

THE TELEPHONE AUTO-COMMUTATOR.

Every one who is obliged to use a telephone knows how long it takes to make connections in the central office. Inventors have dreamed of devising some means whereby it would be possible to permit subscribers to call one another without the aid of the central office.

Such a scheme seems visionary at first sight, since a person naturally asks how it could be possible for an apparatus, at any instant, to select, out of ten thousand subscribers, any two who wish to be momentarily connected.

It is a fact that during the twenty years that telephone lines have been operated it has been impossible to accomplish this object, although several apparatus have been proposed and tried. The Direction Générale des Postes et des Télégraphes, which has conducted the French telephone system since 1891, installed in its offices about three months ago, says La Nature, a trial apparatus invented by an American and called an "Auto-Commutator," which appears to combine all the features requisite for attaining the end desired.

The auto-commutator gives direct communication at once, without any confusion in the line, and assures entire secrecy of the conversation. If the station called up is "busy" the subscriber calling is at once notified of the fact by a peculiar humming sound produced by his instrument.

We will not undertake to give a complete description of the mechanism by which these different results are obtained, but will endeavor merely to explain the principle of the system. All the subscribers are connected with a central station (Fig. 3), where each is represented by a commutator apparatus (Fig. 1) at which terminate the line wires of all the other subscribers.

Each subscriber has an instrument (Fig. 2) which comprises a battery, the usual devices for conversa-

tion (transmitter, *P*, and receiver, *E*), a call bell, and a special mechanism which is indicated at the exterior by a dial, *L*, provided with figures of the decimal numeration. This dial is movable around a central pivot, and is provided at its circumference, opposite each figure, with an aperture into which the finger may be inserted. In order to form any number whatever, each of the figures that goes to make up the number is brought in succession opposite a stop fixed beneath the dial. After each figure is thus indicated the finger is removed from the aperture corresponding to such figure, and the dial returns automatically to its initial position. The dial in its motions carries along with it a toothed wheel which is connected with the battery and breaks the circuit of a number equal to the figure indicated by every movement. For example, when the finger is inserted in aperture 5, and

the latter is moved to the stop, five emissions of current are produced in the line. The commutator placed in the central office is actuated by this current. An electro-magnet, *E*, at each emission causes a vertical rod, *A B C*, to ascend one notch. This rod carries three horizontal pins, which can be brought in contact with the extremities of all the wires. The wires are arranged circularly, one alongside of the other, in superposed rows, at the bottom, *D*, of the apparatus. It is therefore possible, from the calling station, to determine the vertical position of the pins 1, 2, 3 opposite the row which has been chosen. And by the rotation of the rod, *A B C*, the horizontal position of the same pins, which must be assumed in order to make the necessary contacts, can be likewise determined. In order to obtain greater resources in the combinations the two line wires are used separately, and one or the other is employed, according to cir-

cumstances, the earth being used as a return circuit. After the use of one wire for the emissions of current to give the vertical motion by means of the electro-magnet, *E*, the second is used for determining the horizontal motion by means of the electro-magnet, *H*. This changing of wires is done automatically at the last revolution of the dial. Hence the dial should always be made to effect the same number of movements, whatever be the number to be inscribed. In the apparatus now under experiment in Rue de Grenelle, for example, which is constructed for 9,999 subscribers, it is necessary always to indicate a number of four figures, with the exception that zeroes may be used at the beginning. After the subscriber has thus marked the number of the correspondent whom he asks for, he has merely to push the button of the call bell, which receives its current from the central station. After the bell has been

rung the telephone receiver is unhooked. If the line is already in use the subscriber hears a humming that indicates the fact to him. The receiver is hung up and the subscriber waits a few minutes before making another call. From what has been said it follows that it is possible to bring the pins of the commutator rod into contact with all the lines of which the extremities end at the bottom, *D*. This condition alone would suffice for a number of subscribers not exceeding a hundred, but, in order to avoid the use of too large a number of these apparatus, when there are several thousand subscribers, an arrangement has been adopted by which it is possible to combine them in groups. The one actuated first seeks in one group the "thousand" demanded, and in another group the hundred and the units corresponding to the number called up. Such combination of the apparatus, which is ob-

