(No Model.) 2 Sheets—Sheet 1.

A. S. HIBBARD.

DISTRIBUTING FRAME FOR ELECTRIC CONDUCTORS.

No. 453,863. Patented June 9, 1891.

Fig. 2.

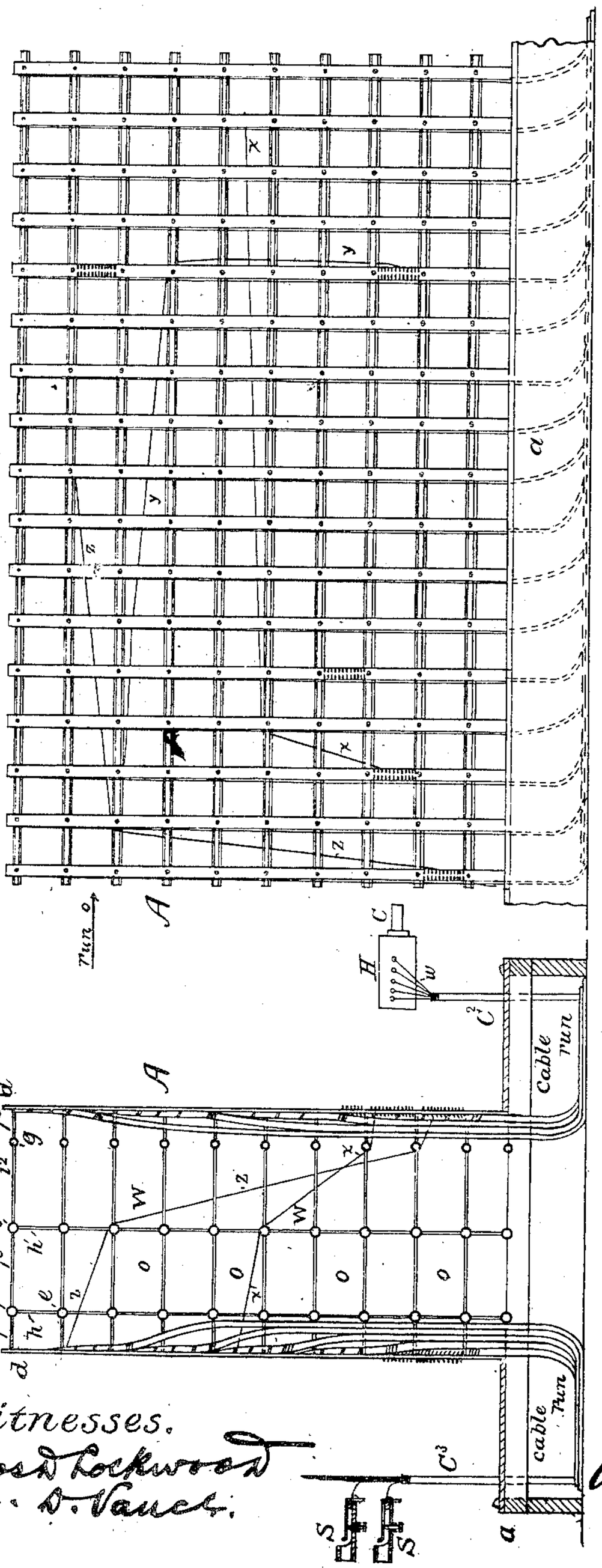

Fig. 3.

