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Clark

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[54] **ATTACHMENT FOR BACKHOE BUCKET**

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[52] **U.S. Cl.**..... **37/118 R,** 37/80 A, 37/103, 214/145

[51] **Int. Cl.**..... **E02f 5/02**

[58] **Field of Search** .. 214/138, 145; 37/103, 118 R, 37/118 A, 141 R, 80 A

[56] **References Cited**

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[57] **ABSTRACT**

A pair of triangular wings are detachably mounted on the opposite side panels of a backhoe bucket to enable the same bucket to be used efficiently to dig excavations with sloped sidewalls or with conventional vertical walls.

4 Claims, 5 Drawing Figures

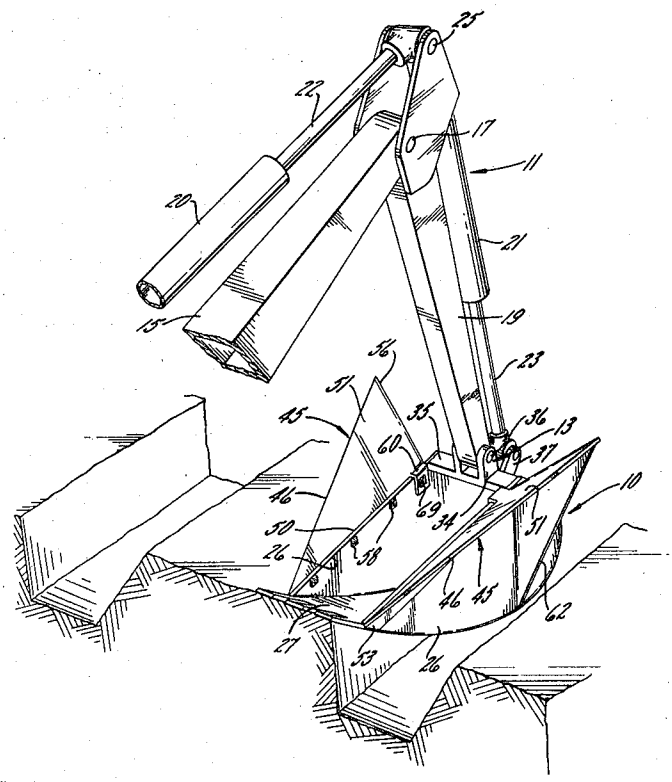


Fig. 1

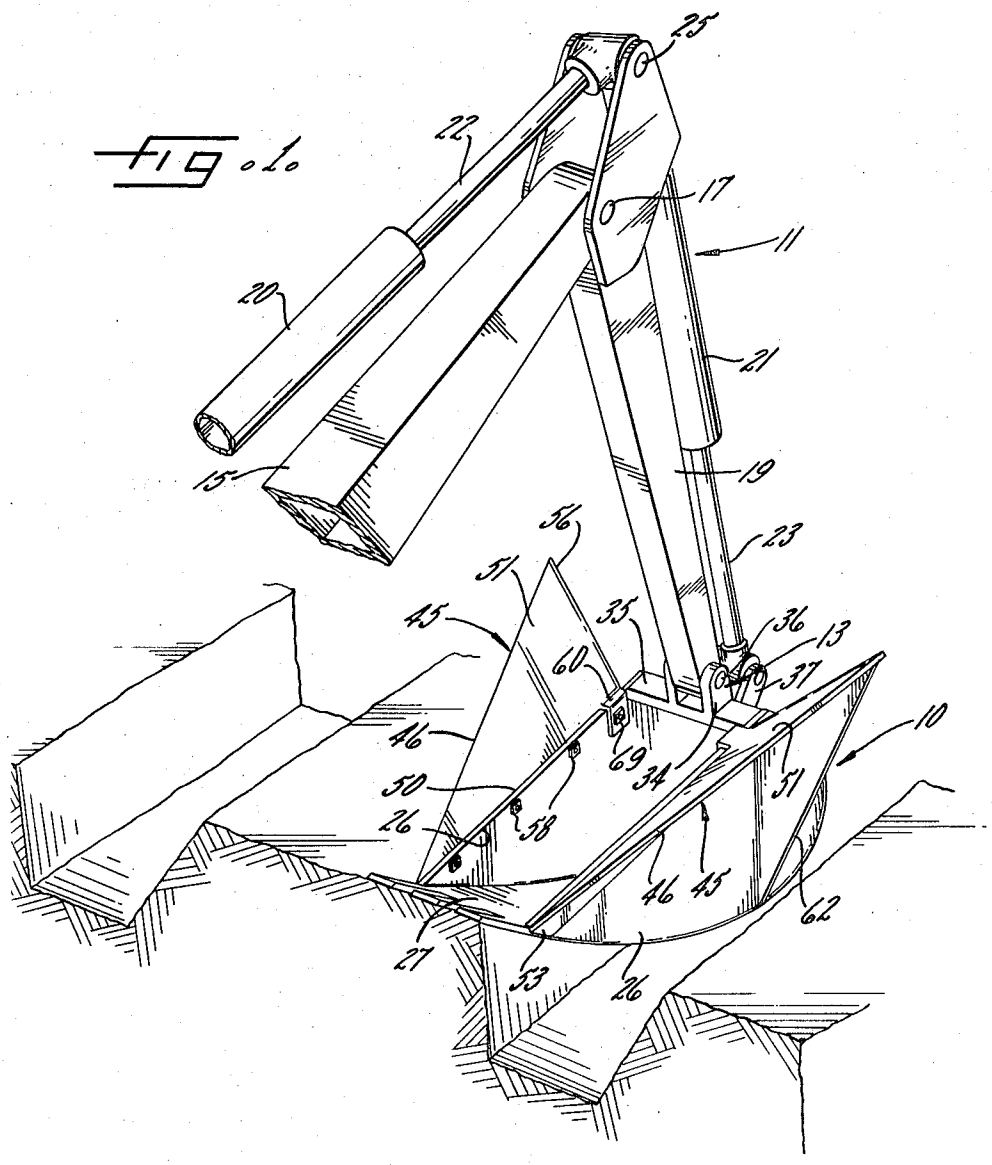
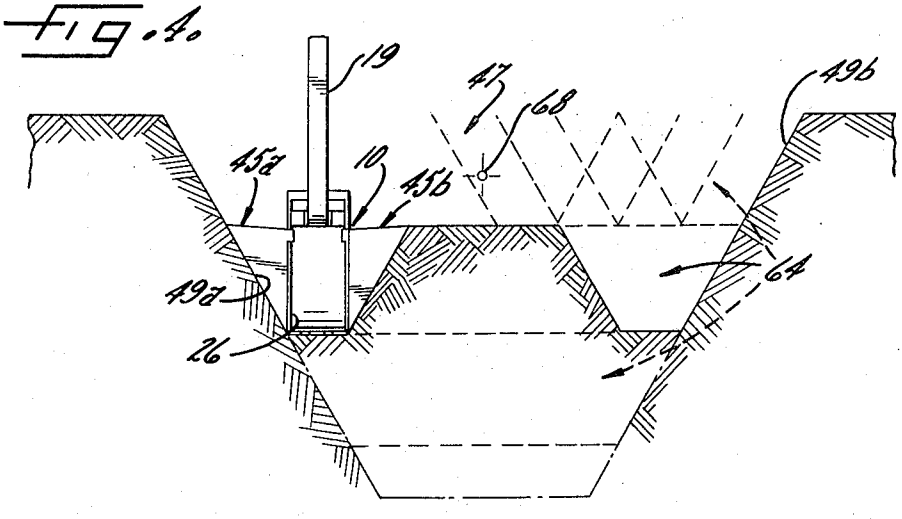

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23
51
45
35
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13
60
37
10
46
69
34
50
58
26
62
27
53

