Gravity Track Systems at Anthracite Coal Breakers*

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SYNOPSIS—*Five typical arrangements of tracks at coal breakers and washeries are here presented. Local conditions dictate what general plan of trackage must be adopted. Sometimes local topography dictates a design inconvenient from the operating standpoint.*

IT HAS been estimated that in the United States nearly half a million freight cars are continuously employed in hauling coal traffic. All railroads derive some revenue from this trade, but with certain roads it is the main source of income. Such roads as a rule originate the coal traffic and are vitally interested in methods that prove most economical in handling cars. This applies with particular emphasis to the loading of cars at the mines and their subsequent making up into trains. This article deals particularly with the conditions and methods employed in the anthracite region of northeastern Pennsylvania.

Coal mining and transportation have a mutual attraction for each other. Wherever convenient, collieries are located on the main line of some railroad; otherwise, a branch is built to the mine. The former practice is preferable, since in a thickly settled rolling country the construction of branch lines is difficult, and high real-estate values render it costly. Frequently the haulage problem can be most readily solved by means of narrow-gage tracks either on the surface or underground, over which the unprepared coal may be taken to a convenient breaker. Nevertheless, an extended network of railroads traverses this coal region, upon which traffic moves in all directions.

Maximum Production Not Maintained

The annual production of somewhat over 80 million tons of anthracite in Pennsylvania is divided among many collieries. The daily capacity of these plants ranges from 500 to 3000 tons and more, but the maximum capacity is not maintained throughout the entire year. With an eight-hour working day the annual production of an up-to-date colliery will not average much over 500,000 tons. At the rate of 3000 tons a day about 70 cars will be required to move the coal, and 45 tons per car may be taken as an average of capacity. It may readily be seen that the cost of switching such a number of cars day after day for the purpose of loading them would be extremely high.

Collieries are usually constructed with the idea of giving service for fifty years, or even more. Consequently, a careful study of the requirements of each individual plant with regard to track facilities is necessary. As a general rule a colliery has upon one side the track or system of tracks, for holding the empty cars. These are known as the "light tracks." On the other side of the breaker is another track or system of tracks, for holding loaded cars, known as "loaded tracks." Scales are placed upon either side of the breaker, between the building and these systems of tracks, for the purpose of weighing both the empty and loaded cars. These are known respectively as the "light" and "loaded" scales.

The track connections and grades are so arranged that a locomotive places empty cars only above the breaker and takes out the loaded cars below it. For the purpose of loading, the cars are run beside or underneath the breaker by gravity. The movement of cars from the light to the loaded tracks is of course not continuous. They are stopped at the light scales for weighing, spotted at the loading chute and stopped again for weighing on the loaded scale.

Grade of 1½ Per Cent. Most Desirable

The placing of empty cars and the removal of loaded ones do not interfere with the operation of loading or weighing in the least. The tracks running through the breaker and over the scales are not intended for locomotives so far as the curves and track materials are concerned. In a like manner the scales are constructed only to weigh cars and have no dead rail to permit a locomotive to cross over them.

Experience has shown that a grade of about 1½ per cent. is the most desirable for the operation of these gravity track systems. Under favorable conditions cars will run on a 1¼ per cent. grade, or even lower, but around sharp curves and over comparatively rough tracks, also for operation in winter, anything less than a 1½ per cent. grade proves insufficient. On the other hand, grades much in excess of 1½ per cent. will make it comparatively difficult to stop the cars upon the scales or under the breaker chutes.

The accompanying illustrations show typical track arrangements at coal breakers. They may be grouped into four distinct classes, the chief difference being in the method in which they are connected with the main track.

From an operating standpoint the most desirable method is to make connection with the main line for both light and loaded tracks, as shown in Fig. 1. In this arrangement, however, it is difficult as a rule to secure the necessary 1½ per cent. grade adjacent to the main line without resorting to a hump in the light track connection, a depression in the loaded track connection, or possibly both. Furthermore, if the main line has a low grade, the approach to the hump will be of considerable length and require a large amount of track. Finally, the distance between the light and loaded track connections on the main line will be increased. It will thus be only in rare instances, where the ground ad-

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jacent to the main line is favorable, and where the required right of way will be available for such a purpose, that an installation as shown in Fig. 1 can be made.

Track systems with connections at both ends are always expensive to install, and it is doubtful if the advantages from an operating standpoint are of much significance.

The method most frequently employed is to provide a direct connection from the main line to the loaded tracks, as shown in Fig. 2. A thoroughfare, or running track, is built alongside the loaded track to a point above the light scale where it connects with the light tracks. The only disadvantage of this construction is that it interferes with the continuous loading of cars when the locomotive places the empties on the light track. However, this operation takes only a comparatively short time, and if convenient can be carried out when the breaker is idle.

The advantages in the construction of this type of track system will readily be appreciated. This layout is quite flexible and can be fitted to local conditions in most cases. Since the grade of the track can be raised or lowered to fit the ground the grading is reduced to a minimum, while at the same time it is not necessary to have the breaker tracks parallel, or even approximately parallel with the main line. They may curve in any direction and be kept upon ground best suited for the purpose. The high ends of the light tracks are not connected with each other. It would be useless to make such a connection. Moreover, the stub ends save car capacity and reduce the length which would otherwise be required for the light tracks and the track system in general.

