the same vertical tier in a manner which effects the elimination of a plug-shelf projecting in front of the jack field and which prevents interference between the cord weights and the teletypewriter and jack wiring and in which the cords and plugs are within easy reach of the operator seated at the teletypewriter.

Attention is particularly called to the fact that in the teletypewrier switchboard according to this invention the separate plug-shelf projecting in front of the board which has always been provided when the jack bank, the teletypewriter and the cord plugs have been arranged in the same vertical line-up has been eliminated. Notwithstanding the elimination of the separate cord plug-shelf projecting before the board, the cord plugs as located in their present position are easily accessible to an operator seated before the board. Both the teletypewriter and a separate cord plug-shelf are not interposed between the operator and the lowest jack level. The number of jacks brought within the reach of the teletypewriter operator seated before the teletypewriter is greater than in any other design in which a jack field, a teletypewriter and cord plugs are available in the same vertical tier, due to the saving of the space heretofore required for the cord plug-shelf and for clearance between the cords and the teletypewriter.

In the present invention the cords and plugs are arranged so that the plugs protrude horizontally through openings in the vertical face of the switchboard, between the same vertical stiles in which the jack bank is secured. The cord arrangement is such that the plugs may be mounted at any level in the space between the vertical jack stiles and the level of the cord-shelf to which the cords are connected in the rear of the board may be adjusted to correspond to the level of the plugs. A second important feature of the invention, therefore, is a plug and cord assembly which is adjustable in height.

There are a number of advantages to be derived from mounting the plugs at about the middle level of the jack field to which connection is made. The preferred location of the plugs per this invention, therefore, is in the middle of the jack field which they serve. But the invention is not limited to the location of the plugs in the middle of the jack field. Since the cord-shelf is adjustable in height and the plugs may be located at any level in the board these facilities may be mounted at any desired level in the board. The plugs may be arranged to protrude horizontally through openings immediately above the teletypewriter and below the jack field. In all positions the cord weights are arranged so that they cannot strike the teletypewriter and so that the teletypewriter and cords do not interfere. If the plugs are located in the space between the bottom of the jacks and the top of the teletypewriter instead of in the preferred location in the middle of the jack field space, however, a number of the important advantages to be derived from the invention in speed and convenience of operation and in reduced first cost and maintenance expense to be described hereunder are sacrificed.

Attention is called to the fact that to establish each connection by means of a cord in a manual switchboard of any kind requires the performance of work by the operator. It is necessary to raise a certain length of cord through a certain height. It is necessary to raise a cord weight through a certain height. It is also necessary to overcome a certain amount of friction dependent upon the length of cord required, and other factors such as the manner in which the cords and plugs are arranged in the switchboard. Although the amount of work required in establishing a single connection may be small, the amount in the aggregate is considerable and affects the rate of operation and the total number of connections established by an operator in a given time.

One of the important aspects of the invention herein is that the amount of work required to be performed in the operation of the switchboard is reduced. This is attributable to the location of the plugs in the middle of the jack field in the preferred arrangement.

In the ordinary manual cord operated switchboard the plugs are located below the jack field. If it is assumed that the average connection is made to a jack in the center of the jack field, it is necessary as an approximation to raise a length of cord equal to one-half the height of the jack field through a distance equal to one-half the height of the jack field. It is necessary to raise a cord weight through one-half of this distance or one-quarter the height of the jack field. When the plugs are located in the center of the jack field, if it is assumed that the average connection is made to a jack in the middle of the upper half of the jack field, it is necessary to raise a length of cord equal to one-quarter the height of the jack field through a distance equal to a quarter the height of the jack field. Further, it is necessary to raise the cord weight through a distance equal to only one-eighth the height of the jack field. In making connections to the lower half of the jack bank the work involved is somewhat less than in making connections to the upper half due to the fact that the weight of the withdrawn cord is tending to aid the operation. As a result of this, the work involved in lifting the weight of the cord and cord weight in the new preferred embodiment of the cords and plugs per the invention herein is reduced to less than half of that required in performing corresponding operations in the ordinary switchboard.