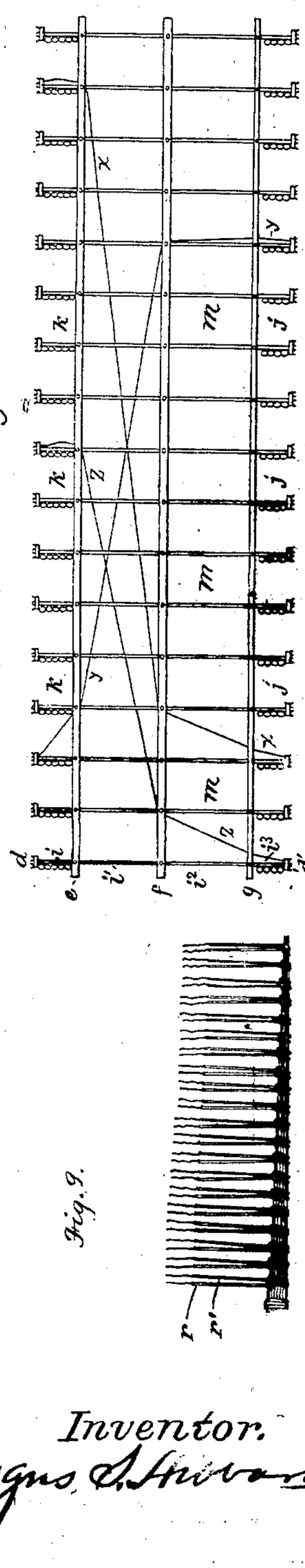

Fig. 1.

Fig. 9.

Witnesses.
Thos. D. Lockwood
A. D. Vance.

Inventor.
Angus S. Hibbard

(No Model.) 2 Sheets—Sheet 2.

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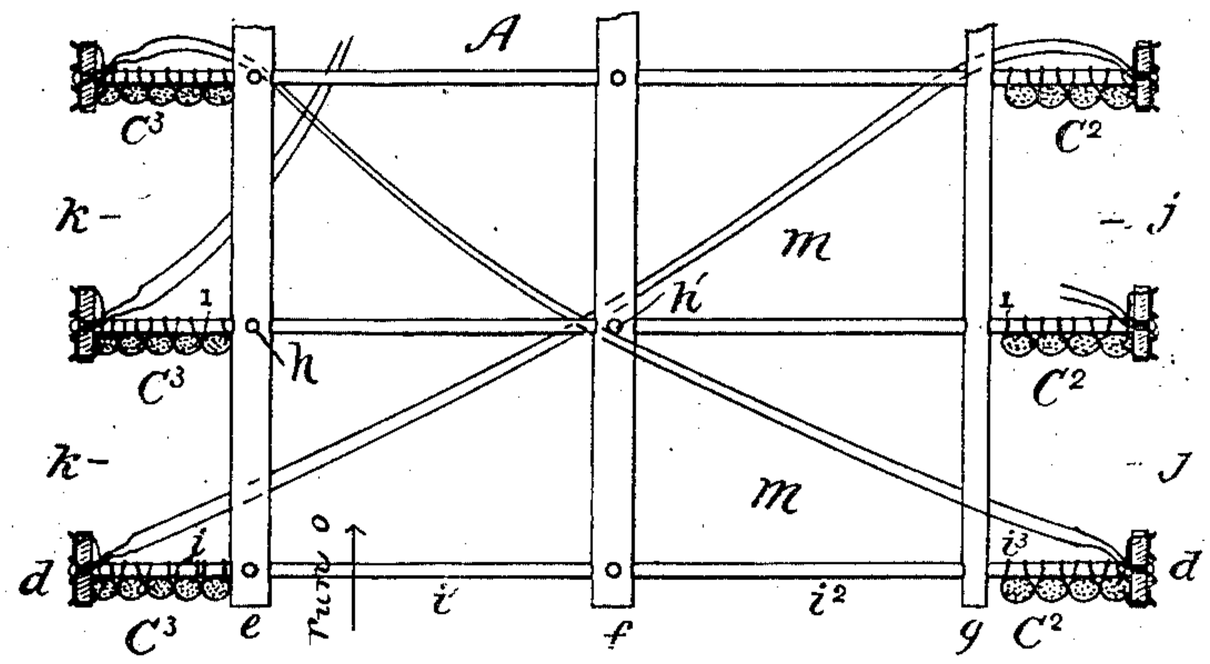


Fig. 4.

Fig. 5.

