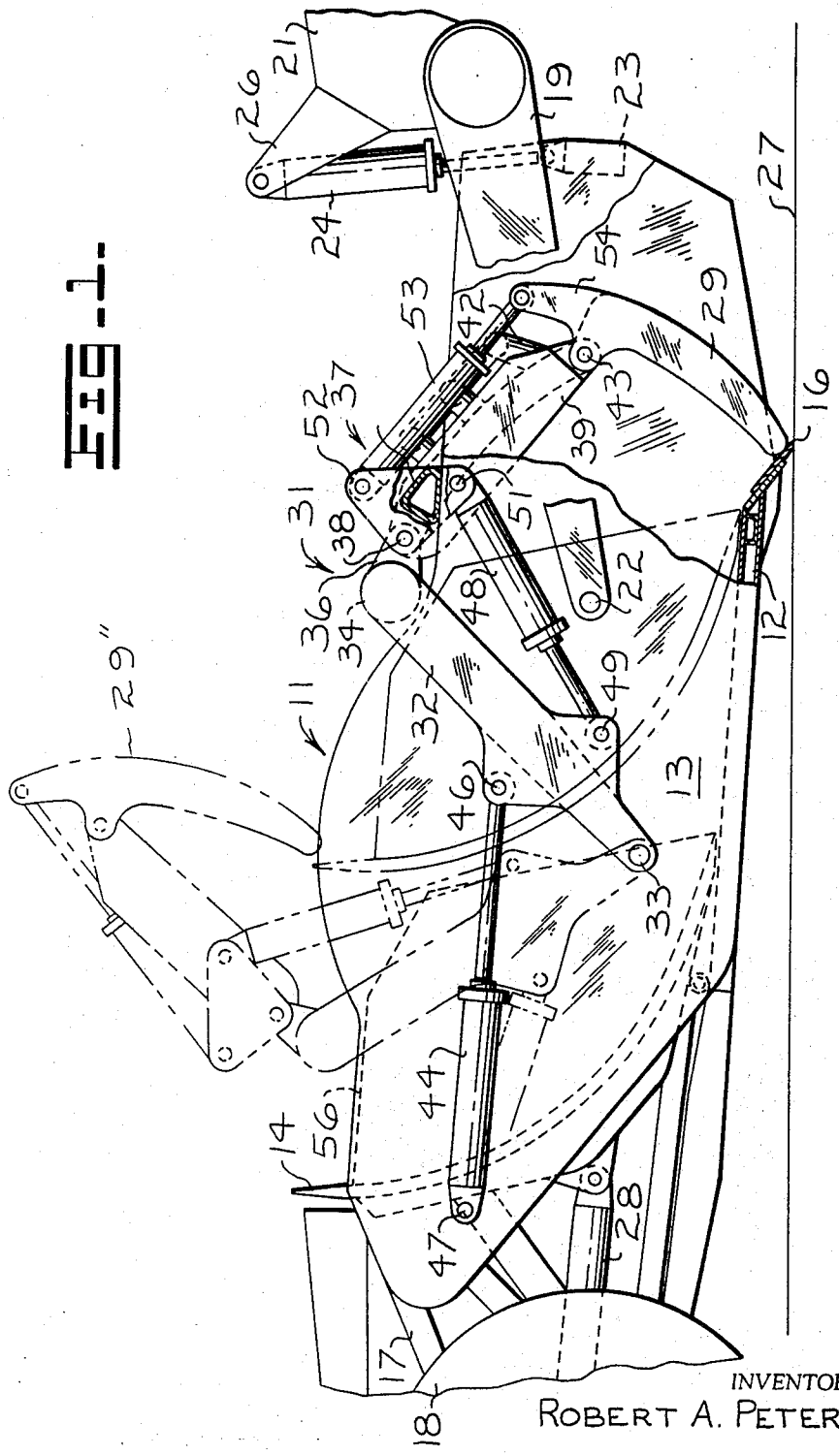
Oct. 14, 1969 R. A. PETERSON 3,471,952

EARTHMOVING SCRAPER WITH MULTIPLE ARTICULATED APRON STRUCTURE

Filed Oct. 27, 1966 3 Sheets-Sheet 1

Fig. 1.



