

PATENT SPECIFICATION (11)

1 576 048

1 576 048

- (21) Application No. 34118/77 (22) Filed 15 Aug. 1977 (19)
(31) Convention Application No. 715 560 (32) Filed 18 Aug. 1976 in
(33) United States of America (US)
(44) Complete Specification published 1 Oct. 1980
(51) INT. CL.³ E02F 3/81
(52) Index at acceptance
B8H JB



(54) IMPROVEMENTS IN EXCAVATING BUCKETS

(71) I, CHARLES WAYNE HEMPHILL, of 1106 Green Valley Lane, Duncanville, Texas 75116, United States, citizen of the United States of America, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to improvements in excavating buckets.

The modern backhoe, sometimes called a "pull shovel", is of a design which results from combining the most desirable features taken from the prior art steam shovel and drag line.

The prior art steam shovel bucket is rigidly affixed to a movable boom and is arranged to cut or excavate while going upwardly and away from the machine. This arrangement causes the bucket to work at a mechanical disadvantage and the weight of the machine must therefore be greater than the resulting forces encountered while making the cut. Moreover, the machine must be positioned in its own excavation so that it works at the bottom of the cut.

The drag line, on the other hand, digs in opposition to the shovel, with its bucket suspended from a boom by a series of cables so that the bucket is swung away and pulled towards the machine. The drag line works above its cut thereby enabling it to excavate a relatively narrow trench of varying depth as well as enabling it to work in water or mud. The drag line provides the mechanical advantage of working below and pulling the bucket toward the machine. The operation is not directly dependent upon the weight of the machine in order to effect the pull of the cut. The major disadvantage found in the drag line is the inability to precisely position and control the bucket because of its cable suspension arrangement. Furthermore, the downward digging force applied to the bucket is dependent upon the weight thereof as well as the skill of the operator.

The modern backhoe is a combination of

recent advances in hydraulics along with the most desirable features found in the steam shovel and the drag line. The backhoe bucket is affixed to a movable boom and is turned in a direction to make the cut towards the backhoe machine. The bucket boom is arranged to enable the machine to be positioned on top of the cut, thereby providing the mechanical advantage of disposing the bucket so that it cuts from below and towards the machine.

Before the advent of modern hydraulics, the backhoe depended upon weight and brute force for proper performance of its dipping function. Modern hydraulic systems have substantially reduced the weight of the machine, thereby eliminating the need for a heavy bucket and boom. Modern hydraulics also enables the bucket to be movably affixed to the boom, thereby enabling the cutting edge of the bucket to be continually adjusted for optimum alignment regardless of the position of the boom.

With the exception of being made lighter, backhoe buckets have remained essentially unchanged from the original design created from the combination of features taken from the steam shovel and the drag line bucket. In order for the backhoe bucket to penetrate the material to be excavated, it is essential that the digging teeth thereof be placed in aligned relationship on the lower flat surface of the leading edge of the bucket. The magnitude of force required to effect penetration of the bucket into the earth is related to the number and location of teeth. The fewer the teeth, the more difficult is the pulling of the bucket. Therefore, a compromise has heretofore been necessary in selecting the number of teeth to be employed on the prior art bucket.

The area of the bucket lip which is not covered by excavating teeth must be forced into the ground with a tearing effect. This represents a tremendous expenditure of power. Formations such as soapstone, will not easily tear or shatter as it is penetrated by the teeth, but instead, the individual teeth form a series of spaced grooves.

As the lip of the bucket contacts the ridges between the spaced grooves, the digging can no longer proceed. The tremendous forces required by the tearing effect therefore limits the amount of work a specific backhoe can achieve.

Conventional backhoe buckets are tapered with the bucket being wider at the leading edge as compared to the trailing edge thereof. The teeth usually are arranged to simultaneously cut on the same plane; and accordingly, when the bucket encounters damp or muddy conditions, a substantially solid cube of material is torn loose and forced back into the tapered bucket. Hence, this design is satisfactory for excavating dry material, but is undesirable for digging into wet material because the cube of removed material is tightly packed within the tapered interior of the bucket. Hence, movement of the bucket into the uncurled configuration fails to empty the bucket because the excavated material sticks to the sidewalls thereof and refuses to be discharged therefrom.

