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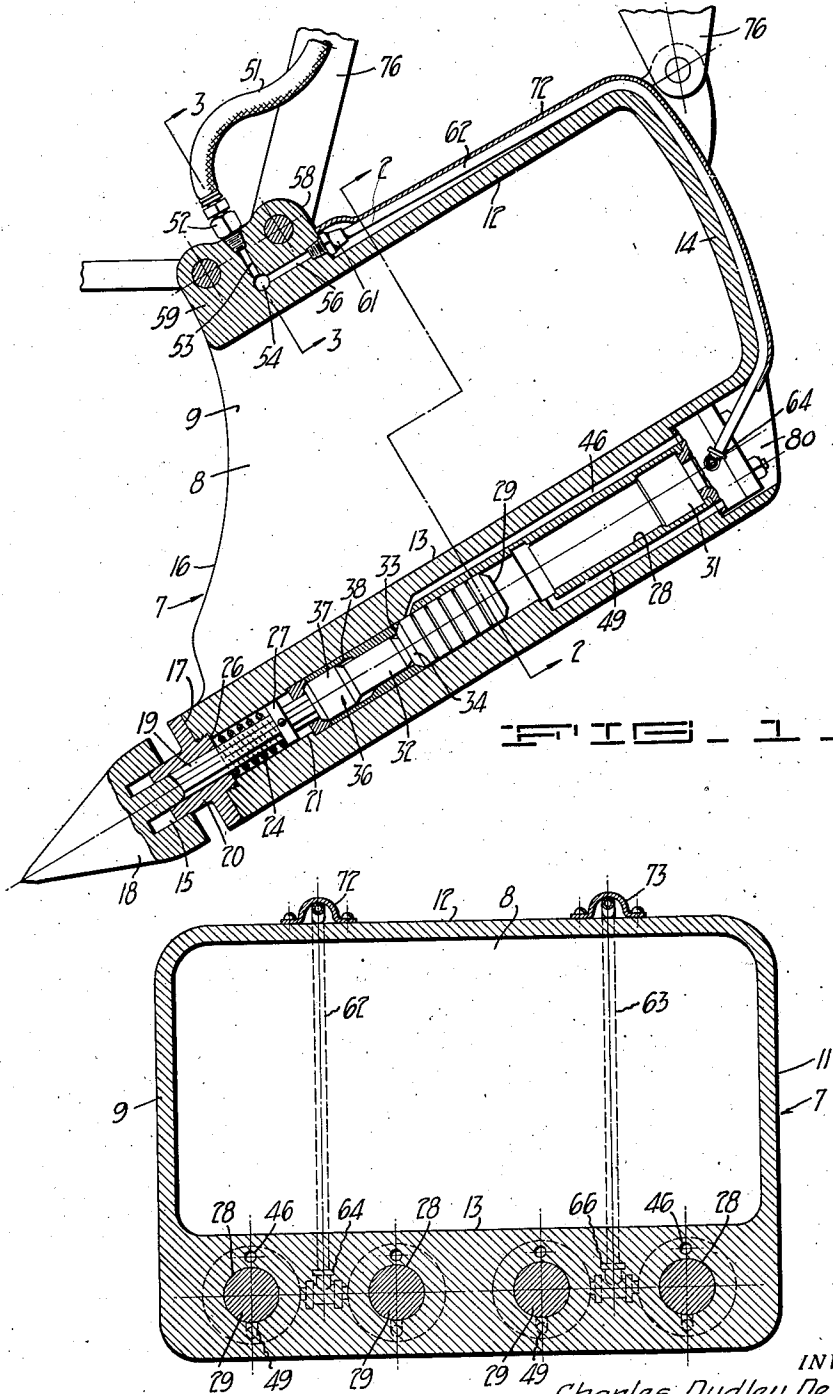
C. D. DE VELBISS

