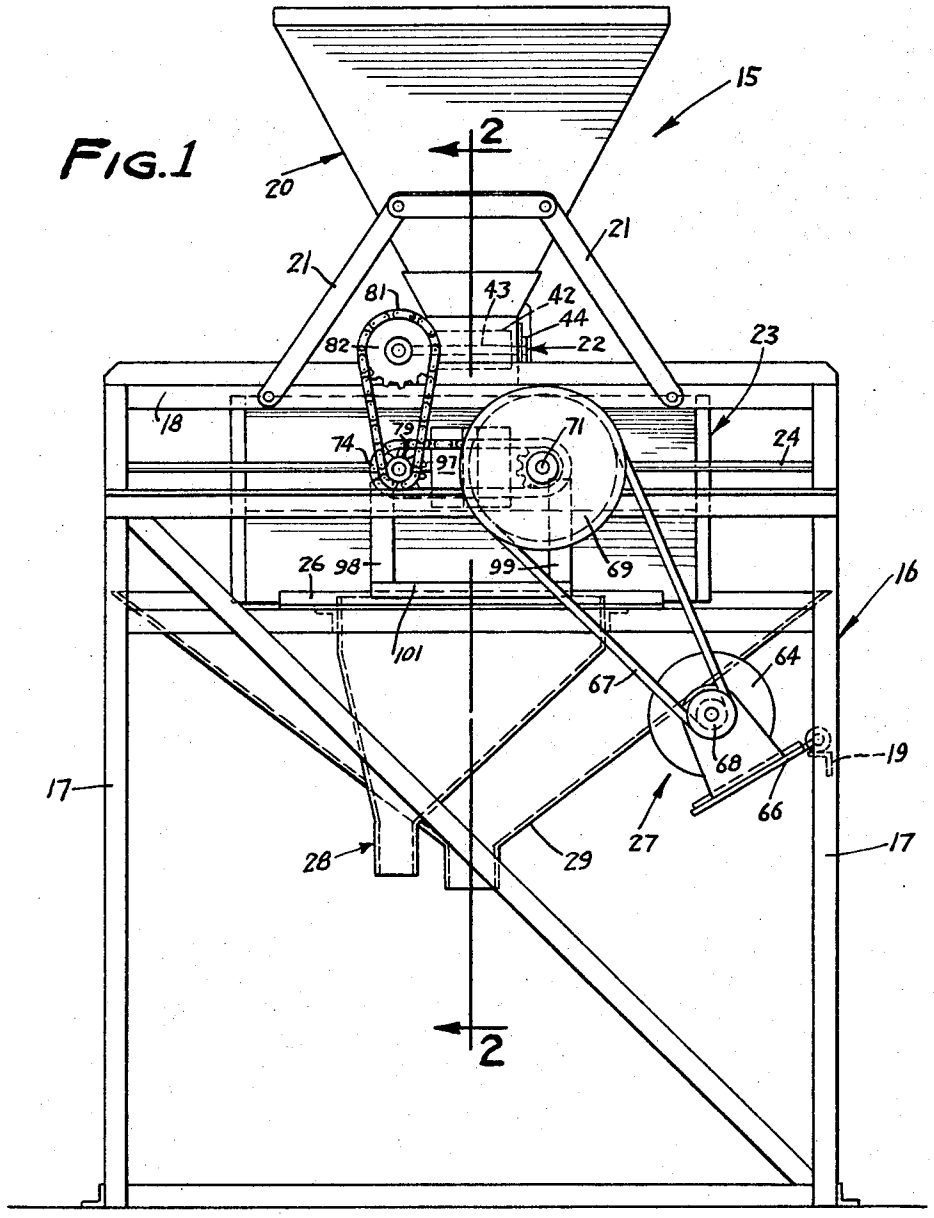
Aug. 20, 1968 E. K. STRAND 3,397,582

MATERIAL SAMPLING APPARATUS

Filed Feb. 17, 1966 5 Sheets-Sheet 1

FIG. 1



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MATERIAL SAMPLING APPARATUS

