No. 818,214. PATENTED APR. 17, 1906.

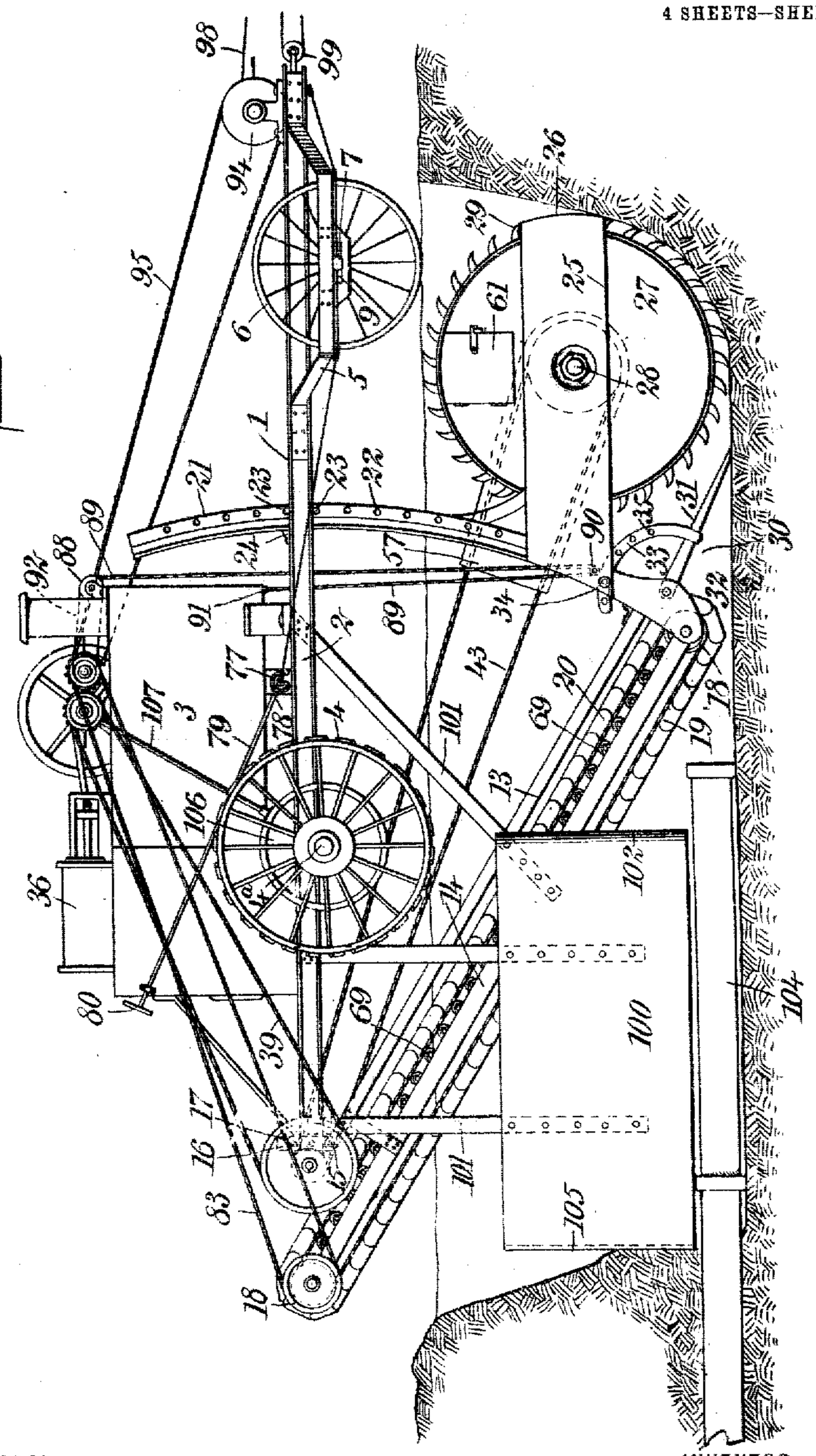
A. M. ANDERSON.

EXCAVATOR.

APPLICATION FILED MAY 11, 1905.

4 SHEETS—SHEET 1.

FIG. 1.



