Dec. 27, 1966 W. H. McAULIFF 3,293,778

MAUL IMPACTING DEVICE FOR EXCAVATING BUCKETS

Filed March 5, 1964 4 Sheets-Sheet 1

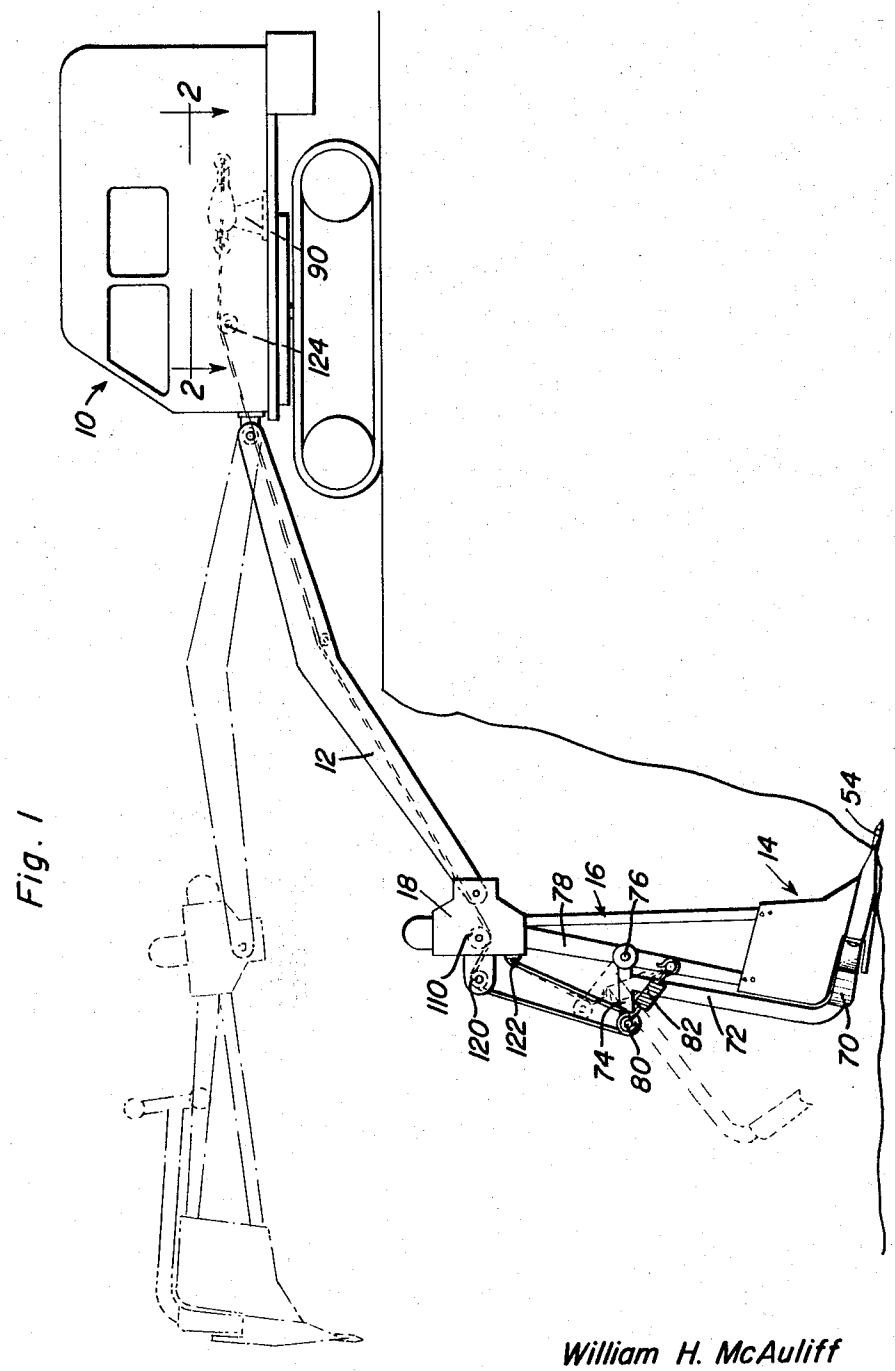

Fig. 1

