Feb. 5, 1946. A. C. COX 2,394,428

EXCAVATOR

Filed Sept. 3, 1942 5 Sheets-Sheet 1

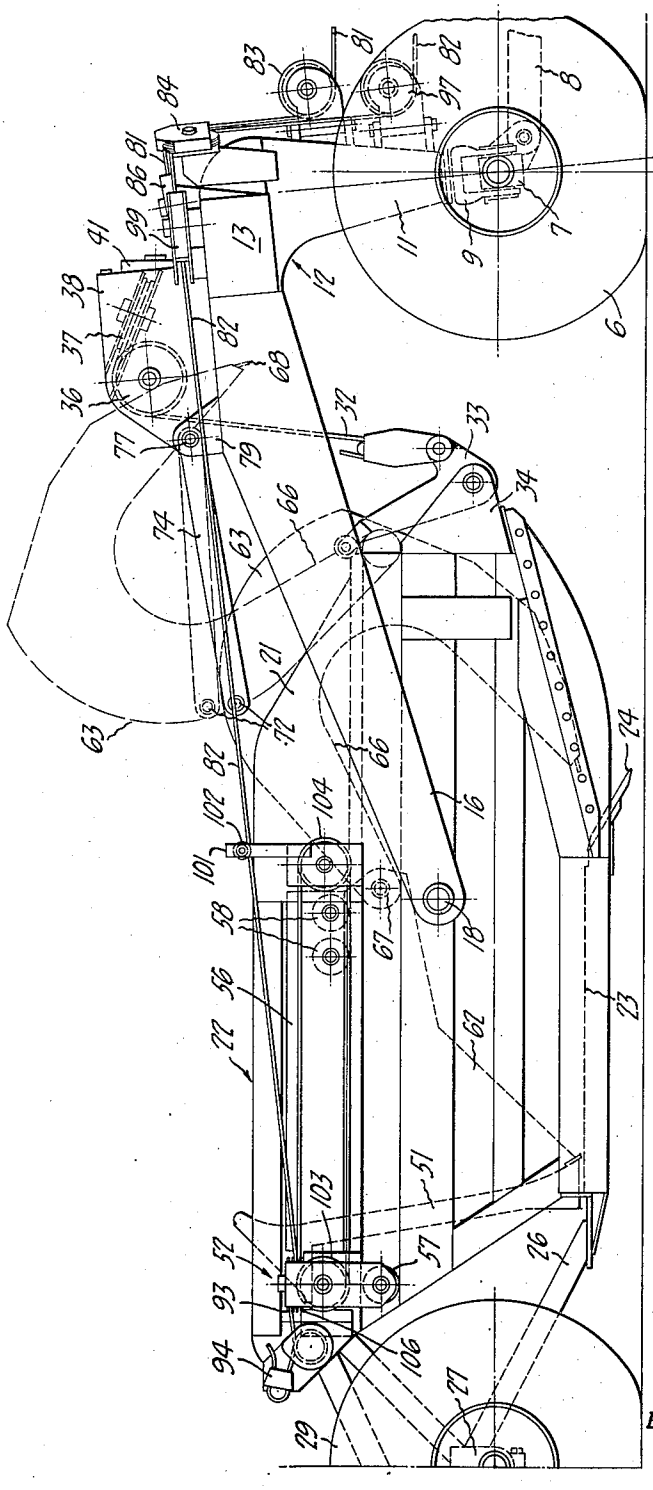


FIG. 1

INVENTOR.
Alonzo Chloe Cox
BY
Marcus Lothrop

Feb. 5, 1946. A. C. COX 2,394,428

EXCAVATOR

Filed Sept. 3, 1942 5 Sheets-Sheet 2