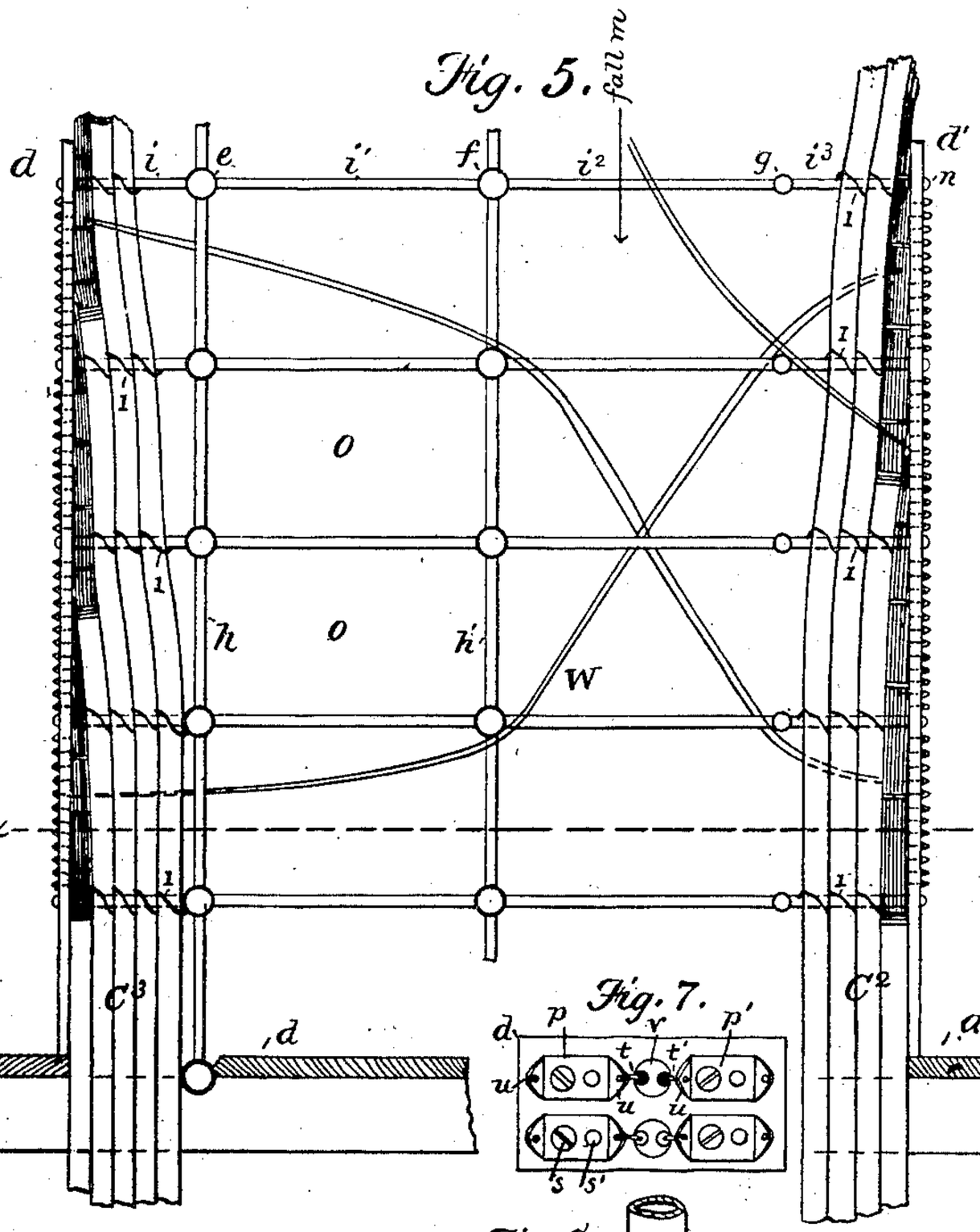


Fig. 6.

