

DISCUSSION ON "THE AUTOMATIC TELEPHONE IN RELATION TO CITY SERVICE." JEFFERSON, N. H., JUNE 29, 1910.

Frank F. Fowle: Mr. Smith's paper is a very interesting description of the general features of a large automatic installation, from an operating standpoint. The descriptive nature of the paper does not permit of elaborate discussion, but there are several novel features worth emphasizing.

The ingenious method of checking suburban toll calls, with the "rapid fire" or "express" method of operating, is especially interesting. It does away with the drag on the service caused by releasing the calling subscriber and then calling him back when the connection is ready—a procedure which, as Mr. Smith describes, is only necessary to verify his number and prevent mistakes or fraud.

The problem of a meter for measured service seems to have been solved to the same degree that it has been worked out in manual practice, but it is yet lacking from the standpoint of the subscriber. The only satisfactory solution to the subscriber will be an indicating meter at his telephone, which he can read himself. The means for accomplishing this appear to be at hand, both in manual and in automatic service. There seems to be some apathy towards realizing this ideal arrangement on the part of telephone companies, due no doubt in part to the cost of an extensive change in subscribers' equipment, and in part to a belief that the public does not demand it. On the latter score, the public has been discouraged in some cases into believing that this ideal plan is very costly and difficult of achievement.

Coin boxes for prepayment service have long been in use in manual systems. They have been operated under two plans, one requiring the deposit of the coin to signal the operator, and the other requiring the coin to be deposited after the order has been given, when told to do so by the operator. The former plan is used in business districts, the latter in residence districts, where it might occasion some inconvenience to find a coin in an emergency or late at night. Under both plans, the operator controls the disposition of the coin by means of keys in her cord circuit, sending it into the coin box if the call is completed, or returning it to the subscriber if the call is not completed.

Mr. Smith describes a device by means of which the coin box is employed in automatic prepayment measured service. The coin here is not deposited until the called party responds, and then it must be dropped in the box in order to take a short circuit off the transmitter at the calling station.

This form of service admittedly has disadvantages in public places, stores, waiting rooms, etc., but on the other hand it has admittedly several disadvantages for offices and residences. In view of the fact that this class of service is usually charged

for at a low minimum, it comprises in some cities a large part of the whole development, and considerations affecting it are therefore important.

The functions now controlled at the subscriber's station could be arranged to operate a meter dial and thus register the call within sight of the calling party, thereby doing away with the objections to the coin box in office and residence service. The costs of reading and collecting might be slightly greater than they are with the present system, but not such as to increase the total cost of operation to any appreciable extent. It is quite conceivable that the meters could be read by calling the subscriber on his telephone and asking him for the reading, although in such a case it would be necessary to have duplicate meters in the exchange, as a check.

A meter situated in the exchange, assuming that to be the only meter, is beyond the control or observation of the subscriber, and theoretically this is not the proper place for it, although such an arrangement is both convenient and economical for the company. There is natural suspicion of such a plan on the part of subscribers, particularly when they are unable to check their bills.

Under the proposed plan, the meter should not cost more than the present coin boxes, and probably less. The maintenance costs should also be no greater.

The writer asks Mr. Smith the following questions in regard to automatic practice in San Francisco and Oakland.

1. In the case of manual private branch exchanges, what arrangements are made for night service when no operator is on duty? That is, is there any practice which corresponds to the plan of connecting certain extensions through the branch board to the exchange for night service, as in full manual systems?

2. In the case of manual private branch exchanges, are the extensions equipped for automatic or manual operation, or both?

3. Are automatic, unattended private branch exchanges in demand or in use?

4. Has party line service been developed, and if so, of what classes. Is selective ringing employed?

5. What standard of transmission in terms of No. 19 B. & S. gauge cable with 0.054 or 0.060 mf. per mile, was employed in laying out the distribution, and the toll trunks, for all service in the automatic zone?