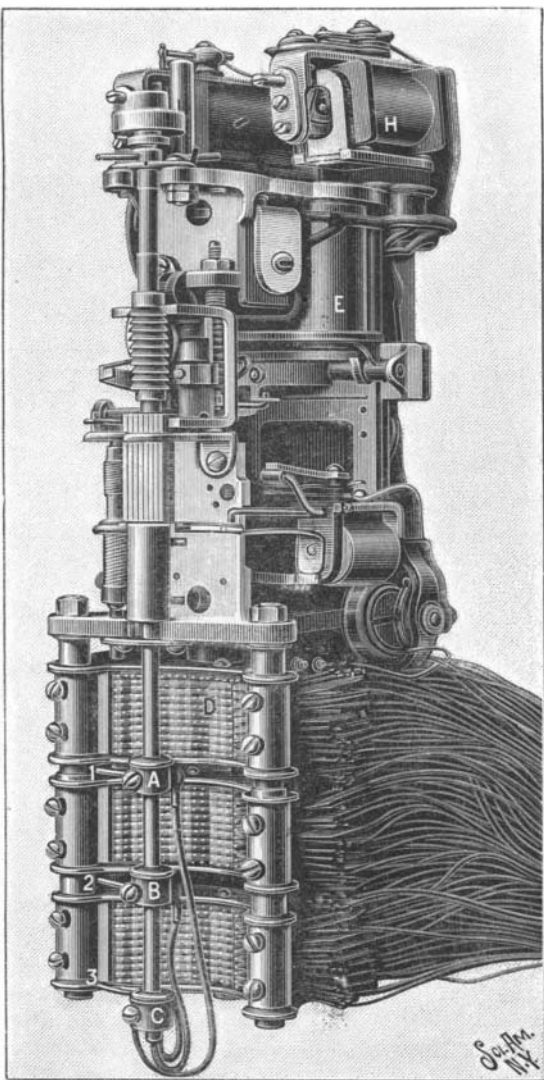


Fig. 1.—DETAILS OF A SUBSCRIBER'S COMMUTATOR AT THE CENTRAL STATION.

tained by means of the third contact pin, is analogous to that which is now made between different district offices or between the groups of the same offices. It permits of doing duty for an unlimited number of subscribers, so to speak. Nevertheless, upon the whole, although the pieces of the mechanism are not very complicated, there results, from their great number and the multiplicity of the automatic contacts that must be made, a certain complication that increases with the number of the subscribers. So, in order to begin the practical application of this system, which has given good results up to the present in the experiments that have been made with it, M. Mougeot, Under-Secretary of State, has decided that the installation should be effected in the first place in a city with but a hundred subscribers.