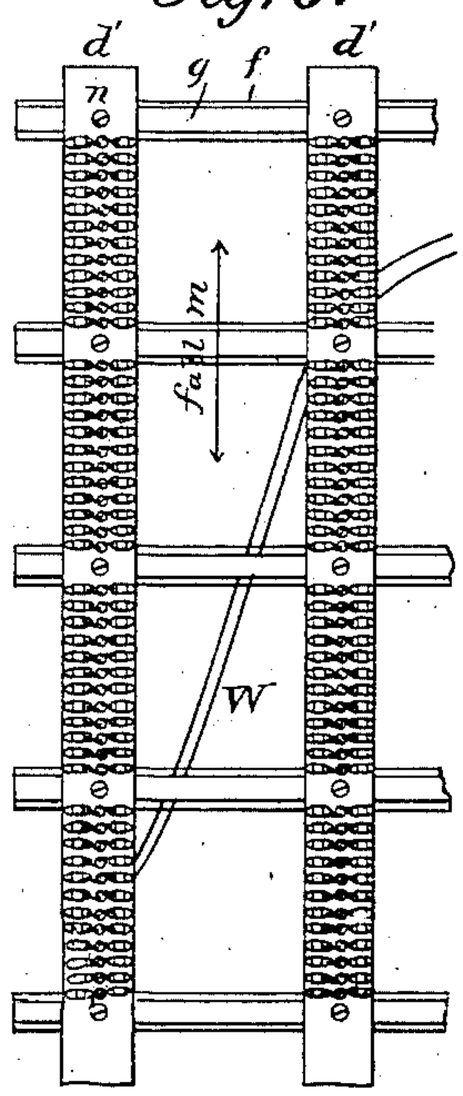
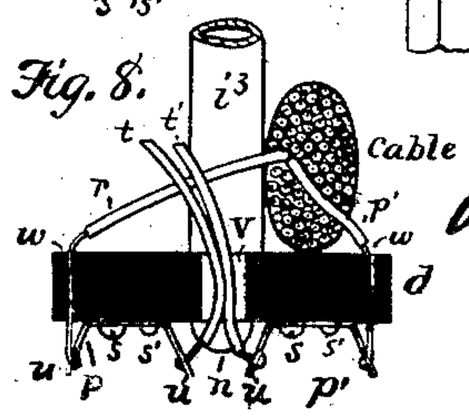


Fig. 7.

Fig. 8.



Witnesses,
Thos. Lockwood
A. D. Vaues.

Inventor.
Angus. S. Hibbard

UNITED STATES PATENT OFFICE.

ANGUS S. HIBBARD, OF MORRISTOWN, NEW JERSEY, ASSIGNOR TO THE AMERICAN TELEPHONE AND TELEGRAPH COMPANY, OF NEW YORK.

DISTRIBUTING-FRAME FOR ELECTRIC CONDUCTORS.

SPECIFICATION forming part of Letters Patent No. 453,863, dated June 9, 1891.

Application filed February 28, 1891. Serial No. 383,259. (No model.)

To all whom it may concern:

Be it known that I, ANGUS S. HIBBARD, residing at Morristown, in the county of Morris and State of New Jersey, have invented certain Improvements in Distributing-Frames for Electric Conductors, of which the following is a specification.

In telephone-exchanges it is desirable to interpose between the main cables leading to the street and the office-cables leading to the switch-board spring-jacks some means whereby the several lines may readily be distributed at will in any desired way among the switch-boards. Prior to my invention this had been done, but without order, and in the use of modes which involved much crossing of wires and much confusion, for the connecting-wires, being run straight or diagonally from the cable-head to the switch-board terminal, were inextricably interlaced and otherwise involved, so that when it became necessary to change or withdraw any of the interconnecting-wires for redistribution, testing, or for any purpose whatever this could only be accomplished with great difficulty and by the employment of considerable force. To obviate these defects and to provide a distributing board or frame whereby the interconnecting-wires may be run or withdrawn with great facility, whereby work among the wires is made easy, and whereby redistribution or change of any kind can be accomplished with neatness and expedition is the object of my invention. In attaining this object I provide a distributing board or frame located at any convenient point between the main cable-heads and the operating switch-board and connected with each by means of intermediate cables which lead from the main cable-heads to permanent connections at one side of the distributing-frame, and which lead from the operating switch-board to permanent connections on the other side of the said frame. This frame is an open-work or skeleton structure of metal rods or pipes, whereby lightness as well as strength is secured, and the several permanent connections are mounted upon non-conducting strips secured to the ends of each vertical series or horizontal bars or pipes crossing the frame from side to side. In the frame any one of the circuits entering from the line side may be connected to any one of the switch-board connections on the other side on the same or on different horizontal and vertical planes. By the construction adopted openings are provided between the bars of the frame, through which the interconnecting wires are led from the connections on one side to those on the other. The openings on one side are clear from the top to the bottom of the frame, constituting wide vertical channels, and on the other side are clear from end to end of the frame, constituting horizontal channels, and by the said construction the said wires are first led in a vertical direction up or down, as required, until the horizontal plane of the desired switch-connection is reached, and are then passed over to the inner side and led through the horizontal channel on the said plane to the right or left, as the case may be, until the required switch-board connection is reached.

