Marcus Screen at Plants of the Carnegie Coal Co., Pennsylvania

By RICHARD G. MILLER*
Chicago, Ill.

IT HAS been said that the most vital question before the American people today is the coal problem. Authoritative opinion asserts that the labor and transportation questions are the principal difficulties in the mining and distribution of coal. Over 100,000 coal miners are subject to the draft, so that the industry is facing a serious labor problem. Moreover, according to estimates, 100,000,000 more tons of coal will be required during 1918 than during 1917, for carrying on our war program and continuing our national life. Under the existing circumstances these 100,000,000 more tons of coal likely will not be forthcoming, so it remains for us to do what we can in order that we come as near to meeting the requirements as possible. It will therefore be necessary to make the greatest use of efficient machinery and labor-saving devices in our attempt at this goal.

Transportation or the lack thereof received a good share of the blame for past and present conditions, and no doubt the car-shortage problem has to a greater or lesser degree affected the shortage of labor. Furthermore, the shipping of dirty coal not only compels the railroads to haul useless material, but it decreases the efficiency of industrial plants as well as the railroads, by reason of the increased percentage of refuse in the coal. This decrease in efficiency is not only due to the low heat value of the dirty coal, but also to the additional expense necessary for handling the larger quantity of ash.

There is a difference of opinion among people with regard to who is most responsible for this larger percentage of refuse in the coal. Some think it is due to the defects in the producing organization, while others think that the miners are more to blame. However, the blame in many instances, no doubt, should be shared by both.

Methods of Removing Impurities

In some localities mining conditions are such that it is not advisable or practical to attempt to eliminate all the removable refuse at the face; while there are many instances where coal, devoid of rock or slate, could readily be delivered to the tipple or screening equipment. However, operators have an opportunity at this time to manifest their patriotism and provide themselves, where necessary, with adequate means for removing as large a percentage as possible of the slate, rock, bony coal or sulphur balls from the good coal at the tipple before loading into the railroad cars.

Of course, each particular mine has its own set of conditions to consider in determining just what methods should be provided for producing a coal with a minimum percentage of ash. All the measures adopted should be made fully adequate to the task to be imposed upon them irrespective of the enormous demand for coal, or the price paid for it; the former has run riot, while the latter has been regulated by the Government.

Many operators have had the foresight to include in the design of their plants special machinery and equipment for improving the quality of their product. Those now in a position to market, and also those who can modify their facilities for marketing a better prepared product, should receive recognition from the Fuel Administration by the granting of an additional price per ton to such operators. The justification for this premium, whatever the merits of a particular case may warrant, will be due to the additional investment required for the special means and the additional labor also required for obtaining the "extraordinarily clean coal."

Problems in Coal Cleaning

In deciding upon the type of equipment, many features of existing plants govern the procedure, due to the fact that the impurities in the various coals exist in different forms, and also that in one size they are different from that in another. For example, it may happen that the lump coal at a particular plant carries with it most of the removable refuse either as rock, slate, bone or sulphur balls, while the nut or egg coal at another plant might carry these impurities. It therefore may be necessary in one case to use one method of elimination and in the other case some other method.

If, however, these impurities occur in the finer sizes of coal, a more complex method of improving the quality, such as washing, might be necessary. The coarser sizes at most mines are the grades which could be more easily improved by simpler methods. If a large part of the impurities in these sizes could be picked out by the addition, to existing plants, of a moderate amount of simple picking machinery (especially the Marcus combined screen and picking table), then the necessary additional investment and labor required for manning the improvements would be small in proportion to the improvement in the product.

Coal companies in various localities have adopted picking facilities of one or another type. It is notable at this time to observe that especially in the western Pennsylvania field, such companies as the Pittsburgh Coal Co., the Pennsylvania Coal and Coke Corporation and the Carnegie Coal Co. have adopted the combined screen and picking table as a means of meeting the present situation in the most economical way. This is true both as to the necessary investment of capital and the labor required for producing a coal with the minimum amount of ash without going to the necessity of washing. It is desirable to avoid washing except where the coal is used for coking purposes, in which

*Contracting engineer of the Roberts & Schaefer Co., engineers and contractors, McCormick Building, Chicago, Illinois.

case low ash and also low sulphur are imperative. These and other coal companies who have adopted the Marcus screen are in a position to ship "extraordinarily clean coal" and thereby receive an additional price per ton by obtaining permission from the Fuel Administration.