Filed Feb. 17, 1966 5 Sheets-Sheet 2

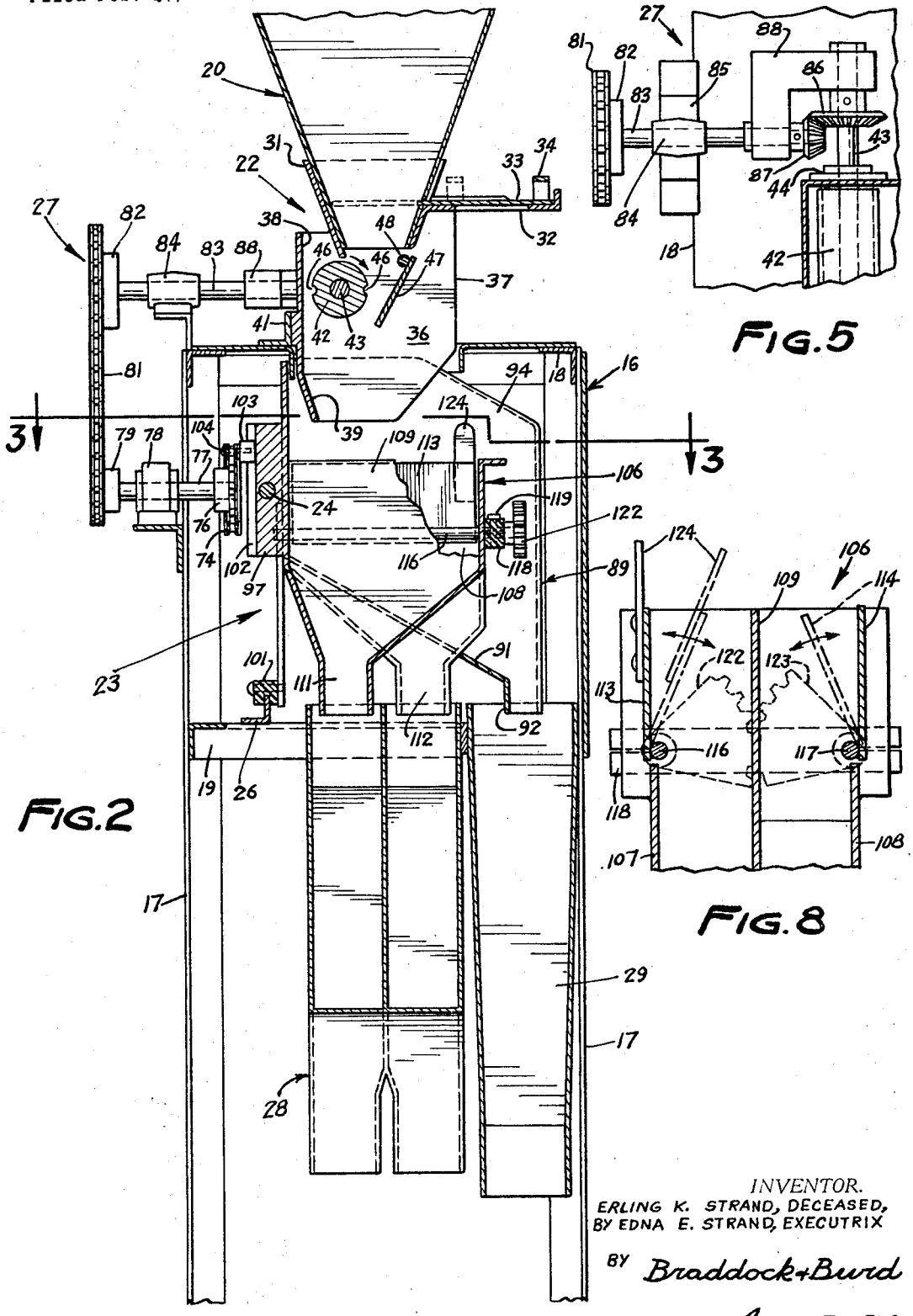


FIG. 2

FIG. 5

FIG. 8

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MATERIAL SAMPLING APPARATUS

Filed Feb. 17, 1966 5 Sheets-Sheet 3