Digging in wet or plastic-like material represents one of the major problems associated with the backhoe. Digging in hard formations, such as the above example of soapstone, presents a similar problem to the backhoe. It would therefore be desirable to have made available a backhoe bucket of a design which represents a definite step forward in overcoming the above-recited problems. The solution to this problem is the subject of the present invention.

The invention comprises an excavating bucket for a backhoe, said bucket having a V shaped bottom wall which terminates in a leading end, said leading end being spaced from a trailing end, means forming a plurality of excavating teeth which define at least part of said leading end so that when said bucket is moved relatively to the ground, said excavating teeth engage and cut into the ground to cause the bucket to be filled with excavated material, said excavating teeth including a central digging tooth, opposed intermediate digging teeth, and opposed outermost digging teeth, each of said digging teeth being spaced from one another, either laterally or vertically said intermediate teeth being located rearwardly and below said outermost teeth; and, said intermediate teeth being located forwardly and above said central tooth.

The interior of the bucket is contoured in a special manner with the bottom thereof having opposed adjacent sides which slope in a downwardly direction toward one another, with the slope progressively increasing in a direction toward the central tooth. The back wall of the bucket is curved from a vertical plane which connects to the curved bottom thereof. This configuration

of the bucket provides unexpected improvements in structural integrity as well as improvements in the digging and dumping characteristics thereof.

The excavating teeth each include a penetrating member and a lifting member, with the penetrating member proceeding the lifting member. The teeth which are located on either side of the centrally located tooth are each contoured in a special manner to cause excavated material to be turned towards the center of the bucket as the individual teeth excavate material from the ground. The teeth, together with the bucket design, enhance both the digging and dumping attributes thereof.

Various different embodiments of the bucket and the excavating teeth are set forth herein and may be individually employed to attain great advantage over the prior art.

A primary object of this invention is to provide improvements in excavating buckets which result in increased digging efficiency.

Another object of the invention is to provide a new method of excavating material.

A further object of this invention is to disclose and provide improvements in excavating teeth associated with apparatus for digging into the earth.

A still further object of this invention is to provide a new combination comprised of digging teeth and an excavating bucket.

Another and still further object is to provide improved digging and dumping characteristics for the bucket of a backhoe.

An additional object of this invention is to provide an improved arrangement of excavating teeth on an excavating bucket.

Another object of the invention is to provide an improved bucket design which reduces the tendency of mud to become packed therein.

A further object of this invention is to provide improvements in excavating buckets and teeth which overcome many prior art disadvantages.

These and other objects and advantages of the invention will become readily apparent to those skilled in the art upon reading the following detailed description and claims and by referring to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a three-quarter, front perspective view of an excavating bucket made in accordance with the present invention;

Figure 2 is a three-quarter, rear perspective view of the bucket disclosed in Figure 1;

Figure 3 is a fragmented, side elevational view of another bucket, similar to the bucket disclosed in Figures 1 and 2;

Figure 4 is a front view of the bucket disclosed in the foregoing figures;

Figure 5 is a fragmented, top view of the bucket disclosed in the foregoing figures;

Figure 6 is a rear view of the bucket disclosed in the foregoing figures;

- 5 Figure 7 is a schematical presentation of a cross-section of a strata of the earth from which material has been excavated by employment of the excavating bucket of this invention;

- 10 Figure 8 is a fragmented, front view, similar in some respects to the disclosure as seen in Figure 4;

Figure 9 is a fragmented, top view, similar to the disclosure of Figure 5;

- 15 Figure 10 is a top plan view of one embodiment of the excavating tooth which can be used in conjunction with the bucket of the present invention;

- 20 Figure 11 is a bottom view of the tooth disclosed in Figure 10;

Figure 12 is a side elevational view of the tooth disclosed in Figures 10 and 11;

- 25 Figure 13 is a top plan view of another embodiment of an excavating tooth made in accordance with the present invention;

Figure 14 is a bottom view of the tooth disclosed in Figure 13;

- 30 Figure 15 is a side elevational view of the tooth disclosed in Figures 13 and 14;

