Feb. 11, 1936. W. A. BILLINGS 2,030,045

TRENCH DIGGER AND BACK FILLING MACHINE

Filed Aug. 22, 1934 3 Sheets-Sheet 1

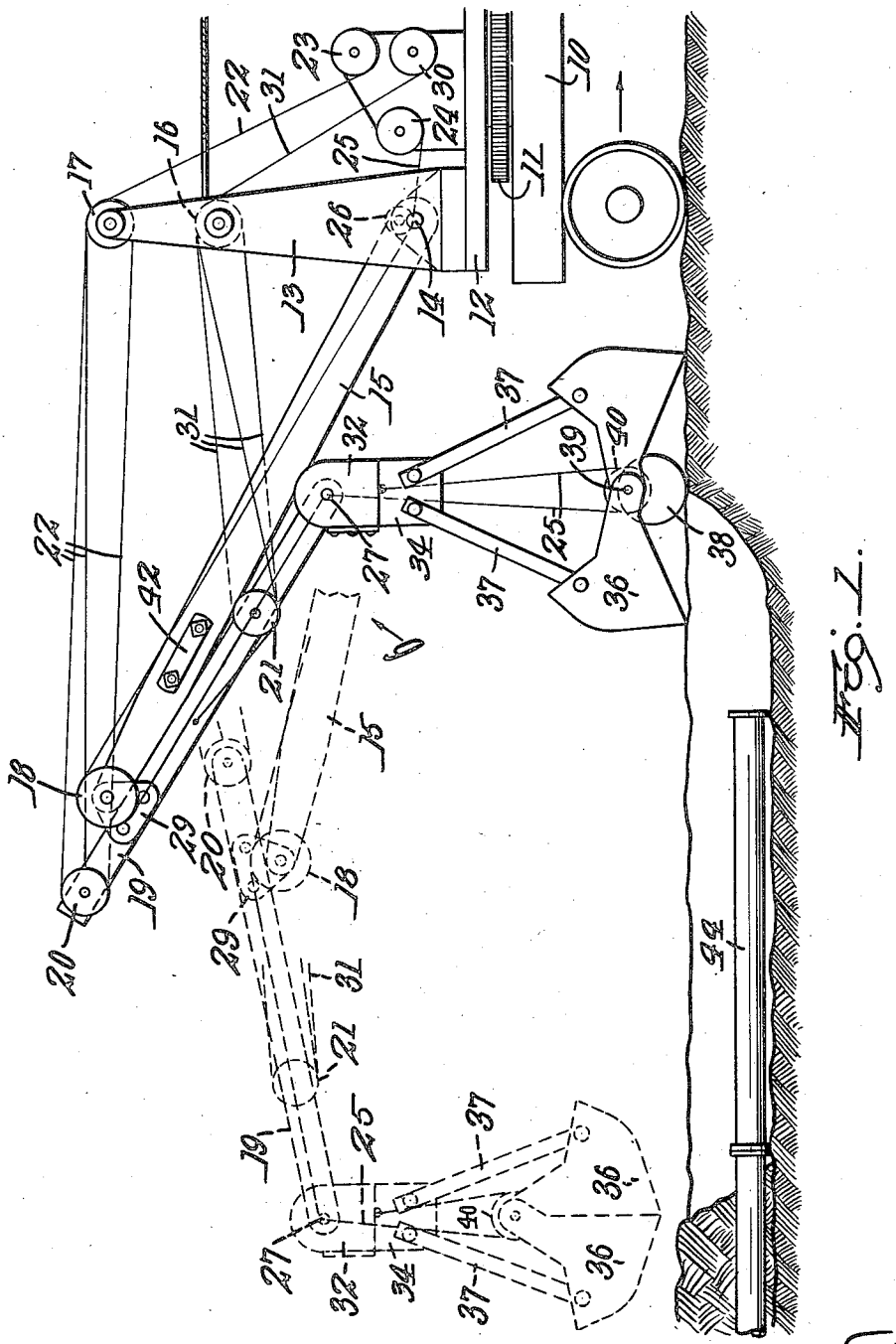


Fig. 1.

