Aug. 18, 1970 J. M. PAUL 3,524,352

MATERIAL SAMPLER

Filed March 21, 1968 2 Sheets-Sheet 1

FIG. 1

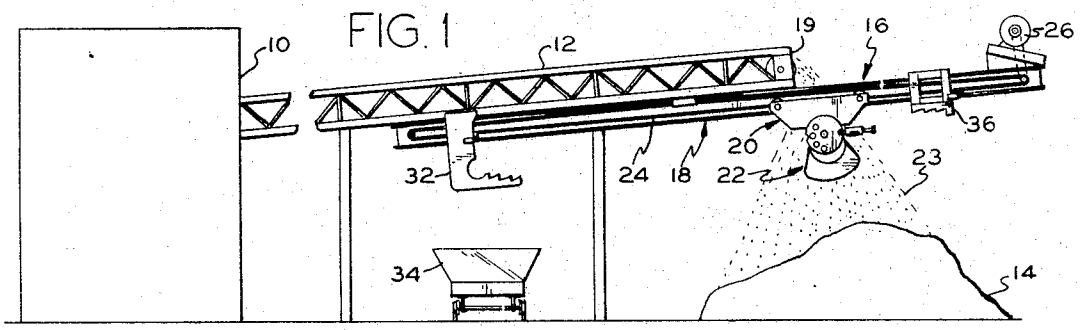


FIG. 4

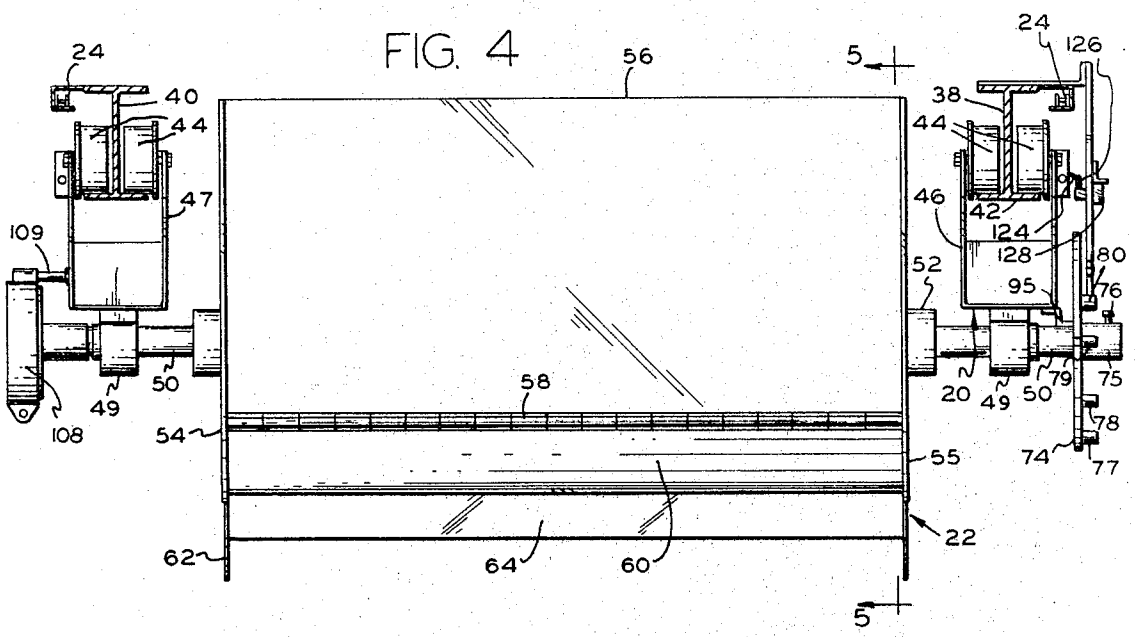
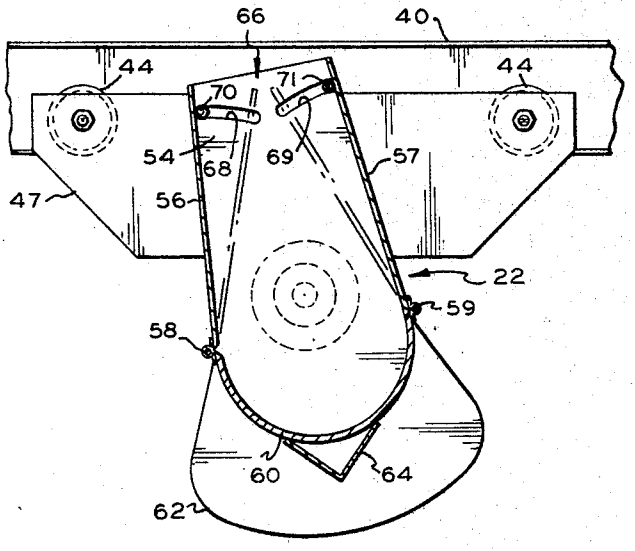


