erty of which is leased to others for operation. The income which these companies receive is substantially the rent paid to them by the lessee companies from which their own corporate expenditures, including dividends, are made.

The Union Electric Train Staff.

The Union Switch & Signal Company has brought out a new design of electric train staff instrument, called model No. 2. This design is like the last one made by this company in having a small staff, but in its mechanism it is more like the earlier Webb & Thompson design. As the reader is aware, the train staff is a billet of wood or metal which is given to the engineman of a train to signify that he has the right to the road between two stations, the names of which are inscribed on the staff. Without a staff, no engine can start from either station. A train running from A to B, with the staff for that section, gives up the staff at B and receives another one as authority to run from B to C, and so on. By the original plan a single staff was provided for each section, and thus could be used only by regularly alternating trains; thus, A to B; B to A; A to B, etc. By the use of tickets, a staff was made to serve for two or more trains following one another in the same direction. This, however, was cumbersome, and the electric apparatus was devised to make the staff always as readily available at one end of the section as at the other. Tyer's tablet apparatus was the first electrical device of this kind; next came Webb & Thompson's electric train staff (1889); then the American modification of this, brought out by the Union Switch & Signal Company a few years ago, and now we have the latest

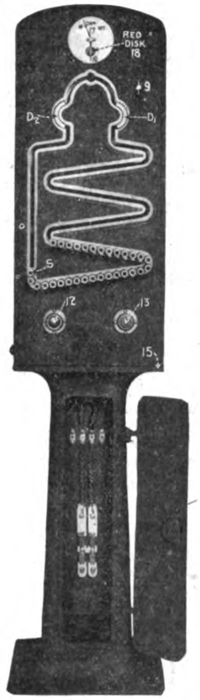

Fig. 1—Front View, Normal Position.

Fig. 2—Indicator 16 Showing White.

Fig. 3—Indicator Showing "Staff Out."

Fig. 6—Staff Out; Same as Fig. 3.

improvement.* The most noticeable outward change that has been made is in the arrangement of the magazine, Fig. 1, by which the staffs must always be taken out at one point and be put in at another, so that all of the staffs are used in rotation. In the earlier designs a few of the staffs did all of the work.

Of the illustrations, Fig. 4 shows the apparatus in the same position as it is in Fig. 1; Fig. 5 the same as Fig. 2; and Fig. 6 the same as Fig. 3.

The principal parts are shown in Figs. 4

*The Webb & Thompson staff machine was described in the *Railroad Gazette*, August 1, 1890. The operation of the staff on the Philadelphia & Reading was described Dec. 6, 1901, and on the Atchison, Topeka & Santa Fe Dec. 19, 1902.

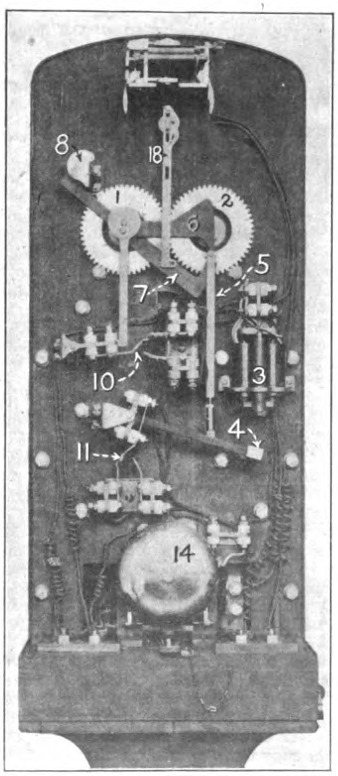

Fig. 4—Back View of Interior; Corresponds to Fig. 1.

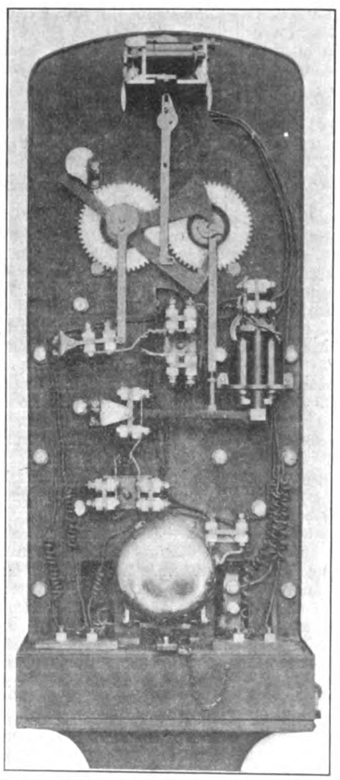

Fig. 5—Back View of Interior; Corresponds to Fig. 2.