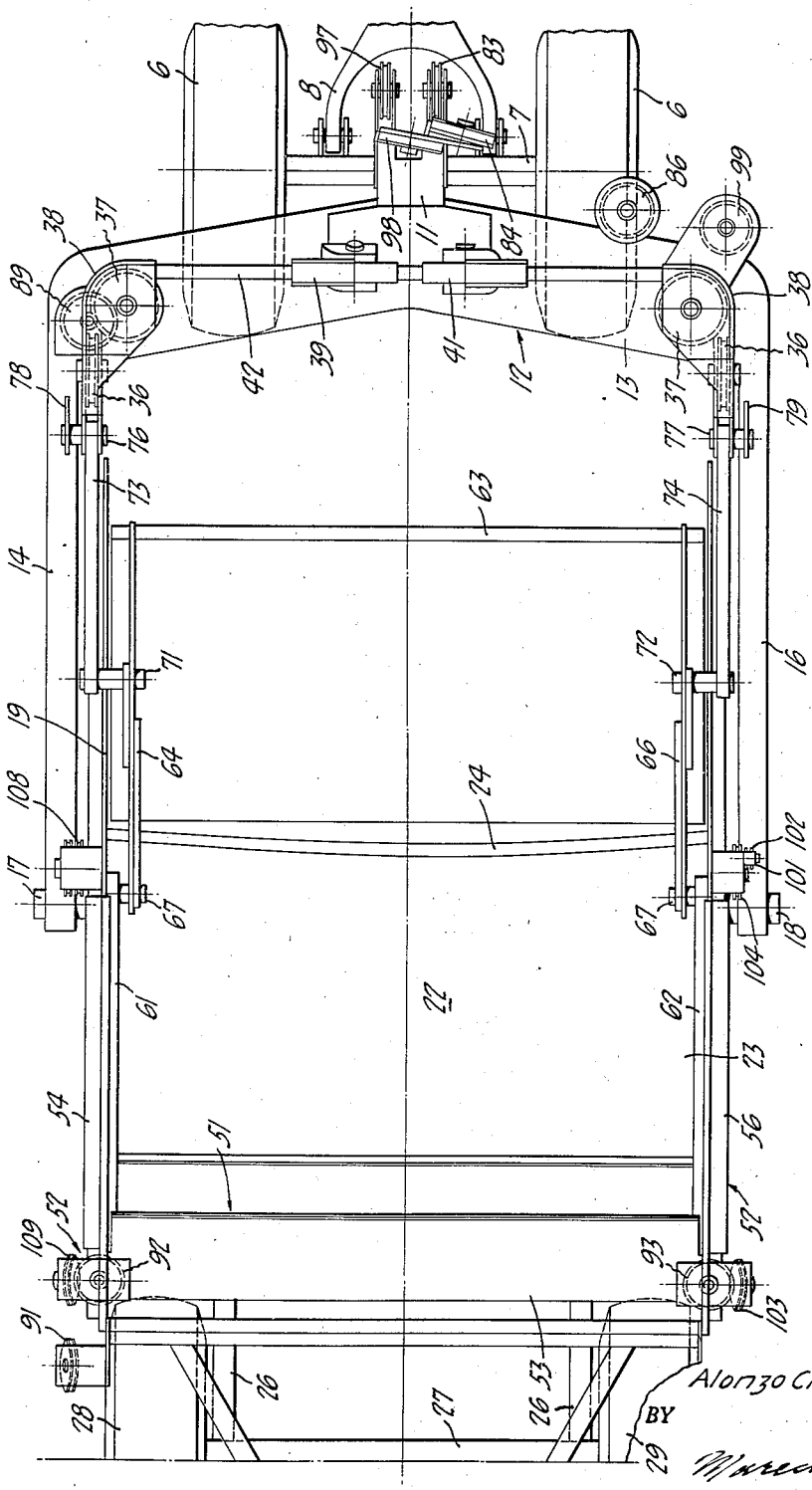


FIG. 2.

INVENTOR.
Alonzo Chloe Cox
BY
Marcus Luthrop

Feb. 5, 1946. A. C. COX 2,394,428

EXCAVATOR

Filed Sept. 3, 1942 5 Sheets-Sheet 3

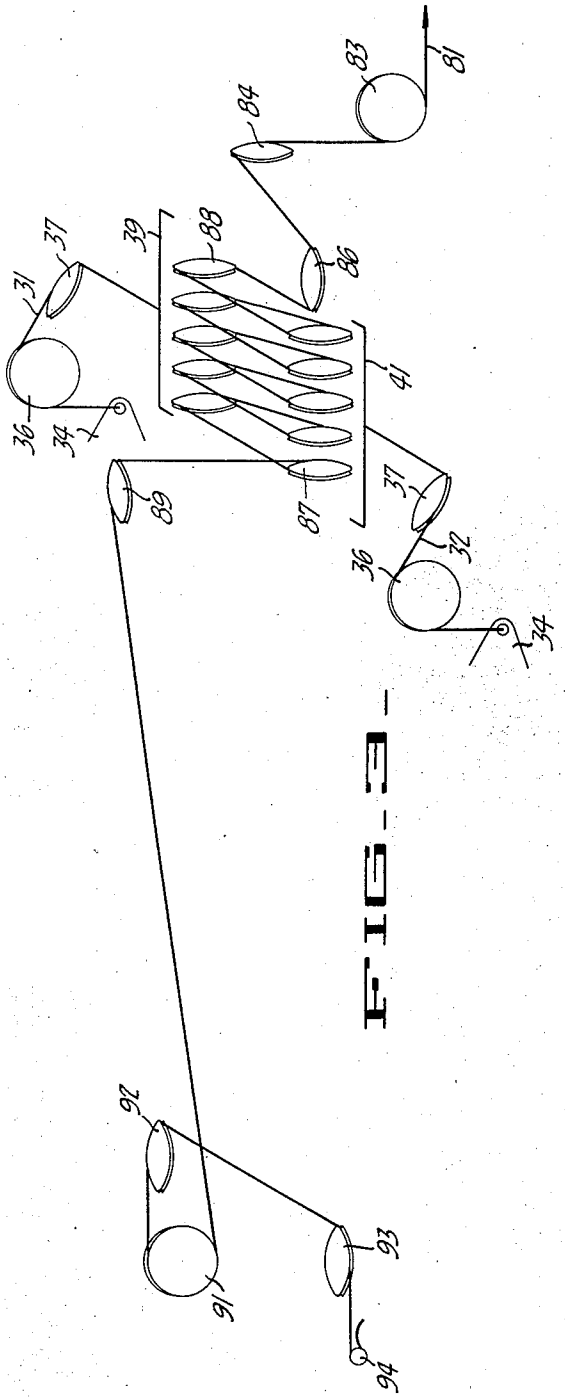


FIG. 3.

