the 24-hr. period. The purpose of the storage battery is to maintain a practically constant voltage under continued discharge such as a train stopping in the block. At several towns where a. c. current is available the a. c. floating system is used to charge the storage batteries within the limits of the head block signals. Primary battery is used for track circuits throughout.

Great Northern officers consider the light signal as a forward step in the art of signaling in that simple construction and elimination of rotary parts simplified the operation and maintenance. The excellent visibility of indication for both day and night is highly satisfactory. In making use of the light signal, the standard operating rules remain unchanged and need only be supplemented to the extent of using the standard colors continuously throughout the twenty-four hours of each day instead of at night and at other times as heretofore required.

Neon—A New Gas for Electrical Use

The Development of This New Gas and Its Application to Signal Lights and Lightning Arresters

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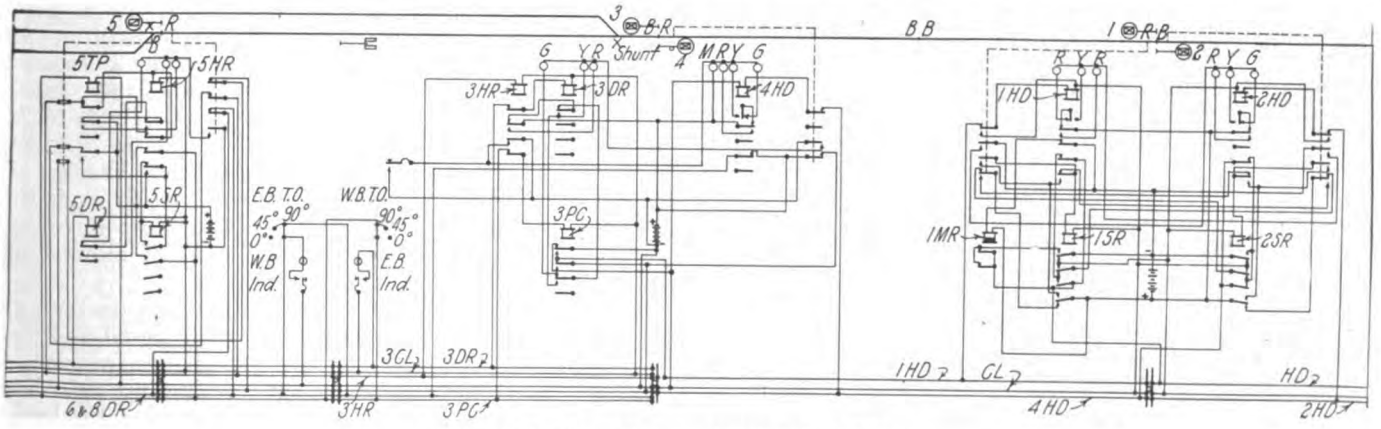
IN 1894 it was noticed by Lord Rayleigh that the density of nitrogen gas derived from the air was consistently slightly higher than that made by chemical means. This observation lead to the discovery of argon which constitutes 1.3 per cent by weight (0.933 per cent by volume) of the atmosphere. Since 1914, argon has been manufactured from air for use as an inert gas in incandescent electric light bulbs and for some years now it has largely replaced nitrogen for this use.

After the discovery of argon, the crude gaseous residues left from extraction of nitrogen, oxygen and argon from the air were carefully collected and examined spectroscopically for the presence of other elements. Four were disclosed: Helium (now quite will known as being the balloon gas par excellence), neon, krypton and xenon. These all occur in air in such small amounts that they would be obtainable only at very great expense as scientific curiosities if it were not for the air liquefaction plants now operating in all the large industrial centers. At the present moment argon is the only one that can be called a commercial success. The helium used in balloons is extracted from certain natural gases, some running as high at 2.5 per cent helium, although the average is considerably lower—whereas helium occurs in air only as one part in 250,000 by volume. Both the argon and the helium depend upon their inertness—what we might call chemical unfriendliness—for their industrial value. So far no application has been found for krypton nor xenon, which both occur in most infinitesimal quantities—many times less than helium.

Neon and Its Electrical Features

Neon, discovered in 1898, is more abundant in the air than helium, there being 15 parts of neon in one million parts of air. Like the other gases of the atmosphere neon is colorless, odorless and tasteless; it is very inactive and will neither support combustion (as does oxygen) nor combine with even the most re-active of the other chemical elements or compounds. It is very difficult of liquefaction, a temperature of 246 deg. C (475 deg. F) being necessary; purification must be carried out at liquid air temperature in special and expensive apparatus, absolute purity being quite difficult of attainment.

Electrically, neon is most unusual. It is exceedingly sensitive to electrical discharges; a tube containing a bit of mercury sealed in with pure neon when shaken will cause the neon to glow. The gas has an electrical conductivity seventy-five times as great as air. When in rarefied condition, pure and dry, the passage of a high tension electric current causes it to glow with a very beautiful and noticeable orange red light. Numerous limited uses of these properties have been tried out so far. There is no doubt that neon has a commercial future when its proper applications are developed. Al-



Color-light Signaling on the Great Northern

ready some strikingly beautiful lighting effects have been produced and though the use of the gas is not widespread, it has met with much favorable comment among advertising and display experts.