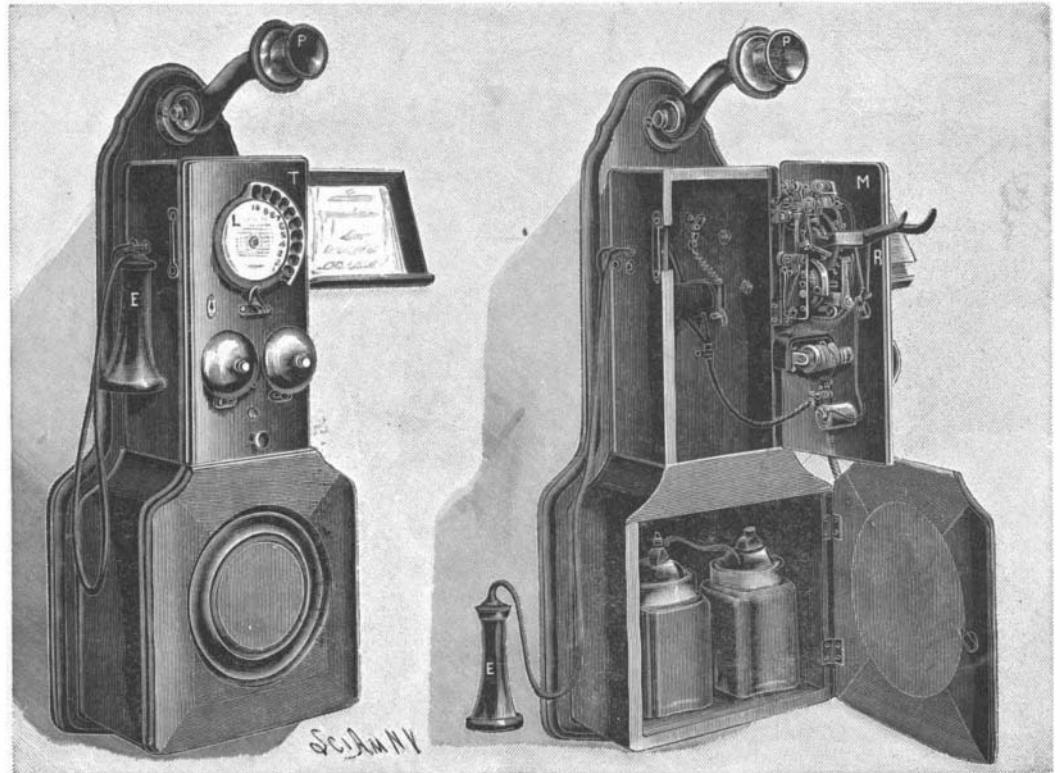


Fig. 2.—SUBSCRIBER'S APPARATUS—EXTERNAL AND INTERNAL VIEWS.

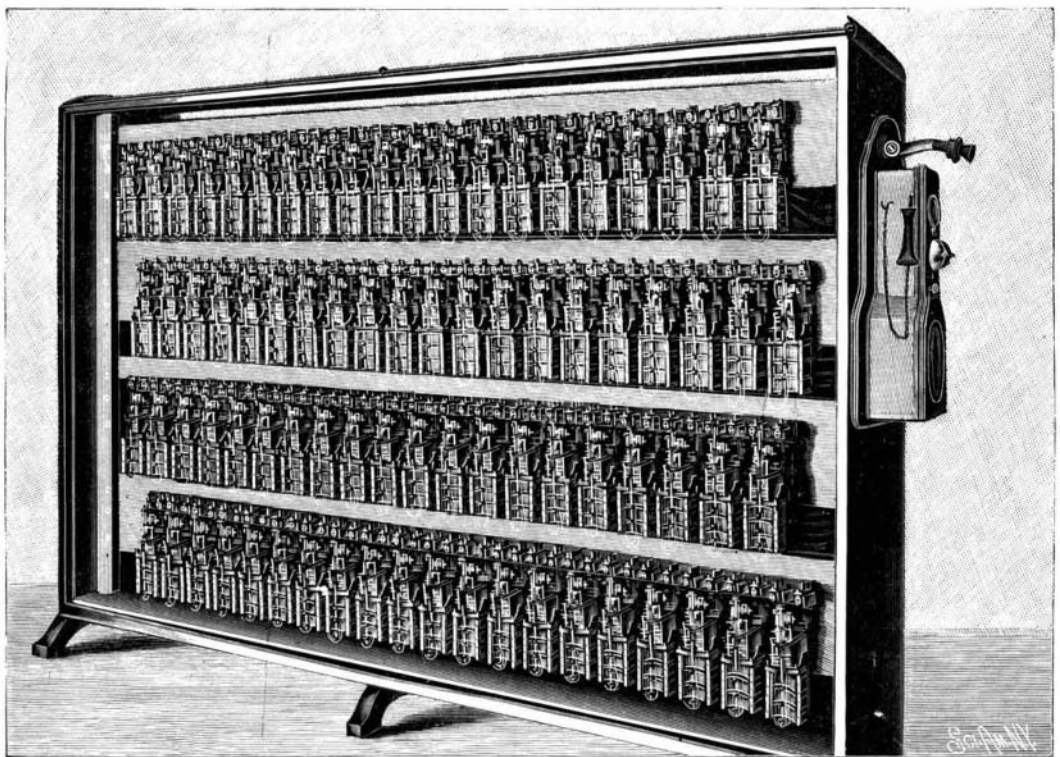


Fig. 3.—CONNECTION OF ALL THE COMMUTATORS AT THE CENTRAL STATION.

