ment, while quite often the power is left on until the brakes are set.

This current recorder consists of an oblong wooden box 35 in. long by 2¾ in. × 2¼ in. in which a thin strip of alloy 17 in. long is placed vertically in a groove and is supported by a short piece of German silver wire of such cross-section as to be heated by the current which flows through it to operate the car. The strip of alloy is held against the wire by a weight clamped to the lower end of the strip. When the temperature of the wire has reached a certain point, due to the passage of the current through it, the wire melts its way through the alloy strip, thus allowing the strip and weight to descend. There is also an automatic short-circuiting device, as a precaution, to prevent injury to the recorder or the stoppage of the car should the hot wire melt under an abnormal current.

The recorder, supplied with a new strip of alloy, is locked and given to the motorman at the beginning of each run and is placed by him in the case fixed to the car; at the end of the run he returns the recorder to the office. The act of pushing the recorder into its case closes the car circuit through the recorder. Unless the recorder is in place the circuit is open and the car cannot be started.

The record kept in the office for each man is the number of miles run and the number of inches of metal melted, the recorder giving merely a comparative record of the performance of each motorman, as it does not record except when an excess of current is used. At the end of the month a bulletin is posted showing the performance of each man, and it is expected that this will have the same effect in reducing the amount of power wasted as the locomotive performance sheets have had on the steam railroads.

Careful tests of this device recently made on the Chicago General Railway, showed a saving in power of nine per cent. after the recorders had been in service about two months. This is only a short line, and the motormen are given more direct supervision than is possible on the larger electric roads in Chicago; therefore a greater saving would naturally be looked for where a large number of cars were operated for longer distances.

New Union Station at Columbus, O.

We show in this issue the floor plans of the new Union station, now in process of erection at Columbus, O. This building is being built by the Guarantee Construction Company of Chicago, from plans furnished by D. H. Burnham & Company, architects, also of Chicago, who are superintending the work.

The plan in general consists of the building of a viaduct to carry High street over the railroad tracks west of the station, the extension and re-arrangement of the present train shed and the construction of an entire new station building, fitted with all modern improvements.

The station proper consists of a basement, Fig. 1, on a level with the tracks; a first or main floor, shown in Fig. 2, which is level with the floor of the viaduct, and a second story used for offices by the railroad companies. The whole design, from an architectural point of view, is artistic and complete, and the decorations on the viaduct and station are in perfect accord, so that the station may properly be said to commence at the viaduct.

The viaduct in High street, including the approaches, is over 800 ft. long, while the clear space for tracks beneath, between walls, is 279 ft. 6 in. The approaches consist of earth filling retained by heavy stone walls. That part of the viaduct above the tracks is supported by steel columns and plate girders, the latter ranging in depth from 3 to 4 ft. Between the girders are sprung arches supported by heavy angles riveted to the web of the girders. Concrete filling is used above the arches and the surface finish is asphalt for the roadway, while the sidewalks are of cement, resting on arches sprung between steel I-beams.

Along the side of the approaches, toward the station, is a row of buildings, arranged for small stores, which hide the trains from view. These are all two stories in height, with the exception of the ones at the extreme ends, which are three stories.

On the viaduct at the center is an arcade, formed by arches and columns, which is the entrance to the station. The street front of the shops and the arcade is entirely of terra cotta, while the sides and back of the shops are of first quality light buff Roman pressed brick. The partitions between the shops are of 6-in. tiling.

As shown in Fig. 2, an asphalt driveway 21 ft. wide leads from the viaduct to the first floor of the station and terminates in an open space for carriages. This roadway is carried on arches, sprung between 15-in., 60-lb., steel I-beams, supported by masonry walls. The floor of the carriage space is carried on cast-iron columns and I-beams. A covered passage is also provided for pedestrians, 16 ft. wide and separated from the driveway by an 18 in. × 6 in. granite curb, while on the side toward the track there is an ornamental iron railing. The floor is cement and the ceiling and roof corrugated iron, supported by ornamental cast-iron columns.