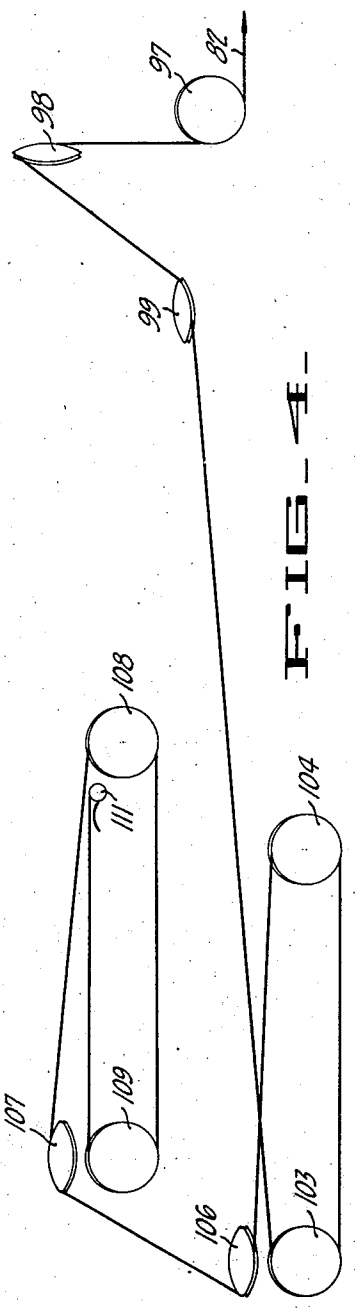


FIG. 4.

