

# Public Telephone

JOURNAL FOR THE TELEPHONE PROFESSION

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No. 2



**Five Years of  
Automatic  
Operation Inquiries on  
Public Operation  
for Long Beach, Cal.  
Automatic Switch —  
y and Today**

“T frequent times during the past eighteen years we have installed in our Lincoln Main Exchange, Automatic equipment of the various latest type then available.

“All of these types of equipment are working together and furnishing a grade of service that is very satisfactory to the telephone using public.”

- M. T. Caster, Plant Superintendent,  
Lincoln Telephone and Telegraph Company.



fundamental case for automatic—that is, “Service.” And service includes not only accuracy, speed, and reliability, but transmission as well. It would be easily possible to construct automatic switches to work with a fair degree of satisfaction on lines with poor insulation, with heavy leakage, or even on grounded lines. But transmission on such lines, whether they terminate in manual exchanges or automatic, can never be satisfactory.

When we say that automatic switches are constructed so as to have a wide margin of operation, we do not mean that they can be expected to operate faithfully on lines where the conditions are so severe as to bring the quality of transmission far below ordinary standards; but that lines will become practically useless for common battery transmission purposes long before they become so bad as to prevent reliable operation of switches.

Among those who have made no close investigation of the subject there seems to be some doubt as to whether automatic switches are not expensive to maintain in proper operating condition. In answer to this we find it valuable to call attention to maintenance expenses in actual exchanges in which automatic equipment has been in operation for several years. In every exchange where automatic is adopted, we recommend definite maintenance routines, whereby switches can be kept easily within the limits of operating possibility continuously. We have found that where these recommendations are followed faithfully, maintenance expense is even lower than it is in manual exchanges of similar size. As to the training of employees for this work, our experience has been that the telephone company's maintenance force can learn sufficient of the principles of operation during the time that the automatic equipment is being installed. In very rare cases it is desirable to place a man in our manufacturing plant for a short period, and this can be arranged for when desired.

#### USING OLD TELEPHONES

In an effort to reduce the amount of investment to as low a figure as possible, it is sometimes suggested that when converting to automatic, the old telephones be retained and equipped with dials. Except where the telephones are of the local battery type, this can be done, and has been done in very many cases. There is no doubt, however, that it is more satisfactory to install entirely new instruments, since they are designed to operate especially in conjunction with automatic switches, and transmission will be at its very best when they are so used. It frequently happens, however, that a company feels that in order to reduce the amount of investment to as low a figure as possible, it would be better to mount dials on the old instruments, and our experience has been that good service can be given in this way.

“How much floor space is required for automatic equipment?”

The saving in the amount of floor space, although great, is not usually so important as the saving in the cost of building construction as a whole. There is a decided reduction in the amount of space taken up by the equipment itself; but the reduction of expense of operators' quarters, halls, stairways, etc., is by far the bigger item. Frequently the automatic equipment is installed in the same building that formerly housed the manual switchboard, although it is desirable to construct an entirely new building for the purpose.

“When the telephone line or instrument is out of

order on an automatic system, how is the trouble reported?”

In every automatic main exchange, there is at least one operator present to handle toll service and perform those functions that cannot well be taken care of by machines. This operator is reached by dialing a special number. It frequently happens that where the toll traffic is not heavy, the toll operator can care for all complaint and information calls as well. In other cases a special position is installed. In the case of an unattended exchange (C.A.X.), the subscriber may reach an operator in the city exchange by a similar method.

“Have any automatic switchboards been taken out of service and manual substituted?”

Sometimes in competitive territory a company operating an automatic switchboard has been bought out by a competitor and the switchboard dismantled. In no case has an automatic switchboard been removed because it has reached the end of its useful life or has failed to give satisfactory service.

#### RURAL EQUIPMENT

“What number of stations can be placed on an automatic rural line, and how are they signalled?”

There are no real limitations as to equipment, except that the lines must be full metallic. If selective harmonic ringing is required, as many as ten stations may be placed on a line and loop dialing used. For a larger number of stations, automatic code signalling is used with either loop or simplex dialing. As many as twenty stations can be handled this way if desired.

“How are calls to dead numbers, changed numbers, etc., handled?”

In every automatic switchboard provisions are made so that by making a very simple change in the terminal assembly, such calls are automatically routed to the information or other operator for disposal.

“Is our company too small for the use of Automatic to be profitable?”

To attempt to draw a definite line in size of subscriber list beyond which Automatic equipment will not prove in, would be futile. At the same time there is little doubt that for companies operating single exchanges of 100 or 200 subscribers, for Automatic to be profitable, all operators must be eliminated.