Neon for Signal Lights and Lightning Arresters

For signal purposes there is no doubt that the neon light has unique possibilities when its method of use has been suitably worked out. The neon light is not one that can be overlooked, its color and general characteristics being of a peculiarly distinctive nature. It has high visibility in daylight, and in fog, as well as having special brillance at night.

In like manner neon is coming into use as the current carrying agent in safety devices designed to protect electrical instruments and buildings from high voltages. These devices because of the peculiarities of neon will allow hardly any current to pass below what is known as their break-down voltages. In fact, below this point the current flowing through the gas is almost infinitesimal. When once the break-down voltage is reached, however, and it may be somewhat under 200 volts, depending on the design of the device, the current begins to flow. As soon as this occurs the neon is ionized; its resistacne greatly decreases with a corresponding increase in carrying capacity. As the result of the lowered resistance, very high currents can be conducted by a trace of the neon, while in the case of other gases only moderate currents can pass. Unless subjected for a long period to the action of the current these devices are able to function many times, a small tube with gas at very low pressure, conducting as much as 10 amp.

Exhaustive tests in the laboratory have invariably tended to demonstrate that the accuracy and dependability of the neon type of lightning arrester is very much greater than that of any other arrester now known. If the results of experience in field tests parallel experience in the laboratory, there can be no question that an extensive commercial application of neon is assured for use in lightning arresters alone.

Three Train Control Contracts Let

G. R. S. Continuous System for C. & N. W. While Intermittent Inductive Is Chosen by A. C. L. and Southern

THE Chicago & North Western, the Atlantic Coast Line and the Southern have all decided to use train control of the General Railway Signal Company manufacture. However, the Chicago & North Western is to use the continuous inductive system, while the Atlantic Coast Line and the Southern are to use the intermittent inductive apparatus. The territory included in these installations and a description of the operating characteristics of these two systems are explained below.

Characteristics of Continuous System

The Chicago & North Western will install continuous inductive automatic train control on 149 miles of double track between Boone, Ia., and Council Bluffs. Control is to be of the "Two Position Continuous Type," i. e., alternating current, controlled by an existing signal system, is fed into the running rails, and is picked up by receivers on the locomotive and amplified to operate a two position control relay. Interposed between the control relay and the brake applying apparatus is a governor-cam mechanism which functions on the speed distance principle to decrease the speed limit of a train gradually in passing through a caution zone, giving automatic brake applications a distance from the danger point for high speed and closer to the danger point as the speed decreases. This mechanism is also utilized in providing a maximum speed limit and in giving audible signals, etc.

The brake applying apparatus is to be of the actuator type, in which a device known as an actuator is attached to the engineer's brake valve and operates it to give a full service automatic application in practically the same manner as the engineer does it manually.

The principal results to be secured in this installation of automatic train control are as follows:

(1) To compel the engineman to acknowledge a Caution signal and to force the speed of a train to be reduced to a predetermined low rate before reaching a stop signal; to compel acknowledgment in order to pass a Stop signal and thereafter enforce a low speed restriction until this restriction is removed by the removal of conditions which caused it to be put into effect; to enforce a maximum speed limit for all trains operating under normal conditions.

(2) Brakes to apply automatically and remain applied until the train comes to a complete stop in case the engineer fails to acknowledge a Caution or Stop signal.

(3) Brakes to apply automatically at any time in a Clear block when the maximum speed limit is exceeded and may be released as soon as the speed is below the maximum. The maximum speed for passenger trains is 70 m.p.h. and for freight trains, 50 m.p.h.

(4) Brakes to apply automatically at any time in a Caution block when the speed exceeds that prescribed by the speed-distance mechanism and may be released when the speed is brought under the limit prescribed by this mechanism.

(5) The brakes to apply automatically at any time in a Stop block when the speed exceeds 20 m.p.h. and may be released as soon as the speed is brought under this amount.

(6) An audible signal in the cab begins to sound as soon as the speed increases to within three miles of the limit imposed and continues to sound until the speed is reduced. This permits the engineman to operate his train very close to the maximum speed limit in a Clear block, or the tapered speed limit in a Caution block or the low speed limit in a Stop block by the usual method of braking.

The Intermittent System as Designed for the Southern

The Southern Railway is to install the G. R. S. intermittent inductive type of automatic train control on two locomotive divisions. One is located on the lines west between Cincinnati, Ohio, and Somerset, Ky., and consists of 80 miles of double track and 77 miles of single track. The other is located on the lines east between Spencer, N. C., and Greenville, S. C., and consists of 153 miles of double track. Both of these divisions are partly equipped with automatic block signals which are operated by direct current on the lines west and by alternating current on the lines east.

In this intermittent system one restrictive inductor and one releasing inductor is located at each signal and the locomotive carries a receiver for picking up restrictive control and another receiver for picking up releasing control. Between the receiving equipment on the locomotive and the brake applying apparatus is a speed