FIG. 5



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MATERIAL SAMPLER

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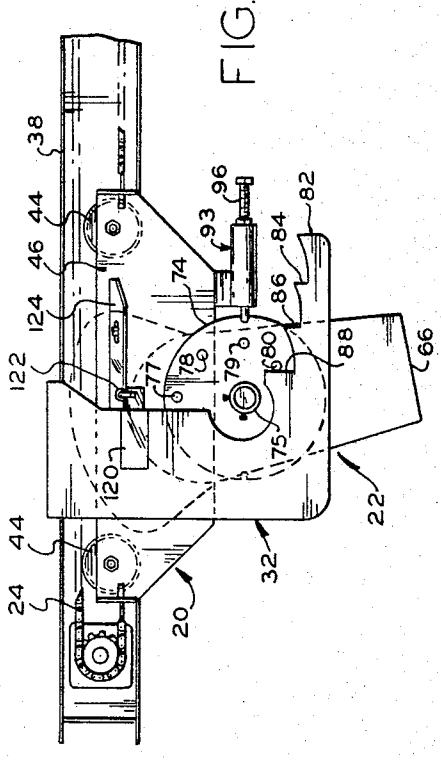


FIG. 3

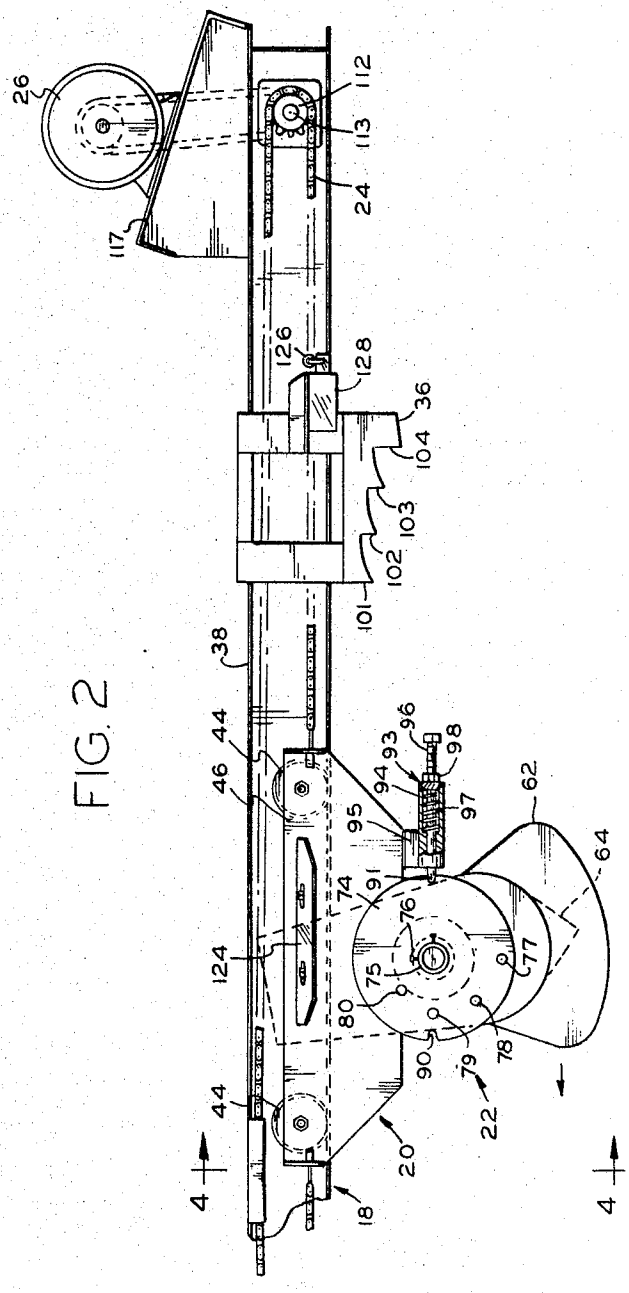


FIG. 2

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MATERIAL SAMPLER

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Int. Cl. G01n 1/00
U.S. Cl. 73—423 8 Claims

ABSTRACT OF THE DISCLOSURE

A material sampler which moves a sample bucket with an adjustable upper opening in a straight path through a stream of aggregate or other material falling from the offbear end of a belt conveyor. The bucket travels beneath the conveyor belt in the longitudinal direction of the belt so as to pick up fine aggregate which clings to the belt as well as coarser aggregate to obtain a true sample. The bucket travels through the stream in one direction with its opening directed upwardly and through the stream in the opposite direction with the opening directed downwardly.

BACKGROUND OF THE INVENTION

Field of the invention

The present invention relates to material samplers and more particularly to a sampler of particulate materials falling in a stream from a conveyor belt.

Description of the prior art

In road and other construction work aggregate samples are taken from time to time for quality control. In the past such samples have usually been taken manually simply by passing a bucket across a stream of falling aggregate at the offbear end of one of the belt conveyors used to transport aggregate from rock crushers at the construction site. Mechanical means have been devised for the same purpose, but these too have passed a bucket through a falling stream of the aggregate in a direction cross-wise to the conveyor belt. True samples of the aggregate stream are not obtained by such procedures because fine aggregates tend to cling to the belt longer than coarser aggregates and thus such fines tend to leave the belt at a different point more nearly beneath the end of the belt than the coarse aggregates. Usually bucket-type samplers are passed cross-wise through the falling stream at a point where coarse aggregates predominate, thereby missing a large percentage of the fines.