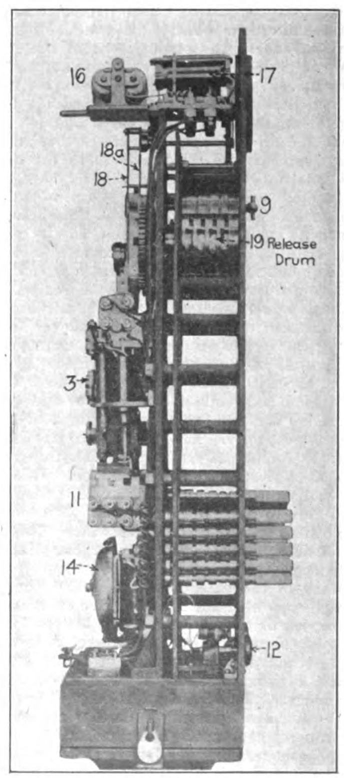

Fig. 7—Side View.

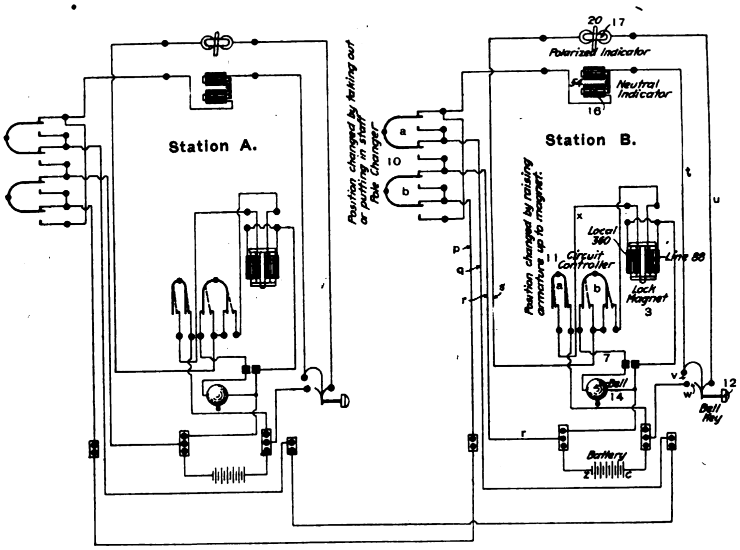

Fig. 8—Electric Circuits.