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MAUL IMPACTING DEVICE FOR EXCAVATING BUCKETS

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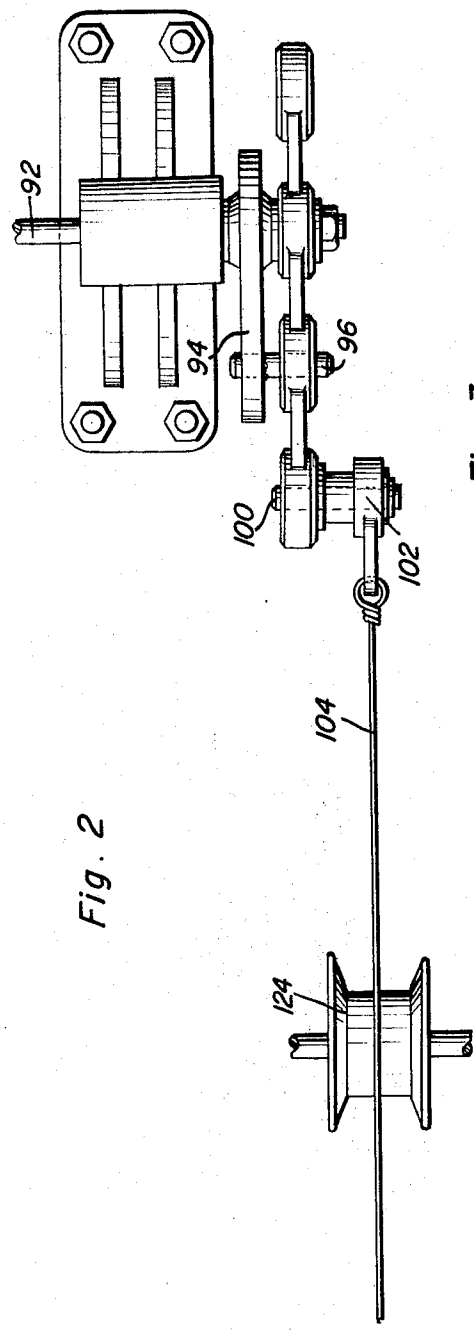