Figure 16 is a top plan view of still another embodiment of an excavating tooth used in conjunction with the bucket of the present invention;

- 35 Figure 17 is a bottom view of the tooth disclosed in Figure 16;

Figure 18 is a side elevational view of the tooth disclosed in Figures 16 and 17;

- 40 Figure 19 is a three-quarter front perspective view of still another embodiment of an excavating tooth made in accordance with the present invention;

Figure 20 is an enlarged, part cross-sectional, rear view of the tooth disclosed in Figure 19;

- 45 Figure 21 is a part cross-sectional, side elevational view of the tooth disclosed in Figures 19 and 20;

- 50 Figure 22 is a three-quarter front perspective view of still another embodiment of an excavating tooth which can be used in conjunction with the bucket of the present invention;

Figure 23 is a three-quarter front perspective view of still another embodiment of the excavating tooth of the present invention which can be used in conjunction with the bucket of the present invention;

- 55 Figure 24 is a rear view of the tooth disclosed in Figure 23;

Figure 25 is a side elevational view of the tooth disclosed in Figures 23 and 24;

- 60 Figures 1 and 2 of the drawings disclose a bucket 10¹ made in accordance with the present invention. The interior 12 of the bucket opens in an outward direction, with

the opening being in the form of a polygon which is defined by a peripheral edge 14. The perimeter of the opening includes an edge portion 15 located on one side of the bucket, an edge portion 16 presented by the opposed side of the bucket, an end 17 formed by the illustrated rear member of the bucket, and a leading edge portion 18 presented by the V-shaped bottom of the bucket.

The bottom and side walls are joined together by a member 19, while the rear and bottom of the bucket are joined together by a member 20. The rear and bottom walls progressively curve toward one another where one becomes the other as they meet at some arbitrary location broadly indicated by the arrow at numeral 21.

Suspension members 22 and 23 are rigidly attached to the rear of the bucket to provide mount means by which the bucket can be attached to the dipper stick of a backhoe in the usual manner. The interior of the bucket adjacent to the leading edge is wider, or of greater cross-section, as compared to the interior of the bucket adjacent to the trailing end. A centrally located keel 25 extends from and forms a central part of both the rear and bottom wall. The bottom wall is comprised of two opposed sloped portions 26 and 28, each of which are attached to the side walls where they downwardly slope towards one another into attachment to the keel.

A central excavating tooth 29, which can take on any number of different forms, is forwardly attached to the keel 25. Numeral 30 indicates a plurality of specifically made teeth which are positioned forwardly of the bottom 28 and laterally of the central tooth. Numerals 31 and 31¹ indicate the rear portion of opposed tooth-receiving members by which the teeth of the present invention are removably mounted to the lip or forward edge portion 18 of the bucket.

As best seen illustrated in Figures 1 and 2, numeral 32 indicates a plurality of intermediate tooth receiving members which are located on one side of the bucket lip, while numeral 32¹ indicates a plurality of opposed intermediate members which are located on the opposed side or bottom of the bucket. Numeral 33 indicates a plurality of teeth which are mirror images of the teeth 30 located on the opposed side of the bucket. Numeral 34 is two connected straight lines indicating the terminal leading edge of the excavating teeth.

Accordingly, the excavating teeth of the present invention are arranged on the leading edge of the excavator bucket such that there is a central excavating tooth 29, a plurality of excavating teeth 30 located laterally of the central tooth, and a plurality of opposed excavating teeth 33, with

intermediate teeth attached to members 32 and 32¹, and with opposed outermost teeth affixed to the members at 31 and 31¹.

As seen illustrated in Figures 4—9, in conjunction with Figures 1—3, the central tooth 29 is the lowermost and rearwardmost located tooth, with each tooth adjacent thereto being progressively located forwardly and above the central tooth, with the teeth 30 located on one side of the bucket being mirror images of the teeth 33 located on the opposed side of the bucket, and with the central tooth having a configuration which differs from the configuration of the teeth located on opposed sides of the bucket.

As best seen illustrated in Figures 8 and 9, in conjunction with other figures of the drawings, the excavating teeth have a rear end 45 of a hollow configuration made complimentary respective to the members 32 so as to enable the teeth to be wedgedly received thereagainst. Aperture 46 vertically extends through both the teeth and socket to enable the teeth to be individually pinned to their respective socket.

