

No. 770,778.

PATENTED SEPT. 27, 1904.

W. J. PATTERSON.

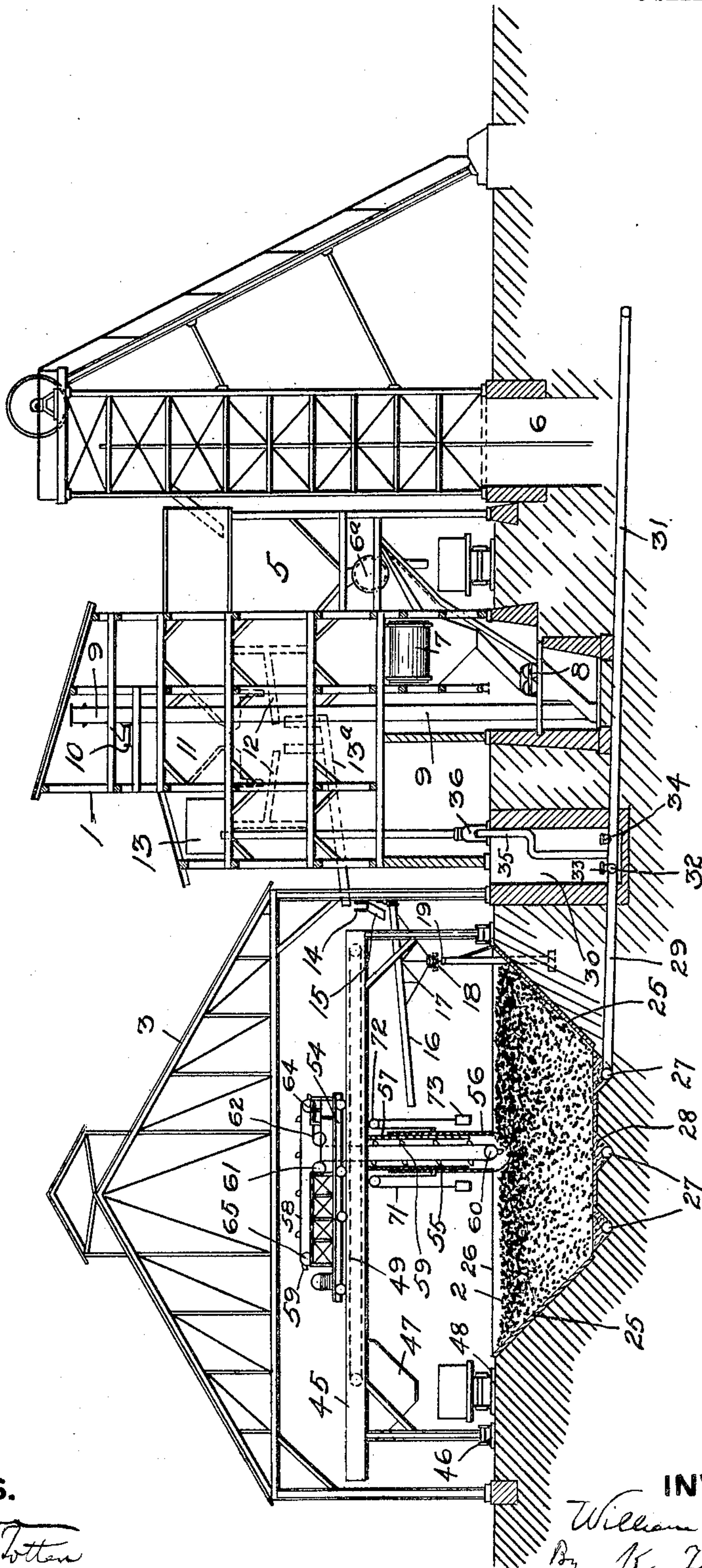
METHOD OF TREATING AND HANDLING COAL FOR COKING PURPOSES.

APPLICATION FILED MAR. 11, 1904.

NO MODEL.

3 SHEETS—SHEET 1.

FIG. 1



WITNESSES.

