Railway Signaling & Communications

S&C Role Is Basic To Bison Yard

New electronic retarder yard at East Buffalo, N.Y. is expected to handle and classify in excess of 3,000 cars daily. The $13 million facility is a joint venture of the Erie-Lackawanna and the Nickel Plate, and is expected to provide better car utilization and eliminate many duplicate operations. Appropriately named, Bison yard, the new facility will materially reduce interchange time for the roads, their connecting lines and for shippers.

This time-saving is especially important when one considers the number of cars interchanged in the Buffalo gateway, one of the east's major rail centers. E-L and NKP received 560,000 cars from nine connecting roads in 1962, and delivered 580,000. Interchange between the two roads in 1962 was in the neighborhood of 95,000 cars each.

The new yard, located on the site of the former east and westbound DL&W yards, will feed traffic westbound to points on both the E-L and NKP, and via connecting roads north and west to Niagara Falls and Canadian points. South and eastbound traffic will flow over the E-L. Heaviest traffic periods at the yard will be Friday through Sunday, for all three tricks.

Although to the casual observer of the railroad scene, Bison yard may appear to be just another modern electronic classification yard, it is notable for several firsts and other features that make it different as well as interesting. Briefly stated, here are some Bison yard highlights:

- First retarder classification yard to be jointly owned and operated by two Class I railroads.
- Yard was built under traffic (constructed in stages) with the E-L using sections of the new yard as soon as possible after tracks were completed.
- Electrical distribution, and lighting system has 19 floodlight towers, each 150 ft high and built to withstand 150 mph winds. Severe winters necessitated electric snow melters on 240 switches, hand-throw as well as power.
- First use of Videograph car checking system whereby inbound trains are scanned and their pictures

printed on paper tape in the yard office.

- Blue flagging system provides protection for car inspectors working in the class yard.
- Ultrasonic presence detectors used with 55-ft detector track circuits to detect presence of piggyback and other long cars.
- Distance to coupling data on the class tracks is automatically fed into the computer of the automatic retardation control system.

Although Bison yard was originally designed as a modern classification facility for the Erie-Lackawanna only, an agreement was reached with the Nickel Plate Road in the fall of 1961 for its participation. Each road has an undivided one-half interest and ownership to use the yard in common. Employees and supervision of both railroads will jointly participate in the operation and maintenance of the yard.

At the time of the agreement, some grading, removal of trees, brush, etc. had taken place and, of course, the basic design had been established. However, with NKP's interest in the yard designs were revised for increasing its size to handle the additional traffic.

Contingent upon the NKP participation, a joint operating committee was formed consisting of T. E. McGinnis, assistant general manager, E-L; V. E. Coe, general superintendent, NKP; J. I. Michel, assistant comptroller, E-L; and W. F. Bowman, assistant comptroller, NKP. This committee worked out the details of the agreement for joint operation, as well as the myriad of other details attendant upon two railroads owning and operating a large retarder classification yard. Administration and supervision of the yard will be distributed among both railroads subject to the agreement.

Because Bison yard was started by the E-L (it let the original contracts), construction has been under the jurisdiction of E-L's assistant chief engineer, maintenance of way, R. F. Bush. Since its inception, the joint operating committee has been very much interested in the construction of the yard, and has worked with Mr. Bush even though the committee's major interest has been working out agreements for the joint operation.

At the present time, Bison yard is classifying E-L trains. The Nickel Plate is expected to begin using the yard June 1, at which time it is anticipated that the diesel servicing and car repair (spot repair system) facilities will be completed. Chesapeake & Ohio and Wabash trains which were handled in other E-L yards are temporarily running into the new yard pending agreements between those roads and Bison yard's co-owners.

The new yard with its 49-track classification yard is designed to classify 3,000 cars daily. Space limitations did not permit an in-line yard, so that receiving and departure yards are on either side of the six-group class yard. North yard has nine such tracks, while south yard has five corresponding tracks. Dwarf-type signals mounted two high and facing in opposite directions serve as shove signals for departure yard tracks. Illumination of the lunar-white shove signal alerts the crews to stop shoving to avoid fouling leads on the opposite end of these departure tracks.

Classifying is from east to west (to take advantage of the lay of the land). Trains are pulled back and shoved over one of the two hump leads towards the crest by road switcher locomotives equipped with radio and inductive-type cab signals. Wayside hump and trimmer signals are also provided. Trimming is performed by a separate locomotive that is radio-equipped. Although not installed, there is room to extend the second hump lead over the crest to provide simultaneous humping of two trains if future traffic warrants. Also, there is room for an additional class track group north of the present six groups.

Automatic switching (hump conductor presses numbered buttons corresponding to class tracks) and automatic retarder control is provided by General Railway Signal Co.'s Class-Matic II system. Piggyback cars are to be humped as single-car cuts.

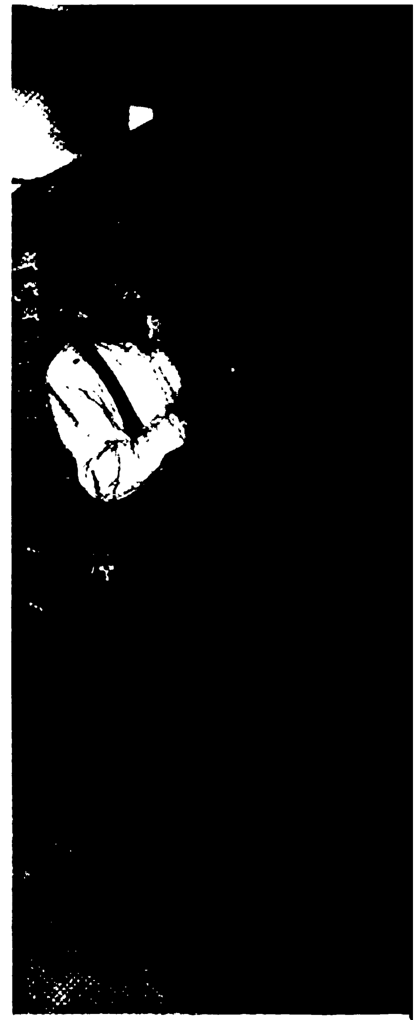
To prevent cars from fouling leads at the bowl end of the class yard, Racor inert retarders (made by American Brake Shoe Co.) were installed on each of the 49 class tracks.