The apparatus is quite costly, since it must be constructed with great care; but the price is of small

consequence in comparison with the capital represented by the salaries of the personnel that they replace. At all events, the operation is exceedingly simple; communications are obtained with very great rapidity, and the rather acrimonious remarks that are so frequently exchanged between the subscriber and the "telephone girl" will be dispensed with.

THE HAMBURG-AMERICAN YACHT "PRINZESSIN VICTORIA LUISE."

It is now about ten years ago that the Hamburg-American Company made the experiment of sending one of their regular passenger steamers, the "Augusta Victoria," for a winter trip from Hamburg to the Mediterranean. The venture was looked upon as somewhat in the nature of an experiment, and it was undertaken partly with the object of giving employment to the vessel during the slack season of the transatlantic trade. The tour was such a thorough success that it was determined to make New York the starting point of the next trip, the results of which were such as to justify the company in instituting a regular winter service of this kind. In the earlier years of the venture, the greater proportion of the passengers were European; but of late years Americans have shown such a growing appreciation of these tours, that to-day the bulk of the passengers are taken aboard at New York city.

For some time past the directors of the company have realized that the popularity of these Oriental tours would be greatly increased if a vessel were specially designed and built for the service, and in the handsome yacht which forms the subject of our front page illustration, they have embodied all those features of convenience and comfort that have been suggested by the experience of the past decade. The "Prinzessin Victoria Luise," which has been so named in honor of the youngest child and only daughter of the German Emperor, conforms in her appearance, speed and appointments to the present accepted ideas of what goes to make up a first-class cruising yacht. With the exception, perhaps, of the new royal yacht recently built in Great Britain, she has the largest displacement of any yacht in the world, although her speed is considerably lower than that of the Russian, German and British imperial yachts. The "Queen's Yacht," as she has been called, is 420 feet long, with 50 feet beam, 18 feet draught and a speed of 20.5 knots, her displacement being 4,700 tons, or 200 more than the "Victoria Luise." The "Victoria Luise" is 450 feet in length by 47 feet in beam, with a molded depth of 30 feet, and a trial speed of 16 knots. The Russian imperial yacht "Standart" is 410 feet in length, 50 feet 7 inches in beam, has a draught of 20 feet, and a trial speed of 21.5 knots. The "Hohenzollern" is 370 feet in length, 45 feet in beam, has a molded depth of 33 feet, and a trial speed of 21 knots. The "Prinzessin Victoria Luise" is driven by twin-screw, triple-expansion engines which indicate 4,000 horse power when the vessel is traveling at 16 knots an hour. Her ordinary cruising speed, however, will be about 13½ knots an hour.

As will be seen by our engravings, she has all the characteristics of the modern yacht, such as the clipper bow, bowsprit, long overhanging stern, and ample promenade deck room. The vessel is given up entirely to the accommodation of passengers and crew. There are no second or third class accommodations, and the staterooms are loftier and more roomy than those which are found on the transatlantic service. Passengers are accommodated on three decks, known as the saloon deck, the upper deck and the promenade deck. There is also a large gymnasium located amidships between the two funnels on the boat-deck. The dining-saloon, which is on the saloon deck forward of the boiler room, accommodates a little over 200 passengers, this being the number that can be carried when the ship is completely full. A particularly pleasing feature in the saloon is a series of high-class paintings, representing the harbors of Constantinople and Sydney, and various landscapes in Germany and in North America. One of our views is taken from the gallery on the upper deck and shows the open well through this deck and the promenade deck, by which light is received from a broad glass dome above the social hall. This arrangement is similar to that on the "Deutschland," and by giving an open view through three decks it affords a sense of spaciousness which is decidedly pleasing. The upper deck is devoted entirely to staterooms, while on the promenade deck above are the social hall, library and smoking-room. The former is tastefully decorated and furnished in red, the walls being enriched with a series of beautiful paintings illustrative of scenes in the Mediterranean and the Orient. The smoking-room is finished in carved oak and the walls are relieved with numerous majolica paintings, illustrative of various aquatic sports. Agreeably to her duties as a yacht, the "Prinzessin Victoria Luise" affords a particularly spacious promenade on the promenade deck, and a nov-

el feature, now introduced for the first time, is the provision of deck shelters, which are formed by extending aft the walls and roof of two of the deck houses, thus providing an open air shelter, where passengers can get the sea air without being exposed to wind and spray.