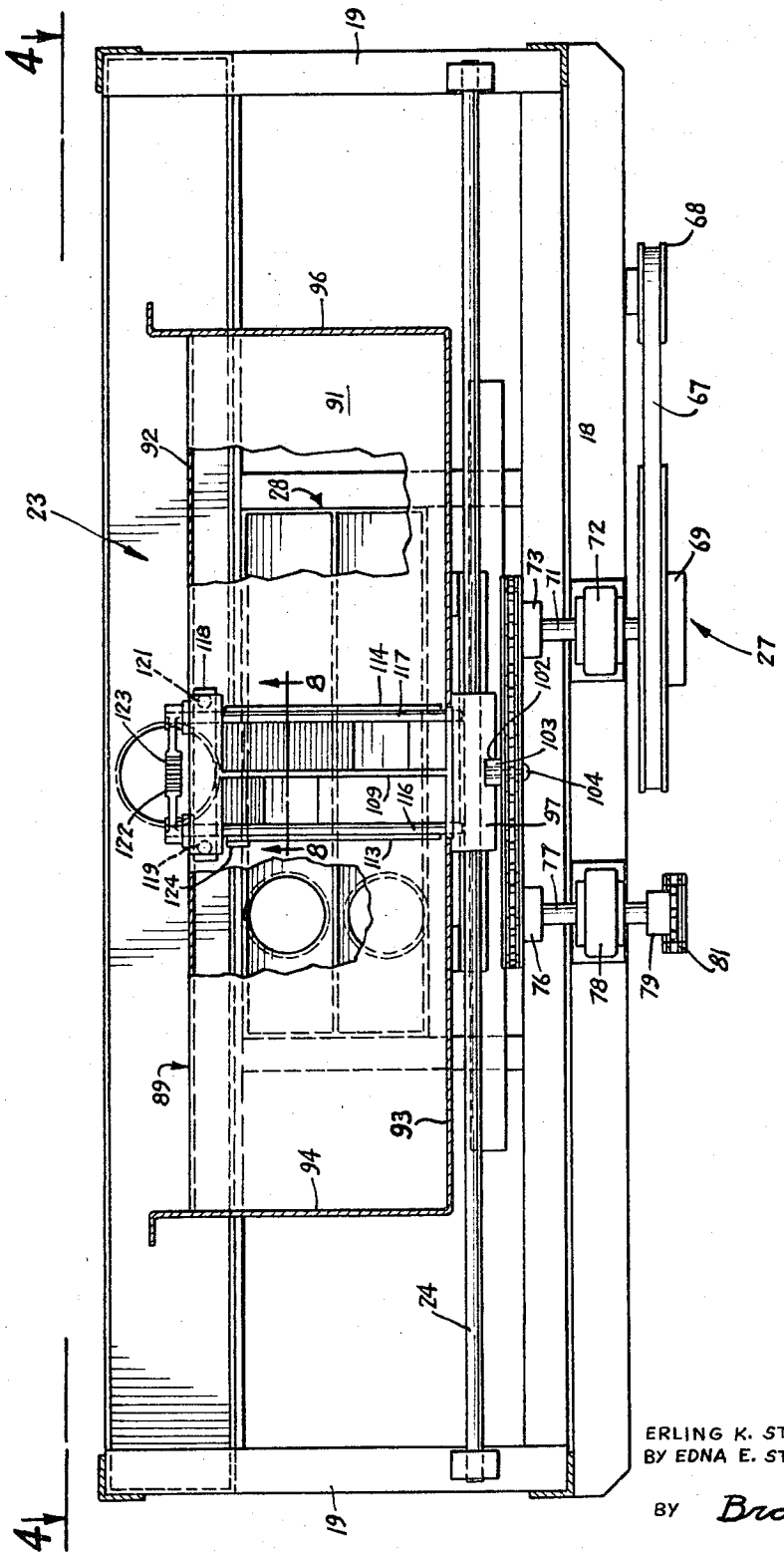


FIG. 3

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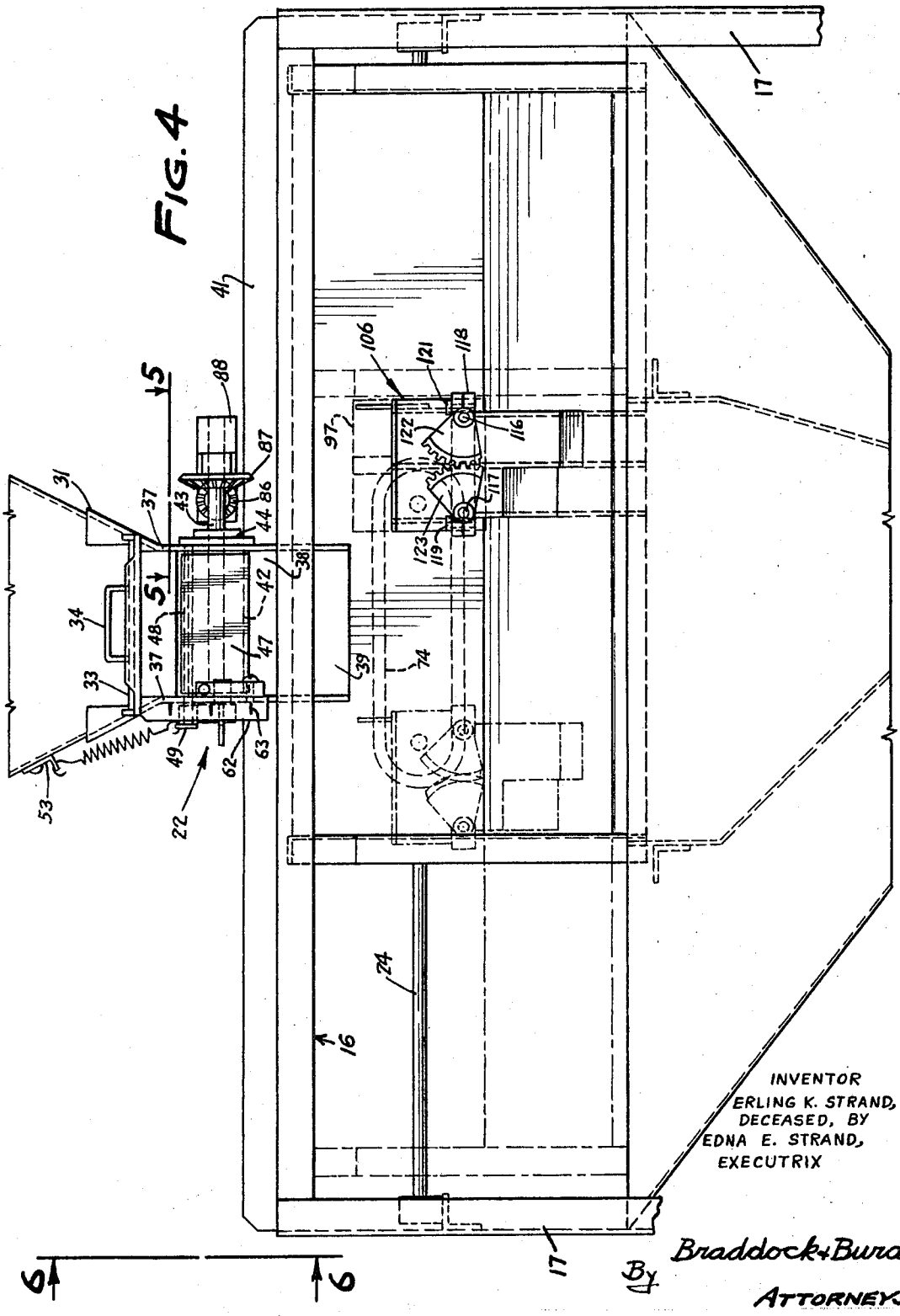
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MATERIAL SAMPLING APPARATUS