Fig. 2

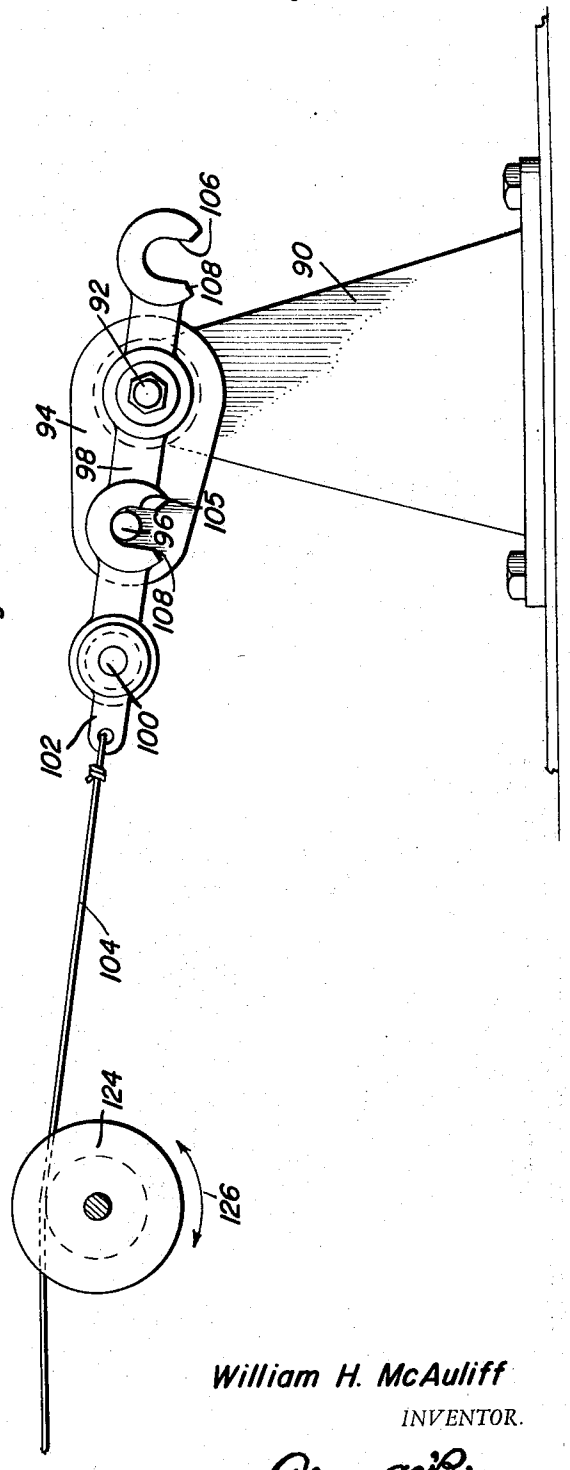

Fig. 3

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MAUL IMPACTING DEVICE FOR EXCAVATING BUCKETS

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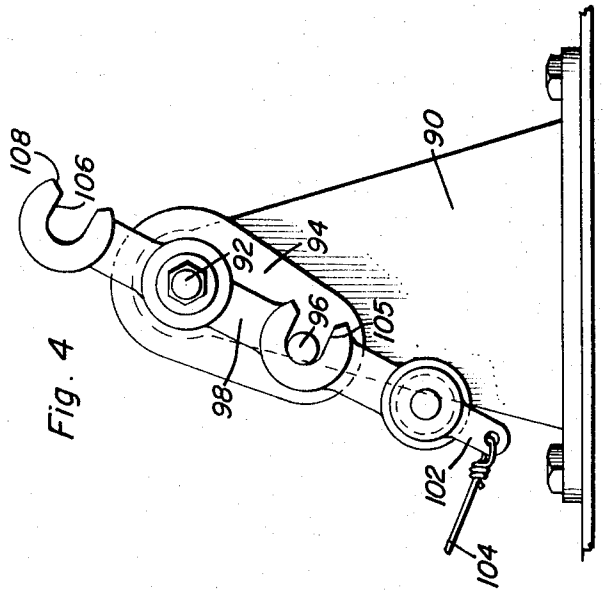

