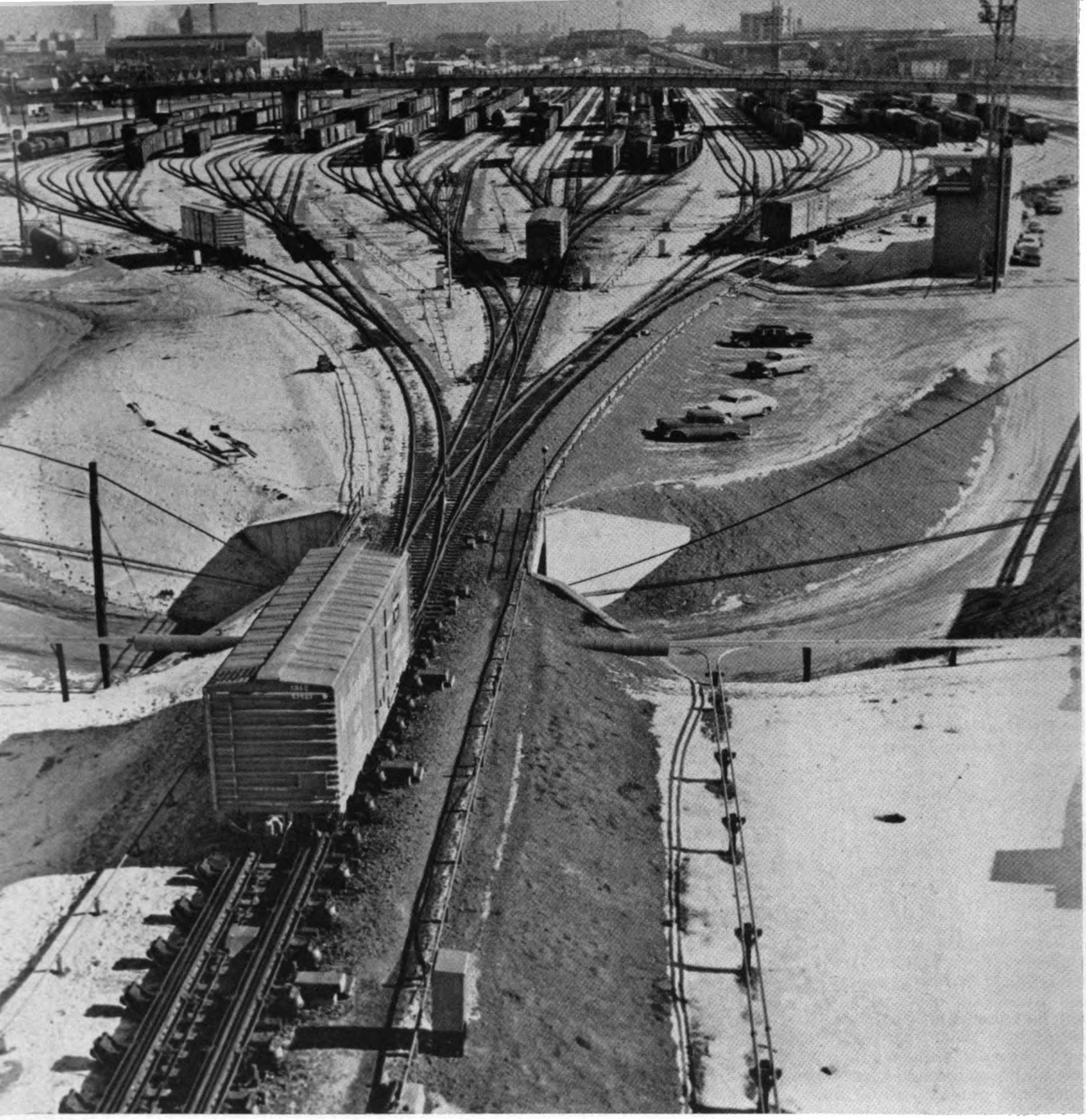


Automatic Classification Yard in Service

. . . on the Burlington at Chicago

- ***Designed to classify 3,000 cars daily. Cars move through yard 3½ hours faster.***
- ***Savings equal 10 per cent on cost of $4,000,000 investment, after taxes.***
- ***Damage to cars and lading has been reduced approximately 85 per cent compared with operations in former flat yard at same location.***
- ***Western Avenue Yard, 3 miles east, which served industries and for interchange, is now being used to serve industries in that area only, the balance of this work being done now in the new Cicero Yard.***
- ***Retarder control system is completely automatic. Instruction to operator is that he is to keep equipment in automatic position.***

Retarder operator has control of non-interlocked switches at extreme west end of yard (panel at left foreground)

TO HELP EXPEDITE the overall movement of freight traffic through the Chicago terminal area, the Burlington has constructed new, completely automatic gravity classification facilities at Cicero, Ill., near Chicago. This new yard replaces several flat switching yards formerly in this same area.

All incoming eastward Burlington road trains terminate at this yard, where cars are classified for delivery to connecting railroads or to industries and freighthouses. This same yard classifies westward outbound cars received from industries, freighthouses and connecting lines, to make up outbound westward Burlington road freight trains. Approximately 1,500 inbound eastward cars, and about 1,500 outbound westward cars are handled through this yard daily. The yard facilities as a whole occupy about 200 acres of land extending about two miles, approximately east and west, along the south side of the three-track main line. This is the same area occupied by former flat yards. No more land was available, therefore the new yard had to be designed to fit the space.

Receiving Yard

The receiving yard, used for all inbound road trains as well as switch runs from industries and connecting roads, is located in the central portion of the west half of the overall area, as shown in the plan. This receiving yard has 16 tracks, with a total capacity of 1,386 cars. Incoming trains can enter either end of this receiving yard without interfering with the hump operation. Incoming eastward road trains enter the west end. Incoming westward switch runs from industries or connecting lines are routed on either of the two "westward receiving yard leads" around the classification yard, to enter the east end of the receiving yard, via single switches and double-slips to any one of nearly all of the tracks in the receiving yard.

If an incoming eastbound road train includes a long "block" of cars that need not be classified, this "block" can be pulled out the east end of the receiving yard via one of the "receiving yard" leads. Thus this special track layout at the east end of the receiving yard has merit.

The westward departure yard for outbound road trains is located along the north portion of the area, along the north side of the receiving yard. This departure yard has seven tracks with a total capacity of 832 cars.