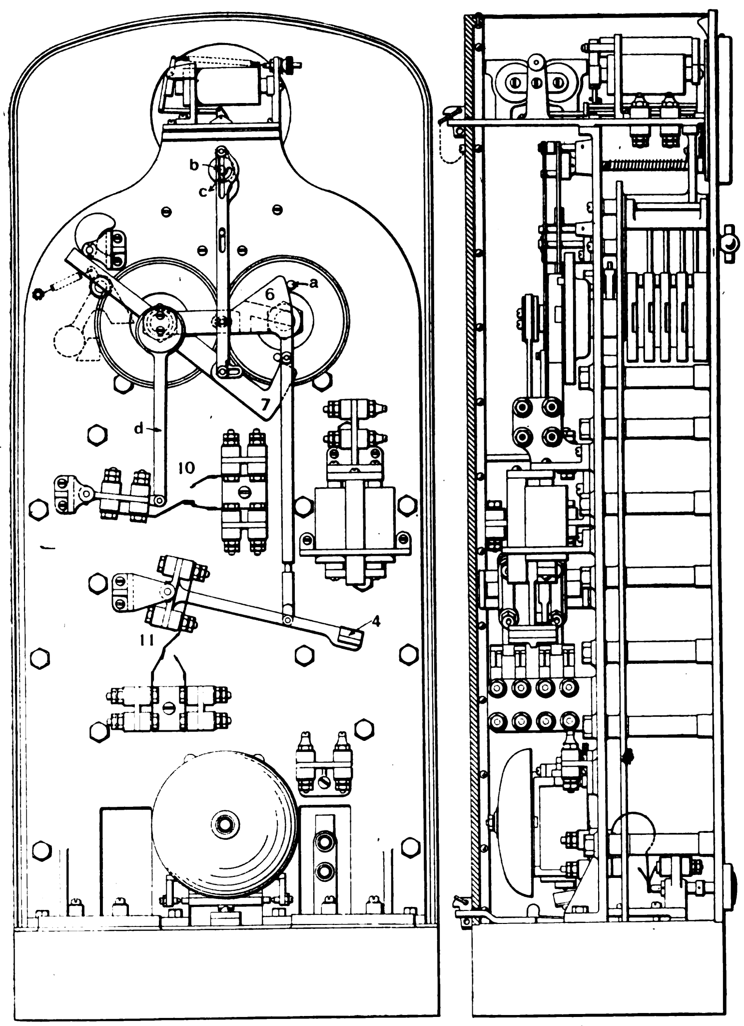

Fig. 9—Union Electric Train Staff, Model No. 2.

and 7, as follows: 1, releasing wheel, and, 2, locking wheel, these being geared together, and always moving in unison; 3, special compound magnet; 4, armature of magnet; 5, rod to lift armature; 6, lock; 7, arm for lifting 5, 6 and 18; 8, cam (turned by knob 9, Fig. 1) for moving arm 7; 10, pole changer; 11, circuit controller; 12, bell key (key 13 shown in Fig. 1 is not used); 14, bell; 15 (Fig. 1), base; 16 (Figs. 1 and 7), neutral indicator; 17, polarized indicator; 18 (Fig. 1), red disk; 19 (Fig. 7), releasing drum. Disks D 1 and D 2, Fig. 1, can be revolved only when wheels 1 and 2, Fig. 4, are free to revolve with them.

Compound magnet 3 consists of one coil of high resistance and one of low; the two, when energized by currents of opposite polarity, both exert an influence in the same direction to hold an armature placed between them, at right angles to a line passing through the axes of the two coils. The electrical connections are shown in Fig. 8. The arrangement is the same at both stations, and there is one metallic circuit (two wires) from station to station. The normal position of the apparatus is as shown in Fig 4; and the electric circuit from station to station is normally dead. The operator at A, desiring to send a train to B, calls *B* by pushing the bell key 12 (Figs. 1 and 7), which closes the points at *w* (Fig. 8), closing circuit through indicator 16 at station B (as well as in his own machine). At B, points *w* being open, the current passes through the polarized indicator 17 also; and thence through wire *s* and points *b* in the circuit controller, 11, to bell 14; thence through wire *r* and points *b* in pole changer, 10, and wire *p*, to line, and back to station A.

If all the staffs are in, at both station *A* and station *B*—that is, if no train is in the block section—*B*, responding, presses key 12 and holds it in until *A* turns knob 9. The turning of knob 9 at A, depressing the left hand end of lever 7 (Fig. 4), by means of cam 8, lifts 5, bringing armature 4 up to the magnet; and also lifts lock 6, thereby unlocking wheel 2 by removing the obstruction from the pin *a* in this wheel (Fig. 9). At the same time the other pin in wheel 2 is obstructed by the lower end of lever 7, and the wheel cannot be moved until lever 7 has dropped to its normal position, as shown in Fig. 5.

The operator at A therefore does not hold knob 9, but at once releases it, and arm 7 falls back; but armature 4 is held by the magnets. When *A* lifts 4 he moves controller 11, closing the circuit through wire *x* (Fig. 8), and local coil 360 of magnet 3, at the same time opening the circuit through wire 7 and the bell. The current from station B is by this transferred from the bell to line coil 88 of lock magnet 3. By this means this current (points *w* at B still being closed) energizes both coils of 3 so that they act together to hold up armature 4. The apparatus is now in the position shown in Figs. 2 and 5. The red disk has become invisible, indicating that a staff may be taken out.

A now lifts a staff *s* (Fig. 2) to the disk D 2, and, revolving the disk one-half revolution, removes the staff from the machine and delivers it to the train.