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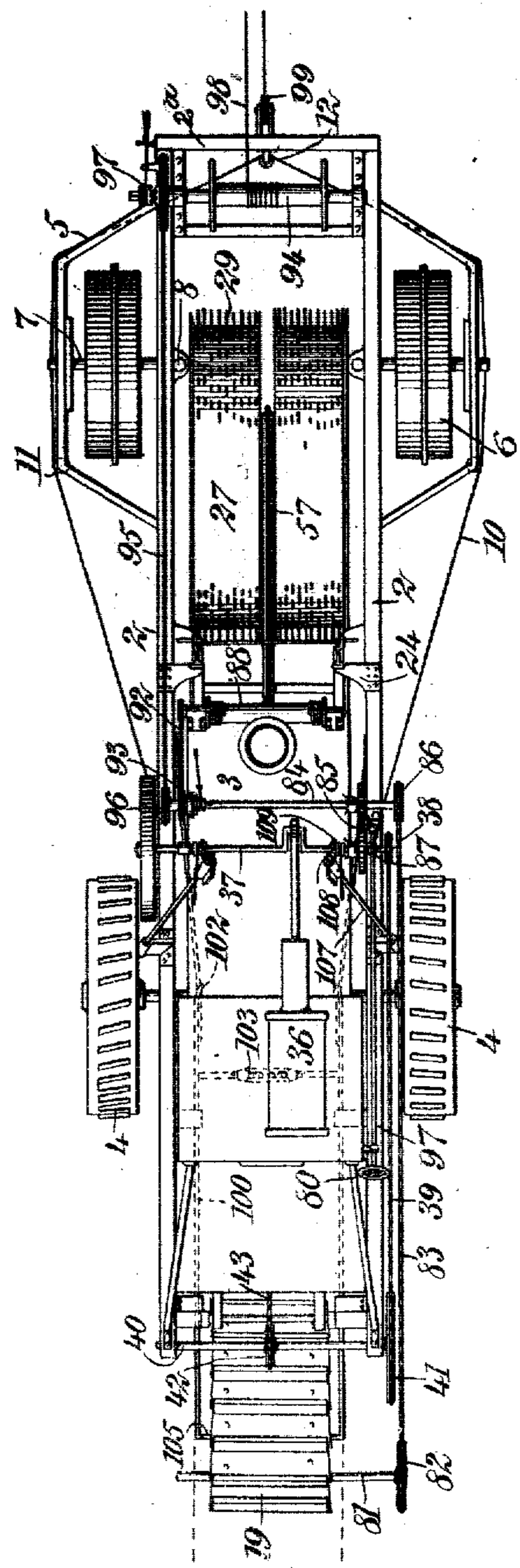
4 SHEETS—SHEET 2.

FIG. 2.



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4 SHEETS—SHEET 3.

FIG. 3.