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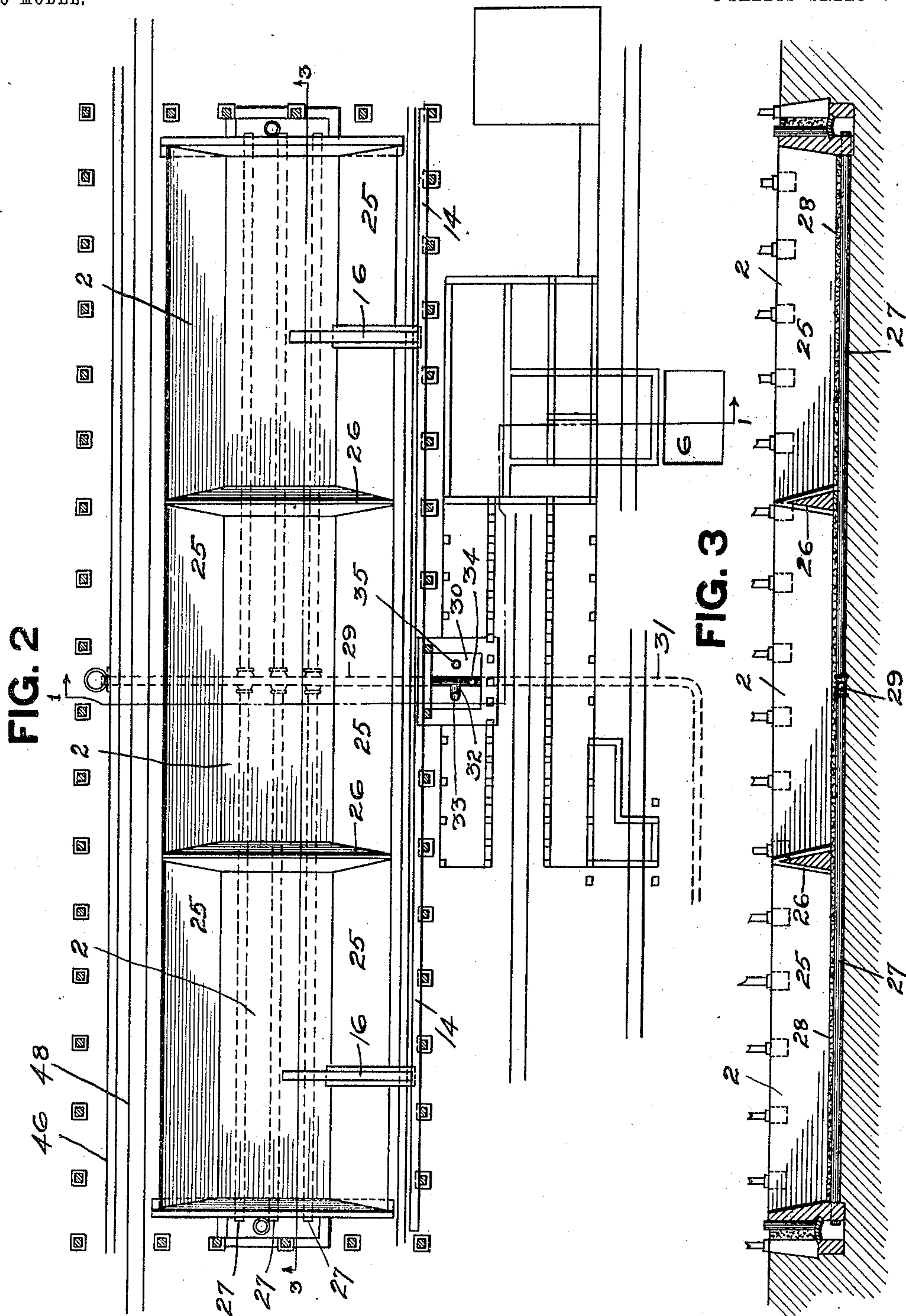
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3 SHEETS—SHEET 2.



WITNESSES.

