Feb. 5, 1963 G. D. BECKER 3,076,549

VIBRATING UNIT FOR SCREENING AND FEEDING

Filed Feb. 29, 1960 4 Sheets-Sheet 1

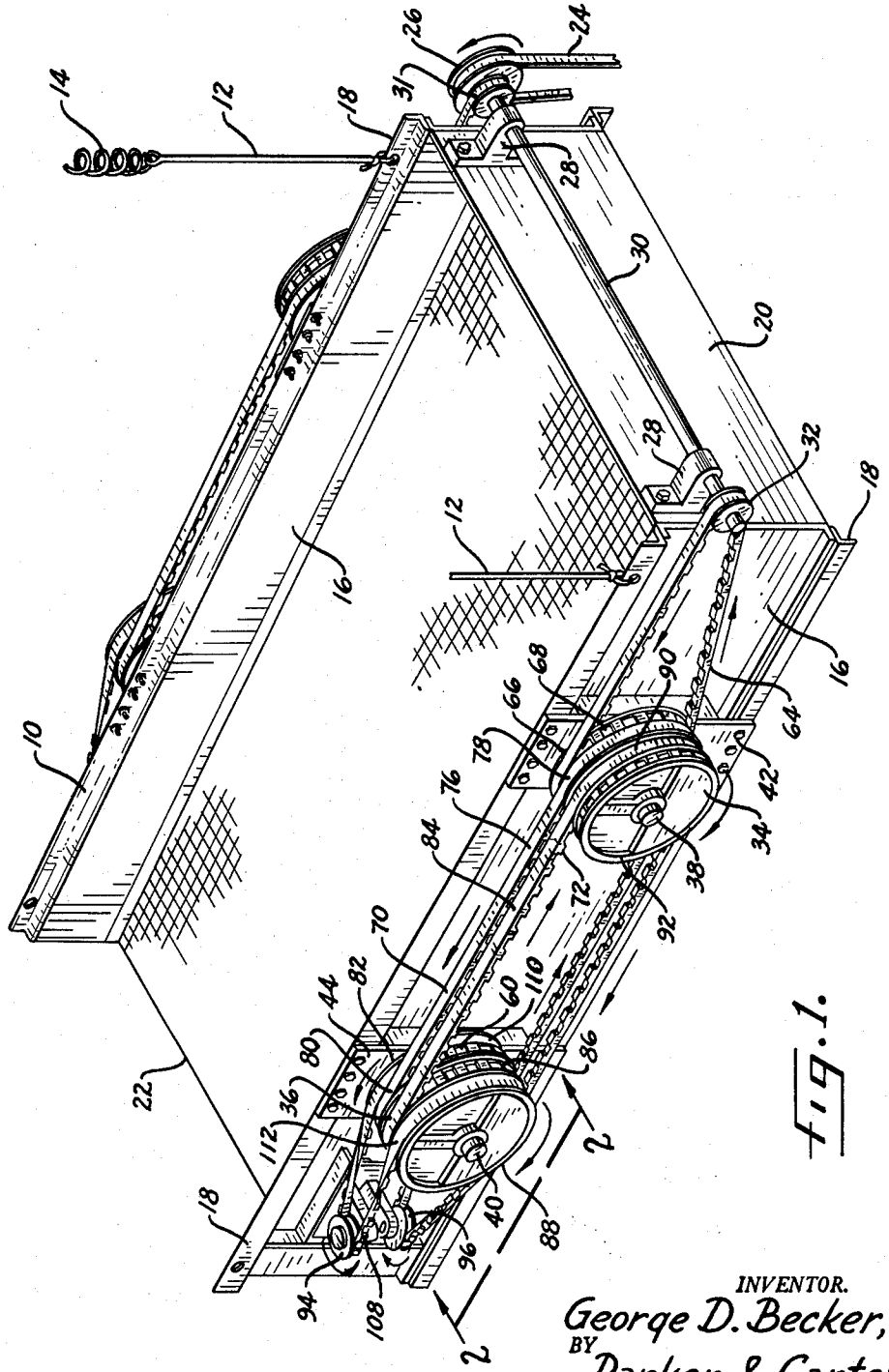


Fig. 1.