The organizations mentioned above have, all told, 17 of their properties equipped as stated, but the Carnegie Coal Co., with six operating properties near Pittsburgh, is in a class by itself, having six tipples provided with seven of the Marcus horizontal combined screens and picking tables.

One of these installations is a new plant, while the rest are old plants worked over, the old plants having previously been equipped with the old style gravity bar screens and weigh baskets.

New Carnegie Plant

The new plant of the Carnegie Coal Co. is at the Louise mine, illustrated by Fig. 1A and shown diagrammatically in Fig. 1. This plant is unique for the reason that the Marcus screen *A* is designed so that a car of coal is dumped into the dump chute, fed by means of the feeder *B* so that the preceding car of coal remains separate on the screen from the car following and the removable refuse is picked out by pickers after the fine or slack coal passes to the bottom deck.

When the picking operation is completed the coal enters the weigh hopper *G*, the pickings never being weighed, so that the miner in no case is paid for the removable dirt in the coal. Moreover, the speed of the coal on the screen is such, and the arrangement of the screenhouse and the position of the weighman is such, that if a car of coal comes along which contains an extra large quantity of dirt, then the equipment is stopped for an instant—long enough to completely remove all of these visible impurities.

The miners knowing this are therefore more careful not to waste their time filling a car with dirt, because it would be useless to them. It might be said in passing that this design was more or less experimental at the time it was developed, but with only a few minor changes in details after erection it was made to work most satisfactorily.

If Fig. 1 is carefully followed, it will be noticed that the lump coal is delivered by means of the shaker loading boom *I* to the center track, while the nut coal is loaded by the chute *N* to the outside track and the slack coal by the chute *S* to the inside track.

Figs. 2, 3, 4, 5 and 6 are diagrams of the McDonald, Atlasburg, Primrose, Armide and Oakdale plants respectively, all of which illustrate installations at existing tipples. All these tipples, with the exception of the Atlasburg plant, are single Marcus screen installations; the Atlasburg plant is a shaft mine and provided with duplicate equipment.

In Fig. 2 the coal is dumped into a weigh hopper, the weighing and operating mechanism of which is suspended overhead. The reciprocating feeder *B* feeds the coal onto the horizontal screen *A*, after which it passes successively over the slack perforated screen, the blank picking space and then the nut perforated screen.

By this procedure, the fine coal is first removed from the coarser sizes so that the removable impurities can be more easily seen and removed because of the decreased quantity of coal on the combined screen and picking table. These finer sizes pass to the lower deck, and in the case of the slack coal is immediately loaded into railroad cars on the slack track by the chute *S;* the nut is loaded into railroad cars on the center track by the chute *N* and the lump over the shaker loading boom *I* is loaded on the outside track. The pickers remove the rock, slate, bony coal or sulphur balls, throwing them into the refuse trough *F*, which being rigidly attached to the screen conveys them forward, delivering them by means of the chute *K* to a refuse car for the purposes of disposal.

This arrangement of combined screening and picking machinery gives the most perfect screening and loading facilities as well as a most efficient means for picking. Obviously this design lends itself readily to installation in existing structures, which is quite in its favor, in addition to the greatly improved preparation that is thus made possible.

Coming to a discussion of the Atlasburg plant, which is illustrated diagrammatically in Fig. 3, we have an example of a duplicate horizontal equipment as applied to a shaft tipple. The original plant was of steel construction and with slight modifications in it the equipment readily adapted itself, giving all the advantages of modern screening and picking. The weigh basket *G* was changed to a double bottom discharge type so that it became necessary to furnish a new dump chute designed with doors for the disposition of mine rock by way of the rock chute *O*. The car on the rock trestle carries this to a rock pile not shown in the diagram. From the weigh basket *G* the coal from either or both self-dumping cages is delivered to either or both of the reciprocating feeders *B* and onto the Marcus screens *A*. The operation of these screens is the same as previously described, including the feature of the fixed refuse trough *F* for delivering pickings to the pickings chute *K*.