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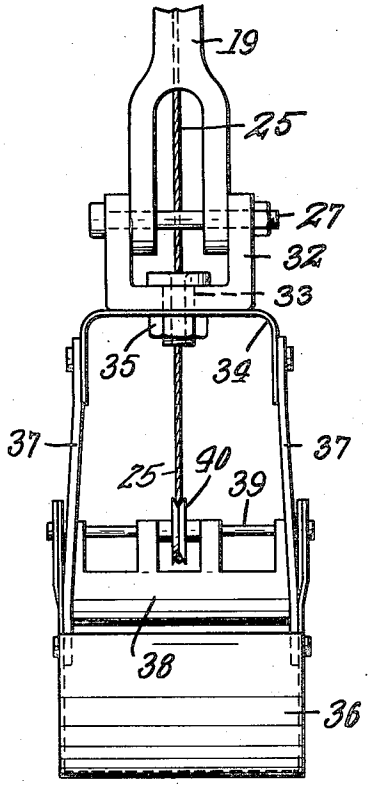


Fig. 2.

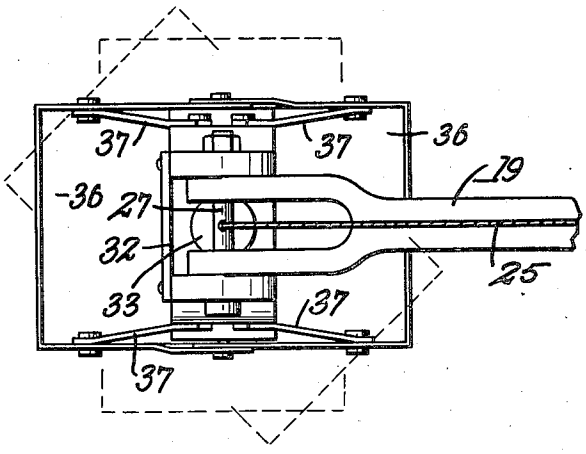


Fig. 3.

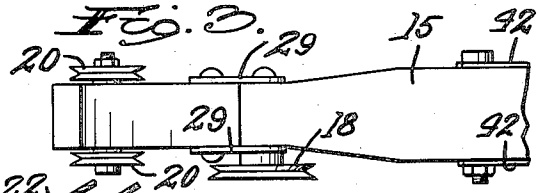


Fig. 5.

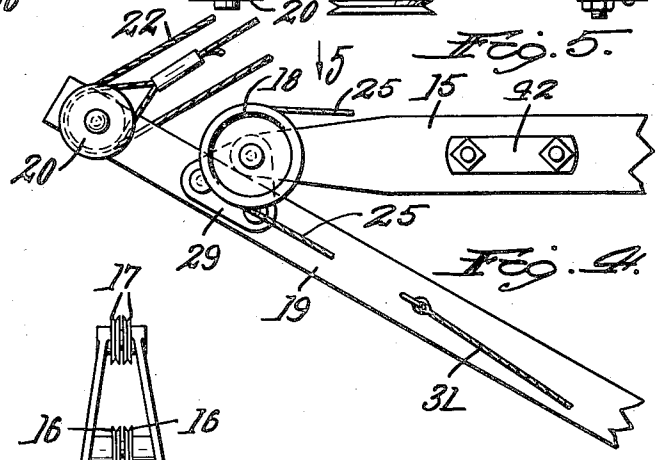


Fig. 4.

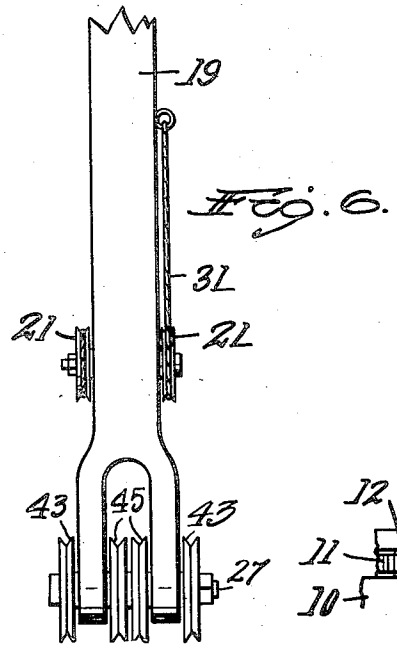


Fig. 6.

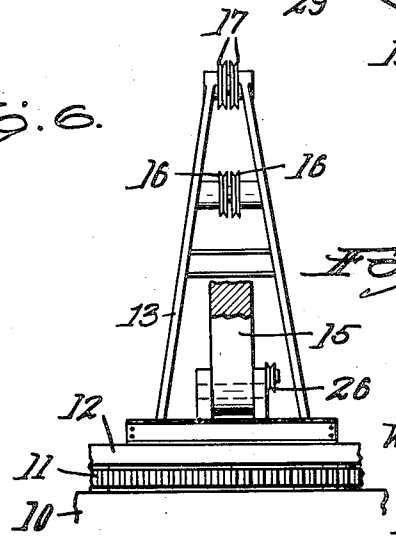


Fig. 7.

