Jan. 31, 1950 W. H. PLETTA ET AL 2,495,944

APPARATUS FOR SAMPLING MATERIAL, SUCH AS COAL

Filed Sept. 8, 1947 3 Sheets-Sheet 1

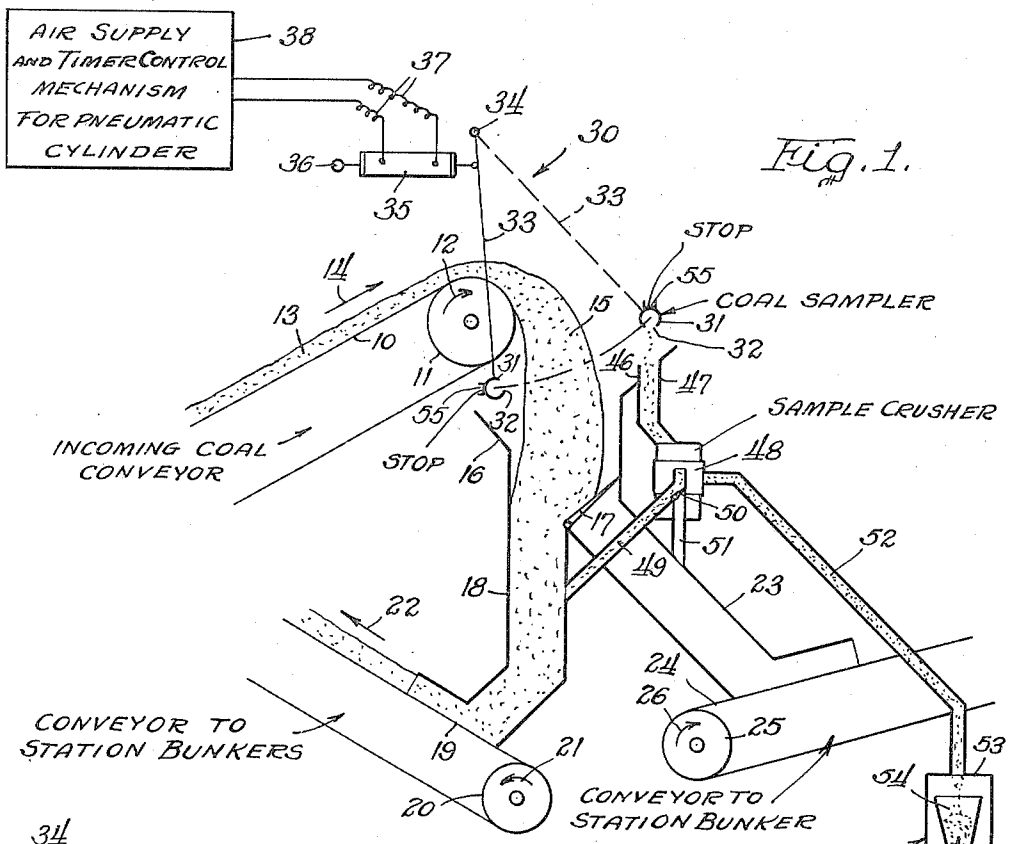


Fig. 1.

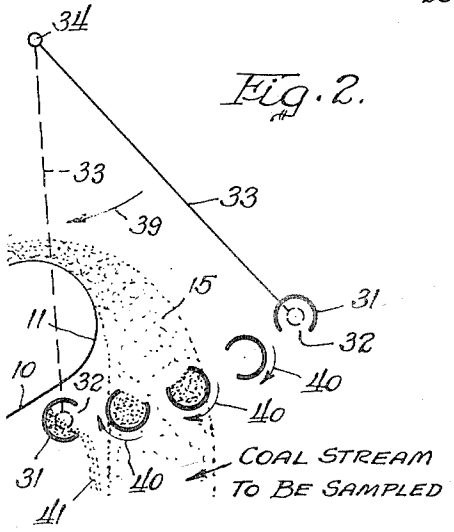


Fig. 2.