Fig. 4

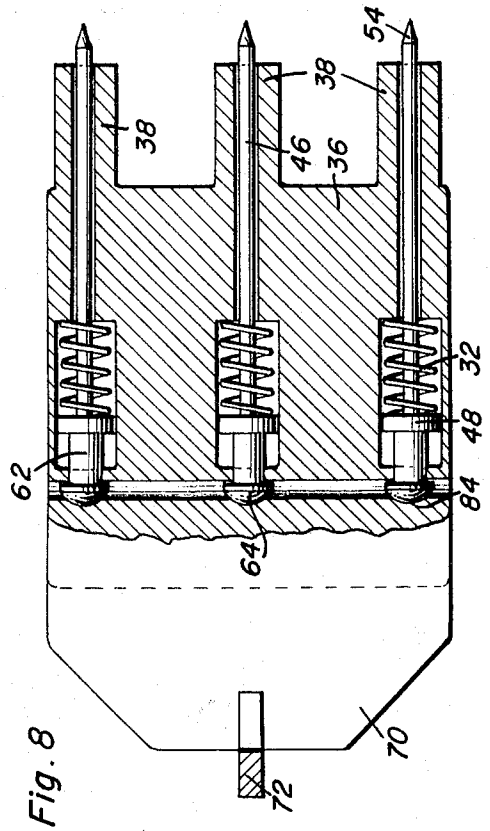

Fig. 8

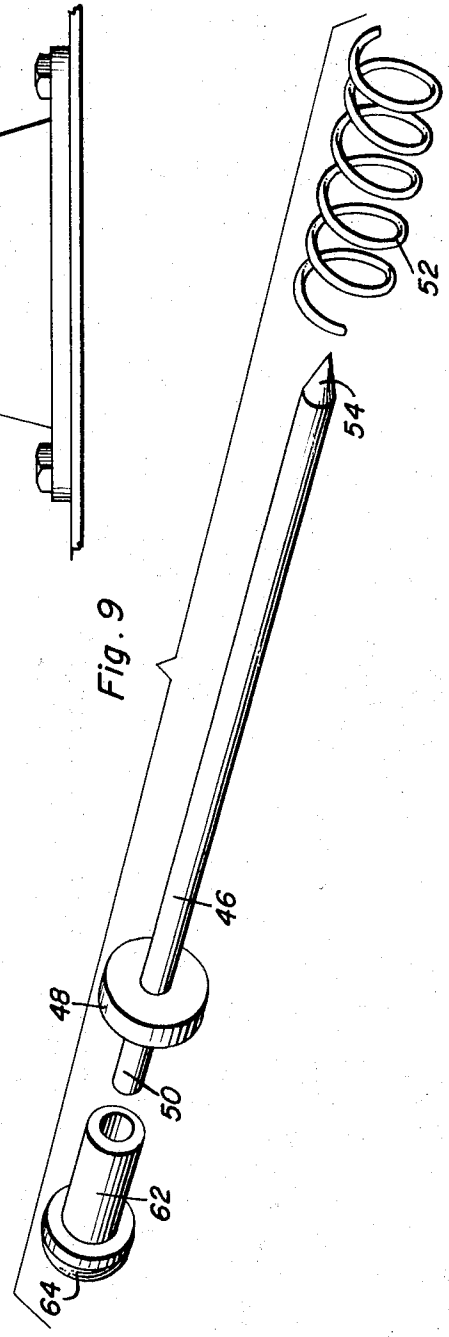

Fig. 9

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MAUL IMPACTING DEVICE FOR EXCAVATING BUCKETS

Filed March 5, 1964 4 Sheets-Sheet 4

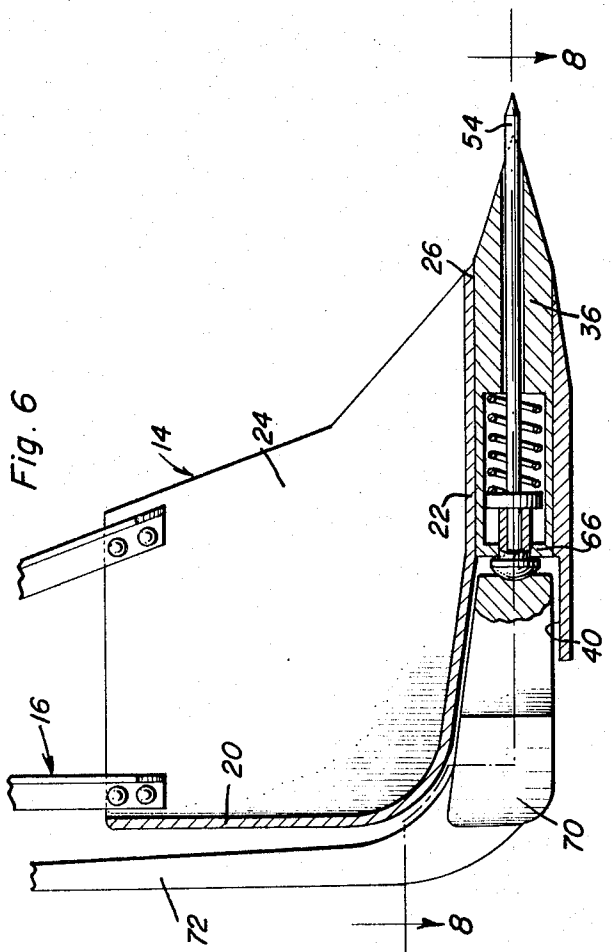

Fig. 6

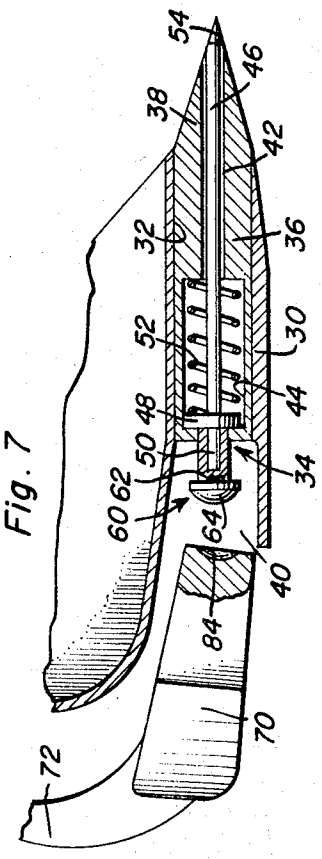

Fig. 7

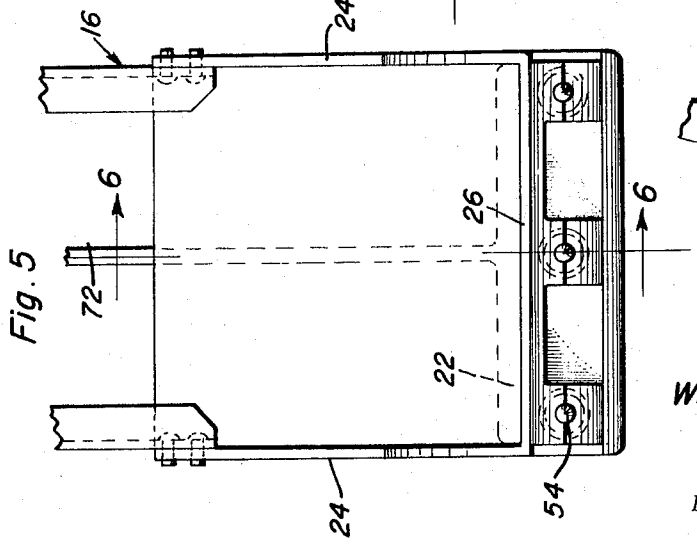

Fig. 5

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3,293,778

MAUL IMPACTING DEVICE FOR EXCAVATING BUCKETS

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8 Claims. (Cl. 37—141)

This invention comprises a novel and useful maul impacting device for excavating buckets and more particular pertains to an earth working, shoveling or digging implement having improved means for digging and excavating together with supplementary means capable of independent operation for effecting an ancillary or alternative digging and penetrating action by a plurality of reciprocating teeth.

In the operation of power operated shovels, buckets, scoops and other excavating devices it is frequently difficult to effect efficient penetration of the soil or other material by the forward edge of the implement owing to the limitations imposed upon the use of the tool in restricted locations. It is therefore a very important object of the invention to provide a means for overcoming this difficulty and facilitate the action of the blade of the implement in its penetration of the soil or other material.