USE POWER SWITCHES

To expedite movement of trains into and out of receiving and departure yard tracks, non-interlocked model 6A power switches were installed. These switches, controlled by an operator in the west end yard office, have only an operating rod and are equipped with a switch circuit controller.

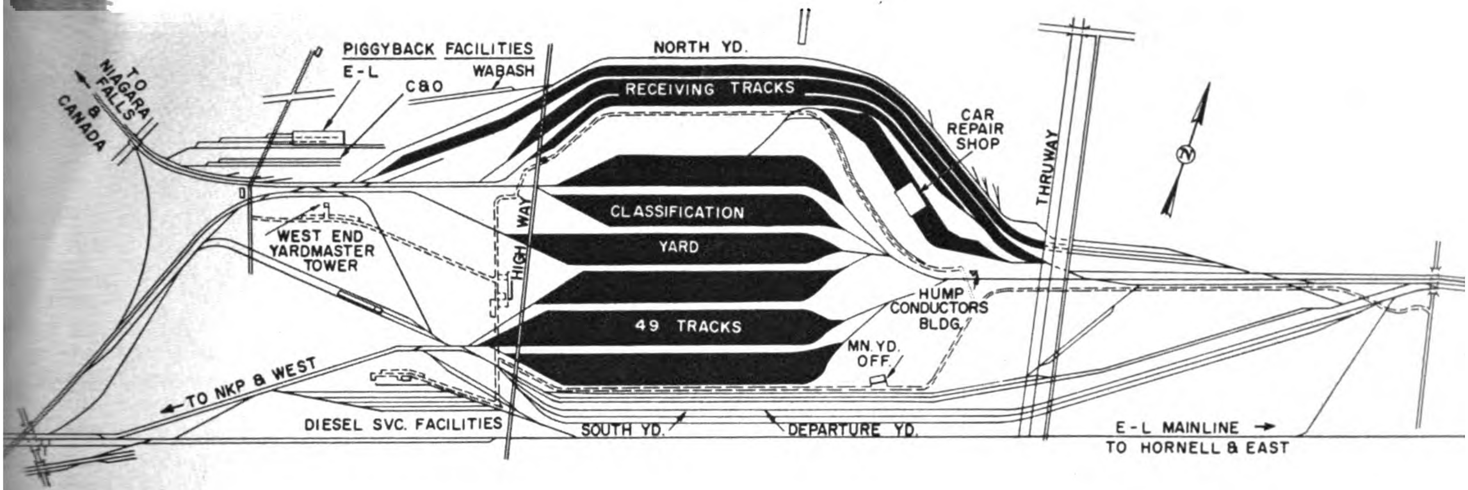
Signaling and communications facilities at the yard were installed under the jurisdiction of F. Youngwerth, general superintendent communications and signals, E-L.

Several communications systems were provided to insure efficient operation. Western Railroad Supply Co. was the contractor for installing the communications facilities. Seven talk-back speaker systems, three two-way radio systems, three pneumatic



tubes, printing telegraph equipme and PBX dial telephones off existi exchanges were installed. Made Electronic Communication Equipmen Inc., the loudspeaker systems have total of 178 talk-back speakers, ea controlled by the following person from a console in his office: gene yardmaster, west end yardmaster, r tarder operator, west end operator (co trols non-interlocked power switche train yard foreman, car repair forema and hump conductor. Intercom circui connect these consoles to provide i stant two-way communications. Faci ties have been provided whereby t general yardmaster can, when require take over individually or collective the west end yardmaster system, t car repair foreman system, and the tra yard foreman system.

The three VHF radio system (Motorola transistorized equipmen are designed to operate as indepen ent entities. One of the systems under the control of the hump co ductor and is used by him f communication with the hump engine Only the hump conductor has acce to the transmitter in this system However, a monitoring facility is pro vided whereby the general yardmast and west end yardmaster can monito the transmission.



son yard features automatic retarder d automatic switching controls, hich are housed in cabinets in the sement of the yard office (left). A wer on this building contains the fices of the retarder operator and the neral yardmaster (right). Communi-tions console of the general yard-ster enables him to keep in contact th yard personnel via loudspeakers, dio and intercoms.

A second radio system is provided r communication with the trimmer igine and also with road trains of e E-L and the NKP. This system is ntrolled by both the general yard-aster and the west end yardmaster. addition to the E-L base station ard and road frequencies), an NKP se station was provided. To obtain od coverage to road trains, the tennas for the E-L and NKP base ations are atop 150-ft floodlight wers, as are the other radio system se station antennas.

The car inspectors' radio system is ntrolled by the train yard car reman and provides not only for mmunication between him and the r inspectors, but also for instant vo-way communication between the r inspectors. This system consists of parate transistorized transmitters 60.95 mc) and receivers (161.55 mc) rried by the inspectors in a belt ound the waist. The units work with ree receiving base stations and one ansmitting station. A voting circuit lects the strongest received signal, hich is sent via wire line to the ansmitter and the train yard car fore-ian's console.

Three Kelly pneumatic tube systems re provided to transmit waybills vitch lists, etc., to proper personnel with minimum delay. One 6" tube system connects the east end entrance to the yard with the general yard office. To enable conductors of in-bound trains to put their waybills into the tube system without stopping the trains an ingenious conveyor belt-and-hopper unit was installed. The conductor is provided with a conventional pneumatic tube carrier in which to place the waybills. As the train approaches the hopper, occupancy by the train of a track circuit actuates a 40-ft conveyor belt. As the caboose passes, the conductor lobs the carrier into the hopper and the conveyor moves the carrier into the tube system. The second 6" pneumatic tube system connects the west end yardmaster with the general yard office. An access point to this system is provided approximately midway between the two terminations. This access point enables the inbound train crews to use the facilities of the system.