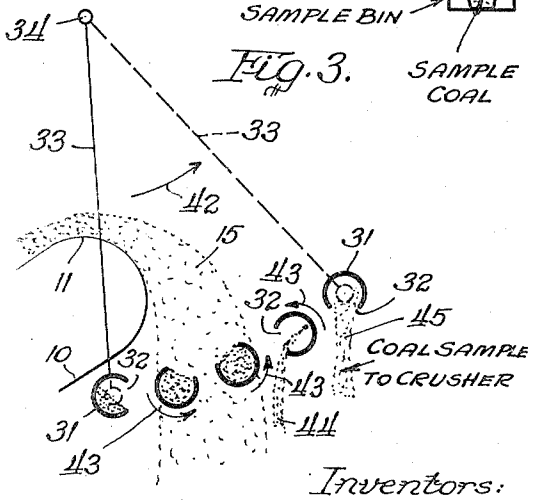


Fig. 3.

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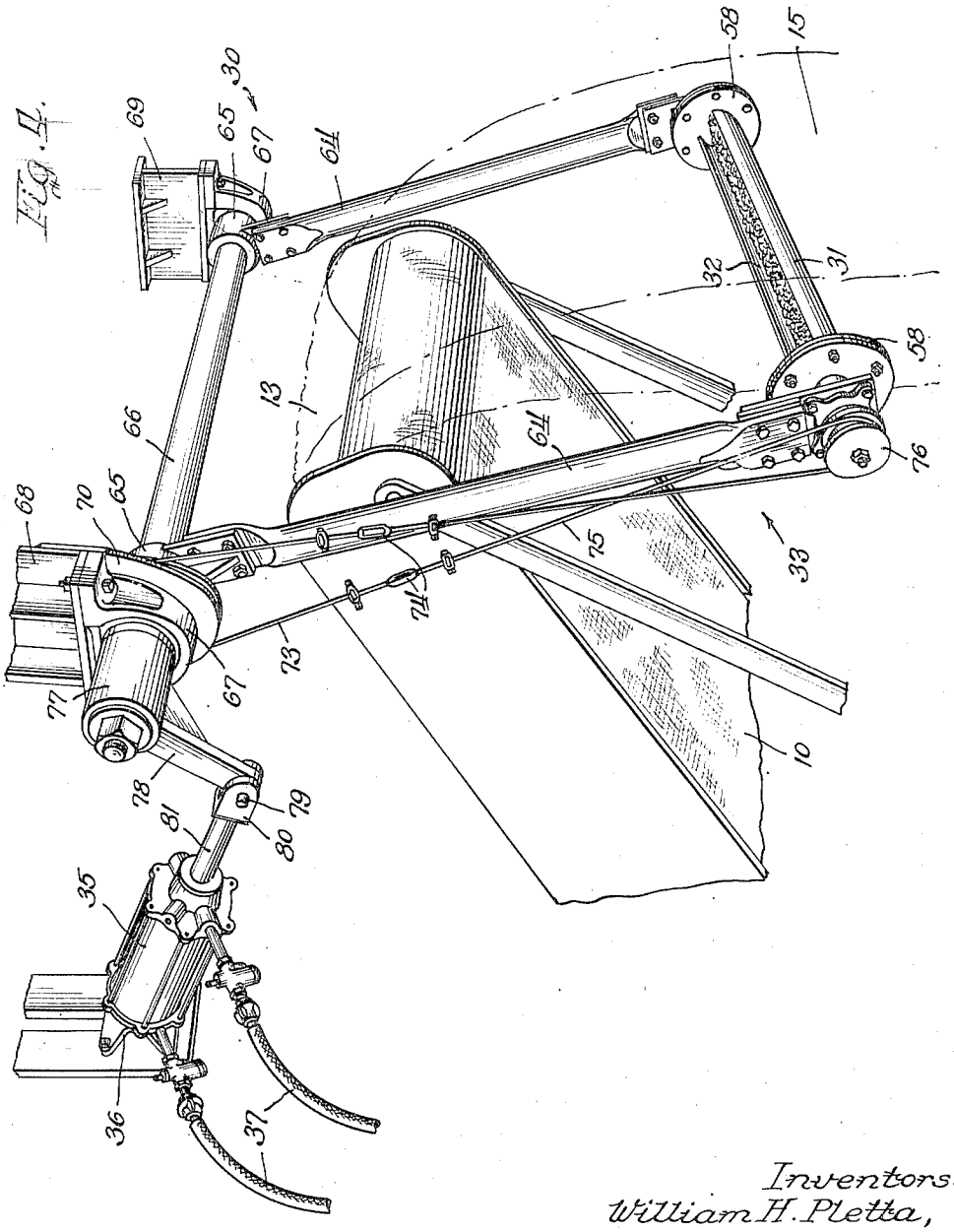
By Brown, Jackson, Boettcher & Dienner
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Fig. 4.