The roadway to the basement is 18 ft. wide, paved with cedar blocks on the slope and with brick throughout the basement. The outer wall is of brick with stone coping. This roadway is used by baggage, express and mail wagons. Continuous cast-iron wheel-guards 6 in. high are used along the roadways.

By reference to Fig. 1 it will be seen that the basement floor is taken up largely by the baggage and waiting-rooms, while ample space is allowed for an emigrant waiting-room and lunch-room. Each express company has been provided with a room 20 ft. by 40 ft., and a room of the same size is used for mail. The engine-room and boiler-room are at the extreme end of the building.

The heavy columns running up through the building, supporting the floors, have foundations built up of steel beams and concrete, while the lighter columns have foundations of concrete and dimension stone.

The waiting and lunch rooms on this floor have tile floors and enamel brick walls and ceilings. The baggage, express and mail rooms have floors of asphalt and cement plaster ceilings. The engine-room has a glass floor one inch thick, enamel brick walls and plaster ceiling, and contains the engine and dynamo. The building has its own electric lighting and steam heating apparatus.

To reach the trains an underground subway has been constructed, running out under the tracks in the train shed, with iron stairways leading up to the platforms between each pair of tracks, so that it is not necessary for passengers to cross the tracks at grade. The floor above the subway is carried on concrete arches on corrugated iron, sprung between steel girders, while the walls of the passages are faced with enamel brick.

The general baggage-room is on this floor and all baggage which is received from or is to be delivered in the city, is sent to the baggage room on the first floor, for which purpose an elevator 11 ft. × 14 ft. is provided.

As shown in Fig. 1, a track runs the full length on the *south* side of the building; this is to be used for express and baggage cars while loading and unloading.

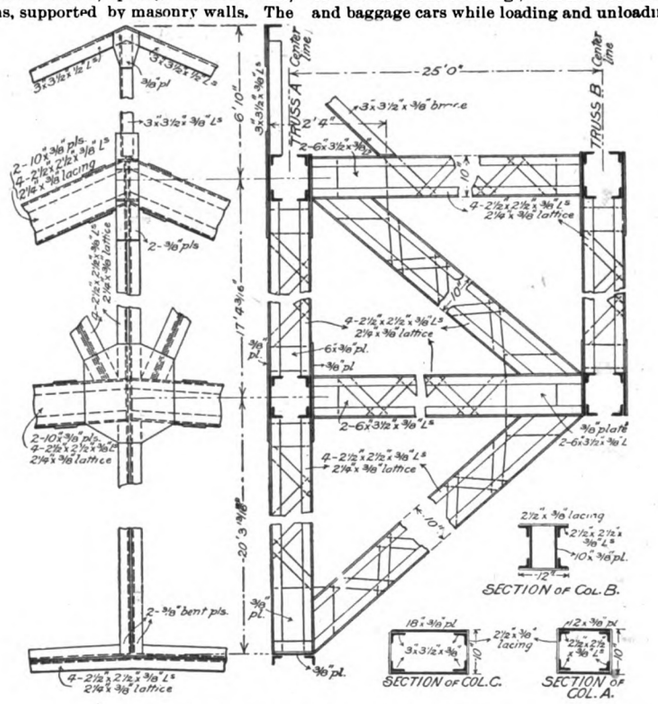

Fig. 5.—Detail of Truss and Bracing.