2,228,445

EXCAVATING BUCKET

Filed Oct. 12, 1938

2 Sheets-Sheet 1



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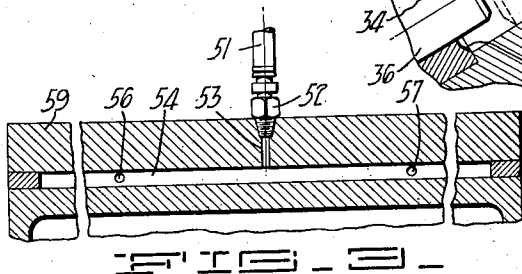
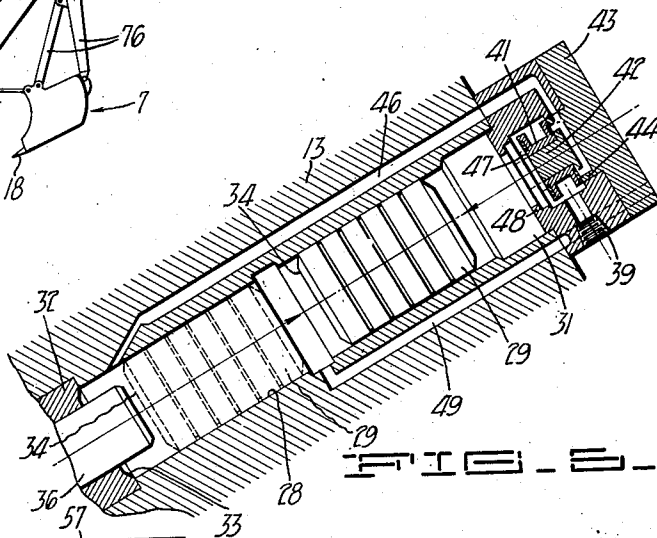
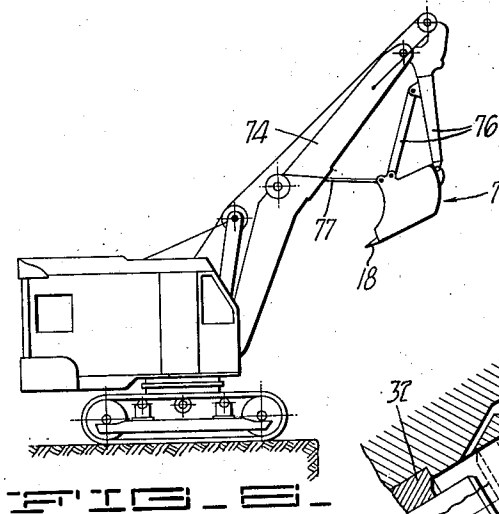
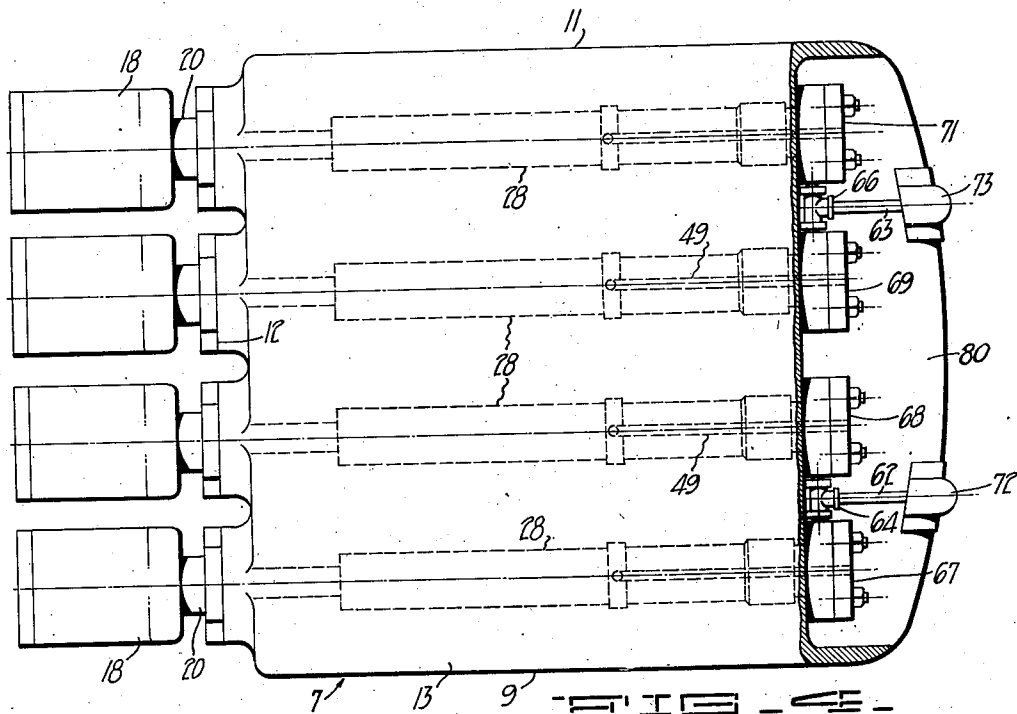
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EXCAVATING BUCKET