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APPARATUS FOR SAMPLING MATERIAL, SUCH AS COAL

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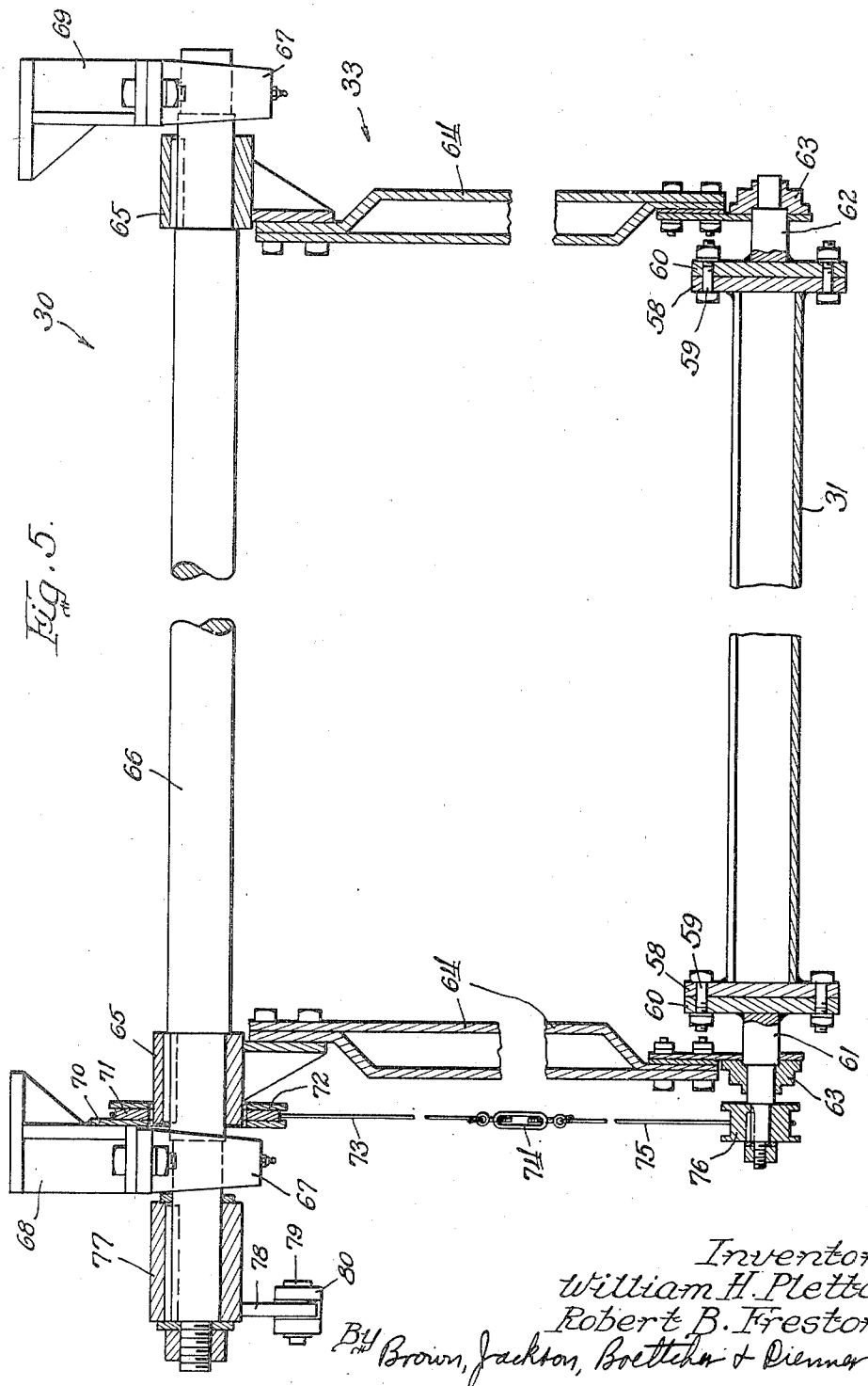


Fig. 5.

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APPARATUS FOR SAMPLING MATERIAL, SUCH AS COAL

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7 Claims. (Cl. 73—423)

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This invention relates, generally, to material sampling apparatus and it has particular relation to apparatus for sampling a material such as coal.