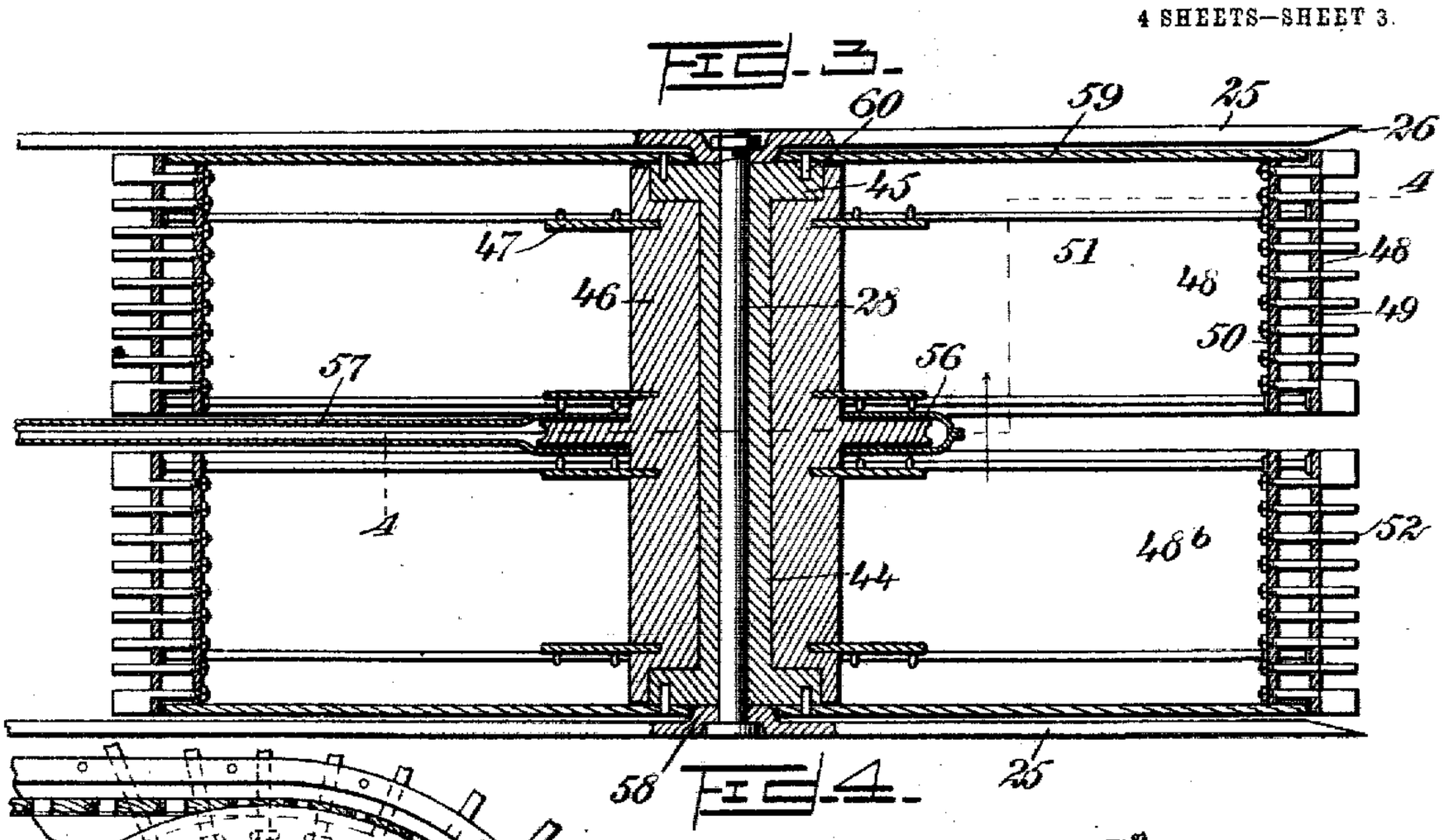

FIG. 4.

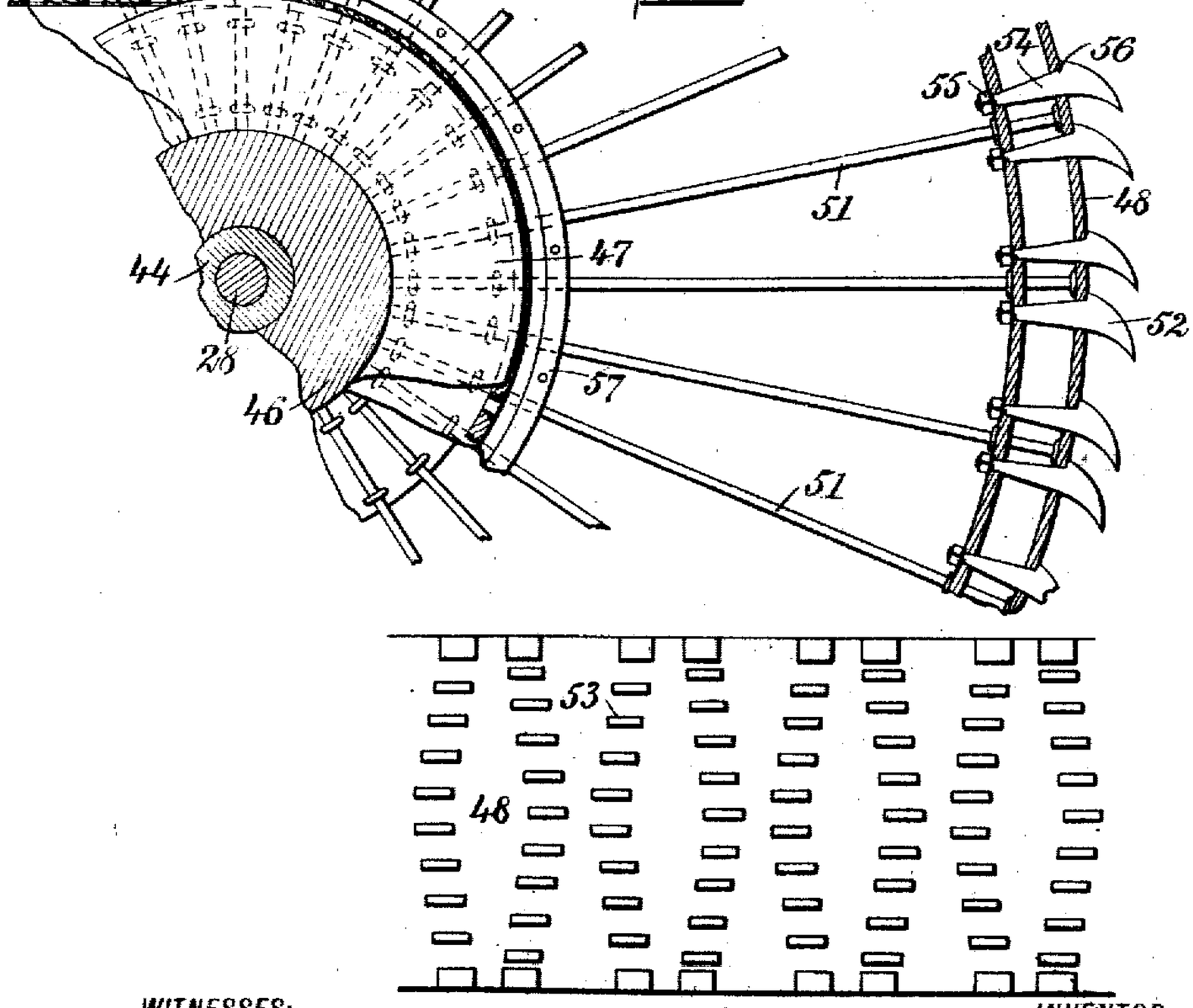

FIG. 5.

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APPLICATION FILED MAY 11, 1905.