There is a plan, however, whereby such small exchanges can be made very profitable. This is, by establishing a toll checking center for two or more such exchanges in a community, and installing C.A.X. switchboards for local traffic. The only operating cost in such cases would be that of toll checking which could be shared by all companies, and that of periodic maintenance visits which would be negligible. It is probable that this plan will be used very extensively in the future.

The above questions by no means include all of the topics in which operating men are showing interest; but they are typical, and indicate that the progressive telephone man today is thinking automatic more than ever before.

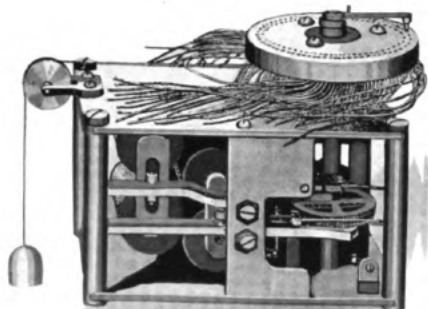
#### SERVICE AND PROFITS

Naturally the two phases of the business uppermost in his mind are rates and service. They are fundamental; everything else depends on these considerations.

The writer has frequently spoken with operating men using manual equipment who declare their profits are just as high as those of automatic operating com-

# The Strowger Automatic Switch— Yesterday and Today

*The Present Design and Construction of Strowger Automatic Equipment Result from Developments and Experience Extending Over a Period of More Than Thirty Years. Efforts of Pioneer Engineers Show That Time Has Been an Essential Factor in the Present Success and Widespread Adoption of Automatic*



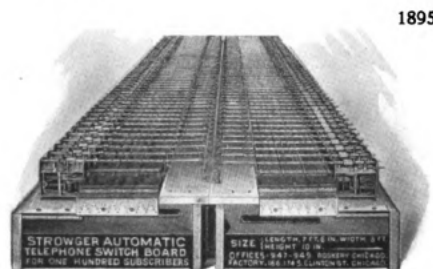
1892

CUMBERSOME and expensive as it was claimed to be (and undoubtedly was), the most remarkable fact (to outsiders at least) about the first Strowger switches ever placed in public service was that they worked and gave entire satisfaction.

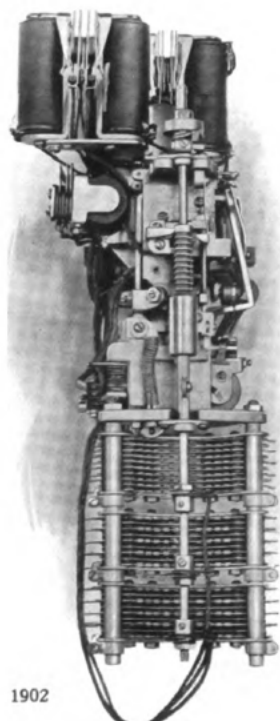
This view shows one of the switches installed at La Porte, Ind., in 1892. The line terminals were placed around the circumference of a flat rubber disc. The wiper was mounted on a shaft which was run through the center of the disc at right angles to its plane. The rotary motion of the wiper shaft was supplied by two sets of magnet-actuated pawls. One set moved the wiper over ten contacts at a time; the other moved it over one contact at a time. A release magnet disengaged both pawls, allowing the wiper to return to the "zero" position.

The operation of the system required the use of five wires from each telephone to its switch.

THE "zither" type of switch is of particular interest in that it represents a radical departure from any other switch designed either before or since it made its appearance. The idea back of its design was to get away from the multiplicity of bank wires which had been one of the troubles of the first switch. The "bank wires" of the "zither" switch were bare wires stretched parallel across a wooden box and surmounted by rods carrying a number of wipers. The wipers were mounted ten on each shaft and arranged helically, so that a certain number of longitudinal steps followed by a number of rotary steps placed one of the wipers in contact with the proper wire.



1895



1902

FOR the first ten years of its development the Strowger switch took numerous forms, each one radically different and measurably better than the preceding. But with the invention of the principle of trunking by groups, it was possible to adopt a form which would be fundamental, and then to build it up to perfection by means of minor improvements and refinements as fast as they were made possible.

This illustration shows a switch which, although developed twenty years ago, bears close resemblance to the switch of today. The line terminals are arranged as in the modern switch except that the line bank is divided into two sections, each having five "levels." This was necessary in order to keep adjacent levels far enough apart to reduce cross talk between lines terminating on adjacent levels to a low point.