SWITCH LISTS VIA TUBE

A third tube (3") connects the general yard office with the hump conductor, general yardmaster and retarder operator. This system provides the means of quick distribution of the train switch lists.

IBM-Teletype equipment is used at the general yard office for preparation of switch lists, train consists, etc. The teleprinter system connects the general yard office with the nearest advance train consist relay points (major yards). Westbound consists are sent simultaneously to Conneaut, Cleveland and Bellevue Ohio on the NKP and to "BX" office at Buffalo and then to Meadville, Pa. on the E-L. Eastbound consists are sent to "BX" office at Buffalo and then to the E-L yard at Hornell, N.Y.

At the spot repair car facility, a car reporting recording system will be installed enabling the general car foreman to record the necessary information required for accounting of car repairs. An electronic tape recording device in the car repair office will be actuated by the foreman pressing a pushbutton on a telephone handset plugged into any of several outlets along the repair tracks.

Because Bison yard occupies the site of the former DL&W east and westbound yards, the new yard was built under traffic. Design of the new yard had to take into account highway and railroad overpasses at the east and west ends, the Lehigh Valley mainline on the south and industries on the north. These factors and the contour of the land, determined where the class yard and hump would be located.

As the E-L was using the former DL&W yards, the new yard had to be built in stages. One of the first steps was the construction of what is now the south yard. Land was cleared and graded. The new tracks, using 130 lb rail obtained from other areas of the E-L railroad (portions of double main track removed when mainline was single-tracked and equipped with CTC) were laid using the panel method. After several tracks were connected to other sections of the yard, these tracks were released to the operating department for its use. In turn, the eastbound yard was taken out of service, and new tracks laid following grading and the installation of drainage facilities. One of the last stages was the removal of the former westbound yard. Portions of the former Erie yards and the NKP yards will be used for local purposes. Tracks not required will be removed and the land made available for industrial development.

This type of construction required considerable flexibility on the part of the operating departments to keep traffic moving. Other yards, such as Meadville and Hornell, helped reduce Buffalo switching requirements by preblocking cars for connections at Buffalo. Similarly, Buffalo was able to send blocks to these yards without any presorting, so that finer classification was performed at Meadville and Hornell for cars destined to these points and beyond. Nickel Plate, and also Wabash and C&O performed blocking or presorting of cars for the E-L to help reduce its switching load during the construction of the new yard.

NKP trains will enter and leave Bison yard over double-tracked access routes acquired by the Nickel Plate.

Only 130 lb rail is used in the new yard. New 130 lb rail was purchased for use over the hump, the crest and down to the clearance point on the classification tracks.

To assure that the track over the crest of the hump and the class tracks are kept at proper grade, permanent top of rail grade stakes will be set every 25 ft over the crest of the hump, every 50 ft to the clearance point in the class tracks, and then every 200 ft down the class tracks. Permanent bench marks have been set on the concrete foundations of the 19 floodlight towers.

Although not quite turning night into day, Bison yard's floodlighting provides a minimum light level of one-half ft candle, rising to 10 ft candles at the retarders and reaching a maximum of 20 ft candles at the crest of the hump (conservative ratings).

Mounted atop each of the 150 ft floodlight towers are incandescent, 1500-watt bulbs with spun aluminum reflectors. A tower at the crest of the hump and two in the retarder area have a second set of lamps mounted at the 85 ft level (above ground). Control of the lighting for each tower is by a photocell mounted at the 38 ft level (above ground). The lights are automatically turned on when the ambient light level falls to 3 ft candles. The photocells face north, and the narrow beam floodlights are focused in an east-west direction so that the photocells will not receive enough illumination from the floodlights to turn them off.

Each of the light towers is 150 ft high and built to withstand 150 mph wind loading. The use of towers was preferred because of high winds and blowing snow in the winter. High winds prevalent in the area, it was felt, would probably damage a catenary lighting system (where strings of lights are hung low on catenaries over the tracks). The tower system was considered most desirable and allowed the use of narrow beam floodlights to concentrate the light where needed.

PRIMARY POWER

Primary power for the yard is supplied by dual 34.5 kv three-phase aerial feeders from Niagara-Mohawk Power Co. through two 3,750 kva transformers to provide a yard distribution voltage of 4.8 kv. Both incoming feeders are energized, but either can supply the entire power requirements if and when necessary. To supply power for the floodlighting and other facilities in the yard, electrical distribution is provided by seven 4.8 kv radial feeder circuits supplying 17 three-phase transformer substations at load centers. These feeder circuits consist of three single aluminum conductors mounted in a triangular ceramic spacer suspended from an Alumoweld messenger that is grounded. Ground rods are driven at every 4th or 5th pole, and resistance to grounding is one-half ohm or lower. The substations are at ground level and have self-contained transformer banks. At each substation 4800 volts from the aerial distribution line is dropped down the pole to an oil fuse disconnect to the transformer primary. The transformer secondary is Y-connected providing 277/480 volts on the secondary for distribution directly to loads. This 277/480 volts was chosen because it is an economical voltage for distribution and provides a safe voltage ground, reports the Harry F. Ortlip Co., electrical engineers and constru tors for the yard. Distribution from th transformer substations is by unde ground cable.

Because of possible heavy sno and ice conditions at Bison yard durin the winter months, all 240 power (GRS and hand-throw switches (Ramapo-Aja model 22, trailable) are equippe with Rails Co. electric snow melter For the power switches, the sno melters are rated at 8 kw, using a ro rated at 500 watts per ft; and on th hand-throw switches, the snow melte are rated at 4.6 kw (300 watts pe ft.). Snow melters in the class yar are controlled from the retarde operator's location; melters at the ea end of the yard are controlled fro the general yardmaster's office; an those at the west end of the yard ar controlled from the west end yard master's office. When the snow mel ers are to be operated the contr circuitry is through a ratchet time so that the melters are turned on i groups of about 200 kw thus prevent ing overloading the distribution net work by connecting the entire lo on the line at one time.