INVENTOR.
ROBERT A. PETERSON

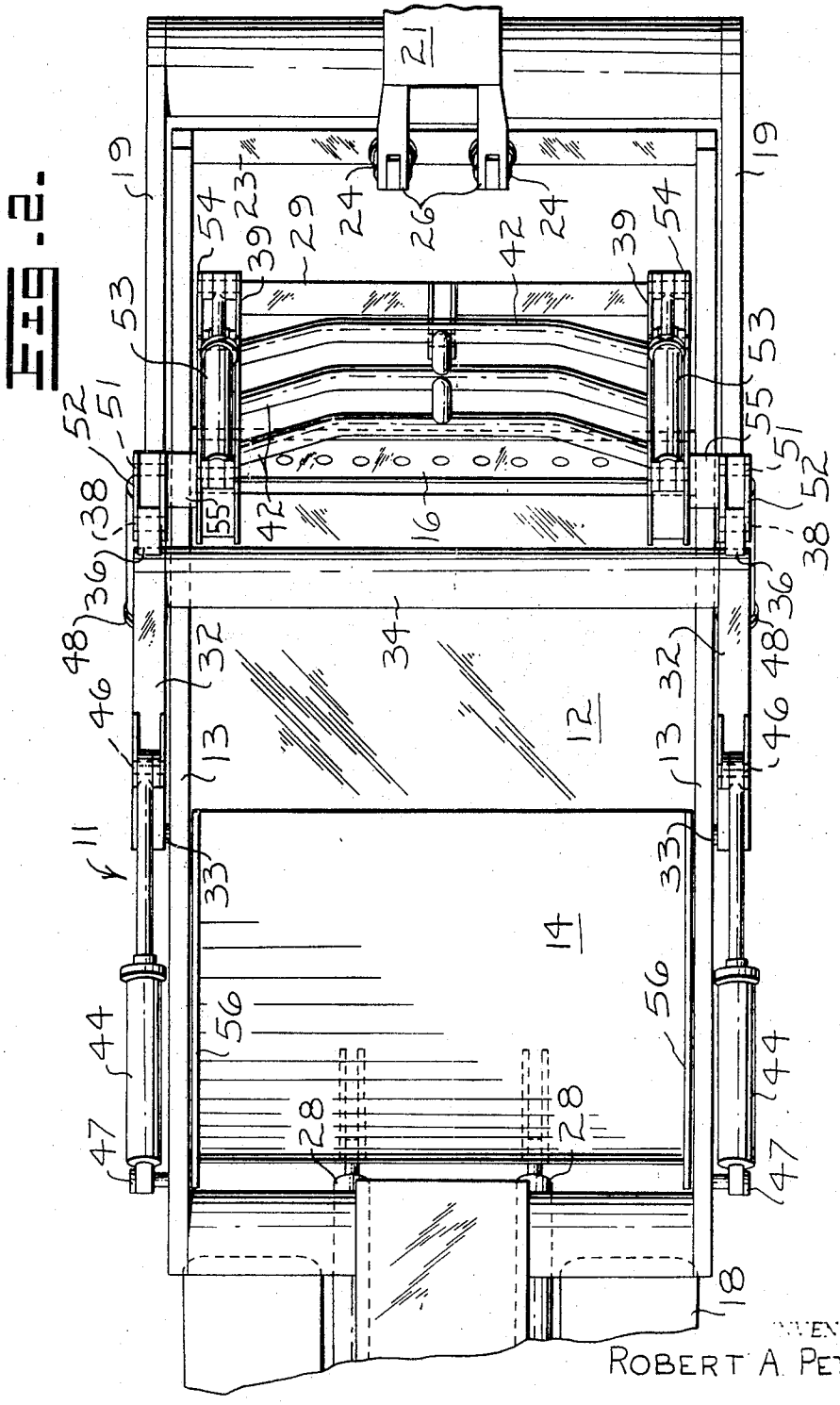
BY
Fryer, Tjensvold, Feix & Phillips
ATTORNEYS

