May 30, 1933. J. BROWN 1,911,880

HYDRAULIC CONVEYING SYSTEM FOR USE IN MINES

Filed July 18, 1930

Fig. 1.

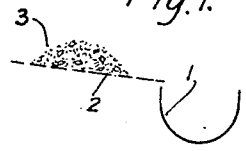


Fig. 2.

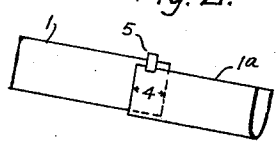


Fig. 3.

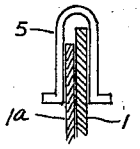


Fig. 4.

Fig. 6.

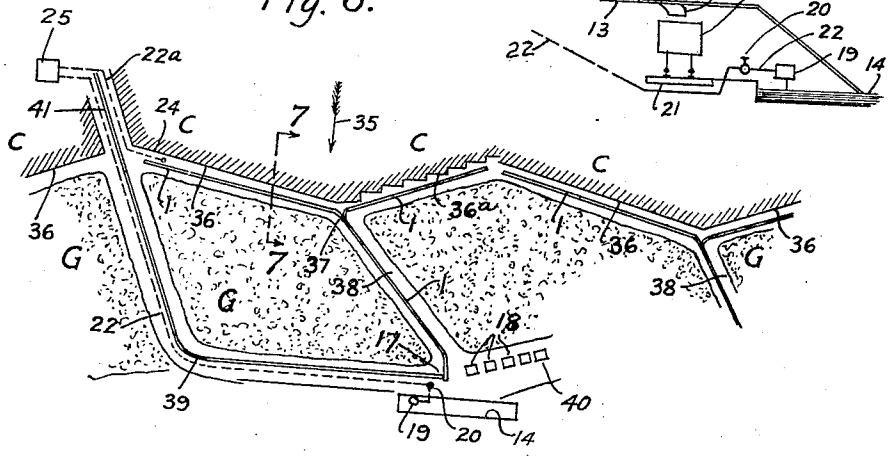


Fig. 5.

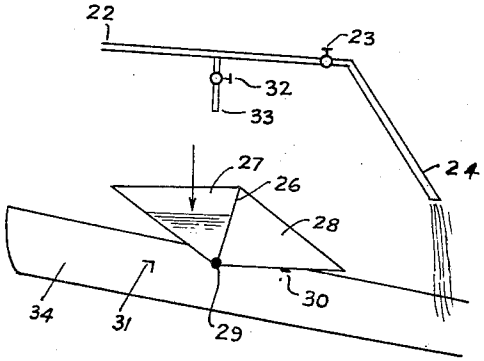
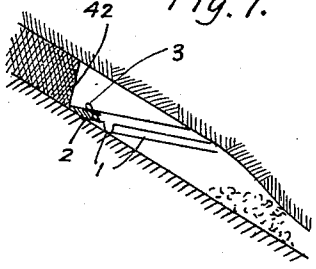


Fig. 7.



J. Brown INVENTOR

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UNITED STATES PATENT OFFICE

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HYDRAULIC CONVEYING SYSTEM FOR USE IN MINES

Application filed July 18, 1930, Serial No. 468,959, and in British India April 10, 1930.

This invention relates to a method and apparatus for handling materials such as coal, light ores or the like.

It is more particularly devised for the transport of coal in coal mines, but is not necessarily restricted to use in mines, nor to use in transporting coal alone, as it will be obvious that the principles involved are applicable in other situations and to other materials where the conditions are favourable and where the grades are suitable and plenty of water is available.

Broadly speaking the invention consists in providing troughs laid at a proper inclination and in washing the coal or other material down these troughs.

The invention has mainly been developed for the purpose of transporting coal from the working faces in coal mines to the loading positions where the said coal is loaded into tubs or skips to be hauled to the surface. The invention is only applicable in situations where suitable gradients are available and where water is also available.

In many coal mines the coal seams are on the dip or are inclined and there is often, particularly in this country, too much, rather than too little, water available in mines.

In coal mines the problem of handling the coal is a very important one. The coal is obtained from galleries or working faces which may be a very considerable distance from the main inclines or the shaft at which the coal is to be loaded to be hauled to the surface.