An Onan 85 kw standby powe plant is located in the basement o the general yard office and provide emergency 480 volts, 3-phase AC fo retarder and signal operation. Th unit cuts in automatically if the com mercial power fails. The retarde operator and the general yardmaste are located in the tower of thi building. Automatic retarder an switching control equipment as well a the radio station equipment and talk back speaker system amplifiers ar located in this building. It is truly th signal and communications nerve cen ter of the yard, hence the need fo emergency standby power.

CAR CHECKING PICTURE

A new feature of Bison yard is th use of the A. B. Dick Videograp system for car checking of inbou trains. The system scans a railro train or cut of cars moving at spe ranging from 4 to 35 mph and i mediately provides a black and wh printed picture of each car, showi all identification features of the c on a 2¾" paper tape at the gene yard office. A clerk checks t advanced Teletype train consist agai the picture of the arriving train.

The system consists of three sca ners and three printers interconnect by means of underground video-p cable. Scanners are located at e trances to the yard and printers a located in the yard office. Normal a printer is associated with each sca ner. However, in case of need, an

›ne of the three scanners may be used vith any of the three printers. One scanner is located approximately).300 ft east of the yard office and ıas a wide-band amplifier located ıpproximately midway between the canner and the printer. The other two canners are located about 4,000 ft vest of the yard office and do not ave intermediate amplifiers. Each canner is located in a T-shaped uilding which spans the track and orms a tunnel for a distance of 40 t. The scanner is mounted on a eavy concrete base in a compartıent in the end of the T of the uilding. Cars are scanned through a arrow vertical slot, 3 inches wide. 'he side of the car is lighted by a ank of nine 500-watt floodlamps ıounted vertically on a frame atıched to the wall and located close to he vertical slot. On the wall opposite he slot is a fluorescent light tube to rovide a distinctive white separation etween cars for the scanner's viewıg field.

[RAIN STARTS CHECKER

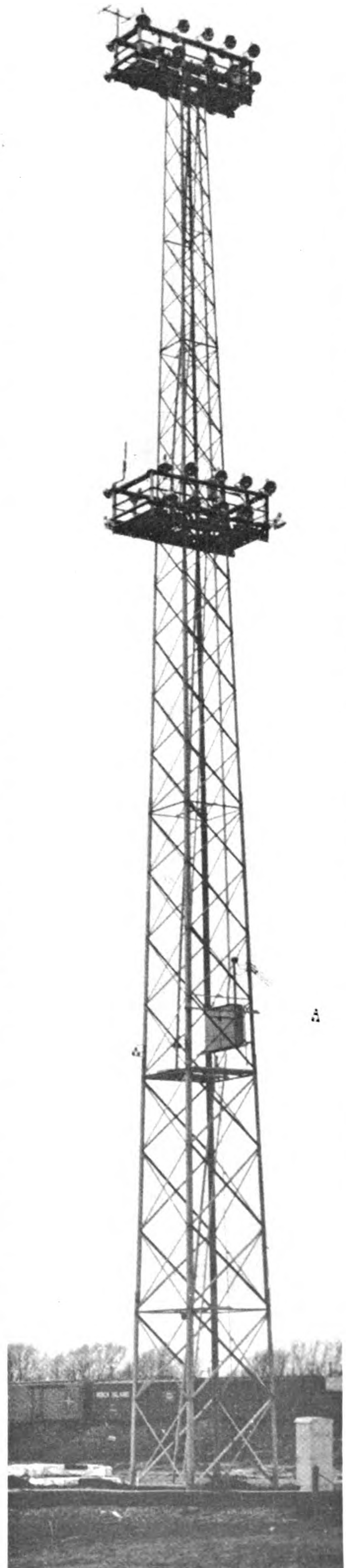
The individual scanner, flood lightıg and associated printer are placed n operation by a train or cut of cars ccupying a track circuit in approach o the scanner. Enclosing the scanner nd light source in the T-shaped uilding was done to minimize the ffects of weather, differences in ighting between daytime and night n the operation of the system.

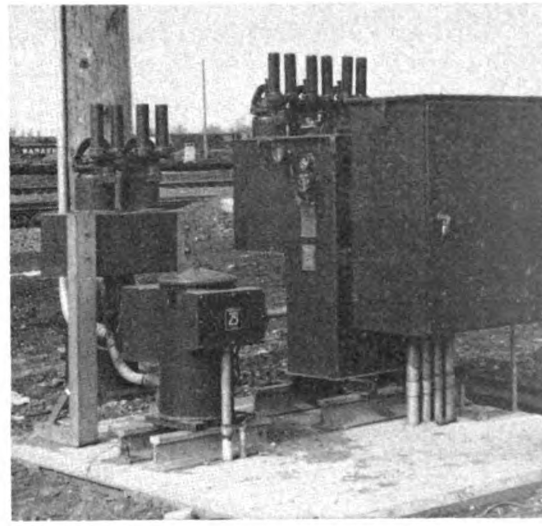
Operation of the Videograph car ecording system is automatic, reuiring only that the operator load a resh supply of paper and liquid toner s necessary and remove the printed utput roll.

The scanner is a mechanical-optical levice designed to scan a narrow, ertical area of a moving freight car. Vhile it is scanning a vertical distance f about 10 ft, the movement of the ar itself provides the horizontal comonent of the picture. The scanner onsists of a lens arrangement, a highpeed rotating prism, a photomultiplier ube and the necessary electronic ircuiting for converting light images nto television-type signals. The use of mechanical-optical scanner rather han a television camera is based on btaining maximum reliability at no acrifice in picture quality.