Each telephone at this time had but two wires leading to the central office. These were used for voice transmission, signaling, and, using a ground return, for the transmission of impulses. Local batteries were used for furnishing current for voice transmission. The magneto used with former telephones was replaced with a central office ringing machine, and the ringing controlled by a push button on each telephone.

The fundamental problem of trunking having been solved, there was now no limit to the size of exchange in which automatic equipment could be applied. Within the next two or three years systems using the above switches were placed in service in several cities, some of them having an installed capacity of several thousands of lines, and it is an interesting fact that nearly all of this equipment is in use today and working in conjunction with equipment installed in later years.

Equipment of this type was also developed for use with common battery transmission, for use on party lines using full selective (harmonic) ringing, and for other various classes of service which up to that time had been declared impossible with automatic equipment.



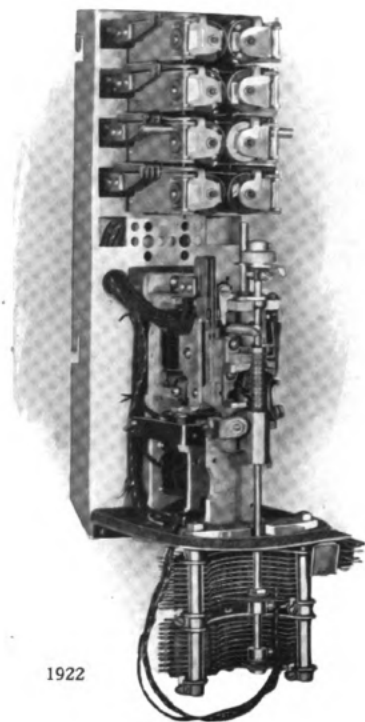
AS stated in the preceding paragraph, the operation of the "three-wire" switches required a ground wire at the subscriber's station. This ground wire was used for effecting release of the switches when the hook was depressed and for transmitting impulses to the switch magnets.

The "three-wire" calling device and hook switch were linked together mechanically and formed a rather cumbersome arrangement—necessarily so, since it has many functions to perform. Automatic development workers cast about for some means to simplify this design, and at the same time to improve, if possible, the performance of the switches at the central office. The two-wire system, one of the earlier switches of which is illustrated here, was the result of these efforts.

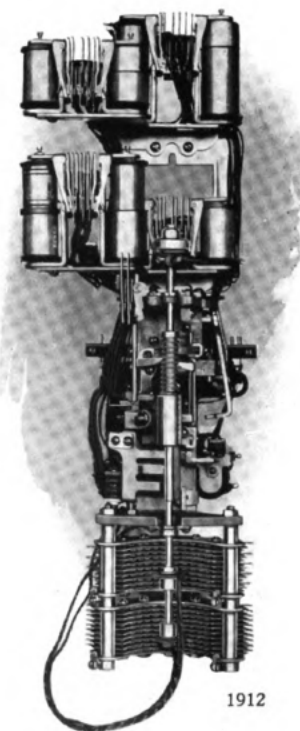
There were three major results attained by the development of this system: First, the function of the hook switch was merely to close the line circuit through a line relay at the central office, upon the lifting of the receiver. Second, the calling device, instead of sending a separate group of impulses over each line wire, merely served to open the line circuit (previously closed by the hook switch) a number of times in rapid succession corresponding to the figure dialed. Third, the release was simplified, being controlled by the same pair of springs on the hook switch that were utilized to close the line relay circuit.

The design of this switch was made possible by the perfecting of the now familiar copper-clad slow-acting relay, which is so constructed that it may be held energized by a series of rapidly recurring impulses of current such as are produced by the operation of the two-wire dial.

While the main idea back of the design of the wire system was the simplification of subscriber's station equipment, the performance of the central office equipment was decidedly improved also. One result of two-wire operation has been the practical elimination of "off-normal." In the three-wire system grounding of a line caused the switch at the central office to step up one step, and remain in that position until the switchman perceives the signal given, even though the ground be momentary. In a two-wire system a momentary ground or cross means but a momentary pulling up of the line relay, while, if the ground or cross be permanent, a signal is given which enables the central office attendant to detect the trouble and take steps to clear it. More remarkable still, the change from three to two-wire has not affected the basic principles of automatic trunking.