Oct. 14, 1969 R. A. PETERSON 3,471,952

EARTHMOVING SCRAPER WITH MULTIPLE ARTICULATED APRON STRUCTURE

Filed Oct. 27, 1966 3 Sheets-Sheet 2

FIG. 2



INVENTOR
ROBERT A. PETERSON

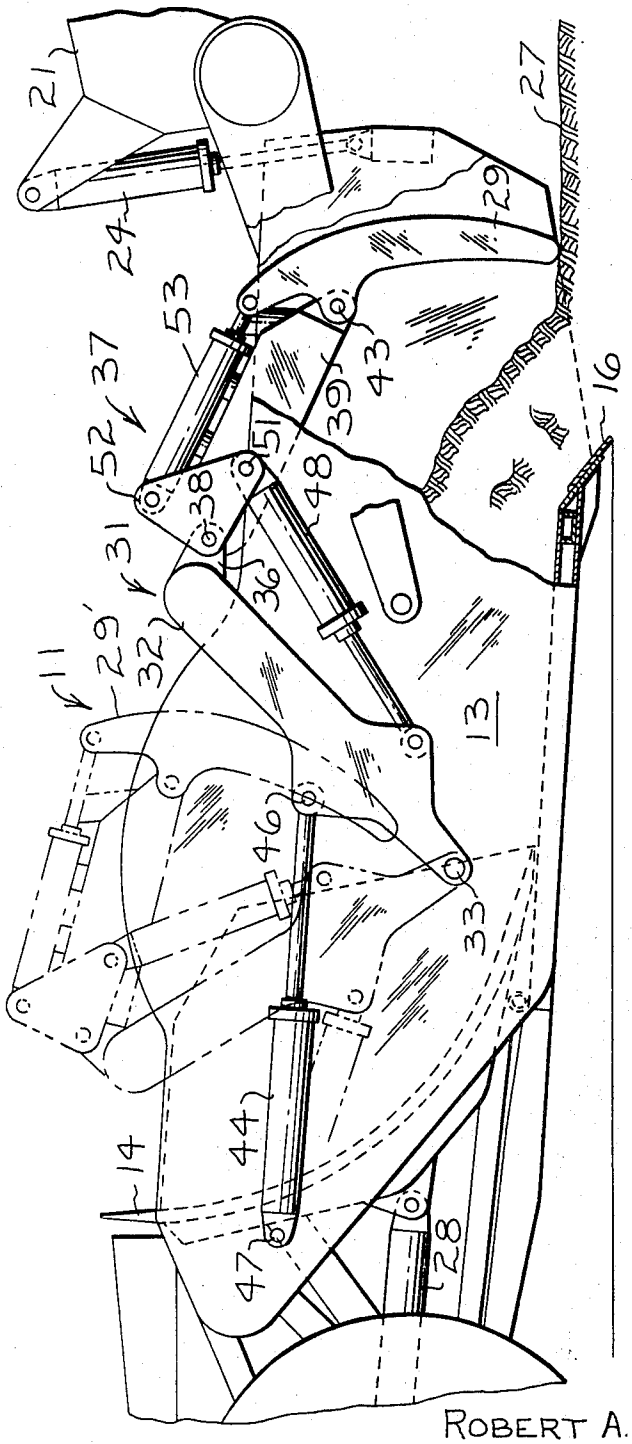
BY
Fryer, Tjensvold, Feix & Phillips
ATTORNEYS

Oct. 14, 1969 R. A. PETERSON 3,471,952

EARTHMOVING SCRAPER WITH MULTIPLE ARTICULATED APRON STRUCTURE

Filed Oct. 27, 1966 3 Sheets-Sheet 3

FIG. 3.



INVENTOR.
ROBERT A. PETERSON

BY
Fryer, Tjensvold, Feix & Phillips
ATTORNEYS

United States Patent Office 3,471,952 Patented Oct. 14, 1969

3,471,952

EARTHMOVING SCRAPER WITH MULTIPLE ARTICULATED APRON STRUCTURE

Robert A. Peterson, San Leandro, Calif., assignor to Caterpillar Tractor Co., Peoria, Ill., a corporation of California

Filed Oct. 27, 1966, Ser. No. 589,978
Int. Cl. E02f 3/62, 3/64
U.S. Cl. 37—129 10 Claims

ABSTRACT OF THE DISCLOSURE

A self-loading scraper is provided with a manipulatable apron which is coupled to the bowl of the scraper through an articulated support frame having three pivot axes together with powered means for flexing the structure about each of the axes whereby the apron may be made to undergo a variety of motions to facilitate the movement of earth into the bowl, to facilitate the ejection of material therefrom, to reach out and draw large objects into the bowl and to effect still other operations.

