the feed circuit to relay C, which in turn causes relay D to drop. Relay E being slow-release retains the closed front contact, and with back contacts of relay D closed, the apparatus is set up to give the first impulse to dispatcher's circuit. The relays continue to drop in sequence causing the second impulse to be transmitted through relay F down and relay G up and the third impulse through the relays H and J.

When the back contacts of relay J are closed, energy is again fed through to relay A and the chain of relays once more picks up in sequence. This process of picking up and dropping of the relays continues throughout the period that the track circuit is occupied.

To obtain a one-impulse signal over the dispatcher's telephone, terminals 4 and 7 are connected. This connects the battery to a front contact of relay E and back contacts of relay D, so that the circuit is closed only when D is down and E is up, during the release sequence, which is but for an instant. This circuit is completed through a non-inductive limiting resistor, the primary of the Western Electric No. 42 induction coil and back to the battery at terminal 1. The secondary winding of this coil connects to the dispatcher's telephone circuit through two back contacts of the controlling track relay. In this case single impulses, separated by a time interval, are transmitted to the dispatcher's loud-speaker.

In like manner, if terminals 5 and 7 are connected, relays F and G as a pair operate as do D and E, to provide the second impulse. The third impulse is established by H and J, if terminals 6 and 7 are connected. Of course, it is possible to obtain any number of successive impulses by the addition of the necessary relays, one pair being required for each additional impulse.

Cost Is Small

It has been recommended that a number of these units could be installed on any dispatcher's circuit, using a different number of "ticks" for each station, to spot the location of trains. The total out-of-pocket cost for one installation is less than $100 per location. In the first two installations, mentioned previously, telegraph operators whose main duties were OSing trains, were relieved. In the third case, delays to trains were becoming serious, and the application of the automatic OSing device relieved the condition without the necessity for adding a telegraph operator at this station.

Rectifier Applications

(Continued from page 262)

tive and relay B will pick up with the top line positive.

If we apply alternating current between the two lines and add rectifiers C and D where the dotted connections are shown, both A and B relays will pick-up, so that we have three choices of circuit over and above the de-ener-

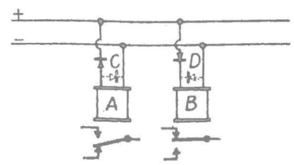

Fig. 4—Four circuit choices obtained through the use of the rectifiers, a-c, and polarized d-c. supply

gized condition, and we can use these combinations to save line wires and carry out three different switching movements with two line wires.

Another use of rectifiers as "one-way" devices is that of making neutral relays slow-acting by connecting a rectifier in parallel.

Surge Absorbers

In this class, the same principles as those described in the previous paragraph are applied for different purposes. It is well known that any form of arcing or sparking at contacts is destructive and, therefore, must be avoided.

In direct-current circuits, a combination of a condenser and resistance is sometimes used to prevent this sparking, but is only partially effective, because the condenser must charge up to a higher voltage than that of the line and must then discharge through the resistance.

If a rectifier is used, it is possible to open the control contact of a highly-inductive circuit without visible sparking and allow the current in the circuit to die down gradually, without a serious rise of voltage across the control contacts.

Use With Instruments

In the fifth class, we have measuring instruments and other testing and checking schemes dependent on rectifiers. This class, although small in its application to most signal installations, is none the less important.

A few years ago, low-reading a-c. voltmeters had a resistance of 20 ohms per volt and a poor scale badly cramped at one end. At that time, if we wanted to measure the voltage across the track element of a two-element a-c. track relay, we connected a voltmeter having a resistance of 60 to 100 ohms, or we carried around either a thermal or a valve voltmeter and filament battery and made a calibration before taking a measurement. In either case, we were handicapped in getting accurate results. With the aid of a rectifier, we can connect across the relay a d-c. voltmeter having a resistance of 1,000 ohms per volt, which is so high that the effect on the track circuit is negligible, and the instrument at the same time has a linear scale for accurate readings.

Having examined a few of the many applications of rectifiers to railway signaling in five different categories, we find that they have become an integral part of track circuits, power supply, signals and maintenance meters. Many of the less usual applications in centralized traffic control systems, relay interlockings, and all the telephone and telegraph circuits in which rectifiers now play a large part, have not been dealt with for want of space.

A Letter to the Editor

D-C. Track Circuits

Cleveland, Ohio.

To the Editor:

The article in the February *Railway Signaling* on "The Use of Modern D-C. Relays" strikes me as being a very interesting and instructive contribution to the literature on this subject. Evidently this required a lot of work on the part of Mr. Parkinson.

Certain economic results are achieved, all of which I believe are based upon track circuits 2,600 ft. in length. While it is probably too much to ask, it is my suggestion that Mr. Parkinson go further and develop the economies effected on track circuits 3,600 ft., 4,600 ft., and 5,600 ft. in length.

This would have the effect of materially increasing the current values involved, as the longer circuits require greater surplus in order to prevent failures during wet weather. It would also take care of the railroad whose track circuits are longer than 2,600 ft. and prevent such road from being misled in the thought that the economic situation would be essentially the same regardless of the track-circuit length.

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