Fig. 4


19
47
68
49b
45a
10
45b
64
49a
26

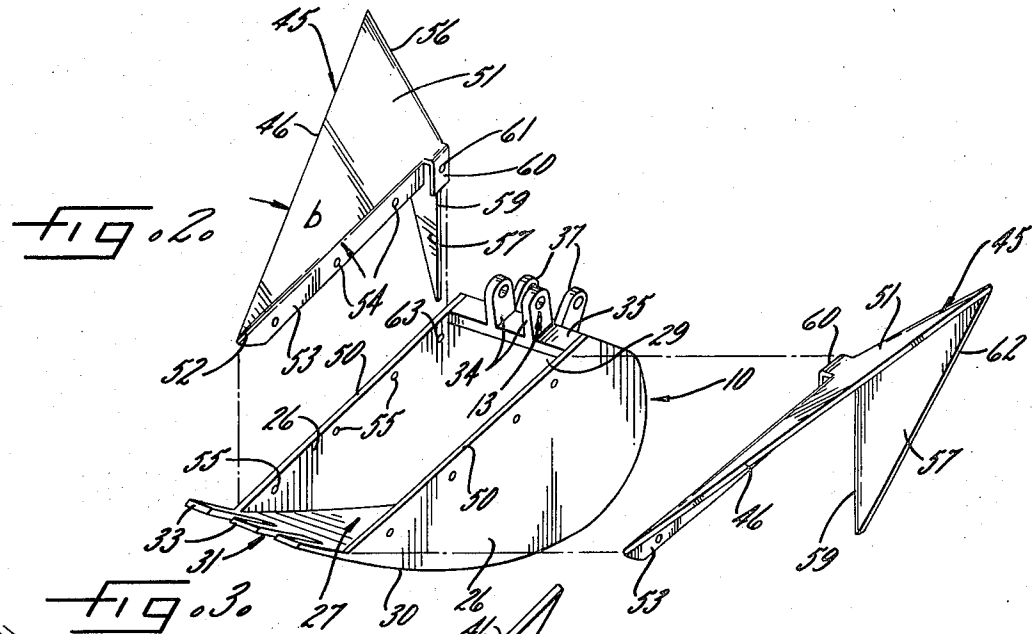


Fig. 2.

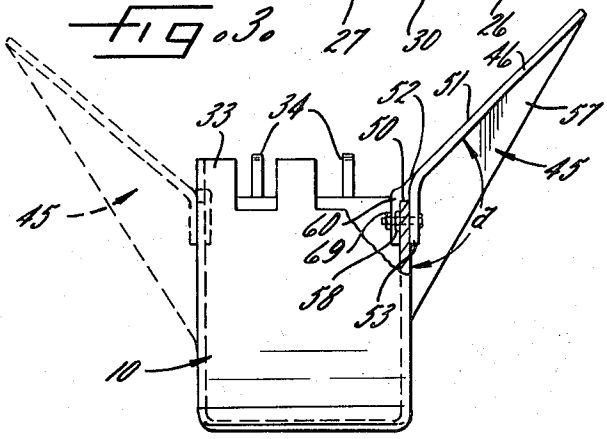


Fig. 3.

Fig. 5.

ATTACHMENT FOR BACKHOE BUCKET

BACKGROUND OF THE INVENTION

This invention relates generally to a backhoe bucket for use in digging a trench or other excavation and, more particularly, to a bucket for digging an excavation with sidewalls which slope upwardly and outwardly from the bottom of the excavation to reduce the danger of the sidewalls caving in.

SUMMARY OF THE INVENTION

The primary object of the present invention is to provide a unique attachment for use with a conventional backhoe bucket to enable the same bucket to be used selectively and efficiently to dig excavations with sloped sidewalls or to dig standard excavations with vertical sidewalls.

A more detailed object of the invention is to accomplish the foregoing through the provision of novel wings adapted to be mounted detachably on opposite sides of the bucket so that the sloped sidewalls are formed by the slicing action of the outer edges of the wings as the bucket is operated in a normal fashion to dig the excavation. When the wings are removed, the bucket can be used to dig a standard vertical excavation without the wings resisting movement of the bucket through the earth and without the wings interfering with the maneuverability of the bucket.

The invention also resides in the novel shape of the wings and in the unique arrangement for attaching and supporting the wings on the opposite side panels of the bucket.

These and other objects and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary perspective view of a backhoe equipped with a digging bucket embodying the novel features of the present invention.

FIG. 2 is an exploded perspective view of the digging bucket.

FIG. 3 is an end view of the bucket with parts broken away and shown in section.

FIG. 4 is a cross-sectional view of an exemplary excavation and showing the condition of the excavation during an intermediate stage of digging with the bucket.