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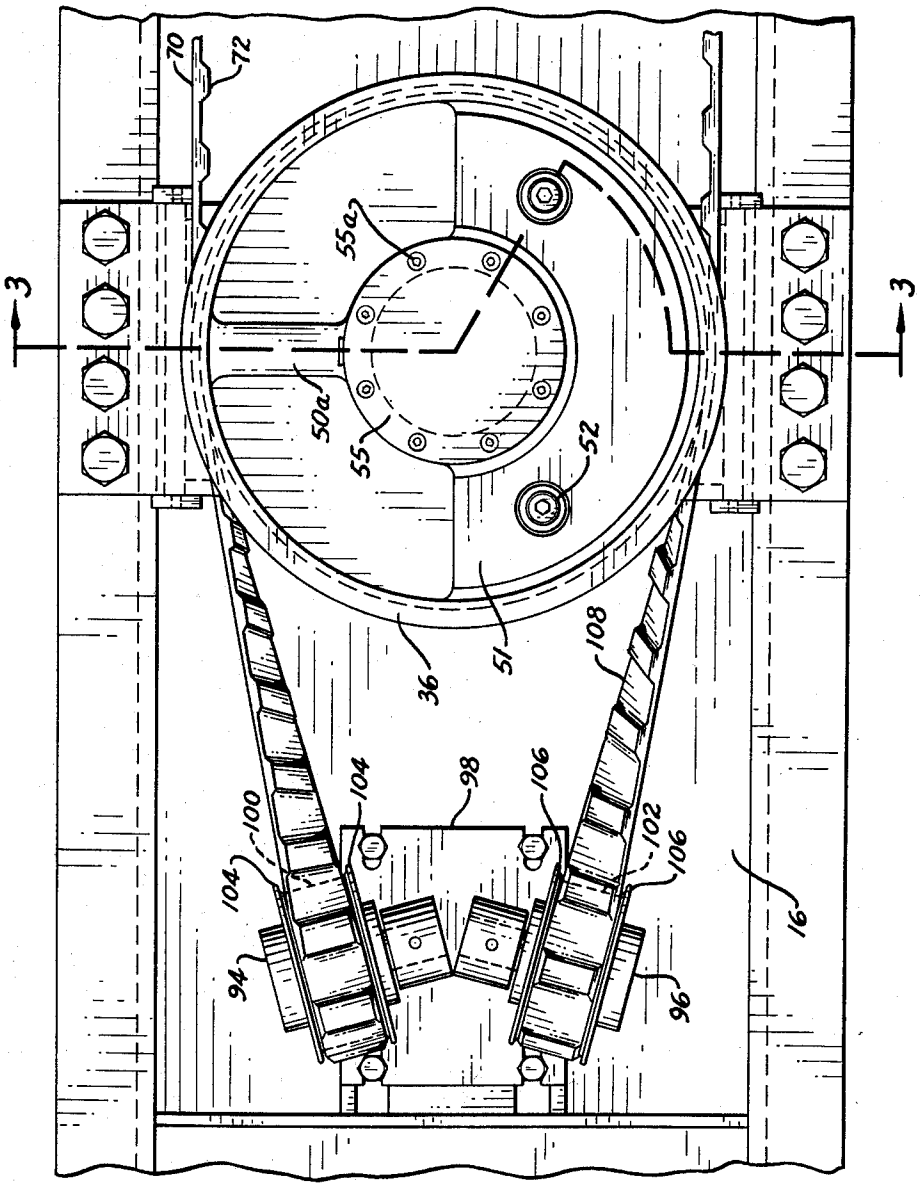


Fig. 2.

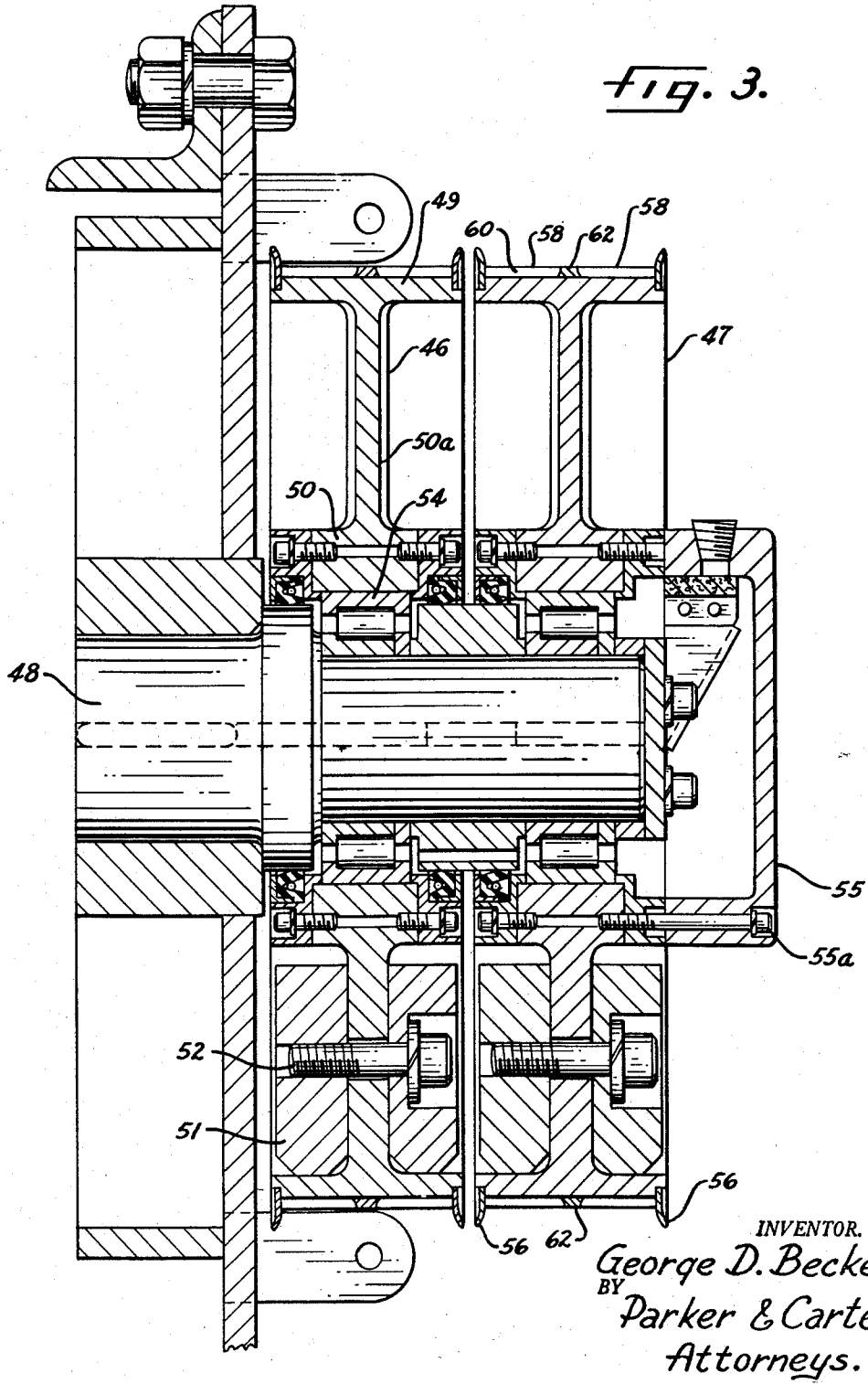
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Fig. 3.



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VIBRATING UNIT FOR SCREENING AND FEEDING

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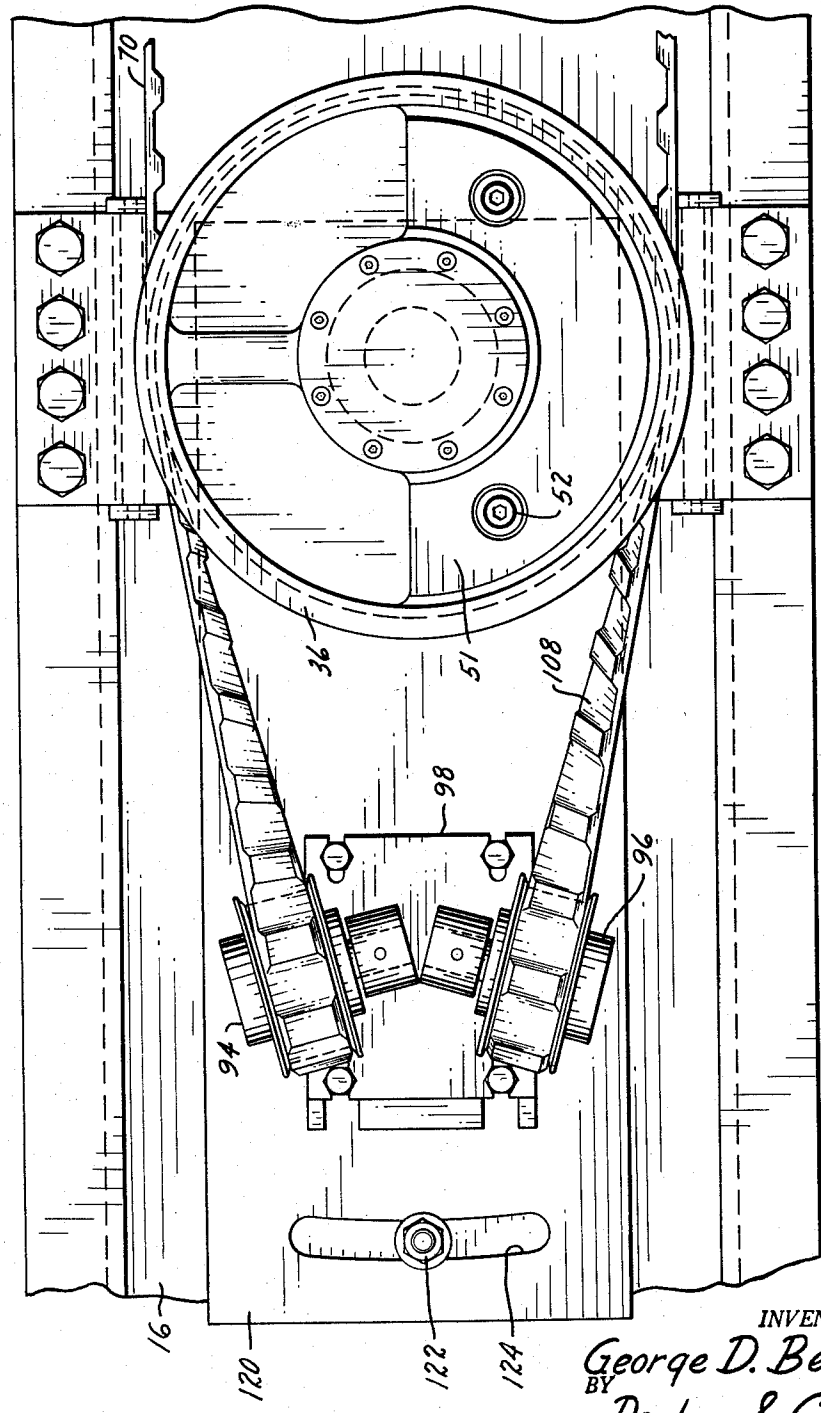


Fig. 4.

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3,076,549
VIBRATING UNIT FOR SCREENING AND FEEDING

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2 Claims. (Cl. 209—367)

This invention relates to a screen assembly, and in particular to improved means for providing vibratory motion thereto.

One purpose of the present invention is a screen assembly including a simple and efficient drive means for providing vibratory motion.

Another purpose is an improved wear-resistant, drive arrangement for vibrating a screen assembly.

Another purpose is an improved means for providing straight line vibratory motion for a screening assembly or the like.

Another purpose is an improved drive arrangement for rotating a pair of weights in opposite directions about a common shaft.

Another purpose is an improved drive arrangement for simultaneously driving a plurality of actuators each of which include a pair of weights rotating in opposite directions.

Another purpose is an improved means for vibrating a screen assembly which includes a pair of counter rotating unequal weights which produce elliptical vibration.

Other purposes will appear in the ensuing specification, drawings and claims.