This invention relates to earthworking equipment and more particularly to tractor drawn scrapers of the class having a load carrying bowl with a cutting edge of directing earth into the bowl. The invention provides a multiple jointed apron assembly which may be manipulated through a variety of movements to provide for self loading, to facilitate ejection, and for other purposes.

A conventional earthmoving scraper depends upon the forward motion of the vehicle to force earth from the cutting blade up into the load carrying bowl. As the contents of a partially filled bowl offers substantial resistance to the entrance of additional material it has usually been necessary to make use of a pusher tractor, in addition to the tractor which draws the scraper, in order to completely fill the bowl so that the full load carrying capacity of the scraper is utilized. As this practice is costly and inefficient a variety of self loading scrapers have been developed.

The most commonly used form of self loading scraper is provided with a chain and flight elevator structure at the forward face of the bowl and above the cutting edge. The elevator functions to continually carry earth away from the immediate region of the cutting edge and thus lessens the resistance to entrance of additional soil into the bowl. Under many conditions, the elevator enables complete filling of the bowl without employing supplementary motive power.

However, elevator equipped self loading scrapers have been found to be subject to certain operating problems of their own. The elevator limits the size of the entrance opening into the bowl and thereby prevents the loading of boulders or other objects which are larger than some specific size. Further the elevator is particularly susceptible to jamming and damage from large boulders or other similar obstructions. Certain types of soils and soil conditions seriously interfere with elevator operation. Still another problem is encountered in that there are conditions under which the elevator will not insure full loading of the bowl and it becomes desirable to utilize a pusher tractor as with a conventional scraper. As the elevator partially obstructs the front of the scraper bowl, push loading is inefficient. Although multiple elevator speeds can be provided, the rate at which material is forced into the bowl by push loading is difficult to coordinate with that of the elevator.

To avoid some of these problems a second general class of self loading scraper has heretofore been proposed. Instead of an elevator, such scrapers have an apron mounted at the open front of the bowl in such a manner that it may be pivoted upward and downward and may be reciprocated in a horizontal direction. The apron may thus be made to undergo a kind of raking or hoeing motion to pull material into the bowl from the region of the blade. Scrapers of this class are not extensively used in the industry at present. This results at least in part from operational limitations of the apron manipulating mechanism as heretofore designed. The mechanism has been cumbersome while providing for only a very restricted variety of motions thereby limiting its utility for facilitating loading and preventing its use for other scraper operations.

The present invention is a scraper having a manipulatable apron mounted at the bowl by a multiple articulated structure with independent powered control of flexing at each joint so that the apron may be made to undergo a variety of movements within the bowl, above the bowl, and forwardly thereform. The extreme degree of manipulatability and the range of apron positions obtainable with this structure greatly facilitates a variety of scraper functions.

The apron of this invention may be readily manipulated to scoop material across the blade and into the bowl with any kind of a linear or curvilinear motion which may be appropriate to the circumstances and at any desired elevation with reference to the blade. The structure facilitates a kind of progressive loading in which the ejector is initially moved to a forward position in the bowl and loaded by the above described scooping action of the apron, after which the ejector is moved rearwardly carrying the contained material to the rear of the bowl and leaving the forward portion thereof available for receiving additional material. The apron may readily be lifted as high as might be necessary to receive boulders and other large objects into the bowl and may further be employed to reach forward and over such objects to forcibly load the object into the bowl.

The manipulatable apron may be lifted completely above the bowl during ejection of the load and may be moved down along the face of the ejector in a scraping movement to remove any lodged or sticky material therefrom.

Accordingly it is an object of this invention to provide a more versatile earthmoving scraper.

It is another object of this invention to provide a self loading scraper free from fixed mechanism restricting the opening at the load carrying bowl.

It is still another object of this invention to provide a more efficient and flexible self loading mechanism for earth moving scrapers.

It is a further object of the invention to provide a self loading scraper which may be push loaded without complications or problems where soil conditions make such operation necessary.

It is still another object of the invention to provide a self loading mechanism for a scraper which may be completely lifted from the bowl of the scraper during ejection of the contents thereof and which may be utilized to facilitate such ejection.

Still a further object of this invention is to provide a self loading earthmoving scraper having powered mechanism for facilitating the loading of large boulders and similar objects.