Filed Feb. 17, 1966 5 Sheets-Sheet 4

FIG. 4



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MATERIAL SAMPLING APPARATUS

Filed Feb. 17, 1966 5 Sheets-Sheet 5

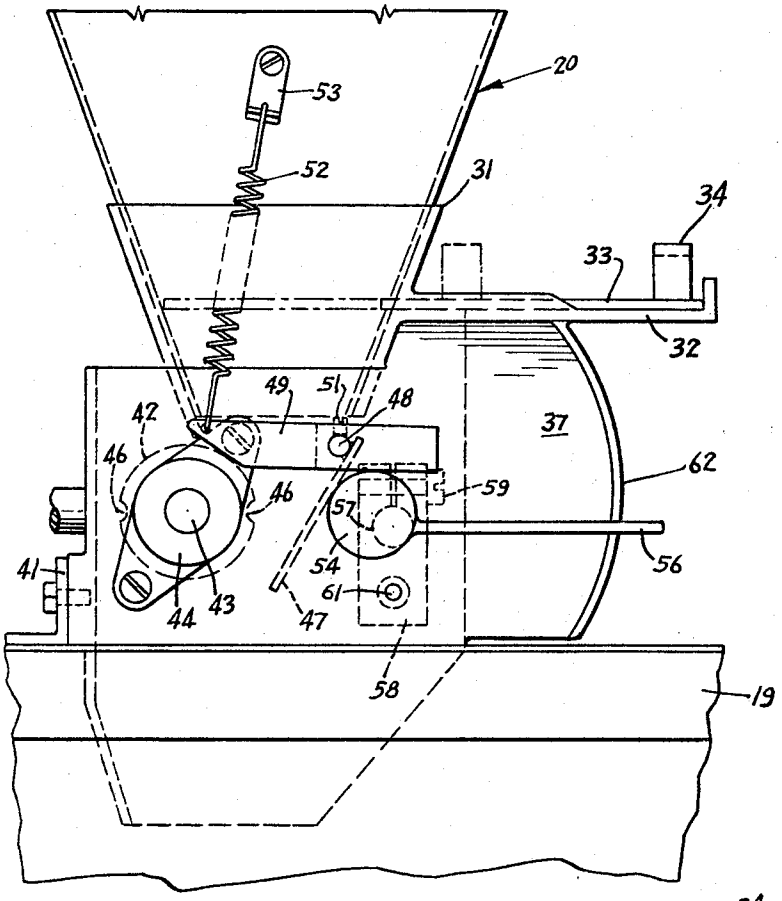


FIG. 6

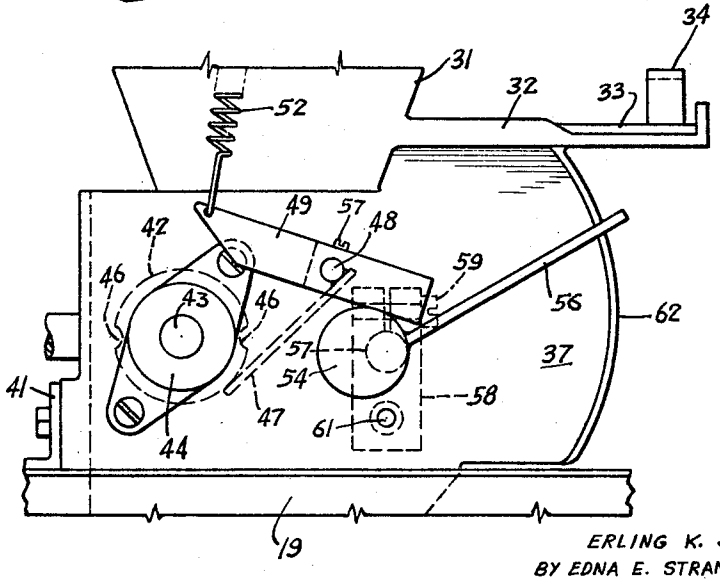


FIG. 7

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United States Patent Office 3,397,582 Patented Aug. 20, 1968

3,397,582

MATERIAL SAMPLING APPARATUS

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10 Claims. (Cl. 73—423)

ABSTRACT OF THE DISCLOSURE

A grain sampling apparatus having a feed chute for directing grain between a driven roller and a gate operable to spread the grain into a generally flat sheet. Reciprocating transversely through the sheet of grain is a carriage having a pair of hoppers for collecting samples of grain and directing the samples into separate sample discharge chutes. The excess grain is directed into a bypass chute with a trough mounted on the carriage.

Summary of invention

This invention relates to an apparatus for sampling particulate material and more particularly to an apparatus for taking a plurality of representative samples from a stream or lot of particulate material such as grain, coal, ore, cement, lime, sand and the like.

One of the objects of the invention is to provide a new and improved apparatus for sampling particulate materials by automatically and continuously taking one or more representative samples from a stream or lot of material.

Another object of the invention is to provide a sampling apparatus operable to remove a representative sample of material from a moving stream of material without unduly interrupting or interfering with the continuing movement of the material.

A further object of the invention is to provide a sampling apparatus operable to take a truly representative sample from either a continuous stream of material or intermittently flowing material.

A further object of the invention is to provide a sampling apparatus with an adjustable material feeding unit which is readily changeable to accommodate varying flows of material and materials having different sized particles.

A further object of the invention is to provide an improved method of simultaneously taking a plurality of representative samples from a stream of material.