FIG. 5 is a plan view showing various steps carried out while performing an exemplary digging operation with the bucket.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in the drawings for purposes of illustration, the present invention is embodied in a digging bucket **10** such as is used with a tractor-mounted backhoe to perform various excavation work. Herein, the bucket is mounted on the free end of an articulated boom **11** at a pivot **13** on the top of the bucket as shown in FIG. **1**. The other end of the boom is connected pivotally to the rear of the tractor (see FIG. **5**) at **14** for horizontal swinging relative to the tractor. More particularly, the boom is formed by an elongated main arm or mast **15** fulcrumed at one end on a pivot **16** for vertical swinging and having a horizontal pivot **17** at its free end supporting a second arm **19** of the boom, the latter arm commonly being called a dipper stick. The bucket, in turn, is mounted to swing at the lower end of the dipper stick about the generally horizontal pivot **13**.

With the foregoing arrangement, vertical movement of the bucket **10** is accomplished with the usual operating mechanism including hydraulic cylinders **20** and **21** which include rods **22** and **23**, respectively. The cylinder **20** acts between a platform **24** on the rear of the tractor and a pivot **25** on the upper end of the dipper stick **19** to swing the latter toward and away from the tractor. The cylinder **21** is fastened at one end to the upper portion of the dipper stick and at the other end to the bucket to rock or curl the bucket about its pivot **13**. Additional actuators (not shown) act between the platform **24** and the mast **15** to swing the latter upwardly and downwardly and from side-to-side.

The bucket **10** is formed by two side panels **26** (FIG. **2**) disposed in vertical planes and spanned by a generally curved plate **27** which forms the rear and bottom walls **29** and **30** of the bucket. At the front of the bucket, the plate terminates in a digging edge or lower lip **31** which, in the present instance, has mounted thereon three horizontally spaced and forwardly extending teeth **33**. The top of the bucket is open and includes upstanding forward ears **34** integrally connected to a bar **35** spanning the two side panels. A pivot pin **36** (FIG. **1**) extends through the ears to connect the bucket to the dipper stick **19** and to define the pivot **13**. Two rear ears **37** are also mounted on the bar **35** and are connected to the end of the rod **23** leading from the cylinder **21**. Thus, as the rod is moved in and out of the cylinder, the bucket is pivoted or curled on the end of the dipper stick.

In use, the rear of the backhoe is supported by a pair of legs **40** (FIG. **5**) which are mounted on the rear of the tractor adjacent opposite sides of the platform **24**. Each of the legs includes a hydraulic cylinder **41** with one end connected to the tractor and a rod **43** extending out of the other end. Pivotally attached to the free end of each of the rods is a foot pad **44** for distributing the weight of the tractor across a relatively large area of the ground. By adjusting the extent of projection of the rods from the cylinders, the rear of the tractor may be leveled and supported by the legs for digging with the bucket **10**.

Once the tractor is in position and set up for excavating, initial entry into the ground is accomplished by actuating the cylinders **20** and **21** to retract the rods **22** and **23** and thereby straighten out and fully extend the boom **11**. At the same time, the actuator controlling vertical movement of the mast **15** is actuated to pivot the mast toward the ground until the digging teeth **33** strike the ground. Thereafter, the bucket **10** is curled on the end of the dipper stick **19** which is pivoted toward the tractor while the mast is pivoted away from the ground to cause a load of earth to be scooped into the bucket. Repeated scooping forms the desired excavation which may be widened simply by swinging the mast horizontally to one side or the other and scooping alongside the hole previously formed.

Digging in the above described fashion with the usual bucket **10** having vertical or upright side panels **26** results in the formation of an excavation with standard vertical sidewalls. Such excavations may be satisfactory for some purposes but in other instances, such as for

purposes of safety, it may be necessary to have the sidewalls of the excavation on a slope to reduce the danger of the sidewalls caving inwardly.