Geo. D. Shepardson (by letter): The telephone exchange systems present an interesting case of the gradual displacement of sentient actions by automatic operations which has been going on in most lines of industry. It is common to distinguish between "manual" and "automatic" exchanges according to whether human effort at the exchange is or is not required for performing the various operations of connecting the calling and the called subscribers. As a matter of fact, manually operated

systems use more and more automatically operated devices, and automatic systems require more and more manual operation as they become more and more extensive. The exact stage where a given system shall change from automatic to manual operation or vice versa is a question partly of simplicity of design and of certainty of operation, and partly a question of required investment and of dividend-earning capacity.

The first impulse or judgment regarding automatic telephone systems is that they may be suitable for small towns, but that they are inherently outclassed by manual systems when applied to the multifarious demands of large business communities. It is interesting to learn that practically every service has been met successfully by automatic devices, with the single exception of toll service, where partially manual operation is found desirable. Theoretically the automatic system could take care even of such service, and the probable reason for the introduction of manual operators at this stage is doubtless due to financial rather than to purely theoretical or engineering considerations.

The various checks on measured and toll service are of much interest. The feeling that an automatic apparatus is insentient probably adds greatly to the instinctive desire of customers with weak or perverted moral natures to "beat the company." A somewhat similar tone-test on the line of the subscriber reported as calling for a toll connection might save full-manual systems some trouble from tolls erroneously or viciously charged against an innocent subscriber.

The development of the automatic telephone system has proceeded to a stage that compels admiration. Both the electrical and the mechanical features bear evidence of careful forethought and of fruitful experience. A detail that contributed much to the successful operation of switching devices at a considerable distance from the battery, is the minimizing of friction in the selecting switch by having the plunger move to the chosen position before coming into contact with the fingers or jacks.

An equally ingenious feature of the earlier exchanges was the use of one side of the line for selecting the bank or group, while the individual unit was selected over the other wire. In the later development the successful use of the time element in differentiating between the group and the individual, bears evidence of careful design and development. The elimination of the ground connection doubtless removes a source of considerable stray noise and other trouble. But a question arises as to whether trouble is not experienced in requiring the calling subscriber to observe a certain rapidity in making successive settings of the dial, lest too long an interval result in automatically cutting off the connection before it is complete.

The use of primary and secondary line switches for saving time and trunks seems closely analogous to the development of local automatic exchanges for handling business of a district at some distance from the main exchange, such as are being used as auxiliaries to automatic or manual exchanges.

The mention of difficulties arising from the Chinese method of counting, prompts the suggestion that French girls should make good telephone operators on manual boards having twenty jacks in each row. For, if the French think as they speak, they think in twenties rather than in tens. Thus, instead of thinking of 88 as eight tens plus eight, they apparently think of it as four twenties plus eight, for they call it "quatre-vingts huit." The neophyte French operator would automatically look to or reach for the fifth row of jacks instead of for the ninth row as would be more natural for the ordinary girl.

A point of especial interest in the automatic system as presented in this paper is the simplicity of the talking circuit and its freedom from series impedances and objectionable leakages.

Altogether, the system here presented seems to be a triumph of inventive skill, of engineering research and of financial perseverance and courage.

L. M. Antoine (by letter): The paper is limited to a description of the San Francisco plant and does not touch on the advantages to be derived by the system installed there over other systems originally installed.

A point which appealed to me was the small number of switches used, and the flexible arrangements by which these few switches were made to handle the load. The elimination of all superfluous equipment should carry with it many advantages, such as lower first cost, less floor space, reduced maintenance cost and more efficient service due to less chances for trouble. The latter two points are of paramount importance to an operating company, for a lesser amount of equipment will require fewer switchmen to attend it and can be more carefully watched. At the present time first class switchmen are very hard to get and command good salaries. Practice has shown that equipment in constant use is less subject to trouble than that which is only used occasionally, for dust will collect on contacts and moving parts of idle switches, and make their operation sluggish and uncertain.

Another problem which has confronted operating companies, and which seems to be satisfactorily solved in this system is that of giving good measured service. It is not an easy matter to design a meter that will automatically register completed pay calls only and eliminate incomplete and busy calls, calls to free numbers, etc. It has evidently been accomplished and the device and circuits are so simple that its operation should be positive.