4 SHEETS—SHEET 4.

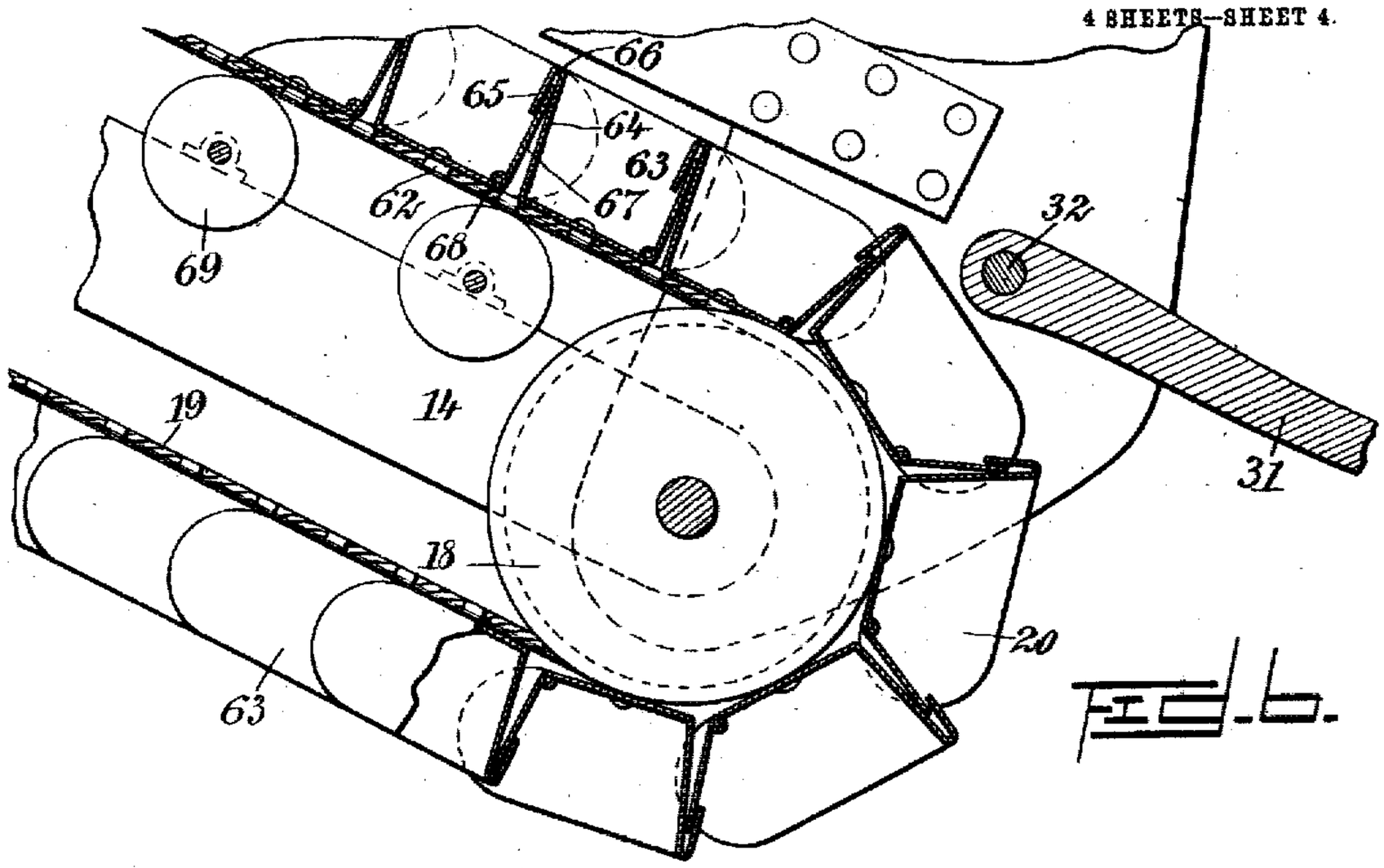


FIG. 6.

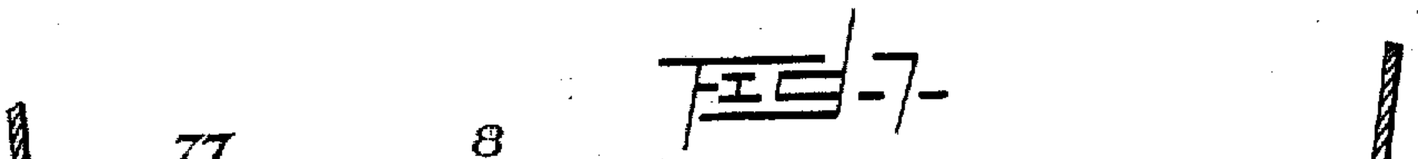
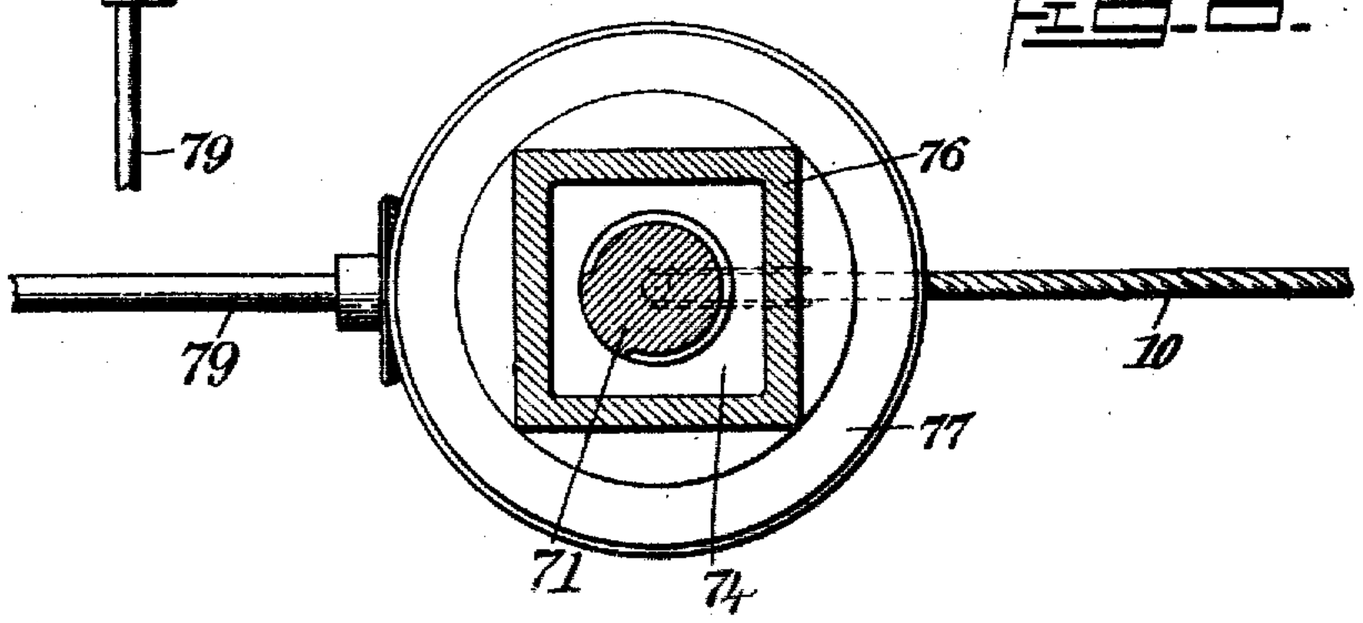


FIG. 7.

FIG. 8.



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UNITED STATES PATENT OFFICE.

AUGUST M. ANDERSON, OF MOORHEAD, MINNESOTA.

EXCAVATOR.

No. 818,214. Specification of Letters Patent. Patented April 17, 1906.

Application filed May 11, 1905. Serial No. 259,861.

To all whom it may concern:

Be it known that I, AUGUST M. ANDERSON, a citizen of the United States, and a resident of Moorhead, in the county of Clay and State of Minnesota, have invented a new and Improved Excavator, of which the following is a full, clear, and exact description.

This invention relates to excavators, and especially to machinery for making ditches and trenches.

The invention is especially applicable in laying pipe-lines.

The invention consists in the construction and combination of parts, which will be more fully described hereinafter and definitely set forth in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a side elevation of the machine, representing the same in operation. Fig. 2 is a plan. Fig. 3 is a horizontal section taken through an excavating-wheel which constitutes a feature of the invention. In this view contiguous parts are represented in section and broken away, as will appear. Fig. 4 is a section taken substantially upon the line 4 4 of Fig. 3. Fig. 5 is a developed plan of the face of the excavating-wheel and illustrating the arrangement of cutters or teeth carried by the wheel. Fig. 6 is a sectional view taken through a portion of a plow and the contiguous portion of a conveyer which receives the material from the plow. Fig. 7 is a horizontal section taken through a portion of the steering mechanism, and Fig. 8 is a section taken substantially upon the line 8 8 of Fig. 7. Figs. 6, 7, and 8 are upon an enlarged scale, as will appear.