An additional object of the invention is to provide a self loading mechanism for an earthmoving scraper which may be used in conjunction with the ejector thereof to facilitate complete filling of the bowl of the scraper.

The invention together with further objects and advantages thereof will best be understood by reference to the

following specification in conjunction with the accompanying drawings of which:

FIGURE 1 is a side elevation view of the bowl and associated structure of an earthmoving scraper embodying the invention;

FIGURE 2 is a plan view of the scraper structure of FIGURE 1; and

FIGURE 3 is an additional side elevational view of the scraper structure of FIGURE 1 showing certain mechanisms thereof in moved positions for the purpose of facilitating loading of the scraper.

Referring now to the drawing and more particularly to FIGURES 1 and 2 in conjunction, a scraper of the class to which the invention is applicable has a load carrying bowl **11** generally formed by a floor **12**, sidewalls **13**, and with the rear wall being formed by a movable ejector **14**, the top and the forward face of the bowl being open. The cutting edge is formed by a blade **16** extending forwardly and downwardly from the front edge of floor **12**. The bowl **11** is supported at the back end by frame members **17** which extend to the rear wheel assembly **18** of the scraper. The bowl **11** is supported at the forward end by a pair of draft arms **19** which extend from a tractor hitch **21** back along each side of the bowl and which are connected thereto by pivots **22** situated at a central position on the bowl sidewalls **13**. The tractor which draws the scraper through hitch **21** and the rear wheel assembly **18** of the scraper may be of conventional construction and accordingly will not be herein described.

The bowl sidewalls **13** extend a substantial distance forward from the position of the cutting edge **16** and a cross beam **23** extends between the two sidewalls at the forward end thereof and at a level well above that of the cutting edge. Raising and lowering of the bowl **11** is effected by a pair of hydraulic jacks **24** connected between the cross beam **23** and a pair of arms **26** projecting rearwardly and upward from the tractor hitch **21**. Extension of jacks **24** thus pivots the entire bowl assembly **11** downward about the axis of rear wheels **18** to cause the cutting edge **16** to bite into the ground surface **27**. Forward motion of the scraper then causes a superficial layer of earth to be carried up over the edge **16** and into the bowl **11**. When the bowl **11** has been filled jacks **24** are contracted pivoting the bowl upward about rear wheels **18** into the load carrying position at which the scraper may travel at a relatively high speed to transport the earth away from the site. Discharge of the contents of the bowl **11** is accomplished by extension of a second pair of jacks **28**, connected between the ejector **14** and the rear wheel assembly **18**, which move the ejector forward towards the cutting edge **16**.

In order to utilize completely the load carrying capacity of the bowl **11**, means must be provided to hold the material therein at the open forward end. In a conventional scraper a singly pivoted apron closure is used for this purpose and most self loading scrapers employ an earth elevator extending upwardly at the front of the bowl.

This invention provides an apron **29** carried on an articulated support assembly **31** which provides for manipulation of the apron forwardly and rearwardly, up and down and angularly with respect to an axis transverse to the bowl **11**. Any combination of these movements may be made simultaneously so that the apron **29** may be maneuvered in what ever manner may be desirable to facilitate scooping of material into the bowl **11** and to assist other scraper operations.

Considering now the detailed structure of apron support assembly **31**, a pair of arms **32** are situated one on each side of the bowl **11** with the lower end of each arm being coupled thereto by pivots **33**. A cylindrical cross member **34** connects the opposite end of arms **32** above the bowl sidewalls **13** which preferably have a circular profile at the upper edge to maximize load carrying capacity while providing for pivoting of the arms **32** and cross member **34** about pins **33**.

An extension **36** projects a short distance from the upper end of each arm **32**, at an angle with respect thereto, to pivotally connect with one end of an intermediate frame section **37** at pivots **38**. Frame section **37** is formed by side members **39** which are connected by a series of transverse tubular reinforcing members **42**. In addition to reinforcing the intermediate frame section **37**, the tubular cross members **42** serve to aid in retaining material at the forward end of the bowl **11** when the apron **29** is moved to the load carrying position. Apron **29**, which has an arcuate profile, is coupled to the end of intermediate frame section **37** opposite pivots **38** by an additional set of pivots **43** near the upper edge of the apron.