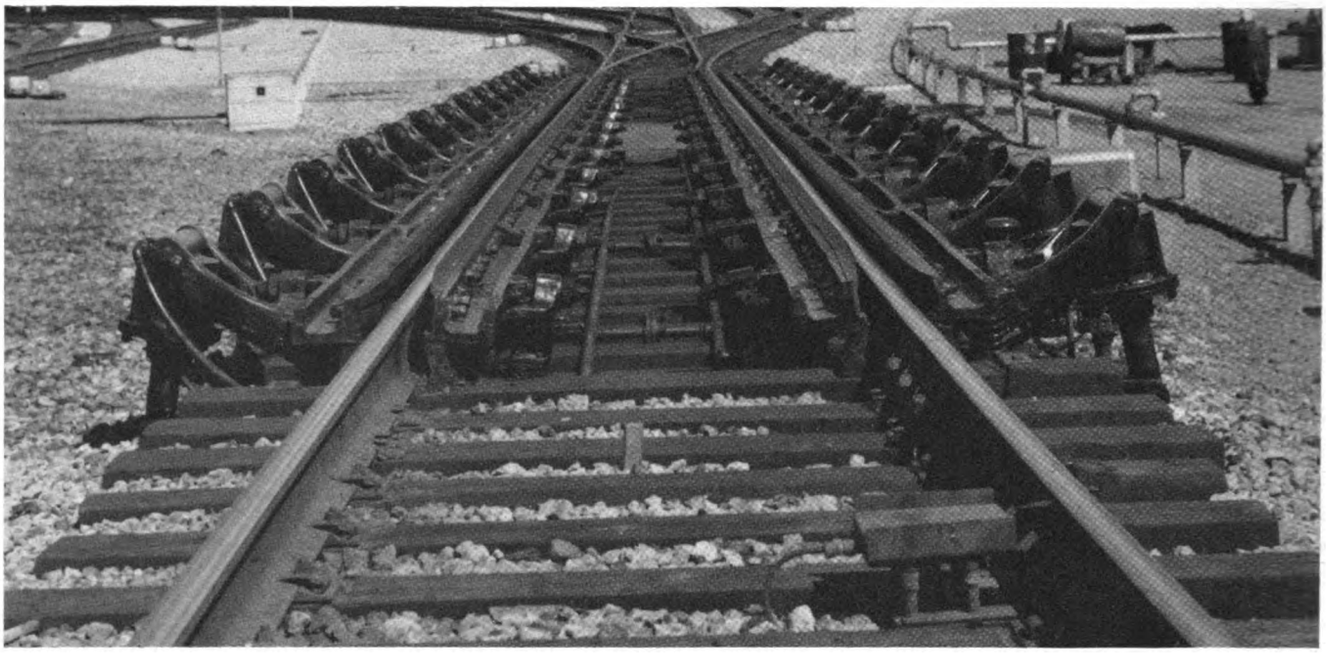
The eastbound departure yard is located along the south side of the receiving yard. This eastbound departure yard, in combination with a storage yard, consists of 22 tracks with a capacity of 1,794 cars.

From the receiving yard, cars are pushed eastward up to the hump, from which they coast down to the tracks in the automatically controlled classification yard. This yard has 43 classification tracks, arranged in five groups of seven tracks each, and one group of eight tracks. This one yard classifies all cars for all directions.

The switches are operated by direct - acting electro - pneumatic switch machines, which are controlled by an automatic switching system. The foreman of the crew that is pushing cars, works in an office at the hump, where he pushes buttons which initiate the controls of the switches for routes to respective classification tracks. The system is also arranged for tape switching.

The retarders are the electropneumatic type. A master retarder, 103 ft long, is located on the lead down the hump. A group retarder, 84½ ft long, is located on each of the six leads to respective groups of classification tracks. These retarders are controlled automatically by Velac automatic classification yard system.

A panel machine for manual control of the switches and retarders is located on the third floor of a brick tower on the south side of the yard opposite the group retarders. With the automatic control nor-



Rail treadle for track fullness count in approach to group retarder. Radar unit is at center of retarder

mally in effect, the primary duty of the man at this machine is to watch cars to see that they go to the correct class tracks, and that they keep going to couple with cars standing there, at speeds that are not too high. Normally this is not to exceed 4 mph. When trimming is underway this operator controls the switches and retarders manually. More than six months service has proved that the automatic control system works as intended, and therefore the standing instruction to the operator is that he is to keep his hands off and let the automatic system control the retarders.

How the Control System Works

The objective of this automatic retarder control system is to control the speed of each car so that it will couple with the car standing on its respective classification track at a speed not to exceed 4 mph. The factors which determine the speed at which cars are released from retarders include:

Weight of car.

Rollability, as determined by rate of acceleration, on known grades.

Characteristics of turnouts and curves leading to each of the 43 classification tracks.

Track fullness, which is a measure of the distance a car is to travel on its classification track, until it couples with the car then standing on that track.

Weather conditions such as extreme temperatures, moisture and wind.

The weight of each car (or cut) is classified by a weighing device known as a "weigh rail" located 7 ft in approach to the entering end of the master retarder. This device consists of a special section of rail 7 ft 4 in. long, including a lengthwise slot enclosing special material which is affected by flexing of the rail under load. Thus the weight of each car is automatically classified as either "light," "medium" or "heavy."

Light-weight cars, which are usually harder rolling, are released from the master retarder at higher speed. "Medium-to-heavy" cars are released at a slower speed. Radar equipment measures the speed of the car constantly while it is in the master retarder. This radar operates at 10,525 megacycles, so that the speed is checked every $\frac{9}{16}$ in. as the car proceeds.

Each retarder is composed of two sections. While a car is in the first section or partly in both sections, the control of the first section applies to both sections. After the rear wheels of a car clear the first section, the control for that car applies only for the second section. Thus the retarder as a whole can control the speed of two separate cuts at one time.

The automatic equipment controls the retarder so that when a car leaves the master retarder the speed is according to that called for within plus or minus $\frac{1}{10}$ mph. Normally a "light" car is released at 12.2 mph, and a "medium-to-heavy" car at 10.6 mph. In cold weather cars roll harder. Then the operator turns a dial control from the "Normal" to the "Fast" position, which causes "light" cars to be released from the master retarder at 13.4 mph, and "medium-to-heavy" cars at 11.8 mph. Rain or wet rail causes cars to roll easier (up to 20 per cent in some conditions). Therefore, during warm, rainy weather the operator turns a special dial from "Normal" to "Slow" position, which reduces the release speed from the master retarder to 10.4 mph for light cars, and to 8.8 mph for heavy-to-medium cars.

As Car Proceeds to its Group Retarder

After a car leaves the master retarder it rolls down through switches to the lead to its track group. On this lead each car passes through its group retarder, then on down through switches and turnouts to its own classification track. Thus the group retarder for that class track is the last opportunity to control the speed of the car.

In addition to the weight of a car and weather conditions, numerous other factors are taken into consideration for the control of the group retarders. Each of these factors will now be discussed.

Each car has its own individual rolling characteristics, depending not only on weight but also on the condition of the bearings and trucks, as well as other factors. A measurement of rollability of each

car or cut is necessary in order to know ahead of time how a car will roll after it leaves its group retarder.