Another important feature of the invention herein, therefore, is that the cord and plug arrangement of the invention herein halves the physical labor of operating the cords of a manual switchboard. Attention is called to the fact that although the cord and plug arrangement of the invention herein is particularly efficacious in the case of teletypewriter switchboards in that it eliminates the separate plug-shelf which was

formerly required in addition to the teletypewriter shelf and prevents mechanical interference between the cord weights and the teletypewriter, the rear of which can now be let into the switchboard for a considerable distance, the cord and plug arrangement is not limited to teletypewriter switchboards, but may be used to advantage in all switchboards employing cords and plugs in establishing connections. It may be used to advantage, for instance, in telephone switchboards where it will doubtless have its widest field of application.

There is another important aspect of the invention. One of the major difficulties encountered in the operation of manual cord operated switchboards is caused by the fact that cords connected to jacks cover the openings in other jacks and interfere with new connections. At times in all switchboards a considerable number of the cords will be connected to jacks. When the plugs are mounted at the bottom of the entire jack field, their attached cords will, when connected, inevitably cover the openings of large numbers of jacks and interfere with connections to these and to large numbers of others. Under certain conditions the difficulty is increased, for example, when a cord is already connected to a jack at a position close to, but not quite at, the limit of the operator's reach to the left or right and another connection must be made to a jack located beyond the cord already connected; or when two or more cords are connected to closely spaced jacks and another connection must be made to a jack in the area between the hanging cords. Not only is the difficulty of making connections and the time required to make connections increased, due to the greater length of cord required in switchboards having cords arranged as heretofore, but also the longer cords obscure the operator's vision to a larger extent and cover the numbering of a larger number of jacks. Further, they cover the signal lamps. As a result of this, connections to jacks obscured by connected cords are not infrequently made unconsciously by estimate and approximation and not infrequently erroneously, particularly by inexperienced operators. This affects not only the patron, but the time required to correct the error reduces the effective operating load which can be handled per unit of time and represents a considerable total loss in the aggregate.

Obviously the longer the cord required in making connections the greater the difficulty. Any rearrangement of the relationship of cords and plugs to the jack field which effects a reduction in the length of cord required in establishing connections minimizes these disadvantages. The invention herein, due to the new relationship which it establishes between the cords and the jacks, effects the maximum possible reduction in these difficulties.

Another feature of the invention herein, therefore, is that the operating difficulty caused by long lengths of operating cords hanging down in front of the jacks in the jack bank is minimized due to the shorter length of cord required in establishing a connection when the cord plugs are located in the middle of the jack field.

As a result of devising the new cord arrangement of the invention herein in which cords are carried back horizontally from the rear of the plugs to which they are attached between the layers of jack cabling and wiring until they clear the cabling and wiring and then drawing the cords over horizontal bars of circular section arranged parallel to the face of the jack field, before permitting the cord slack to depend behind the cabling under the influence of the cord weight, an added advantage of the invention herein is obtainable which will now be particularly pointed out.

In the former arrangement of cords in manual switchboards where the cords were located below a jack field and where teletypewriters were located below the plugs, it was necessary to provide space immediately below the plugs for the cords attached to the plugs. This was the controlling factor in the disposition of the teletypewriter instrument in such switchboards. The teletypewriter wherever it has been located in the same vertical tier with cord plugs has been located on a separate table below the plugs and in front of the cords depending from the plugs. The table has been completely independent of the switchboard. The teletypewriter could not be let into an obviously very desirable space immediately below the plug shelf since the space formerly had to be reserved exclusively for the cords and cord weights. Mechanical interference between these elements could not be permitted for obvious reasons.

The improved cord arrangement per the invention herein permits the rear of the teletypewriter to be let into the board for a considerable distance. This permits the operator to sit closer to the board. The shelf on which the teletypewriter is mounted is depressed in the rear to effect an increase of approximately three inches in the vertical jack field space within reach of the operator.

The elimination of the plug-shelf with the plugs protruding upwardly, letting the rear of the teletypewriter into the space formerly reserved exclusively for the cords and depressing the teletypewriter shelf so that the higher rear portion of the teletypewriter fits into a depressed recess behind the board have, in combination, increased the effective radius of the jack field within reach of the operator so that the number of jacks brought within the reach of the average operator seated before the board may be increased by approximately 15 per cent over the other arrangements in which the teletypewriter is mounted on a separate table beneath the cord plug-shelf. And this has been effected while safeguarding the teletypewriter and the cabling and wiring from injury due to their being struck by the cord weights which is impossible with the new arrangement.