According to this invention any suitable device for automatically turning on or supplying water in intermittent flushes may be used. According to one specific embodiment the intermittent flushing device comprises a pivoted vessel having two compartments adapted to take up one or other of two fixed positions, in either of which, when empty, it is in stable equilibrium, a pipe being adapted to supply water to the device centrally over the pivotal point to fill the upper one of the said two compartments, the balance being such that when the said compartment is full it will cause the device to overbalance and to move from its first said fixed position to the other said fixed position, and in moving will discharge the contents of the said filled compartment into the trough, the said last filled compartment then becoming the lower one and the other compartment being the higher one which will be filled in turn by the continuously running supply from the said pipe to operate the vessel in the reverse direction in a similar manner, and so on.

In such a plant layout the cocks or valves for controlling the supply of water to the coal conveying troughs may be situated at, or are controlled by means or signals from, the point at which the tubs are loaded, so that the delivery of coal thereto may be regulated.

The invention will now be described with reference to the accompanying drawing in which:—

Fig. 1 is a section of a convenient form of trough.

Fig. 2 is an elevation of a joint between two lengths of trough.

Fig. 3 shows a clip which may be used to keep two lengths together.

Fig. 4 is a diagram of the system of transporting as applied to a coal mine.

Fig. 5 is a diagram showing a device which can be used for giving flushes of water down the trough.

Fig. 6 is a diagram representing a plan of part of a coal mine to which the system is applied, and

Fig. 7 is a sectional view on line 7—7 of Fig. 6.

The trough 1 is made of steel plates of any suitable gauge and in any lengths convenient for manufacture and handling. For example the trough might be 24 inches wide and 18 inches deep and in lengths of about 12 feet each.

In Fig. 2 it is shown how the lower end of the upper trough 1 is placed inside the upper end of the next trough 1*a* below it, and the two ends are clipped together by spring clips 5 shown in Figure 3 to provide an overlap 4.

On the side of the troughs towards the

working face of the coal seam the trough may have a loading plate 2 placed alongside, the edge of which plate overlaps one edge of the trough, and coal may be allowed to collect as indicated at 3, on this plate or on the floor in readiness for shovelling into the trough when the water is turned on and a line of tubs is ready for loading on a track to the dip of the seam.

Referring now to Fig. 4 the length A B of the trough 1 is understood to be approximately parallel to the general line of the working face. This length of trough may slope downwards towards B at any suitable slope within limits. The slope along this length may be for example about 1 in 12 to 1 in 6.

From point B to point C the trough is at a steeper slope. It will be assumed that this length B to C is in a gallery. The slope in this length may perhaps be from 1 in 6 to 1 in 3. With such steeper slopes the coal passing down the trough would travel too fast if the supply of water needed to shift the coal along the length A B still were flowing. To regulate the speed of travel of the coal down the length B C the trough at 6 is perforated so that part of the water drains out into the depression or receptacle 7. The excess water drained out at 6 may flow down a subsidiary channel alongside the trough or in a pipe such as 8.

From C to D the slope of the trough is indicated as flattening considerably. At this lesser slope the coal cannot be moved quick enough by the reduced flow of water which shifts it down the steeper slope B to C. Hence more water is needed at C. This extra supply may be given by turning the pipe 8 over the top of the trough again at 9 and discharging the excess water extracted at 6 into the trough again at 10. Further water might be supplied at the point 10 by a pipe and valve (not shown).

The water supply in any case will be regulated in different lengths of the trough so that as the slope increases the water supply is decreased, and vice versa.

At the point D it is assumed that the loading position is being approached. The trough is accordingly provided at 11 with perforations at the sides and bottom so as to let out all the water, or practically all of it. This water is caught at 12 and passes through the pipe or channel 13 into a water standage or onto settling beds at 14. If there is any quantity of dust slack or the like in the coal it will be washed down into 14 and can be recovered therefrom later.

The coal practically free from water must still slide down the trough. For this purpose the length of trough 15 is given a steeper grade to overcome the frictional resistance to sliding. At E, the loading position, the trough is converted into a tube or pipe at 16. The end of the pipe may be curved down as indicated at 17 to discharge the coal practically vertically into the tub 18.

A line of tubs 18, will be provided on a suitably graded track 21 so that the tubs may be shunted one after the other under the discharging mouth 17 of the pipe. This can be done so quickly that little if any coal falls between the tubs.