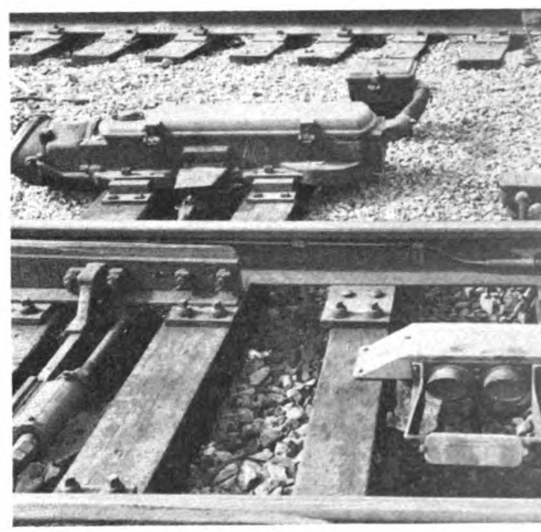
The scanner transmits a wide-band elevision-type signal, which can be ransmitted over coaxial cable, video air or microwave. Coaxial cable or ideo pair are useable over short listances of a few miles when wideand amplifiers are used and placed t approximately one mile intervals.

The printer utilizes a special cath-

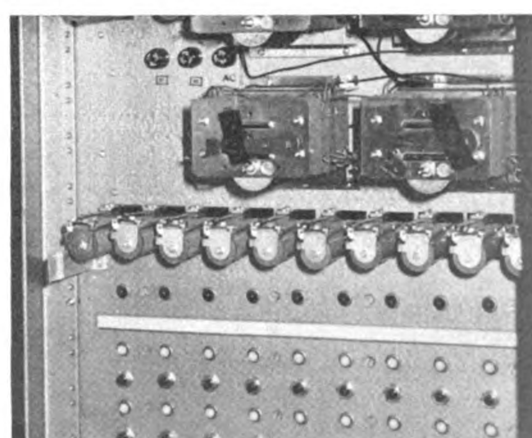




Seventeen three-phase self-contained transformer substations are at the load centers. Distribution voltage is 277/480.

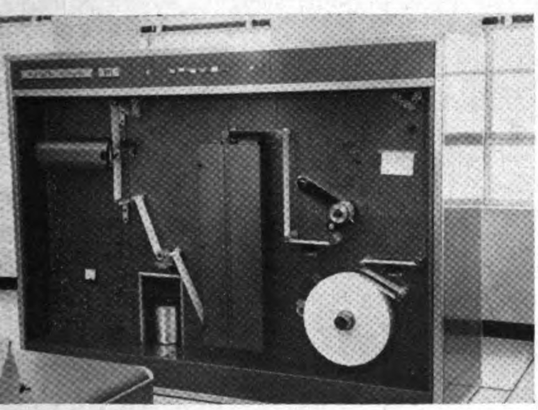


Electric snow melters (tube along rail) are rated at 8 kw for power switches and 4.6 for hand-throw switches.

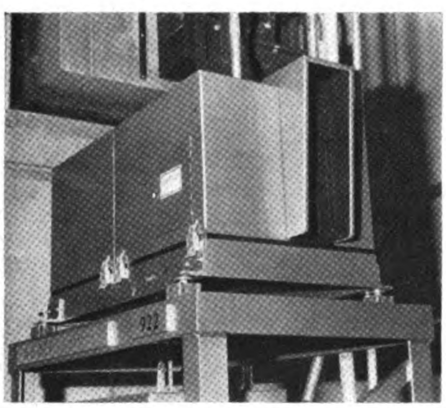


Snow melter circuits go through ratchet timers (top of photo) so melters are turned on in groups of 200 kw.

Scanner (out of sight at right) looks at side of passing train (moving into page, toward yard).



Electrostatic printing method is used to make picture of train. Printing is at rate of 3 ft of paper tape per second.



Scanner is a mechanical-optical unit designed to scan a narrow vertical area of a moving freight car.

Car checker in yard office moves train picture tape by foot controls, leaving hands free to check consist list.

A picture of the inbound trains as they pass through the scanner building is printed out on a paper 2¾ inches wide in th

ay tube for electrostatic printing speed of 3 ft of paper tape per d. This development employs the f a matrix of fine wires perma- y fused in the face of the de-ray tube at a density of ap- imately 250 wires per linear inch in or more rows across the tube face. eries of tiny electrostatic charges placed on the paper as it moves the face of the tube, and the ern of these charges is in the n of the image being scanned. rges are then developed into the ge by application of a black-dyed id toner which adheres to the er only in the charged areas. After elopment, the paper tape is air- ed and fixed for permanency.

aper used in the printer is coated n a non-sensitized plastic base ing. One side is coated for proper ductivity and the other side for uired insulating properties. This ults in an inexpensive paper stock ich makes possible optimum print- quality. The paper tape is 2¾" de and comes in 6,000 ft rolls.

The printer features smooth, silent ration and the speed is adjustable ording to the speed limits which e previously been established for or train movements. Should a move slower or faster than the ablished speed it merely results in ither an elongated picture for slower eed movements or a shortened cture for higher speed movements. ormally a picture of an average eight car occupies about 12" of paper pe.

In order to handle the printed tape cords quickly and efficiently, a small sk-top viewing device is used to ndle the printed output rolls of the rinter. A foot pedal facilitates start- g and stopping the viewer, thus aving the hands free to handle aybills, check consists, prepare switch ts, etc. A narrow band along the ge of the paper tape is left blank r any special notations (arrival time d train number, for example).

It is expected that this Videograph r recording system will eliminate the need for manual car recording at the entrances to the yard. Identification will be speeded up and errors and delays associated with manual recording greatly lessened.

A standby car recording system is provided using a magnetic disc recorder remotely actuated by a person pressing a pushbutton on a telephone handset at the scanner locations. This magnetic recording system is provided for emergency use only in case any of the three scanners fail.

A special system of protection has been set up to protect car inspectors working on transfer cut cars in the classification yard. The two blue-flagging switch key controller panels are located at the west end of the classification tracks. These controllers provide means for supplementing blue-flagging rquirements under operating rules. The device electrically locks a switch leading to the selected class track, ensuring that the retarder operator (or the automatic switching system) cannot route a car into the track under blue flag protection. Tracks selected for the blue-flagging system can be used to classify transfer and/or local cars. By eliminating the need for setting these cars over into the departure yards, the cars are inspected and depart directly from the classification yard.