In the various figures of the drawings, the plate member 35 forms the upper marginal end of the rear wall which is tied to the adjacent opposed similar plate members 36. Members 36 form the outer marginal end of the opposed side walls. The side walls 37 are tied to the opposed plate members and to the sloped bottom walls. Opposed bottom plate members 38 form the leading marginal edge portion of the bottom walls and receive the tooth sockets in mounted relation thereto so that the resulting structural integrity of the bucket can withstand the tremendous force which must be imparted into the digging teeth mounted thereon.

Accordingly, the excavator bucket of the present invention is comprised of an entrance made of plate members 35, 36, and 38 which are tied to the side walls, rear wall, and bottom wall, with the rear wall commencing to slope in a downward direction toward the keel 25 after leaving plate member 35, with the magnitude of the slope progressing where the rear and bottom walls join, and where the slope continues to progressively increase towards member 38.

The teeth-receiving members can take on any number of different forms, but preferably are fabricated in the illustrated manner of Figures 1—9. The teeth illustrated herein are specifically designed to be received by the sockets and arranged in the novel tooth pattern illustrated in the drawings for optimum efficiency. The lowermost and central tooth is fabricated symmetrically so that the forward edges of the tooth engage the ground with a digging action, and thereafter lifts material in an upward direction. Figures 1, 4, 5, 17, and 23 illustrate the preferred form of the central ex-

cavating tooth. The teeth 30 are made into a configuration which turns the material toward the central tooth. The teeth 33 are mirror images of the teeth 30 so that the teeth 33 likewise turn the material toward the centrally located digging tooth.

The central tooth is located so that it is the lowermost and rearwardmost of the plurality of teeth. The remaining teeth are located forwardly, laterally, and upwardly respective to the central tooth, with the teeth on one side of the bucket being mirror images of the corresponding teeth located on the opposed side, and with the correspondingly located teeth on opposed sides being positioned at the same elevation and at the same forward displacement. The outermost teeth are positioned at the forwardmost, outermost, and uppermost location respective to the lowermost, rearwardmost, centrally located tooth.

The stair-stepped, spaced, saw-tooth configuration of the teeth present a cutting edge or cutting surface at the forward end of the digging bucket which engages each increment of excavated material. The teeth cooperate together to roll the individual increments of excavated material upwardly and toward the center of the bucket as the material is forced up into the interior thereof.

The sloped bottom and rear walls of the bucket present a supporting surface to the excavated material in such a manner that the material has very little tendency to stick thereto. Moreover, wet, sticky, excavated material is not packed into the bucket, but instead is rectified therein as discrete increments of material which retains a self-supporting form and thereby avoids being packed or compressed into a highly dense solid mass or cube of plastic material. This cooperative action between the teeth and the bucket presents a phenomenon which enhances the dumping characteristics of the bucket as it is uncurled into the dumping configuration.

Stated differently, the action of the bucket as it receives the excavated material from the plurality of digging teeth is similar to placing a mass of spaghetti into the bucket, whereas the prior art bucket and teeth is analogous to placing a mass of mashed potatoes thereinto. The mashed potatoes, naturally, stick with great adherence to the sidewalls of the bucket and is therefore quite difficult to dump therefrom, whereas a mass of spaghetti has decidedly less tendency to adhere to the sidewalls of the bucket because of the discrete, individual extruded form thereof.

In Figures 10—12 there is disclosed a specific digging tooth 84 having a leading edge 86 spaced from the rear 45 thereof. The paddle-shaped tooth includes an upper

70

75

80

85

90

95

100

105

110

115

120

125

130

face 88 which upwardly slopes from the penetrating inclined forward edge 86 toward the rear, and which upwardly slopes from foreshortened side 92 toward the longer side 94. The bottom of the tooth includes the connected faces 90 and 90¹. The face 90¹ upwardly slopes toward the leading edge 86 and joins the relatively flat face 90 at 90¹¹. Leading edge 86 is inclined, or set at an angle, with respect to the vertical, with the interface formed between faces 90 and 90¹ being disposed substantially parallel to the leading edge 86.