The relation of lever 6 to wheel 2 is shown in Fig. 9. Locking pin *a* is released as soon as lever 6 is raised sufficiently to bring the slot shown by the dotted line opposite the pin, this slot being cut in the back side of the lever. The control of disk 18, Fig. 1, by lever 7 and lock 6, is best shown in Fig. 9. Rod 18 (Fig. 7), is lifted by lever 7 (Figs. 4 and 9), and rod 18 *a* is lifted by lock 6; and the disk, carried on the shaft *b* (Fig. 9), is moved when the slots in the two rods have both been brought into the right positions to release pin *c*. This position of rods 18 and 18 *a* is shown in Fig. 5.

The withdrawal of a second staff at either station is impossible because the process above described cannot be repeated until a staff (the one just taken out) has been inserted in either the A machine or the B machine. If a second staff, at A, or a staff at B, be lifted to drum D 2, which is on the same axis with wheel 2, this wheel, locked by its lower pin having made a half revolution and been stopped by lock 6, will prevent the drum from turning, and will thus keep the staffs in the machine; and the only way to unlock the wheel is by repeating the electrical operations before described. If these be attempted the effort will be futile, because the next current sent by either station will be of such polarity that magnets 360 and 88 will neutralize each other, and so will not hold up armature 4. The change of polarity was effected when the staff was taken out. When this was done (revolving wheel 2 one-half turn), wheel 1 was also revolved the same distance; and thus, by means of eccentric and rod *d* (Fig. 9), changed the path of the current by moving pole-changer 10 (Figs. 4 and 8) so that if the battery should be again connected to the line, the current would flow through magnet 88 in a direction opposite to that which it flowed before, and thus it would neutralize instead of reinforce the current through 360.

Replacing the staff in the machine (by passing it through slot D 1, Fig. 1) again changes the points 10 *a* and 10 *b* (Fig. 8), and a staff may be taken out as before. Staffs always come out through D 2, revolving wheel 2; and always go in through D 1, revolving wheel 1; but either of these two wheels always revolves the other with itself.

If the staff is restored to the same machine from which it was taken, it restores the pole-changing points to the positions from which it had withdrawn them; if it is taken to B and put into the machine there, it moves the pole-changing points there so as to make them correspond with the changed position of the corresponding parts at A.

The operations that we have described may be summarized as follows: *A*, having a train that he wishes to send forward to *B*, presses the bell key 12 the prescribed number of times (called for by the bell code), which rings the bell 14 (Fig. 4) at *B*; *B* answers and holds in his bell key 12, which moves over the current, indicating needle 16 to the right (see Fig. 1). *A*, seeing this indicator standing over, at once turns the preliminary spindle handle 9 over to the right as far as it will go. He immediately releases it, and it returns automatically to its normal position. As soon as this occurs, the red disk 18 (Fig. 1) will show white as in Fig. 2. This indicates to *A* that the instrument is unlocked. He then moves a staff S through the vertical part of the slot into engagement with and revolving the drum D 2 and withdraws the staff at the circular opening at the uppermost point. When the drum D 2 is revolved the circuits are changed, throwing the instruments out of synchronism. At the same time, the staff-indicating needle 17 (Fig. 1) will move from "Staff in" to "Staff out." As soon as *A* has withdrawn the staff he presses in his bell key 12, which will move the indicating needle at B to "Staff out" (16 Fig. 1).

The staff is 6 in. long and ¾ in. in diameter. Staffs for different sections of the road have rings or wards of different shapes or sizes, so as to prevent the use of any staff in any machine except the two to which it belongs. The four steel disks a, a, a, a, Fig. 10, fixed to shaft B, constitute a lock to prevent the improper manipulation of the dogs C.

Machines of this design will probably soon be put in use on the Chicago, Burlington & Quincy's line across the Missouri River between Pacific Junction, Ia., and Plattsmouth, Neb.

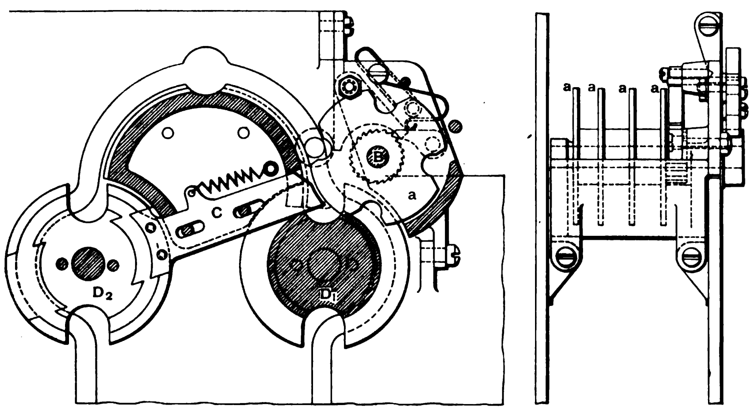

Fig. 10—Sectional View of Drums.