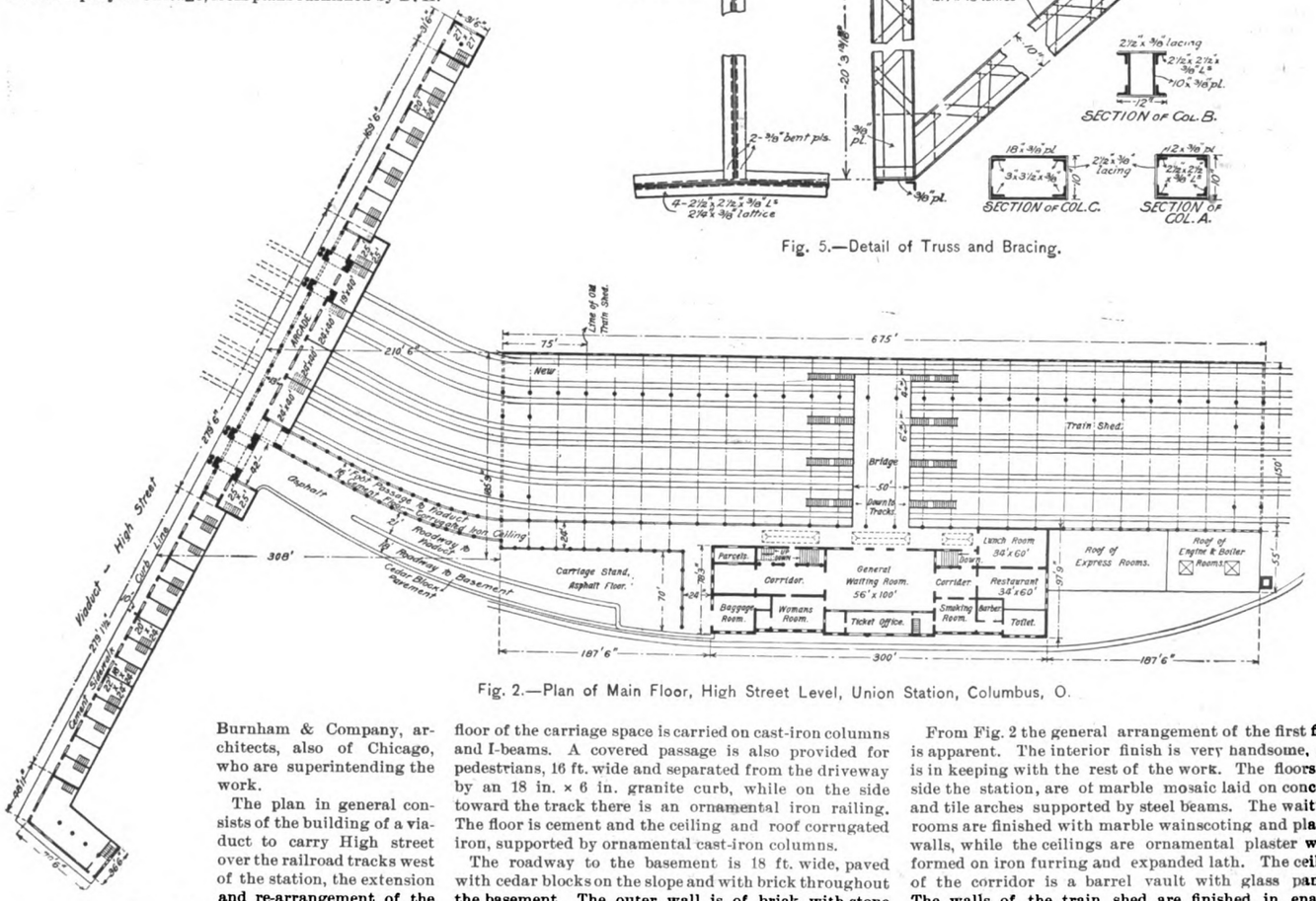

Fig. 2.—Plan of Main Floor, High Street Level, Union Station, Columbus, O.

From Fig. 2 the general arrangement of the first floor is apparent. The interior finish is very handsome, and is in keeping with the rest of the work. The floors, inside the station, are of marble mosaic laid on concrete and tile arches supported by steel beams. The waiting-rooms are finished with marble wainscoting and plaster walls, while the ceilings are ornamental plaster work formed on iron furring and expanded lath. The ceiling of the corridor is a barrel vault with glass panels. The walls of the train shed are finished in enamel brick.