INVENTOR.
Alonzo Chloe Cox
BY

Feb. 5, 1946. A. C. COX 2,394,428

EXCAVATOR

Filed Sept. 3, 1942 5 Sheets-Sheet 4

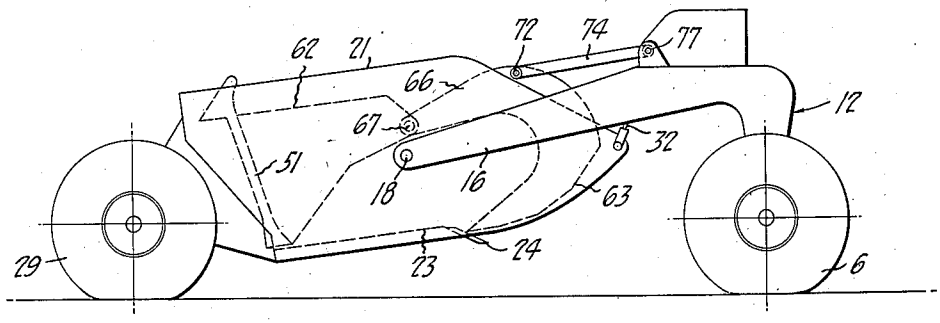


FIG_5_

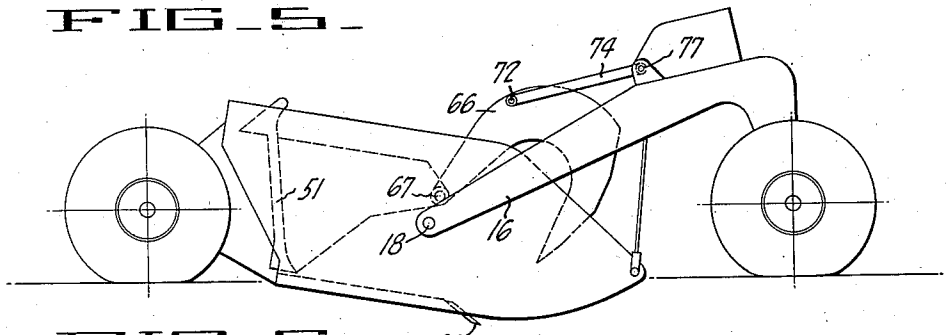


FIG_6_

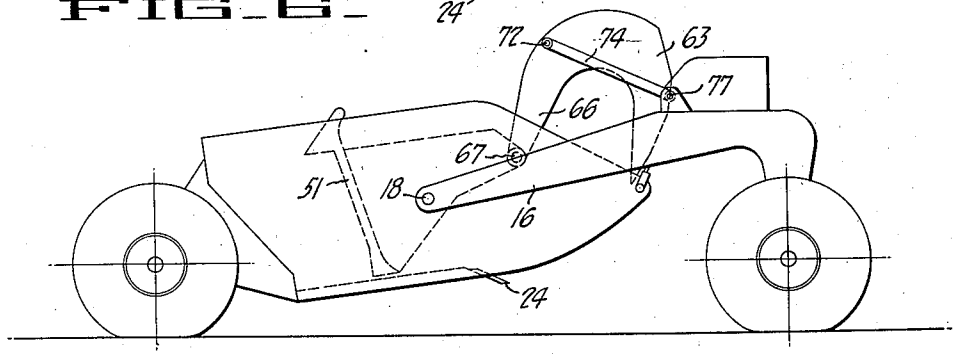


FIG_7_

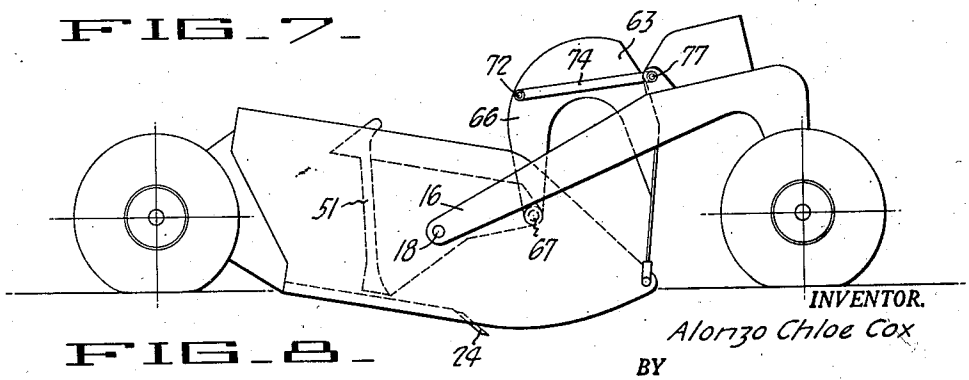


FIG_8_

INVENTOR.
Alonzo Chloe Cox
BY
Marcus Lothrop

Feb. 5, 1946. A. C. COX 2,394,428

EXCAVATOR

Filed Sept. 3, 1942 5 Sheets-Sheet 5

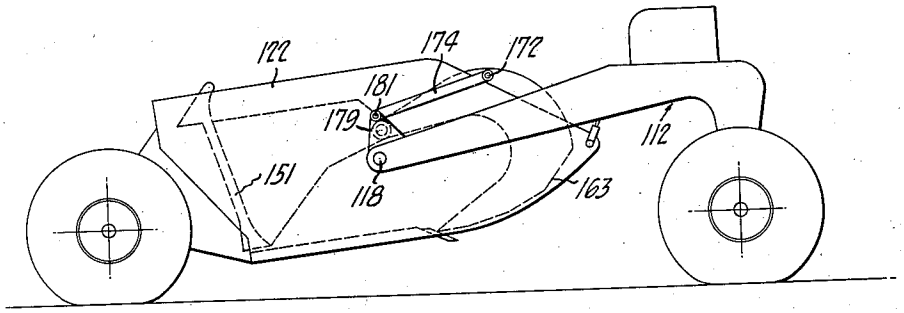


FIG_9_

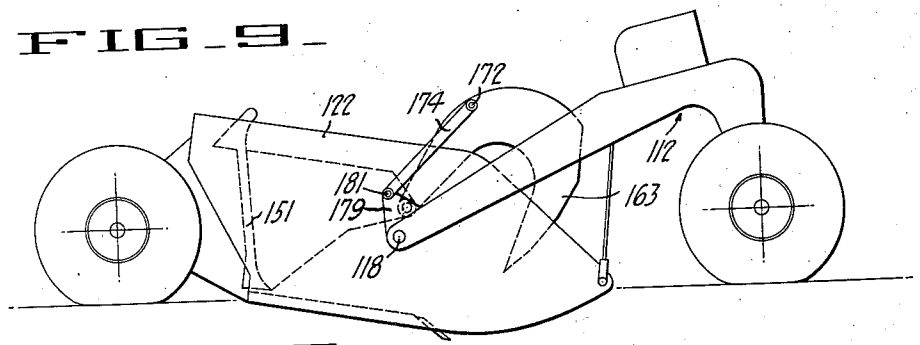


FIG_10_

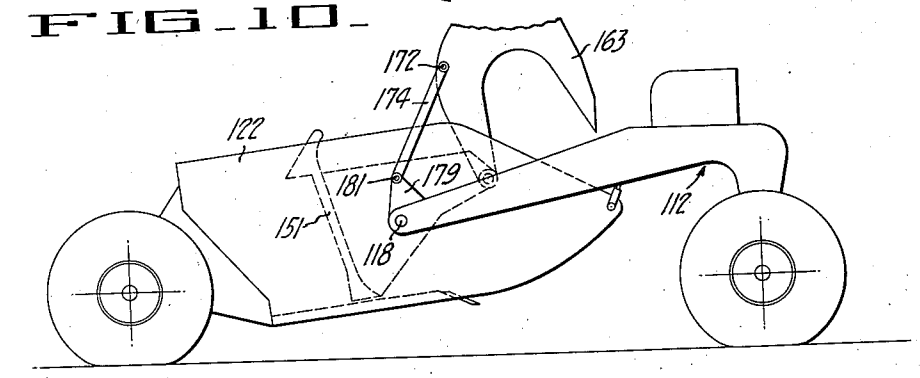


FIG_11_

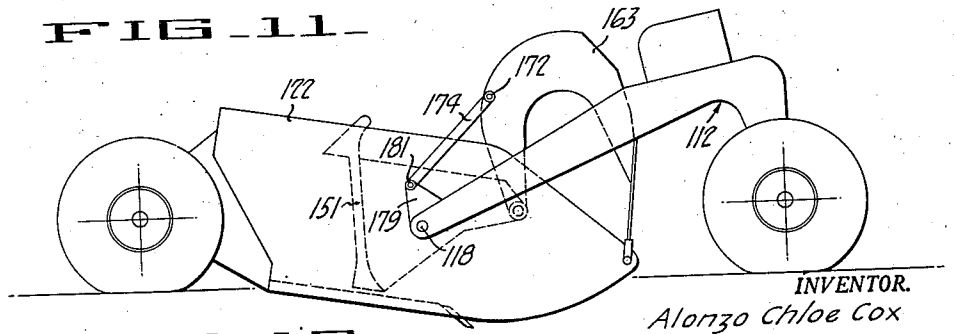


FIG_12_

INVENTOR.
Alonzo Chloe Cox
BY
Marcus Lothrop

Patented Feb. 5, 1946 2,394,428

UNITED STATES PATENT OFFICE

2,394,428

EXCAVATOR

Alonzo Chloe Cox, Cedar Rapids, Iowa, assignor to LaPlant-Choate Mfg. Co., Inc., Cedar Rapids, Iowa, a corporation of Delaware

Application September 3, 1942, Serial No. 457,223

6 Claims. (Cl. 37—126)

My invention relates to excavators of the portable earth moving type and is particularly concerned with an improvement in excavators of the type shown in the patent to Ellsworth W. Austin, 2,329,448.

Excavators of this general type are provided with a main bowl for the reception and carrying of excavated earth and are likewise provided with a front apron which moves toward and away from the open front end of the main bowl in order to retain or permit the discharge of earth therefrom. It is customary normally to control the operation of such front apron by the use of a power means such as a cable. a hydraulic mechanism, or other equivalent device, either separately at the will of an operator or conjointly with the operation of some other instrumentality, such as an earth ejector or pusher. It is likewise customary practice to minimize the number of the control instrumentalities utilized and the number of controls in order to have a simple operation to reduce mechanical complexity as much as possible, as well as to maintain the cheapness of manufacture and maintenance of the structure. It is often desirable, however, to have the front apron subject to a different control in order to produce operation even though portions of the mechanism customarily operating therewith are not necessarily operated. It is therefore an object of my invention to provide an excavator in which the front apron, while capable of performing substantially all of its normal operations in conjunction with the remainder of the structure, has as an added function the ability to be operated by other means.

