Feb. 9, 1960 S. A. O. BODIN 2,924,345

DIGGING-BUCKET FOR LOADING MACHINES

Filed Oct. 3, 1957 2 Sheets-Sheet 1

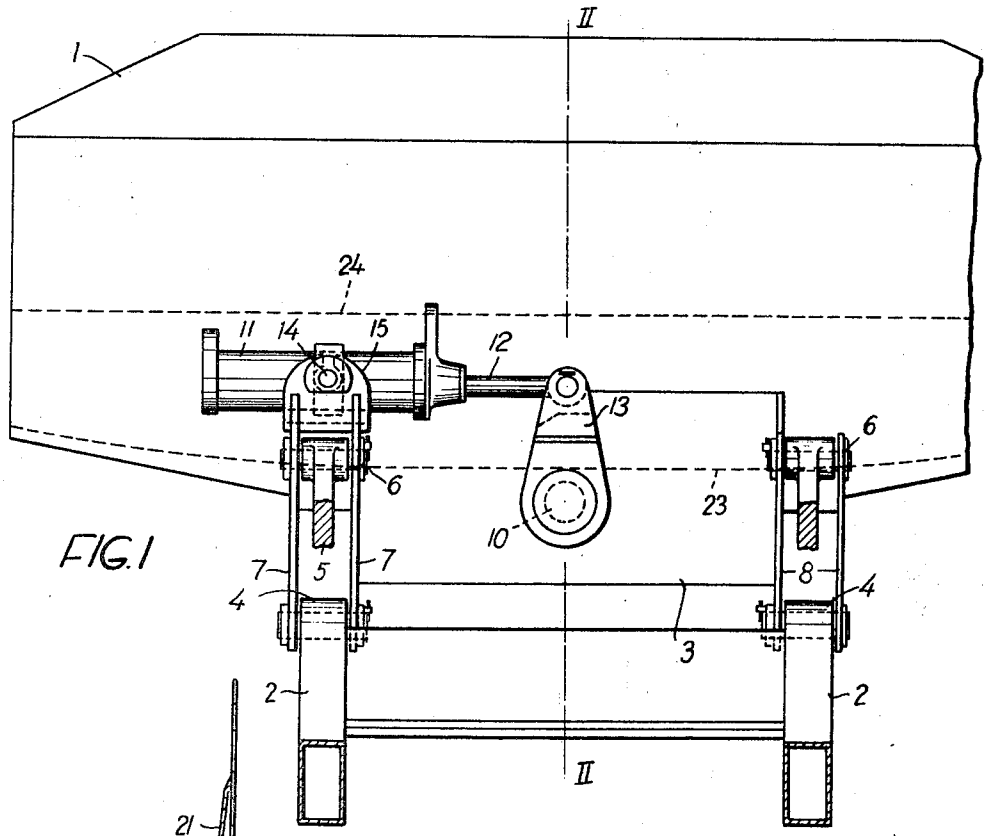


FIG. 1

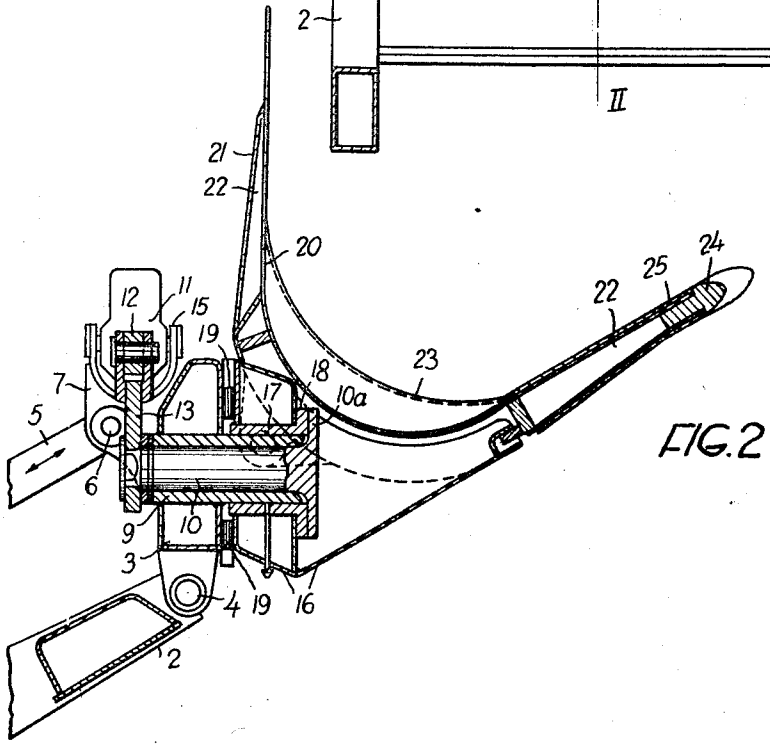


FIG. 2

Feb. 9, 1960 S. A. O. BODIN 2,924,345

DIGGING-BUCKET FOR LOADING MACHINES

Filed Oct. 3, 1957 2 Sheets-Sheet 2

FIG.3

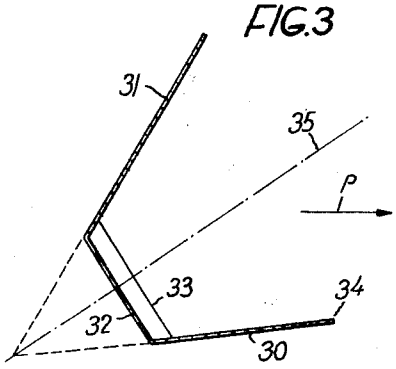


FIG.4

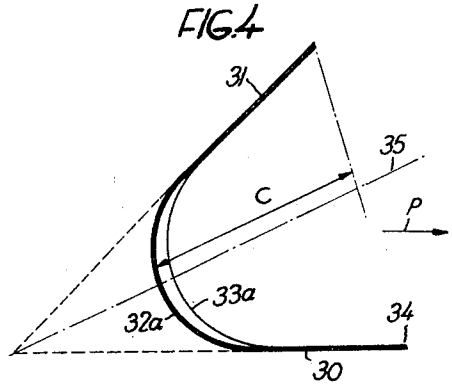


FIG.5

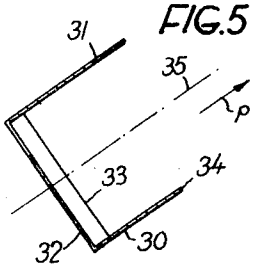


FIG.6

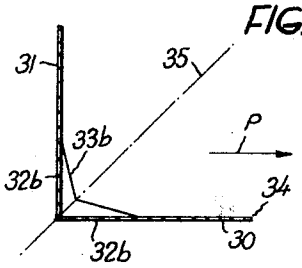


FIG.7

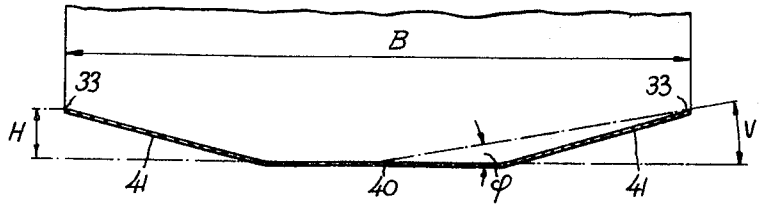
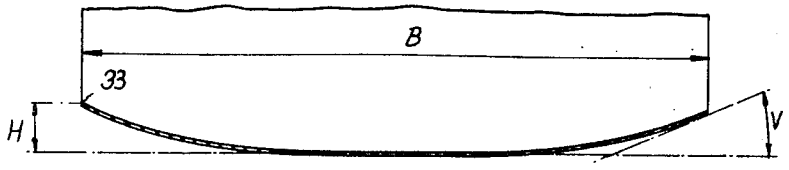


FIG.8



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2,924,345

DIGGING-BUCKET FOR LOADING MACHINES

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6 Claims. (Cl. 214—145)

This invention relates to a digging-bucket for loading machines. The bucket according to the invention is particularly intended for digging and loading of rock, such as blasted rock, as well as sand, gravel, till and similar material. Conventional buckets for digging machines are provided with vertical side walls. The object of the invention is to eliminate disadvantages which result from these side walls and which hitherto have been disregarded or considered as unavoidable inconveniences. The side walls result in a considerable resistance during the digging operation and may be considered, in this respect, as extensions of the digging edge of the bucket. Moreover, they often make the digging work difficult or even impossible if the material to be handled consists of rocks or similar materials. If a relative large rock happens to be located right in front of one of the side walls of the bucket and particularly in the case where the rock is located in front of the corner between the digging edge and one of the side walls, it may be entirely impossible to force the bucket into the material to be loaded, resulting in that the operation has to be repeated with corresponding waste of time.