One use to which coal is put is in the generation of electricity in large central stations. It is desirable in the operation of such a generating station to check constantly its operating efficiency. This is done, in part, by taking small samples of coal that is consumed in the operation of the station and analyzing the same.

For this purpose a large number of small portions of the coal are obtained and combined into a single sample for test purposes. In order that the efficiency calculations may be accurate it is essential that the ultimate sample be representative of all the coal that is delivered during a given period, such as an eight hour shift. At the same time the ultimate sample must be small enough to be handled conveniently in the laboratory where the analysis is made. The present invention has to do particularly with an approved apparatus for obtaining the ultimate sample.

Such apparatus should be so designed and constructed that the individual sample size and the number of samples per unit of time can be varied. In addition each sample should be truly representative of all of the material passing a given point at the time that the sample is taken so that there will be no error as a result of stratification. Since the apparatus necessarily must operate in dust ladened atmosphere, it should have a minimum of moving parts. The portion of the sampler which is subjected to the abrasive action of the material being sampled should be readily detachable from the remaining mechanism so that it can be replaced quickly and economically when it becomes worn.

In the past samplers for this purpose have been made up of complicated mechanisms employing motors, gear reducing units, various forms of moving scoops, screw conveyors and reversible jack shafts. Since this apparatus is required to operate in a dust laden atmosphere it requires constant maintenance to keep the same in operation. Such apparatus has been unsatisfactory because it has required a great deal of time and effort in order to adjust the same so that the ultimate sample which is obtained is truly representative of the coal that has been consumed by the station.

Accordingly, among the objects of our invention are to provide an apparatus for sampling material such as coal which shall be simple and efficient in operation and which may be readily and economically manufactured and installed.

Other objects are: To provide for sampling a falling stream of material such as coal in such manner that a truly representative sample is obtained: to obtain a sample of the material in the

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stream along the entire width thereof beginning at one side, to return a portion of this sample to the stream, and to obtain an additional sample along the entire width of the stream beginning near the other side thereof so that the composite sample which is obtained is representative of the entire width and thickness of the stream along a relative short length thereof; to obtain a sample by swinging a sample collector in the shape of a trough with a pendulous movement through the stream while the sample collector is rocked simultaneously about its longitudinal axis; to arrest the motion of the sample collector at the ends of the forward and reverse movements thereof with a jar so as to dislodge the material therein; and to provide a construction wherein the sample collector is the only part of the sampler mechanism which is subjected to the abrasive action of the material with the sample collector being arranged to be replaced readily when it becomes worn.

Other objects of our invention will, in part, be obvious and in part appear hereinafter.

Our invention is disclosed in the embodiment thereof as shown in the accompanying drawings and it comprises the features of construction, combination of elements, arrangement of parts and method of operation which will be exemplified in the construction hereinafter set forth and the scope of the application of which will be indicated in the appended claims.

For a more complete understanding of the nature and scope of our invention reference may be had to the following detailed description, taken together with the accompanying drawings, in which:

Figure 1 illustrates diagrammatically a conveyor system for material such as coal in which our material sampling apparatus is incorporated;

Figures 2 and 3 illustrate, diagrammatically, various positions of the sample collector that is employed for obtaining the individual samples and illustrating its position as it swings with a pendulous motion through the falling stream of material;

Figure 4 is a perspective view of our material sampling apparatus illustrating how it can be used in conjunction with a falling stream of material such as coal; and

Figure 5 is a longitudinal sectional view of the material sampling apparatus illustrated in Figure 4.

The present invention has been referred to hereinbefore as being applicable for sampling material such as coal. While it is particularly applicable for use in sampling coal from a falling stream thereof, it will be understood that it can be used for sampling other material in like circumstances if desired.

Referring now particularly to Figure 1 of the

drawings, it will be observed that the reference character 10 designates an incoming coal conveyor which is trained over a pulley 11, magnetic or otherwise, that rotates in a clockwise direction as indicated by the arrow 12. The coal on the conveyor 10 is indicated at 13 and it is moved in the direction indicated by the arrow 14 until it falls in a stream as indicated at 15. The stream 15 is generally rectangular in cross section.

It is desirable to obtain a sample of the coal in the stream 15 which is representative of the coal not only across the entire width of the stream 15 at right angles to the plane of the paper but also is representative of the coal for the full depth of the stream 15 from one side to the other. A method and apparatus will be described hereinafter for obtaining such a representative sample.