Fig. 3 shows a layout in which the light tracks are connected with the main line. This construction is not as desirable as the one just described, the main objection being that the locomotive does more or less switching when the loaded cars are removed. This switching necessarily interferes with the running of the loaded cars onto the loaded tracks immediately after they have been filled with coal. Whenever convenient the loaded cars should be taken away during the hours when the breaker is not in operation. Generally, however, there will be more interference in removing the loaded cars than in placing the empties on the light track. In this type also loaded cars have to be hauled up a steep grade when they are removed from the colliery.

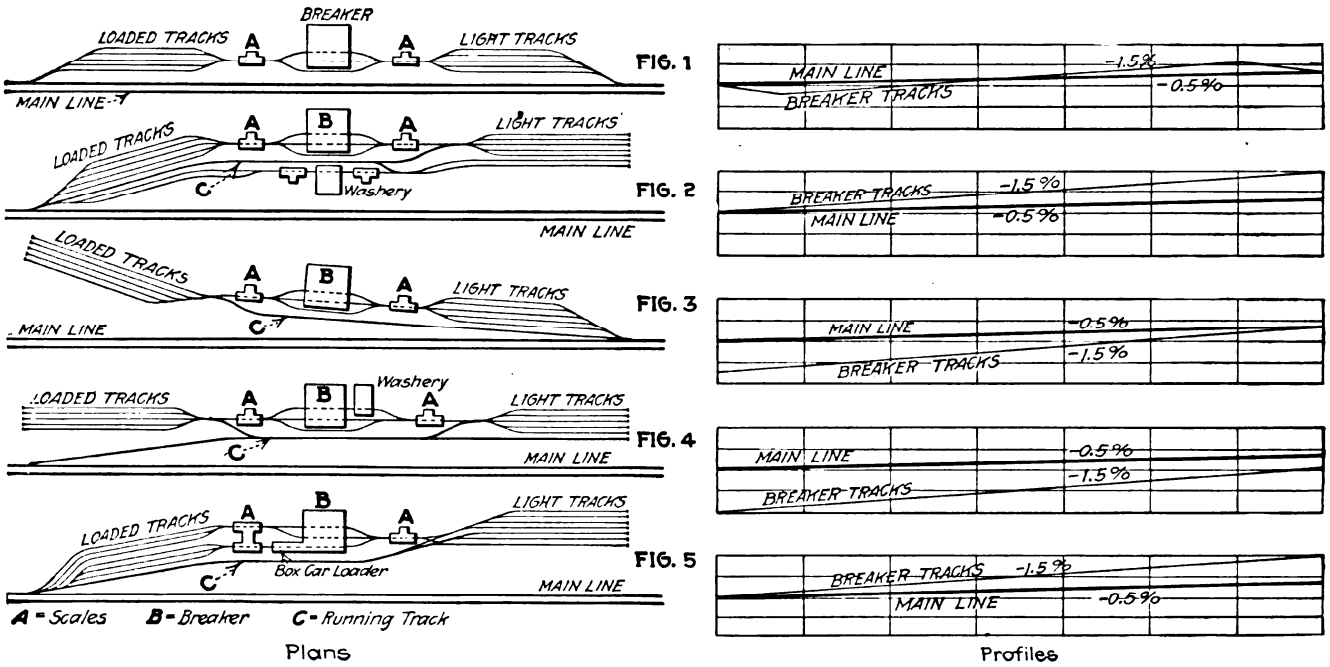
Such a track system as this is resorted to in places where the main line is on a high embankment, and where it is desired to construct the breaker on low ground beside it. In flexibility of construction there is no difference whether the light tracks or the loaded ones are connected with the main line; the difference lies in the operation alone, as has been shown.

A track system not frequently employed is shown in Fig. 4. Here the far ends of both the light and loaded tracks are disconnected, and both the operations of placing empties and removing loads will result in interference with the continuous loading of cars, because the only access to the track is over the connections alongside the breaker. Moreover, a reverse movement is necessary, either in placing empties or removing loads, depending on whether the loaded or light tracks form a continuation of the branch leading to the colliery.

From an operating standpoint, therefore, this track system is not desirable. Its advantage lies in the fact that for the same car capacity it will require less space than any other system, and that it can be readily adapted to the various conditions of insufficient right-of-way and unfavorable topography.

A construction of this type will usually be found some distance from the main line of a railroad, the difference in elevation between the main line and the colliery track determining to a considerable degree the location and grade of the branch line.

At the present time many washeries usually located adjacent to collieries are reclaiming coal from the old



FIGS. 1 TO 5. TYPICAL RAILWAY TRACK SYSTEMS AT ANTHRACITE-COAL BREAKERS

culm banks. A considerable number of these banks, however, are located at points where the collieries have been abandoned. In such cases the tracks serving the washery are extremely simple, as the capacity of such a preparation plant is only a few hundred tons a day.

Frequently a single track without scales is laid either through the washery, or beside it, the grade being made such that the cars may be moved by gravity after they have been placed by locomotive.