In the past construction has been slowed while adjustments in aggregate mixes have been made to meet specifications when in reality none were required. Thus, inaccurate sampling procedures are time-consuming and costly and can result in aggregate mixes which do not meet specifications.

SUMMARY OF THE INVENTION

The problems of the prior art as aforesaid are overcome by the present invention through the provision of a bucket-type sampler apparatus which passes a sample bucket having a width at least as good as that of the conveyor belt, through a stream of falling aggregate in a direction lengthwise of the belt and beneath the belt so as to obtain a true cross section of the falling aggregate. Means are provided for automatically upsetting the sample bucket after each pass through the stream to deposit the sample and for uprighting the bucket after it returns to its starting position. Means are also provided for adjusting the size of the bucket opening and for reversing the direction of travel of the bucket as it moves beneath a belt conveyor. In accordance with the invention, the bucket reciprocates along a path of travel with its opening directed upwardly when passing through the aggregate stream in one direction and with its opening directed downwardly when passing through the aggregate stream in the opposite direction.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects and advantages of the invention will become more apparent from the following detailed description, which proceeds with reference to the accompanying drawings wherein:

FIG. 1 is a side elevational view of a rock-crushing operation including a belt conveyor utilizing the sampling apparatus of the present invention;

FIG. 2 is an enlarged side elevational view of the right-hand portion of the sampling apparatus of FIG. 1;

FIG. 3 is an enlarged side elevational view of the left-hand end of the sampling apparatus of FIG. 1;

FIG. 4 is a vertical sectional view taken along the line 4—4 of FIG. 3 on a slightly large scale than FIG. 3; and

FIG. 5 is a vertical sectional view taken along the line 5—5 of FIG. 4 on the same scale as FIG. 4.