Another object of my invention is to provide an excavator in which an earth discharging device and the front apron operate in conjunction and also in which the front apron can operate without substantial operation of the earth discharging device.

An additional object of my invention is to provide in an earth mover in which the main bowl and frame member are relatively movable, a front apron for the main bowl which operates upon relative motion between the main bowl and the frame member.

Another object of my invention is, in general, to provide an excavator in which the front apron automatically is moved to open position as the main bowl moves with respect to the frame member toward excavating position.

A further object of my invention is to provide an excavator in which an automatically opening front apron is provided, but which does not differ greatly in manufacturing design from other excavators without this feature.

The foregoing and other objects are attained in the embodiments of the invention illustrated in the drawings, in which—

Fig. 1 is a side elevation of an excavator constructed in accordance with my invention, the front apron being shown for the most part in dotted lines in a nearly closed position and also in an open position.

Fig. 2 is a plan of the structure shown in Fig. 1.

Fig. 3 is an isometric view showing diagrammatically the reeving of the cable which operates the main bowl with respect to the frame member and which likewise assists in returning the earth discharging means to a rearmost position.

Fig. 4 is an isometric view showing diagrammatically the cable reeving which is effective to move the earth discharging member toward foremost position.

Fig. 5 is a diagram showing the excavator in side elevation with the parts in uppermost carrying position.

Fig. 6 is a similar view showing the parts in a lower excavating position with the earth discharging means at the rear, and the front apron automatically partly open.

Fig. 7 is a similar view but showing the parts in position during discharge with a maximum depth spread.

Fig. 8 is a similar view showing the main bowl in excavating position and the earth discharging means placed in an intermediate position to disclose a further opening of the front apron in addition to the automatic opening thereof.

Fig. 9 is a view similar to Fig. 5, but showing a modified form of structure.

Fig. 10 is a view similar to Fig. 6 with a modified form of structure.