HOW BLUE-FLAG WORKS

Operation of the blue-flagging device is as follows: When it is necessary to blue-flag one of the class tracks, a car repairman calls the retarder operator on the talk-back speaker system and requests permission to use a certain track. The operator positions the switch at the entering (east) end of the class yard track in a manner preventing entrance of a car onto such track, and places a pin in a hole corresponding to the track being blue-flagged. The pin opens a switch control circuit so that the automatic switching system cannot route a car to the track that is to be blue-flagged and displays a flashing light on the field key controller. Next, the retarder operator notifies the car repairman that the track may be blue-flagged. The carman then inserts a switch key in the key controller marked Cut-Out under the track number of the track to be blue-flagged. Turning the key activates a circuit electrically locking the entering switch to that track. When the route is properly locked, the light indicator in the key controller panel changes from flashing to steady.

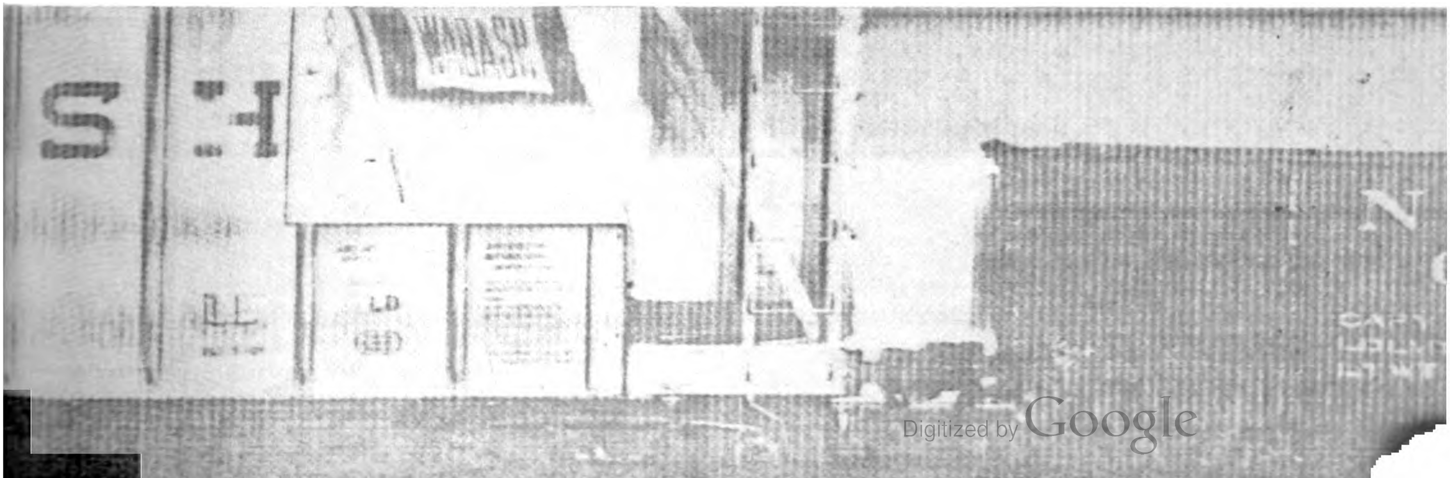
When work is completed and the blue flag is to be removed, the carman again contacts the retarder operator to so advise him regarding removal of the blue flag. The operator must then restore the switch involved to the automatic position FIRST, and then remove the pin from the proper hole. This extinguishes the light on the carman's key controller panel. The carman then inserts the key, turns it clockwise and back, then removes it. The operator then checks the switch manually for proper control and correspondence.

Ultrasonic presence detectors are used at Bison yard in conjunction with 55 ft impulse-type track circuits in the class yard. The detectors are equipped with a heater (200 watts at 115 volts AC) under the reflector plate to melt ice and snow. Here, as explained by GRS engineers, is a description of the operation of the ultrasonic detector:

It operates in parallel with the existing detector track circuit in such a way that the length of the detection zone is, in effect, adjusted in proportion to the length of the car. As a result, extra long cars are handled automatically, the same as normal length cars. The ultrasonic, track-mounted sensing unit is located within the circuit, approximately at the switch points. Thus, although an extra-long car can span the track circuit, it is still protected by the presence detector, thereby preventing switch movement until the trailing trucks of the car are off the track circuit.

The car presence detector utilizes two elements: a track-mounted sens-

Below is the actual size of the reproduction on the paper tape.)



ing unit and an electronic transmitter and receiver. The sensing unit consists of a reflector plate, a transmitter transducer, and a receiving transducer. The transmitters and receivers are located in wayside equipment cases and cable-connected to a junction box attached to the sensing unit. The transmitter feeds electrical energy to the transmitting transducer. The transmitting transducer converts the electrical energy to ultrasonic energy, and beams it off a reflector plate which is part of the sensing unit housing. The plate reflects the ultrasonic energy upward to the underside of the car. It is then reflected back via the reflector plate to the receiving transducer which converts the ultrasonic energy back to electrical energy for transmission to the receiver in the wayside case. The output of the receiver deenergizes the ultrasonic detector relay, which is interlocked with the detector track relay. Thus, fail-safe operation is ensured.

The car presence detector is available in two types of installations: for a single detector track circuit, or for several detector track circuits. A single installation consists of a power supply, an ultrasonic transmitter and receiver, and timing circuits, all on a common chassis. A multiple installation for three and up to a maximum of ten detector track circuits consists of a common power supply, common transmitter, multiple receivers, and the necessary output relays. With both type installations, the equipment must be within 500 ft of each track instrument.

An organizational block diagram of the car presence detector is shown in Sketch A. The oscillator generates a 19-kc signal in bursts of 1 millisecond duration, with approximately 20 milliseconds between each burst. Each burst is amplified, filtered, and fed to the transmitting transducer. The transmitting transducer converts the burst to ultrasonic energy, which is then directed upward. If a car is over the transducer, energy is reflected back to the receiving transducer. If a car is not present, no energy is reflected back to the receiving transducer.

