Nov. 14, 1967 A. R. SWANSON 3,352,037

POWER OPERATED APRON FOR TRACTOR SCRAPERS

Filed June 10, 1965 2 Sheets-Sheet 1

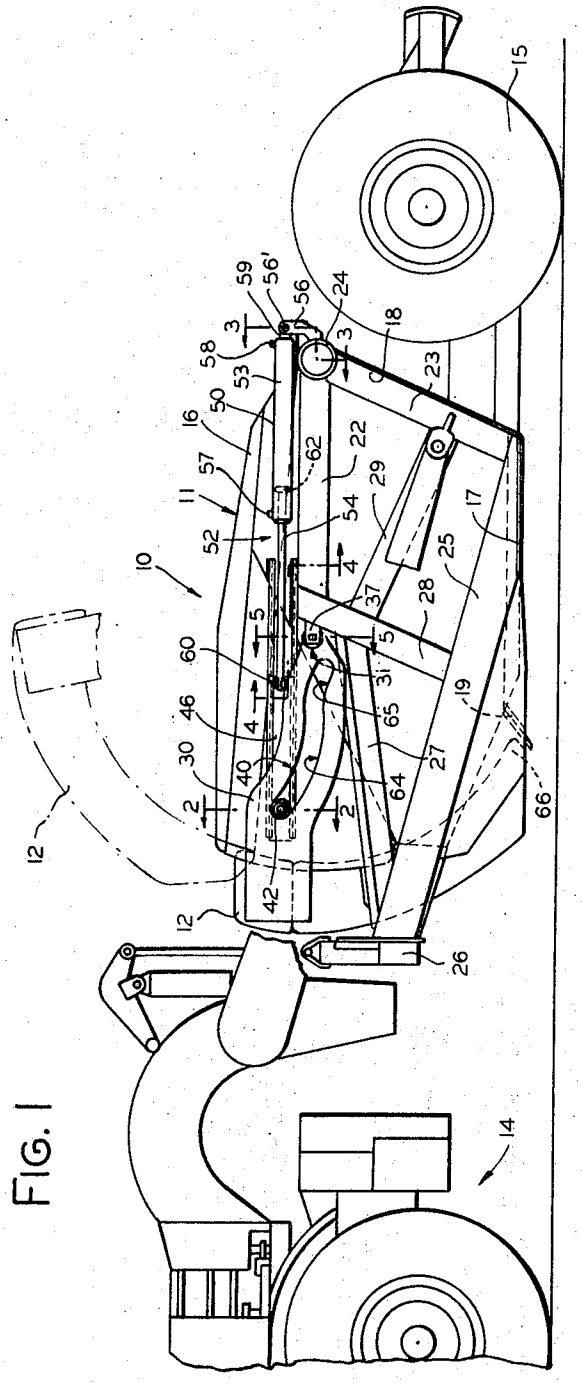


FIG. 1

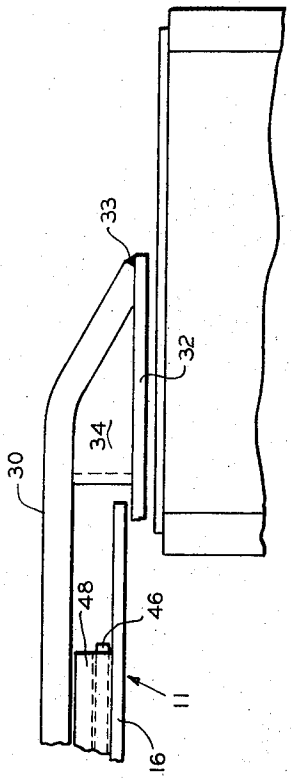


FIG. 6

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FIG. 2

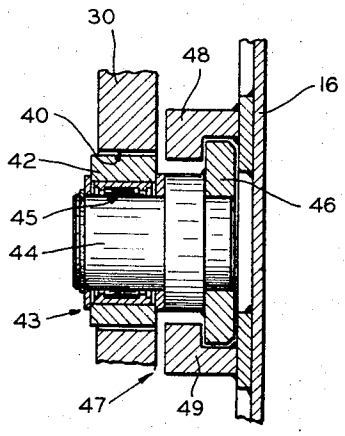


FIG. 3

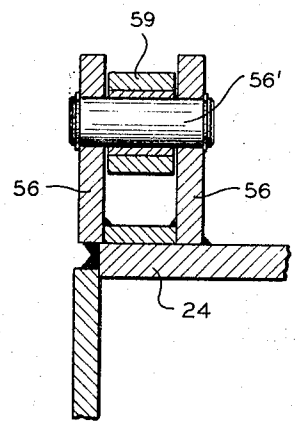


FIG. 4

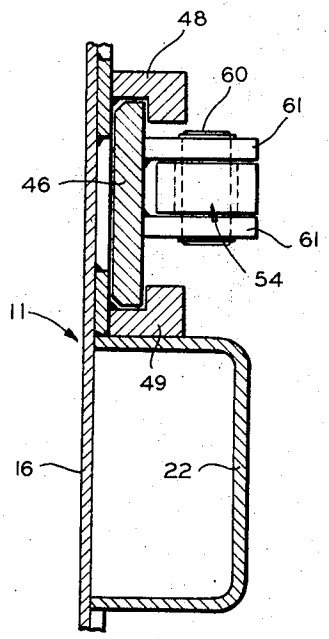
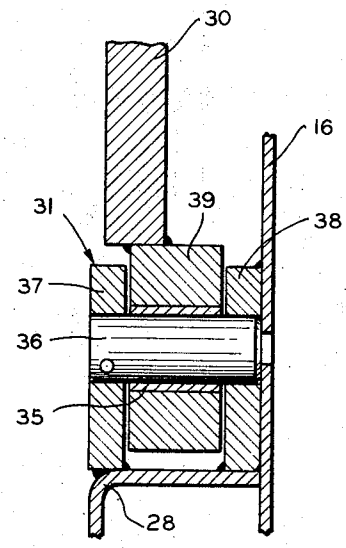


FIG. 5



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United States Patent Office 3,352,037
Patented Nov. 14, 1967

3,352,037

POWER OPERATED APRON FOR TRACTOR SCRAPERS

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Filed June 10, 1965, Ser. No. 462,820
6 Claims. (Cl. 37—129)

ABSTRACT OF THE DISCLOSURE

Power operated apron for opening and closing a bowl of an earth moving scraper in which cam means and cam follower means between the apron and the bowl are associated with power actuating means for effecting application of torque of the power actuating means to and for moving the apron.

The present invention relates to power operated aprons for tractor propelled earth moving scrapers.

In the known apparatus to which the present invention relates scrapers are provided which comprise an earth carrying bowl open at its forward or leading end, and at the lower edge of which a cutting edge is provided for engaging ground or other material to be displaced into the bowl. An apron pivotally mounted on the bowl is conventionally provided and which apron is movable between open and closed positions for opening and closing the open end of the bowl. Thus, when a bowl of such a scraper is charged with dirt or other material collected in it, the apron is disposed to closed position for transport of the collected material to a place of deposit. The bowls of such scrapers are generally of large capacity, many of which are designed to accommodate loads of the order of 25 or more cubic yards of dirt. In order to open the apron of a scraper carrying a load of the order indicated, a high torque is required in that part of the load in the bowl is resting on the apron and tends to hold the apron in closed position. Also, in the closed position of the apron, the center of the mass of the apron is at a substantial distance from the pivot axis of the apron on the bowl. After predetermined initial opening movement of an apron with respect to the bowl and as the dirt falls from the apron, the weight of such dirt no longer has to be overcome in the further opening movement of the apron, and the center of mass of the apron moves progressively closer to the pivot axis of the apron on the bowl. Thus, in the arrangements referred to, maximum torque is required to move an apron from its closed position toward its open position during an initial predetermined range of initial opening movement of the apron with the amount of torque to continue to raise the apron decreasing after such predetermined range of initial opening movement of the apron.