An additional object of the invention is to provide sampling apparatus for automatically removing samples from free flowing material which is simple and sturdy in construction, economical in cost, and reliable and efficient in use.

The exact nature of the invention as well as other objects and advantages thereof will be readily apparent upon reference to the following description and the accompanying drawing, wherein:

FIGURE 1 is a side elevational view of the grain sampling apparatus of this invention;

FIGURE 2 is an enlarged fragmentary sectional view taken along the line 2—2 of FIGURE 1;

FIGURE 3 is a sectional view taken along the line 3—3 of FIGURE 2;

FIGURE 4 is an enlarged fragmentary view taken along the line 4—4 of FIGURE 3;

FIGURE 5 is an enlarged view taken along the line 5—5 of FIGURE 4;

FIGURE 6 is an enlarged view taken along the line 6—6 of FIGURE 4 showing the open position of the material flow control gate;

FIGURE 7 is a view similar to FIGURE 6 showing the closed position of the material flow control gate; and

FIGURE 8 is an enlarged fragmentary sectional view taken along the line 8—8 of FIGURE 3.

Referring to the drawings, there is shown in FIGURE 1 the sampling apparatus of this invention indicated generally at 15. The sampling apparatus 15 comprises a skeleton frame 16 having upright legs 17 secured to side members 18 and end members 19. Located above the frame in a position to receive particulate material is a funnel-shaped hopper 20. Upwardly converging supports 21 secure the hopper 20 to the frame 16. Positioned below the discharge end of the hopper 20 is a material feeding unit, indicated generally at 22, operable to control the flow of material into a material collecting carriage 23 positioned below the feeding unit. The material collecting carriage 23 is movably supported on a rod 24 and a rail 26 secured to and extended longitudinally of the frame 16. The material collecting carriage 23 functions to collect a plurality of representative samples of the material as it is discharged from the feeding unit 22. The samples are collected by reciprocating the carriage 23 on the rod 24 and rail 26 with a drive mechanism indicated generally at 27. The material collected by the carriage 23 is diverted into a sample discharge chute unit 28. The excess material is directed by the carriage into a bypass chute 29.