The multivibrator (clock) determines the repetition rate of the oscillator, and also times the opening of the detector gate. With this arrangement, only reflections from objects one half to four feet above the rails are detected. Extraneous signals and reflections are rejected.

Timing circuits establish the continuity of the reflected bursts before relay operation occurs. The relay amplifier requires eight successive and valid reflected bursts before the relay is deenergized to signify detection. Ten successive missed reflected bursts are also required before the relay is again energized to indicate the end of the detection for a valid object. In this manner, extraneous reflections are further rejected. Momentary loss of a signal during the passage of a valid object in the detection zone does not appear as a loss of detection.

Automatic gain control ensures that the detected signal is always of sufficient amplitude for operation. This eliminates manual readjustments for aging, or decreased efficiency of the oscillator, transducers, or input amplifier. It also corrects for rain or snow which may collect on the transducer reflector plate.

One of the new features of the Class-Matic II automatic yard control system at Bison yard is the automatic correction for car count distance-to-coupling. As stated by GRS engineers, the automatic DTC feature is described as follows:

The development of an automatic correction for car count distance-to-coupling provides a means of measuring the actual distance to the coupling point. This corrects for errors resulting from the variations in car length, and changes in the coupling distan caused by stalls or the pulling do of cars. The problem of the car cou system was not knowing where a c stopped. Now a track circuit is us to measure the distance to couplin It is a constant current track circu the voltage changes as the track fi up. A motion detector has been pr vided to sample the voltage to dete mine whether cars are in motion on track. If not, the impressed voltage used as a correction factor.

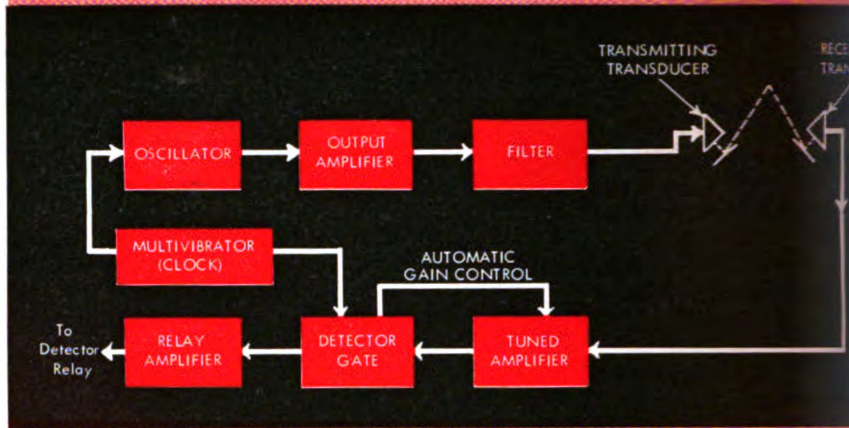
The Class-Matic distance-to-coupl system provides:

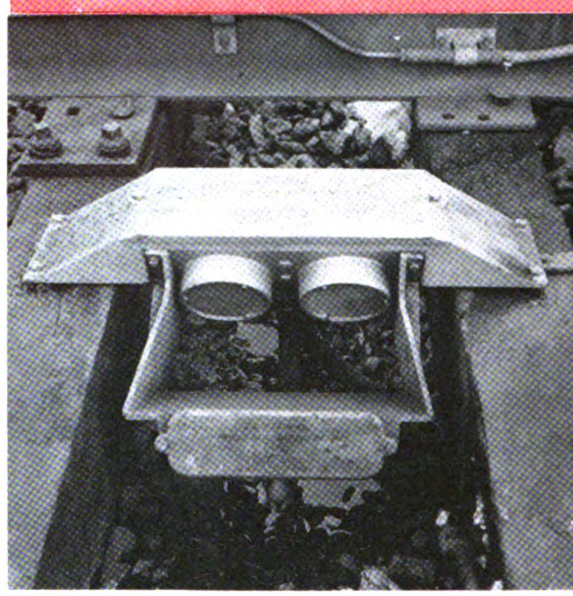
(a) A storage of the count of c whether positioned by actual cou automatic correction when called f or manual correction.

(b) Lights to indicate occupan of each clearance point track circ and a numerical display, to indic distance-to-coupling (DTC).