Fig. 11 is a view similar to Fig. 7 with a modified form of structure.

Fig. 12 is a view similar to Fig. 8 with a modified form of structure.

In its preferred form, the excavator of my invention includes a main bowl movably mounted on a frame member and provided with an earth discharging means movable within the main bowl, and likewise having a front apron movable with respect to the main bowl to close the open front end thereof. The front apron and earth discharging means are related together for a predetermined mode of operation, and in addition, the front apron is related to the frame member for a predetermined mode of operation, depend-

ent upon relative motion between the main bowl and the frame member.

While the excavator of my invention can be embodied in numerous different forms and with different types of excavators, it is especially useful in connection with the type shown in the identified application of Austin in which the details of such a machine are described. The machine comprises a pair of front wheels 6 at the ends of a front axle 7 having a draft connector 8 extending to any suitable source of draft power, such as a tractor. The axle is rockably mounted on a pivot head 9 journalled in a mast 11 at the forward central portion of a frame member 12 which includes not only a yoke cross beam 13, but likewise a pair of side frame members 14 and 16. The side frame members at their trailing ends are connected by pivots 17 and 18 with the respective side walls 19 and 21 of a main bowl generally designated 22. The main bowl, in addition to the sides, is provided with a reinforced bottom 23 having a cutting blade 24 at its leading edge but is open at its rear and front ends in the customary fashion. The rearward portion of the main bowl is connected by structural framework 26 to a rear axle 27 at the opposite ends of which rear ground-engaging wheels 28 and 29 are disposed. With this arrangement the main bowl 22 is movable about a horizontal axis passing through the pivots 17 and 18 with respect to the frame member 12 so that the cutting edge 24 may be raised and lowered upon such relative pivotal motion.

The relative motion between the frame member 12 and the main bowl 22 is under the control of support cables 31 and 32, respectively, connected through buffer cranks 33 to pivot ears 34 at the leading edges of the side walls 19 and 21. Each of the cables 31 and 32 is trained around a respective one of a pair of sheaves 36 and 37 mounted in superstructure framing 38 on the yoke beam 13 and in turn leading to the respective one of a pair of sliding blocks 39 and 41 guided on a rail structure 42 supported on the superstructure 38. The blocks 39 and 41 are made to approach and recede from each other under the control of an operator by a cable mechanism later described. Upon such approaching and receding motion, however, relative movement between the main bowl and the frame member is accomplished and the cutting edge 24 is correspondingly raised and lowered.

Designed to operate within the main bowl 22 is an earth supporting or discharging member 51, sometimes termed a "pusher," which in one position constitutes a substantially vertical transversely extending rear wall for the main bowl. The pusher 51 is mounted on a carriage structure generally designated 52, including a cross member 53 spanning the space between and over the side walls 19 and 21 and connected to trucks 54 and 56, respectively, each of which is provided with suitable rollers 57 and 58 so as to guide the pusher 51 in a rectilinear path to and fro within the main bowl 22 from a rearmost position as shown in Fig. 1, for example, into a forward position substantially overlying the cutting edge 24.

Also included in the truck mechanisms 54 and 56 are forward extensions 61 and 62 of the pusher which likewise serve as pivotal mountings for a front apron 63. The front apron has two side arms 64 and 66, respectively, each of which at its trailing end is connected by a pivot pin 67 with the extension 61 or 62 so that relative pivotal motion between the front apron and the pusher can take place. Thus, the front apron is movable between a closed position overlying the cutting edge 24 and substantially occupying the otherwise open front end of the main bowl 22, and a series of open positions to allow varying amounts of throat opening or space between the cutting edge 24 and the lowermost edge 68 of the front apron.

In addition to the pivotal connections 67, however, and especially in accordance with my invention, there are provided other means for relating the front apron to the rest of the structure. As shown in all of the figures, except Figs. 9 to 12, inclusive, each of the side arms 64 and 66 of the front apron is provided with a pivot pin 71 or 72 located at a suitable point on said side arm and designed to afford a pivotal connection with the rearmost end of an associated one of a pair of links 73 and 74. The opposite or forward end of each one of the pair of links 73 and 74 is connected by an associated pivot pin 76 or 77 with a bracket structure 78 or 79 upstanding at an appropriate location on the yoke beam 13 of the frame member.

Motion for the various parts is produced by the operation of one or both of a pair of cables 81 and 82 which extend rearwardly from a suitable power control unit, not shown, on the tractor, not shown, connected to the draft bar 8. For example, the cable 81 is reeved over suitable sheaves 83, 84 and 86 and over a plurality of sheaves 87 and 88 arranged respectively in the blocks 39 and 41, and then extends over a guide pulley 89 to a similar pulley 91 on the side wall 19 of the main bowl from whence it is passed over a pair of cable wheels 92 and 93 disposed on the cross beam 52 and is finally connected to an anchor 94 on the side wall 21 of the main bowl.