The trains are reached from this floor by a bridge, 50 ft. wide, running out over the tracks, with iron stairways leading down to the platforms. The bridge is supported on steel columns, built up of channels, which carry plate girders and arches, with a surface finish of cement. The bridge has an ornamental iron railing on either side.

The old trainshed will still be used. This, however, has been extended 75 ft. westward (toward the viaduct) and an ornamental screen of copper and iron put in the gables

at both ends. This made necessary a special construction in the first two trusses at either end to carry the wind pressure on the ends of the shed. We show, in Figs. 3, 4 and 5, line drawings of the end and one of the intermediate trusses, beside the detail construction of the end truss showing the bracing to carry the side pressure due to the wind. The roof of the station proper is pressed tile, while corrugated iron is used as roofing on the trainshed and the viaduct shops.

This work will be completed about July 1, and will cost approximately $600,000.

We are under obligations to D. H. Burnham & Co., architects, who have furnished the drawings of this station.

Best Location for the Air Gage Where it Can be Seen by Night and Day.*

The air gage is supposed to indicate to the man handling the brakes what pressure is being maintained; but in consequence of a failure to realize its importance, the air gage has been located in all sorts of out of the way places, and in some cases has been so placed that it is almost impossible to read it in broad daylight, and at night it is

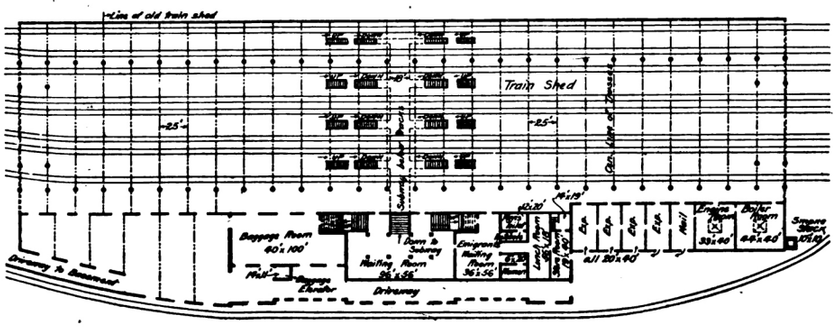

Fig. 1.—Plan of Basement (Track Level).

entirely lost. To this may be traced, in many cases, the rough handling of trains. It is very important that the air gage be located where it can be seen at any time either day or night, and that without taking the engineman's attention from the track ahead, the signals of various kinds along the line, and trains that are met and passed.

Smooth and safe braking can be secured in a greater number of cases where the gage is so located that the pressures at the beginning of the application and during the several reductions can be easily read; this is especially true where engines are equipped with brake valves of such type that, in making an ordinary application, the engineer would have to measure and limit the rate of discharge to suit long and short trains. With this type of brake valve it would be necessary to watch the gage closely for two purposes other than the ordinary; first, to see that the speed of train pipe reduction is not so rapid that "quick action" would be obtained; second, with a long train in closing the discharge from the train pipe, to note that no rise in pressure occurs such as would if this were done too abruptly, which would cause the release of the head brakes. With the Westinghouse equalizing discharge valve, however, this action cannot take place, as in ordinary applications the volume of air to be drawn from by the engineer remains constant, the equalizing feature of the valve automatically measuring and regulating the discharge from the train line in proportion to its length, and the brakes are applied as nearly alike as possible on long and short trains. With this valve in good condition, the enginemen soon become accustomed to the length of time required to make a given reduction, and a great many have trained themselves to brake by the sound of air discharging from the brake valve in connection with the effect on the speed of the train; but very likely this plan was forced upon them by the fact that the gage was practically invisible to them part of the day and all of the night, unless they made a special effort to look at it. This latter would, of course, take heir attention from the important duty of carefully tobserving the landmarks and exact points where they should stop.