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TRENCH DIGGER AND BACK FILLING MACHINE

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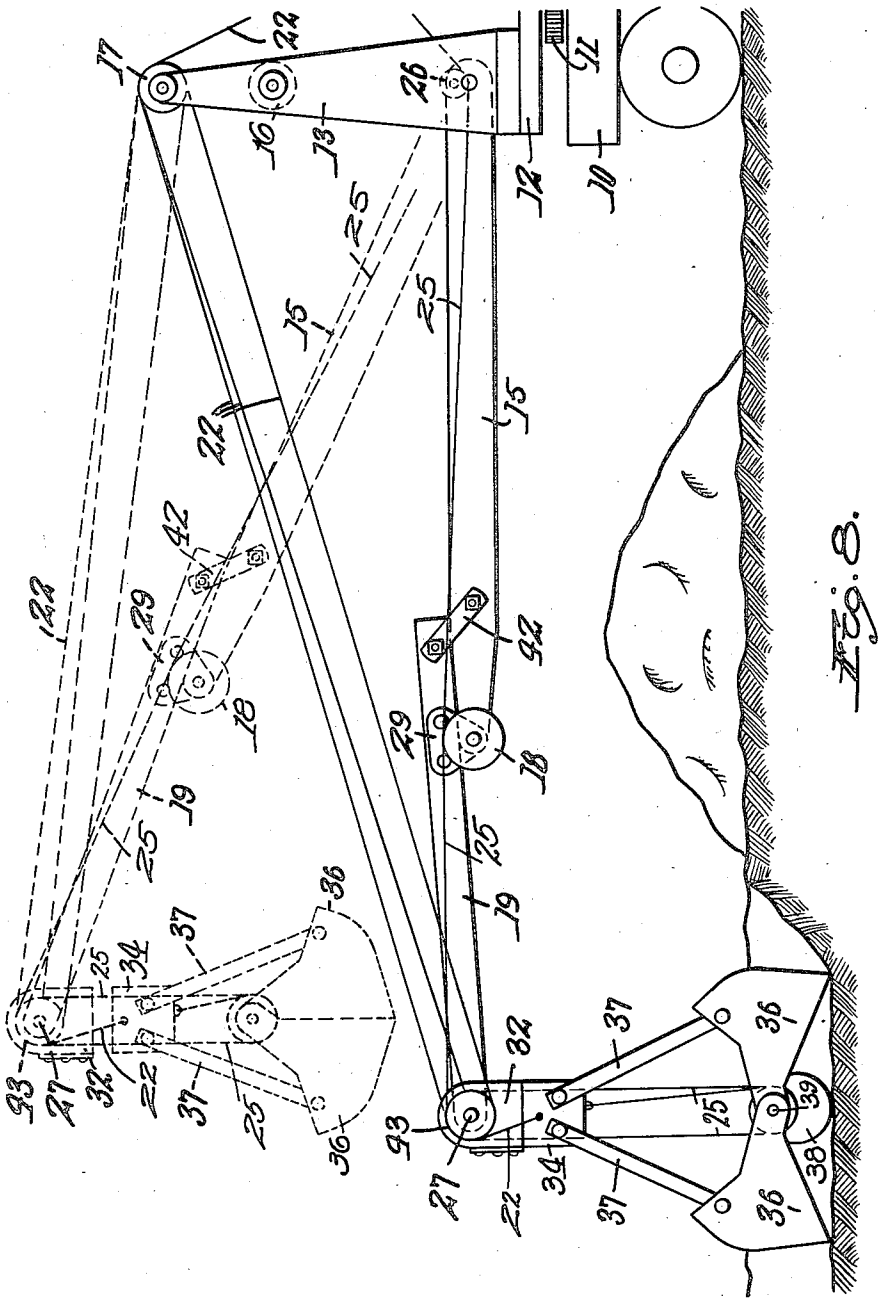


Fig. 8.

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UNITED STATES PATENT OFFICE

2,030,045

TRENCH DIGGER AND BACK-FILLING MACHINE

Wilfred A. Billings, Shrewsbury, Mass.