Immediately aft of the larger of these shelters is a space measuring about 45 feet by 50 feet, in which the hatchways have been laid perfectly flush, in order to afford a smooth dancing floor. A permanent awning framework is provided, with a view to entirely inclosing this over with canvas, and thus affording a sheltered ball-room, the orchestra being placed in the permanent shelter above described.

Another novel feature which has been carried out on quite an elaborate scale is the gymnasium, of which we present an interior view. It is fitted with Dr. Zander's system of gymnastic apparatus, of which there are fully a dozen different electrically operated pieces installed. One of these, which is known as the horse, is intended to imitate the movement of a trotting horse, vertical and slightly horizontal reciprocating movement being imparted by means of cams and connecting rods. There are also a bicycle, a form of rowing machine, and the customary chest weights, dumb-bells and Indian clubs. Most of the apparatus, however, is designed to enable the user to subject himself to more or less violent mechanical massage, the rubbing and kneading being performed by rapidly reciprocating rubber-tired wheels.

The yacht started on Saturday, January 26, for her first cruise, one of thirty-five days to the West Indies and Venezuela. She will touch at all the more important points in the islands and at La Guayra, where a stop will be made for several days' trips into Venezuela. Here it may be mentioned that on account of the great number of landings which are made in the course of a tour, the yacht is provided with two large naphtha launches, each capable of holding forty passengers, and six lifeboats which are constructed on the lines of a surfboat, to facilitate landings at points where boats of this type are required. On her return to New York, the vessel will start on a fifty-seven days' cruise to the Mediterranean and the Black Sea, and on the following May a three weeks' trip will be taken around England, Ireland and Scotland. Then there will follow two trips to the North Cape; and the season will close with a voyage through the Baltic, touching at the important points, including St. Petersburg.

Swiss Hydraulic Plant.

A new hydraulic plant is to be installed in Switzerland by a large company. The motive power of the Avancon will be utilized for a generating plant which will furnish electric lighting for the town of Besc with its numerous hotels, and for the transmission of power to various enterprises in the neighborhood. A large part of the current will be used for the new rack-and-pinion electric railway which runs from Besc to the towns of Gryon and Villars. The hydraulic plant will include a dam of 32 feet upon the Avancon, from which a canal of 4,300 feet will run underground to a reservoir, and from there a conduit of 1,200 feet leads to the turbines. The generating station will be laid out for six groups of turbines and dynamos. The head of water will be nearly 500 feet, giving 1,300 horse power at the turbines during low water, and 2,400 horse power for the greater part of the year. The installation of the reservoir and canal will be carried out by the use of "béton armé," on what is known as the Malgarin system. The high-pressure conduit is in cast iron laid upon the surface; an overflow conduit in cement will be also provided, this being 910 feet long. The station will be equipped with six high-pressure turbines of the Escher-Wyss pattern with horizontal axes, each giving normally 400 horse power at 600 revolutions: they are provided with automatic regulators of improved type. The dynamos are direct-connected to the turbines, four of these being Westinghouse three-phase alternators giving 33 amperes per phase at 3,200 volts. The remaining two dynamos are six-pole direct current generators having a capacity of 300 amperes at 700 volts. The sub-stations will contain transformers built by the Compagnie de l'Industrie Electrique, of Geneva; from these current will be distributed for lighting and traction, using different systems of distribution according to the needs of each case. One of the main features of the system will be the supplying of small motors in the town of Besc and the surrounding district; the motors will range from 30, 12, down to 1 horse power. The electro-chemical works of Monthey will take about 900 horse power to supply three motors of the triphase type of 300 horse power each.