Referring more particularly to the parts, and especially to Figs. 1 and 2, 1 represents the frame of the machine, which comprises a pair of oppositely-disposed parallel beams 2. These beams 2 are connected forwardly by a cross-beam 2^a. Upon this frame a boiler 3, of any common type, such as that shown, is mounted, the same being disposed preferably above driving-wheels 4, upon which the rear portion of the frame is supported. Near the forward portion the side beams 2 are provided on their outer faces with brackets 5, which facilitate the mounting of the forward wheels 6. These forward wheels are mounted upon axles 7, which are pivoted at 8 at their inner extremities to the beams 2, as illustrated. The outer extremities of these axles 7 are received in longitudinally-disposed guide openings or slots 9, which are formed at the under edges of the brackets 5, as illustrated. This arrangement for mounting the forward wheels reduces the wheel-base and facilitates the guiding of the machine. As illustrated most clearly in Fig. 2, the extremities of the axles 7 project beyond the brackets 5, and these projecting extremities have attached thereto a steering-cable 10, which passes continuously around the brackets, passing over guide pulleys or sheaves 11 arranged at the outer portions thereof, as indicated. Near the forward portion of the frame 1 this cable 10 passes over another guide-sheave 12, preferably arranged centrally of the machine, as shown. From this arrangement it should be understood that if one side of the cable 10 is drawn in while the other side is let out the axles 7 may be thrown into corresponding inclined positions, so as to change the course of the machine when advancing. The details of the arrangement for effecting the control of this steering-cable will be described more fully hereinafter. At the rear extremities of the beams 2 a conveyer 13 is supported, the same comprising a girder-like arm 14, which is pivotally attached at 15 to a bracket 16, the said brackets being provided with a plurality of openings 17, enabling the same to be adjusted vertically at their connection with the beams. At the extremities of the girder-body or girder 14 rollers 18 are provided, over which pass a continuous belt or conveyer 19, carrying buckets 20, the construction of which will be more fully described hereinafter. At the forward extremity of the girder 14 a pair of bow-frames or bows 21 are attached, and these are arranged in a substantially vertical plane, as indicated, and pass upwardly adjacent to the faces of the beams 2. These bows are provided with a plurality of openings 22, through which removable keys 23 pass in order to lock the bows to the beams, as will be readily understood. As indicated in Fig. 1, the pins lie respectively on the upper and lower faces of the beams. At these points of connection between the beams 2 and the bows brackets 24 are provided, which conform substantially to the curvature of the bows, as will be readily understood. Near the lower extremities of the bows 21 forwardly-projecting arms 25

are rigidly attached. These arms preferably consist of elongated plates provided with sharpened forward edges 26, adapted to cut their way in an earth bank, as will be readily understood. Between the arms 25 an excavating-wheel 27 is mounted upon a horizontal shaft 28, and the outer face of this wheel is provided with a plurality of teeth or cutters 29, which are adapted to excavate the material in advance of the wheel, as will be readily understood. The construction of this wheel and the manner of driving the same will be described more fully hereinafter. Near the lower portions of the bows 21 and just to the rear of the excavating-wheel 27 I provide a plow 30, which plow preferably consists of an inclined plate 31, pivotally attached at 32 to the bows, as indicated. At a point removed from this pivot 32 this plate is provided with quadrants or arcs 33, which enable the inclination of the plate to be adjusted by means of a removable bolt 34 and a plurality of openings 35, formed in the quadrants, as shown.

The mechanism of the machine is actuated by an engine 36 of any common form, such as that shown. As illustrated, this engine is mounted upon the boiler and operates to rotate its shaft 37, which is disposed transversely of the machine, as indicated in Fig. 2. Near one extremity this shaft 37 is provided with a sprocket-wheel 38, over which a chain 39 passes, the said chain passing rearwardly, so as to actuate a counter-shaft 40, disposed transversely of the machine and mounted in the extremities of the beams 2, as shown. This counter-shaft 40 carries a sprocket-wheel 41, receiving the chain 39, as will be readily understood. At substantially the middle point of this shaft 40 a sprocket-wheel 42 is attached, over which runs a chain 43, and this chain actuates the excavating-wheel 27 in a manner which will presently appear. Recurring now to this excavating-wheel, and referring especially to Figs. 3, 4, and 5, at its hub the excavating-wheel comprises a sleeve 44, which envelops the shaft 28, as indicated, the same being provided with heads 45 for a purpose which will appear more fully hereinafter. Upon this sleeve 44 a rotatable hub 46 is mounted, and this hub is provided with a plurality of annular disks 47, which project laterally therefrom, as indicated. The rim 48 of the wheel is of substantially cylindrical form and formed in sections 48^a and 48^b, which are separated, as shown, so as to leave an opening therebetween. This rim 48 comprises an outer rim 49 and an inner rim 50, and it is rigidly connected with the hub 46 by means of radial spokes 51, which attach to the sides of the disks 47, as indicated. The outer face of the rim 48 is studded with cutters or teeth 52. These teeth are preferably arranged in rows 53, the individual members whereof are arranged progressively in advance of each other, as indicated in Fig. 5. The form of these teeth 53 and the manner of mounting the same in the rim are most clearly illustrated in Fig. 4. The bodies of these teeth are preferably curved and sharpened forwardly with respect to the direction of rotation of the wheel. They comprise shanks 54, which pass through elongated openings in the outer rim, and the extremities of these shanks 54 project through openings in the inner rim and receive nuts 55, which secure the teeth in position, as will be readily understood. Near their outer portions the teeth are provided with shoulders 56, which abut against the outer face of the rim, as shown. At the central portion of the hub 46, which lies in the space between the rim-sections, a sprocket-wheel 56 is formed, and over this sprocket-wheel the driving-chain 43 aforesaid passes, enabling the wheel to be rotated, as will be readily understood. That portion of the chain which lies near the excavating-wheel is completely inclosed by a casing 57, which preferably extends back to a point to the rear of the bows 21.

