in the machine and protecting every part, as the lubricant will not melt under 400 degrees F.

The feed screw is entirely inclosed and flooded with lubricant, dust and rust can never effect it.

The machine is so light in weight and so well adapted to be carried, that either the track drill or the bonding drill may be carried with ease on the lightest track bicycle. This has proved a great convenience in block signal work, enabling a signalman to reach the break in the block signal system in the quickest posssible time and take the machine with him to make the repairs.

The essentials of drilling are a rigid drilling base, a continuous speed to the drill and a perfect feed, which we believe on trial will be found in the Groff Drill.

The Groff Drill & Machine Tool Co. have recently issued a handsome illustrated catalogue, which shows the several types of drills manufactured and a sectional view of the machine, together with a complete description of the design, assembling and operation of the machines. Catalogues will be mailed upon request.

A New 10,000 Line Telephone Exchange for Paris, France.

By R. J. Hardacker.

"How soon can you ship a complete telephone exchange for 10,000 subscribers?"

This was the astonishing cablegram as it came to to the Sales Department. Surely there must be some mistake about the size of the order for who could want a complete telephone system with its myriad of wires and numberless details which go to make up the intricate workings of a modern telephone exchange large enough for a city of 100,000 inhabitants? And above all, who should want such an extremely large outlay in such a hurry as to inquire by cablegram how soon it could be shipped? No questions were asked about price or quality or material, the all prevailing item was time, time, time.

Cablegram: *"How-soon-can-you-ship?"*

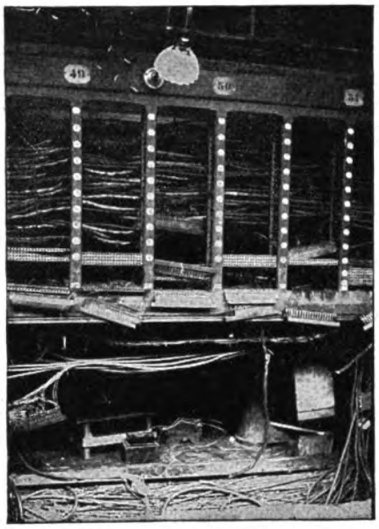
Every one had read of the big fire in Paris, France, on the night of Sept. 20th, in which the big Gutenburg exchange of the Paris Telephone Company had been completely destroyed and the telephone service of 10,000 subscribers cut off without a moment's warning.

Ten years ago it would not have been much of a hardship to 10,000 firms and families to be without telephone service for a few weeks, but in the present day, when we have come to regard the telephone as an absolute necessity instead of a luxury, the removal of this convenience for a short time even, causes consternation in many lines of business.

The Gutenburg Exchange situated as it was in the heart of the business district of the great metropolis of France, carried a large proportion of the city's business over its wires. People had become so dependent upon the telephone for the rapid transaction of their business that they were dumb-founded when they came to their offices one morning facing the problem that they would have to resort to the old customs of messenger boys, the mails and the walking-talking methods. In olden times this system seemed quite satisfactory, but after the telephone had been used in its stead for several years without thought as to its real advantages, to revert back to the primitive methods seemed to put the heretofore unnoticed rush of present-day business methods at a stand-still. No messenger service could ever take the place of the telephone with any degree of satisfaction. No one realized this more than did the Paris Telephone Company. They knew that business in that section of the city would be demoralized until their service could be restored to its normal conditions and immediately set about making their plans for replacement.

The switchboard which was destroyed had been purchased in America, but although the equipment had given satisfactory service, the present demands for an outfit in the shortest possible time seemed to put any American firms entirely out of consideration. It was not thought possible that they could even attempt to compete with the firms on the same side of the sea when it came to a matter of rapid delivery.

