

United States Patent

Wasp

[15] 3,637,263

[45] Jan. 25, 1972

[54] TRANSPORTATION OF COAL BY PIPELINE

[72] Inventor: Edward J. Wasp, San Rafael, Calif.

[73] Assignee: Bechtel International Corporation

[22] Filed: Mar. 3, 1970

[21] Appl. No.: 16,160

[52] U.S. Cl. 302/66, 302/14

[51] Int. Cl. B65g 53/04

[58] Field of Search 302/14, 15, 16, 66; 137/13

[56] References Cited

UNITED STATES PATENTS

3,305,106	2/1967	Ishino	302/14
2,791,471	5/1957	Clancey et al.	302/66
2,920,923	1/1960	Wasp et al.	302/14

3,168,350	2/1965	Phinney et al.	302/14
3,405,976	10/1968	Anderson et al.	302/14

Primary Examiner—Richard E. Aegerter

Assistant Examiner—H. S. Lane

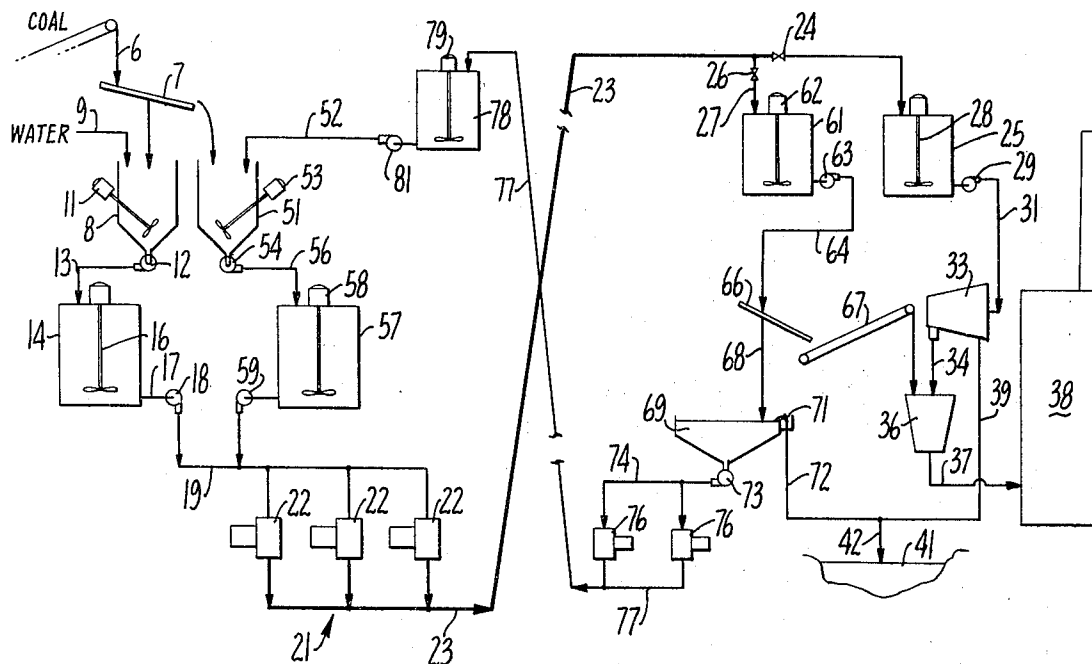
Attorney—Eckhoff and Hoppe