Tensioning of the cable 81 therefore tends to induce the blocks 39 and 41 to approach each other, thereby lifting the cutting edge 24 and in addition exerts tension tending to draw the pusher 51 rearwardly within the main bowl. Thus, upon tensioning of the cable 81, the cutting edge 24 is lifted after, while or before the pusher is drawn rearwardly, depending upon the relative resistance of the parts.

Somewhat similarly the cable 82 is trained around sheaves 97, 98 and 99 located on the frame member 12, extends through a loop 101 provided with a guide pulley 102 and is trained around a pulley 103 on the truck 56. It then extends around a pulley 104 mounted on the stationary side wall 21, passes then around a pair of pulleys 106 and 107 on the cross beam 52 and then passes around a pulley 108 on the side wall 19, around a pulley 109 on the truck 54 and finally is connected to an anchor 111 on the side wall 19.

Upon tensioning of the cable 82, the pulleys 103, 106, 107 and 109 are caused to approach the pulleys 104 and 108, thus drawing the pusher forwardly. At the same time, the cable 81 is normally slackened an equivalent amount, or is left alone and the necessary travel of the pulleys 92 and 93 results in a slight lifting of the cutting edge 24.

Upon appropriate operation of the cables 81 and 82 therefore, the pusher 51 is moved to and fro within the main bowl 22 and likewise the cutting edge 24 is raised and lowered with respect to the ground and the main bowl 22 is given a motion relative to the frame member 12.

As a result of mounting the front apron 53 by

means of the links 73 and 74, the front apron is able to partake substantially of its normal opening and closing movement as the pusher is advanced and retracted within the main bowl, but in addition the pusher can be left substantially in any selected position and as the cutting edge 24 is lowered, the front apron is automatically opened. Correspondingly, as the cutting edge is raised, the front apron is automatically closed. Thus, an additional function of the front apron is afforded without any extra control instrumentality and with a structure which is substantially standard except for the link mountings 73 and 74 and their appurtenances.

For example, as particularly shown in Fig. 5, the parts are all in substantially normal position for a carrying operation. If it is assumed that at the conclusion of the operation depicted in Fig. 5 it is desired to initiate an excavating operation, it is only necessary for the operator to lower the cutting edge sufficiently into the ground. During such movement, because of the linkage employed, the front apron automatically is opened an adequate amount to admit the ingress of the excavated earth. That is to say, no separate control is necessary to lift the front apron to provide such a throat opening and it is not necessary as it is with the excavator as shown in the mentioned Austin application to move the pusher somewhat forwardly in order to provide a partly open position of the front apron. It will be especially observed that the pusher in Figs. 5 and 6 is in its rearmost position in both instances and has not been moved therefrom despite the fact that the front apron has moved from a closed position in Fig. 5 into an adequately open position for excavating in Fig. 6.

If it is assumed that the device in Fig. 5 position is full of earth which it is desired to discharge and the pusher is brought forwardly for that purpose, then the front apron automatically opens with the movement of the pusher as shown in Fig. 7, a substantial opening being afforded when the pusher is approximately half way through its discharge stroke.

If, on the other hand, it is desired in comparison with the position of parts shown in Fig. 6 to have a much wider throat opening for excavation as it sometimes is because of large boulders or comparable obstructions, then it is quite possible with this arrangement by moving the pusher partly forward to attain an extremely large throat opening, although at the sacrifice of some main bowl capacity.

With the mounting of the front apron as shown, it is possible to have not only a fair throat opening during excavation without sacrificing any main bowl capacity whatsoever, but it is likewise possible to secure a good front apron opening for discharge and to move the front apron in excess of any automatic opening movement by a suitable operation of the pusher.

As a variation on the scheme disclosed in the remaining figures, there is shown in Figs. 9 to 12, inclusive, generally identical structure which differs, however, in that the front apron links 174, although connected in the same fashion to the front apron and although connected to the frame member, are connected to the frame member at a point somewhat to the rear of the apron connection and substantially coincident with the connection of the frame member to the main bowl. For example, the frame member 112 is connected to the main bowl 122 on a pivotal axis 118; while the rearward end of the links 174 is connected to brackets 179 on the frame member 112 on a pivotal axis 181 very close to the axis 118.

With this arrangement, as shown in Fig. 9, the position of the parts is comparable to that shown in Fig. 5 at maximum carry. Also, as disclosed by comparison of Figs. 10 and 6, when the cutting edge is lowered to excavate, the throat opening, or the amount of opening between the cutting edge and the lower edge of the front apron is substantially the same in either instance. However, as shown by comparison between Figs. 11 and 7, during a discharge operation for a relatively high spread, for example, when the pusher 151 is substantially half way forward on its discharge stroke, the front apron 163 is considerably farther open or has a much larger throat than with the Fig. 7 arrangement. This is an advantage if it is desired to have the front apron 163 opened very rapidly with respect to the forward movement of the pusher 151 and has the further characteristic that the pivotal connection between the pusher and the front apron as it moves forwardly during a discharge operation, for example, passes beneath the pivotal connection 172 between the links 174 and the front apron 163, so that such pivotal connection during the forward movement of the pusher ascends to a maximum height and then descends as the pusher concludes its forward motion. This effect is quite marked in the modification shown in Figs. 9 to 12, but little if any of it occurs with the modification shown in the other figures.