1922



1912

PERFECTION and permanence in modern telephone equipment adequately describes the Strowger Automatic switch of 1922. The mechanical differences between the switch shown here and the one pictured above are fairly apparent. Chief among these improvements is the development of the standard horizontal relay and their arrangement on the switch so that they are easily accessible for adjustment or repair. Back of this design also was the recognition of

a need for the individual dustproof switch covers which have characterized all Automatic installations for the past six years. This was also made possible by the compact relay assembly illustrated here.

The minor improvements made in mechanical construction and in the material used are too numerous to mention in detail. It is sufficient to say that the switch of today is so reliable in operation and so permanent in construction and adjustment that maintenance costs—always extremely low—have been considerably lessened.

The most significant fact about the present design is that, with only slight modification, it has been capable of meeting every telephone traffic or service need that has come up either in this country or abroad. In fact, the difference in design or installation arrangement are chiefly of a circuit nature, and would not be discernible to anybody not familiar with Automatic design. The resulting economy, both in the manufacture of the equipment and in its proper care and maintenance, is of no small importance.

The fact that nowadays the flexibility of Strowger Automatic equipment is seldom questioned is ample evidence of what it has done to serve the telephone-using public of cities of all sizes throughout the world. There will, of course, be further improvements made, new materials introduced, new problems to be met and solved, and through these things, the Strowger switch of five or ten years hence will be better than that of today. But the fundamental problems of Strowger Automatic, solved twenty years ago, will remain solved, and through their solution the needs of the world in automatic telephony will be met in the future as they have been in the past by Strowger, the telephone of the present and the future.

## Automatic Telephone

*A Journal of Information for the  
Telephone Profession*

Issued Monthly by  
**AUTOMATIC ELECTRIC COMPANY**  
CHICAGO, U. S. A.

H. E. CLAPHAM :: Editor

*This publication will be sent without charge to all  
interested persons upon request*

### Service as Rate Basis

**B**Y far the most important development revealed by a review of recent decisions on rate cases is the increasing tendency for regulating bodies to take a decided stand against basing rates entirely on property valuation. Quality of service is becoming more and more important a consideration in aiding a commission to reach a fair decision.

This was emphasized recently when a certain state commission, in refusing an increase of more than 15 per cent (leaving the company with the lowest telephone rates in the state), while admitting that the rates granted would not pay a fair return on the amount of money invested, declared that they were awarding the company all that the service warranted.

This opinion declares that the proper basis for rates is not what the service costs under conditions where antiquated or extravagant equipment is used, but what it would cost if the equipment were modern and efficient.

This does not mean, of course, that it is fair to make service alone a basis for rate awards, but it does mean that it is to become a more important factor in the future.

The service rendered by companies operating Automatic protects them from such adverse decisions as the one outlined above.

### "Inexpensive" or "Cheap"

**I**T is quite natural that one of the chief resistances that the telephone operating man builds up in his mind when approached concerning his attitude toward automatic is against the somewhat higher first cost of that equipment as compared with manual. Nobody wants to pay 20 or 30 per cent more for a certain class of product unless he can be assured in his own mind that the additional cost will eventually be *more than* justified.

The whole question of cost of telephone equipment resolves itself into this: Does the prospective buyer want something "inexpensive," or something "cheap"? For a product to be "inexpensive" its value must exceed its cost, however high that cost may be. A "cheap" product has its cost reduced to an attractive figure, but at the expense of value.

Herein lies the fundamental difference between manual and automatic telephone equipment. Automatic equipment is inexpensive because, even though costing somewhat more at first, it eventually brings more real value in profits and satisfaction to those who buy it.

### New York Telephone Men Meet

**T**WO hundred and fifteen delegates, representing 315 independent telephone companies, attended the opening session of the first annual convention of the Upstate Telephone Association at the Hampton Hotel on January 18.

Mayor William S. Hackett welcomed the delegates to Albany, and Mr. George R. Fuller, president of the association, responded. Mr. Roy S. Smith welcomed the members in behalf of the Chamber of Commerce.

Other speakers on the program were Messrs. F. B. MacKinnon, president of the United States Telephone Association; Charles E. Morris of New York, W. S. Vivian of Chicago, and J. G. Ihmsen of Albany, all of whom talked on the telephone situation, growth of telephone associations, insurance, and accident prevention.

Mayor Hackett in his address of welcome declared co-operation essential in every business. "A demonstration of the co-operation and harmony which exists in the telephone business is shown in the gathering of so many independent operators here in Albany," he said. "I hope you will make Albany the permanent headquarters of all future conventions, and I want you to feel that Albany is on the map and extends its heartiest welcome to all," he declared.

Senator Frederick M. Davenport and Mr. E. B. Rogers, telephone engineer of the public service commission, spoke at the second day session.

### Remarkable Record of Automatic Service at Lincoln

**T**HE Automatic equipment in the Main Office at Lincoln, Neb., furnishes almost a complete history of Automatic telephone development since 1903, when the first switchboard of 3,000 lines was placed in service. Following is a brief summary showing the original 1903 installation and the various additions made since that time:

- 1903—3,000 lines 3-wire local battery with individual first selectors.
- 1905—1,000 lines 3-wire local battery with individual first selectors.
- 1906—500 lines 3-wire local battery with individual first selectors.
- 1906—500 lines round type Keith units 3-wire local battery.
- 1907—1 Keith flat type 3-wire local battery P.B.X. unit.
- 1910—10 2-wire Keith units, common battery.
- 1910—2 2-wire P.B.X. units, common battery.
- 1911—5 2-wire Keith units, common battery.
- 1912—10 2-wire Keith units, common battery.
- 1916—1 2-wire P.B.X. units, common battery.
- 1919—5 2-wire Keith units, having connectors with horizontal type relays.

In a letter recently received from Mr. M. T. Caster, plant superintendent of the Lincoln Telephone & Telegraph Company, he says, in referring to this summary:

"All of the equipment listed above is still in service in practically its original form, with the exception of the 500 lines of individual first selector equipment installed in 1906. These switches were remodeled in 1912 and used to provide additional trunk switches at that time. No equipment has been discarded except parts of the original power plant which became inadequate for our needs in recent years.

# The P-A-X in Public Schools

*The Growing use of the P-A-X in Public Schools is Recognition of its Efficiency and Adequacy in Meeting the Needs for a Rapid and Accurate System of Interior Communication.*

**P**UBLIC school authorities are coming more and more to the conviction that an efficient interior system of communication is essential to the proper conduct of any intermediate or high school of fair size.

When it is considered that the teaching force and mechanical force of the average school, outside of the elementary or grade schools, consists of fifty or more employees; that the average salary paid is higher, and that the amount of time actually spent in school work is shorter than in any business concern, it must be conceded that any device which will save the time of these forces and thereby increase the amount of effective time they can spend in actual work, is well worth consideration. It is in recognition of this fact that the use of Automatic telephones in public schools is becoming more common.

The advantages of the P-A-X are just as valid in public schools as they are in business and industrial concerns. First, there is the entire elimination of operator expense. When a manual telephone switchboard is used, someone must be near the switchboard

at all times. Frequently manual service is used as an excuse for having an extra clerk in the office, where part of the time of a teacher or student would be

ample to take care of the small amount of clerical work required. The saving of the salary required by a clerk or an operator to attend to a manually operated switchboard soon pays for the cost of a P-A-X system, and returns good dividends for all time in the future.

Any telephone service, to be worth while, must be prompt. With the P-A-X, connections can be made in less than three seconds, which shows remarkable contrast with the kind of service referred to above, where a clerk in the office attends the switchboard along with her other duties, and where the average time necessary to get her attention is from twenty to

## CITY PUBLIC SCHOOLS JACKSON, MICH.

January 25, 1922.

Mr. D. R. Middleton,  
Automatic Electric Company,  
Detroit, Michigan.

Dear Sir:

*I am pleased to report that the P-A-X systems, which were installed in all the rooms of our East and West Intermediate schools about four years ago, have proved exceedingly satisfactory. The ease of establishing connection without the intervention and expense of a switchboard operator, the clearness of communication, and the absence of mechanical defects, are features which have strongly commended this system to principal and teachers. We are also pleased with the prompt service rendered by your company whenever the engineers in charge of the school plants have needed assistance. A different system installed in our central high school some years ago is now entirely out of use because of mechanical defects. We are rooters for the P-A-X.*

Very truly yours,

E. O. MARSH,  
Superintendent.

thirty seconds.

Occasionally the objection is raised, that in a school the principal must have supervision of all calls in order to prevent the abuse of the service by teachers calling each other unnecessarily, and thereby wasting time. Just why this danger is any greater in a school



The P-A-X-Equipped West Intermediate School at Jackson, Michigan



by careful attention to maintenance, and the installation of proper quantities of equipment. Even here the comparison may be qualified by pointing out that during the busy instant, the necessary average delay due to busy equipment is much greater on a manual switchboard than on automatic.

But in an automatic exchange there are no errors due to manual operation. This is where the biggest difference shows and must always show, in a comparison between the two types of equipment.