Thus complete flexibility of movement of the apron **29** in the forward, rearward, vertical, and angular directions is afforded inasmuch as the apron may be pivoted with respect to intermediate frame **37**, which in turn may pivot with respect to the arms **32**, and the arms **32** are in turn pivotable about a transverse axis through the bowl. Mechanism for effecting and controlling such motion includes a first pair of double acting hydraulic jacks **44** each being coupled to one of the arms **32** at a pivot **46** situated at an intermediate point therealong and being coupled at the opposite end to a side wall **13** of the bowl **11** at a pivot **47** situated rearwardly from the pivot **46**. Extension of jacks **44** therefore pivots the arms **32** forwardly while retraction of the jacks **44** swings the arms to the rear.

Pivoting of the intermediate frame section **37** relative to arms **32** is controlled by a second pair of jacks **48** each of which is connected between a pivot **49** at an intermediate point on one of the arms **32** and a pivot **51** on one of a pair of triangular pivot bracket assemblies **52** secured to the intermediate frame section **37** at the end thereof closest to arms **32**. A pair of stops **55** secured to the brackets **52** and side members **39** are positioned to contact the top edges of the bowl side walls **13** to limit inward pivoting of the apron assembly.

A corner of each pivot bracket **52** projects upwardly and an end of one of a third pair of double acting hydraulic jacks **53** is pivotally coupled thereto. The opposite end of each jack **53** is pivoted to an arm **54** which extends a short distance upward from the apron **29**. Thus the third set of jacks **53** may be utilized to pivot the apron **29** with respect to the intermediate frame section **37**. The three sets of hydraulic jacks **44**, **48** and **53** are preferably controlled from the operator's station of the tractor which draws the scraper, suitable control systems for such jacks being understood within the art.

Considering now typical manipulations of the apron **29** which may advantageously be made during operation of the scraper, extension of jacks **44** accompanied by a partial extension of jacks **48** and **53** will position the apron **29** at the cutting blade **16** with the upper edge of the apron being situated above and forwardly therefrom as illustrated in FIGURE 1 in particular. This is the normal position of the apron for transporting a load. Referring now to FIGURE 3 further extension of jacks **48**, generally accompanied by contraction of jacks **53**, positions the lower edge of the apron **29** forwardly from the cutting edge **16** and slightly above the cutting edge so that the edge may bite into the surface soil layer **27** and guide soil backwardly into the bowl **11**. At this stage of operation soil will tend to mound up immediately above the cutting edge **16** and movement of such soil back into the bowl **11** may be assisted by contracting jacks **44** and **48** while extending jacks **53** so that the apron **29** performs a kind of scooping motion back into the position illustrated at **29'**. This movement of the apron **29** may be cyclically repeated during loading of the scraper bowl **11** while the scraper is in motion, and will generally eliminate any need for use of a pusher tractor with the scraper.

Referring now again to FIGURE 1, the availability of the kind of apron motion described above facilitates an advantageous use of the ejector **14** to assist loading. In particular, at the start of loading the jacks **28** may be

actuated to move ejector **14** forward so that the lower edge of the ejector is adjacent the cutting blade **16**. Apron **29** may then be manipulated to load soil onto the ejector **14** after which jacks **28** are contracted to draw the ejector to the rear of the bowl carrying the soil with it. Thus in contrast to a conventional scraper the initial loading is at the rear of the bowl leaving the forward portion unobstructed and capable of receiving additional soil without resistance. Ejector **14** preferably has sidewalls **56** to facilitate such use of the ejector in carrying material to the rear of the bowl **11**.

During discharge of the soil from bowl **11** apron **29** may be lifted completely above the bowl by contracting jacks **44** while extending jacks **48** as illustrated at **29''** in FIGURE 1. Ejector **14** may then be driven forward by extension of jacks **28** to force the contents of the bowl out of the open forward end thereof. Should soil or other materials stick to the ejector **14**, jacks **48** and **53** may be progressively contracted while jacks **44** are gradually extended to cause the lower end of apron **29** to sweep downward and forward along the face of the ejector and forcibly wipe lodged material therefrom.

It will be apparent that by the appropriate operation of the several jacks **44**, **48** and **53** various other operations may be accomplished. For example the apron **29** may extend forwardly from the cutting edge **16** above some large object such as a boulder and may then be utilized to draw the object back and up into the bowl **11**.