In the embodiment illustrated in Figures 13—15, the digging tooth is provided with a primary penetrating member 98 which extends forwardly of a secondary penetrating member 89. The tooth includes opposed side walls 91 and 93. An elongated upper face 95 of the tool slopes from the upper edge of side wall 91 down to an interface 99 where the faces 95 and 99 are smoothly joined together.

The penetrating end 98 of the tool is ground into the illustrated leading plane which slopes toward face 95 and edge 97. Edge portion 97 is placed at an angle respective to the side walls and joins together the spaced ground engaging members 89 and 98 of the tool.

The penetrating member 98 includes a lower face 100¹ which joins a lower face 100 at interface 96. Side walls 91 and 93 outwardly diverge in a forward direction respective to one another. Side wall 93 slightly spirals while at the same time curves outwardly from the rear wall toward the cutting edge 89.

The embodiment of Figures 16—18 discloses a central digging tooth 29¹ having a bifurcated forward marginal end comprised of spaced similar digging members 66 and 68 which curve rearwardly and downwardly toward a recessed midportion 70. The tooth is symmetrical on either side of a vertical plane passed centrally therethrough and includes a bottom face 72 which is upwardly inclined towards the midportion 70. Centrally located face 74 is equally spaced from opposed side walls 76 and 78 by the inclined faces 80 and 82 of the opposed forwardly directed digging members.

Side walls 76 and 78 slightly spiral away from one another and diverge in a forwardly direction in the illustrated manner of the drawings.

Figures 19—25 set forth one embodiment of a set of excavating teeth which may be employed in conjunction with an excavating bucket made in accordance with the present invention.

Figure 19 specifically discloses an excavating tooth 33. The tooth includes a trailing end 45 which forms the shank thereof. Aperture 46 cooperates with the illu-

strated apertures formed in the tooth-receiving sockets 32¹ of Figure 1. The tooth is hollow at 48 for snugly receiving the forward portion of a tooth receiving socket therewithin, with the apertures of the socket and the shank being indexed with one another to thereby receive a bolt or pin therethrough.

The leading edge 50 of the excavating tooth is in the form of a chisel. The leading edge is forwardly spaced from a second leading edge 52 of a secondary digging member which is also in the form of a chisel. The tooth upwardly slopes at 54 towards the rear 45, thereby leaving a relatively flat bottom edge portion 57 and an upwardly curved edge portion 58.

Member 50 has a vertical sidewall 59 resulting from removal of material for formation of the secondary chisel-like tooth 52. As seen in Figures 20 and 21, the leading member 50 includes a sidewall 61 which is parallel to and opposed to the side wall 55. Member 50 is sloped from edge portion 60 towards the vertical wall 59, thereby presenting an inclined face 62 which downwardly slopes towards face 54, with the faces 54 and 62 jointly forming an interface at 63.

Accordingly, the tooth 33 includes a forwardly directed pilot portion 50 which initially engages and excavates material, thereby enabling member 52 to likewise engage and remove adjacent material rearwardly of member 50.

Material engaged by member 50 is folded by face 62 towards the vertical wall 55 because of the sloped face 62. Material excavated by member 52 is lifted in an upward direction where it encounters the previously removed material which is being moved upwardly and laterally and rearwardly by face 62 so that all of the material excavated by the tooth is moved upwardly, rearwardly, and towards the center of the bucket.

The digging tooth of Figure 22 is a mirror image of the tooth illustrated in Figures 19—21. In this instance, material engaged by member 50 is lifted upwardly and laterally by the inclined face 62, where the material flows up into the bucket along with the additional material which is simultaneously removed by member 52.

In the embodiment of Figures 23—25, there is disclosed a central excavating tooth 29 which includes a centrally located excavating member 50¹; and, opposed, inwardly sloped, excavating members 52 and 52¹. Members 52 and 52¹ have an upper, inwardly sloped surface 62, 62¹, which meet the central, horizontally disposed surface along the two spaced interfaces indicated by numerals 63 and 63¹. The central member 50¹ underlies and forwardly pro-

12

jects respective to the opposed secondary members 52, 52¹, thereby leaving spaced vertical, opposed walls 64.