### At the Minnesota State Convention

THE opening session of the 13th Annual Convention of the Minnesota Telephone Association at the West Hotel, Minneapolis, Tuesday afternoon, January 24th, had an unusually large attendance. Almost 300 people registered there during the three days of the Convention.

The addresses and papers presented were all excellent and a great deal of interest was manifested in them. The subject which aroused the greatest interest was that of high line interference, a discussion of which took place at the Wednesday afternoon session.

The old board of directors were re-elected. The members are: H. F. Leuders, Norwood; Thomas Vollom, Erskine; E. P. Wright, Alexandria; D. W. Gretorex, Blue Earth; Jay Greaves, Glencoe; P. M.

Ferguson, Mankato; W. S. Clay, Hutchinson; Irving Todd, Hastings; F. D. Linquist, Fulda; and D. M. Neill of Red Wing.

One of the most interesting addresses of the convention was that by Professor C. M. Jansky of the Department of Electrical Engineering, University of Minnesota, on the subject of "Wireless Telephony."

Wednesday evening a complimentary banquet and theater party was tendered to members of the association by the exhibitors and others interested in sales. This was the largest banquet the association has ever held, approximately 250 being present. Orchestra music and solos were rendered during the meal.

At the concluding session on Thursday morning two addresses were made.

The first address was on the "Toll Situation," by Roy F. Wilder, commercial engineer of the Tri-State Telephone and Telegraph Company. This was followed by a discussion on "Public Relations," led by Mr. P. M. Ferguson, manager of the Mankato Citizens' Telephone Company.

The directors held an organization meeting Thursday afternoon and elected these officers:

President, Jay Greaves, Glencoe; vice-president, E. P. Wright, Alexandria; vice-president, D. W. Gretorex, Blue Earth; secretary-treasurer, E. C. Kast. The executive committee consists of D. M. Neill, Red Wing; H. F. Leuders, Norwood; and D. W. Gretorex, Blue Earth.

## Automatic Switching of Toll Lines

*A Paper Presented Before the Western Society of Engineers  
in Chicago on Thursday, October 6th, 1921, and Reprinted  
Here by Permission.*

By ARTHUR BESSEY SMITH

Chief Research Engineer  
Automatic Electric Company

*(Concluded from last month.)*

The Fort Wayne operator seizes the line with a key (CD key-1). This makes the line busy on the toll board, switches the line thru at Warsaw and closes the loop to the 2-wire Automatic switchboard. The ground placed on the release trunk by the first selectors actuates the usual busy signal at the South Bend toll board and prevents the cut off relay (COR) from being operated if the operator should plug in.

At Warsaw, the switching relay (Sw Ry) locks itself into circuit, so that the calling device key (CD key-2) cannot open the simplex circuit.

The rest of the operation is self-evident.

The Warsaw operator by throwing the calling device key (CD key-2) cuts off the simplex from

Fort Wayne and grounds the simplex toward South Bend thru her calling device (CD-2). The control is the same as before.

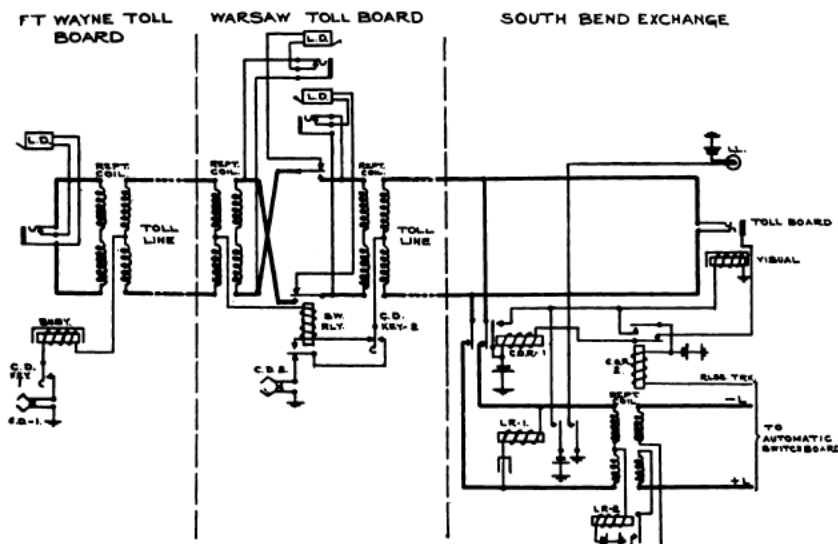


Fig. 19—Automatic Toll Line, Fort Wayne to South Bend