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2 Sheets-Sheet 2.



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EXCAVATING BUCKET

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6 Claims. (Cl. 262—9)

The invention relates to excavating buckets or dippers such as used in conjunction with power-driven excavating machinery.

While power-driven excavating machinery such as shovels, drag-lines, trench diggers and the like are widely used for the economical excavation of large quantities of earth, such machines are frequently rendered ineffectual and substantially useless in dislodging certain types of earth, such as either very hard and compact earth on the one hand, or heavy-bodied sticky earth, such as some clays, on the other hand. The difficulty in excavating such earth lies in the inability of the shovel bucket to properly loosen and dislodge the earth for movement into the bucket. Ordinarily an excavating bucket is provided with a plurality of teeth on the leading lower edge of the bucket for engaging in and loosening the earth in advance of the bucket. However, where the earth is very hard and compact, these teeth can only be driven into the earth with great force, and on the other hand when the earth is heavy-bodied and soggy and sticky, the movement of the bucket through the earth offers such a viscous resistance that an extremely large amount of power is required to pass the bucket into and through the earth.

In accordance with the present invention and as one of the principal objects thereof, I provide an excavating bucket of the character described having a plurality of movable bucket teeth which may be power-driven to positively dislodge the earth by means of a force separate from and far greater than the normal force of engagement of the bucket against the earth. With the present bucket, hard and compact earth may be quickly and readily broken and loosened up for movement into the bucket and on the other hand, when the bucket is used with soft, heavy-bodied soggy or sticky earth, the teeth act to positively sever the earth and pass the same into the bucket without the necessity of cutting such earth with the inert, dull leading edge of the bucket.

Another object of the invention is to provide an excavating bucket of the character described which will automatically act to free the bucket teeth from earth deposited thereon and compacted thereagainst.

A further object of the invention is to provide an excavating bucket of the character above which may be used with substantially all existing types of excavating machinery, such as power-shovels, drag-lines, trench diggers or pull shovels, or the like.

The invention possesses other objects and fea-

tures of advantage, some of which, with the foregoing, will be set forth in the following description of the preferred form of the invention which is illustrated in the drawings accompanying and forming part of the specification. It is to be understood, however, that variations in the showing made by the said drawings and description may be adopted within the scope of the invention as set forth in the claims.

Referring to said drawings:

Figure 1 is a vertical cross-sectional view of an excavating bucket constructed in accordance with the present invention.

Figure 2 is a vertical cross-sectional view of the bucket illustrated in Figure 1 and is taken substantially on the plane of line 2—2 of Figure 1.

Figure 3 is a fragmentary cross-sectional view of a portion of the bucket and is taken substantially on the plane of line 3—3 of Figure 1.

Figure 4 is a bottom plan view of the bucket.

Figure 5 is an enlarged sectional view of a part of the bucket showing the pneumatic motor driving means.

Figure 6 is a side elevation of a power-driven trench digger type of excavating machine with the present bucket connected thereto.

The excavating bucket of the present invention comprises briefly a bucket or dipper of more or less standard construction having an open side for movement of earth into the bucket, and one or more bucket teeth which are movably carried by the bucket adjacent to and projecting forwardly of the open side of the bucket, and motor means preferably of a pneumatic type for driving the tooth or teeth to a forwardly extended position relative to the bucket, so as to forcefully engage and loosen the earth in advance of the bucket.