DETAILED DESCRIPTION

(a) General assembly

With reference to the drawings, FIG. 1 illustrates somewhat schematically a typical rock-crushing operation at, for example, a road construction site wherein a rock crusher **10** delivers crushed aggregate on a belt conveyor **12** to a stockpile **14**. A material sampling apparatus shown generally at **16** in accordance with the invention is mounted at the discharge end of the belt conveyor and includes a track means **18** extending longitudinally beneath conveyor **12** and inwardly and outwardly beyond the discharge end **19** thereof. The track means mounts a wheeled carriage means **20** which supports a sampling bucket **22**. Carriage means **20** is pulled back and forth in a straight path along the track means and through a stream of aggregate **23** falling from the discharge end **19** by a chain **24** powered by a motor means **26** mounted at the outer end of the track means. Bucket **22** travels in an upright position inwardly beneath the conveyor to receive an aggregate sample and engages an upending means **32** at the inner end of the track means which flips the bucket over the deposit its sample into an awaiting receptacle such as the wheeled receiving wagon **34**. Then the bucket returns in its upended position to the outer end of the conveyor where an uprighting means **36** pivots the bucket back to its upright position for receiving another sample.

(b) Details of apparatus

Referring now to the more detailed views of FIGS. 2 through 5, track means **18** includes a pair of I-beam track members **38**, **40** secured to the laterally opposite undersides of belt conveyor **12** in the manner shown in FIG. 1. Each track member supports on its lower flange **42** two pairs of carriage wheels **44**, one pair of which is rotatably mounted at each of the opposite ends of two carriage channel brackets **46**, **47**. Each of the pair of carriage brackets **46**, **47** mounts on its underside a bearing member **49** which journals a stub shaft **50** connected at a boss **52** to sampling bucket **22**. Thus bucket **22** is capable of horizontal pivoting movement about the axis of stub shafts **50**.

As shown most clearly in FIG. 5, sampling bucket **22** includes opposite end walls **54**, **55** and opposite side walls **56**, **57** hinged at **58**, **59**, respectively, to a semi-circular bottom wall **60**. End walls **54**, **55** include an enlarged shield portion **62** extending beneath the bottom wall which protects the carriage and drive components from falling aggregate as the bucket travels through the stream of aggregate in an upended condition. A welded bottom angle member **64** depends from bottom wall **60**

and shields the bottom wall from falling aggregate during its upended travel.

The hinged connections of the bucket side walls to the bottom wall permit adjustment of the side walls toward and away from one another so as to control the size of the upper aggregate-receiving bucket opening **66**. Bucket end walls **54**, **55** are provided with slots **68**, **69** adjacent their upper ends within which threaded studs **70**, **71** welded to opposite side walls **56**, **57** slide and are secured in various adjusted positions by nuts threaded on the studs.

Referring especially to FIGS. 2 and 4, the outer end of one bucket shaft **50** carries a disc **74** having a hub portion **75** secured to the shaft by set screws **76**. Disc **74** is provided with four tooth projections, or pegs, **77**, **78** **79**, **80** on its outer face. As the bucket travels in its upright position toward the inner end of the track, the lowermost tooth **77** of the disc engages the forward edge of a lower tooth **82** of upending plate **32**, shown most clearly in FIG. 3, to start to pivot the bucket on its shaft in a counterclockwise direction. Continued travel of the bucket toward the inner end of the track causes the next adjacent tooth **78** of bucket disc **74** to engage the next tooth **84** of upending plate **32** to continue the counterclockwise pivoting movement of the bucket. Continued travel of the bucket toward the left-hand end of the track causes the next disc teeth **79** and **80** to engage respectively upending plate teeth **86** and **88** until the bucket is fully upended as shown in FIG. 3, whereupon the contents of the bucket are dumped into an awaiting receptacle **34**.

Bucket disc **74** is provided with peripheral edge notches **90**, **91** at 180 degree spaced-apart positions which are alternately engaged by a detent means **93** for maintaining the bucket in either an upright or upended position until acted upon by either upending plate **32** or uprighting plate **36**. Detent means **93** includes a cylindrical casing **94** mounted by an angle bracket **95** to carriage channel **46** and a detent pin **96** biased by a spring **97** within casing **93** into engagement with one or the other of disc notches **90** and **91**. Detent pin **96** is adjustable toward and away from the disc by threads at its head end engageable with a nut portion **98** of casing **94**.