The stream 15 falls into a hopper 16 where a flap gate 17 directs it into a chute 18 that opens onto an outgoing conveyor 19 in the form of a belt that is trained over a pulley 20 which rotates in a counter clockwise direction as indicated by the arrow 21. The conveyor 19 carries the coal as indicated by the arrow 22 to certain of the station bunkers or to other repositories for the same, as will be understood readily.

The flap gate 17, when moved to the alternate position, directs the stream 15 of coal into a chute 23 whence it is carried by a conveyor 24 to other station bunkers as may be desired. The conveyor 24 is in the form of a belt which is trained over a pulley 25 that rotates in a clockwise direction as indicated by the arrow 26.

The conveyor system which has been described is entirely conventional and forms no part of the present invention. Rather, the invention resides in the construction and operation of a coal sampler which is indicated, generally, at 30 in Figure 1. The coal sampler 30 includes a sample collector 31 which, as will appear hereinafter, is in the form of a trough which is mounted for rocking movement about its longitudinal axis. The sample collector 31 may be formed of a length of pipe which has a longitudinally extending quarter section removed. For illustrative purposes it is pointed out that the sample collector 31 may be formed of a pipe having an internal diameter of four inches and a length of fifty three inches. However, it will be understood that these and other dimensions set forth herein may be varied as circumstances may dictate.

The sample collector 31 has an arcuate opening 32 which, as indicated, is provided by removing a quarter section of the pipe employed for making the same. It is through the arcuate opening 32 that the desired sample of coal from the stream 15 falls into the sample collector 31 and likewise through this opening that it is deposited in a suitable crusher, to be described, for further processing.

The sample collector 31 is bodily mounted by a frame which is indicated at 33 and, as will appear hereinafter, comprises a generally rectangular construction which is rockably mounted at 34 so that the sample collector 31 can be swung, as shown in Figure 1, from one side of the stream 15 to the other and back again in order to obtain the sample which is truly representative of the coal in the stream 15. The length of the frame 33 may be such that the sample collector 31 is swung about the center 34 at the end of a five foot radius.

Any suitable means can be employed for rocking the frame 33 and at the same time for rocking the sample collector 31 about its longitudinal axis. For illustrative purposes a pneumatic cylinder mechanism 35 is illustrated which is pivotally mounted at 36 and may be connected by flexible hose 37 to an air supply and timer control mechanism which is indicated at 38. It will be understood that other means than the pneumatic cylinder mechanism can be used to move the sample collector 31 as described. The timer and control mechanism 38 may be adjusted to swing the frame 33 of the coal sampler periodically. A preferred arrangement is to operate the coal sampler 30 once each minute at a speed such that the sampling operation is performed in about six seconds. Obviously the mechanism 38 can be adjusted so that the interval between operations can be increased or decreased and the speed of operation of the coal sampler in each cycle can be increased or reduced.

The sample of coal is obtained, as indicated in Figure 2, by rocking the frame 33 in a clockwise direction as indicated by the arrow 39 from the right hand or normal position. In this position the arcuate opening 32 faces downwardly; the sample in the sample collector 31 having been dumped therefrom previously. As the frame 33 is rocked in a clockwise direction, the sample collector 31 simultaneously is rocked in a clockwise direction as indicated by the arrow 40 about its longitudinal axis by means which will be described hereinafter. As the sample collector 31 rotates, the arcuate opening 32 gradually shifts from the complete upside down position to a right side up position within the stream 15. It is filled with coal shortly after it enters the middle of stream 15 and remains so until it passes beyond the rear of the stream as illustrated where the arcuate opening 32 occupies a vertical position and some of the coal, as indicated at 41, is returned to the main stream 15. The reason for returning a portion of the sample already obtained is to provide a space for obtaining a sample from the rear part of the stream 15 so that the final sample, which remains in the sample collector 31, will be truly representative of the coal across the entire cross section of the stream 15 at the time that the sample is taken.