It is an object of the present invention to provide a simple arrangement of components between an apron pivotally mounted on the bowl of a scraper embodying cam means and cam follower means associated with the apron and the bowl together with power actuating means for effecting relative movement of the cam means and cam follower means, and in which arrangement the cam means affords desired application of torque of the power actuating means to the apron in movement of it relative to the bowl.

It is a further object of the present invention to provide cam means and cam follower means for association with the bowl and apron elements of a scraper together with power actuating means for effecting relative movement of the cam means and cam follower means and in which such cam means provides for substantially

constant application of the torque of power actuating means to the apron over a predetermined initial range of opening movement of the apron, and for the lessening of the application of torque of the power actuating means in the continued opening movement of the apron beyond the predetermined range of initial opening movement of the apron.

In accordance with the foregoing objects the present invention provides an arrangement in which maximum torque of the power actuating means may be utilized in the initial opening movement of the apron, and after which the torque decreases as the load of the apron decreases upon its further opening and to increase the speed of angular velocity of the apron to fully open position, which is highly desirable for the rapid and efficient discharge of a load from the bowl of the scraper.

A further object of the invention resides in the provision of double acting power actuating means operable in one direction of actuation thereof to provide the aforenoted advantages and which when operated in the other direction of actuation thereof effects power closing of the apron at maximum torque of the power actuating means to close the opening of the bowl.

In an apparatus in accordance with the last noted object, in the event dirt in the bowl or foreign material is disposed at the cutting edge of the bowl, the lip of the apron is positively forced against such material to enable full closing of the apron with respect to the bowl.

The above and other objects and advantages of the invention will appear from the following detailed description of a preferred embodiment of the invention.

Now in order to acquaint those skilled in the art with the manner of constructing scrapers in accordance with the principles of the present invention, there is described below in connection with the accompanying drawings a preferred embodiment of the invention.

In the drawings:

FIGURE 1 is a side elevational view of a scraper embodying the present invention;

FIGURE 2 is a detail vertical sectional view taken substantially along the line 2—2 of FIGURE 1 looking in the direction indicated by the arrows;

FIGURE 3 is a detail vertical sectional view taken substantially along the lines 3—3 of FIGURE 1 looking in the direction indicated by the arrows;

FIGURE 4 is a detail vertical sectional view taken substantially along the line 4—4 of FIGURE 1 looking in the direction indicated by the arrows;

FIGURE 5 is a detail vertical sectional view taken substantially along the line 5—5 of FIGURE 1 looking in the direction indicated by the arrows; and

FIGURE 6 is a plan view showing the relationship of certain portions of the bowl, apron and associated parts illustrated in FIGURE 1.

Referring now to FIGURE 1, there is shown a scraper 10 comprising a bowl 11 and an apron 12 for the closing of the forward or open end of the bowl 11. The apron 12 is shown in full lines in its closed position for closing the open end of the bowl 11 and in dotted line in its fully open position with respect to the bowl.

The scraper 10 may be drawn to the left as viewed in FIGURE 1 in a conventional manner by a tractor, a portion of which is shown at 14. The rear end of the scraper 10 may also be supported in a conventional manner by wheel means indicated at 15.

The bowl 11 per se is of conventional known construction and comprises a pair of vertically spaced apart side walls 16, anly one being shown in FIGURE 1, a bottom wall 17 extending between the side walls 16 and an end wall 18 for closing the rearward end of the bowl. The forward end of the bowl is open and at the lower edge of which a cutting edge member 19 extends trans-