In operation, the central digging tooth illustrated in Figures 23-25 provides a centrally located member 50¹ which engages and lifts excavated material upwardly and rearwardly. Members 52, 52¹ are mirror images of one another and lie rearwardly and above member 50¹. The opposed members 62, 62¹ therefore turn or fold the excavated material towards the centralmost portion of the bucket.

It should be noted that commencing at the central portion of the central tooth 29 of Figures 4 and 23 and progressing outwardly towards either side of the bucket, there will be encountered a series of excavating members which are arranged respective to one another, to the bucket, and to the material being excavated, such that a number of different, unexpected and beneficial results accrue. Commencing with the most central digging member 50¹ of the central digging tooth 29, for example, it will be noted that excavating members 52 and 52¹ are located laterally, rearwardly, and above member 50¹. At the same time, members 52, 52¹ urge excavated material toward the central portion of the bucket.

As illustrated in Figures 1 and 4, and progressing laterally toward the left side of the bucket, for example, tooth 33 is encountered. This particular configuration of the excavating tooth presents a forwardly directed excavating member which precedes a secondary member thereof to pry material loose, thereby leaving a surface which must be encountered and removed by the secondary member; however, the surface to be removed by the secondary member has already had material removed from the two sides thereof, thereby leaving material attached at only two sides thereof which is more readily engaged and removed. This phenomenon is best understood by comparing Figure 7 with Figures 10-25, along with the various figures of the digging bucket.

As one progresses to the next excavating tooth, this same phenomenon will be encountered until the outermost tooth is viewed.

In operation of the first embodiment of the invention, using a bucket constructed substantially as illustrated, the bucket digs into the earth in a conventional manner. The precise angle with which the bottom of the bucket of the ditch is determined by the type of material being excavated. For example, when digging into fairly loose soil, it is advantageous to tilt the bucket so that each of the teeth uniformly engage the same depth of soil. The teeth are arranged so

that approximately 18 inches of material overlies each of the excavating teeth, for example. At the same time, the operator can slightly adjust the angle of the bucket to improve its efficiency of operation. The operator soon learns to "tune" his ear to the engine noise of the backhoe so that he can ascertain the most optimum angle to be employed to optimize the power consumed by the apparatus.

Upon engaging hard surfaces, such as shale or other rocklike substances, the bucket is tilted towards the uncured position, thereby causing the centrally located tooth to dig further into the shale, as compared to the outermost teeth.

On the other hand, where it is desired to contour the excavated ditch into a flat bottom, the bucket can be further uncured so that the aligned ends of the teeth at 34 simultaneously engage the bottom of the ditch. This enables the marginal ends of the teeth to be forced slightly below the surface of the ditch where it can be raked level in this manner.

A further advantage gained with the present invention is the savings in padding material which is usually required in laying pipelines. In Figure 7, for example, the bottom of the ditch is contoured in the illustrated stairstep manner so that the sides of the ditch slope towards the center in a sawtoothed manner. This expedient saves a tremendous amount of padding material, and furthermore centrally positions the pipe laid within the ditch in the most optimum manner.

Sometimes it is expeditious to dig the ditch in accordance with Figure 7 and thereafter complete the bottom of the ditch by utilizing the embodiment of the invention disclosed in Figures 26 and 27.

WHAT I CLAIM IS:—

1. An excavating bucket for a backhoe; said bucket having a V shaped bottom wall which terminates in a leading end said leading end being spaced from a trailing end, means forming a plurality of excavating teeth which define at least part of said leading end so that when said bucket is moved relative to the ground, said excavating teeth engage and cut into the ground to cause the bucket to be filled with excavated material; said excavating teeth including a central digging tooth, opposed intermediate digging teeth, and opposed outermost digging teeth, each of said digging teeth being spaced from one another, either laterally or vertically; said intermediate teeth being located rearwardly and below said outermost teeth; and, said intermediate teeth being located forwardly and above said central tooth.

2. An excavating bucket as in Claim 1 wherein said bucket has, a rear wall and



jects respective to the opposed secondary members 52, 52¹, thereby leaving spaced vertical, opposed walls 64.