The new teletypewriter switchboard arranged according to this invention to eliminate the plug-shelf may in small offices be used independently without other supplementary switchboard positions. Further, in large installations, line-ups of such switchboards may be used in which each switchboard position is so arranged. In such arrangements no plug-shelves would appear in the switchboard line-up. Switchboards, both telephone and teletypewriter, employing the principles of this invention may be used as originating boards, completing boards, toll boards, supervisory boards, maintenance boards, information boards and service observing boards as well as for other purposes. Concentration boards used in telegraph services for establishing semi-permanent concentration groups or networks of facilities for businesses such as brokerage and newspaper chains, etc., may be so arranged. Further, the new switchboard may be located so as to abut against switchboards of other types hav-

ing their cords arranged as heretofore. An illustration of such a situation would be the employment of a switchboard having cord plugs protruding through the middle of a jack field and a teletypewriter mounted immediately below the jack field so as to abut against a test board having cords mounted in a plug-shelf located below the jack field.

There is another important aspect of invention herein. In certain types of communication switchboards such as in telegraph or teletypewriter concentration boards wherein lease concentrations are established which may remain unchanged for days or even weeks at a time, large numbers of cords are required since many of them remain in service indefinitely. It has been the practice heretofore for this type of service to employ patching cords equipped at both ends with plugs. These patching cords were completely detached from the switchboard and hung in some convenient position when not in use. When they were used in making connections the plugs were inserted in the jacks in the face of the switchboard and the entire cord was suspended between the plugs in front of the jacks. Large numbers of cords draped in front of the jack field obviously was a disadvantage.

Cords attached to plugs projecting through the middle of the jack field may be used for this purpose. Where the number of cords required is very large and it is not convenient to arrange all of the required cords in this manner, additional cords may be attached to plugs in the same vertical tier, which plugs are mounted in a plug-shelf which projects in front of the board as formerly. The two sets of cords are arranged according to the invention herein in the same vertical tier in such manner that there can be no interference between the cords in the two different locations.

These and other features of the invention may be understood from the following description when read with reference to the associated drawings, in which:

Fig. 1 is a left-hand front perspective view of an exemplary embodiment of this invention comprising a complete teletypewriter switchboard in which the teletypewriter is located immediately below the jack field, the cords and plugs project through openings in the middle of the jack field and the plug shelf which has always heretofore projected in front of the jack field is eliminated;

Fig. 2 is a left-hand side view of the switchboard per Fig. 1, partly in section, which discloses the manner in which the cords are arranged so that they may be drawn through openings in the middle of the jack field, while interference between both the cords and cord weights and the teletypewriter, which is let into the space ordinarily occupied by the cords, as well as interference between both the cords and cord weights and the jack wiring is prevented;

Fig. 3 is a left-hand rear perspective view of the switchboard;

Fig. 4 is a left-hand front perspective view of an embodiment of the invention applied to a service in which a very large number of cords and special equipment such as meters are required such as in a combined telegraph lease concentration and testing board, and in which an inclined operating shelf projects in front of a position adjoining the new switchboard and abuts against the teletypewriter in the adjoining position;

Fig. 5 is a left-hand rear perspective view of the combined arrangement; and

Fig. 6 is a left-side view, partly in section, of the arrangement of the embodiment per Fig. 4 showing two sets of cords, one set being arranged to be drawn through an opening in the jack field and a second set being arranged to be drawn through an opening in the inclined shelf projecting in front of the switchboard.

Refer now to Fig. 1.

The switchboard **100** comprises essentially a framework **101**, preferably of steel and a casing **102** preferably of wood. Secured to the upper front of the framework are vertical stiles **103**, **104** and **105**. Between the vertical stiles are openings in which are secured four vertical pile-ups of jack strips **106**, **107**, **108** and **109** arranged so that their jack openings form a vertical jack bank or jack field. It is pointed out that lamp strips may be included with the jack strips for certain services to be explained below. The two upper jack pile-ups **106** and **108** are spaced from the two lower jack pile-ups **107** and **109**, respectively. In the opening between jack pile-ups **106** and **107** are two rows of cord plugs **110** and **111**, a strip of keys **112** and two strips of lamps **113**. In the opening between jack pile-ups **108** and **109** are two rows of cord plugs **114** and **115**, a strip of keys **116** and two strips of lamps **117**.