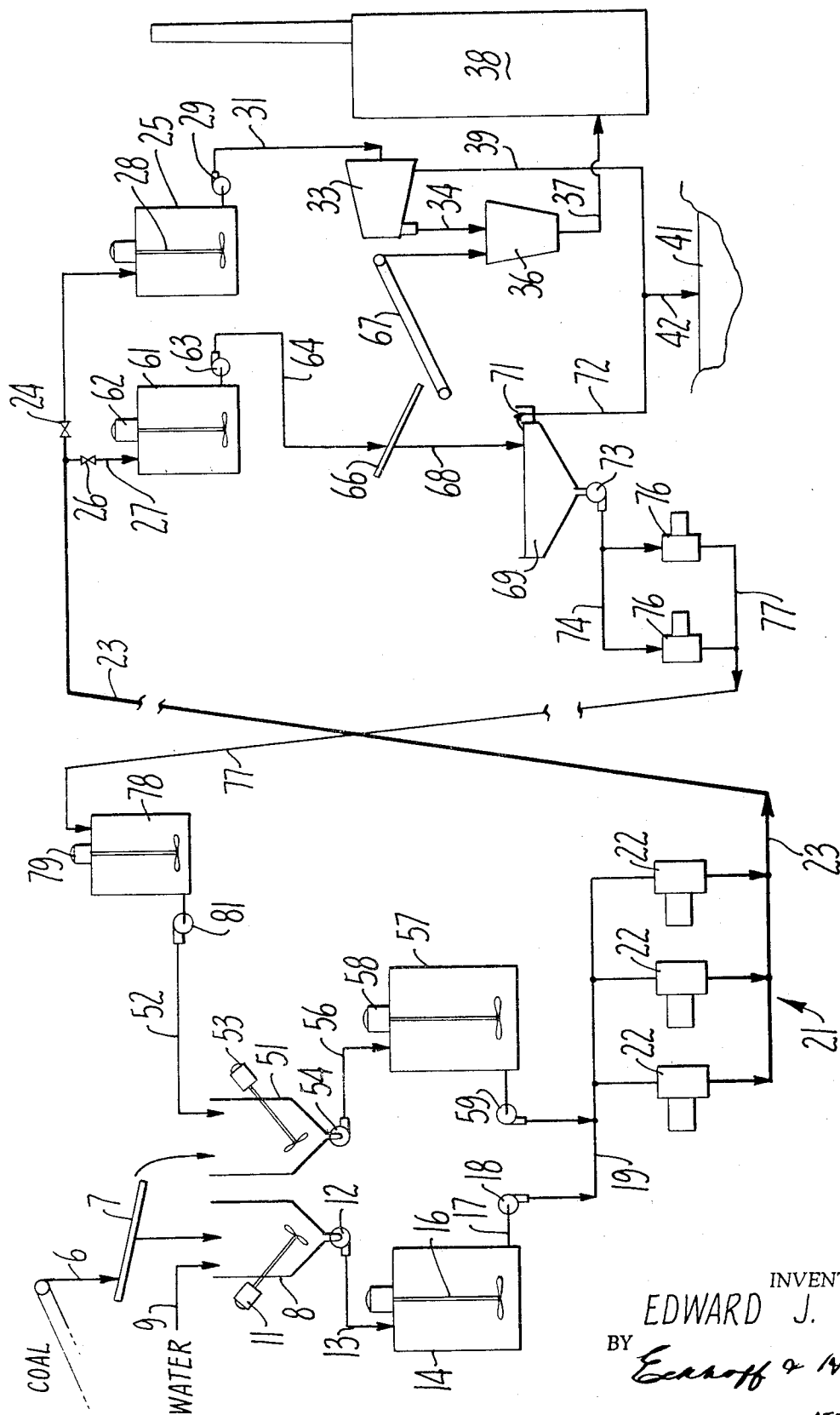
[57]

ABSTRACT

This invention relates to the art of transporting coal with water through pipelines. More particularly, it relates to a method of preparing at one point an aqueous slurry made up of a mixture of particulate coal and an inorganic finely divided water insoluble solid carrier having a specific gravity of at least 1.6. The slurry is then pumped through a pipeline to a location many miles away where, after being separated from the carrier, the coal is utilized and the coal-free carrier is returned to the point of beginning. By using a material heavier than coal, the settling rate of the coarse coal can be reduced nearly to zero while maintaining turbulent flow conditions.