Where a washery is operated in conjunction with a breaker it is highly desirable to have this washery located beside the breaker, provided there is sufficient room. In such a case there will be no duplication of facilities, and the washery will be benefited by all the advantages secured from the breaker track system. It is not always possible, however, on account of lack of sufficient space to effect such a location, and frequently the washery is placed on the opposite side of the running track, as shown in Fig. 2.

Tracks serving a washery are constructed on the same principles as those serving a breaker, and parallel with them, although of course the capacity will be much less.

Sometimes existing collieries are overhauled, equipped with improved machinery and the capacity increased. In such a case it is necessary to provide additional tracks to take care of the increased output. The track system already existing and designed with the intention of occupying as little space as possible may present a difficult problem when extensions are required and expenses must be kept down.

If it is impossible to add length to existing tracks, which is not uncommon, the only alternative is to construct new tracks paralleling the existing ones, and make the best connections possible.

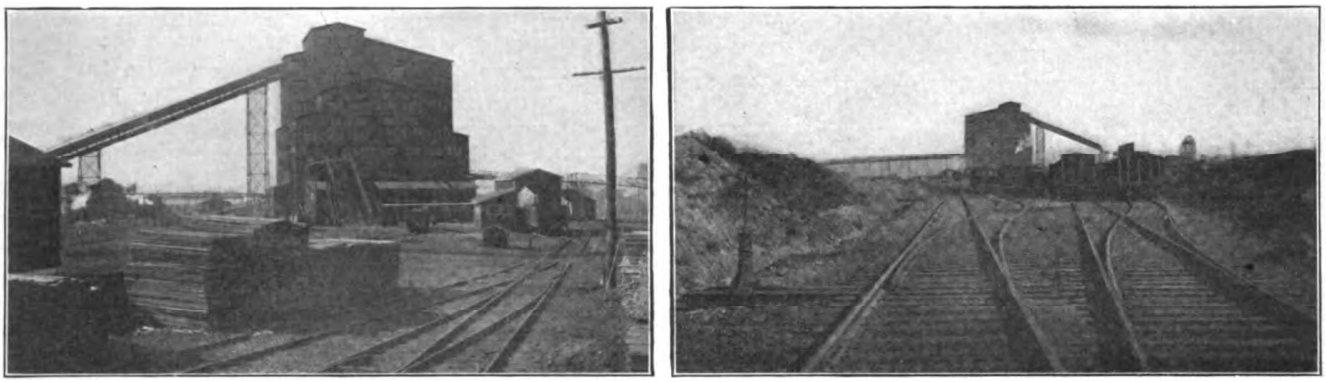
Fig. 5 shows a satisfactory method of adding to the capacity of a track system which could not be extended in length. Each group of light tracks has to be accessible to the running track (for the purpose of placing empties) as well as to the light scales. This results in a set of crossing frogs. The loaded track additions require the construction of a second loaded scale, so as to use all of the available space.

The total capacity for which the light and loaded tracks should be designed will depend not only on the capacity of the colliery, but also to a considerable extent upon operating conditions. After the daily capacity of the plant goes beyond a certain number of cars, which may be handled by one locomotive, the capacity of the tracks may have to be only slightly in excess of this, because the switching service can be so timed that empty cars will always be on hand. For instance, a train of empties may be placed early in the morning and another one early in the afternoon.

The rail employed in the construction of breaker tracks is usually "relayer," and in places where the track is not traversed by locomotive this may be as light as 62 lb. per yard. Turnouts through which locomotives run are usually No. 8's; but those which only take cars may be No. 6's or even No. 5's. In order to save as much room as possible turnouts are frequently designed on the style of the old three-throw stub switch, except that the two switches are about 25 ft. apart and the frog is not in the center of the main track.

Formerly scales 38 ft. long were ample, but at the present time the length of cars has been increased so that 42-ft. scales are too short, and 50-ft. scales are being installed.

To facilitate the filling of box-cars, which are quite common nowadays, to their full capacity, box-car loaders of various types are being employed. One type of this device consists of a vertical turntable on which the cars are placed and revolved through a vertical arc, first one end of the car being lowered and filled with coal and then the other.



FIGS 6 AND 7. LIGHT TRACKS SHOWN IN THE LEFT-HAND VIEW. LOADED TRACKS IN THE RIGHT

Modern collieries also have facilities for the economical handling of condemned coal. Cars condemned for having too much slate are taken by locomotive from the loaded track and replaced on the light track. From here they run by gravity over a hopper pit, just above the breaker, where they are emptied and again spotted for loading. The condemned coal is taken by a conveyor back into the breaker for retreatment.

One of the outside tracks of the breaker is frequently used for the unloading of supplies of various kinds, such as mine props. Sometimes, also, there is an extra track leading to the power house, where fuel may be unloaded. Provision for such track forms a variation in the layouts as shown in this article.

The temperature in a boiler furnace is about 1400 deg. C. At this temperature oxygen reacts with the combustible material to be burned very rapidly, but proper conditions for reaction must be provided.—*Bureau of Mines Bulletin No. 135.*