When the sampling bucket travels to the inner end of the track and is upended in the manner just described, it remains in its upended position during its return travel through the falling stream of aggregate until it approaches the outer end of the track as shown in FIG. 2. Then a toothed uprighting plate **36** mounted on track **38** engages the teeth on bucket disc **74** to pivot the bucket back to its upright position. Explaining further, uprighting plate **36** includes a first tooth **101** which first engages disc tooth **77** during outward travel of the bucket to commence a counterclockwise pivoting movement of the bucket on its shaft toward its upright position. Thereafter, continued outward travel causes plate teeth **78**, **79** and **80** of the bucket disc to continue the pivoting movement of the bucket until it returns to its upright position.

The left-hand bucket shaft **50** of FIG. 4 carries a brake **108** which is also connetced by a brake arm **109** to carriage channel **47**. The brake applies a predetermined frictional force to shaft **50** to retard its tendency to pivot in shaft bearings **49** unless acted upon positively by the upending or uprighting plates. Without such brake the rapid acceleration and deceleration of the carriage at the ends of the track would tend to dislodge the detent pin from the disc notches, thereby possibly causing premature upending or uprighting and uncontrolled swinging of the bucket.

Referring again to FIGS. 2 and 3, bucket drive chain **24** is trained about a drive sprocket **112** on a shaft **113** journaled at the outer end of tracks **38**, **40** and about an idler sprocket **114** on a shaft **115** journaled at the inner end of such tracks. The opposite ends of the chain are secured to the opposite ends of carriage channel **46**. Drive sprocket **112** is driven through a chain and sprocket driven from the motor means **26** angularly mounted on a motor platform **117** at the outer end of the tracks. Motor means **26** may be either electrical or hydraulic, but hydraulic is preferable because of its resistance to the shock of sudden carriage stops and starts. In any event, motor **26** must be reversible to reciprocate bucket **22** back and forth beneath the discharge end of the belt conveyor.

Upending plate **32** carries an electrical limit switch **120** having a roller actuator **122** which is engaged by an outwardly projecting flange **124** on the outer face of carriage channel **46** when the carriage reaches the inner end of the track. The limit switch serves to shut off motor **26** and thereby retain the bucket in its upended condition until the motor is restarted to return the upended bucket to the outer end of the tracks. Thereafter the motor may be restarted manually to return the bucket upended to the outer end of the tracks. As shown in FIG. 2, when the bucket nears the outer end of the tracks, carriage flange **124** engages a roller actuator **126** of a second limit switch **128** carried by uprighting plate **36** to reverse the direction of motor **26** and thereby return the bucket in its upright position to the inner end of the tracks. Thereafter the cycle of operation of the sampling bucket can be repeated through manual actuation of a motor starter button (not shown).

(c) Operation

Summarizing the operation of the apparatus, when a sample is desired, motor **26** is started manually to rotate drive chain **24** in a counterclockwise direction, thereby pulling sample bucket **22** in its upended position from its starting position at the inner end of the tracks to the outer end of the tracks. Upon approaching the outer end of the tracks, the bucket is uprighted through engagement of the teeth on bucket disc **74** with the teeth on the uprighting plate **36**. At the same time the carriage actuates limit switch **128** to reverse motor **26** and send bucket **22** in its upright position through the falling stream of aggregate and beneath the discharge end of the belt conveyor toward the inner end of the tracks. Upon the bucket reaching the inner end of the tracks with a sample, upending plate **32** upends the bucket to deposit the sample in receiver **34**, and limit switch **120** de-energizes motor **26** to end the cycle.

Because the transverse width of the bucket equals or slightly exceeds the effective width of the belt conveyor **12** and travels in a straight path longitudinally of and beneath the discharge end of the conveyor through the falling stream **23** of aggregate, the bucket passes through a full cross section of the flow and thus will receive a true sample of the aggregate being deposited by the belt on stockpile **14**. In this regard, the bucket will include in its sample the extremely fine aggregate portions which are usually missed by conventional samplers because of their tendency to cling to the belt at its discharge end. These fines are thus discharged beneath the discharge end of the belt at the left-hand side of the stream **23** shown in FIG. 1.