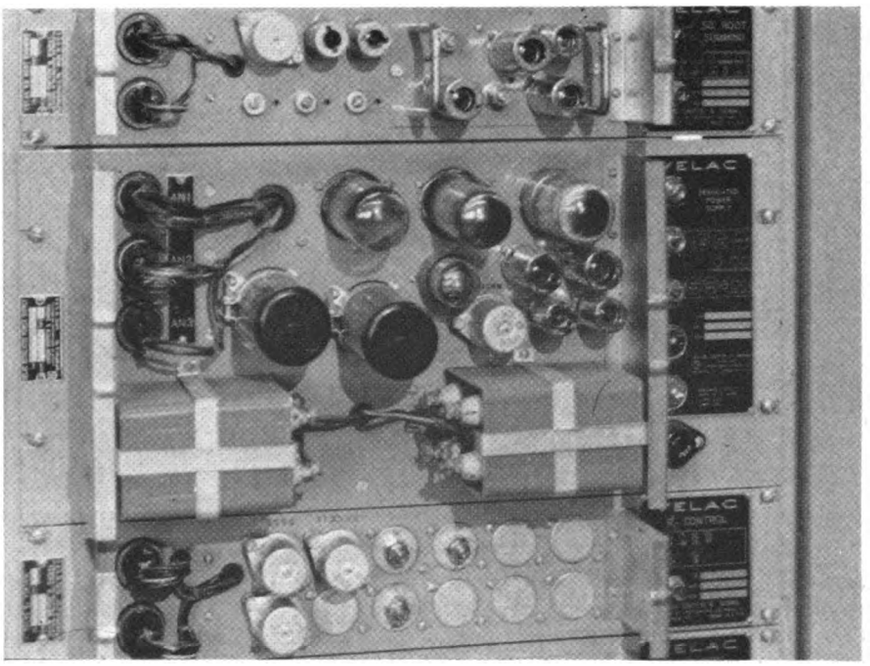
The Velac electronic automatic system includes equipment for measuring rollability of cars on tangent track and on curve track. Ordinarily, measurement of rollability on tangent is made on a section from the crest to the master retarder. However, area was not available in the construction of this yard to allow enough tangent in approach to the master retarder. Therefore, average values for rollability on tangent, based on weight classifications, are used in this yard.

Measurements of rollability of each car on curve track are made while traversing the section from the master retarder to the respective group retarder. This information is required to know ahead of time how that car will operate on curves and turnouts between its group retarder and its class track.

Theoretically, if a car had no rolling resistance, the rate of acceleration would be according to Newton's law of gravity, i.e., 32.2 ft per second, reduced in accordance with the grade, which in this instance is 1.06 per cent. A measurement of the increase in velocity on a known grade, compared to the theoretical value with no resistance, gives a figure which represents the rollability of the car.

Number of Cars in Cut

A car or cut of cars is not free rolling until the rear wheels leave the lower end of the master retarder. Therefore, the free rolling distance from the master retarder to the entering end of the respective group retarder is the total distance, less the length of the car or the total length of the cars in a cut. A method to determine the number of cars in each cut uses four successive track circuits in approach to the entrance of each group retarder, and are used to distinguish between cuts having different lengths. For example, a 29-ft car; a car between 29 and 58 ft long; a cut of cars 58 to 73 ft long; a cut of cars 87 to 116 ft long; or a cut in excess of 116 ft. When the number of cars in a cut is determined, the radar equipment at the center of the master retarder, directed down the grade, reads the speed of each car or cut, so that they leave the master retarder at proper speed. Radar equipment at the center of each group retarder, directed up the grade, reads the speed of each car or cut as it approaches a point 2 ft 4 in. from that retarder. Subtracting the two speeds gives the increase in velocity. The electronic equipment derives a value for the rollability of that car or cut.



Electronic computer calculates proper release speed of car from group retarder

If a car leaves the master retarder within plus or minus ¼ mph of requested speed, a "yes" function is delivered to the automatic switching system. If "yes" is received at the group retarder it is assumed that car left the master retarder at predetermined speed as a function of weight and FNS setting.

Track Emptiness Determined

The distance a car is to travel on its classification track before coupling with the car standing there, is a factor in calculating the speed at which that car is to be released from its group retarder. A Silec mechanical-type track treadle is located on the gage side of one rail about 6 ft in approach to the entering end of each group retarder. Each wheel actuates the treadle, thus four operations indicate the passing of a car.

Based on controls from the automatic switching system, each indication of the passing of a car, at the treadle, actuates a Kellogg impulse counter. Two Kellogg impulse counters are used, one counts units, the other counts tens. Each step introduces 100-ohm resistance into the circuitry of the electronic controls. This affects the controls so that the "distance to go" is a factor that makes a corresponding reduction in the speed at which a car is released from its group retarder. For example, if other factors establish a release speed of, say, 9 mph for a cut to go to the far end of a 100-car class track, this release speed would be reduced to about 7 mph by the track-empty factor if the track is already half full, or to about 5 mph if the track is nearly full, so that car is to go only 4 or 5 car lengths.

The machine in the retarder control tower includes not only levers for controlling switches and retarders, but also a special panel—at the right—which includes small numbered indicators—one for each class track—that are controlled automatically by the treadles discussed above, to indicate the number of car lengths of track that are not occupied on each class track.

When cars are pulled from a class track, the operator operates a key and footswitch which runs the indicator to correct the figure displayed. This action by the operator also resets that portion of the automatic control which has to do with the length of track that is unoccupied on the corresponding classification track.

A somewhat similar track-fullness indicator is located in the yardmaster's office, which is on the top floor of a 60-ft tower at the hump. This indicator shows a figure which counts the cars that have been routed to each track, rather than indicating the length of track yet to be filled.

The 52nd Avenue viaduct crosses the classification yard at the west

Non-interlocked power switches enable trains to arrive and depart without stopping for switches to be thrown

end and wind velocity may vary from that which prevailed at the time rolling characteristics were measured west of the viaduct. A strong wind from the west may increase the speed of a car as it rolls along its classification track. Or a wind from the east may reduce the speed. An anemometer, operated by wind in any direction, is mounted on a mast 20 ft tall, at a point near the center of the classification tracks. This anemometer controls an indicator, showing the velocity of the wind, mounted on the panel of the operator's control machine. By means of a knob, which operates a potentiometer, the operator can make a small change, plus or minus, in the value representing the tangent rolling-resistance factor.

The switches, curves and grades from the respective group retarders to each classification track are different for each of the 43 tracks. In a series of tests, the same separate cars were repeatedly routed 30 times from the hump to each of the 43 class tracks (15 heavy cars and 15 light cars). Rolling resistance measurements were made on each car when rolling between the master and group retarder, and again between the group retarder and the point of clearance on its class track.

Correlation produced a relationship between these measurements. These values are stored, and when needed are brought forth in accordance with the automatic switching system routing for each car or cut.

How Electronic Computer Gets Answer

Thus a value has been determined for each factor: rollability on tangent; rollability on curves; length of cut; characteristics of route to each class track; and length of empty track to first standing car. Also, provisions are included with respect to extremely cold weather, strong wind and wet rail.