The American firms were therefore almost forgotten



Paris Main Office 10,000 Line Board, burned Sept. 20, 1908.

when the company started to look about for some manufacturing company to take their large contract on short notice and guarantee the earliest possible delivery under penalty. It was only after they had had several European firms figuring on the deal that the enormity of their order and their abnormal demands for rapid delivery were realized. It was soon learned that no firm on that side of the sea would dare enter into such a gigantic undertaking with a time limit less than a matter of months. This was altogether too long to wait and the officials were about to give up in despair. It began to dawn on them that very, very seldom had a large exchange to be built under such a pressure of time. Under normal conditions when they perceived that their business was increasing to such an extent that another exchange would soon be necessary to carry the work efficiently, they would lay their plans and make arrangements deliberately, stating their very exacting requirements to the manufacturing companies, emphasizing all the while that the most particular items were good design, quality of material and workmanship and at the same time a reasonable delivery. They would probably place their order for the switchboard six months before they actually wanted it delivered.

But now the conditions were quite different.

Time was the all-important element to be considered. They would accept the standard type of apparatus providing they could get it soon enough. The fire had caused them a severe loss, but that was not to be compared with the loss they would sustain for

each day's delay in restoring their service to their customers. As a last resort they went to the Paris house of a large American firm with a feeling that possibly the American factory was large enough to overcome the great distance the goods would have to be shipped by its enormous manufacturing facilities.

They were correct in their assumption. The large American firm had on hand two emergency outfits each large enough for an exchange of 9,600 subscribers which they always carried for just such emergencies, one in New York and one in Chicago.

The American firm with its enormous amount of business ($70,000,000 worth in a fair year) is enabled to carry this $100,000 investment in idle equipment for emergency purposes which no other firm in the world can do.

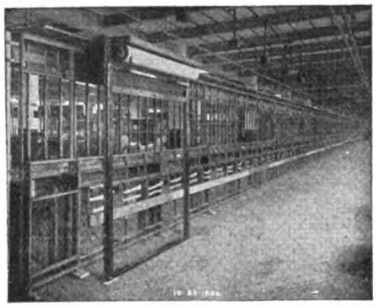
The Paris branch of the American firm offered to have this emergency outfit shipped by the very first steamer leaving New York, but the telephone company decided that it would take too long to pay to install such a large outfit only temporarily.

Negotiations were immediately entered into for the permanent installation. The Paris house took the matter up with the New York Export Department of the Western Electric Company and here we see the first cablegram, "How soon can you ship a complete telephone exchange for 10,000 subscribers."

After telegraphing the Chicago factory for definite information New York cabled Paris, "Can ship 10,000 line equipment, if engineering conditions are easy, two months after receiving full information."

On Sept. 24th, two days later, Paris cabled New York, "Nothing can be done." This seemed to indicate that the American firm was too far away to be of any assistance to the telephone company in solving their problem.

Later the same day the situation took on a different aspect. After translating the next cablegram from the code it read, "What is largest quantity switchboard cable you can send weekly, six weeks?" After communicating with the Chicago factory, New York cabled Paris on the 25th: "Can ship 135,000 feet switchboard cable Oct. 7th. Can ship 1,000,000 feet seven week." Paris' reply was, "Ship switchboard cable as per New York cablegram 25th."



Rear View of Framework of new board just prior to shipment.

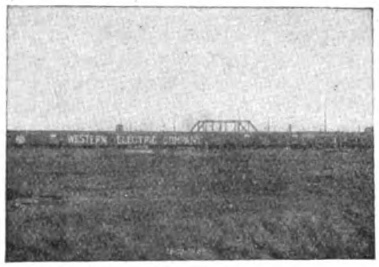
The order was telegraphed to Chicago and this lot of 135,000 feet of cable, consisting of four different sizes, ranging from 21 to 64 wires to a cable, was packed on 52 reels and started on its journey from Chicago within two days from the receipt of the order.

Although the cable was in stock it was necessary to unreel it and paraffine the ends, then rewind on reels and pack the reels in cases lined with paraffined and tar paper to protect against moisture during the ocean voyage. The cases were also hoop-ironed to further protect them against the rough usage encountered on export shipments.