In the drawings which illustrate and form a part of this specification, Figure 1 is an end elevation of my distributing-frame, indicating the connections with the switch-board and main cable-heads. Fig. 2 is a side elevation of the said distributing-frame. Fig. 3 is a plan top view thereof. Fig. 4 is a horizontal section on the line $x\,x$ of Fig. 5 of a portion of the frame. Fig. 5 is an end view on an enlarged scale. Fig. 6 is a side view of a portion of the frame, showing two of the connection strips on an enlarged scale. Fig. 7 is a detail showing two of the said connections. Fig. 8 is a detail giving a horizontal section of one of the said connections and the mode of attaching the wires thereto, and Fig. 9 indicates the mode of fanning out the several pairs of cable-conductors adopted on both sides of the frame.

The frame A is preferably mounted upon a hollow platform a, through which it is reached by the cables from both sides. Arranged through its longitudinal center, at suitable distances apart, are strong vertical bars or pipes h', which are intersected longitudinally in horizontal planes by similar bars or pipes f, and also by transverse pipes or bars i, these also being in horizontal planes, which may correspond to the planes of the pipes f.

As already stated, the structure may be made either of pipes or solid bars; but I prefer for the main parts of the frame-work pipes

or tubes, which are by far the lighter and of sufficient strength, and although for the transverse pieces, which are of smaller cross-section, bars are often employed, the term "pipes" will alone, for the avoidance of verbiage, be hereinafter used. They may be constructed of any suitable metal or alloy; but iron is preferred for obvious reasons. The central system, composed of its several series of uprights and longitudinal and transverse pipes, may be regarded as the backbone of the frame. At a suitable distance to one side of the center a series of horizontal pipes *g* intersect with the transverse pipes *i*, and at a suitable distance to the other side a series of vertical pipes *h* intersect the said transverse pipes *i* in the same way, and the said transverse pipes are thus divided into four sections $i\ i'\ i^2\ i^3$.

If desired, the vertical system of pipes *h* may be intersected by a longitudinal horizontal series *e*, and the horizontal system *g* on the other side of the frame may in like manner be intersected by a corresponding series of vertical pipes. I have shown this arrangement on the switch-board side of the frame, where it is of more utility than it would be on the cable-head side. The result of the arrangement is that two series of channels bounded on all sides by periodic pipes are formed one on each side of the center. One of these series of channels *m*, bounded by the pipes *f*, *g*, and *i*, is vertical, as indicated especially in Fig. 3, while the channels *o* of the other series, bounded by the pipes *h*, *h'*, and *i*, are horizontal and longitudinal, their ends being indicated in Fig. 1. These channels are technically termed, respectively, the "fall" and the "run." A further result is that two other series of vertical channels, one on each side of the frame, are formed. These are inclosed on three sides only, being outwardly open. Those which are designated as *k* are bounded rearwardly by the pipes *e* and *h* and on their two sides by the end sections *i* of the two adjacent transverse pipes *i*, while those marked *j* on the opposite side of the frame are, as shown, bounded rearwardly by the longitudinal pipes and *g* on their two sides by the opposite end sections i^3 of the said transverse pipes.