versely of the scraper to engage the ground with the apron **12** in a partially open positoin and in movement of the scraper to the left, as viewed in the drawing, for loading the bowl with dirt to be collected at a first position for deposit elsewhere. It will be understood that the apparatus also includes conventional and known control means (not shown) for raising and lowering the scraper **10** in earth collecting and depositing operations. Suitable channel reinforcing members are provided at opposite side walls of the bowl, such as channel members **22**, extending lengthwise of the bowl adjacent the upper edges of the rearward portions of side walls, and rear channel reinforcing members **23** at the rear of the bowl between which a transversely extending tube **24** extends for reinforcing the rearward end of the bowl. Upwardly and forwardly inclined channel members **25** extend from the lower rearward end of the bowl to the hitch assembly as shown at **26** for mounting the scraper to the tractor. Additional reinforcing channel members such as shown at **27**, **28** and **29** are provided to provide strong cross reinforcement of the scraper bowl to enable the handling of large loads as, for example, the order previously noted of 25 cubic yards and more. The apron **12** as best seen in FIGURES 1 and 6 comprises a pair of pivot arms **30** lying outwardly of the side walls **16** of the bowl **11**, and inner side walls **32** of the apron with the outwardly extending ends of the pivot arms **30** being welded to side wall plates **32** as indicated at **33**. The arms **30** and side wall plates **32** of the apron may be reinforced by a gusset **34** as shown in FIGURE 6. The opposite or inner ends of the apron arms **30** as best seen in FIGURE 1 are pivotally mounted about a fixed axis of rotation at and laterally of the side walls **16** of the bowl as indicated generally at **31**. As best seen in FIGURE 5, the ends of each of the arms **30** has a bearing hub **39** secured thereto provided with a bearing sleeve **35** journalled on a pivot pin **36** mounted between lugs **37** and **38** with the lug **37** being secured as by welding to the upper end of channel strut **28**, and the lug **38** being secured to the adjacent side wall **16** of the bowl **11**.

Each pivot arm **30** is formed with cam means **40** comprising a cam slot receiving, as best seen in FIGURE 2, a roller **42** of cam follower means **43**. The cam follower means **43** further comprises a stub shaft member **44** for supporting the roller **42** for rotation at one end thereof with there being a bearing assembly **45** arranged between the roller **42** and the shaft **44**. Shaft **44** at its end opposite roller **42** is rigidly fixed in a slide member **46** which is mounted for reciprocatory horizontal sliding movement in track means **47** defined by opposed upper and lower flange frame members **48** and **49** formed to provide channels in which the upper and lower edge portions of the slide member are disposed. The flanged frame members **48** and **49** are rigidly secured as by welding to the adjacent side wall **16** of the bowl **11** and the lower flange frame member **49** adjacent the portion thereof extending rearwardly of the bowl is further secured, as by welding, to the upper wall of channel member **22**.

Power actuating means, indicated generally at **50**, may by way of example, comprise a hydraulic piston and cylinder assembly **52** having a cylinder assembly **53** and piston rod means **54**. As best seen in FIGURE 3, the rear transversely extending tube **24** supports a pair of spaced apart upwardly extending lugs **56** for supporting a pivot pin **56'** providing an anchor mounting for the mounting flange **59** extending rearwardly of the closed end of cylinder assembly **53**. The outwardly projecting end of piston rod means **54** is connected by pin **60** mounted between spaced apart lugs **61** extending laterally away from the end of slide member **46** opposite roller **42**. The hydraulic cylinder assembly **53** as shown may be of the double acting type and for this purpose is provided with fluid connecting ports **57** and **58** through which fluid under pressure may be selectively admitted to one side or the other of the piston **62** of the piston means **54**. The double acting hydraulic piston and cylinder assembly is of known construction and is operative in opposite directions by the selective admission of fluid under pressure through port **57** or port **58** so that the piston means **54** is power driven in either direction by relative movement with respect to the cylinder **53**.