It also occurs under certain conditions of excavation that it becomes necessary in order to penetrate or break-up excessively hard material to employ the use of a separate tool such as a pneumatically operated reciprocating chisel or impact implement. This usually occasions a delay in discontinuing the operation of the power shovel or other excavating implement and then positioning and operating a power operated hammer or the like.

It is therefore a further purpose of this invention to overcome the above-mentioned difficulties and providing a reciprocating impact element attached to a conventional power operated shovel or other excavating implement whereby to combine therein in a single apparatus the operation of the power shovel with the reciprocating action of a hammer or drill.

A still further object of the invention is to provide a power operated excavating implement having combined therewith a power operated reciprocating hammer or drill which will be operated during or independently of the normal power operation of the excavating implement.

Still another purpose of the invention is to provide an improved and advantageous mounting upon a bucket or other excavating implement of a reciprocating drill or hammer attachment.

A still further object of the invention is to provide a device in accordance with the preceding objects wherein novel and improved means are provided for effecting a mechanical operation of the reciprocating elements without necessitating the provision of fluid pressure operating lines and the like.

Still another more specific object of the invention is to provide a device wherein an excavating bucket has mounted thereon a plurality of reciprocating impact elements and wherein a maul or hammer is mounted upon the bucket and the support means for cooperation with the impact elements together with a mechanism for intermittently imparting operation to the hammer or maul.