The water collecting in the settling tanks 14 may be pumped out by a pump 19. This pump discharges through the pipe line 22. A cock may be provided at 20 near the loading station so that the person in charge of the loading can stop the pump and turn off the supply of water at a convenient interval before the loading is to cease.

The pipe line 22 (and there may of course be several branches to different working faces in the mine) takes water to the cock or valve 23 at the upper end of the long wall coal face A—B and discharges at 24 into the top sections of the trough 1.

It will of course be understood that the pipe lines and the pumping plant may be arranged in any manner convenient for the particular mine or situation. For example, if considered better the pump 19, or other suitably placed pump, may pump up water to a tank or reservoir above the surface of the ground or in any convenient situation to have sufficient head to command all the working faces. From such tank or reservoir (25 in Fig. 6) the water may be led to the working faces in separate pipes.

In such a case the cock 23 will only be turned on at any particular working face when the instructions are received that a series of tubs are in position for loading. For instance, the person in charge of the loading at E may be in telephone or bell communication with the people at A and may signal when loading should be started.

Referring now to Fig. 5 a diagram is shown illustrating one manner in which an intermittent water supply to the troughs 1 may be effected. In this case a vessel 26 having two compartments 27 and 28 is pivoted at 29 so as to swing between two stable positions, one stable position, when the vessel is empty, is shown in Fig. 5 with the vessel resting against the stop 30. The other stable position, when empty, is when the vessel has rotated anti-clockwise about its pivot 29 to rest against the other stop 31.

The balance of the vessel 26 is such that when the upper of the two compartments (27 in the figure) is filled with water the vessel will rock (to the left in this case) and take up its other limiting position against the stop 31. In rocking the contents of compartment 27 is discharged suddenly into the end 34 of the trough 1. To fill the compartments 27, 28 the pipe line 22 is provided

with a cock 32 and a discharge outlet 33. This discharge outlet is conveniently placed over the pivotal point 29 or at least so that the discharge will enter the higher of the two compartments whichever it may be.

The cock 32 may be turned on to such an extent that the compartment 27 or 28 will fill in any desired period of time, say 1 minute or half a minute, and discharge. When compartment 27 has discharged and the vessel has taken up its other limiting position to the left, then compartment 28 is uppermost and will fill automatically in its turn to cause the vessel to swing back when it is full to discharge its contents in turn. The vessel 26 may in fact go on discharging at desired time interval the contents of the compartments.

Whilst the cock 32 is discharging to give these intermittent flushes to the trough the cock 23 may be so set that a continuous discharge is taking place at 24. The quantity of water discharged as a continuous discharge and that discharged as an intermittent flushing may be regulated with great nicety and be under complete control.

Referring now to Fig. 6 which shows the lay-out for a mine in a diagrammatic manner. The dip of the seam is indicated by the arrow 35. Let us assume for the moment that this dip is steeper than is required for the purpose of conveying coal to the dip along troughs. The solid unworked coal is indicated by the letters C, C and the worked out areas or "goafs" by the letters D D. If the working faces were laid out parallel to the strike of the seam, that is at right angles to the arrow 35, they would be level. It is however desired that the working faces shall be on a small slope of say 1 in 8.

The working faces therefore are laid out in sections to be at an angle to the dip, the angle being selected with relation to the dip of the seam so that the working face is at a convenient slope. It will be seen that this means that the working faces, which will be worked preferably on the long wall system are laid out at angles to each other if the mine as a whole is to be worked out regularly from the dip to the rise.

The troughs 1, 1 are laid parallel to the working faces and are kept as close as is convenient to the faces to allow coal as it is cut to be collected ready for shovelling down into the troughs with the least possible extra work.

It will be understood that the working face need not be a continuous slope as indicated at 36 but may be in steps or benches as indicated at 36*a*.

At convenient distances along the working faces, preferably at points such as 37 the troughs are turned down the slope through the goaf G. For this purpose convenient roadways or gate roads may be left through the goaf. These roadways may run straight down the dip if the slope is not too steep. If however the slope is too steep they are formed at an angle to the dip so as to moderate the steepness of the slope of the passage. Preferably the slope should not exceed 1 in 3 otherwise the coal may get out of control.

Referring to Fig. 6 it will be seen that two lines of trough from working faces 36 and 36*a* meet opposite to the corner 37. These two then proceed as one down the slope. At the point 37 some of the water will be discharged out of the troughs in order to check the rate of travel of the coal down the steeper slope in the gallery 38.