4 Claims, 1 Drawing Figure





INVENTOR.
EDWARD J. WASP
BY *Edwards & Napper*
ATTORNEYS

TRANSPORTATION OF COAL BY PIPELINE

BACKGROUND OF THE INVENTION

It has been proposed heretofore to transport coal in an aqueous slurry through a pipeline in U.S. Pat. No. 2,791,471. It has also been proposed in U.S. Pat. No. 3,168,350 to utilize a blend made up of two quantities of coal each having a different spectrum of particle sizes, mixing the blended coal particles with water to obtain a slurry that requires less energy to transport the slurry through a long distance pipeline. In making up such a blend, a major part of the cost is in preparing the coal, not only to a suitable top size but also to have sufficient fines to convey the coal in the pipeline. The fines enhance the stability of the line and permit relatively easy pressure conditions to prevail on restart. However, not only are the fines expensive to produce but they also provide a problem at the discharge end in separating the water from the fines so these can be burned.

In accordance with this invention, the noncarbonaceous finely divided solids provided the fines are separated at the discharge end of the pipeline and are returned in a smaller pipeline to the inlet terminal for reuse. Thus, the cost of separation of slurry and subsequent removal of water from the defined coal is very much reduced.

Further, in accordance with this invention, I propose the use of noncarbonaceous materials as the carrier. Thus, one can use the ash from a power plant which has a high-specific gravity so as to provide a high-specific gravity media to transport fairly coarse coal. In addition to ash, one can use a material such as magnetite. This has the further advantage that if any coal fines are present in the magnetite carrier, these can be removed by passing the magnetite over a magnetic separator.

SUMMARY OF THE INVENTION

It is in general a broad object of the present invention to provide an improved method of transporting coal in a pipeline.

A further object of the present invention is to provide a method of mixing coal and water with a high-specific gravity noncarbonaceous carrier such as coal ash, magnetite or the like to provide a slurry from which the coarse coal particles are readily separated.

The invention includes other objects and features of advantage, some of which, together with the foregoing, will appear hereinafter wherein the preferred embodiment of the invention is disclosed.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic flowsheet embodying the present invention and illustrating how the method can be successfully employed.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, previously ground coal is fed by a conveyor 6 to a 14 mesh Tyler screen 7. The coal fines pass to a mixing tank 8 where they are mixed with water from line 9 under the action of the mixer 11 to form a slurry. The slurry is removed from the bottom of the tank 8 and is forced by pump 12 through line 13 into a slurry storage tank 14 where the slurry is maintained in suspension by the action of mixer 16. When desired, the slurry is withdrawn from the storage tank 14 through line 17 and is forced by pump 18 through line 19 to one or more mainline pump stations, generally indicated at 21, wherein several pumps 22 force the coal through the main pump line 23 to a point of use. The fine coal slurry is delivered to a mixing tank 25, valve 24 in the mainline being open and valve 26 in line 27 being closed. The slurry in the fine coal slurry storage tank 25 is maintained in suspension by agitator 28. The slurry is withdrawn from the tank 25 by pump 29 and it is sent through line 31 to centrifugal separators 33 which separate the coal fines from the water, the fines being sent

through line 34 to pulverizer 36 from which they pass through line 37 to the power plant boiler 38. Water from the centrifuge is withdrawn through line 39 and is sent to an effluent dam 41 through line 42. The operation so far described follows along the line of the process disclosed in the first-mentioned U.S. Pat. No. 2,791,471.

The pumping of the fine coal slurry is continued for a desired number of hours while the overflow from screen 7 of a size between 1-½ inch and plus 14 Tyler screen mesh passes over the end of screen 7 into the tank 51 wherein it is mixed with the recycled fine slurry from line 52. The origin of the recycled fine slurry will be presently described. In tank 51 mixer 53 maintains the coarse coal suspended in the recycled fine slurry. The slurry is removed from tank 51 by pump 54 and is passed through line 56 into the coarse coal slurry storage tank 57 wherein it is maintained in suspension by the mixer 58. When desired, the coarse coal slurry is withdrawn from the tank 57 by pump 59 and is then delivered to one or more of the pumping stations 21 for passage through the main pipeline 23 under turbulent flow conditions. The proportion of coarse coal to the carrier and to the water is about 33 weight percent of coarse coal to about 30 weight percent carrier with the remainder water. At the time coarse coal slurry reaches the terminal, valve 24 is closed and valve 26 is open so the coarse coal slurry flows into tank 61 where it is maintained in suspension by the mixer 62. The coarse coal slurry is removed by pump 63 through line 64 and it is passed over a screen 66 wherein the carrier fines are separated, the coal being delivered to conveyor 67 and thence to the pulverizer 36 for feed through the line 37 to the power plant boiler 38.