A further specific object of the invention is to provide a construction conforming to the foregoing objects wherein each reciprocating element is reciprocably mounted in a recessed housing provided in the bottom wall of the excavating bucket or scoop and spring urged to a retracted position in which its impact end extends forwardly of the cutting edge of the bucket and wherein the operation of the impact ends of the elements are independently

projected forwardly of the cutting edge of the bucket to deliver an impact stroke.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is a view in side elevation showing the principles of the invention applied to a conventional excavating apparatus such as a back hoe, alternative positions of the parts being shown in dotted lines therein;

FIGURE 2 is a fragmentary view in top plan of a portion of the means for intermittently operating the reciprocating impact elements of the invention, being taken substantially upon the plane indicated by section line 2—2 of FIGURE 1 and upon an enlarged scale;

FIGURE 3 is a view in side elevation of the structure of FIGURE 2;

FIGURE 4 is a fragmentary view of the intermittent actuator of FIGURE 1 but shown in a succeeding position in its operation, the direction of travel in FIGURES 3 and 4 being intimated by the arrows therein;

FIGURE 5 is a view in front elevation of the excavating bucket shown in the apparatus of FIGURE 1;

FIGURE 6 is a view in vertical transverse section taken substantially upon a plane indicated by section line 6—6 of FIGURE 5 and showing the position of the impact elements at the extreme forward end of their travel after an impact has been delivered to these elements;

FIGURE 7 is a fragmentary view similar to FIGURE 6 but showing the position of the parts when the impact elements are in their retracted and rest position;

FIGURE 8 is a detail view in horizontal section taken substantially upon a plane indicated by broken section line 8—8 of FIGURE 6; and

FIGURE 9 is an exploded perspective view of an impact element and certain of the associated members.

Reference is now made specifically to FIGURE 1 for an illustration of one satisfactory manner of applying the principles of this invention. Indicated therein a conventional type of back-hoe indicated generally by the numeral **10** and having thereon a conventional power operated boom **12** upon which is mounted the usual back-hoe bucket indicated generally by the numeral **14**. Inasmuch as the construction and operating means for the boom and back-hoe bucket are conventional and form no part of this invention, a further description thereof is deemed to be unnecessary. However, it will be noted that a supporting arm structure **16** connects the bucket **14** with a housing **18** secured to the end of the boom **12**.

Referring now especially to FIGURES 5 and 6 it will be observed that the bucket **14** includes a back wall **20**, a bottom wall **22** and a pair of side walls each indicated at **24** and which unite the back and side walls to the bottom wall thus providing a scoop-like receptacle which is open at its top and at its front. The forward or front end of the bottom wall **22** terminates in a forwardly extending cutting edge or cutting blade **26**. In operation upon proper manipulation of the conventional operating means, the bucket is moved to effect a digging stroke as will be apparent from a comparison of the dotted lines shown in FIGURE 1 to the full line position thereof. However, in certain positions of the bucket it becomes extremely difficult to effect a digging stroke or penetration of the cutting edge into the soil or other material being excavated. Further, in some instances, when the bucket strikes an obstruction which it is difficult to move and which must be broken before the excavating operation can continue, it is necessary to remove the excavating implement, replace it with some other

implement as for example a reciprocating chisel, hammer or the like until the obstruction is broken up, after which the excavating implement is again positioned and operated.

In accordance with this invention, the bucket structure itself is modified to incorporate therein a power operated reciprocating cutting element or elements such as drills, chisels or the like. Consequently, the excavating apparatus may remain in its site of operation and upon selective operation of the auxiliary equipment, the construction may be broken up thereby permitting the bucket to resume its normal excavating operation.

In accordance with this invention there is mounted upon the bottom wall **22** and preferably upon the underside thereof a plurality of cutting or digging elements in the form of an attachment or adjunct to the bucket itself. For this purpose, as shown best in FIGURES 5–8, the underside of the bucket is provided with a housing means **30** in which are disposed a plurality of chambers, tunnels or recesses **32**. In each recess there is disposed and secured a reciprocating impact element assembly designated generally by the numeral **34**. Each assembly includes a housing **36** having a conical forwardly projecting portion as at **38** which extends forwardly beyond and constitutes an extension of the cutting edge **26** of the bucket bottom wall **22**. The housing **36** is secured in the opening **32** preferably being inserted from the open rear end **40** thereof as shown in FIGURES 6 and 7 and when inserted is rigidly secured in place in any suitable manner as for example by welding or the like.