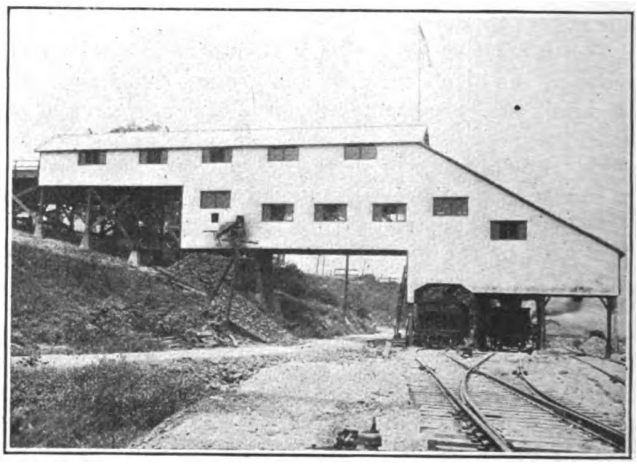

FIG. 1A. VIEW OF TIPPLE SHOWN IN FIG. 1

One point of difference, however, is that this is a four-track equipment, which lends itself to loading lump coal from one Marcus screen over the shaker loading boom *I;* picked run-of-mine or picked egg and lump combined can be loaded on the second track, or *vice versa;* at the same time slack coal and nut coal can be loaded from either or both screens to the railroad

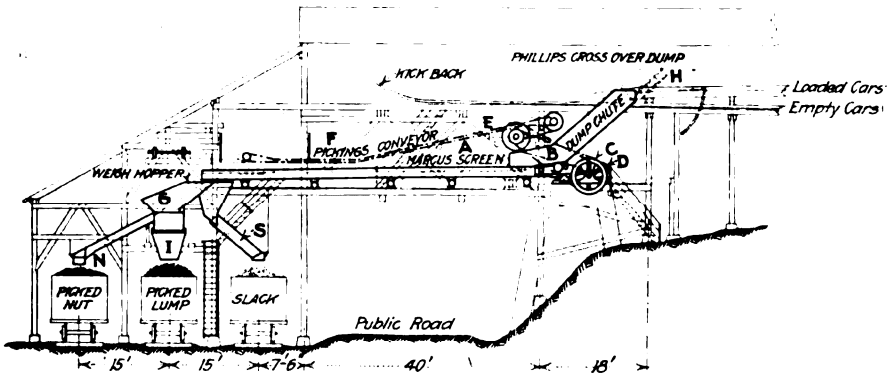

FIG. 1

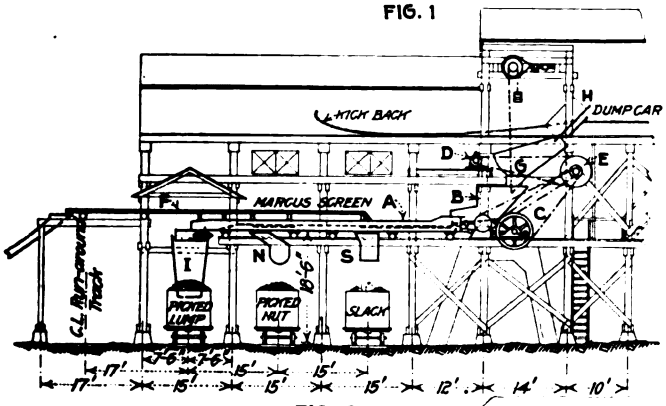

FIG. 2

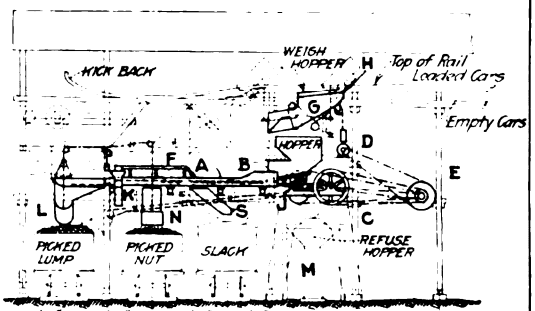

FIG. 4

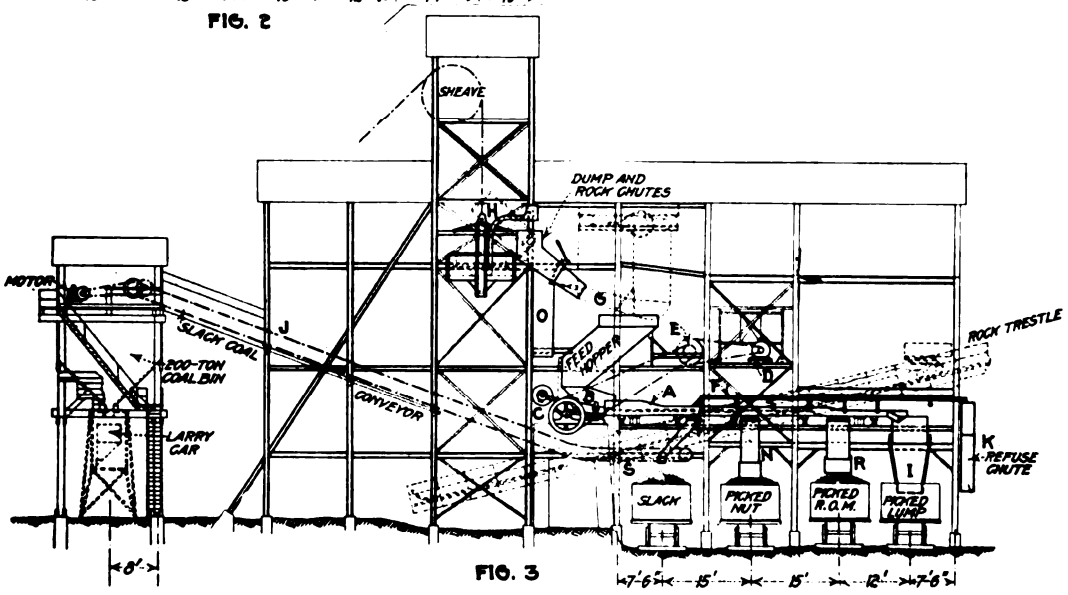

FIG. 3

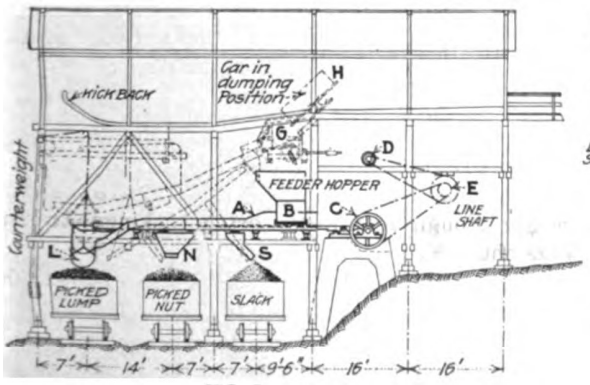

FIG. 5

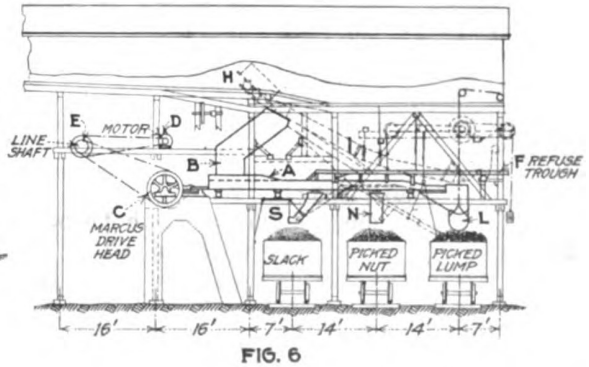

FIG. 6

FIGS. 1 TO 6. PLANTS OF CARNEGIE COAL CO. IN WHICH MARCUS SCREEN HAS BEEN INSTALLED

cars on the slack track by way of the chute *S;* or railroad cars can be loaded on the nut track by way of the chute *N*. This point in the design adds to the flexibility of operation in the case of emergency, which is a valuable asset at any coal-preparation plant. In connection with this installation, also, the slack conveyor *J* can receive slack coal from either or both screens and deliver to the 200-ton coal bin on the left for loading larries to charge the coke ovens. The installing of this equipment at the Atlasburg plant was done without interfering with the operation of the mine or hoisting of coal.

The Primrose plant, as illustrated in Fig. 4; the Armide plant, Fig. 5; as well as the Oakdale plant, Fig. 6, are similar equipments of the same type of machinery which was installed where the old gravity bar screens and weigh baskets were undisturbed. These are shown in light dotted lines, whereas the new equipment is shown bolder. Each is a three-track arrangement making lump, nut and slack coal. Loading booms in these three cases were not required for the lump coal, and the plant illustrated in Fig. 5 is not equipped for refuse disposal as the nature of the coal and preparation required did not demand it.