Within the vertical channel *j* the intermediate cables C^2, leading from the cable heads H of the main-line cables C are run, the end of each overlapping all that terminate below it, as clearly shown in Figs. 1 and 5. In the same manner the cables C^3 from the operative switch-board (conventionally indicated by spring-jacks S) are led through the hollow platform *a* and upward through the channel *k*, those which are intended for connections on the upper levels of the frame A overlying those which terminate below.

The cables on both sides and their arrangement are shown in section in Figs. 3 and 4, and in elevation in Figs. 1 and 5, and as they pass each transverse bar *i* they are bound thereto by cords or covered wires *l*.

Fig. 9 indicates the mode in which the individual conductors *r r'* emerge from the cable containing them and are branched to their respective connections.

No arbitrary construction or arrangement is required; but it is convenient in practice to provide that the number of conductors in the cables C^2 shall be a sub-multiple of the number in the main cables C, and, if desired, the switch-board cables C may comprise a still smaller number.

At each side of the frame is a series of vertical strips *d*, of non-conducting material. Each of these crosses and is secured to the ends of all the transverse pipes *i* in the same vertical plane and overlaps the same on both sides, forming by one of the wings thereof a flange for keeping the cable layers in place. By examining the drawings it will be seen that the said cables only occupy one side of the cross-pipes *i* and that they only occupy a small portion of the spaces *k* and *j*.

Figs. 6, 7, and 8 more particularly show the non-conducting strips *d* and the fixed connection-pieces *p* and *p'*, mounted thereon. Of course any desired form of connection-piece may be adopted. The style shown is found convenient in practice and consists of a pair of metallic plates of semi-hexagonal form, each secured in line with its mate by a screw *s* and a steady-pin *s'* to the non-conducting strip *d*, and constituting practically a flat central plate with two outwardly projecting and flaring lugs *u*. In the two wires of a circuit entering or leaving a cable *t t'* represent their insulating covering, and *w* the wire itself bared. The bared portions *w* pass through the non-conducting strip, and are attached by riveting or soldering, or both, to the outer lugs *u* of the two connection-plates of a pair. The connections on one side of the frame are united with their corresponding connections on the other sides by suitable insulated wires W, which are secured to the connections on the cable-head side of the frame, pass through the interior of the said frame, and, reaching the connections on the switch-board side, are united to them. For this purpose the non-conducting strips *d* have holes *v*, one between the two plates *p* and *p'* of each pair of fixed connections. The two insulated wires of any pair, arriving at or leaving any connection, pass through the said hole, and are secured by soldering or otherwise to the inner lugs of the plates *p*. I have endeavored to show the mode in which the insulated wires W traverse the interior of the frame in the several drawings, and a clear idea may be obtained thereof by considering Figs. 1 and 2 together. Leaving their permanent connection on the cable-head side, they pass through the hole *v*, and, reaching the nearest horizontal longitudinal pipe or stanchion *g*, they pass partly round the same, and then in a substantially vertical direction upward or downward, as indicated at *z*, as the case may be, until the horizontal plane is reached on which is located the

permanent connection on the switch-board side of the frame. This may, however, be some distance in one direction or the other horizontally from the initial vertical run of said wire. Therefore after being brought to the proper level by being drawn, as *z*, through the vertical channel *m*, the wire then crosses the frame into the horizontal channel *o*, which, as at *y*, it traverses until the proper non-conducting strip *d* is reached. The wire W is then bent round the proper vertical tube *h*, which also serves as a stanchion, and led through the proper hole *v* in said non-conducting strip to its connection with the inner lug of the plate *p*. The characteristic idea of this arrangement is that the distributing-wires W may be led from one terminal directly into the frame, then turn substantially at a right angle to the vertical channel or fall, and after passing through that turn again at a similar angle into and through the horizontal run to a point behind the complementary terminal desired, and then outward to the said terminal. By this arrangement the open spaces will be occupied only by wires running in substantially direct lines, and not in diagonal lines, and therefore the said open spaces will admit of being utilized to their fullest extent, and will remain open until filled with wires.