The steamship "Mariposa" arrived at San Francisco January 12, from Australia, breaking the record which she had for fast time across the Pacific. The actual steaming time from Sydney was twenty days three hours; from Auckland, sixteen days twelve hours; and from Honolulu, five days eighteen hours.

Engineering Notes.

It is estimated that the dense fog in London costs the city from \$250,000 to \$500,000 daily in the matter of bills for gas and electricity.

A new bridge is being planned for the Bosphorus. The designs which have been prepared are extraordinary. Each tower is surmounted by what appears to be a mosque with domes and minarets.

The Erie Railway is remodeling its passenger terminal facilities in Buffalo, in view of the business which will undoubtedly accrue to it, as well as other lines which enter Buffalo, by reason of the coming Pan-American Exposition.

Senator Hoar has introduced a bill into the Senate making train robbery in the United States and its territories punishable with death. A similar bill has been introduced into the House of Representatives by Chairman Ray of the House Judiciary Committee.

A company has been organized to build a railroad from Vancouver eastward through the Kootanai mining district. The government of British Columbia will probably give a subsidy of \$4,000 per mile for 330 miles. The country to be opened by the new road is one of the richest in mineral wealth in British Columbia.

The steamship "Hawaiian," of the American-Hawaiian Steamship Company's fleet, has just arrived at Philadelphia. This is one of the seven vessels of the new line which will run between New York, San Francisco, and Honolulu. The steamer is 435 feet long, 51 feet beam, and 33 feet depth. The gross tonnage is 6,000, and the cargo capacity is 8,250 tons.

A colossal ferry bridge is to be erected over the River Tyne at the harbor mouth, connecting North with South Shields. The bridge will be similar in design to that erected at Bizerta in Spain. The suspension bridge will be erected at a height of 270 feet, and will have a clear span of 640 feet, so that even the largest vessels may be able to pass up and down the river with facility. From the bridge will depend a platform, suspended upon cables, which will have accommodation for tramcars, horses, vehicles, and 200 passengers. The mechanism of the bridge will be actuated throughout by electricity.

A curious fire broke out in the coal storage yards of the British Admiralty at Portsmouth recently. The Welsh steam coal reserved for naval purposes is stored in huge heaps, each containing many thousand tons. One of these heaps evinced signs of spontaneous combustion. No flames were visible, but copious volumes of smoke were emitted. Fortunately, there were several dockyard hands on the spot, and the fire was soon extinguished. The authorities, however, are constantly encountering trouble of this description. After periods of prolonged wet weather, such as England has been recently experiencing, these heaps ignite through spontaneous combustion, because the Welsh coal is highly inflammable. During the past few months no less than three such outbreaks have occurred, only they have been attended with much more serious results than this last conflagration, since several hundred tons of coal were consumed before the flames were extinguished. The naval authorities intend to store the coal in large inclosed depots, the building of which is now in rapid course of construction, so as to obviate further trouble of this description.

The high price of coal in England has had the effect of attracting attention to the vast wealth of this product in the colonies, especially in Australasia, and determined efforts are being made to place the article upon the English market. The progress made in this industry in New South Wales and Victoria during the past few years has been remarkable. Australia possesses extensive areas of coal-bearing territory, and up to the present over 100,000,000 tons have been produced for the world's markets. Last year alone no less than 6,000,000 tons were exported from the collieries in New South Wales. Hitherto the industry has been handicapped by the inefficiency of the transport service by which to convey the material to the coast, but now that railways are rapidly developing through the various colonies numerous collieries are being established. In Victoria seams varying from 2 feet to 5 feet in thickness are found in abundance, and in some districts where boring operations have been carried out, it is computed that nearly 60,000,000 tons are available. The coal is specially recommended for steaming purposes, since it emits only a minimum of light smoke. It practically costs nothing to mine the product, since it lies so near the surface and in some instances the coal beds, averaging 70 feet in thickness, are worked as a quarry with open face. It has been seriously considered by the British Naval Department whether this fuel could not be requisitioned for naval purposes, in which event it could be more expeditiously and more economically utilized for stocking the naval bases in the East, and in the Antipodes. Should the suggestion be affirmed it will have the effect of stimulating the industry considerably.