In Figure 3 the return stroke of the sample collector 31 and frame 33 is shown. The frame 33 is rocked in a counter clockwise direction as indicated by the arrow 42 and simultaneously the sample collector 31 is rocked in a counter clockwise direction, indicated by the arrow 43. The sample collector 31 again traverses the falling stream 15 of coal and takes a sample across its entire width from the rear portion thereof. When the sample collector 31 is moved out of the stream 15 toward the initial or normal position, the arcuate opening 32 is rocked so that a portion of the sample as indicated at 44 is returned to the main stream 15. However, the coal which remains in the sample collector 31 is representative of the coal across the entire width and depth of the stream 15 while the sampling operation was being performed. When the sample collector 31 is returned to the initial or normal position as shown in Figure 3, the contents thereof are dumped as indicated at 45 to the right hand side of a wear plate 46, Figure 1, into a hopper 47 leading into a sample crusher 48 where the sample is crushed to the desired fineness.

A substantial portion of the sample thus crushed is returned through a chute 49 into the chute 18. A flap gate 50, which operates conjointly with the flap gate 17, controls the dis-

position of the surplus portion of the sample from the crusher 48. When the stream 15 flows into the chute 23, the flap gate 50 is operated to direct the surplus portion of the samples into a chute 51 which opens into the chute 23.

The desired portion of the sample on which an analysis is to be made is directed by a chute 52 into a sample bin 53 where the sample 54 is collected in a suitable container. The operation is such that a composite sample weighing about 40 pounds is obtained for each eight hour shift of the station operation. By taking the sample in the manner described, it has been found that it is truly representative of the coal that has been consumed during the corresponding period. This amount, while small, still makes it possible to run the necessary analysis quickly and efficiently.

The preferred manner of moving the sample collector 31 through the stream 15 is to mount the same on the frame 33, as described, and rock the latter about the axis 34 which is parallel to the stream 15 and spaced above the same. The purpose of this is to have a minimum of the operating mechanism below the uppermost level of the stream 15. However, other means can be employed for moving the sample collector 31 transversely of the stream 15. For example, the sample collector 31 may be moved bodily with a translatory movement through the stream 15 in a plane either at right angles or inclined thereto. As indicated, however, it is preferred to swing it through the stream 15 for the reasons stated. Whether the sample collector 31 is moved with a pendulous movement or with a translatory movement, it is rocked about its longitudinal axis in order to obtain the truly representative sample as described.

At each end of the forward and reverse strokes it is desired that the sample collector 31 be stopped with a jarring movement so as to dislodge the material therein which should at that time be emptied therefrom. This is particularly important when a sample is being taken of relatively wet coal. Under these conditions the coal tends to pack and, if not dislodged, would remain in the sample collector 31, thus preventing the taking of the desired sample. For this purpose a stop 55 is provided against which the sample collector 31 is caused to strike at each end of its movement. The stops 55 may be in the form of channels which are mounted suitably from the building construction housing the material handling and sampling apparatus.

In Figures 4 and 5 of the drawings are illustrated the preferred details of construction of the coal sampling apparatus 30. It will be observed that the sample collector 31 has circular end plates 58 secured, as by welding, to its ends and that these plates are held by bolts 59 to plates 60. This construction permits the sample collector 31 to be removed readily from the frame 33 and to be replaced if necessary when it becomes worn. The sample collector 31 is of sufficient length so that its ends extend beyond the sides of the stream 15 of coal in order to obtain a sample thereof across its entire width.

The plates 60 are secured, as by welding, to short shafts 61 and 62 which permit the sample collector 31 be accomplished by the pneumatic as described. The shafts 61 and 62 are rockably mounted in suitable bearings 63 that are carried at the outer ends of arms 64 which make up the frame 33 previously referred to. As shown, the arms 64 are tubular members having the ends

flattened as shown for mounting purposes. At their upper ends the arms 64 are secured to brackets 65 which may be keyed to a main shaft 66 the longitudinal axis of which corresponds to the center 34 previously referred to and shown in Figure 1.

The main shaft 66 is rockably mounted near its ends by bearings 67 which may be carried by suitable supports 68 and 69 attached to the building construction as may be desired.

It will be recalled that the sample collector 31 is rocked about its longitudinal axis in taking the sample as it moves transversely in the stream 15 of coal or other material to be sampled. It is desired that this rocking movement of the sample collector 31 be accomplished by the pneumatic cylinder mechanism 35 without requiring an additional power generating mechanism or a complicated system of gearing, levers, etc. With this in mind a plate 70 may be secured, as by welding, to the right hand side of the support 68 and it may have secured thereto a narrow drum 71 which has a radially extending guide flange 72. A flexible tension member in the form of a wire rope 73 is trained over the narrow drum 71 and is securely fastened thereto. While the drum 71 is mounted around the shaft 66, it is stationary with respect to the same. The flexible tension member 73 is connected by turnbuckles 74 to the ends of another flexible tension member 75 which likewise is in the form of a wire rope and preferably is wrapped two and one half times around a pulley 76 which is fast on shaft 61. The flexible tension member 75 is fastened to the pulley 76.