In accordance with the primary aspect of the present invention, provision is made of two unique wings **45** detachably mountable on the bucket **10** to enable the backhoe operator to selectively use the bucket for digging excavations with sloping sidewalls. When attached to the bucket, the outer edges **46** of the wings are positioned to dig an excavation **47** (see FIG. 4) with sloping sidewalls **49** which resist cave-ins and thereby make the excavation safe for those who subsequently work in the excavation. By detaching the wings from the bucket, the backhoe may be used in the normal fashion to dig standard excavations with vertical sidewalls and, when so used, the bucket may be moved straight down into the earth without need of forcing the wings through the earth. Thus, through the provision of the wings **45**, the same bucket **10** may be used efficiently to dig different types of excavations.

In the present instance, the two wings **45** are mounted on opposite sides of the bucket **10** along the upper edges **50** of the side panels **26.** Since the wings are mirror images of each other and are mounted on the bucket in the same fashion, only one of the wings will be described in detail. As best seen in FIGS. **1, 2** and **3,** the wing **45** comprises a generally triangular planar portion **51** disposed in a plane which is inclined upwardly and outwardly from the side panel at an obtuse angle *a*, of about 125°. A rear edge **56** of the triangular portion forms a generally right angle with an inner edge **52** which extends along the upper edge **50** of the side panel. Depending from the inner edge is an integral flange **53** for abutting the outer surface of the side panel. A plurality of openings **54** in the flange are aligned with similar openings **55** formed through the side panel along the edge **50** to receive bolts **58** for securing the wing detachably on the side panel. In addition, an L-shaped connector **60** interfits with the edge **50** to transmit load and digging forces from the wing to the side panel. A hole **61** through the connector and a corresponding opening **63** in the side panel also receive a bolt **69** to help secure the wing to the side panel.

As shown in FIGS. **1** and **2,** the outer edge **46** of the wing **45** is inclined inwardly and forwardly and thus converges upon the upper edge **50** of the side panel **26** upon progressing from the rear to the front of the bucket **10.** In the exemplary embodiment, the angle *b* at which the outer edge **46** is inclined with respect to the inner edge **52** is approximately 25°. The outer edge of the wing serves as the cutting edge for digging the sidewall on a slope which substantially corresponds to the angle *b* at which the outer edge slopes away from the side panel.

Integrally formed with the rear edge **56** of the planar portion **51** is a triangular brace or support plate **57** which extends downwardly at a substantially right angle from the underside of the planar portion. The vertical inner edge **59** of the support plate **57** abuts the outer surface of the side panel **26** to prevent the wing from being folded downwardly against the side panel during digging. An outer edge **62** of the support plate slants inwardly from the outer edge **46** of the wing toward the side panel and thus is relieved so as to avoid digging into the sidewall **49** as the bucket is curled on the end of the boom **11.**

Advantageously, the wings **45** enable the sloped sidewalls **49** to be formed quickly and easily as an incident to digging the excavation **47** and without a substantial increase in the amount of maneuvering which would be required to dig a normal excavation with vertical sidewalls. Many different procedures may be followed in digging the sloped sidewalls, depending upon the type of excavation being dug and the nature of the earth being removed. One preferred way of digging with the wings is illustrated in FIGS. **4** and **5** where an excavation **47** such as a trench with sloped sidewalls **49** is dug by removing successive horizontal layers **64** of earth (see FIG. 4). In this instance, the tractor is set up along the centerline **68** of the trench to be dug. If, however, the trench is to be dug substantially wider than the extended length of the boom **11,** the tractor may be set up and operated first on one side and then the other side of the trench to remove the layers of earth. In either instance, as each layer of earth is removed, portions of the sloped sidewalls of the trench are formed at the opposite ends of each layer.

It will be appreciated that with the tractor set up on the centerline **68** of the trench **47,** the normal scooping action of the bucket **10** toward the rear of the tractor will dig the sidewalls so that they converge on the centerline to make the trench narrower as it approaches the rear of the tractor. In order to dig the sidewalls so that the width of the trench remains constant, the boom **11** must be swung away from the centerline as the bucket is scooped through the earth to form one of the sidewalls. The usual backhoe does not have a substantial amount of power for swinging the boom from side to side. For this reason, it has been found desirable to remove the layers **64** of earth from the trench **47** by first removing the earth from the opposite ends of the layers (see FIGS. **1, 4** and **5**) before removing the earth in the center of the layer. By digging in this manner, the bucket is captivated in the earth between the walls of the hole being scooped out and thus is supported along the outer edges **46** of both wings **45** so that only a small amount of force is required for swinging the boom away from the centerline as the bucket is scooped through the earth. Thus, it is relatively easy to dig the sidewalls **49** of the trench **47** parallel to the centerline by taking advantage of the lateral support provided by the unremoved earth along both sides of the bucket.