Each factor value is represented by a separate d.c. voltage. When each car or cut is immediately approaching its group retarder (34 in. from it) the car enters a short track circuit which causes the stored d.c. voltages to be fed to an analog electronic computer, which within a milli-second (time for relays to operate) produces an answer, which, in effect, is the speed at which the car is to be released from this group retarder. Then the system controls the retarder accordingly.

Each computer is normally in operation solving a typical problem. Thus the computer is hot, so that it can solve any new incoming problem instantaneously. If a computer, in normal operation, fails to solve its normal problem, the failure is indicated. This expedites replacements and thereby minimizes delays in yard operations.

To perform its calculations, a computer must be able to add, subtract, multiply, and extract square root. Addition and subtraction are accomplished by resistance networks at the input circuit to a d.c. amplifier. Voltages of same polarity add. Opposite polarities subtract.

Multiplication can be done two ways. In the first method a potentiometer is used when the input voltage is to be multiplied by a constant less than 1. In the second method, a d.c. amplifier with a feed-back network is used. The ratio of the feed-back resistance to the input resistance determines the amount by which the input is multiplied. Square roots are computed by using a d.c. amplifier with a feed-back network, the resistance of which changes as a function of output voltage. This is done by biasing elements of feedback network to different potentials.

The track circuits in this yard are fed a.c., with a rectifier at the other end which supplies d.c. to operate a d.c. track relay. All relays are in the tower. The relays on the measuring circuits and on the circuits within the retarders are the K-N type, rated at 60 ohms. On detector locking track circuits the relays are the safety type PN 50B, rated at 2 ohms. The track circuits are the single-rail type with the other rail common.

The minimum detector track circuit length is 57 ft 6 in. (to handle most piggy-back cars). Of this total, 22 ft 6 in. is in approach to the facing point.

Color-light signals are on masts at proper locations to be seen by enginemen when pushing cars up to the hump and when trimming. Each of the three diesel locomotives used for pushing cars up to the hump are equipped with cab signals which are controlled by the inductive system. A cab signal can display four aspects, "green"—hump fast, "yellow"—hump slow, "red"—stop, and "red-over-red"—back up. A bell sounds in the cab when an aspect changes.

Stop-Pushing Signal

To make up westbound road trains, yard crews pull cars eastward out of the classification tracks, then push the cars westward on a lead that connects to the long tracks in the westward departure yard. At the far west end of each departure track there are four track

Stop-pushing signal indicates car lengths to go to clearance point

Special guard rails, each 16 ft 6 in. long, are for straightening "skewed" trucks of cars as they approach their classification tracks

circuits, each 200 ft long, about the same as four car lengths. At the east end of the departure yard, on the leads used to push cars into that yard, there is a position-light type dwarf signal, in which all four lights are white and normally lighted to display figures or a letter. Painted on the cover glass of the lamp units are: "12," "8," "4" and "E." When a yard engine is pushing a string of cars west into one of these tracks in the departure yard, and when the lead car on the west end enters the first track circuit the figure "12" aspect on the dwarf is extinguished, thus warning the engineman to reduce speed. When the lead car enters the second track circuit the "8" is extinguished, and when the car enters the third track circuit the "4" is extinguished. By that time the engineman has reduced to slow speed. When the lead car enters the last track circuit the "E" aspect on the dwarf is extinguished. Then the engineman stops, and pulls the cars back east far enough so that the "E" aspect is again lighted. At that location, track length is left beyond the west end of the cars for a four-unit diesel locomotive to couple on with its head end in the clear. If additional room over and above a four-unit diesel is required for a "fill" on the head end of the train, a "pull back" movement may be made in connection with the display of figures "4," "8" and "12."

Non-Interlocked Power Switches

To avoid stops and to reduce delays when trains are entering or leaving the ends of this yard area, non-interlocked power switch machines have been installed at each end of the yard on switches and crossovers, to replace hand-throw switch stands that otherwise would be operated by switch tenders or members of train or yard crews.

At each switch there is a small two-unit electric colorlight switch lamp, which displays yellow when switch is normal, or red when switch is diverging. All train movements in this area are within the yard, and are governed by yard rule No. 908.

In order to hold other yard movements when a road or transfer train is entering or leaving, special "Holding" signals are located on some of the principal lead tracks approaching the receiving yard from the east and power switch layouts from the west. These "Holding" signals are lever controlled with no track circuit control.

The 20 power switch machines and six signals at the east end of the yard area are controlled from a panel type machine by a switch tender in a tower at the East End.

The 21 power switches and signals at the extreme west end of the yard area are controlled by levers from a special panel, which is part of the machine in the retarder tower at the south edge of the yard, opposite the group retarders.

The non-interlocked switch machines used at East End and at West End as discussed above, are the Model NA-15 direct-acting electro-pneumatic type, including dual-control levers.

The "Holding" signals are the searchlight type. They normally display "green," or can be controlled to display "red" to hold trains at certain points.

The new yard as a whole contains 93.2 miles of track, 383 turnouts, 12 lap turnouts and 4 slip switches. Rail from the crest of the hump to the clearance point on classification tracks is 129-lb section of Burlington design. Other yard tracks are relay rail from 90 lb to 112 lb. Slag ballast is used throughout.

The grade down the hump is 4.36 per cent through the master retarder; 1.06 per cent between the master and group retarders; varies from a minimum of 1.0 per cent to a maximum of 1.48 per cent through the group retarders; and 0.13 per cent in the classification tracks.

The Railroad Products Division of American Brake Shoe Company furnished all the 129-lb special trackwork for the hump and main leads into the classification yard, including standard No. 9 and No. 11 turnouts with manganese tips on the curved points to offset the expected wear. Racor type 3131 adjustable braces, and heavy duty integral-base solid manganese self-guarded frogs are used. Nine special lap switches were also involved in the heavy traffic main leads, with manganese tips on the special 13-ft switch points. Racor 22 automatic switch stands were installed on switches at the east end of the receiving yard, the east end of the 43-track classification yard and both ends of the departure yard.

Other special trackwork furnished by American Brake Shoe included six manganese-insert, integral-base depth hardened crossings over the main lines and two leading to the partially completed new freighthouse.

To aid in straightening "skewed" trucks on cars, this yard includes two guard rails 16 ft 6 in. long on the first portion of tangent beyond the curve of the turnout leading to

each of the classification tracks.