It is particularly pointed out that the association of keys and lamps with the cord plugs is characteristic of cord circuit equipment such as is used, for instance, in an originating board or what is known in the art as an A board in which one of a pair of cords would be employed in responding to an incoming call, and another of the pair in extending the call either to a subscriber's calling jack directly or to an outgoing trunk jack to a distant switchboard. The lamps would in such case perform the function of cord supervisory lamps. In such case, subscriber's calling lamps would be associated with certain of the jacks in the jack bank as subscriber's calling signals.

In cases where the invention herein is applied to a certain type of completing switchboard such, for instance, as is known in the art as a B board, each plug and cord would be used to terminate a trunk circuit incoming from a distant switchboard and the keys would generally be omitted. In such a case, no subscriber's answering jacks or lamps would be required and the jacks would be used for completing calls to the subscriber only. And in general, it is to be understood that the cords and plugs of the invention herein may serve any purpose for which such apparatus is employed in the communications industry. And the operating apparatus with which the cords and plugs is associated will vary to suit the special conditions. The greatest advantage in the matter of additional jack space placed within reach of the operator will be achieved in the case of boards in which no operating keys are required. In such case, the only operating equipment required to be mounted in the vertical face of the board in addition to plugs, other than the multiple jacks, would be either one or two strips of lamps in each vertical panel which would require not more than one inch of vertical space.

At the bottom of the jack panels and immediately above the teletypewriter **18** are piling rails **119** and **120**. The teletypewriter **118** is mounted on a shelf immediately below the jack panels.

As may be seen best in Figs. 2 and 3 the teletypewriter **118** is mounted on a shelf **119** which is supported on a pair of bars **120** and **121**. Bar

120 is welded to vertical frame members 122, 123 and 124 and bar 121 is welded to corresponding members. The shelf and bars are inclined downwardly from the front toward the rear. This permits the rear portion of the teletypewriter which is higher than the front to be depressed behind its front portion, and pushed behind the jack field as indicated to effect a saving in the vertical space taken up by the teletypewriter in the plane of the jack field.

The space immediately in the rear of the jack bank is ordinarily occupied exclusively by the cabling and wiring serving the jacks. Reference to Figs. 2 and 3 discloses the manner in which the cords and jack wiring have been rearranged per this invention to permit the plugs to be located in the middle of the jack field and to permit the teletypewriter to be located in the space ordinarily occupied by the cord plugs and cords while at the same time preventing mechanical interference, between these elements and consequent damage therefrom.

A cord-shelf 125 is secured at each end to the rear of transverse bars such as 126. Secured to the forward ends of each of the bars is a right angle bracket such as 127. The depending vertical arm of the brackets such as 127 is drilled so they may be secured to vertical frame members 123 and 128. A row of tapped holes extends along the edges of the vertical frame members 123 and 128 to engage with the drillings in the brackets such as 127 to permit the cord shelf assembly to be mounted at any desired height in the board.

It is particularly pointed out that although in the preferred arrangement the plugs protrude through an opening in the middle of the jack field, the number of jacks which are mounted in the jack field space will vary in different boards and at different times in the same board. As is well known, a board may have relatively few jacks when it is first put into service. The small number of jacks initially required is invariably mounted in the lower part of the jack space. Under such circumstances the cord-shelf assembly and the plugs will be lowered to take advantage of this condition. When the jack space is full the recommended position for the cord-shelf assembly is in the middle of the jack field space. And for certain operating conditions in certain special positions where speed and convenience of operation are not of importance, such as in the location of trouble cords, that is, cords which are employed to place a tone condition on the sleeve, for instance, of a jack connected to a line in trouble, to provide an indication of the trouble condition when an operator connects to a multiple appearance of the jack at an adjoining position, it will be convenient to locate the cord-shelf assembly at the top of the jack field space above the jacks.