More specifically and with reference to the accompanying drawings, the bucket or dipper of the present invention consists of a dipper body providing an internal chamber 8 defined between opposite side walls 9 and 11, opposed top and bottom walls 12 and 13 and rear wall 14, the body being provided with an open front portion 16 defined between the leading edges of the side and bottom and top walls, for passage of earth into the interior chamber 8. The bucket is so formed and normally supported by the excavating apparatus as to position the leading face 17 of the bottom wall somewhat forwardly of the leading faces of the side and top walls, and in accordance with this form of construction I prefer to mount a plurality of bucket teeth 18 on the bottom wall, so that the teeth will

normally project forwardly thereof in advance of the bucket to engage and loosen earth for movement into the bucket. As aforementioned, these teeth are movably secured to the bucket and as here shown, each bucket tooth 18 is provided with a shank portion 19 which is slidably received in a bore 21 provided in the bottom wall 13 and extending rearwardly from the leading front edge 17 thereof. Preferably, the shank 19 and bore 21 are of non-circular cross-section such as the polygonal form here shown, so as to retain the tooth against rotation relative to the bucket. To further assist in the support of the tooth, the latter may be provided with an annular slotted portion 15 which is slidably engaged over a tubular extension 20 on the bottom wall. Preferably, a helical spring 24 compressed between abutments 26 and 27 on the shank and bore wall urges the tooth to retracted position relative to the leading edge 17 of the bottom wall.

In accordance with the present invention and as above noted, motive means is used for driving the teeth 18 to an outwardly extended position so as to positively drive the teeth into the earth ahead of the bucket to loosen and dislodge such earth for ready movement into the bucket. Preferably, such motive means is of the pneumatic air-hammer type and in the present bucket I use an individual motive means for each of the teeth. Accordingly, a description of one of these motive means will suffice.

The motive means associated with each of the teeth consists of an elongated cylinder 28 formed preferably directly in the bottom wall 13 of the bucket and preferably in substantial alignment with the bore 21. A piston 29, preferably of the solid slug type, is reciprocally mounted within the cylinder for movement between the head end 31 thereof and an insert member 32 positioned in the cylinder adjacent to and registering with the inner end of the bore 21. The insert member 32 provides at its rearward end a seat 33 for one end 34 of the piston and reciprocally carries a connecting member 36 for the piston and tooth shank. The member 36 is preferably provided with an enlargement 37 which cooperates with an enlargement 38 in the bore of the insert 32 for limiting the reciprocal movement of the member 36.

A suitable fluid inlet passage and valve means is associated with the cylinder and piston for reciprocally driving the piston within the cylinder. This reciprocal driving of the piston is effected by alternately connecting the ends of the cylinder to fluid under pressure, while the opposite end of the cylinder is at a reduced pressure. As here shown with particular reference to Figure 5, the cylinder is provided with a fluid inlet passage 39 which preferably enters to the cylinder at the head end 31 thereof. Mounted in the head end of the cylinder in opposed relation to the air inlet passage 39 is a spool type slide valve 41 which is reciprocally carried on a centrally disposed guide 42 formed integrally with one of the cylinder head members 43. The member 43 is provided with a circumferentially extending shoulder 44 which provides a stop for the upward movement of the valve 41, and opening to this shoulder is a fluid passage 46 which extends laterally therefrom into the wall portion of the cylinder 28, and longitudinally to the end of the cylinder adjacent to the insert member 32. The valve 41 is so formed that in its upward position against the shoulder 44, the same will seal off

the passage 39 to the passage 46, and open the passage 39 to the head end of the cylinder, and in its lower position the lower end 47 of the valve will engage a seat 48 provided by the cylinder side wall so as to seal the passage 39 from the head end of the cylinder and communicate the same to the passage 46 for passage of fluid under pressure to the lower end of the cylinder. Provided in the bottom wall of the bucket and intermediate the length of the cylinder is a discharge passage 49 which, as here shown, is embodied in the bottom wall and extends longitudinally of the cylinder to the rear wall of the bucket and functions to communicate the cylinder to the atmosphere for alternately relieving the pressure at the ends of the cylinder.