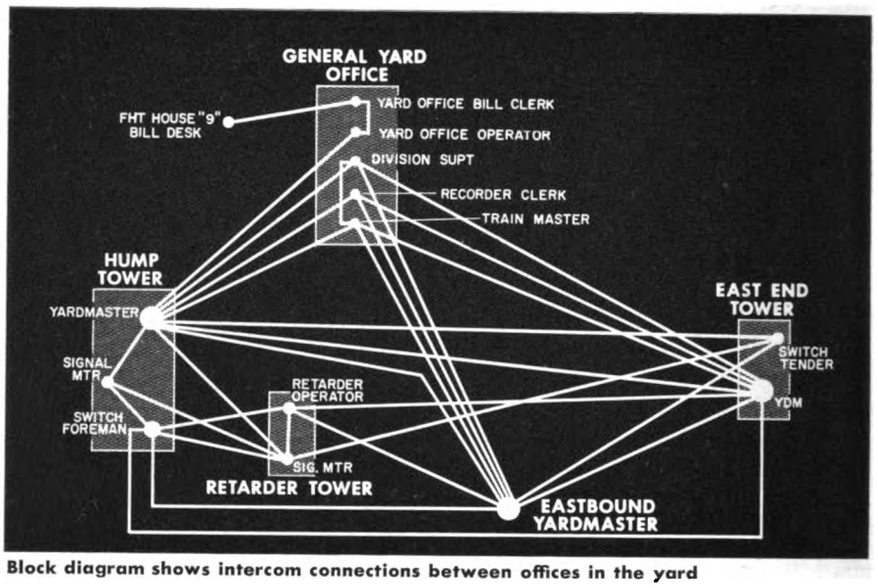
In this yard, most of the circuits from the towers to the power switches, retarders and control equipment outdoors, are in buried cable. Six wires go from the tower to each power switch. Eight wires go from the tower to each of the two controllers at each retarder. Cables are 6-conductor, 9-, 12-, 15- and 25-conductor. These are No. 14 solid copper wires except for two No. 6 wires in some of the 45-conductor cable.

The special circuit from each of the radar track units to the tower is in a 2-conductor No. 14 cable, which has a "shielding" copper sheath that is grounded at one end only to prevent interference. In these cables each No. 14 conductor has a layer of Okonite insulation, a layer of Okoprene, lead sheath, a layer of saturated jute, two layers of steel tape, and an outer layer of jute. The No. 6 wire has Okonite, and Okoprene layers with same outer protection as listed above. Also, there is some 7-pair cable with No. 18 copper and steel strands, latex insulation, rayon braid, pairs twisted, layer tinned copper shielding, braid, and neoprene outer jacket.

The cables are continuous from the field unit to the tower, with no junction boxes or joints. Cables are brought in underground at the tower first floor, and extend vertically through a masonry chase to the second floor. In this vertical chase each cable is supported by an angle-iron crossbar with circular holes, each about 3 in. in diameter. A cone-shaped wedge, with a hole lengthwise, fits around the cable. The wedge goes down in the 3-in. hole in the angle-iron crossbar, thus gripping the cable to support the weight of the cable, but not so tight that the cable sheath is damaged.

The insulated wire and cable in the power switch, retarder, and interlocking portions of this project were furnished by The Okonite Company. Solderless wire terminals were made by AMP, Inc. Storage batteries for relay and control circuits are the lead type made by Exide. The power switch machines, car retarders, Velac automatic control systems and cab signaling equipment were made by the Union Switch & Signal Division, Westinghouse Air Brake Company.

This car retarder and power switch project was planned and installed by Burlington forces under the direction of A. L. Essman, Chief Signal Engineer, Burlington Lines.



Block diagram shows intercom connections between offices in the yard

Good Communications

. . . In Cicero Yard

- ***Telephones***
- ***Talk-Back Loudspeaker***
- ***Direct-Calling Intercoms***
- ***Radio on Locomotives and in Offices***
- ***Tape Recorders for Recording Car Numbers via Radio or Direct***
- ***Pneumatic Tubes and Facsimile***

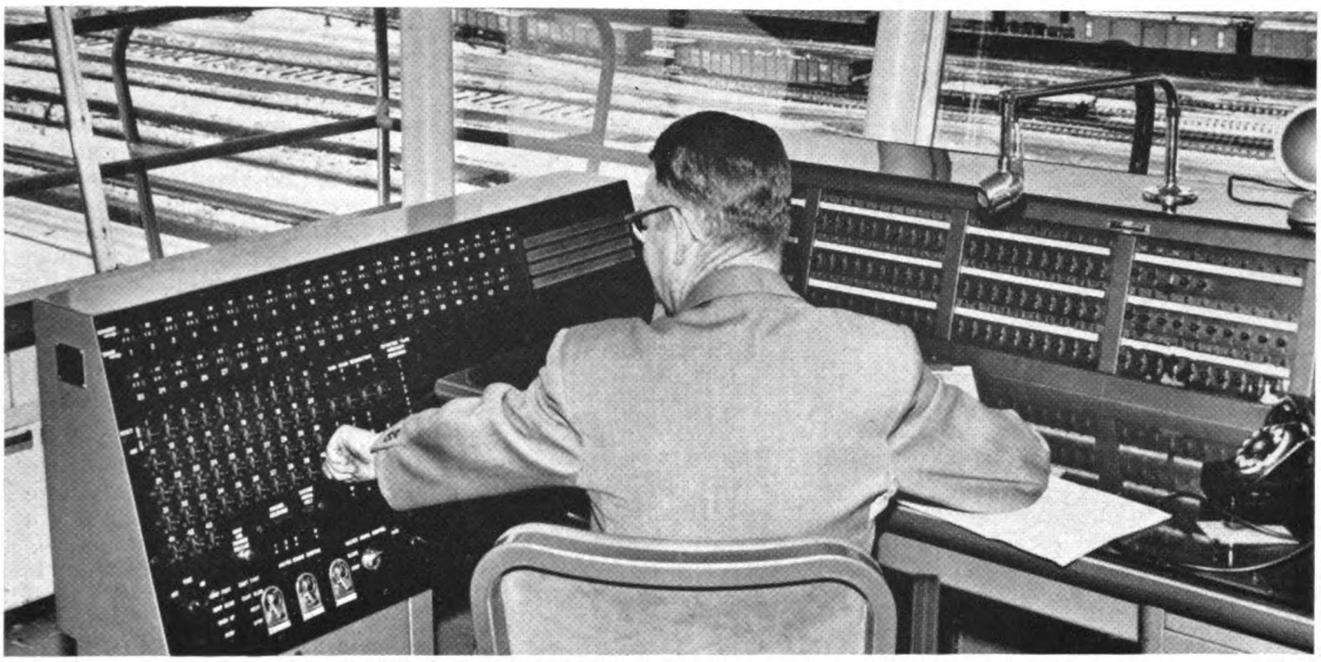
THE NEW BURLINGTON YARD at Cicero is equipped with modern communication systems that were planned to meet requirements, using construction practices that insure consistent performance, and permit economical maintenance. If one talk-back speaker is used in two systems there are two push-buttons in the one housing, with the housing painted two colors to designate the two systems.

Nine separate talk-back systems each serve a special purpose. Any talk-back speaker can be identified as being part of a certain system by a color painted on the housing for the pushbutton, which is halfway up the mast. Most of the speakers are mounted back-to-back in pairs on 2-in. pipe masts, 8 ft tall.

Features of Talk-Back Circuits

The circuits from the control consoles to the outdoor talk-back loudspeakers are 500-ohm balanced, with a matching transformer at each speaker location. When a man pushes a button at a speaker, the center tap of the transformer is grounded, which causes a relay to operate at the console, to light the indication lamp above the corresponding key and sound a buzzer.

At each speaker location, that can be used for calls to either of two consoles, there are two buttons, one for signaling each of the two consoles. The shielded talking pair from these speakers extend from the speaker through normally-closed contacts of the first console, then on to the key of the second console. The button used to signal the second console grounds the center tap of the transformer, and signaling is carried out in the same manner as a single controlled stand. The button, to signal the first console, grounds an additional signaling wire which extends from the stand to the first console, for operating signaling equipment at this console.



Hump tower yardmaster has class yard track fullness panel (left) and communications console (right)

The hump tower yardmaster is on the top floor of a brick tower 60 ft high near the crest of the hump, where he can see the entire yard. On his desk he has a large communication control console from which he can control the 49 talk-backs marked "H" having red button housings, four of which are dual speakers controlled from other consoles.

The switch foreman, of the crew that is pushing cars over the hump, works in a room on the ground floor of the tower at the hump. For directing pin-pullers, this foreman has control of three talk-back speakers marked "F" along the track over the hump.

A second yardmaster, who has charge of making up trains and cuts for eastbound delivery to connecting lines, industries and freighthouses, is located in the eastbound yard office, which is on the south side of the yard at the east end of the eastbound departure yard. This man controls 29 talk-backs marked "B," with switch housings painted blue; 13 are dual units. Equipment is provided so that the hump tower yardmaster can, by operating one key on his console, transfer all the "B" talk-backs to keys on his console.

A third yardmaster, known as East End yardmaster, on duty only on special occasions of peak traffic, works at a desk on the second floor of East End tower at the extreme east end of the yard. The console on this desk controls 45 "E" talk-backs with switch housings painted yellow; 14 speakers are shared with another console. When this yardmaster is not at his desk the hump tower yardmaster transfers all of the "E" talk-backs to the hump tower console by operating a transfer key.

In the same room with the East End yardmaster there is a machine for controlling the non-interlocked power switch machines near this tower. This machine is operated by a switch tender who formerly operated these switches when equipped with hand-throw stands. Keys for communications control are mounted in the same panel, together with levers that control the power switches. This is an excellent example of coordinating communications and interlocking controls. These keys connect to 8 "S" two-button dual talk-backs east of this tower, all of which are jointly used with the East End yardmaster.

Retarder Operator Also Has Control of Talk-Backs

The retarder control tower is on the south side of the classification yard opposite the group retarders. In this class yard, the power switches and retarders are controlled automatically. A retarder operator monitors these operations. He uses a manual-control machine when the yard is being trimmed. At his left, this operator has a switch control machine with levers to control power-operated switches at the west entrance of the receiving yard, and west exit of the departure yard. In this same machine are keys for control of 10 "W" talk-backs located at the east end of the yard, 3 of which are dual units.

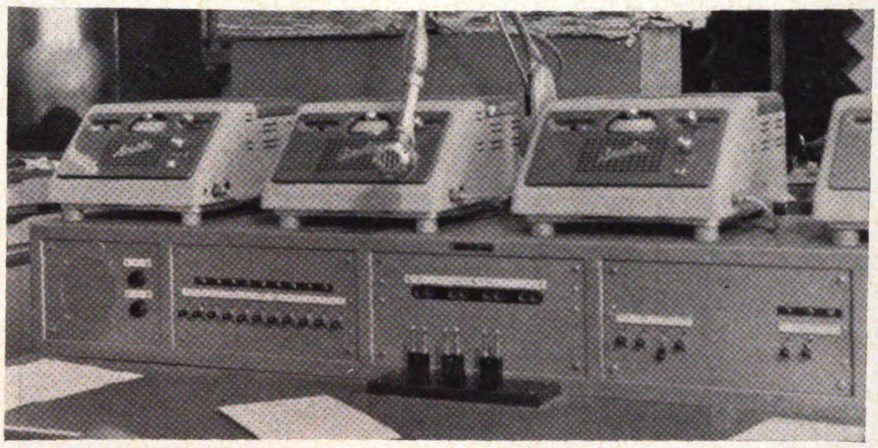
Talk-Backs In Car Repair Yard

The car repair yard is just north of the hump. A console in the car foreman's office has keys connected to 8 talk-backs at various locations along the repair tracks. After 11 p.m. the car foreman's office is closed. At that time the yardmaster in the hump tower can throw a special key which connects the 8 repair-track talk-backs over to 8 keys in his console, and thereby retain use of those speakers along the repair tracks.

The microphones used at all locations where communication equipment is mounted in switch machines, are slim dynamic style No. 623 made by the Electro-Voice Company. These microphones are on special flexible arms which each man can adjust to suit himself. The retarder operator has two microphones, so he can answer any call without turning in his chair.

All intercom in the yard is on zero level private line lamp call basis. This permits the use of telephone level cable and, with lamp call, prevents possible interference at console locations that would be caused by voice call.

A special direct-calling "hump" speaker line connects the car inspection pit, the hump foreman on ground floor of tower, the retarder



Magnetic tape recorder desk for "grabbing" and transcribing car numbers

operator, and the yardmaster in top floor of hump tower. These speakers are "on" all the time, so that if any of these men talk on this circuit his voice is heard on the speakers at the other three locations. If the inspector in the inspection pit sees a defect on a passing car, he calls over this line so that the car can be routed to the bad-order track as it goes over the hump. A special feature is that if the inspector in the pit makes such a call, that call is heard on a fourth speaker which is on the outside of the inspection shelter house, so that a car man can put a "bad" order card on the car.

If the yardmaster prefers not to monitor this line all the time he throws his corresponding key up, which cuts his speaker over to another circuit. If any of the other three men want to call the yardmaster quickly, they throw their key "up" to the other circuit and talk to him directly.

Good Location and Housing for Rectifiers and Amplifier Equipment

The amplifier equipment for the talk-back speaker and intercom systems are in sheet-metal cabinets located in buildings such as the yardmaster's tower, the retarder tower, east end tower, or general yard office. This practice—as compared with outdoor cases—minimizes troubles that might be caused by moisture, dust or variations in temperature. Also, this practice centralizes the equipment where it can be maintained readily.

Amplifiers and power-supply rectifier units are in duplicate for each group. If one fails, the man in charge of the console throws a key to cut in the standby. This practice prevents outages that might delay yard operations, and eliminates the need for calling a maintainer except when on regular day duty.

Radio Used Several Ways

Road and yard engines are equipped with radio operating on 159.69 mc. The three locomotives assigned for humping have two-channel radio, either 159.69 mc or 160.35 mc. The engine being used to push cars over the hump will be working on the 160.35-mc channel. Calls on this hump frequency can be made to the locomotive by the hump foreman, retarder operator, or the hump tower yardmaster.

The 160.35 mc is a channel shared with the Elgin, Joliet & Eastern in its yard near Gary, Ind. To prevent interference with the EJ&E, the Burlington uses an Andrew "corner reflector" antenna, mounted only 20 ft from the ground and directed west (opposite from Gary, Ind.).

If the cab signal equipment on the hump locomotive fails, hump operations are directed by radio. In this instance, the radio is modulated with a 1000-cycle tone, and

Cicero yard is covered with communications:

the transmitter is then keyed for ½ second "on" and 3 seconds "off". While this tone is being received in a cab it is an indication that the radio is operating properly and that humping can be done by verbal orders. If the tone ceases, the locomotive must stop at once.

Tape Recorder and Radio For Obtaining Car Numbers

In the general yard office a special desk is equipped for a clerk to make records of car numbers and initials as trains arrive at the yard or as they depart.

On this desk are four magnetic tape recording and play-back units of a quick-start-stop dictating type. The recording machines are the Scribe, International Model S170A. Below these instruments is a console for connecting the recorders, as well as for making calls to or receiving from road engine radio, train dispatcher, yardmaster; and East End Tower.

Sitting at this desk, the clerk can look out his window to watch cars and read numbers into a recorder as they pass when arriving on the north receiving yard lead.

A separate radio system, operating on 160.59 mc, is used to communicate either way between this clerk and a man in the yard, using a portable radio packset. When the field man calls in, stating that he is ready to report cars, the office clerk plugs connections to a recorder. A squelch relay on the base station receiver used with the recorders is connected to operate the start-stop mechanism of the recorder, so that if the man with the portable radio is walking a train, the tape is only running while he is actually talking. Later, the clerk "plays back" the recording to typewrite the train list.

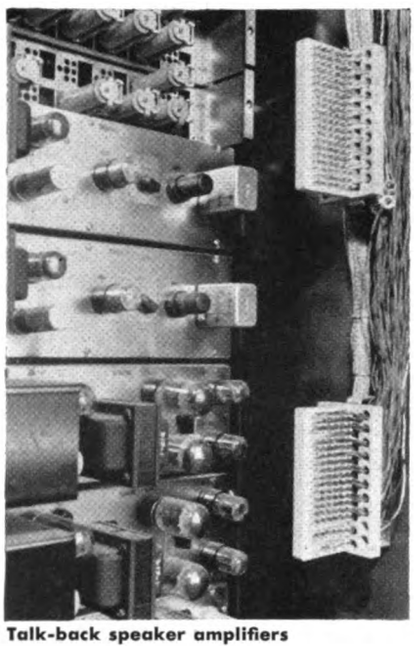
This new yard includes a complete system of pneumatic tubes to send waybills, train consists, switch lists and other papers between offices and towers.

A 6-in. tube extends from the billing department in freighthouse No. 9 to the general yard office. Another 6-in. tube runs from the general yard office to eastbound yard office.

Smaller tubes run from the general yard office to the hump tower; hump tower to the retarder tower office; hump tower to hump foreman on ground floor of this tower. Also, for sending train order to crews ready to depart, a 4-in. tube runs from the general yard office to the diesel locomotive house.

Facsimile for Waybills

Facsimile equipment is used in this area by the Burlington to transmit information required to make up waybills for outbound cars. A facsimile transmitter in freighthouse No. 7 at Western avenue works, with a receiver in the billing department at freighthouse No. 9, at Cicero yard, about 3 miles.

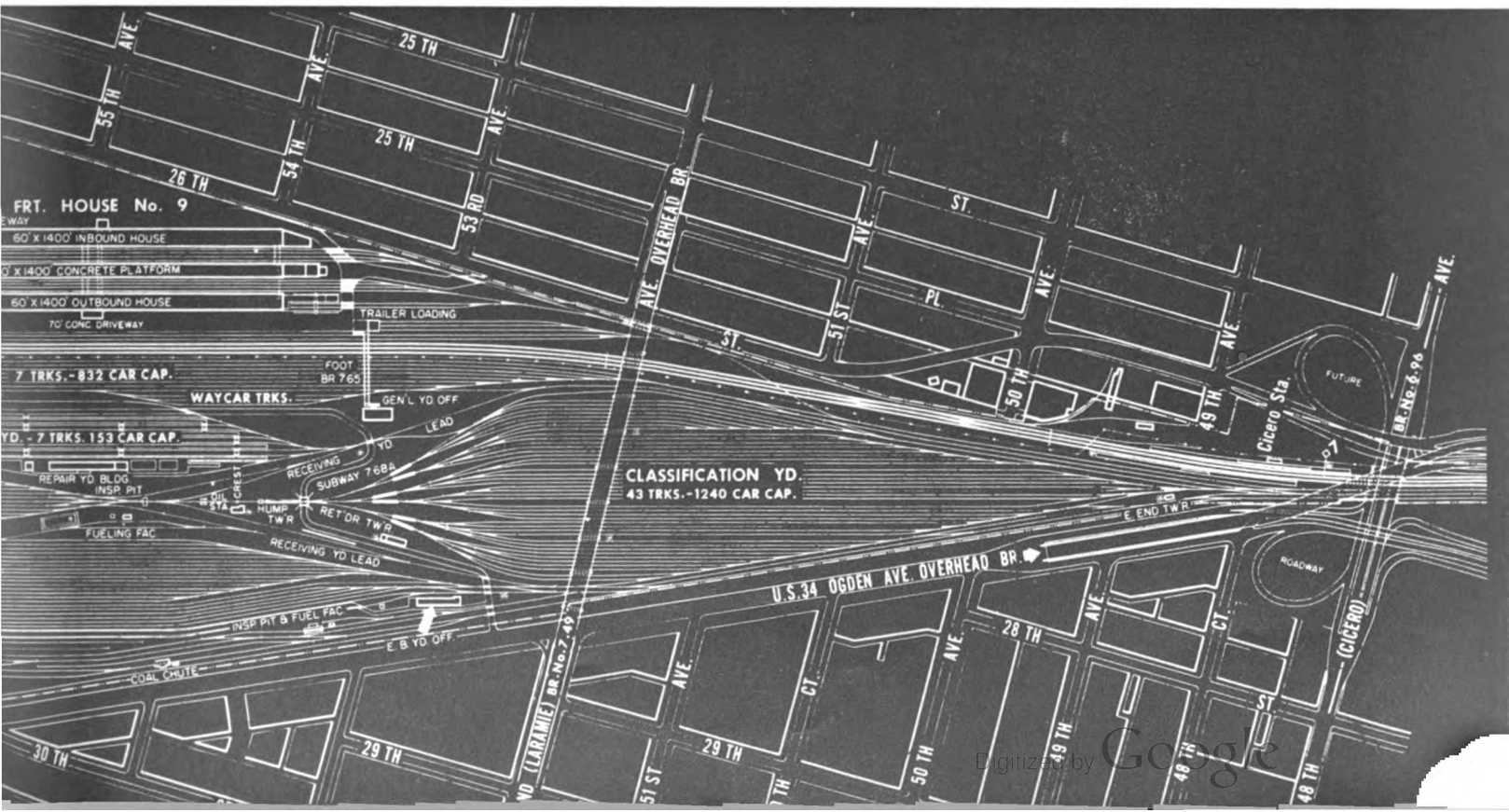


Talk-back speaker amplifiers

Also, a facsimile transmitter in freighthouse No. 10 at Cermak road, works with a receiver in No. 9. This special apparatus saves a lot of time in making up waybills, and in numerous instances prevents delay in the departure of a car. The equipment was furnished by the Facsimile Equipment Division of Air Associates, Inc., sold by the Electronic Communications, Inc.