In operation, the central digging tooth illustrated in Figures 23—25 provides a centrally located member 50¹ which engages and lifts excavated material upwardly and rearwardly. Members 52, 52¹ are mirror images of one another and lie rearwardly and above member 50¹. The opposed members 62, 62¹ therefore turn or fold the excavated material towards the centralmost portion of the bucket.

It should be noted that commencing at the central portion of the central tooth 29 of Figures 4 and 23 and progressing outwardly towards either side of the bucket, there will be encountered a series of excavating members which are arranged respective to one another, to the bucket, and to the material being excavated, such that a number of different, unexpected and beneficial results accrue. Commencing with the most central digging member 50¹ of the central digging tooth 29, for example, it will be noted that excavating members 52 and 52¹ are located laterally, rearwardly, and above member 50¹. At the same time, members 52, 52¹ urge excavated material toward the central portion of the bucket.

As illustrated in Figures 1 and 4, and progressing laterally toward the left side of the bucket, for example, tooth 33 is encountered. This particular configuration of the excavating tooth presents a forwardly directed excavating member which precedes a secondary member thereof to pry material loose, thereby leaving a surface which must be encountered and removed by the secondary member; however, the surface to be removed by the secondary member has already had material removed from the two sides thereof, thereby leaving material attached at only two sides thereof which is more readily engaged and removed. This phenomenon is best understood by comparing Figure 7 with Figures 10—25, along with the various figures of the digging bucket.

As one progresses to the next excavating tooth, this same phenomenon will be encountered until the outermost tooth is viewed.

In operation of the first embodiment of the invention, using a bucket constructed substantially as illustrated, the bucket digs into the earth in a conventional manner. The precise angle with which the bottom of the bucket is arranged respective to the bottom of the ditch is determined by the type of material being excavated. For example, when digging into fairly loose soil, it is advantageous to tilt the bucket so that each of the teeth uniformly engage the same depth of soil. The teeth are arranged so

that approximately 18 inches of material overlies each of the excavating teeth, for example. At the same time, the operator can slightly adjust the angle of the bucket to improve its efficiency of operation. The operator soon learns to "tune" his ear to the engine noise of the backhoe so that he can ascertain the most optimum angle to be employed to optimize the power consumed by the apparatus.

Upon engaging hard surfaces, such as shale or other rocklike substances, the bucket is tilted towards the uncurled position, thereby causing the centrally located tooth to dig further into the shale, as compared to the outermost teeth.

On the other hand, where it is desired to contour the excavated ditch into a flat bottom, the bucket can be further uncurled so that the aligned ends of the teeth at 34 simultaneously engage the bottom of the ditch. This enables the marginal ends of the teeth to be forced slightly below the surface of the ditch where it can be raked level in this manner.

A further advantage gained with the present invention is the savings in padding material which is usually required in laying pipelines. In Figure 7, for example, the bottom of the ditch is contoured in the illustrated stairstep manner so that the sides of the ditch slope towards the center in a saw-toothed manner. This expedient saves a tremendous amount of padding material, and furthermore centrally positions the pipe laid within the ditch in the most optimum manner.

Sometimes it is expeditious to dig the ditch in accordance with Figure 7 and thereafter complete the bottom of the ditch by utilizing the embodiment of the invention disclosed in Figures 26 and 27.

WHAT I CLAIM IS:—

1. An excavating bucket for a backhoe; said bucket having a V shaped bottom wall which terminates in a leading end said leading end being spaced from a trailing end, means forming a plurality of excavating teeth which define at least part of said leading end so that when said bucket is moved relative to the ground, said excavating teeth engage and cut into the ground to cause the bucket to be filled with excavated material; said excavating teeth including a central digging tooth, opposed intermediate digging teeth, and opposed outermost digging teeth, each of said digging teeth being spaced from one another; either laterally or vertically; said intermediate teeth being located rearwardly and below said outermost teeth; and, said intermediate teeth being located forwardly and above said central tooth.

2. An excavating bucket as in Claim 1 wherein said bucket has, a rear wall and



1,576,048

* C L M S *

(14)

side walls, said bottom wall being connected to said rear and side walls; said excavating teeth being affixed to said leading end of said bottom wall in spaced relationship to said rear wall.