When the frame 33 is rocked, as described hereinbefore, in a clockwise direction, the sample collector 31 is likewise rocked in this direction since the ends of the flexible tension member 75 are crossed as illustrated in Figure 4. By adjusting the turnbuckles 74 it is possible to adjust the position of the arcuate opening 32 as may be desired and thus govern the individual sample size. The extent of rocking movement of the sample collector 31 can be varied by varying the diameter of the narrow drum 71 and the diameter of the pulley 76 as will be understood readily. It will be understood that other means such as a cam and track arrangement can be used to rock the sample collector 31. The construction may be such that the sample collector 31 rocks slowly through a given period of its cycle, rapidly through another period and, if desired, it can be stopped momentarily at a point other than the end points. Provision can be made at each end of the stroke to discharge the sample collector 31.

As illustrated in Figures 4 and 5 the main shaft 66 has a sleeve 77 secured thereon by a key. The sleeve 77 has a crank arm 78 extending therefrom which may be connected by a pin 79 to a clevis 80 at the end of a connecting rod 81 which extends from the pneumatic cylinder mechanism 35 and is moved in a forward and reverse direction as described hereinbefore.

Since further changes can be made in the foregoing construction and different embodiments of the invention can be made without departing from the spirit and scope thereof, it is intended that all matters shown in the accompanying drawings and described hereinbefore shall be interrupted as illustrative and not in a limiting sense.

We claim as our invention:

1. Apparatus for obtaining a sample of material such as coal from a stream thereof comprising, in combination, a sample collector in the form of a trough rockably mounted about its

longitudinal axis, a generally rectangular frame for supporting said sample collector and rockably mounted along one side to swing said sample collector in a pendulous fashion transversely through said stream, and means for rocking said frame and simultaneously therewith said sample collector about its longitudinal axis to obtain a sample across the full width of said stream.

2. Apparatus for obtaining a sample of material such as coal from a stream thereof comprising, in combination, a sample collector in the form of a trough rockably mounted about its longitudinal axis, a generally rectangular frame for supporting said sample collector and rockably mounted along one side to swing said sample collector in a pendulous fashion transversely through said stream, means for rocking said frame, and means operatively interconnecting said frame and said sample collector to rock the latter relative to the former to take the sample as the sample collector is swung through said stream.

3. Apparatus for obtaining a sample of material such as coal from a falling stream thereof having a generally rectangular cross section comprising, in combination, a shaft rockably mounted parallel to a pulley axis, a pair of arms extending radially from and movable with said shaft past opposite sides of said stream, a sample collector in the form of a trough rockably mounted about its longitudinal axis at the outer ends of said arms and bodily movable transversely of said stream when said arms are rocked, linkage means operatively interconnecting said shaft and said sample collector to cause the latter to rock about its longitudinal axis to obtain a sample across the full width of said stream when said shaft is rocked, and means for rocking said shaft periodically.

4. The invention, as set forth in claim 3, wherein the linkage means comprises a stationary drum surrounding the shaft, a pulley rockable with the sample collector, and a flexible tension member is trained over and fastened to said drum and said pulley.

5. The invention, as set forth in claim 4, wherein the flexible tension member comprises a wire rope which is crossed between the drum and pulley to rock the sample collector in the same direction that the shaft is rocked.

6. Apparatus for obtaining a sample of material such as coal from a stream thereof comprising, in combination, a sample collector in the form of a trough rockably mounted about its longitudinal axis, means for moving said sample collector transversely of said stream and simultaneously rocking the same about said axis from an upside down position on one side of the stream to a right side up position within the stream, then to a partial upside down position on the other side of said stream and then back to its initial upside down position, and stop means for arresting the motion of the sample collector with a shock at the ends of its movement through the stream to dislodge particles of material that otherwise would remain therein.

7. The invention, as set forth in claim 3, wherein a short shaft is journaled at the outer end of each of the arms, a plate is secured to the inner end of each shaft, the sample collector has a plate at each end, and means are provided to detachably interconnect the juxtaposed plates whereby the sample collector can be replaced without requiring that the remaining part of the apparatus be dismantled.

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