I attain the above object by mechanism described hereinbelow with reference to the annexed drawing, in which—

Fig. 1 is a rear view of the improved digging-bucket with appertaining load-carrying arms. Fig. 2 is a vertical sectional view taken along the line II—II of Fig. 1. Figs. 3 to 6 are views similar to Fig. 2 illustrating in an entirely diagrammatic manner several modifications of the shape of the bucket as viewed in a vertical section parallel to the digging direction. Fig. 7 is a sectional view of the bottom of the bucket, the section being taken along a plane at right angles to the digging direction, and Fig. 8 is a similar sectional view of a modified form of construction.

Referring to Figs. 1 and 2, the bucket is carried by a loading machine in a manner such as to be able to be tilted laterally relative to the digging direction and the loading machine so that the load can be dumped onto trucks which are run along the side of the loading machine. Due to the fact that the bucket lacks vertical side walls and as a result of an appropriate design of the curvature of the bottom of the bucket at right angles to the digging direction, the load can be dumped at a comparatively small tipping angle.

Reference numeral **1** denotes the bucket and numerals **2** denote load-carrying arms which in a conventional manner are pivotally mounted on a loading machine (not shown) for angular movement in a vertical direction. Numeral **3** denotes a bucket carrier which by means of horizontal pivots **4** is mounted for angular movement at the outer ends of the load-carrying arms **2**. The carrier **3** is rigidly connected with arms **7** and **8** which by means of pivots **6** are articulated to the ends of control rods **5**. The control rods are longitudinally movable by means of hydraulic cylinders (not shown) on the loading machine in a manner such that the carrier **3** together

with the bucket **1** can be moved angularly in a vertical plane extending in the digging direction.

The carrier **3** is a box-shaped sheet-metal structure which comprises a bush **9** for a pivot **10** rigidly connected with the bucket **1**. The pivot **10** is located at the center of the bucket and has its axis located in a vertical plane which extends longitudinally of the loading machine. Consequently, when the pivot **10** is turned the bucket will be tilted laterally. To this end, an arm **13** rigidly mounted on the pivot **10** is articulated to a piston rod **12** which forms part of a hydraulic cylinder **11**. By means of pivots **14**, the cylinder **11** is mounted in a stirrup-shaped member **15** rigidly secured to the carrier **3**.

The bucket **1** is provided with a box-shaped fastening member **16** consisting of sheet-metal and comprising a sleeve **17** having a flange **18**. The pivot **10** has a flange **10***a* which is rigidly connected with the flange **18**. Between the carrier **3** and the fastening member **16** there are provided recessed supports **19** which are secured to one of the parts **3** or **16**, while the other part has a strong latch which can be operated from the loading machine and is adapted to enter the recesses in the supports when the bucket assumes its horizontal digging position. In this position, the latch device reacts to bending forces on the bucket so as to relieve the servo-device **11**, **12**, **13** which may be constructed in such a manner that a double-acting piston in the cylinder **11** can be maintained in any desired position by fluid under pressure.

The bucket exemplified in Fig. 2 comprises an inner sheet-metal plate **20** and an outer sheet-metal plate **21** which are differently curved. The bottom part **23** of each plate is curved in two perpendicular planes, one of said planes extending in the digging direction and the other one at right angles thereto. Between the plates **20** and **21** there are webs **22** which may extend substantially in the digging direction, or, alternatively, at right angles thereto. At the front end of the bucket, the plates **20**, **21** are connected to a digging edge **24** which consists of a wear-resisting material. Rearwardly of the edge **24** a wear plate **25** is provided at the inside of the bucket.

If the bucket is to be used for rock loading, the front edge **24** may be centrally pointed or curved in the forward direction as viewed from above. When used for digging sand, gravel, till or similar material, the front or digging edge **24** may be straight, but provided with widely spaced apart teeth.

The shape of the bucket may vary depending upon the nature of the material to be handled and the working conditions. The bucket shown in Fig. 3 in a vertical section along a plane extending in the digging direction *p* has a straight front wall **30** and a straight rear wall **31**. As viewed in this section, the bottom **32** and the lateral edge **33** of the bottom are also represented by straight lines. The bucket is shown in its digging position, the front or digging edge being indicated at **34**. Numeral **35** denotes the transverse plane of symmetry of the bucket. If the bucket is mounted for side dumping, the plane **35** will be vertical or almost vertical in the dumping position of the bucket.

In the embodiment illustrated in Fig. 4, the bottom of the bucket is well rounded similar to Fig. 2. According to Fig. 5, the front wall **30** and the rear wall **31** of the bucket are substantially parallel to each other, whereas in the embodiment shown in Fig. 6 they are located substantially at right angles to each other. As viewed in the section of Fig. 6, the bottom **32***b* as well as its lateral edges **33***b* are composed of straight parts making an angle with each other. Alternatively, the lateral edges may be slightly curved.