On Sept. 29th, instructions were cabled to build a switchboard of 10,000 line capacity and to hurry the work all possible as the Paris house of the American firm had contracted for delivery and complete installation of the 10,000 line equipment in two months' time under a penalty of $600 per day.

This order was telephoned to Chicago giving all the details possible at this time. They were very meager, to say the least.

The next day, Sept. 30th, a cablegram from Paris stated that a standard switchboard would not be satisfactory and added some of the engineering information under which the board must be built. The Paris house also was desirous of impressing upon the minds of those handling the job that all possible haste must be applied to insure an unusually prompt delivery for the cablegram ended thus: "Do everything you can to ship in one month. Time costs $600 daily."



Paris Shipment Leaving Hawthorne plant in 6 cars.

On Oct. 9th, letters dated Oct. 2nd were received from Paris stating what was required and giving the necessary engineering specifications. Up to this time the only information received was by cablegram and had been forwarded by the New York Export Department to the Chicago factory either by telephone or telegraph, each message, of course, being confirmed by letter.

With the complete specifications in their hands, however, the engineers could then go ahead with assurance that the boards were being built correctly.

In accordance with the Paris house request, the relay racks and line distributing frame of the board were shipped first so that they could commence installing. The factory turned out the racks and frame for the complete board in six days' time, shipping them from Chicago on Oct. 16th.

Under the unusual pressure for time the Chicago factory promised to ship the switchboard complete on Oct. 24th. To make this extremely short delivery it was necessary to work the shop night and day, including Sundays.

On Oct. 8th work was started with twenty-four men soldering 3,000 jacks per day, but this number was continually increased, until Oct. 23rd, when the job was completed there were sixty-five men soldering 25,000 jacks per day.

The cable plant was also working overtime to complete its share of the job. At the same time the New York factory was making up about one and one-half car loads of coils and accessories which were needed in installing the board.

The order was shipped complete from Chicago on Oct. 24th, the cars arriving in New York at the ship's side ready for unloading at 9:45 a. m., Oct. 27th. Spe-

cial arrangements had been made with all the railroads over which the cars were routed to have them hurried along with all possible speed. The Chicago house also sent a man along with the goods in order that he might be able to avoid any unnecessary delay in transit. Reservation for space had long before been made with the steamship company, and the six car loads of material were quickly placed in the hold of the vessel. New York then sent a man along to Paris to take charge of the installation of the board.

Within twenty-three days from the time the order was telephoned to Chicago, the switchboard was shipped complete. This prompt delivery is all the more remarkable from the fact that only enough information was received in the first cablegram to enable the shop to line up the necessary apparatus.

Additional information in cablegrams on Oct. 3rd allowed them to go ahead along the lines which they felt would not be contrary to the requirements of the telephone company. Not until the written specifications were received by the shop on Oct. 10th from the Paris letters dated Oct. 2nd, were they inclined to put on the utmost speed in manufacture.

There were in all 307,000 jacks soldered and a million soldered connections made. The cabling on the board contains 15,595,859 feet or 3,000 miles of single wire.

The finished switchboard is 180 feet in length and will require 90 operators to operate it.

The shipping of this big switchboard was greatly facilitated through the co-operation of the Grand Trunk, Delaware, Lackawanna & Western Railroads with the Traffic Department of the Western Electric Company. Together they made all the necessary arrangements so that when the 234 boxes cotaining this switchboard were received at the Hoboken terminal of the Delaware, Lackawanna & Western Railroad, only about two days had elapsed since they were loaded onto the cars at the Hawthorne works of the Western Electric Company.

This speaks very well for the shipping facilities of these railroads.

Patents

We give below an abstract of the most important new patents relating to signaling that have been issued by the United States patent office since our last issue, compiled expressly for THE SIGNAL ENGINEER by Poole & Brown, Counselors at Law and Solicitors of American and foreign patents, 808 Marquette building, Chicago, to whom all inquiries relative to patents, trade marks, copyright, etc., litigations effecting the same, and all questions as to the validity and infringement thereof should be addressed.