To the dip there is the haulage road 39 on which the tubs 18, 18 stand. These tubs may be placed on a slight grade as indicated by the sloping line 40 going partly up the slope so that it will be easy to hand-shunt the tubs past the loading point 17.

The trough may, as already explained, be drained of water before discharging its coal into the tubs. The water and coal dust or slack may collect in the standage 14. Water is pumped from the standage using pump 19 and this water may go up the main haulage 41 through pipe 22 to the tank 25 which commands all the working faces.

From tank 25 pipe lines such as 22*a* supply the working faces.

In working, the coal is accumulated in a pile 3 on the upper side of the trough and it will then need the minimum of time and labour when the water is turned on to shovel coal into the trough at a rate sufficient to load a tub every minute or the like.

The troughs can be taken around quite sharp curves, for example like that indicated at 37 between the working face 36*a* and the return down the passage 38.

The manner of conveying is applicable in coal mines to "longwall" faces, their "gate roads", and to galleries where the alignment of these roads is such as to permit of certain gradients—these latter being approximately between 4¾ degrees and 19 degrees in favour of the coal to be conveyed.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A plant for transporting coal, ore or the like, comprising a plurality of inclined troughs, each having its lower end within the upper end of the succeeding trough, and some of said troughs which are laid on a comparatively steep angle of inclination, being provided with perforations at their upper ends for the purpose of removing fluid therefrom, a fluid receiving receptacle beneath the perforations in the troughs having same, a pipe leading from each recep-

tacle, having an end thereon adapted to deliver the removed fluid into the uppermost end of a succeeding trough which is placed at a comparatively flat angle of inclination, for the purpose of delivering an increased supply of fluid to the latter.

2. In a plant for transporting coal, ore or the like, a connected series of troughs laid at varying angles of inclination, each having its lower end within the upper end of a succeeding trough for guiding fluid from one trough to the next one, some of the said troughs which are laid at a steep angle of inclination having perforations in their upper ends, collecting and conveying means for fluid adapted to convey the fluid leakage from the perforations to the upper ends of the troughs of comparatively smaller inclination, a delivery trough having an angle of inclination greater than the angle of sliding friction of the coal, connected to the end of the series of troughs, provided with perforations at its upper end adapted to completely remove the fluid coal carrying medium from said delivery trough, a settling basin for separating finely divided coal from the coal carrying fluid, means beneath the apertures in the delivery trough for conveying the removed fluid and coal slack to the settling basin, and means for returning the fluid from said basin to the upper end of the trough series for subsequent use in the coal carrying system.

3. In a plant for hydraulically transporting coal, a series of connected metal troughs laid at varying angles of inclination, some of said troughs which are placed at a comparatively steep angle of inclination, having a number of apertures formed in the upper ends of same for withdrawing fluid therefrom, means for collecting and conveying the withdrawn fluid to the upper ends of succeeding troughs which are laid at a flat angle of inclination, a delivery trough laid at an angle of inclination greater than the angle of sliding friction of the coal, having perforations therein at its upper end sufficient to completely remove the coal-bearing fluid from said delivery pipe, and automatic means for supplying a sudden periodic flushing supply of fluid to the series of troughs, for the purpose of overcoming any stoppages in flow in the trough system.

4. In a plant for hydraulically transporting coal, a series of connected metal troughs laid at varying angles of inclination, some of said troughs which are placed at a comparatively steep angle of inclination, having a number of apertures formed in the upper ends of same for withdrawing fluid therefrom, means for collecting and conveying the withdrawn fluid to the upper ends of succeeding troughs which are laid at a flat angle of inclination, a delivery trough laid at an angle of inclination greater than the angle of sliding friction of the coal, having perforations therein at its upper end adapted to completely remove the coal-bearing fluid from said delivery pipe, a settling basin for receiving the coal and slack bearing fluid, means for conveying same from the perforations in the delivery pipe to the settling basin, and automatically operated means for supplying a sudden flushing supply of fluid to the trough series, for the purpose of overcoming any stoppages in flow in the coal conveying system.

5. A plant for transporting coal comprising a trough having varying angles of inclination, said trough being provided with drain openings at certain points of its change of inclination, and means to collect fluid discharged from the drain openings and to transfer the fluid to another point of change of angularity.

In testimony whereof I hereto affix my signature this 5th day of June, 1930.

JOHN BROWN.