Application August 22, 1934, Serial No. 740,986

2 Claims. (Cl. 212—42.5)

This invention relates to a machine for digging trenches and back filling them, and the principal objects of the invention are to provide a machine by which the excavation of the trench and the back filling thereof will be substantially continuous, after the first section of trench has been dug, and the earth will not have to be dumped by the digging machine and thereafter picked up and moved a second time for the back filling; to provide a machine in which the excavating can be accomplished by a bucket of the clam shell type; to provide means for supporting the clam shell bucket on the boom itself in such a way that the weight of the boom will be utilized in forcing the clam shell bucket into the earth so that the total weight of earth that can be removed by it will be very greatly increased over the ordinary ways of manipulating clam shell buckets; to provide a construction in which the digging is not accomplished by dragging the bucket backwardly and removing the earth to a point a rod or more from the original position at one side and leaving it there while the pipe is embedded in the trench; to provide a construction in which the clam shell bucket is mounted, for all substantial purposes, rigidly on the back digger boom which is provided with a second boom preferably connected thereto and capable of being fixed with respect to the back digger boom, so that the two booms constitute a single element adding their weight to the bucket to help to dig into the ground; and to provide a construction in which the earth can be removed from any or all sections, after the first one is dug out, and moved back to the next preceding section without dumping it before it is filled into that section, so that a continuous operation is performed and substantially ninety percent of the back filling operation is saved.

Other objects and advantages of the invention will appear hereinafter.

Reference is to be had to the accompanying drawings, in which

Fig. 1 is a side view of a trench digger constructed in accordance with this invention, showing in full lines the process of excavation, and in dotted lines the process of back filling;

Fig. 2 is a side view of the clam shell bucket and the supporting and operating means;

Fig. 3 is a plan of the same;

Fig. 4 is a side view similar to Fig. 1 of the ends of the two booms showing their connection and illustrating a different position from that shown in Fig. 1;

Fig. 5 is a plan of the same as indicated by the arrow 5 in Fig. 4;

Fig. 6 is a view of one of the booms taken in the direction indicated by the arrow 6 in Fig. 1;

Fig. 7 is a front view of the support for the boom, and

Fig. 8 is a side view showing in full lines a modification in the operation of digging, and in dotted lines the position of the parts when the load of earth is raised.

This invention relates to the operation of back filling in the digging of trenches for the installation of sewer and water pipes, etc.

Heretofore this work has been done by means of a back digger on a crane boom. This back digger has always been in the form of a single scoop bucket. It is connected with the boom in such a way that it digs the trench while dragging the bucket backwardly. This removes the earth for a distance of sixteen or more feet from its original position. This earth has to be thrown out at one side and left there until after the section is completed and the pipe is laid in the trench. Then the earth has to be taken back over the same course and filled in over the pipe. This is necessitated by the fact that the back digger is in the form of a scoop which has to be dragged along the ground in order to make the excavation.

It has not been possible heretofore to use a clam shell bucket for this purpose because such buckets are always carried by cables and depend solely upon their own weight to dig into the ground. Therefore the total weight of earth that can be removed by a clam shell bucket has as its maximum only half the weight of the bucket itself.

In the present case I have mounted the clam shell bucket rigidly on a back digger boom and provided a boom in two sections, the weight of which may be as high as three thousand pounds. When the bucket is lowered the weight of this boom acts upon it and consequently the bucket, aided by this weight, is capable of digging up very much more earth than has been the case with any clam shell bucket as heretofore mounted and manipulated.

The method of operation according to the present invention is to dig the first section of a trench in a way somewhat similar to the old way, but by the use of a clam shell bucket which is lifted vertically, laying the earth from the section to one side. Then the pipe is laid and the machine is moved along to its position to excavate for the next length of pipe. During this second period and every subsequent period each bucket full of earth is removed from the section being excavated and then, without dumping, is moved

back to the previous section and dumped or back filled therein. In this way it will be seen that by a substantially continuous operation each section of earth, except the first one, is immediately deposited over the pipe in the next preceding section. The operation of back filling is continuous with the operation of excavating. Therefore when the entire trench is completed there is only the last section to be filled in. This saves approximately ninety percent of the back filling.

The invention is shown as employing the usual form of truck or vehicle 10 which is moved along the surface of the ground in front of the cut or excavation being made therein.

It is provided with means 11 by which the body 12 is capable of being swung on a vertical axis. This body is provided with an upright frame 13 near the bottom of which at 14 is pivoted a boom 15, in the usual position and capable of swinging in the usual way.