The invention is illustrated diagrammatically in the following drawings wherein:

FIGURE 1 is a perspective view of a screening assembly with the improved drive means of the invention included thereon,

FIGURE 2 is an enlarged section along plane 2—2 of Figure 1, and

FIGURE 3 is a section along plane 3—3 of FIGURE 2.

FIGURE 4 is an enlarged view, similar to FIGURE 2, showing a further form of the invention.

In FIGURE 1, a screening assembly **10**, which as shown herein is supported as a free body, is suitably supported at the four corners thereof by rods **12** suspended from springs **14**. The screening assembly **10** includes side plates **16** having out turned flanges **18** along the top and bottom thereof, and an end plate **20** closing one end of the assembly. It should be noted that the opposite end **22** of the assembly may be open so that if the material to be screened or sifted is introduced at one end, the end adjacent the plate **20**, and the vibratory motion of the screen has a horizontal component as well as a vertical component, the material being screened will be gradually directed toward the open end. The assembly shown herein may be used in sizing, sorting, grading or otherwise and is particularly useful in mining operations.

It is conventional in screening assemblies of the type shown herein to provide a driving means which provides or imparts vibratory motion, generally in a straight line, to the screen. This vibratory motion may be provided by a pair of weights adapted to rotate in opposite directions on a shaft projecting outwardly from the side of the screening assembly. The weights are conventionally positioned so that during rotation they will complement and oppose each other every 90 degrees, thus providing points of coincidence 180 degrees apart. A line connecting the points of coincidence forms a straight line which defines the direction of vibration of the actuator. As can be seen in FIGURE 1 there are four actuators providing the driving force for the screening assembly, however there may be more or less depending upon the

size and particular application. The direction of vibration of the actuators may be horizontal, vertical, or at any angular position in between, or my be relatably varied while in use. Additionally, each of the actuators may be set so that the direction of vibration is the same or the actuators may be set with different directions of vibration, so that the material will be moved toward the open end **22** as it is screened.

A suitable driving means, not shown, is connected through a flexible drive member **24**, which may be a belt, chain or otherwise, to a driving pulley **26**. A drive shaft **30**, supported on plate **20** by spaced brackets **28**, is rigidly connected to the driving pulley **26** and to two spaced pulleys **31** and **32** which drive the actuators. As shown herein, there is a pair of adjacent actuators along each side of the screening assembly. Each pair of actuators is driven by a drive pulley, either the pulley **31** or the pulley **32**. As the actuators and their associated drive means are similar, only one pair of actuators and drive means will be described in detail.

Spaced actuators **34** and **36** are suitably connected to the screening assembly by means of stub shafts **38** and **40** respectively. The stub shafts are suitably mounted on plates **42** and **44** which are in turn fastened to the flanges **18**.

As each of the actuators is identical, only one will be described in detail. Turning now to FIGURE 3, the actuator is shown to comprise two spaced wheels **46** and **47** each mounted for independent rotation on stub shaft **48**. In the preferred form, each of the wheels include a peripheral outer wall **49**, connected to a center hub **50** by a web **50***a*. A weight **51**, which is preferably semicircular, is connected by a bolt **52** to each of the webs **50***a*. Suitable bearings **54** positioned between the hubs and stub shaft provide a smooth surface for rotation of the wheels. A suitable cap or the like **55** may be connected by screws **55***a* to the outer wheel **47** to complete the actuator structure.

As clearly shown in FIGURE 3, the outer circumference of each of the wheels have two upstanding flanges **56** thereon which define the outer boundary of two paths or tracks **58** for the drive members hereinafter described. Each path extends approximately one-half the width of the space between the flanges **56** and is generally equal to the width of the flexible drive members hereinafter described. The paths preferably have a series of generally equally spaced slots or recesses **60**. The slots have a pitch generally equal to the pitch of the teeth on the flexible drive members. A small circumferential bead **62** may be positioned between the adjacent paths **58** to keep the belts separate and on the track during operation.

In order to drive the actuators shown herein a suitable flexible drive member **64**, which may be a belt, chain or otherwise, is positioned on drive pulley **32** and on the inside track **68** of inside weight or wheel **66** on actuator **34**. Each of the flexible drive members shown herein are belts having a smooth surface **70** on one side and a series of generally equally spaced teeth **72** on the other side which will mate with the equally spaced slots **60**.