Next in importance to a good location for the air gage is that it be well lighted at night. Where a poor grade of signal oil for cab lamps is used, and the lamp bracket fastened directly to the boiler, as is quite frequently done, the oil often gets hot, and some of the oils are so adulterated, or so poorly refined, as to cause badly smoked globes. All oils furnished for cab lamps should be of such quality as to give off a clear white light of the yellowish hue we so frequently notice. A good solid lamp that will not commence leaking at the first opportunity, with ratchet for raising the wick; the globe, or hood, securely fixed so that it cannot work around while the engine is running, and only throw the light where wanted, and not all around the cab to blind the engineman, is what is needed.

A practice followed by a number of railroads with splendid results is painting the globe on the *outside*, the first coating being of white paint, the second that of any desired shade. The white coat acts as a reflector and, on account of being on the outside, is easily kept clean. A decided advantage of the painted style of cab globe is the ease with which the paint can be removed, allowing the light to pass through in any desired direction.

Duplex gages for air pressures, as now made by a number of the leading gage makers, approximate a standard in diameter of dials and location of the numerals. Air gages on locomotives should be so attached as to bring the pipe connections pointing directly down, and not rolled over to one side to accommodate crooked piping, as the location of piping is of secondary importance. By placing them squarely, as stated, a given numeral will always be at about the same angle, relative to a horizontal line drawn through the center of the gage.

The pertinent question has been asked: "If 70 lbs. is the standard train line pressure, why is this not better indicated by, say, a heavy cross red line at that point?" We read a gage as we do a watch, not so much by figures as by the angle of the hands. Any unusual position taken by the pointers will be quickly noted by the observing engineman, and he will at once take steps to remedy the trouble the silent monitor brings to his notice.

All air gages should be so arranged that both pointers move in the same direction, as this style of gage is more readily read than the type where the hands start at zero near the bottom of the gage and work up toward full pressures on opposite sides of the dial. This latter type of gage being so different from the regular duplex gage in general use, is quite confusing, and it is a great trial to the engineman to be obliged to use it. The spaces are also much smaller and inaccuracies are not so noticeable in testing.

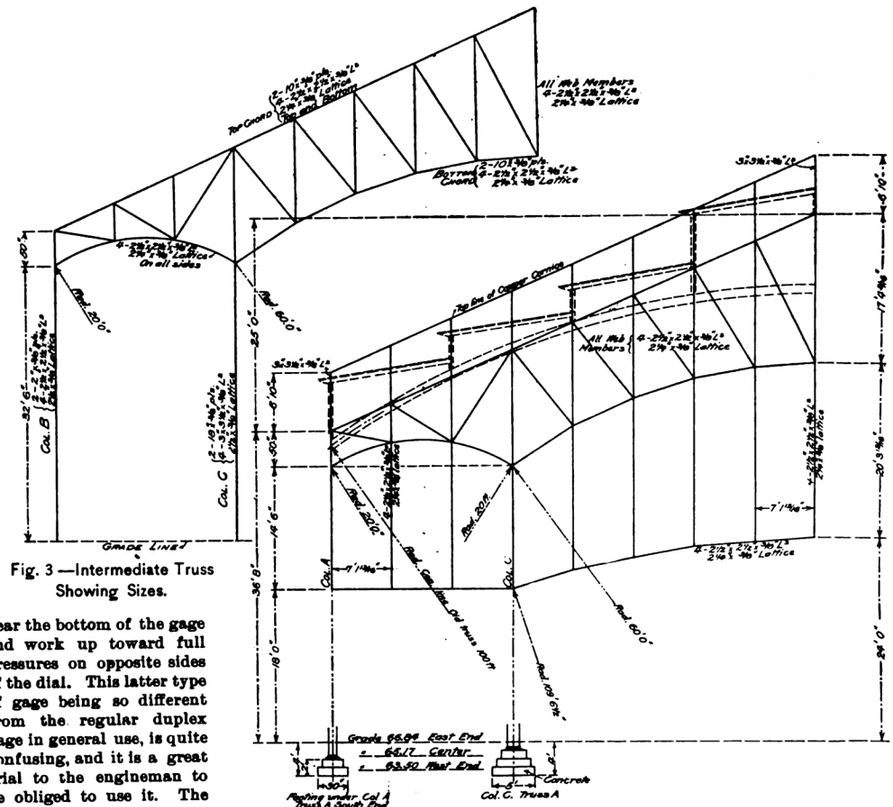

Fig. 4.—One-half Elevation of End Truss, Union Station, Columbus, O.