A complete copy of the specifications and drawings of any of the following patents, or any other U. S. patent in print, will be sent to any address at the rate of 10 cents each.

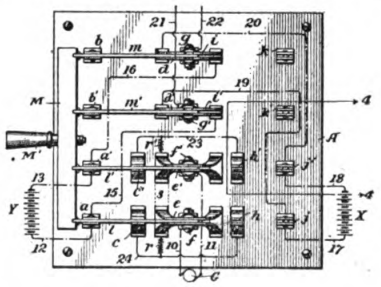
901,423. Switch for Charging and Discharging Storage Batteries. James H. Cormick, Belleville, N. J., assignor to The Union Switch and Signal Company, Swissvale, Pa., a Corporation of Pennsylvania. Filed Feb. 29, 1908.

1. In a switch for charging storage batteries, the combination with two batteries, of two pivot supports, a pair of knives pivoted on said supports, a generator, wires connecting said generator to the pivot supports, two pairs of charging clips connected respectively to the respective batteries and with which the knife blades co-operate to close a circuit between the generator and the batteries, a pair of clips between the charging clips and the pivoted supports with which said knives are in contact after they are disengaged from the charging clips, and circuits connecting the clips to each other.

2. In a switch for charging storage batteries, the combination with two batteries, of two pairs of charging clips connected respectively to the batteries, two pivot supports intermediate the clips, knives pivoted to the supports to co-operate with the charging clips, a generator, wires connecting the generator to the pivot supports, a series of clips of different heights interposed between the two pairs of charging clips and with which the knives contact when they are disengaged from the charging clips, and circuits connecting said interposed clips to each other.

3. In a switch for charging storage batteries, the combination with two batteries, of two pairs of charging clips connected respectively to the batteries, two pivot supports intermediate the clips, knives pivoted to the supports to co-operate with the charging clips, a generator, wires connecting the generator to the pivot supports, two pairs of clips of greater height than the charging clips interposed between the pivot supports and the respective pairs of charging clips, a pair of clips forming an arch over the pivot supports and of greater height than the said interposed clips, and circuits connecting the interposed clips to each other.

4. In a switch for charging and discharging storage batteries, the combination with two batteries, of two pairs of charging clips connected respectively to the batteries, two pairs of discharging clips arranged adjacent to each other but separated, two pivot supports intermediate the pairs of



charging clips, two pivot supports intermediate the pairs of discharging clips, two pairs of knives pivoted on the respective pivot supports to co-operate respectively with the charging and discharging clips, a generator, wires connecting said generator to the pivot supports intermediate the charging clips, a discharging line the wires of which lead from the pivot supports intermediate the discharging clips, wire connections between the batteries and the respective pairs of discharging clips, a series of pairs of clips interposed between the said pairs of charging clips of greater height than the charging clips with which the knives contact when they are disengaged from the charging clips, circuits including resistances connecting the interposed clips to each other, and means for moving the blades simultaneously, and one pair of blades at a point in their movement engaging both pairs of discharging clips.

901,441. Selective Signaling System. Orlando W. Hart, Fall River, Mass. Filed Aug. 10, 1907.

1. A transmitting device; a distant signal at a station; means controlled by said transmitting device, to set the signal; means whereby the signal becomes locked when the signal is set; means operatively connected with said locking means whereby a sign characteristic of the station may be made when the signal is set and so locked; manual means at the station to restore all of said above mentioned apparatus to normal position.

2. A transmitting device; a distant signal; a rod operatively connected to said signal; means controlled by said transmitting device to cause the signal to become set; a bolt to engage, and means to cause said bolt to engage, said rod when the signal is set; means operatively connected to said bolt, whereby when said bolt engages the rod after the signal is set, electrical impulses characteristic of the station may be sent; means where-