Moreover, the size of the sample-receiving opening **66** of the bucket is adjusted through the adjustment of the angle of side walls **56** and **57** to receive the quantity of sample desired, depending on the rate of discharge of material from the belt conveyor and the speed of travel of the bucket along the track. It will also be noted from FIGS. 2 and 5 that the bucket in its sample-receiving position is cocked at an angle from the vertical to correspond with the angle of discharge of the majority of the aggregate from the discharge end of the belt.

Although the bucket sampler has been described with respect to collecting aggregate samples, it will be appreciated that the sampler also has other sampling applications for any other particulate materials or items.

Having described what is presently a preferred embodiment of my invention, it should be apparent to those

skilled in the art that the same permits of modification in arrangement and detail.

I claim:

1. Apparatus for sampling bulk material as it falls in a continuous stream from the offbear end of an endless belt or similar type conveyor defining a generally longitudinally extending conveyor path, said apparatus comprising:

container means having an opening directed upwardly when in its sample-receiving position,

means for transporting said container means in its sample-receiving position through said falling stream in a path generally normal to said falling stream and longitudinally of said conveyor path and beneath said offbear end of said conveyor,

said means for transporting including means for reciprocating said container means through said stream with said opening directed upwardly when traveling in one direction through said stream and with said opening directed downwardly when traveling in the opposite direction through said stream.

2. Apparatus according to claim 1 including means for upsetting said container means following passage of said container means in its sample-receiving position in one direction through said falling stream along a reciprocative path so as to dump a sample from said container means and means for uprighting said container means following passage thereof in the opposite direction along said path in an upside down condition through said stream.

3. Apparatus according to claim 1 wherein said container means has a bottom wall portion and said means for transporting includes track means for supporting said container means in its reciprocating movement, and shield means on said container means for shielding said bottom wall and said track means from said falling stream during movement of said container means through said streams with said opening directed downwardly.

4. Apparatus according to claim 1 wherein said container means includes plate-like sidewalls defining an upper sample-receiving opening, at least one of said sidewalls being hingedly connected to a bottom wall of said container means and being pivotally adjustable toward and away from an opposed said sidewall for regulating the size of said opening.

5. Apparatus for sampling bulk material as it falls in a continuous stream from the offbear end of an endless belt or similar type conveyor defining a generally longitudinally extending conveyor path, said apparatus comprising:

container means having an opening directed upwardly when in its sample-receiving position,

and means for transporting said container means in its sample-receiving position through said falling stream in a path generally normal to said falling stream and longitudinally of said conveyor path and beneath said off-bear end of said conveyor,

said means for transporting including track means and carriage means movable back and forth along said track means,

said carriage means mounting said container means,

means pivotally mounting said container means on said carriage means for movement about a horizontal axis,

and pivoting means on said track means operable to pivot said container means at a predetermined position of said container means along said track means.

6. Apparatus according to claim 5 wherein said pivoting means includes toothed plate means on said carriage means engageable with cooperative stationary toothed means on said track means.

7. Apparatus according to claim 5 including means on said carriage for maintaining said container means in an upright position until acted upon by said pivoting means.

8. Apparatus for sampling bulk material as it falls in a continuous stream from the offbear end of an endless belt or similar type conveyor defining a generally longitudinally extending conveyor path, said apparatus comprising:

container means having an opening directed upwardly when in its sample-receiving position,

and means for transporting said container means in its sample-receiving position through said falling stream in a path generally normal to said falling stream and longitudinally of said conveyor path and beneath said offbear end of said conveyor,

said means for transporting including track means and carriage means movable along said track means,

means pivotally mounting said container means on said carriage means,

reversible motor means supported on said track means,

motion-transmitting means interconnecting said motor means and said carriage for moving said carriage means along said track means,

means for reversing said motor means at predetermined positions of said carriage along said track means,

and means for pivoting said container means from an upright to an upset condition and from an upset to an upright condition at a predetermined position of said container means along said track means.

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