Welded to each of the transverse bars such as 126 intermediate the ends of each bar is a vertically depending bar such as 137. Secured between the vertical bars in any convenient manner near the tops thereof and disposed so that they are horizontal and parallel to the jack field and spaced one from another in vertical alignment are two rods 129 and 130 of circular section. The bars are spaced vertically to correspond to the vertical spacing of the plugs 110 and 111 in the face of the board. The cords 135 and 136 are arranged so that they extend from the plugs to which they are attached horizontally to the rear passing over the tops of the circular rods 129 and 130. Then the cord slack depends from its respective circular rod, each cord passing through an individual weighted sheave or cord weight, after which the rear end of each cord is attached to a cord hook such as 131 and the cord conductors are attached to individual terminals 132 all secured to the cord-shelf 126. Extending between the vertical depending bars such as 137 and secured to them in any convenient manner is baffle board 133. The arrangement of the cords themselves together with the interposition of the baffle board 133 between the cord weights and the wiring and other apparatus provides ample protection against injury due to the swinging of the cord weights.

Reference to Fig. 2 discloses, as mentioned heretofore, that with the cords arranged as shown in this figure the length of cord which it is necessary to draw through the opening in order to make connections will on an average be less than is required when the plugs are located in a shelf projecting in front of the switchboard below the jack field. The work which must, therefore, be performed in operating the board will in the aggregate be less. Further, the elimination of the plug-shelf projecting in front of the board above the teletypewriter permits the operator to reach over a greater area of jack field while seated before the switchboard. The lengths of cord draped in front of the jacks will be on an average shorter. There will obviously be less interference between cords already connected and cords in process of being connected. In short, the new arrangement disclosed in Figs. 1, 2 and 3 provides a manually operated teletypewriter switchboard in which the essential elements are so disposed that they cooperate to permit the interconnection of more circuits and at a faster rate and with the expenditure of less physical energy than in any previously known teletypewriter switchboard.

Refer to Figs. 4, 5 and 6. Fig. 4 shows an arrangement in which the new switchboard disclosed in Figs. 1, 2 and 3 abuts against an adjoining switchboard on the left of a special type, such as a testing board, wherein special apparatus such as meters is required as well as a considerable number of special plug-ended testing cords such that the aggregate number of cords is more than can be conveniently accommodated in the upper portion of the board in the manner heretofore described and the single teletypewriter in the right-hand portion of the combined switchboards is adequate for the combined boards.

In this arrangement, advantage is taken of the vertical height taken up by the teletypewriter in the right-hand position in that the shelf 200 of the special board in the left-hand position is inclined upwardly so that its vertical rise is equal to the vertical height of the teletypewriter in the plane of the jack field. As thus arranged the meters will be approximately normal to the line of vision of the operator. Further, the plugs 201 are raised as close to the bottom of the jack field as possible, so that the physical effort of raising the special cords is minimized.

Reference to Fig. 6 discloses the relative positions of the two sets of cords in this arrangement. The arrangement of the upper set of cords is the same as heretofore described. The rear end of each of the lower set of cords is attached to a second cord-shelf 202 which is secured in a fixed position between vertical frame members such as 203. This permits a considerable increase in the number of cords which can

be located in a switchboard position within convenient reach of an operator seated before the switchboard. The spacing of the cords prevents interference between them. This obviates a difficulty previously encountered when the location of a large number of cords in a position within convenient reach of an operator was attempted.

What is claimed is:

1. In a communications switchboard, a cord having a plug attached thereto, vertical stile strips having openings therebetween, a displaceable plug seat for positioning said plug when in the normal idle disengaged condition at various levels in said openings, a cord-shelf, means for attaching one end of said cord to said shelf, and means for positioning said shelf at various levels dependent upon the level at which said plug is positioned.

2. In combination in a manual teletypewriter switchboard, a communications conductor plug ended switching cord fastened at one end to a cord-shelf in the rear of said switchboard and arranged to project through a plug support in the front of said board, means for displacing said support and means for displacing said shelf to accommodate the displacement of said support.