The overflow from the screen 66 is preferably dewatered before being returned, although it can be returned without this if desired. It is sent through line 68 to a thickener 69 wherein the fine slurry is thickened, overflow water being taken off through launder 71 and is sent through line 72 to line 42 and to effluent dam 41. The slurry fines are taken off by pump 73 and are sent through line 74 to fine slurry recycle pumps 76 which force the fine slurry recycle through line 77 to return to the place whereat the coarse coal slurry was assembled. Thus line 77 delivers the recycled fine slurry to the fine slurry storage tank 78 wherein the slurry is maintained in suspension by mixer 79. A pump 81 forces the fine slurry recycle to tank 51. Periodically it may be desirable to pass the magnetite over a magnetic separator to separate the magnetite from residual coal fines.

In an operation involving this method and wherein magnetite was used as the fines, the main pipeline was a steel pipe 18 inches in diameter and some 70 miles in length. Two pumping stations were used with three pumps at each station, the total installed horsepower being 8,400 horsepower. The recycle pipeline 77 was 9 inches in diameter and required two pumping stations with three pumps at each station with an installed horsepower of 2,400 horsepower. The coarse coal magnetite slurry was screened on a 28 mesh Tyler screen as at 66 to separate the magnetite from the coarse coal. The total throughput per year was 5 million tons.

In the following table, I provide a financial comparison of an operation of a conventional pipeline as operated under U.S. Pat. No. 3,168,350 and that in accordance with the present invention.

	Conventional Pipeline	Fines Recycle System
Capital Cost	\$14.6 million	\$14.3 million
Capital Charges at 15%	44 /ton	43 /ton
Operating Cost	31 /ton	16 /ton
Transportation Cost	75 /ton	59 /ton

Thus, fines recycle system of this invention provides a cost savings of 16 /ton of coal transported to the power plant.

With a throughput of 5 million tons a year, the annual saving is \$800,000.00 for substantially the same capital investment.

In place of magnetite or coal ash, one can use any solid inorganic material which is water insoluble and which has a specific gravity of 1.6 or more, about twice that of coal. Thus, to name a few materials which can be used: barytes, magnesite, hematite, limonite, pyrites and galena. If the material has a specific gravity less than that of magnetite, the use of a dispersant is desirable to provide the desired flow characteristics. Such dispersants are well known in the art.

I claim:

1. A method of transporting coal from a preparation site through commercial pipelines to a point of use comprising at such site separating the coal to be transported into two fractions the first containing coal fines and the second containing the coarse coal, adding water to said first fraction to obtain a first slurry, preparing a second slurry of said second fraction, water and finely divided noncarbonaceous water insoluble in-

organic solid carrier fines having a specific gravity several times that of coal, separately and alternately pumping each slurry through the same pipeline to a point of use whereat the coal fractions are separated from their respective slurries and recovered for use, and recovering said solid carrier fines from said second slurry and returning same through a separate pipeline to the preparation site for admixture with further coarse coal.

2. A method as claimed in claim 1 wherein said second slurry contains about 33 weight percent of coarse coal and about 30 weight percent of said solid carrier fines and the balance being water.

3. A method as claimed in claim 1 wherein said solid carrier fines comprise magnetite.

4. A method as claimed in claim 1 wherein said solid carrier fines comprise coal ash.

* * * * *

20

25

30

35

40

45

50

55

60

65

70

75