Figs. 7 and 8 are sectional views of the bottom of the bucket, the sections being taken along the plane **35** in Figs. 3 to 6 at right angles to the digging direction. The

width of the bottom is indicated at B, whereas H denotes the distance from the outer edges 33 of the bottom to a plane tangent to the lowermost part of the bottom. In accordance with the invention, the distance H is between

$$\frac{B}{a}$$

and

$$\frac{B}{5}$$

Accordingly, the shape of the bottom as viewed in this section may be straight or slightly curved. In practical design the distance H may vary between

$$\frac{B}{100}$$

and

$$\frac{B}{10}$$

to

$$\frac{B}{8}$$

and preferably between

$$\frac{B}{60}$$

and

$$\frac{B}{8}$$

In Fig. 7, the bottom of the bucket is composed of parts making an angle with each other. The central part 40 is substantially horizontal, whereas the lateral bottom parts 41 are inclined toward the central part by an angle ν which should be smaller than 60°. In a side dump bucket as illustrated in Figs. 1 and 2 the angle ν should not exceed 35°. The positions of the edges 33 may instead be defined by the angle between the horizontal line through the central part 40 and a line extending from the center of the bottom to the edge 33. In a side dump bucket for blasted rocks and the like material, the last named angle is between 0° and about 7° and preferably between 1° and 5°. The maximum load is obtained with an angle of about 3°. For sand, till and similar material, the angle φ is between 0° and about 12° and preferably between 2° and 10°, the maximum load being obtained with about 6°. For a universal bucket the ideal value of the angle φ is between 4° and 5°. The above values are theoretical and may be somewhat altered in practical constructions. They are calculated for the maximum filling-degree and suitable dumping conditions. The shape of the bottom may be altered such as to coincide with the upper leg of the angle φ.

In the modification shown in Fig. 8, the bottom is slightly curved at least at its lateral ends. The greatest angle ν between a line tangent to the bottom and the horizontal line is preferably smaller than 35° for side dump buckets.

In buckets not intended for side dumping the angles ν and φ may be greater, but the firstnamed angle should not exceed 60°.

The digging side 30 should be plane or substantially plane so as to exert as little resistance as possible during the digging operation. Due to the fact that the bucket is laterally open and thus lacks upstanding edges which make the digging work more difficult, the bucket may be made considerably wider than conventional types having the same digging-resistance, thus enabling a higher filling-degree and facilitating the digging work and tilting of the bucket and shortening the time of operation.

The ratio between the depth c (Fig. 4) and width B of the bucket should be greater than 0.1:1 and preferably greater than 0.15:1.

What I claim is:

1. In combination with an earth-digging front-loading machine having a vertically-movable longitudinally-arranged support arm; a digging and earth transporting side-dump bucket pivotally connected to said support arm about a pivot axis in the plane of the longitudinal axis of the machine, said bucket having in vertical longitudinal cross-section a generally U-shaped configuration and consisting solely of forwardly extending first and third bucket walls joined at their adjacent rear edges by a transverse second bucket wall, said second wall having in transverse cross-section a generally concave configuration with the distance between each of the free side edges of said second wall and a plane tangent to the central portion of said second wall being no greater than one-fifth of the width of the bucket.

2. Apparatus as defined in claim 1 wherein said distance between each of the free edges of said second wall and said plane tangent to the central portion of said second wall lies between the range of one-sixtieth to one-eighth of the width of the bucket.

3. Apparatus as defined in claim 2 wherein said second wall has in transverse cross-section a flat central portion and flat outer portions angularly inclined relative thereto, the angle between the plane of said flat central portion and a plane containing the longitudinal central axis of said central portion and a free side edge of the bucket second wall being less than 12°.

4. Apparatus as defined in claim 1 wherein said second wall is curved throughout its width.

5. Apparatus as defined in claim 1 wherein each of said bucket walls consists of a pair of spaced plates having reinforcing webs therein extending in vertical planes parallel to the longitudinal axis of the machine.

6. In combination with an earth-digging front-loading machine having a movable support arm, a digging and earth transporting side-dump bucket connected to said support arm for oscillatory movement in a plane normal to the plane of the longitudinal axis of the machine, and means for moving said bucket relative to said support arm; the invention wherein said bucket has in vertical longitudinal cross-section a generally U-shaped configuration consisting solely of first and third bucket walls joined at their adjacent corresponding edges by a transverse second bucket wall, said second wall having in transverse cross-section a generally concave configuration with the distance between each of the free side edges of said second wall and a plane tangent to the central portion of said second wall being no greater than one-fifth of the width of the bucket.

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