Hereinafter I will use the terms "weight" and "wheel" interchangeably and the term "weight" may be thought of as including both the wheel and the mass or weight maintained on the wheel.

As the weights are mounted for independent rotation, it will be seen that weight **66** on actuator **34** will be driven in a predetermined direction, for example that shown by the arrows, by belt **64** and pulley **32**. A second flexible drive member **76** may be positioned around outside path **78** on weight **66** and on outside path **80** formed on weight **82** of actuator **36** to drive weight **82** in the direction of

the direction of the arrows. The driving connection between the pair of actuators is completed by a second belt **84** which is positioned on inside path **86** on outside weight **88** of actuator **36** and on the inside path **90** formed on weight **92** of actuator **34**. The driving means, as thus far described, show means whereby the rotation of weight **66** drives weight **82** through belt **76**. Belt **84** provides a connection between weights **88** and **92** so that they will be driven in the same direction.

FIGURE 2 shows the details of the reversing means whereby the rotational motion of weight **82** is given to weight **88**, but in an opposite direction. Spaced, freely rotatable, idler pulleys **94** and **96** are suitably mounted by means of a bracket or plate **98** on plate **16** adjacent actuator **36**. The idler pulleys each have a generally central channel **100** and **102** respectively formed by spaced flanges **104** and **106** to provide a path for the flexible drive member hereinafter described. As shown in the drawings, the idlers have a smooth channel surface to receive the flexible drive member although it may be otherwise, for example, the channel surface may have teeth or grooves. The idlers are preferably disposed at a slight angle to the vertical to provide a more compact sructure. A flexible drive member **108** which is usually the same as the fiexible drive belts heretofor described connects both of the idlers and the two weights on actuator **36**. In order to better understand the reversing assembly shown herein, the path of belt **108** will be traced starting at weight **82** and returning thereto. Belt **108** is positioned on weight **82** on inside path **110** and as the belt leaves the bottom of this weight it is rotated or twisted through 90 degrees so that it may be wound around idler **96** which rotates at an angle of 90 degrees to the plane of rotation of the actuators. From idler **96** the belt is against twisted or rotated through 90 degrees and then placed on outside path **112** on weight **88**. The belt will travel on weight **88** through 180 degrees after which it will run to idler **94**, again after being twisted or rotated through an angle of 90 degrees while passing between the weight and the idler. The belt moves around idler **94** and then returns, again after being rotated through 90 degrees, to weight **82**. From the above description of the reversing mechanism it can be seen that a single flexible driving member or belt and two spaced, freely rotating, idler pulleys provide a means whereby the inside weight of actuator **36** drives the outside weight, but in the opposite direction.

FIGURE 4 shows a modified form wherein provision is made for varying the direction of vibration of the rotating weights. The plate **98** mounting the idlers **94** is not mounted directly on plate **16**, as was the case in FIGURE 2, but may be secured to a rotatable plate **120**. In the alternative, the idlers may be mounted directly to the rotatable plate **120**. In any event, the plate **120** is rotatable about the axis of the actuator **36** and is held in any angular position by a bolt or the like **122** extending from plate **16** through an arcuate slot **124**. By changing the angular position of the plate **120** and so the angular position of the weights, the points of coincidence of the weights are varied, thus changing the direction of vibration of actuator **36**.

The use, operation and function of the invention are as follows:

Shown and described herein is an improved means for imparting straight line or elliptical vibratory motion to a screening assembly or the like. Each of the actuators used herein include rotating weights which may be equal or unequal and which revolve in opposite directions and have points of coincidence and opposition 90 degrees apart. The points of coincidence may form a straight line which is the direction of vibration of the actuators, or if the weights are unbalanced the motion may be elliptical. In any such screening assembly it is necessary to provide a simple and efficient method of driving the actuators so that the weights are properly rotated. Instead of the conventional gears, pinions, etc., which have been used in the past to provide the driving means for such oppositely rotating weights, shown and described herein is an improved driving means including flexible driving members which may be belts, chains, or otherwise. Also shown is a reversing assembly including two spaced idlers and a belt positioned therearound which rotates the weights in opposite directions. As a screening assembly is conventionally used to screen, sort, or grade minerals or ore it is necessary to have a system for driving the screen which will not easily clog or become inoperative when small particles become embedded in the machinery. The cog-belts or other flexible driving means shown herein will have an extremely long life and are highly wear-resistant.