In use, the hopper 20 collects the particulate material directing it to the material feeding unit 22. The material feeding unit 22 diverts the material into a downwardly directed sheet. This sheet falls toward the material collecting carriage 23. With the drive mechanism 23 in operation the carriage reciprocates transversely of the sheet in a horizontal path. As the carriage moves through the sheet of material a portion of the material is collected and diverted into the sample discharge chute unit 28. The remainder of the material is directed into the bypass chute 29.

As shown in FIGURE 2, a cone-shaped sleeve 31 surrounds the discharge end of the hopper. Integral with one side of the sleeve 31 is a laterally projected horizontal guide 32 carrying a slide 33 having an upright handle 34. The slide 33 is movable to open and closed positions, shown in full and broken lines, to regulate the flow of material through hopper 20.

The material feeding unit 22 has a housing 36 having an open front and open top and bottom ends. The housing 36 is formed by upright spaced side walls 37 joined to an upright back wall 38 having an inwardly directed lip 39. As shown in FIGURE 4, the upper edges of the side walls 37 are intgeral with the cone-shaped sleeve 31. A longitudinal beam 41 mounted on the top of the frame 16 is secured to the back wall 38 thereby mounting the feeding unit 22 on the frame 16.

Extended horizontally between the side walls 37 is a cylindrical roller 42 mounted on a horizontal shaft 43. Bearings 44 secured to the outside of the side walls 37 rotatably mount the shaft 43 on the housing 36. As shown in FIGURE 2, the peripheral surface of the roller 42 has a cylindrical shape which is interrupted by a pair of diametrically opposed axial grooves 46. The shaft 43 is positioned in an upright plane passing through a plane which is tangent to the lower discharge opening of the funnel 20. This positions approximately one-half of the roller 42 in the stream of material flowing from the funnel 20.

Located immediately below the opposite side of the funnel 20 is a gate 47 comprising a flat plate secured to a horizontal rod 48. As shown in FIGURE 4, the gate 47 has a length which is equal to the length of the roller 42. The rod 48 is rotatably mounted in the housing side walls 37 and extends substantially parallel to the shaft 43. The lower portion of the gate 47 may be moved into engagement with the peripheral surface of the roller 42 as shown in FIGURE 7. The angular position of the gate 47 is controlled by a lever 49 secured at its mid-section to the

end of the rod **42** by a set screw **51**. A spring **52** connected to the forward end of the lever **49** and connected to a bracket **53** secured to the hopper **52** biases the lever in an upward direction forcing the gate **47** into engagement with the roller **42**.

The opposite end of the lever rides on an eccentric cam **54** having an outwardly projected handle **56**. Integral with the cam **54** is a stub shaft **57** projected through the side wall **37** to rotatably mount the cam on the housing **16**. The inner end of the shaft **57** carries a clamp **58** which is formed from plastic material such as nylon and the like. The upper end of the clamp **58** is bifurcated and positioned about shaft **57**. A bolt **59** threaded through the bifurcated ends of the clamp is adjustable to regulate the friction drag on the shaft **57**. The opposite end of the shaft carries a pivot member **61**, such as a rivet or nut and bolt assembly, to pivotally connect the clamp **58** to the housing side wall **37**.

As shown in FIGURE 4, the handle **56** is positioned adjacent a flange **62** projected outwardly from the arcuate edge of the housing side wall **37**. Indicia **63** on the outer face of the flange **62** is used to provide a visual indication of the angular position of the gate **47**.

The feed roller **42** is rotated by the drive mechanism **27**, shown in FIGURE 1, which comprises an electric motor **64** mounted on a plate **66**. The outer end of the plate **66** is pivotally connected to frame end member **19** thereby pivotally mounting the motor **64** on the frame for movement about a horizontal axis. Power is transmitted from the motor **64** through a belt **67** trained about motor pulley **68** and a large pulley **69** mounted on a horizontal shaft **71**. Bearing **72**, shown in FIGURE 3, journals the shaft **71** to the top of the frame side member **18**. A sprocket **73** secured to the inner end of the shaft **72** carries a link chain **74**. From the sprocket **73** the chain **74** is trained about a similar sprocket **76** secured to a shaft **77**. The shaft **77** extends substantially parallel to the shaft **71** and is rotatably journalled in bearing **78** mounted on the frame member **18**. The outer end of the shaft **77** carries a small sprocket **79**. A link chain **81** drivably connects the sprocket **79** with a large sprocket **82** secured to a horizontal shaft **83**. A bearing **84**, shown in FIGURES 2 and 5, mounted on an upright support **85** rotatably carries the shaft **83**. The shafts **43** and **83** are drivably coupled by a pair of bevel gears **86** and **87** secured to the ends of the respective shafts. A right angle arm **88** having normally disposed bores for accommodating the shafts **43** and **83** maintains the bevel gears **86** and **87** in meshing engagement.

Referring to FIGURES 2 and 3, there is shown the material collecting carriage **23** which operates to collect a plurality of equal representative samples of material discharged from the feeding unit **22**. The carriage **23** comprises an upwardly and forwardly open trough indicated generally at **89** having a forwardly inclined bottom wall **91** terminating in a downwardly projected lip **92**. The lip **92** is positioned in the area of the inlet of the bypass chute **29** and functions to prevent material from accidentally falling into the sample discharge chute unit **28**. Integral with the upper edge of the bottom wall **91** is an upright back wall **93** joined with forwardly extended side walls **94** and **96**. The trough **89** is slidably mounted on the rod **24** by a support **97** shown as a rectangular block having a longitudinal bore accommodating the rod **24**. The support **97** is secured by fastening means (not shown) to the outside of the back wall **93**. As shown in FIGURE 1, a pair of downwardly projected legs **98** and **99** are secured to the back wall **93** on opposite sides of the support **97**. A horizontal guide **101** is attached to the lower ends of the legs **98** and **99**. The guide **101** is formed from a plastic material, such as nylon, and has longitudinal groove and an inverted U-shaped transverse cross sectional configuration. The guide **101** positioned about the upright horizontal flange of the rail **26** functions with the rod **24** to maintain the linear position of the trough **89**.

As shown in FIGURES 2 and 3, the support **97** has an upright vertical groove **102** on the side thereof facing the link chain **74**. Positioned for sliding movement in the groove **102** is a rectangular shaped slide **103** secured to one of the links of the chain **74** by a bolt **104**. Upon operation of the drive mechanism **23** by the motor **64** the chain rotates about sprockets **73** and **74** carrying the carriage **23** along the rod **24** and rail **26** in a linear reciprocating path as shown in full and broken lines in FIGURE 4. During this reciprocal movement the lip **92** of the trough **89** remains in the inlet of the bypass chute **29**.

Mounted in the center of the trough **89** are a pair of upwardly projected sample collector hoppers indicated generally at **106**. The number of hoppers may be increased or decreased according to the number of samples desired. The hoppers **106** comprise spaced upright side walls **107** and **108** joined with the bottom wall **91**. The hoppers are separated by a common upright wall **109** which projects above the plane of the top of the walls **107** and **108**. Each hopper has a downwardly directed discharge spout **111** and **112** aligned with separate compartments of the chute unit **28**.

As shown in FIGURE 8, a pair of doors **113** and **114** are pivotally mounted adjacent the upper ends of the side walls **107** and **108**. The doors **113** and **114** are secured to horizontal rods **116** and **117** projected through suitable holes in the hopper end walls.

As shown in FIGURES 2 and 4, a long block **118** having spaced holes is positioned about the forward ends of the rods **116** and **117**. The opposite ends of the block **118** have longitudinal slits which permit the block to be clamped about the rods **116** and **117**. This is accomplished by bolts **119** and **121** which are threaded downwardly into the ends of the block **118**. The block **118** in conjunction with the bolts **119** and **121** are used to clamp or frictionally hold to the rods **116** and **117** thereby preventing free angular movement of the doors **113** and **114**.

To provide for equal movements of the doors **113** and **114** a pair of sector gears **122** and **123** are secured to respective ends of rods **116** and **117**. The sector gears **122** and **123** have meshing teeth drivably coupling the rods **116** and **117**. The angular positions of the doors **113** and **114** are manually determined to adjust the flow of material into the collector hoppers **106**. An upwardly extended tab **124** is secured to the outer end of the door **113** to provide a convenient handle.

In terms of a method of simultaneously taking a plurality of truly representative samples of material from a stream of particulate material the material to be sampled is first collected in the hopper **20** and directed by the funnel-shaped walls of the hopper in a downward direction into the feeding unit **22**. The downwardly directed material is continuously diverted into an elongated sheet of uniform thickness by the action of the feed roller **42** and the spring biased flat gate **47**. As the sheet of material falls from the feeding unit it is intermittently interrupted across the width of the sheet by transverse removable hoppers **106** which collect a plurality of substantially equal portions of the material and separately directs the portions of material into separate compartments of the sample discharge chute unit **28**. Adjustment of the inlet openings to the collector hoppers **106** may be made to either reduce or increase the size of the samples. All the material which does not constitute part of the sample is guided by the trough **89** into the bypass chute **29**.