3. In combination in a communications switchboard, a plug seat, a cord shelf, a communications cord having a first and a second end, a switching plug attached to said first end, said second end attached to said shelf, said plug supported in said seat, said cord adapted to be drawn through said seat to the front of said switchboard, means in said switchboard for positioning said seat at various levels in said switchboard and means in said switchboard for positioning said cord shelf at various levels in said switchboard to correspond with the position of said seat.

4. In a communications switchboard, a vertical jack bank, jack wiring behind said bank connected to said bank, an opening forming a plug seat in substantial vertical alignment with jacks in said bank below said opening in said bank, a plug protruding through said opening, a communications cord having one end connected to said plug and extending from said plug rearwardly directly horizontally between said wiring to a point behind said wiring, and means, comprising a cord weight depending from said cord, for introducing cord slack behind said point.

5. In a manual teletypewriter switchboard, a vertical jack field, wiring connected to the rear of jacks in said field, a communications cord connected at a first end to a cord-shelf located behind said wiring intermediate the top and bottom of said field, said shelf in substantial horizontal alignment with an opening in said field, a plug having a first end projecting through said opening in front of said field and a second end connected to a second end of said cord.

6. A manual teletypewriter switchboard, a vertical jack bank in said switchboard, a plug attached to a cord in the rear of said jack bank, said plug projecting in front of said jack bank through a horizontal opening between said jacks in said bank, said opening separating said jack bank into two portions one above the other in vertical alignment, jack wiring behind said bank connected to said jacks, an opening in said wiring, a first support means for said cord comprising an element immediately behind said wiring, a second support means for said cord comprising a cord shelf behind said element, slack in said cord depending behind said wiring between said first and said second support means, said support means cooperating to adapt said cord so that it may be drawn through said opening for connection to jacks in either of said jack field portions, to minimize the length of cord draped in front of said switchboard to reduce interference with other connections.

7. A manual teletypewriter switchboard, a communications cord attached at one end to a plug, a vertical jack bank in the upper portion of said switchboard, jack wiring connected to the rear of jacks in said bank, a horizontal opening in said bank between horizontal layers of said jacks, means for mounting said plug in said opening, and means for arranging slack in said cord behind said wiring so that said cord may be drawn through said opening for connection to said jacks from the front of said switchboard without interfering with said wiring.

8. In a manual cord communications switchboard, a vertical jack field having separate jack sections one above the other in the same vertical tier, an opening between said sections, cables behind said bank connected to the rear of jacks in each of said sections, an opening between said cables in alignment with said opening between said sections, a communications cord, supports for said cord so that said cord may be drawn through said opening between said cables and said sections for connection to jacks in either section to reduce the labor of operating said switchboard.

9. In a manual teletypewriter switchboard, horizontal layers of jacks arranged to form a vertical jack field, a cord having a first end connected to a horizontal cord shelf behind said jack field, said shelf mounted intermediate the top and bottom of said jack field, said cord having a second end arranged to extend through an opening between successive horizontal layers of jacks in said field.

10. In a teletypewriter switchboard, a vertical jack field, wiring connected to jacks in said field, an opening in said field, said opening separating said jack field into two portions one above the other, a plug ended switching cord attached at one end to a horizontal cord shelf behind said wiring, said cord extending through a cord weight attached to said cord and means for supporting said cord so that said cord may be drawn through said opening between said portions without interfering with said wiring, so that said plug may be connected to a jack in either of said portions, to minimize the length of cord draped in front of said jack field.

11. In a manual cord teletypewriter switchboard, a plurality of jacks secured in jack strips, a plurality of said strips piled in horizontal layers to form a vertical jack bank, a vertical opening in said bank separating said bank into vertical sections one above the other, cord support means in said opening, a flexible switching cord adapted to be drawn through said support, and a plug connected to said cord, for establishing connections through said cord to any of said jacks in either of said sections, so as to minimize the length of cord draped in front of said sections when connections are established between said cord and any one of said jacks to reduce interference when connections are established between other cords in said switchboard and other jacks in said bank.