As illustrated in Fig. 12 which can be compared with Fig. 8, a larger throat opening can automatically be attained if desired. When the pusher is substantially half way forward and the cutting edge is in a lower position the throat opening is substantially the same in the Fig. 12 modification as it is in the Fig. 8 modification.

In either event, there is provided a structure in which the front apron is automatically opened as the cutting edge descends to cutting position to an amount which is appropriate for excavation and in which the front apron automatically closes to closed position as the cutting edge is drawn upwardly out of excavating position toward carry position. As shown in Fig. 1, when the cutting edge is thus above or substantially free of the ground and has substantially concluded excavating, the front apron is very nearly closed and for most soils, which are capable of bridging a relatively small gap, the front apron is in effect closed. Further ascending movement of the cutting edge, however, produces an absolute closure of the front apron on the cutting edge.

It is within the purview of my invention that some adjustment be provided, either in the mounting or length of the links, such as 74, in order to effectuate a reduction in the throat opening between the rear edge of the front apron and the cutting edge of the main bowl to any desired amount down to zero at any selected relative position of the front apron and main bowl.

In addition to the automatic opening of the front apron as the front edge drops to excavating position and automatic closing of the front apron as the cutting edge rises from excavating position, the front apron is raised and lowered in conjunction with the advancing and retracting movement of the pusher and even more, the advancing and retracting movement of the pusher can be combined with raising and lowering movement of the main bowl to produce by their joint

action a combined effect upon the relative position of the front apron.

I claim:

1. An excavator comprising a frame member, a main bowl movably related to said frame member, a pusher movable within said main bowl to discharge earth therefrom, a front apron movable with respect to said main bowl, means for interconnecting said pusher and said front apron, and a link pivoted at its rear end to said front apron and at its forward end to said frame member.

2. An excavator comprising a frame member, a main bowl movably related to said frame member, a pusher movable within said main bowl to discharge earth therefrom, a front apron movable with respect to said main bowl, a pivotal connection between said pusher and said front apron, a link, a pivotal connection between one end of said link and said front apron and a pivotal connection between the other end of said link and said frame member at a point forward of said front apron.

3. An excavator comprising: a frame member; a main bowl pivoted to said frame member; a pusher disposed within said main bowl for translatory movement therein; a front apron pivoted to said pusher; and a link pivoted at its rear end to said front apron and at its forward end to said frame member.

4. An excavator comprising: a frame member; a main bowl pivoted to said frame member; a pusher disposed within said main bowl for translatory movement therein; a front apron pivoted to said pusher; a link pivoted at its rear end to said front apron and at its forward end to said frame member; opposed pulley blocks mounted on said frame member for relative movement toward and away from each other; a first cable secured at one end to said main bowl and at its other end to one of said pulley blocks; a pulley wheel mounted on said main bowl to the rear of said pusher; and a second cable extending from the front end of said excavator over the pulleys of said pulley blocks rearwardly to said pulley wheel, over said pulley wheel in operative engagement with said pusher, so that forward movement of the front end of said second cable causes a retraction of said pusher and an elevation of the forward end of said main bowl.

5. An excavator comprising: a main bowl supported at its rear end by a pair of wheels and pivoted intermediate its ends to the forked rearwardly extending ends of a frame member, the forward end of said frame member being supported on a pair of wheels; a pusher disposed within said main bowl for relative rectilinear movement therewith; a front apron pivoted to the forward end of said pusher; a link pivoted at one end to said pusher and at its opposite end to said frame member at a point in advance of said pusher, so that pivotal movement is imparted to said front apron in response to relative movement between said main bowl and said frame member; opposed pulley blocks carried by said frame member for relative movement toward and away from each other; a first cable secured at one end to the forward end of said main bowl and at its opposite end to one of said pulley blocks; a pulley wheel carried by said main bowl to the rear of said pusher; and a second cable operatively associated at one end with said pusher and extending rearwardly over said pulley wheel and then forwardly to said opposed pulley blocks and around the pulleys of said blocks.

6. An excavator comprising: a frame member; a main bowl pivoted to said frame member; a pusher disposed within said main bowl for translatory movement therein; a front apron pivoted to said pusher; a link pivoted at its rear end to said front apron and at its forward end to said frame member; opposed pulley blocks mounted on said frame member for relative movement toward and away from each other, each of said pulley blocks being connected to said main bowl; a pulley wheel mounted on said main bowl to the rear of said pusher; and a cable extending from the front end of said excavator over the pulleys of said pulley blocks rearwardly to said pulley wheel, over said pulley wheel in operative engagement with said pusher, so that forward movement of the front end of said cable causes a retraction of said pusher and an elevation of the forward end of said main bowl.

ALONZO CHLOE COX.