As indicated in Fig. 3, the arms 25 are provided with openings through which the shaft 28 passes, and at these openings the arms are preferably offset inwardly so as to form bosses 58, which rest against the extremity of the sleeve 44. Between the arms and the heads 45 of the sleeve 44 end plates or heads 59 are provided, which substantially close the ends of the wheel, as indicated, and these heads are preferably rigidly attached to the heads 45 by bolts or rivets 60. The heads 59 are preferably provided with openings constituting manholes, and these are closed by doors 61, as illustrated in Fig. 1.

The construction of the conveyer 13 will now be described, referring especially to Fig. 6. This figure represents, partially in section, the lower extremity of the conveyer near the plow. The conveyer comprises a continuous belt 19, referred to above, and the buckets 20 are preferably attached thereto near the central point of their bottoms by means of rivets or similar fastening devices 62. These buckets are formed with rigid side walls 63 and rigid forward walls 64, the said forward walls 64 being formed with downwardly-bent flanges 65, which are forwardly disposed, as shown, so as to form recesses or pockets 66. The rear walls 67 of the buckets are hinged to the bottoms thereof at 68, and the upper edges of these rear walls are received in the aforesaid pockets 66. The forward extremity of each bucket is received between the side walls of the bucket next in advance. From this arrangement the buckets may pass around the guide-rollers 18 very readily and without becoming disconnected, it appearing that the jointed rear walls adjust themselves to the particu-

lar angular relation of the parts. The upper side of the belt 19, which carries the full buckets, is supported upon transversely-disposed rollers 69, which are attached to the girder 14, as illustrated.

The mechanism for operating the steering-cable 10 will now be described, referring especially to Figs. 7 and 8. At a suitable point, preferably beneath the forward portion of the boiler 3, I provide a bracket 70, which has a threaded bore through which passes a screw 71. This screw is provided with swivel-heads 72, to which the extremities of the cable 10 attach, as shown, the said cable passing around guide-sheaves 73 for this purpose. The screw 71 is formed with a square head 74, which head is mounted in the square bore 75, as indicated, the said bore being formed in the enlarged cylindrical shaft 76 of a bevel gear-wheel 77. The bevel gear-wheel 77 meshes with a bevel gear-pinion 78, attached to the shaft 79, which shaft projects rearwardly, as indicated in Fig. 1, to a point at the rear of the boiler, where it carries a suitable hand-wheel 80. Evidently by rotating the hand-wheel 80 the bevel gear-wheel 77 will be rotated, and this wheel transmits rotation to the screw 71. In this way the screw 71 may be advanced longitudinally in either direction. It will then of course operate to draw in upon one side of the cable 10, while the other side of the cable is let out.

In order to enable the conveyer 13 to be driven by the engine 36, the shaft 81 of the uppermost guide-roller 18 is extended, as indicated, and carries a sprocket-wheel 82, over which a chain 83 passes. Forwardly of the engine-shaft 37 a counter-shaft 84 is provided, which may be driven continuously through gears 85, meshing between the shafts. This counter-shaft 84 carries a sprocket-wheel 86, over which the chain 83 passes, as illustrated. Upon the shaft 37 a clutch 87 is arranged, which enables the rotation of the shaft 84 to be discontinued without stopping the engine 36.

At a suitable point, and preferably near he forward portion of the boiler 3, a drum 88 s provided, the same being disposed horizonally and transversely of the machine, as llustrated. At the extremities of this drum ables 89 attach, which pass downwardly round guide-sheaves 90, attached to the ows 21 near the lower portions thereof, he extremities of these cables being atched near the under side of the boiler, as idicated at 91. This drum enables the potion of the excavating-wheel 27 to be regulated as desired. This drum is controlled om the counter-shaft 84 by means of a rocket-chain 92, as indicated in Fig. 2. pon the counter-shaft 84 at a suitable point clutch 93 is placed, which enables the chain to be thrown out of operative connection th the counter-shaft, as will be readily understood. This clutch would normally be open, as the position of the excavating-wheel would be seldom changed.

At the forward portion of the frame a feed-drum 94 is mounted upon a horizontal shaft, and this drum may be rotated by means of a chain 95, which passes forwardly from a sprocket-wheel 96, carried by the aforesaid counter-shaft 84. This chain may be operatively connected with the shaft of the drum 84 through a clutch 97, as will be readily understood. This clutch 97 would normally be closed when the machine is in operation, so as to enable the machine to be advanced or conveyed forwardly into the earth bank being excavated. Upon the feed-drum 94 a cable 98 is wound, which cable passes forwardly to a suitable anchor fastened in the ground or to a tree which is conveniently located. To the forward extremity of the frame 1 a sheave 99 is attached which may be used in conjunction with the cable 98 when desired.