The housing **36** has an axially extending bore **32** therethrough, the bore in turn having its rearward portion diametrically enlarged to provide a chamber as at **44**. Slidably received within the bore **42** is the shank **46** of the reciprocating element whose rearward portion is provided with a collar or flange as at **48** and a rear extremity **50**. The flange is slidably guided and received within the chamber **44** so that the element may reciprocate therein, a spring as at **52** engaging the collar **48** to yieldingly retain the element in its retracted position at which time its forward extremity **54** which constitutes an impact surface is retracted into position slightly in advance of the conical surface **38** and the cutting edge **26** of the bottom wall **22**. The forward extremity has been designated as the impact element inasmuch as it may take the form of a supported extremity as shown in FIGURE 9, or conversely may take any other shape such as that of a chisel or even a blunt hammer surface if desired.

An impact cap indicated generally by the numeral **60** is also provided, the latter consisting of a tubular sleeve **62** together with a diametrically enlarged impact head **64** having a convex impact surface thereon. The sleeve **62** is slidably received in the rear end wall **66** of the housing **36** with the sleeve also slidably embracing and guidingly receiving the extremity **50** of the impact element which together with the sleeve projects into the open end **40** of the opening **32**.

In the position shown in FIGURE 7 it will be evident that the spring retains the impact element in its retracted position so that the collar **48** is abutted against the end wall **66**. In this position, the cutting elements function as additional or auxiliary teeth or impact members mounted upon and forming a part of the bucket **14** thereby assisting the cutting edge **26** of the latter in performing its excavating function. However, by means to be subsequently set forth, it is possible to independently reciprocate the impact elements and cause them to reciprocate and project forwardly from the cutting edge of the bucket and thus independently effect an impacting or cutting action in the material against which the end of the bucket is abutted.

A mechanical means is provided for intermittently or periodically operating the impact element and effecting reciprocatory movement thereof. This operating means includes a hammer or maul **70** of a considerable and sufficient mass and which is carried by an actuating arm **72** having a crossbar **74** forming a T-shaped head therefor. As shown in FIGURE 1 one end of the head is pivoted as at **76** to a frame member **78** of the arm assembly **16** while its other end has pivoted thereto a pulley **80**. A tension spring **82** is secured to the member **70** at one end and its other end is secured to the pivot **80** thereby yieldingly urging the handle **72** and the hammer or maul **70** in a counterclockwise direction towards the impact elements from which it is withdrawn by a mechanism to be subsequently set forth.

As will be observed from FIGURES 7 and 8, the hammer **70** on its impact face is provided with a series of recesses **84** each of which is adapted to engage one of the impact heads **64** when the end of the maul enters the opening **40** of the tunnel **32**.

Reference is now made more specifically to FIGURES 2, 3 and 4 for an understanding of the operating means for the periodic actuation of the hammer or maul **70**. A suitable stand **90** is provided which may be conveniently mounted within the interior of the cab of the apparatus **10**. Journalled on this stand and operated by any suitable power source, not shown, is a continuously rotating drive shaft **92**. Fixed to this shaft is a crank arm **94** having a laterally projecting crank pin **96** thereon. Likewise, secured to and freely rotatable upon the shaft **92** is a lever arm **98**. Secured to one extremity of this arm is a pivot pin **100** having pivotally mounted thereon for free swinging movement a link **102** to which is secured one end of an actuating cable **104**. Also provided upon the lever **98** and equal distances on opposite sides of the shaft **92** is a pair of sockets or recesses **105** and **106**, the former being adjacent to and the other being remote from the link **102**. The recesses are positioned to each lie in the circular path of the travel of the crank pin **96** and the recesses have beveled openings **108** in each which facilitates the entry of the crank pin **96** into the sockets or recesses.

The actuating cable **104** extends from the interior of the cab of the device **10** over suitable guiding pulleys, not shown, down the length of the boom **12** and from thence passes over a guide pulley **110** of the housing **18** and over a further guide pulley **120**. The cable has been entrained about the previously mentioned pulley **80** and has its extremity secured as to a suitable stationary anchor **122** provided upon the member **118**. As will be noted from FIGURES 1, 2 and 3, there is provided a further guide pulley **124** disposed within the body of the apparatus **10** and which pulley has oscillatory movement as shown by the arrow **126** in FIGURE 3.