3. An excavating bucket as in Claim 1 wherein said bucket has opposed sidewalls, said bottom wall being connected to said opposed sidewalls and to the rear wall; said bottom wall sloping downwardly from each sidewall, the slope of said bottom wall being progressively greater from said rear wall towards said leading end.

4. An excavating bucket as in Claim 1 wherein said bucket includes spaced sidewalls, a rear wall, said rear wall being disposed at said trailing end, said bottom, rear, and side walls terminating in an edge portion to form said outward opening, said bottom wall having an end spaced from said rear wall to form said leading end; said bottom wall having opposed, downwardly sloped portions which progressively increase in the amount of slope from said rear wall towards said leading end.

5. An excavating bucket as in Claim 1 having included spaced sides, a rear wall connected to said sides, and a bottom wall connected to said side walls and rear wall; said side walls and rear wall, forming said outward opening of said bucket; said rear wall curving forwardly and downwardly into said bottom wall; said bottom wall has opposed edges connected to said side wall, from which said bottom wall downwardly slopes with the amount of slope progressively increasing from said side wall towards said leading edge; said bottom wall includes an edge spaced from said rear wall which forms said leading edge; and means formed on said bucket by which it can be affixed to the dipper stick of a backhoe.

6. An excavating bucket as in Claim 1 wherein said digging teeth include means by which they are removably affixed to said leading end; there being two opposed pairs of intermediate teeth, one tooth of one of said pair of intermediate teeth being located adjacent to each of said outermost teeth; one tooth of the remaining said pair of said two opposed pairs of intermediate teeth being located adjacent to said central digging tooth; the teeth of said opposed pairs of teeth being located on either side of said central digging tooth itself being located progressively more forwardly and upwardly of said central digging tooth in a direction towards said sides.

7. An excavating bucket as in Claim 2 wherein said central digging tooth is an excavating tooth having a shank to which there is affixed a penetrating member and adjacent secondary members, said secondary members being separated from one another

by said penetrating member, said secondary members having a sloped face which forces excavated material to move towards said penetrating member.

8. An excavating bucket as in Claim 7 wherein said intermediate teeth each have a penetrating member and a secondary member, said secondary member includes a cutting edge which is disposed rearwardly of the cutting edge of said penetrating member such that the penetrating member excavates material in advance of said secondary member.

9. The excavating bucket of Claim 1 wherein there is included spaced sides, a rear wall connected to said sides, and a bottom wall connected to said side walls and rear wall, the said side walls and rear wall, forming said outwardly opening of said bucket; said rear wall curves forwardly and downwardly into said bottom wall; said bottom wall having opposed edges connected to said side walls, from which said rear wall slopes downwardly with the amount of slope progressively increasing from said rear wall towards said leading edge; said bottom wall having an edge spaced from said rear wall which forms said leading edge; means formed on said bucket by which it can be affixed to the dipper stick of a backhoe; said central tooth having a central ground engaging member and two spaced pilot members forwardly positioned respectively to said central ground engaging member; said pilot members being mirror images of each other and including an upper sloped face which downwardly slopes into said central member.

10. An excavating bucket as in Claim 1 having means by which said digging teeth are removably affixed to said leading edge; there being two opposed pairs of intermediate teeth, one tooth of one said pair of intermediate teeth being located adjacent to each of said outermost teeth; one tooth of the remaining said pair of said two opposed pairs of intermediate teeth being located adjacent to said central digging tooth; the teeth of said digging member are arranged whereby the opposed pairs of teeth are located on either side of said central digging tooth and located progressively more forwardly and upwardly of said central digging tooth in a direction towards said sides; said teeth located on one side of said central digging tooth being mirror images of said teeth located on the opposed side of said central digging tooth; said teeth located on opposed sides of said central digging tooth each having a forwardly directed pilot member and a rearwardly located secondary member, a cutting edge on said pilot and secondary member, said pilot member having an upper face formed there-

16



* C L M S *

1,576,048

8

on which downwardly slopes towards said secondary member.

11. An excavating bucket for a backhoe substantially as described with reference to the accompanying drawings.

J. OWDEN O'BRIEN & SON,
39 King Street,
Manchester, 2.
Chartered Patent Agents.

Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1980.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.