As shown in FIG. **4,** the desired slope of each of the sidewalls **49** is formed by holding the bucket **10** generally vertically with respect to the ground and by then drawing the bucket toward the rear of the tractor while at the same time operating the cylinders **20** and **21** and the other actuators to swing the boom away from the centerline **68.** As this is done, for instance when digging the sidewall **49**a, the wing **45**a digs through the earth along the edge of the trench (see FIG. **4**) and causes the sidewall **49***a* to slope upwardly and outwardly away from the bottom of the trench at an incline corresponding to the taper angle of the outer edge **46** of the wing.

After the bucket **10** has been drawn through the earth and is almost full, it is curled about the pivot **13** to scoop up enough additional earth to load the bucket completely. It will be appreciated that with the wings **45** flaring upwardly away from the side panels **26** it not only is possible to scoop out a larger volume of earth but also the hole is kept relatively clean since the wings direct the earth more toward the center of the bucket rather than the earth falling over the side panels and

back into the trench 47. In addition, the flaring of the wings sets the wings at a rake angle so that the digging edges 46 of the wings cut or slice through the earth rather than ripping or tearing loose the dirt to be romoved. For this reason, the earth beyond the sidewalls of the excavation remains essentially undisturbed and thus is more resistant to cave-ins.

Once the sidewall 49 has been dug to a depth equaling the length of the bucket 47, any further downward digging ont only would be extremely difficult but also would remove the sloped surface at the upper edge of the sidewall and thus leave a vertical upper portion of the sidewall. In order to continue digging the trench 47 with sloped sidewalls, the mast 15 is swung to the opposite side of the trench (see FIG. 4) and the digging operation is begun again to further remove the first layer 64 and, at the same time, to form a portion of the opposite sidewall 49*b* with the desired slope. The remaining portion of the earth between the two partially formed sidewalls is dug out in the normal fashion to complete the removal of the first layer of earth before beginning to dig out the second layer. Successive layers of earth may be removed in a similar manner to complete digging of the excavation with sidewalls formed with the desired slope.

It will be appreciated that the trench 47 and other similar excavations may be dug with sidewalls 49 of different slopes by using wings 45 with outer edges which taper inwardly at different angles. In addition, minor changes in the slope of a sidewall formed with any particular set of wings may be achieved by actuating the cylinders 40 and 41 to tilt the rear of the tractor in one direction or the other so that the normal digging action on the bucket 47 is in other than a vertical plane.

I claim as my invention:

1. A digging bucket having an open top, a bottom wall with a front digging edge, a back wall and upright side panels, said bucket being adapted for use with a backhoe and including two wings positionable on the side panels adjacent the open top of the bucket so as to flare upwardly and outwardly away from said open top, said wings having outer digging edges inclined inwardly and forwardly and converging toward each other upon progressing from the back wall toward the front digging edge, said outer edges being engageable with the earth to form an excavation with sidewalls which slope upwardly and outwardly, and means for detachably mounting said wings on the bucket to enable the latter to be used to dig excavations with sloped sidewalls when said wings are attached and excavations with vertical sidewalls when said wings are removed.

2. A digging bucket as defined by claim 1 wherein said means includes flanges connected to the inner edges of said wings for abutting engagement with the outer surfaces of said side panels, and bolts projecting through holes in said flanges and aligned holes in said side panels to anchor said wings to the bucket.

3. A digging bucket as defined by claim 2 further including L-shaped connectors connected to the inner edges of said wings and engageable with the inner surfaces of said side panels to transmit force between said wings and said side panels and to help said bolts hold said wings on the side panels.

4. A digging bucket as defined by claim 3 further including support braces connected to and depending from said wings for abutting engagement with the outer surfaces of said side panels to prevent the wings from being bent toward said bottom wall when excavating.

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