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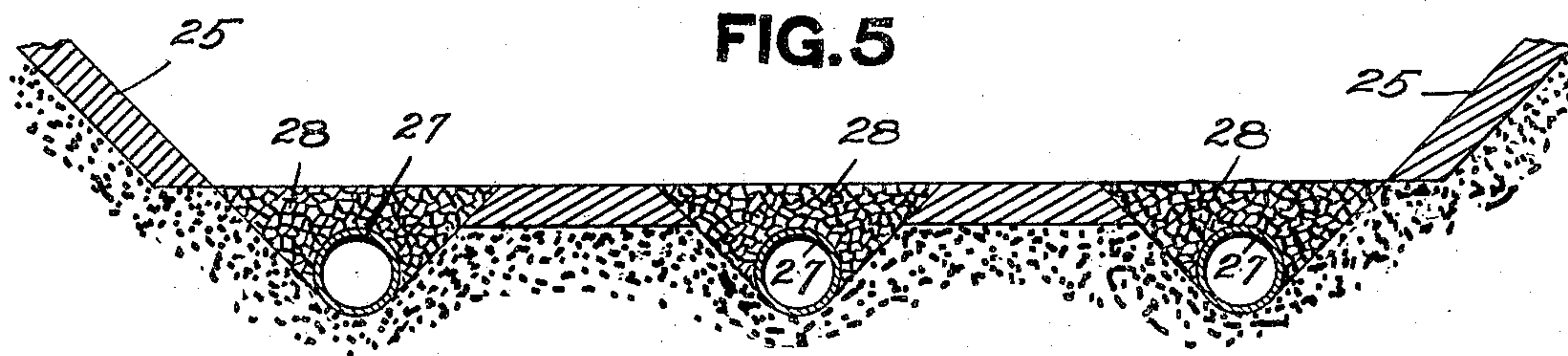
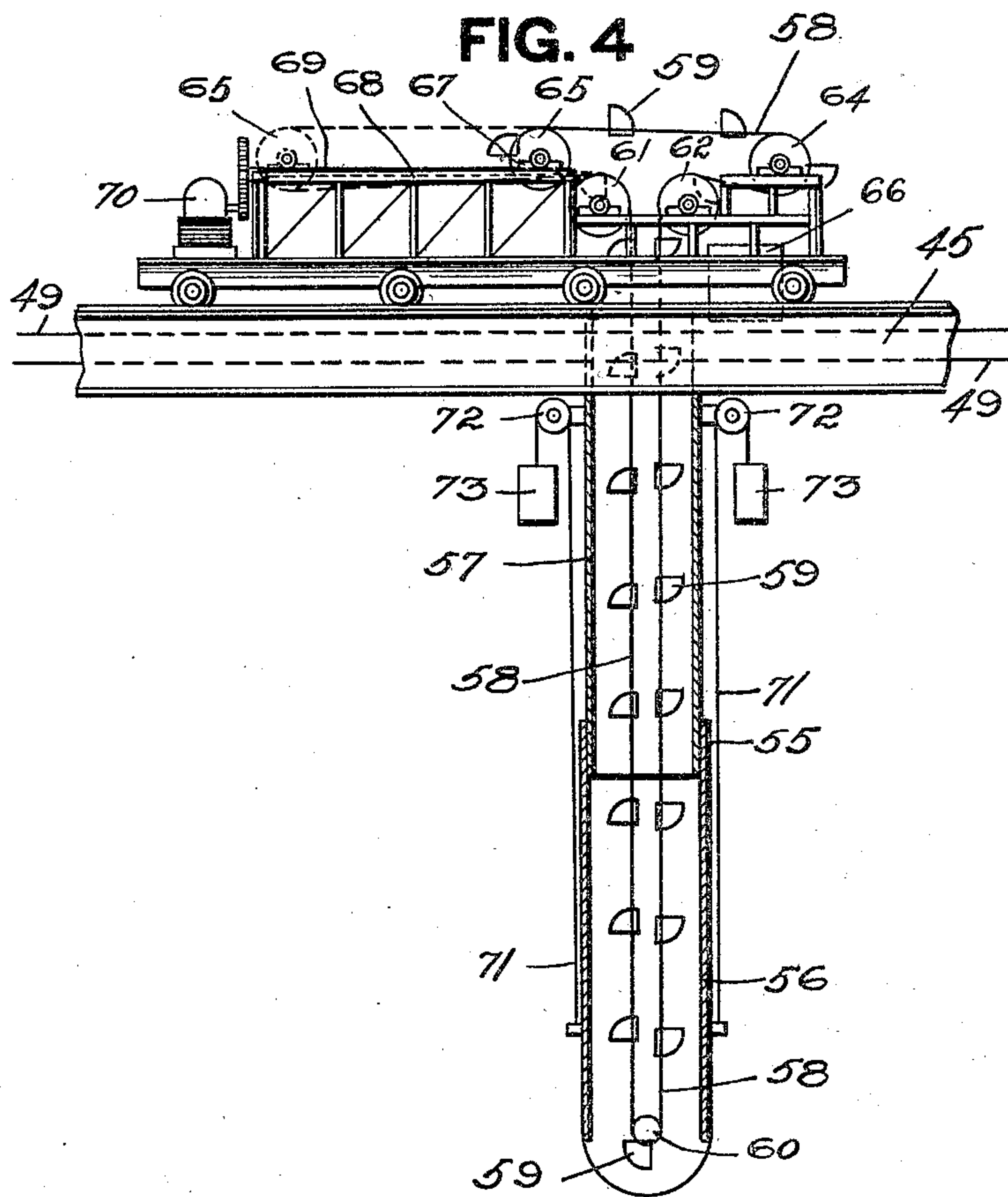
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3 SHEETS—SHEET 3.



WITNESSES.

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METHOD OF TREATING AND HANDLING COAL FOR COKING PURPOSES.

SPECIFICATION forming part of Letters Patent No. 770,778, dated September 27, 1904.

Application filed March 11, 1904. Serial No. 197,707. (No specimens.)

To all whom it may concern:

Be it known that I, WILLIAM J. PATTERSON, a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Methods of Treating and Handling Coal for Coking Purposes; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to a method of treating and handling coal preparatory to its being transformed into coke.

As all coal contains more or less of impurities, such as ash and sulfur, in preparing such coal for coking it is necessary to eliminate these impurities or at least a portion of them. This is done by means of coal-washing apparatus in which the separation is obtained by specific gravity, the impurities, being heavier than the coal, working to the bottom and allowing the coal to be carried off by the flow of the water. As these impurities sometimes consist of very small particles, especially in the case of sulfur, which is more or less diffused throughout the entire mass of coal, it is necessary in order to free this sulfur, so that it may be separated, to reduce the coal from run-of-mine to sizes varying from about three-eighths of an inch to dust. It has been customary to employ suitable crushing apparatus to reduce the coal to the proper degree of fineness, and the coal, having been reduced to the proper degree, is then carried to a suitable storage-bin, from which it is fed to the coal-washers. In the method most commonly employed heretofore it has been customary to discharge the crushed coal from the storage-bin to the washers, by means of which the majority of the impurities were eliminated from the coal. The clean coal and the water coming from the washers were then carried, by means of suitable conveyers, to a pit or hopper. This pit or hopper formed the boot of an elevator, and as the larger particles of the coal settled down into the bottom of the box they were lifted by perforated elevator-buckets, so that the water was permitted to drain from the coal back into the pit as the coal was lifted by the elevator. As a consequence when the

elevator-buckets arrived at the point of discharge the coal contained practically only ten or twelve per cent. of water.

In the coal as it comes from the mine there is always a considerable percentage of dust, and this is correspondingly increased by the further crushing of the coal to bring it to the proper size for washing and coking. This dust, mixed with the larger particles of coal, passes over the washers and is delivered by the sluice-boxes to the pit into which the washed coal is discharged. Much of it being very light remains in suspension, requiring considerable time to settle, and in order to allow it to settle at all the water must be substantially free from agitation. In order to accomplish this, therefore, it has been usual to pass the overflow, which consisted of the water, with the light particles of coal, from the pit or hopper into another compartment or tank of considerable capacity. The water while in this last-named tank being in a substantially quiescent state, the fine coal dust contained in the water would settle to the bottom of the tank, and the tank was usually equipped with a conveyer running along the bottom, which gathered this sedimentary coal and conveyed it to an elevator, by means of which it was lifted out of the tank. Two bins or tanks were therefore required to separate the particles of coal and dust or "sludge," as it is termed, when it becomes wet, as well as several strings of conveyers. As the question of sufficient water-supply is often a very serious one in coal-washing plants, it is customary to use the same water repeatedly in the washing of the coal, and as a consequence it has been customary to take the water from this settling-tank back to the washers. As it would require some hours to permit all of the fine particles of coal to settle in the tank and as it generally requires about a ton of water for each ton of coal washed, a tank which would provide for entirely eliminating the fine coal-dust from the water would have to be an enormous affair. It has consequently been the practice to accept tanks of moderate size, which only indifferently freed the water from the very fine particles of coal, and as a conse-

quence the water pumped back into the washers from this tank contained more or less coal, which to a great extent interfered with the effective operation of the washer irrespective of the type it might be. Heretofore these bins, employed to store the washed coal and where the final drainage takes place, have generally been constructed of wood supported at a suitable height, so as to permit the lorries to be run under the bin, provision being made for making an opening in the bottom of the bin, so as to discharge the coal from said bin into the lorries below. As the washed coal contained only about ten per cent. of moisture when stored in these bins, it was possible to remove the coal in this manner from below, for the reason that the coal had not become so solidly packed as to render its removal in this way difficult. The wettest coal would naturally be at the bottom, so that when the coal was removed only the wettest coal was obtained, and as the water would continue to descend the coal was always kept wet at the bottom, as each fresh charge on top added a certain quantity of water. Even that which had become dry on top would become wet again as it passed to the bottom of the bin. Where, however, attempts had been made to deposit the coal and water in about equal proportions into a bin directly as it came from the washers and then permit the water in the bin to drain off, leaving the particles of coal mixed with the fine dust or sludge to settle in the bin, it was found that this conglomerate mass had become so tightly packed in the bin that it was entirely impracticable to remove it from an opening in the bottom of the bin. In all the methods heretofore employed, therefore, it was necessary to first separate the sludge from the larger particles; second, to allow the sludge to settle in a separate tank; third, to remove the coal from the settling-tanks substantially freed from water; fourth, to remove the sludge from its tank, and, finally, store the coal and sludge in a bin, from which it was removed from below.

The object of my invention is to provide a method by means of which the operation is greatly simplified, a greater quantity of coal handled in a shorter time, and a better distribution of the coal is had, so as to obtain a more perfectly-proportioned mixture of the fine coal and sludge, while at the same time a supply of clean water is obtained for use in the washers without the addition of a large percentage of fresh water.

To these ends my invention comprises, generally stated, the method of treating and handling coal preparatory to coking, consisting in storing the coal and water in one entire mass directly as they come from the washers, permitting the mass so stored to remain in a substantially quiescent state until the water delivered therewith percolates down through the mass of coal, depositing the sludge through-

out the mass, carrying off the water from below and removing the coal from the top of the mass.

To enable others skilled in the art to practice my invention, I will describe the same with reference to the accompanying drawings, in which—

Figure 1 is a vertical section of a plant suitable for carrying out my invention, the section being taken on the line 1 1, Fig. 2. Fig. 2 is a plan view of same. Fig. 3 is a longitudinal section through the storage bins or reservoirs on the line 3 3, Fig. 2. Fig. 4 is an enlarged side view of an elevator for removing coal from the bin, and Fig. 5 is an enlarged sectional detail showing the means for draining the storage-bin.

For purposes of illustration in describing my invention I will employ the following apparatus, which forms the subject-matter of a separate application for Letters Patent filed by me on the 7th day of May, 1902, Serial No. 106,237. A suitable building is employed in which the coal is crushed and washed, and at the side thereof will be the storage reservoirs or bins 2, in which the coal as it comes from the washers is stored and drained, said bins being also preferably covered by a building or roof 3. The building 1 may be of any desired construction and plan, that shown in the drawings being largely diagrammatic. It will be provided with suitable mechanism for delivering the coal thereto and washing the same; but the details of these features (shown in the drawings) are not deemed essential for the purposes of this case. Within the building is the storage-bin 5, into which the coal is delivered either from the mine-shaft 6 or from cars or any other source. From this bin the coal would pass down through the feeder 6^a and breakers 7 and 8, which may be of the usual or any approved construction and connected in any suitable manner. From the last of these breakers an elevator 9 carries the crushed coal to the top of the building and deposits it in a conveyer 10, by means of which it is delivered to one of a series of bins 11, any suitable number of such bins being employed. From these bins the coal will pass down into the washers shown diagrammatically in dotted lines at 12, the water for which comes from a tank 13 from the top of the building. The coal-washers and pertinent mechanisms form no part of my invention and may be of any approved type. From the washers 12 the coal passes down into the trough 13^a and is delivered thereby to a sluice 14, located, preferably, inside of the building 3 and extending longitudinally of the storage bins or reservoirs 2. The sluice 14 is provided at intervals with spouts 15, having suitable cut-off ends and arranged to direct the coal and water to the trough or chute 16, which delivers it to the storage bins or reservoirs. As the latter are of suitable length, the chute or trough 16 will preferably be

movable and as a means to this end is mounted on a suitable truss or frame 17, provided with wheels 18, running on a track 19, located adjacent to the bins. The trough or chute 16 is of such a length that its outer end overbalances the inner end. By this construction the chute 16 can be moved opposite any one of the spouts 15 and used to deposit the coal into any compartment of the storage-bins. The coal is removed from the bins by a traveling crane, and consequently I provide at least two movable chutes 16, as indicated in Fig. 2, one on each side of the traveling crane, so that no matter where the latter may be one or more of the chutes will be available for depositing the coal into the vacant compartment of the storage-bin. The storage-bins are large basins or reservoirs, formed entirely or partly in the ground. In the drawings these are shown as formed entirely in the ground and provided with sloping walls 25 and transverse partitions or abutments 26, which divide the said reservoir into a number of separate compartments. In order to drain the water from the coal, suitable drain-canals may be laid under the floor of the bins. These drain-canals may be of any suitable form. As illustrated, they are formed by a series of hollow perforated drain pipes or tiles 27 laid in depressions in the bin-bottom and covered by means of the broken stone 28 or the like. These drain-pipes 27 extend longitudinally of the bins underneath the floor thereof, and a sufficient number will be provided to thoroughly drain the entire bin. At the middle of the bin they connect with the transverse pipe 29, which leads to a well or sump 30. The pipe 29 extends beyond the sump 30, as at 31, to any suitable place of discharge, and in the sump 30 it is provided with a by-pass pipe 32. This by-pass pipe is provided with a valve 33, and the pipe itself beyond the by-pass is provided with a valve 34, so that the water drained from the storage-bin can be either allowed to flow through the pipe 31 to the place of discharge or else permitted to gather in the well 30. Projecting down into the well 30 is a pipe 35, to which is connected a pump 36, which will lift the water from the well to the tank 13. During the daytime when the plant and pump are in operation, the water will be pumped back into the tank 13 and used over again, and consequently the valve 33 will be open and the valve 34 closed. At night, however, or at other times when the pump is not in operation the valve 33 will be closed and the valve 34 open and the water allowed to flow away.

It is not essential in the practice of my invention that a regular filter-bed such as that illustrated be employed, as the body of the coal itself may form a suitable mass by means of which the water is filtered as it percolates down through the said mass of coal.

To remove the coal from the storage-bins, I

provide a suitable traveling bridge or crane 45, which may move upon suitable tracks on the standards of the building 3, but preferably on the floor at the sides of the bin, as shown at 46. On one end of this bridge is a hopper 47, which lies over a track 48, upon which will be placed the cars into which the coal is to be deposited. A transverse conveyer 49 is carried by the bridge for depositing the coal in the hopper 47. Traveling on the bridge 45 is a carriage or trolley 54, which carries an elevator 55. This elevator forms the subject matter of Letters Patent of the United States, No. 749,803, granted to me on the 19th day of January, 1904. This elevator is composed of telescoping tubes 56 and 57, which inclose the chains 58, carrying the buckets 59, and the lower one of which is open at its lower end, so that the coal can be removed by working from the top surface thereof. The bucket-chains pass over suitable guide-wheels 60 in the lower end of the tube and over two sets of wheels 61 and 62 on the carriage 54 and over two other sets of guide-wheels 64 and 65, also mounted on said carriage. A chute 66 is placed in proper position to receive the coal from the buckets 59 and discharge the same into the conveyer 49. The chain-wheels 65 are movable—as, for instance, by being mounted on the slide or carriage 67—moving on suitable ways 68 on the trolley and which may be moved thereon by any suitable mechanism—such, for instance, as the screws 69, driven by an electric motor 70. By means of these screws the wheels 65 can be moved, as indicated in dotted lines, Fig. 4, thus shortening or lengthening the depending portion of the bucket-chains. The shortening of the sheets will raise the lower tube and cause it to telescope on the tube 57, thus shortening the elevator, and by lengthening said chains the lower tube will by this way drop downward, thus keeping the chains tight. In this manner the elevator can be extended or shortened as is necessary in order to reach all of the coal in the bin. The lower tube will preferably have attached thereto the cables 71, which pass over sheaves 72, mounted on a stationary part of the elevator and provided with counterbalancing-ways 73.

I will now describe my improved method in connection with the hereinbefore-described apparatus. The coal after passing from the breakers 7 and 8 contains, in addition to the fine particles of coal, a great deal of dust, and this mixture of fine particles of coal and dust is carried up by the elevator 9 and deposited by the conveyer 10 into the bins 11. From these bins the coal is permitted to pass in suitable quantities into the washers 12, which are supplied with water from the tank 13. The washers act to separate from the coal substantially all the impurities in the form of ash or sulfur, which impurities are carried off and disposed of in any suitable manner.

The water and coal, however, generally in about equal proportions, are carried from the washers into the sluice 13^a, whence it passes, by way of the trough 14 and chute 16, into the bins or reservoirs 2. As the coal and water are discharged into these bins in about equal proportions, the coal becomes evenly distributed throughout the bins, so that in settling the sludge is quite evenly distributed throughout the mass of coal, while at the same time the entire mass of coal is deposited of a substantially uniform depth over the area of the bin. It is usual to fill the several compartments of the bin alternately, each compartment of the bin being of sufficient size to hold the product of one day's run. The coal naturally settles to the bottom of the bin and the water percolates or filters through the mass of coal and where a filtering-bed is employed also passes through this filtering-bed into the pipes or conduits laid to carry the water off to the well or sump 30. The water in percolating through this mass of coal, even where no special filtering-bed is employed, will be clarified and substantially relieved of all sediment, so that the water which reaches the sump or well 30 will be pure and clean for being pumped back into the tank 13 to be used over again. Owing to the water and coal being taken directly from the washers in about equal proportions, the settling of the coal in the bin in such a body of water will tend to pack the coal in a tight solid mass within the tank. In order, therefore, to remove the coal in this tightly-packed condition, the coal is removed by working from its upper surface. The elevator 55 is brought into proper position with reference to the top surface of the coal, so that when the buckets of said elevator are put into operation they will act to lift the coal from the top of the pile and convey it to the conveyer 49, whence it is conveyed to the hopper 47 to be loaded into the cars 48. In this way, by removing the coal from the top, the driest coal of the mass is obtained, and by the time the coal at the bottom has been reached the water will have had an opportunity to drain off, so as to leave it substantially as dry as that above, there being no new additions of coal and water from above to cause it to become wet again. The drier the coal

when fed to the coke-ovens the less severe the wear on the ovens.

Where the bins are divided up into different compartments, the compartments may be worked alternately, so that while the coal and water are being discharged into one compartment the coal may be in process of removal from another compartment from which the water has been drained. In this manner the process may be practiced continuously, so that great quantities of coal may be washed and handled more directly and in a shorter space of time than any of the methods heretofore employed.

By my improved method it is not necessary to separate the sludge from the other particles of coal; but the entire mass is taken directly from the washers into the bin and the sludge so distributed throughout the mass as to give greater uniformity of product, and by the method of removing the coal from the bins the fact that the mass has become tightly packed and solidified is of no moment.

What I claim is—

1. The method of treating and handling coal preparatory to coking, consisting in storing the coal and water in one entire mass directly as they come from the washers, permitting the mass so stored to remain in a substantially quiescent state until the water delivered therewith percolates down through the mass of coal, depositing the sludge throughout the mass, carrying off the water from below, and removing the coal from the top of the mass.

2. The method of treating and handling coal preparatory to coking, consisting in storing the coal and water in substantially equal proportions in one entire mass directly as they come from the washers, permitting the mass to remain in a substantially quiescent state until the water delivered therewith percolates down through the entire mass of coal, depositing the sludge throughout the mass, carrying off the water from below, and removing the coal from the top of the mass.

In testimony whereof I, the said WILLIAM J. PATTERSON, have hereunto set my hand.

WILLIAM J. PATTERSON.

Witnesses:

ROBERT C. TOTTEN,
G. C. RAYMOND.