The mechanism is operable as follows: When it is desired to activate the impact elements by the maul **70**, either when the bucket **14** is stationary as in FIGURE 1, or while the bucket is in operation, it is merely necessary to apply rotation to the drive shaft **92**. With this shaft continuously rotating, the crank pin **96** will engage a circular path of travel about the axis of the shaft **92**. At this time, the downwardly swinging weight of the arm **72** and the maul **70** carried thereby will tension the cable **104** so that the lever **98** and the link **102** will lie in a straight line with the cable as the latter is entrained over the pulley **124** as shown best in FIGURE 3. When the crank arm **94** during its rotation brings the crank pin into registration with the socket **106** of the lever **98**, the latter will be rotated thereby in a counterclockwise direction. This movement of the lever **98** will in turn pull the cable **104** and thus elevate the maul **70** against this return spring **82** into the dotted line position shown in FIGURE 1, thereby cocking the hammer or maul in readiness for its impacting stroke. However, when the crank pin tilts the lever **98** in a counterclockwise direction, and the cable **104** and its link **102** pass beyond the line of center between the pulley **124** and the drive shaft **92**, the tension of the

cable will now exert a thrust in a counter-clockwise direction upon the lever causing it to rotate with a snap action in the same direction but at an accelerated rate with respect to travel of the crank pin. Consequently, the socket **106** will now leave the crank pin, the lever will turn through a 180 degree arc until the other chank pin socket **105** engages the crank pin in the position shown in FIGURE 3. This snap action will release the tension cable **104** and permit the spring **82** and the force of gravity to swing the maul in a descending stroke and impart a hammer blow to the ends of the impact elements driving them against their springs **52** upon their impact strokes.

It will thus be seen that a continuously rotating drive shaft imparting intermittent cocking action upon the maul and releases it with a snap action to effect the impacting stroke of the maul against the individual impact elements.

Although the principles of the invention have been shown embodied in an excavating bucket in a device such as a back-hoe it will be appreciated that it may fully be utilized in various other equipment which involve the use of a spade or blade for excavating purposes together with a series of reciprocating impact elements mounted thereon.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. In an earth working device, a blade having a digging edge, reciprocatable digging elements carried by said blade and having impact surface cooperating with said blade for digging, said elements being mounted for reciprocation between retracted and extended positions wherein their impact surfaces are disposed respectively at lesser and greater distances in advance of said digging edge, power operating means periodically engaging said elements and effecting reciprocation thereof and including an impact member engageable with said elements and effecting reciprocation of the latter independently of the operation of said blade, said impact member including means yieldingly urging it into contact with said elements and intermittently operable actuating means withdrawing said impact members out of contact with said elements.

2. The combination of claim **1** wherein said blade includes a housing having bores therein with said elements being each slidably received in one of said bores, said bores and elements having cooperating abutting surfaces limiting retraction of said elements into said bores.

3. The combination of claim **2** wherein said elements have each an end portion projecting beyond said abutting surfaces and engageable by said impact member.

4. A material shoveling apparatus comprising a shovel having a bottom wall with a forward cutting edge, digging elements reciprocatingly mounted upon said bottom wall and having impact surfaces projecting forwardly beyond said cutting edge, operating means connected to said shovel and effecting a digging movement thereof, operating means including an impact member engageable with said elements and effecting reciprocation of the latter independently of the operation of said shovel operating means, said impact member including means yieldingly urging it into contact with said elements and intermittently operable actuating means withdrawing said impact members out of contact with said elements.

5. The combination of claim **4** wherein said actuating means has a snap-acting disengagement with said impact member.

6. A material shoveling apparatus comprising a shovel having a bottom wall with a forward cutting edge, digging elements reciprocatingly mounted upon said bottom wall and having impact surfaces projecting forwardly beyond said cutting edge, operating means connected to said shovel and effecting a digging movement thereof, operating means including an impact member engageable with said elements and effecting reciprocation of the latter independently of the operation of said shovel operating means, said apparatus including a boom, an arm swingably mounted on said boom, said shovel being secured to and carried by said arm, said impact member comprising a lever pivotally mounted upon said arm and a maul on said lever engageable with said impact elements, said element operating means being connected to said lever.

7. The combination of claim **6** wherein said element operating means includes a cable and pulley mechanism.

8. The combination of claim **7** wherein said element operating means further includes a continuously rotating drive shaft, an intermittent mechanism connected to said cable and pulley mechanism and being periodically actuated by said drive shaft.

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