Fig. 3 —Intermediate Truss Showing Sizes.

Opinions differ among air-brake men as to the best style of gage face; a great many favor the silvered dial with black and red standard colors for gage pointers. The black dial with white train line pointer and numerals possesses the advantage of doing away with the possibility of mistaking the shadow of the train line pointer for the hand itself, this effect being had where the cab light is dim and placed at the left and a little below the air gage. It might also be stated that the reflection of light into the engineer's face from the dial of this type of gage is practically done away with. The discoloration of dials and glasses is considerably less upon engines burning hard coal than upon those burning bituminous coal.

We would suggest to manufacturers that the style of air-gage front be changed somewhat, so as to avoid as much as possible the shadow of the rim on the dial when the lamp is at one side. Care should be taken to see that the gage front makes a good tight joint when put on, and an occasional resilvering of the dial and retouching of the numerals when the gage is being repaired will be found highly beneficial.

In selecting a standard location for air gages, the influence of heat conducted throug the gage bracket and radiated from the boiler, combination stand and injector pipes and valves, should not be overlooked, as the metal parts of the interior of the gage are subject to the laws of expansion and contraction from heat and cold. We think all gage manufacturers will recommend keeping the temperature as much below 100 deg. as possible. The nearer any gage, whether for air, steam or water use, can be kept to the normal temperature the more accurate it will be. All brackets should have an open space of at least 4⅛ in. in diameter in the flange to which the air gage is to be attached. In addition to this, we recommend an air space between the gage and the bracket by the use of wooden blocks or sleeves of thin brass or zinc pipe slipped over the screws; ¼ in. separation would be ample. We would not suggest locating an air gage nearer than 10 in. to a boiler not lagged. When the boiler is well covered inside of the cab, this distance can be decreased, depending almost entirely on the quality of covering used.

Wherever possible, the gage should be located so that it is about the height of the engineer's eye when in his place on his engine, and so near his line of vision when looking ahead that he can glance at it without turning too much to one side. The object of the designer should be to place them in the best position possible, and in as rigid a manner as conditions will permit, at the same time providing for an unobstructed view of them by the engineer and fireman.

It would appear that these principles should be folfowed by the different builders, doing away with all high bracket fastenings that cause vibration of the gage, together with leaky joints of connecting pipes, at the same time placing no appliances such as lubricators, injector and steam heat pipes and valves between the gages and the view of the engineman. That these principles have been lost sight of in the locating of the air gage on a great many of the older locomotives will be apparent to the most casual observer.

It is believed that the grouping of gages more completely fulfills the above conditions than where the gage is separated from the steam gage. The air gage on all brackets should be placed to the right of the steam gage, never to the left or above it, as is quite frequently done. The flange of the stand to which the air gage is to be attached should be at such an angle as to bring the dial of the gage to squarely face the engineer; this angle will depend on the location of the bracket in relation to the position of the runner. This idea is well worked out on the new Class L engines built by the Pennsylvania Railroad Co., the air gage being about 18 in. from the engineer's position.

As the fireman is an assistant to the engineer in noting anything unusual in the operation of the engine or its equipment, it follows that the gage should be located, if possible, where he can get a clear view of it. Where a type of boiler is used which keeps the engineer and fireman separated, it might be a wise plan to have a single pointer gage showing train line pressure, and so located that the fireman could see it plainly while engaged in

* Extracts from a report of a Committee of the Air Brake Men's Association.