Offices in this yard are equipped with "dial" telephones connected to the Burlington private automatic exchange, which serves the Chi-

Talk-backs, intercoms, radio, pneumatic tubes



cago terminal area. The dispatcher's telephone circuit is connected into consoles in various offices and towers as needed. The communication office, in the general yard office, includes printing telegraph equipment for receiving and transmitting complete information concerning cars in road trains which are ready to leave, or that may be on the way to this yard.

Communication Cable

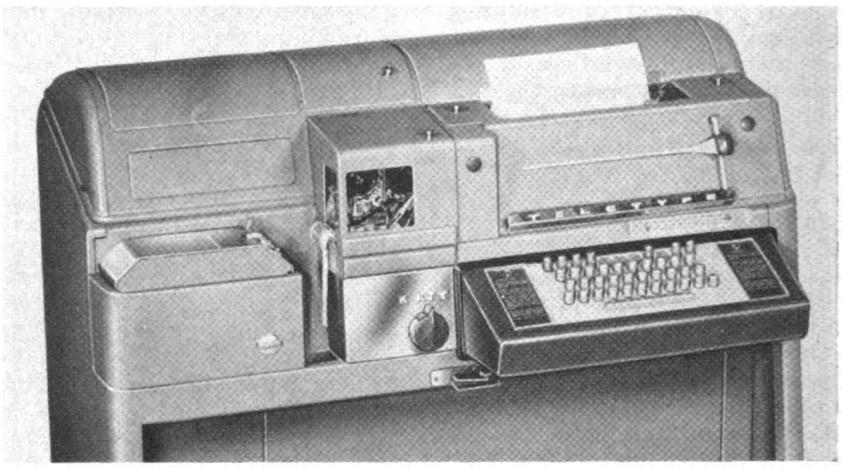
The communication circuits in this yard are in cables, which are aerial on pole lines where practicable, and are run underground elsewhere. Each cable is made up of No. 19 copper wire in pairs. Each conductor has a layer of polyethylene insulation .015 in. thick. The wires of each pair are twisted. A 4/64-in. wall of polyethylene is around the group of pairs in a cable. This is covered with wraps of .002-in. spiral copper tape, with an outer wall of black plastic 6/64 in. thick. The copper tape is grounded on all cables. The cable installed included 7,500 ft of 76-pair; 2,500 ft of 51-pair; 8,000 ft of 26-pair; 3,500 ft of 12-pair; 20,000 ft of 7-pair and 110,000 ft of single-pair, totaling about 2,003,000 conductor-feet.

Where there are several speakers along a yard lead, a multiple-pair cable, such as a 12-pair, goes to the central speaker, which has a junction box half way up the mast. From this box, a two-conductor cable goes to each loudspeaker in that series.

In the cabinets in the towers or buildings, the wires of the communications cables terminate on racks which include Reliable protectors. From these, No. 20 insulated wire is used to the equipment.

This communication system was engineered and installation supervised by the Burlington's Communications Engineer E. F. Hutchinson, under the direction of T. W. Wigton, General Superintendent Communications. The talk-back speaker and intercom equipment, including the tape recorders, were furnished by the R. W. Neill Company. The base station radio equipment was made by Bendix Radio division of Bendix Aviation, Inc. The portable Handie-Talkie radios, used in recording car numbers, were made by Motorola, Inc. The insulated wire and cable used in communications was made by Simplex Wire & Cable Co. The pneumatic tube equipment was manufactured by Kelly Systems, Inc.

Product News



New Teletype

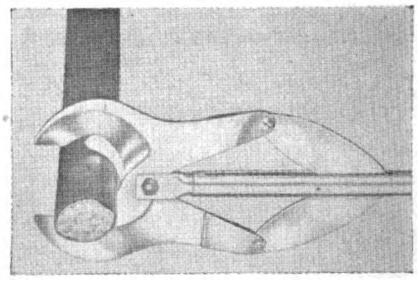
A new Teletype automatic send-receive set operates at 100 words per minute and provides facilities for typing, tape punching, tape transmission, tape reception, sending and receiving page copy on message paper or multi-part business forms, tape as a by-product of both transmission and reception, plus providing a built-in control system for remote apparatus.

The new model 28 ASR will function both "off" line locally, or "on" line over communication channels. This unit measures 39 in. high, 36 in. wide, 18¾ in. deep, with keyboard projection of 4¼ in. Write Teletype Corporation, Dept. SP-1-RSC, 4100 Fullerton Ave., Chicago 39, Ill.

Carrier Telephone

A four-channel type C carrier-telephone system is available from Radio Engineering Products. The three-channel type C carrier-telephone system operates in the frequency range of 6 to 30 kc and provides facilities for superposing three telephone circuits upon an existing open-wire voice-frequency telephone circuit. A fourth standard-grade channel has been added to this standard three-channel system, without changing the frequency allocations or degrading the performance of these three channels. The common equipment at the terminals, and the repeaters are the same as in the three-channel system. The fourth channel provides the same high grade of transmission as that furnished by the other three channels.

A 3-kc physical circuit is provided. The fourth channel is obtained by utilizing the band between the 3-kc physical and channel 3 east-west, for E-W transmission, and the band above channel 3 west-east, for W-E transmission. The four-channel system coordinates with all other type C and similar systems, but not with type H or type B systems. Provision is made in the standard arrangement of repeater to drop the fourth channel as well as the physical in either or both directions, at a repeater point. Write Dept. RSC, Radio Engineering Products, 1080 University St., Montreal 3, Que.



Cable Cutter

An air-driven cable cutter has been introduced by J. T. Henry Mfg. Co. Capable of cutting cables up to 3¼ in. in diameter, the No. 400-C cutter is 3.5 ft long, weighs 12.5 lb, and is operated by 140 psi of air from a ¼-in. hose. Write Dept. RSC, Railroad Materials Corp., 30 Church St., New York 7, N.Y.

Aluminum Wire

Copperweld Steel Co. announces that it is ready to accept orders for "Alumoweld" wire, a completely new product for use in electrical transmission and distribution lines. Alumoweld is made by applying a