The operation of the pneumatic motive means, as will be clear from the above, is as follows: With the valve in raised position, as indicated in Figure 5, the fluid under pressure enters the head end of the cylinder and drives the piston downwardly therein, while the fluid in the cylinder below the piston escapes through the discharge passage 49. As the piston passes the discharge passage 49, this passage is sealed off and the fluid below the piston is placed under compression and passes back through passage 46 to the head end of the cylinder, where the fluid engages the top surface of the valve and displaces the same downward to change the position of the valve to that shown in dotted lines in Figure 5. Meanwhile, the piston, due to its momentum, continues its downward movement and forcibly strikes the connecting member 36 to drive the bucket tooth to a downwardly extended position. With the change of position of the valve, as above noted, the fluid passes from passage 39 into passage 46 to the lower end of the cylinder to engage under the piston to raise the same in the cylinder, while the fluid above the piston is relieved through passage 49. As the piston passes passage 49 in its upward movement, this passage is again sealed off and the fluid in the cylinder above the piston is placed under compression, tending to resist the upward movement of the piston and also throwing the valve to upward position, as first described. As soon as the valve is moved to upward position fluid under pressure passes into the head end of the cylinder and resists the upward movement of the piston and brings the piston to a stop short of the head end of the cylinder and thereby protects the valve and other parts at the head end against impact. Upon stopping of the piston, the movement of the piston is reversed and the same starts its downward movement as first described.

As indicated in Figure 1, fluid under pressure is preferably conveyed to the bucket by means of a flexible conduit 51 which is connected to a fluid inlet fitting 52 in the top wall 12 of the bucket. The fitting, as will be seen in Figure 3, is mounted in a passage 53 which is communicated to a cross-passage 54 which in turn connects a pair of passages 56 and 57 extending to a rear surface 58 on an enlargement 59 on the top wall in which the several passages are contained. Secured in passages 56 and 57 at the surface 58 are a pair of conduit fittings 61 which connect these passages with conduits 62 and 63 extending rearwardly over the top wall 12 and downwardly across the rear wall 14 of the bucket to a pair of fittings 64 and 66 mounted between and connected to pairs of cylinder head members 67 and 68, 69 and 71. Preferably, a pair of sheaths 72 and 73 are fas-

tened to the top and rear walls 12 and 14 of the bucket in enclosing relation to the conduits 62 and 63.

As above noted, the bucket of the present invention may be used with substantially any form of power-driven excavating machine, and in Figure 6 I have illustrated the bucket connected to a conventional type ditch digger or pullshovel. The bucket may be connected to the boom 74 of the excavator by means of dipper sticks 76 and a cable 77 in the usual manner.

As an important feature of the present invention the pneumatic driving mechanisms for the teeth are arranged on the bucket so that the supporting parts or casings for such mechanisms are subjected to a minimum amount of wear. In the present bucket the bottom surface of the bucket is formed smooth and continuous from the front to the rear and from side to side of the bottom wall, whereby a large wearing area is provided. In carrying out this construction the cylinders for the pneumatic hammers are formed directly in the body of the bottom wall of the bucket and this latter wall is sufficiently enlarged in thickness over a standard bucket bottom to accommodate the inclusion of the cylinders. In addition the lower end of the rear wall 14 and the rear end of the bottom wall are joined together in a smooth rounded curve, so as to minimize the strain and wear on the bucket at the heel portion thereof and at the same time the head ends of the pneumatic devices are completely contained within the body of the bucket at the heel and thereby protected against exposure and wearing at this point. As will be seen in Figures 1 and 4, a transverse recess 80 is provided in the bottom wall at the rear thereof in which are mounted the cylinder head members 67, 68, 69 and 71 and these head members are completely contained within the enclosure of the recess. Also, the discharge passages 49 of the several pneumatic units terminate at the rear end of the bottom wall in the aforementioned recess 80, so that a free discharge of air from the units is provided. The discharging air also assists in removing any dirt which may lodge in the recess, although the recess being positioned at the rear of the bucket is substantially free from dirt deposit.