In operation the material to be sampled is collected in the hopper **20**. With the slide **33** in the open position as shown in FIGURE 2 the material is directed to the area adjacent the roller **43** and the gate **47**. The angular position of the gate **47** is adjusted by moving the handle **56** in a downward direction as shown in FIGURE 6 separating the gate **47** from the peripheral surface of the roller **42**. On energization of the motor **64** the drive

mechanism **27** functions to rotate the roller **42** in the direction of the arrow shown in FIGURE 2 whereby the roller provides a continuous flow of material through the space between the roller and the gate **47**. The roller **42** having a cylindrical shape in conjunction with the flat gate **47** spreads the material into an elongated sheet which falls downwardly with a uniform thickness onto the material collecting carriage **23**.

The operating drive mechanism **27** reciprocates the carriage **23** along the rod **24** and rail **26** since the slide **103** interconnects the chain **74** with the support **97**. This moves the collector hoppers **106** transversely through the sheet of material discharged by the feeding unit **22** at an even rate of speed and at evenly spaced time intervals. The top or inlet openings to the hoppers **106** are equal in size and may be adjusted by changing the angular positions of the doors **113** and **114** as shown in full and broken lines in FIGURE 8. Thus, the material collected on opposite sides of the common upright wall **109** is substantially equal in quantity and are truly representative samples of the material flowing through the apparatus.

The material that is not utilized in the samples falls onto the inclined bottom wall **91** of the trough and is directed thereby into the upright bypass chute **29** which carries the material to a storage location or the like.

It is apparent that many modifications and variations of this invention as hereinbefore set forth may be made without departing from the spirit and scope thereof. The specific embodiment described is given by way of example only and the invention is limited only by the terms of the appended claims.

What is claimed is:

1. An apparatus for sampling flowing material comprising a frame having guide members, a material feeding unit mounted on the frame for receiving flowing material and directing the material in a single direction, said material feeding unit including a hopper means having a bottom discharge opening, and cooperating movable means and stationary means operable to spread the flow of material in a generally flat sheet, a material collecting carriage mounted on said guide members for transverse movement relative to said feeding unit, said carriage having at least one sample hopper means, drive means for transversely moving said carriage whereby the sample hopper means moves across said material directed in a single direction collecting sample portions of said material, and collector means for receiving the sample portions from the sample hopper means.

2. An apparatus for sampling flowing material comprising: a frame having guide members, a material feeding unit mounted on the frame for receiving flowing material and directing the material in a single direction, said material feeding unit including roller means and gate means cooperating to spread the flow of material into a generally flat sheet, a material collecting carriage mounted on said guide members for transverse movement relative to said feeding unit, said carriage having at least one sample hopper means, drive means for transversely moving said carriage whereby the sample hopper means moves across said material directed in a single direction collecting sample portions of said material, and collector means for receiving the sample portions from the sample hopper means.

3. The apparatus of claim **2** wherein said drive means rotates said roller means to regulate the flow of material through the feeding unit.

4. The apparatus of claim **2** including first hopper means supported on the frame for directing material in a downward direction into the material feeding unit.

5. The apparatus of claim **2** wherein said carriage includes a material bypass trough.

6. The apparatus of claim **2** wherein said carriage has a plurality of sample hopper means.

7. The apparatus defined in claim **2** further characterized by a door member connected to the sample hopper means for adjusting the size of the inlet to said sample hopper means thereby regulating the size of the sample of material.

8. An apparatus for sampling flowing material comprising: a frame having guide members, a material feeding unit mounted on the frame for receiving flowing material and directing the material in a single direction, said material feeding unit comprising a housing having upright side walls, an open top and an open bottom, a roller having a cylindrical peripheral surface and end portions journalled on said side walls, said roller having at least one groove in the peripheral surface, flat gate means journalled on said side walls for movement about an axis substantially parallel to the axis of rotation of said roller, said gate means having a linear end portion engageable with said peripheral surface, means for biasing said gate means into engagement with said roller, and means for holding the gate means spaced from said roller, a material collecting carriage mounted on said guide members for transverse movement relative to said feeding unit, said carriage having at least one sample hopper means, drive means for transversely moving said carriage whereby the sample hopper means moves across said material directed in a single direction collecting sample portions of said material, and collector means for receiving the sample portions from the sample hopper means.

9. The apparatus defined in claim **8** wherein the means for holding the gate means comprises

(a) a lever secured to said gate means,

(b) an eccentric cam engageable with said lever, and

(c) handle secured to said cam, said lever being movable to rotate said cam and thereby angularly move said lever and the gate means.

10. The apparatus defined in claim **8** including

(a) drive means for rotating said roller.

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