The aforementioned cam means **40** may, as is well known in the cam art, be devised to provide selected torque transmitting characteristics of the power actuating means to the apron **12**. In a preferred arrangement of the invention, the cam means **40** preferably comprises first and second cam paths indicated generally at **64** and **65**, respectively. In the full line position of the parts as shown in FIGURE 1, the apron **12** is retracted to its fully closed position with the lip portion **66** of the apron in engagement with the cutting edge **19** of bowl **11**, which is the normally closed position of the scraper for transporting a load of material contained in the bowl. In order to open the scraper the power actuating means **50** may be suitably energized by admitting fluid under pressure to the port **57** of the cylinder **53** to effect movement of the piston rod means **54** to the right as viewed in the drawing. Energization of power actuating means in the manner noted effects sliding movement of the slide member **46** to the right providing for relative movement of the roller **42** with respect to cam **40** causing the apron **12** to pivot upwardly about pivot **33** toward the position indicated by the dotted lines of the bowl **11** in FIGURE 1. Preferably, the first cam path portion **64** is designed so as to provide for the maximum application of torque of the power actuating means **50** over a predetermined range of initial opening movement of the apron with respect to the bowl. After such initial opening movement, the roller **42** engages the second cam path portion **65** which lessens the torque applied by the power actuating means **50** and increases the angular velocity of movement of the apron **12** in the continued opening movement thereof. As before noted, maximum torque is highly desirable in the initial stage of opening movement of the apron with respect to the bowl in view of the load of the material in the bowl on the apron, and the positioning of the center of mass of the apron with respect to the pivot axis **33**. After such requirement for maximum torque has been met and with lessening of the load on the apron and disposal of the center of mass of the apron closer to the pivot axis **33**, the torque applied by the power actuating means is lessened and the angular velocity of opening of the apron **12** to its fully open position is increased.

In reverse energization of power actuating means **50**, that is energization of it in the opposite direction above described as by admitting fluid under pressure through the port **58** of cylinder assembly **53**, the piston means **54** is moved to the left as viewed in the drawing so that the initial return movement of the apron from its fully open position to closed position is at relatively high angular velocity and low torque by reason of engagement of roller **42** with second cam path **65**, and upon engagement of the roller **42** with the first cam path **64** the angular velocity is decreased and the torque of the power actuating means **50** is increased to power close the lip **66** of apron **12** with the cutting blade **19** of bowl **11**. Thus, in the closing operation, should any debris be collected or be caught between the lip **66** of the apron and the cutting blade **19** of the bowl the full torque of the power actuating means **50** biases the apron toward its fully closed position with respect to the bowl, so the lip **66** and blade **19** will dislodge or break up any material that may be disposed between the lip and the blade of the bowl.

While there has been shown and described a preferred embodiment of the invention, it will be understood that various modifications and rearrangements may be made

therein without departing from the spirit and scope of the invention.

The invention claimed is:

1. In an earth moving scraper having a bowl with an opening at one end thereof and an apron pivotally mounted on said bowl for opening and closing said opening of said bowl, the combination of cam means and cam follower means between said apron and said bowl, power actuating means for effecting relative movement between said cam means and said cam follower means to provide for pivotal movement of said apron about its pivot for opening said opening of said bowl, and said cam means havng a first cam path portion providing for substantially constant application of torque of said power actuating means over a predetermined range of initial opening movement of said apron with respect to said opening of said bowl, and a second cam path portion providing for lessening the torque applied by said power actuating means to said apron in the continued opening movement thereof by said power actuating means beyond said predetermined range of initial opening movement of said apron.

2. In an earth moving scraper having a bowl with an opening at one end thereof, a cutting edge at said opening, an apron pivotally mounted on said bowl for opening and closing said opening of said bowl, and a lip on said apron for registering with said cutting edge, the combination of cam means and cam follower means between said apron and said bowl, double acting power actuating means operable in opposite directions for effecting relative movement between said cam means and said cam follower means to provide for pivotal movement of said apron about its pivot for opening and closing said opening of said bowl, said cam means having a first cam path portion providing for substantially constant application of torque of said power actuating means in one direction of operation thereof over a predetermined range of initial opening movement of said apron with respect to said opening of said bowl, a second cam path portion providing for lessening application of torque and increasing the angular velocity of said apron in the continued opening movement thereof by said power actuating means beyond said predetermined range of initial opening movement of said apron, and said power actuating means in its end position in the other direction of operation thereof biasing said lip of said apron toward said cutting edge at said opening of said bowl.