12. In a manual, cord operated teletypewriter switchboard, a vertical jack bank, wiring connected to the jacks in said bank behind said bank, a plug ended communications switching

cord, a teletypewriter, means for supporting said teletypewriter immediately below said jack bank, an opening in said bank above said teletypewriter and in vertical alignment with said teletypewriter, means for arranging slack in said cord so that it depends behind said wiring without interfering with said wiring, and support means for adapting said cord to be drawn through said opening for connection to any of the jacks in said bank, the arrangement of said switchboard being designed to provide the essential operating elements, namely the teletypewriter, the jack field and the cord, in the same vertical tier so as to dispense with the usual plug-shelf projecting in front of said switchboard and thereby increase the number of jacks within reach of an operator seated before said teletypewriter.

13. In a manual cord operated teletypewriter switchboard, an arrangement of elements adapted to increase the number of jacks within reach of an operator seated before a teletypewriter in said board, said arrangement comprising, in combination, a vertical jack field, wiring connected to the rear of jacks in said field, a teletypewriter, said teletypewriter being higher in the rear than in front, means for mounting said teletypwriter so that its higher rear portion is depressed with respect to its front portion, the rear of said teletypewriter projects behind said jack field and the top of said teletypewriter is immediately below said field, an opening in said field dividing said field into separate vertical sections one above the other, means for positioning the level of said opening between said sections, a horizontal cord shelf in rear of said field and said wiring, means for positioning the level of said shelf to correspond to the level of said opening, a plug ended communications switching cord having one end attached to said shelf, said cord having slack depending behind said teletypewriter and behind said wiring, and means for adapting said cord to be drawn through said opening for connection to any of said jacks in said jack field without mechanical interference between either said teletypewriter or said wiring and said cord.

14. A teletypewriter switchboard arranged to reduce the physical effort of operation and increase the jacks within reach of an operator seated before the teletypewriter by eliminating the usual plug-shelf projecting in front of the switchboard, said switchboard comprising, in combination, a teletypewriter, a teletypewriter support forming part of and integral with said switchboard, a vertical jack field, wiring connected to the rear of jacks in said field and a communications cord, said teletypewriter being mounted on said support so that the top of said teletypewriter abuts against the bottom of said jack field, and the rear of said teletypewriter projects behind said jack field and is depressed below the front of said teletypewriter, an opening in said jack field in vertical alignment with said teletypewriter, slack in said cord depending behind said wiring and said teletypewriter, said cord being arranged to be drawn through said opening for connection to the front of said jacks, and means for restoring said slack to its original position without interfering with said wiring or said teletypewriter.

15. In a teletypewriter switchboard, in combination, a vertical alignment of operating equipment comprising in vertical sequence from top to bottom a first bank of wired jacks, a plug-ended cord, a second bank of wired jacks and a teletypewriter, supports for said banks of jacks, said cord and said teletypewriter in said switchboard said cord being arranged so that slack therein may be drawn from the rear of said banks through a space separating said banks, and means comprising said supports in said switchboard for preventing interference between said cord and said wiring of said jacks or said teletypewriter in establishing circuits interconnecting said teletypewriter and said jacks through said cord.

16. In a teletypewriter switchboard, in combination, a vertical jack bank, an opening in said bank dividing said bank into two separate portions one above the other, wiring connected to the rear of the jacks in said bank, a teletypewriter projecting into the space immediately below said wiring, a cord, said cord having a first end connected to a switching plug and a second end connected to a cord-shelf in rear of said bank and said wiring, support means for said cord in rear of said wiring to adapt said cord to pass through said opening, slack in said cord between said support and said shelf, said slack passing through a displaceable cord weight depending in rear of said wiring and said teletypewriter, and means for preventing said weight from interfering with said teletypewriter and said wiring when said cord and weight are displaced as said cord is moved through said opening in establishing circuits interconnecting said teletypewriter and said jacks through said cord.

17. In a teletypewriter switchboard, in combination, a vertical jack field separated into two parts one above the other by a vertical opening, wiring connected to the rear of jacks in said field, another opening immediately below said field and extending behind said field, a teletypewriter having its rear end depressed below its front end and projecting into said other opening, a support for said teletypewriter in said other opening, cords passing through displaceable cord weights depending behind said wiring and said teletypewriter, a support for said cords in said vertical opening, and means for preventing mechanical interference between said cord weights and said teletypewriter and said cord weights and said wiring as said cord weight is displaced as said cord is drawn through said vertical opening in establishing circuits interconnecting said teletypewriter and said jacks through said cord.

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