used universally for not only electrical, but also steam and mechanical purposes.

The newest departure in the asbestos field is the construction of electrothermic apparatus. The heating effect of the electric current is utilized by embedding the wire in an asbestos sheet or pad. The pad is used by physicians and nurses for maintaining artificial heat in local applications, and is said to be already largely used in hospitals. Another application of the same principle is to car heaters. A sheet of asbestos, with the embedded wires, is clamped between two thin steel plates, and the portable heater thus provided, or a series if need be, is connected to the car circuit quickly and easily. It gives an even and healthy heat, and can be so regulated as not to overheat the car.—George Heli Guy, in New York Evening Post.

THE TELEPHONE IN RAILROAD PRACTICE.*

THE growing use of the telephone in railroad work and its present advantages and future possibilities is a subject well worthy of consideration and study.

The telephone equipment at local points best adapted to the transmission of the internal business of a railroad, depends upon the location and the degree of concentration of the offices at each point. The value of a private telephone line connecting intermediate points and the division headquarters along the line of the road is dependant to a large extent upon the number of instruments that are enabled to secure intercommunication thereby.

In connection with the speaking tube or internal telephone system, special efforts are being made by the local telephone companies to offer the railroad companies instruments and apparatus that vary with the character of the service desired. For instance:

System A—A central switch with lines radiating from it, each line having one or more stations connected with it, the whole being arranged for intercommunication.

This system is operated in much the same manner as an ordinary telephone exchange, a switch being located at some central point, provided with a means for calling and receiving calls from each station, and for connecting the several stations with each other. The switch may be located where it can be operated by some person in connection with other work, or if the system is large, the services of a regular operator may be required.

This system (if but one station is connected on each radiating line) secures secrecy between any two stations and provides for independent communication between a number of stations at the same time.

System B—A switch at a particular office with lines radiating from it, each line having one or more stations connected with it, the whole being arranged for communication to and from this particular office, but not for communication between stations on different lines.

This system is used for transacting business between a particular office and several stations in cases where it is not required that the stations communicate with each other. A switch is provided at the main office only.

This system (if but one station is connected on each radiating line) secures secrecy between the main office and any one of the stations.

System C—A switch at each station, with means for connecting the instrument at such station with lines extending to each of the other stations.

This system is so arranged that a person at any station can call any other station over a special line and establish the desired connection without the aid of an operator. It does not secure secrecy to such a degree as systems "A" or "B." A switch being located at each station, access may be had to all circuits whether in use or not, but as the bell at the desired station is the only one operated when a call is made, secrecy is fairly assured, and interruptions are not likely to occur unless the use of the same circuit should be desired by a second party and his instrument be connected for the purpose of making a call. It is possible for parties at several stations to converse independently with each other at the same time.

System D—A single circuit connecting two or more stations.

All instruments being connected upon one circuit, no switching apparatus is required. Only two stations can use the line at one time and there can be no secrecy, as a call made from any station will ring all bells simultaneously.

Systems "A" and "B" are especially adopted and serviceable for freight offices and yards, round houses, switching towers, etc.

System "C" is perhaps the most convenient and satisfactory when the stations to be connected are not numerous.

System "D" is the most simple and inexpensive.

An outgrowth from system "A" is the present private branch telephone exchange. The benefits derived from the establishment and operation of private branch exchanges seem comparatively unknown, and especially so to those who have not been closely in touch with the growth of this particular line of the business, and it is with a view of arousing interest in this direction, as well as securing additional information through the discussion which I trust will follow this paper, that I have endeavored to collect as much reliable information as possible bearing upon the subject. This very lack of familiarity with the branch exchange frequently results in a much less efficient service from a given number of telephone lines than would be secured were they merged into the so-called exchange.

"In the march of civilization the improvements of yesterday are discarded for those of to-day. The tin speaking tube once used for interior communication gives way to the telephone. In this age when only time saving is considered more important than labor saving, and the combination of both is the prime object with all active minds, the importance of rapid and reliable communication can not be over-estimated. Especially true is this of the business conducted in a large building where the labor and delay incidental to employing messengers or office boys, make an important item of expense. In the general offices of a large railroad company, where every office can be connected one with another, and the various working departments be brought into talking relations with one another, this telephone service is a time, money and labor saver; and where the heads of departments are separated from each other by doors, stairs and passages it is invaluable."

Every railroad man is familiar with the general scheme of railroad organization, and the relationship between the various departments, their chiefs, etc. The lines of authority are closely drawn, and the flow of communication naturally follows these divisional lines.

As the division of responsibility among the several officials and employees who carry on the operation of the railroad company is plainly defined, so the use of the telephone tends to parallel those divisions of responsibility and to follow the lines which separate the duties which are to be performed.

In the application of the telephone to the transaction of internal business at local points and within a certain radius of the office building or about the yards and switching centers, the numerous communications necessary are passed to and fro easily and without loss of time.

The tendency is towards the constant growth of private branch exchanges, as they give more perfect interchange of communication for every class of business, concentrate the service within certain limits and enable the business to be transmitted direct without going through the medium of the local telephone operator, and vary the class and extent of the service desired according to the price paid.

The benefits to be derived from the operation of the private branch exchange have been recognized to a greater extent in the city of Chicago than elsewhere in the country. As a matter of fact there are at present in that city over 130 private branch exchanges, operating an aggregate of over 1,200 telephone instruments. These exchanges are operated by railroad and express companies, large wholesale and retail establishments, manufacturers, etc., and range in extent from four to 100 instruments. They are connected by means of trunk lines with the local telephone company's exchange, so that connection may be had with the public.

In a great many cases a particular telephone, while greatly needed for the handling of railroad business, has no occasion for public connection. If arranged so that they can secure such connection, the result is that the telephone will be used more or less for private ends; consequently, when the public trunk lines are required for legitimate railroad business, they will be reported "busy," while as a matter of fact, they are being used for private business.

To obviate this evil and to furnish as nearly as possible what is absolutely required, the local telephone company has recently adopted a scheme whereby it is made impossible to give certain offices public connection, although they are able to secure unrestricted intercommunication with every line radiating from

* Paper read before the Association of Railway Telegraph Superintendents, Fortress Monroe, Va., June 17, by W. W. Ryder, Chicago.