One of the strong points of this system is its efficient private branch exchange service. In Portland, Oregon, nearly 25 per cent of the automatic telephones are stations on private systems of some kind. In the standard private branch exchange the trunks and stations terminate in jacks with lamp signals at a small manual switchboard and each station is equipped with an automatic telephone.

Taking down the receiver signals the operator who connects the calling station with a trunk, or another local station asked for. All local calls are completed manually by the operator, but on trunk calls the station does the calling and releasing automatically. This is a great advantage for when the station has been connected to a trunk the calling party can operate as on a main line telephone, and call as many numbers as he desires without attracting the attention of the operator. Until he hangs up his receiver for a period of time longer than that required to release the call the operator gets no supervision. On incoming calls from the central office the rotary connectors select the idle trunks, as described in the paper under discussion. All are two-way trunks. The board is equipped with a calling device enabling the operator to do the calling if desired.

Automatic intercommunicating service has been perfected to such an extent that it is very desirable in private systems of but a few stations. The operation is the same as that of a manual intercommunicating system, except that the calling is done automatically.

Another kind of service that is growing into favor is that of inter-communicating between extension telephones on a main line. A party on one extension wishing to talk with another on the same line calls an eight on his dial which connects his line to a specially designed switch. This switch sends out generator to ring bells on his own line, and also furnishes talking battery. By using different rings for each extension it makes a very satisfactory office system.

A service which is being extensively used is that of a house system in connection with main lines in apartment houses. The main lines are wired in the regular way except that they are multiplied into sets at the vestibules, tradesmen's entrance and janitors' quarters. These sets are equipped with push buttons—one for each apartment—with the name of the occupant opposite. When calling any apartment over one of these sets it is merely necessary to press its respective button to ring. On removing the pressure the push button restores itself part way and remains in a talking position until the receiver is hung up, when the button is restored to normal. All 'phones in apartments are so wired that if a push button is depressed before the dial is rotated the bell at the janitor's station is rung and a drop corresponding to the calling telephone energized. If a subscriber wishes to make a trunk call he makes it in the regular way. As soon as the dial is rotated the janitor signal circuit is open.

Toll service is one of the most essential requisites for the success of any telephone system, for the value of a telephone to the subscriber depends as much on the number of subscribers he can reach as on the quality of the service. When toll traffic is as heavy as it is between San Francisco and Oakland, too much attention cannot be given to the development of an efficient and rapid system. With the system installed at San Francisco

and Oakland the service should be very rapid, for the suburban operator dials the required number and the checking is done later.

A. B. Smith: Answering Mr. Fowle's questions in order, I will state as follows:

1. Private branch exchanges, which are used in connection with automatic public exchanges, are given the same night service as is customary in an all manual plant. Such telephones as it is desired to connect up for the night are equipped with automatic calling devices. They are thus enabled, when plugged up to trunk lines for the night, to operate the automatic switches in the public exchange just as if each were on an ordinary subscribers line.

2. As indicated above, only such telephones in the private branch exchange are equipped with calling devices, as are expected to be used for direct calling. Owing to the simple nature of the calling device, it is an easy matter to equip any manual telephone in the branch exchange so that it will be able to operate the automatic switches.

3. Unattended, automatic private branch exchanges are in demand and are in use in a number of places.

4. For many years party line service has been given by automatic exchanges. The four frequency harmonic system is employed, using 16-, 33-, 50- and 66-cycle currents to ring the bells. Both two-party and four-party service are in use.

5. Since the matter of transmission standards falls within the field of the constructing engineer, I will leave the discussion of this point to Mr. S. G. McMeen.

Professor Shepardson's remark regarding the time element necessary in two-wire automatic operations, requires a little explanation. When the subscriber takes his receiver from the hook, a circuit is closed through the telephone in exactly the same way as in any ordinary common battery telephone. When the dial is rotated to send in the impulses for any given digit, it merely opens and closes the circuit as many times as there are units in the digit; that is, if the subscriber pulls the dial for the figure 3 the calling device would open and close the circuit three times, and would come to rest with the circuit closed.

If the subscriber so desires, he may wait several minutes between successive settings of the dial without causing any further inconvenience than to delay the completion of his call. The release is initiated by the opening of the line circuit which is done by the hanging of the receiver on the hook.