At a suitable point, preferably beneath the rear portion of the frame 1, I provide shields 100, which consist, substantially, of rectangular plates held in a vertical position, as indicated, the same being supported by straps or hangers 101, which extend downwardly from the beams 2, as shown. These shields are disposed at a distance apart which is substantially equal to the width of the excavating-wheel 27, and they constitute guards or retainers, which prevent the falling in of the side walls of the trench. They perform the function of the temporary curbing, which has hitherto been set in place as the trenches are excavated. In order to prevent the shields from scraping down the sides of the trench, the forward extremities of the plates are preferably bent inwardly, so as to form lips 102, as indicated in Fig. 1. The shields are preferably kept a suitable distance apart and rendered adjustable by a turnbuckle 103, as indicated in Fig. 2.

Where the machine is being used for laying a pipe-line 104, the laying of the pipe may be carried on while the machine is advancing and excavating material in front of the workmen. When such an operation is being effected, I provide between the shields 100 a tail-plate 105. It should be understood that the workmen would stand in the space which is substantially inclosed by the three sides of the shield thus formed. As the operation progresses the excavated dirt is dumped to the rear of the tail-plate 105, so that the trench is continuously filled behind the workmen.

In case a boulder or loose rocks should be found in the path of the excavating-wheel the machine would be backed, so as to enable the same to be removed.

Arrangement is made for enabling the machine to advance by its own traction when de-

sired. Where a cut would not be of great depth, the machine would be advanced in this manner, as the feeding or advance of the cutting could progress with greater rapidity. To this end the axle 4^a of the driving-wheels 4 is provided with a bevel gear-wheel 106, and this gear-wheel meshes with a pinion carried by a counter-shaft 107, as indicated in Fig. 1, the said shaft being driven by bevel-gears 108 from the engine-shaft 37. A clutch 109, carried by the engine-shaft, enables this traction to be thrown in or out, as desired, without stopping the engine.

The mode of operation of the machine will now be described.

The machine is advanced either by the feed-cables 98 or by its own traction. By operating the engine to actuate the drum 68 the excavating-wheel 27 is raised or lowered to suit the required depth of the cut to be taken. By means of the removable keys 23 the excavating-wheel is held in a fixed position at the desired depth. The rotation of the engine is transmitted to the mechanism and in the manner fully described above, so as to rotate the excavating-wheel in a forward direction. The excavated material passes rearwardly to the conveyer and is carried rearwardly by the buckets 20. If desired, it could be dumped back into the trench behind the newly-laid pipe in the manner described above. However, where the trench is intended to be left open a spreader is used behind the machine, which runs on wheels and is formed with an inclined cover upon which the dirt falls and by means of which is conveyed to one or both sides of the trench. This spreader is employed also where it is necessary to make two successive cuts with the machine in order to attain the desired depth for the trench. As the machine advances it is steered by the hand-wheel 80, operating through the mechanism and in the manner fully described above, so as to throw the axles 7 into inclined position.

When it is desired to move the machine to a new field of operation, the excavating-wheel is hoisted to an elevated position between the beams 2 and is held there by transverse blocks resting on the beams and passing under the wheel.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In an excavator, in combination, a frame, an arm pivotally attached thereto, bows attached toward the free extremity of said arm and lying adjacent to said frame, an excavating-wheel carried forwardly of said arm, and means for locking the same in a depressed position.

2. In an excavator, in combination, a frame, an arm pivotally attached to said frame, bows attached to said arm and lying adjacent to said frame, means for locking said bows to said frame, an excavating-wheel carried forwardly of said arm, and means for rotating said wheel.

3. In an excavator, in combination, a frame comprising a pair of substantially parallel beams, an excavating-wheel, means for lowering said wheel and elevating the same above said beams in the space between said beams, and means for driving said wheel.

4. In an excavator, in combination, a frame comprising a pair of substantially parallel side beams, an arm pivotally attached to said beams, a conveyer carried by said arm, an excavating-wheel supported by said arm, forwardly of said conveyer, means for raising and lowering said arm and wheel, and a cross-beam connecting said side beams beyond the path of said arm and wheel.

5. In an excavator, in combination, an excavating-wheel, a depressible member carrying said wheel, a conveyer carried by said member, and a plow carried by said member, behind said wheel, and adapted to receive excavated material from said wheel.

6. In an excavator, in combination, a frame, excavating mechanism carried thereby, means for advancing said frame, and shields carried by said frame and projecting into the space excavated by said mechanism, said shields constituting retainers for the wall thereabout.

7. In an excavator, in combination, a frame, excavating mechanism carried forwardly thereof, means for advancing said frame, a shield under said frame and behind said excavating mechanism, and means for conveying the excavated material to a point behind said shield.

8. An excavating-wheel comprising, in combination, a transverse supporting-shaft, a sleeve rigid therewith, a hub rotatably mounted on said sleeve, a rim carrying teeth, spokes connecting said rim with said hub, and a fixed head attached to said sleeve and substantially filling the space surrounded by said rim.

9. In an excavating-machine, in combination, an excavating-wheel, a conveyer behind said wheel and adapted to receive excavated material therefrom, a plow between said wheel and said conveyer, and comprising a pivoted plate, and a quadrant attached to said plate and affording means for adjusting the angular position thereof.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

AUGUST M. ANDERSON.

Witnesses:

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