On the upright frame 13 are pulleys 16 and 17. On the end of the boom 15 is a pulley 18 and a pivoted bracket 29, which can be swung around the center of the pulley 18 and has rigidly secured to it a second boom 19, provided at one end with pulleys 20 and at a point somewhat adjacent the other end with pulleys 21. A cable 22 is connected with a winding drum 23 inside the body 12 and operated in the usual way. This cable goes over the pulleys 17 and 20 and back to the boom 19 to which it is fastened and has the effect of turning this boom about the center of the pulleys 18 and also can swing the boom 15.

The auxiliary boom 19 is operated directly through a drum 30 by a cable 31 passing over the pulleys 16 and 21, which cable goes back to the boom 19 to which it is fastened. The triangular frame 29, which is securely fastened to the auxiliary boom 19 can swing around its pivot on the boom 15.

Also operated by a drum 24 is a cable 25 which passes under a guide pulley 26 and the pulley 18 and back through an opening in a pivot shaft 27 for a head 32. This cable 25 passes straight down the center of a clam shell bucket 36 around the pulley 40 thereof and its end is fastened to the head 32 so that this cable can be used to close the bucket and release it to allow it to open. The head 32 is mounted on the free end of the boom 19. The head is provided with a vertical pivot 33 adapted to hold a yoke 34, which can be secured in fixed position by a nut 35 to prevent its swinging about the pivot. When the nut is loose, the head 32 and the parts supported by it can be turned merely by moving them against a pile of previously excavated earth. Also if this head is swung quarter of the way around and fastened a wider trench will be dug. On this yoke is connected the clam shell bucket 36 by means of links 37. This bucket is of the usual type having a weight 38 and a shaft 39 provided with the pulley 40, which is connected to the cable 25.

On the boom 15 are connected links 42 which can be connected with the central stud on which the pulley 20 is mounted so that the two parts of the combined booms 15 and 19 can be fixed relative to each other, the triangular frames or brackets 29 being reversed to provide the arrangement shown in Fig. 8 and cause these two booms to be rigidly connected together. When the machine is used in this form the pulleys 20 and 21 are not used but the cable 22 operates on pulleys 43 placed on the shaft 27.

The pulleys or sheaves 20 and 21 can be, and preferably are, removed and both placed on the shaft 27 as shown in Fig. 6. But I have numbered these pulleys 43 and 45 as if they were different ones. The cable 25 passes over the pulleys 45 and the cable 22 over the pulleys 43. Here the head 32 is separate from the yoke 34 as is usual. Then the clam shell bucket can be lowered from the head 32 in the usual way, as shown in dotted lines in Fig. 8, and manipulated in the old way. This arrangement changes it into a crane boom machine. The back digger can be converted into a crane boom in twenty minutes which, in the old constructions, would take two days. The opening of the clam shell bucket is accomplished by the cable 25 passing over the pulleys 45 and 18 to the drum 24. The weight of the clam shell bucket is carried by the cable 22.

The machine is illustrated in full lines in Fig. 1 in the position it assumes when the first cut has been completed and the clam shell bucket is being lowered to take the first cut in the second section. The bucket is forced into the earth by the weight of the booms resting upon the head 32. It is then raised by means of the cables 22 and is moved to the other position by means of the cables 22 and 31. These cables move oppositely to each other.

The operation of these two cables in the proper sequence swings the boom 19 about the pivots on which the frame 29 is mounted, in the position shown in dotted lines, and then by the action of the cable 25 opens the bucket when it is in the dotted line position, or substantially so, and deposits its contents in the cut previously made and now containing a pipe 44.

The method of manipulating the cables will be readily understood and need not be described in detail.

Having thus described my invention and the advantages thereof, I do not wish to be limited to the details herein disclosed, otherwise than as set forth in the claims, but what I claim is:—

1. In a trench digging machine, the combination of a boom pivotally mounted at its lower end, an auxiliary boom swingingly connected with the end of the first named boom, a clam shell bucket pivoted at the free end of the auxiliary boom and supported solely thereby, means for swinging the auxiliary boom about its pivot, and means whereby the auxiliary boom can be fixed to the first named boom in alignment therewith to extend beyond it.

2. In a trench digging machine, the combination with a main boom pivotally mounted at its lower end, an auxiliary boom pivoted near its inner end to the free end of the main boom, pulleys on the inner end of the auxiliary boom, pulleys on the auxiliary boom near its free end, a cable passing over the first named pulleys for operating the main boom, a separate cable passing over the second pulleys for swinging the auxiliary boom on its pivot, a clam shell bucket carried by the auxiliary boom, and a third cable for opening and closing the bucket.

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