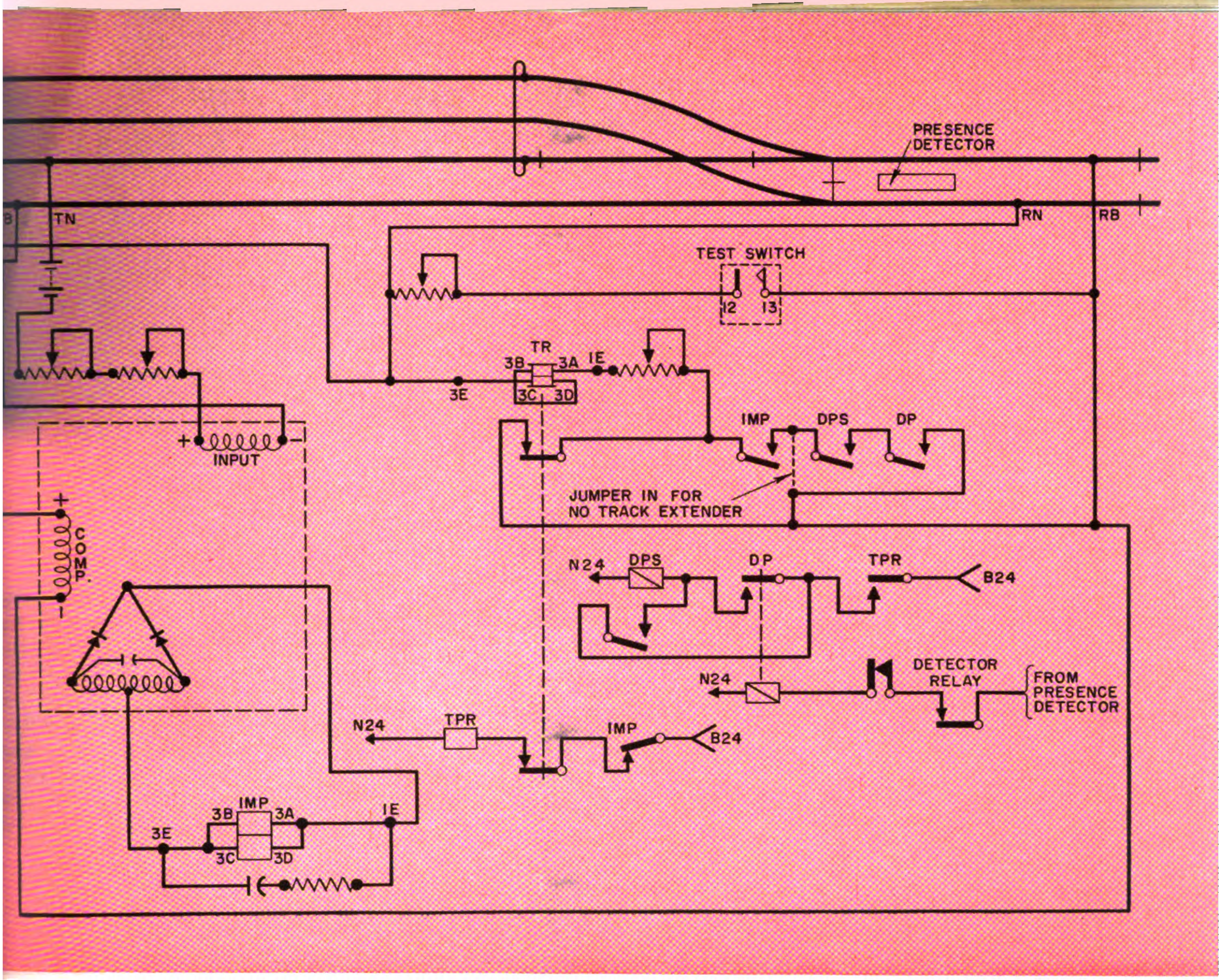
(c) Automatic correction of an em ty track to the correct DTC in acco ance with track capacity.

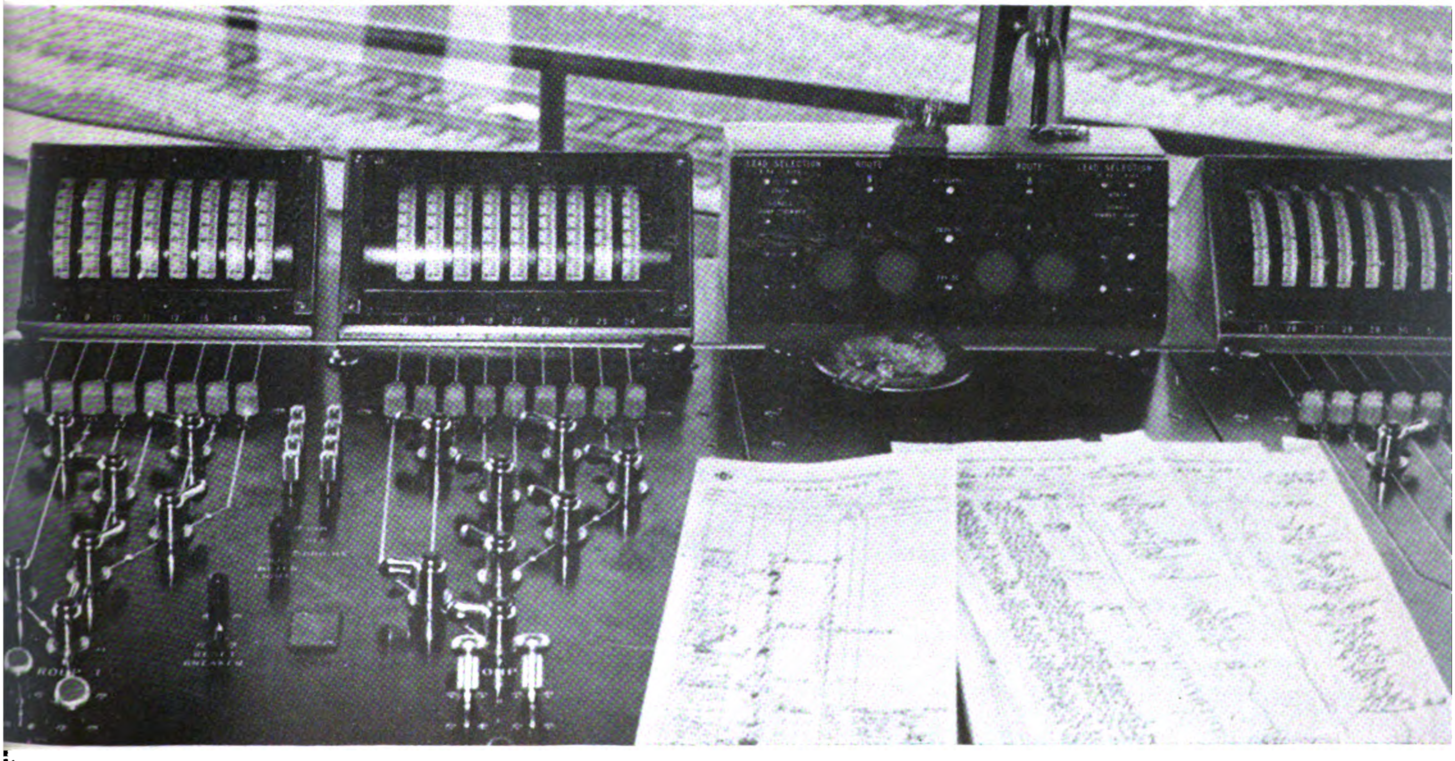
(d) Automatic correction of track to the correct DTC in accor ance with position of last car.





Sketch A (above) show organizational block dia of car presence detector (left) makes use of ultra energy reflected off the tom of passing freight A typical circuit diagra the impulse type track c that is used with the presence detector is sh at the right.





Meters above the class tracks of the retarder control machine indicate distance to coupling on the panel.