The openings are made large enough to admit of the insertion of the hand and arm of a workman at any point desired and at any time until any particular space becomes more than half filled with distributing wires, and any particular wire or pair of wires may readily be reached by hand and drawn out and a new pair as readily drawn in.

In an open-work frame actually constructed on the principles indicated herein the height of the frame is eight feet and the extreme width about twenty-eight inches; but the dimensions will of course be proportionate to the magnitude of the telephone-exchange. If the frame be disproportionately high, the fall must be larger than the run. If disproportionately low, the run is preferably the larger.

Having now described my invention, I claim—

1. In combination with a telephone switch-board and with main-line cables leading into the central station, a distributing-frame interposed between the cable-heads and the said switch-board, provided with terminal connections on one side for the line conductors and with similar terminal connections on the other side for the switch-board conductors, and with vertical and horizontal channels in the interior of said frame, through which intermediate conductors uniting the line and switch-board connections may be drawn, whereby the said conductors can be readily drawn in or out without disarrangement of any others, substantially as and for the purposes described.

2. A distributing-frame for telephone-exchanges, formed of metallic pipes or bars built into an open-work structure, as described, provided with two sets of terminal connections, one set on each side for the line and switch-board conductors, respectively, and with vertical and horizontal channels through the interior of said open-work, the vertical channels being on the line side and the horizontal channels on the switch-board side of said structure, through which intermediate conductors may be drawn to unite the terminal connections of the two sets, substantially as described.

3. In a telephone-exchange, a distributing-frame interposed between the main-line terminals and the switch-board for the purpose of readily distributing the main lines to any desired portion of the switch-board, said frame being formed of metallic pipes or bars built into a skeleton structure, as described, having two sets of terminal connections, one set on each side, to which the line and switch-board conductors are respectively secured, and with vertical and horizontal channels or runways leading through the interior, the vertical channels being on the line side and the horizontal channels on the switch-board side of said structure, combined with intermediate conductors extending through the interior of the said frame, the said conductors being drawn inwardly from the line connection through a vertical channel to the level of the desired switch-board connection, then through a horizontal channel to a point behind the desired switch-board connection, and finally outward to said connection, whereby the said line and switch-board connections may be united, in the manner and for the purposes specified.

4. A distributing-frame for connecting the several line-wires of a telephone-exchange to any desired switch-board connection, having a central series comprising vertical, longitudinally-horizontal, and transversely-horizontal pipes or bars intersecting each other, as shown and described, the vertical pipes determining the height, the horizontal pipes the length, and the transverse pipes the extreme width of the frame, a second series of horizontal pipes extending from end to end of the frame on the line side thereof, each intersecting all the central transverse pipes of the same plane and forming therewith and with the central series a series of vertical open-work channels wherein wires may be run, a second series of vertical pipes of suitable length on the switch-board side of said frame, each intersecting the several transverse pipes of the same vertical plane and forming therewith and with the central series a series of horizontal channels also for the reception of wires, the pipes of both of the said second series serving also as direction-changing stanchions for the said wires, the whole forming an open-work or skeleton structure, and a series of vertical non-conducting connection-strips attached to the ends of each series of transverse pipes in the same vertical plane

on both sides of the frame and carrying connections, each connection on one side being adapted for a line conductor and each on the other side for a switch-board conductor, the corresponding connections being also united with each other by intermediate conductors passing through the interior of the structure, substantially as described.

5. A distributing frame or board for telephone-stations, provided with terminal connections on its two sides for two series of conductors, respectively, and having a vertical series and a horizontal series of channels or runs leading through its interior between the said two series of connections, through which intermediate conductors may readily be drawn to connect the several conductors of one series with any desired conductor of the other series, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 24th day of February, 1891.

ANGUS S. HIBBARD.

Witnesses:
THOS. D. LOCKWOOD,
CHARLES D. M. COLE.