3. In an earth moving scraper having a bowl with an opening at one end thereof and an apron pivotally mounted on said bowl for opening and closing said opening of said bowl, the combination of cam means for said apron, cam follower means engageable with said cam means, means for mounting said cam follower means for movement on said bowl, power actuating means supported on said bowl and connected with said cam follower means for effecting relative movement between said cam means and said cam follower means to provide for pivotal movement of said apron about its pivot for opening said opening of said bowl, and said cam means having a first cam path portion providing for substantially constant application of torque of said power actuating means over a predetermined range of initial opening movement of said apron with respect to said opening of said bowl, and a second cam path portion providing for lessening the torque applied by said power actuating means and increasing the angular velocity of said apron in the continued opening movement thereof by said power actuating means beyond said predetermined range of initial opening movement of said apron.

4. In an earth moving scraper having a bowl with an opening at one end thereof, a cutting edge at said opening, an apron pivotally mounted on said bowl for movement between opened and closed positions for opening and closing said opening of said bowl, and a lip on said apron for registering with said cutting edge in the closed position of said apron, the combination of cam means for said apron, cam follower means engageable with said cam means, means for mounting said cam follower means for movement on said bowl, double acting power actuating means operable in opposite directions for effecting relative movement between said cam means and said cam follower means to provide for pivotal movement of said apron about its pivot for opening and closing said opening of said bowl, said cam means having a first cam path portion providing for substantially constant application of torque of said power actuating means in one direction of operation thereof over a predetermined range of initial opening movement of said apron with respect to said opening of said bowl, and a second cam path portion providing for lessening application of torque and increasing the angular velocity of said apron in the continued opening movement thereof by said power actuating means beyond said predetermined range of initial opening movement of said apron, and said power actuating means in its end position in the other direction of operation thereof biasing said lip of said apron toward said cutting edge at said opening of said bowl.

5. In an earth moving scraper having a bowl with an opening at one end thereof, a cutting edge at said opening, an apron having arm means pivotally mounted at one end on said bowl to provide for pivotal movement of said apron between opened and closed positions for opening and closing the opening of said bowl, respectively, a lip on said apron for registering with said cutting edge in the closed position of said apron, the combination of cam means in said arm means of said apron, track means mounted on said bowl, slide means mounted for reciprocating sliding movement in said track means, cam follower means engageable with said cam means and carried by said slide means, power actuating means comprising a cylinder and piston means reciprocable with respect to said cylinder, said piston means being connected with said slide member, said power actuating means being energizable for effecting movement of said piston means and thereby effect relative movement between said cam means and said cam follower means to provide for pivotal movement of said apron about its pivot for opening said opening of said bowl, said cam means having a first cam path portion providing for substantially constant application of torque of said power actuating means over a predetermined range of initial opening movement of said apron with respect to said opening of said bowl, and a second cam path portion providing for lessening application of torque and increasing the angularly velocity of said apron in the continued opening movement thereof by said power actuating means beyond said predetermined range of initial opening of said apron.

6. In an earth moving scraper having a bowl with an opening at one end thereof, a cutting edge at said opening, an apron having arm means pivotally mounted at one end on said bowl to provide for pivotal movement of said apron between opened and closed positions for opening and closing the opening of said bowl, respectively. a lip on said apron for registering with said cutting edge in the closed position of said apron, the combination of cam means in said arm means of said apron, track means mounted on said bowl, slide means mounted for reciprocating sliding movement in said track means, cam follower means engageable with said cam means and carried by said slide means, double acting power actuating means comprising a cylinder mounted on said bowl and piston means reciprocable with respect to said cylinder, said piston means being connected with said slide means, said power actuating means being energizable for effecting movement of said piston means in opposite directions for effecting relative movement between said cam means and said cam follower means to provide for pivotal movement of said apron about its pivot for opening and closing said opening of said bowl, said cam means having a first cam path portion providing for substantially con-

stant application of torque of said power actuating means in one direction of movement of said piston means over a predetermined range of initial opening movement of said apron with respect to said opening of said bowl, and a second cam path portion providing for lessening application of torque and increasing the angularly velocity of said apron in the continued opening movement thereof by said power actuating means in said one direction beyond said predetermined range of initial opening of said apron, and said piston means in its end position in the other direction of movement thereof biasing said lip of said apron toward said cutting edge at said opening of said bowl.

References Cited

UNITED STATES PATENTS

2,307,933 1/1943 Le Bleu ..... 37—126

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