In the operation of the driving means one of the weights on one actuator, which may be either the inside or outside weight, is driven by a conventional driving pulley. A second belt runs around the same weight and around the corresponding weight on the other actuator. Therefore, the corresponding weight on the second actuator will be driven at the same rate and in the same direction as the weight being driven by the driving pulley. Another belt, positioned on the driven weight on the second actuator, is wound around two spaced, freely rotating idler pulleys and the other weight on the second actuator. The belt is rotated 90 degrees as it passes between an idler and a weight as the idlers rotate in a plane forming an angle of 90 degrees with the plane of rotation of the weights. The idlers then provide a means for reversing the direction of movement of the weights so that the second weight, which as shown herein as the outside weight, but may be otherwise, of the second actuator rotates in the opposite direction from the first weight on the actuator. As the second weight or outside weight, rotates in the opposite direction, and as it is connected through a second belt back to the first actuator, both actuators have weights rotating at the same speed and in opposite directions.

As shown in the drawings, the belts may have equally spaced teeth formed thereon which mate with equally spaced grooves formed in the outer periphery of the weights. This is the preferred form of drive member although a chain is also satisfactory. It should be noted, that when the belt passing around the idlers is rotated through 90 degrees the surface of the belt having the teeth is on the outside of the idler and does not contact the idler surface. This prevents wear on the teeth and provides smoother operation.

Whereas the driving means has been generally described as comprising a pair of actuators along each side of the screening assembly it should be realized that a third actuator may be positioned on each side and the now second actuator would become the center actuator. The third actuator would then have the reversing mechanism associated therewith. In the same manner, a fourth or fifth actuator may be driven through the same mechanism. By the same token, if there is only one actuator, the reversing means shown herein would be positioned next to the first actuator to provide a means of driving the weights thereon in opposite directions.

As has been described, the counter-rotating weights provides straight line vibratory motion. The direction of this vibratory motion may be varied by positioning the weights so that the points of coincidence, although remaining under 180 degrees apart, are at different circumferential positions. As shown herein, once the weights have been set for a certain direction of vibration, this direction remains the same during operation. However it is possible to provide means for rotating the points of coincidence of the weights during operation so that the direction of vibration may be correspondingly varied. For example, as shown in FIGURE 4, the plate **120** may be rotated about the axis of the actuator either during operation of the screen or while the machine is

at rest. Rotation of the plate 120 and hence the idlers change the points of coincidence of the weights and so the direction of vibration. It is also possible to use weights of unequal size on adjacent wheels thus producing elliptical motion whose long axis will respond to variation the same as for weights of equal size.

Whereas the preferred form of the invention has been shown and described herein it should be realized that there are many modifications, substitutions and alterations thereto within the scope of the following claims.

I claim:

1. A screening assembly or the like including a screen and two adjacent actuators secured thereto, each actuator including a pair of weights mounted for opposite rotation about a common shaft secured to the assembly, the forces produced by the revolving weights alternately complementing and opposing each other every 90 degrees, the outer surface of each weight being formed into two parallel tracks, means for rotating the weights including two flexible drive members each of which is positioned in a track on a weight of one actuator and a track on a weight of the other actuator to simultaneously rotate said weights in the same direction, said two flexible drive members moving in opposite directions and in parallel paths, power means for rotating a weight on one actuator in a predetermined direction, and a flexible drive member

positioned in a second track of both weights of the other actuator and arranged to drive said last-named weights in opposite directions.

2. The structure of claim 1 further characterized by two spaced freely rotatable idler members positioned adjacent said other actuator, the flexible drive member connecting both weights of said other actuator moving in a path from one weight around an idler, around the other weight, and then around the other idler and back to said first weight, said flexible drive member being rotated through 90 degrees while passing between a weight and an idler.

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