Supreme Court Decision in Johnson Coupler Suit.

In a decision handed down last Monday by Chief Justice Fuller, in the case of Johnson against the Southern Pacific, the Supreme Court of the United States holds that all cars, including locomotives, should be equipped with uniform automatic couplers. The dining car, which was involved in this case, is declared not exempt from the requirements of the safety appliance law, even though it was empty and standing on a side track.

The accident out of which the suit grew occurred at Promontory, Utah, in 1900, when Johnson, a brakeman, was directed to couple the locomotive to a dining car which was standing on a sidetrack. (Johnson and the engine belonged on a freight and were called in merely to take the car to the turn-table and turn it around.) The engine was equipped with the Janney coupler and the car with the Miller, so, of course, Johnson had to go between the cars to couple with a link, and his hand was so badly mangled that amputation became necessary. He brought suit for damages, but both the Circuit Court for the District of Utah and the Circuit Court of Appeals for the Eighth Circuit decided against him. To-day's opinion reverses both these judgments and orders a new trial.

Chief Justice Fuller said that the purport of the law was to require that cars should be "equipped with couplers coupling automatically by impact, and which can be uncoupled without the necessity of men going between the ends of the cars." He held that the act requires that locomotives should be equipped with such couplers; "it was as necessary for the safety of employees in coupling and uncoupling that locomotives should be equipped with automatic couplers as it was that freight and passenger and dining cars should be, perhaps more so, as Judge Thayer suggests, since engines have occasion to make couplings more frequently. Manifestly, the word 'car' was used in its generic sense."

The locomotive in this case was equipped with an automatic coupler, as was the dining car, but the couplers on the two cars were of different types, and would not couple automatically, so as to render it unnecessary for men to go between the cars to couple them. This, it was held, did not comply with the requirements of the law, "whose object was to protect the lives and limbs of railroad employees by rendering it unnecessary for a man operating the couplers to go between the ends of the cars. That object would be defeated if these different kinds would not automatically couple with each other.

Of the contention that the dining car was not actually engaged in interstate commerce at the time of the accident, the Chief Justice said: "Confessedly the dining car was under the control of Congress while in the act of making its interstate journey, and, in our judgment, it was equally so when waiting for the train to be made up for the next trip." He held that the car could not be considered "empty" when in use, but said that "whether cars are empty or loaded, the danger to employees is the same."

Permanent Way for Fast Train Services.*

(*Continued from page 642.*)

On the continent, there is a tendency to change the process of manufacture of steel for rails; formerly scarcely anything but acid Bessemer was used, but to make this, cast iron manufactured out of ore from phosphorus was required. Such ore being scarce, most of the steel works have been led to adopt the Thomas or basic Bessemer process. Exceptionally there are also steel works where rails are made out of Martin basic or Martin acid steel.

The managements that used Thomas steel ten years ago have had plenty to complain about; metallurgists till then did not understand the process properly. It was thought that any cast iron, of any composition, was suitable for making Thomas steel, and the results obtained were poor. But subsequently, we think that the Thomas steel manufactured for rails was just as good as the Bessemer, and most engineers seem no longer to have any objection to Thomas steel. If, however, we are to believe in certain statistics, the general (?) use in Germany of Thomas steel is the cause of the more numerous rail fractures which occur there as compared with England. Now in the first place, is it true that in Germany there are more Thomas rails than Bessemer rails in actual use? Moreover, there is nothing conclusive about these comparative statistics applying to two countries where the climate, the working, the traction, the cross-section and the dimensions of the rails, their method of manufacture and the railroad system are so entirely different. Any comparison of fractures can only be made between rails of the same cross-section on lines of the same age and carrying the same amount of traffic. The North Eastern in England uses both Bes-

*Extract from a report prepared for the International Railway Congress, by Mr. Van Bogaert.