At Primrose the standard rigidly connected refuse trough *F* is shorter than usual, delivering sideways to the chute *K* into the pickings conveyor *J*. This arrangement facilitates operation by taking the pickings to the rear for disposal; having this fixed refuse trough *F* makes it convenient for depositing the pickings as they are removed from the coal.

The disposal of refuse at the Oakdale plant is done in a manner similar to that described for the McDonald plant, illustrated in Fig. 2. For feeding the screens at Armide and Oakdale, and to facilitate installing them without disturbing the existing bar-screen equipment, the feeders in these two cases were placed at right angles to the screen, which will be noticed by observing the diagrams.

The principal thing to bear in mind in considering these installations, which are intended to facilitate removing the refuse as well as to improve screening, is that in each and every case the fine coal is screened from the run-of-mine coal before any picking is done. This leaves the coarser sizes by themselves and in lesser quantities, so that pickers can see the bone, slate, rock or sulphur balls and therefore can better remove them.

Another big advantage, and this is that after picking is accomplished the finer sizes, screened out at the start, travel to the front end of the screen by closing the slide gates on the bottom deck; here they combine with the picked coarser sizes, giving a picked run-of-mine product mixed as uniformly as it was before the separation at the start of the process.

It is obvious that coals with a large percentage of slack, therefore, are the ones most conveniently picked by this method. For the general run of cases it is a more efficient method as regards operation, because usually about one-third of the run-of-mine coal is black which passes to the lower deck of the Marcus, relieving the picking operation therefore of one-third of the volume of coal. Furthermore, after the coal on the screen passes the nut perforations the egg and lump in lesser volume are more easily picked; after the egg coal passes through the egg screen, the lump coal alone remains and can be picked just before it reaches the lump chute or loading boom.

Every engineer interested in the preparation of coal in all probability has at one time or another felt the need of a combination arrangement whereby coal could be simultaneously cleaned and screened, and it therefore seems strange that until recently a device of this sort had not been developed.

It has been approximately four years since the Marcus combined screen and picking table was introduced into the United States. Previously to that time it had been thoroughly tried out in foreign countries, including among others England, Germany, Algiers, Borneo, Japan, South America, Mexico and Canada.

At the present time in the United States there are more than 100 of this class of coal-preparation plants in operation and building. It is interesting to note that the application of this device has been very general, applying itself to all classes of bituminous coal, including the harder, medium and softer grades as well as the lignites and semi-bituminous coals. These plants are in operation from Wyoming to Pennsylvania and from North Dakota to Alabama.

The installations described and illustrated, and as put in operation for the Carnegie Coal Co., were all designed and built by the Roberts & Schaefer Co., of Chicago, Illinois.

Some New Ideas in Coal Storage

A recent article by Prof. George Knox, published in the Journal of the Monmouthshire Colliery Officials Association, while it advises that no slack coal or mixed small coals be stacked to a height of over 13 ft., urges that coal for coking purposes should not be piled more than 4 ft. deep, for slight heating renders the coal unfit for coking purposes.

Professor Knox adds that inferior coal should not be mixed with the better varieties. "Rashings" or other friable bituminous shale bands should be removed as far as possible. Coal should never be stacked behind wooden structures, on moist vegetable soils or on ground covered by coarse vegetation. Mr. Knox does not say why the vegetation is objectionable, but it may be because it has in itself a great tendency to heat. It probably does not have any direct, or chemical, effect on the coal.

Where "Byproductless" Ovens Waste Coal

The following tabulation has been made from the enumerations of ovens in the various states of the union, as made by *The Coal Catalog* :

State	Beehive Ovens	Rectangular Ovens	Total Ovens	Per Cent.
1. Pennsylvania	45,523	3,185	48,708	57.41
2. West Virginia	16,511	.....	16,511	19.46
3. Alabama	6,111	.....	6,111	7.20
4. Virginia	5,082	.....	5,082	5.99
5. Colorado	2,994	.....	2,994	3.53
6. Tennessee	2,003	.....	2,003	2.36
7. Kentucky	875	150	1,025	1.21
8. Utah	874	.....	874	1.03
9. New Mexico	817	.....	817	0.96
10. Washington	232	.....	232	0.28
11. Oklahoma	200	.....	200	0.24
12. Ohio	178	.....	178	0.21
13. Illinois	104	.....	104	0.12
	81,504	3,335	84,839	100.00

The number will probably decline from this time onward, as the byproduct oven will doubtless drive out the "byproductless" oven in a few short years.