It will now be clear that in the use of the present bucket with any conventional type excavating machine, the earth will be positively and forcibly loosened by the power-driven teeth of the bucket for ready displacement into the bucket, regardless of the hard or sticky character of the earth. It will also be clear that due to the rapid and power-driven movement of the teeth, the latter will constantly free themselves from any earth which tends to compact against the teeth, so that the teeth will always maintain themselves clean and free from adhering earth.

I claim:

1. An excavating bucket adapted for connection to a power-driven excavating apparatus and having side and bottom walls defining a chamber with an open front portion adapted for receipt of earth or the like through said portion into said chamber, a bucket tooth movably carried by said bottom wall and projecting forwardly in advance of the leading edge of said bottom wall, said bottom wall being provided with a longitudinal cylindrical bore in substantial alignment with said tooth, a piston reciprocally mounted in said cylindrical bore, connection means for said piston and tooth providing for a driving of said tooth to a

normally extending position by said piston, valve means and fluid inlet means for said cylinder engaged in said bore and spaced from said piston for conveying fluid under pressure into said cylinder for reciprocating said piston, and a fluid conduit extending from the rear portion of said bottom wall to said fluid inlet means.

2. An excavating bucket adapted for connection to a power-driven excavating apparatus and having side and bottom walls defining a chamber with an open front portion adapted for receipt of earth or the like through said portion into said chamber, a bucket tooth movably carried by said bottom wall and projecting forwardly of the leading edge of said bottom wall, a pneumatically operated mechanism carried by said bottom wall and connected to said tooth for driving the same to a forwardly extended position, said mechanism being positioned outside of said chamber, said bottom wall having a smooth, straight and continuous under-surface extending from substantially the front to the rear and from side to side of the bucket.

3. An excavating bucket adapted for connection to a power-driven excavating apparatus and having side and bottom walls defining a chamber with an open front portion adapted for receipt of earth or the like through said portion into said chamber, a bucket tooth movably carried by said bottom wall and projecting forwardly of the leading edge of said bottom wall, a pneumatically operated mechanism connected to said tooth for driving the same to a forwardly extended position and including a cylinder incorporated directly in the body of said bottom wall, a piston reciprocally carried in said cylinder, connection means for said piston and tooth, and valve and passage means associated with said cylinder and piston at the end of said cylinder spaced from said connection means and being inserted into said bottom wall from a rear side thereof and adapted for connection to a source of pressure for reciprocally driving said piston.

4. An excavating bucket adapted for connection to a power-driven excavating apparatus and having side and bottom walls defining a chamber with an open front portion adapted for receipt of earth or the like through said portion into said chamber, a bucket tooth movably carried by said bottom wall and projecting forwardly of the leading edge of said bottom wall, a pneumatically operated mechanism connected to said tooth for driving the same to a forwardly extended position and including a cylinder incorporated directly in the body of said bottom wall, a piston reciprocally carried in said cylinder, connection means for said piston and tooth, and valve and passage means associated with said cylinder and piston and adapted for connection to a source of pressure for reciprocally driving said piston, the under-side of said bottom wall being smooth and substantially planar from the front to the rear and from side to side of the bottom wall of the bucket.

5. An excavating bucket adapted for connection to an excavating apparatus and having side and bottom walls defining an earth container, said bottom wall having an opening therein at the forward end thereof and a forwardly extending tubular portion surrounding said opening, a bucket tooth having a shank slidably mounted in said opening and provided with an annular opening telescopically engaged with said tubular portion, and a pneumatically operated mechanism

anism carried by said bottom wall and connected to said tooth for driving the same to a forwardly extended position.

- 5 6. An excavating bucket adapted for connection to a power driven excavating apparatus and having side and bottom walls defining a chamber with an open front portion adapted for receipt of earth or the like through said portion into said chamber, a thick bottom wall formed integrally
10 with said bucket, a cylindrical bore extending longitudinally through said bottom wall from the

front to the rear portion thereof, a bucket tooth movably carried by said bottom wall and extending into said bore at the front side of said bottom wall, a pneumatic piston mounted in said bore and operable to drive said tooth forwardly of said bucket, means engageable in the rear portion of said bore and including a covering for said bore and valve and air connection means formed for connection to said bore and a source of pressure.

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