While the invention has been disclosed with respect to a specific embodiment for purposes of example it will be apparent that numerous modifications are possible within the scope of the invention and it is not intended to limit the invention except as defined in the following claims.

What is claimed is:

1. In an earthmoving scraper of the class having a scraper body with a load carrying bowl which is open at the front end and having a cutting edge for guiding material into said bowl as said scraper moves forwardly, a mechanism for facilitating loading and other operations comprising, in combination, an apron member disposed transversely with respect to said bowl, an articulated apron support extending between said bowl and said apron and having at least first and second sections with a first pivot connection therebetween, a second pivot connection coupling said apron to said first support section, a third pivot connection coupling said second support section to said scraper body, first actuating means having an end connected to said apron and another end connected to said first section for pivoting said apron with respect to said first support section about said second pivot connection independently of pivoting motion about said first and third pivot connections, second actuating means having an end connected to said first section and another end connected to said second section for pivoting said first section of said support relative to said second section thereof about said first pivot connection independently of pivoting motion about said second and third pivot connections, and third actuating means having an end connected to said second section and another end connected to said scraper body for pivoting said second support section relative to said bowl about said third pivot connection independently of pivoting motion about said first and second pivot connections.

2. Mechanism as defined in claim **1** wherein said third pivot connection is situated above said cutting edge and rearwardly therefrom.

3. Mechanism as defined in claim **2** wherein said first and second sections of said support have a combined length exceeding the distance between said third pivot connection and said cutting edge whereby said apron may be moved forwardly from said cutting edge.

4. Mechanism as defined in claim **2** wherein said first and second sections of said support have a combined length which exceeds the distance from said third pivot connection to the top of said bowl by an amount at least equal to the height of said apron whereby said apron may be lifted above said bowl while in a substantially upright orientation.

5. Mechanism as defined in claim **1** wherein said second section of said apron support is comprised of a pair of arms each extending along an opposite side of said bowl and being coupled thereto by said third pivot connection.

6. Mechanism as defined in claim **5** wherein a cross member extends between said arms at the ends thereof remote from said third pivot connection and wherein the sidewalls of said bowl have an arcuate profile at the upper edge conforming to the arc traveled by said cross member as said arms are pivoted whereby the load carrying capacity of said bowl is maximized while providing for maximum manipulatability of said apron.

7. Mechanism as defined in claim **1** wherein said first section of said apron support is a framework extending transversely for substantially the full width of said bowl whereby said first section in conjunction with said apron may be positioned to retain material in said bowl at said open forward end thereof.

8. Mechanism as defined in claim **1** wherein said first and second and third actuating means are double acting fluid operated jacks.

9. Mechanism as defined in claim **1** wherein said first section of said apron support is comprised of a pair of side members each coupled to said apron by said second pivot connection and which are spaced apart a distance less than the width of said bowl whereby said apron and first support section may be manipulated within said bowl, and wherein said second section of said apron support is comprised of a pair of arms each extending along an opposite side of said bowl and being coupled to one of said first section side members by portions of said first pivot connection which are transverse to the sides of said bowl.

10. Mechanism as defined in claim **9** wherein said first actuating means comprises a first pair of double acting hydraulic jacks each being connected between said apron and one of said side members of said first section of said apron support, and wherein said second actuating means comprises a second pair of double acting hydraulic jacks each being coupled between one of said arms and one of said side members of said first section of said apron support and wherein said third actuating means is comprised of a third pair of double acting hydraulic jacks each being connected between one of said arms and said scraper body.

References Cited

UNITED STATES PATENTS

2,207,424	7/1940	Wood	37—126
2,795,872	6/1957	Wardle	37—126
3,052,996	9/1962	Holopainen	37—124 XR
3,060,601	10/1962	Reynolds	37—126
3,067,888	12/1962	Reynolds	37—126 XR
3,105,311	10/1963	Hait	37—126 XR
3,221,424	12/1965	Hancock	37—129
3,235,983	2/1966	Wilson	37—126
3,235,984	2/1966	Wilson	37—126

EDGAR S. BURR, Primary Examiner

U.S. Cl. X.R.

37—126

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,471,952 October 14, 1

Robert A. Peterson

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 5, line 64, after "wherein" insert -- the pivot axis of --; line 65, after "is" insert -- fixed relative to said bowl and is --.

Signed and sealed this 10th day of March 1970.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents