July 1, 1930. R. D. BAKER 1,768,657

FINE GRADING MACHINE

Filed Nov. 28, 1927 13 Sheets-Sheet 1

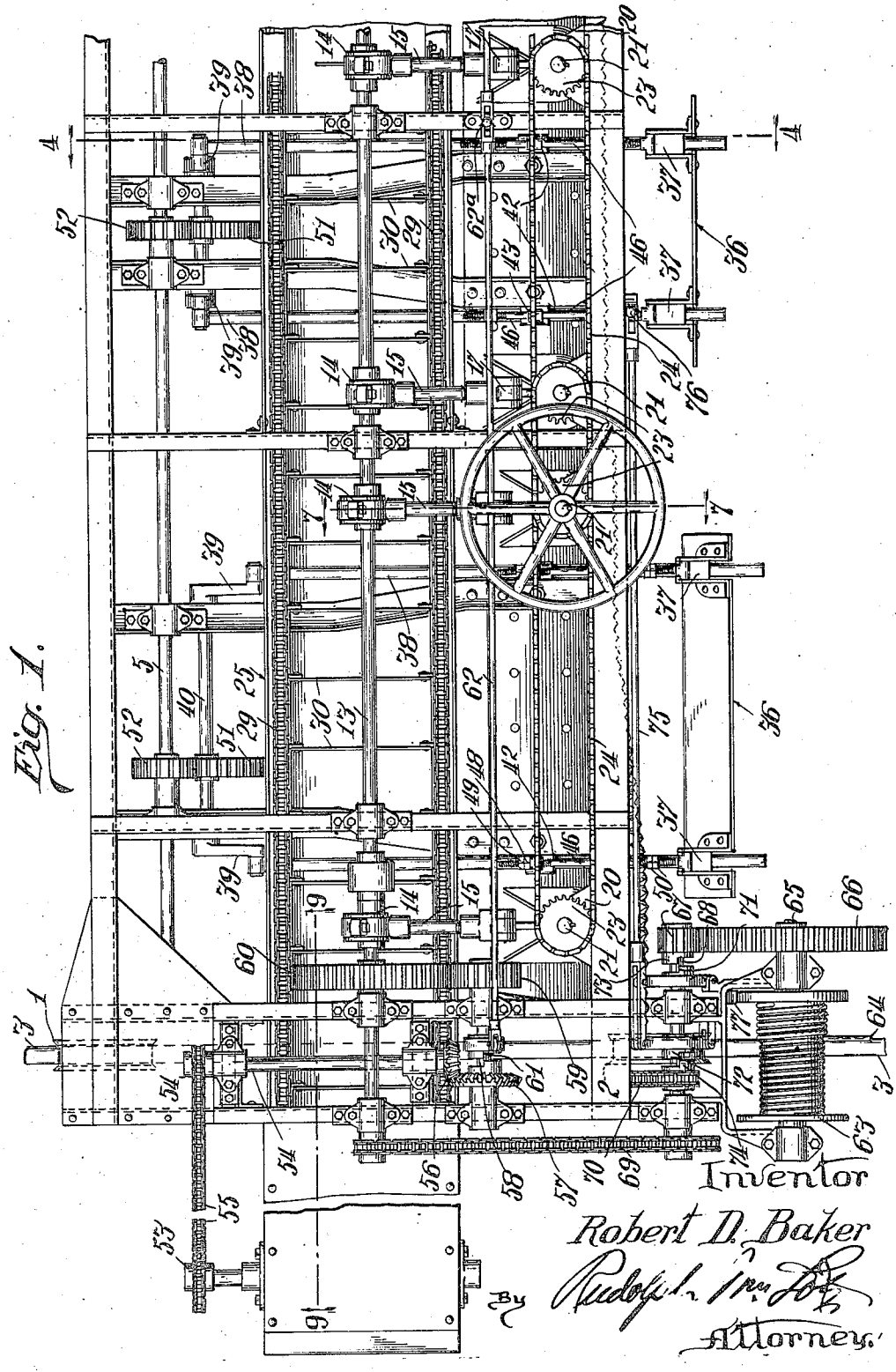


Fig. 1.

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FINE GRADING MACHINE

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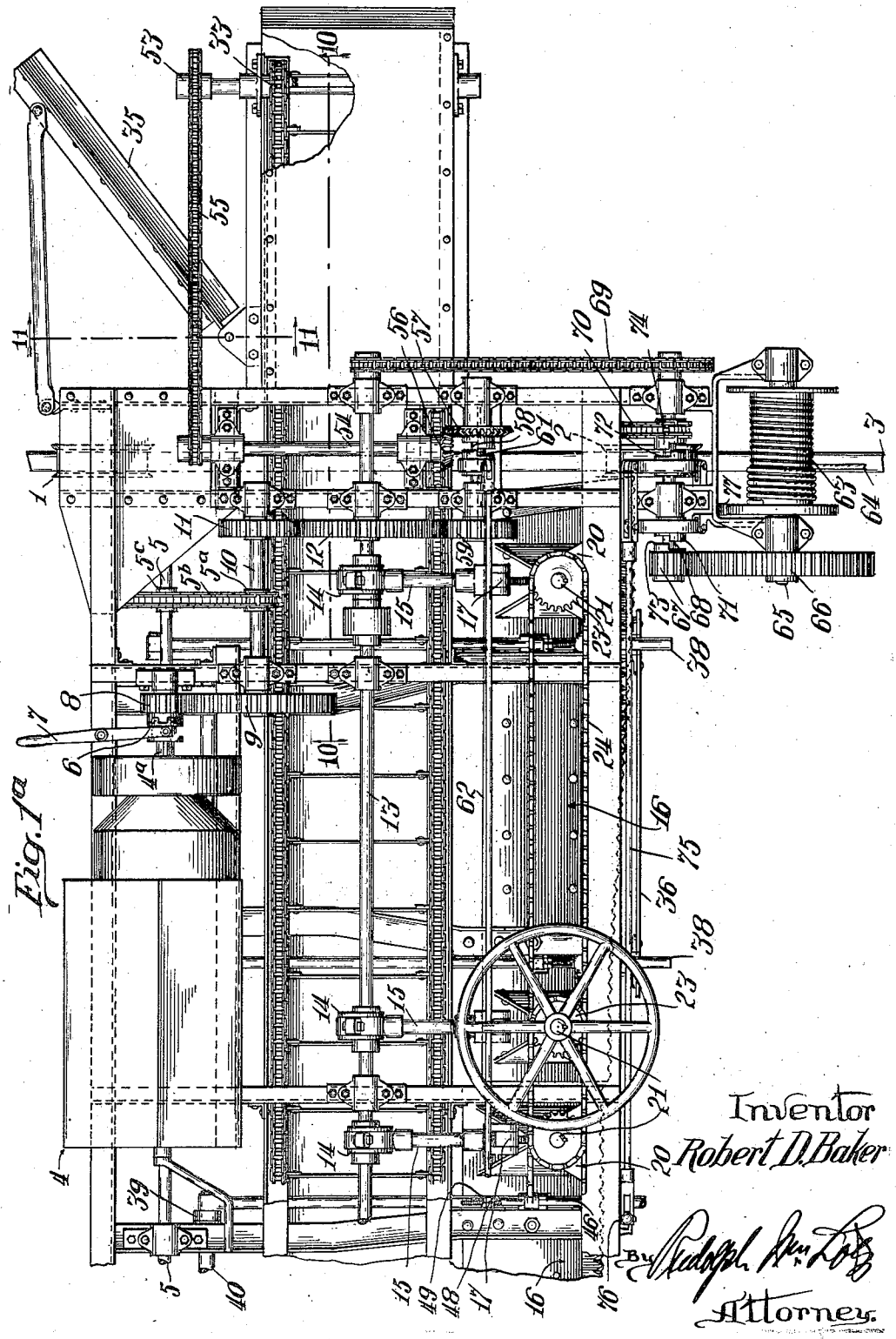


Fig. 1a

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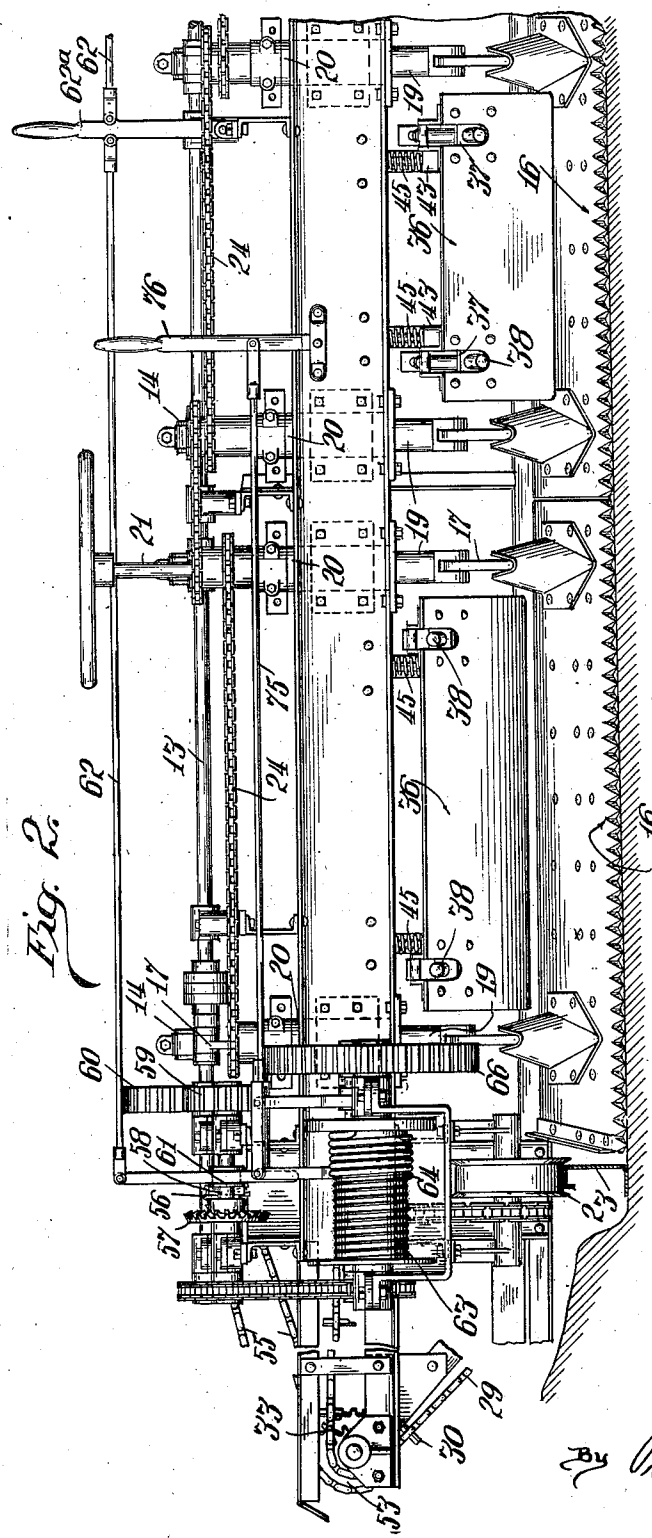


Fig. 2.

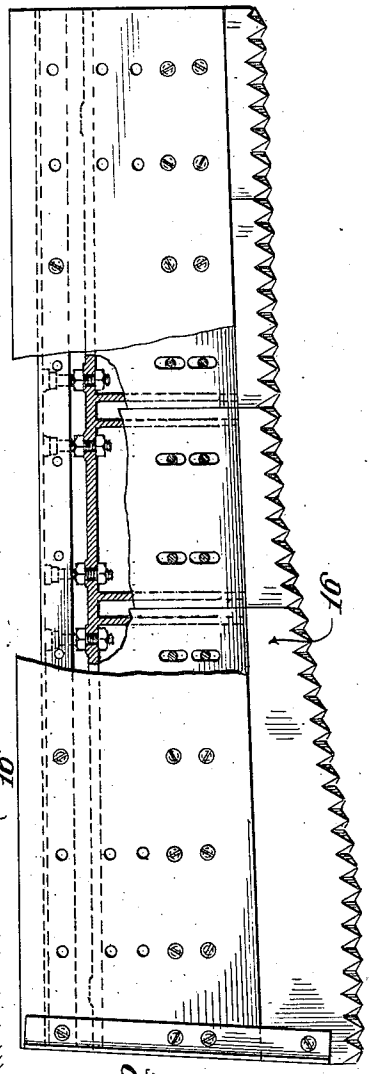


Fig. 12.

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FINE GRADING MACHINE

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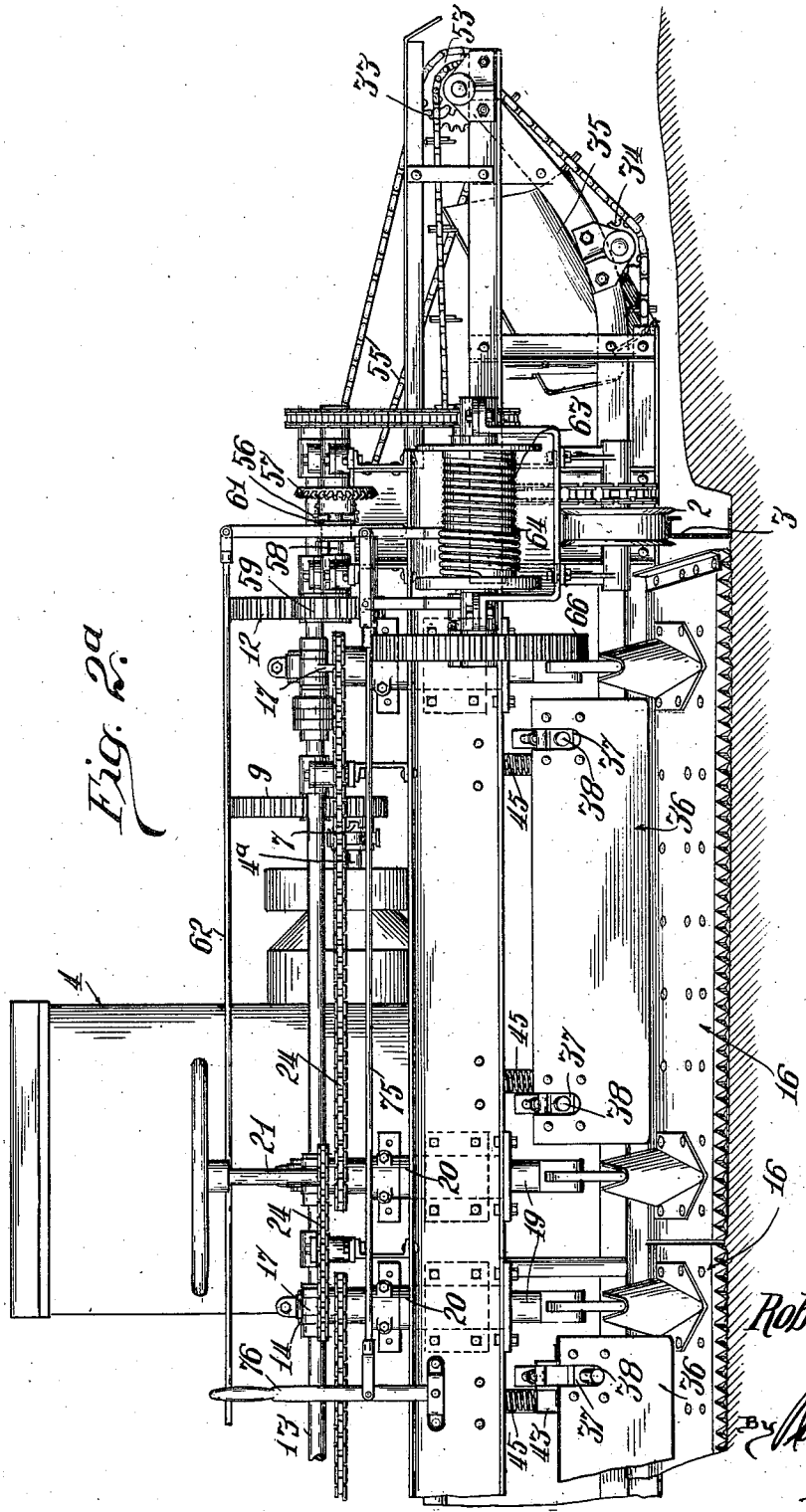


Fig. 2a

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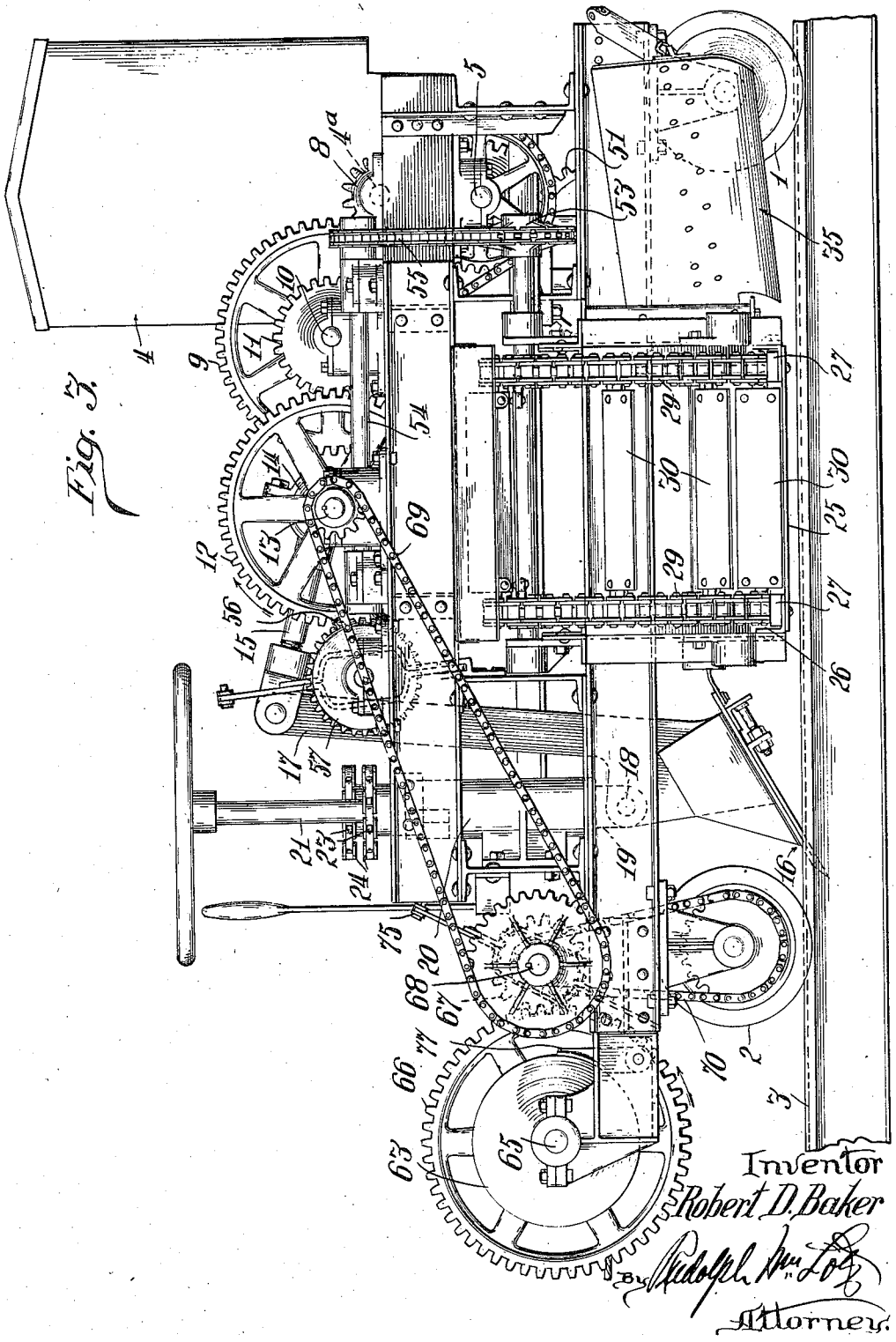


Fig. 5.

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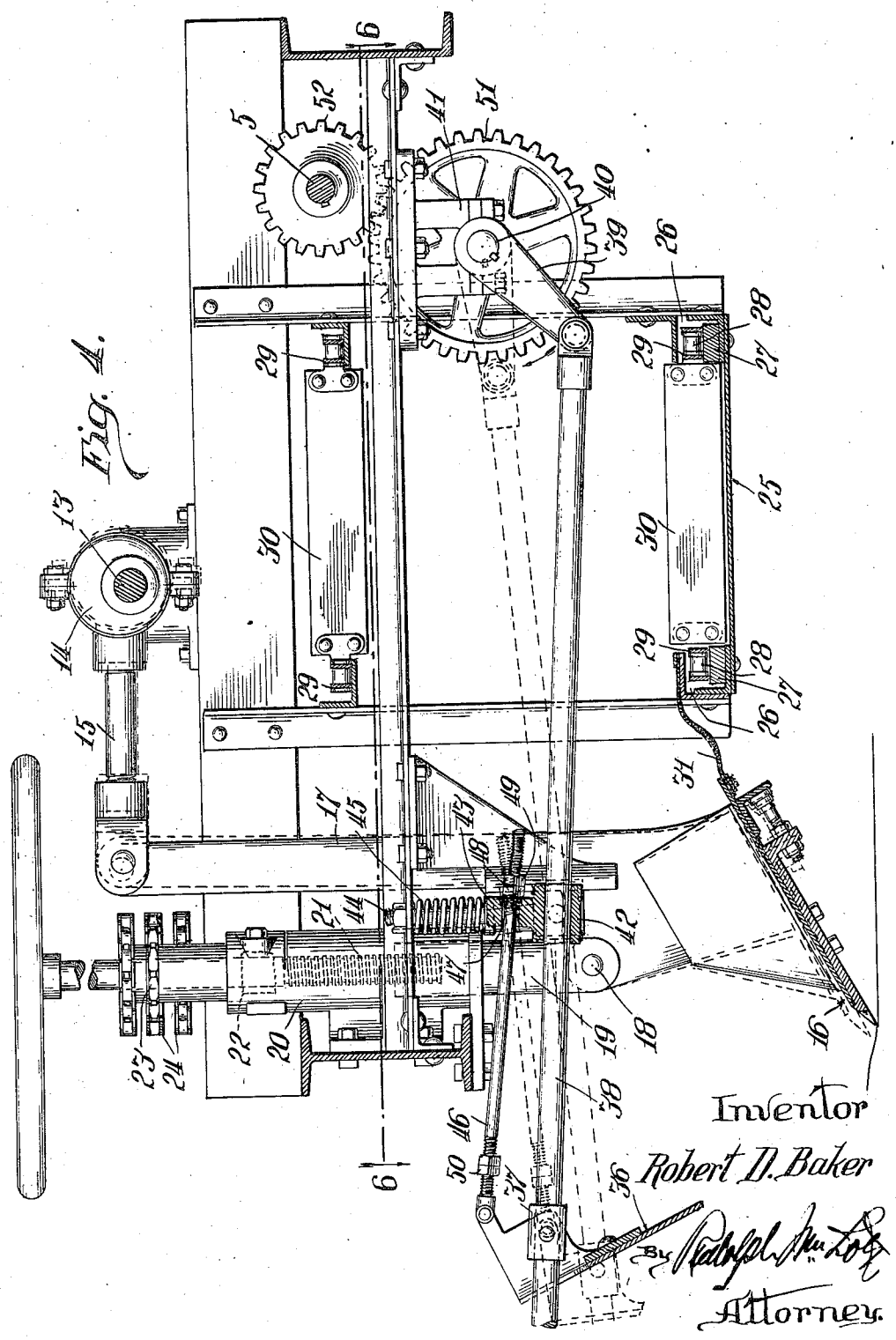


Fig. 4.

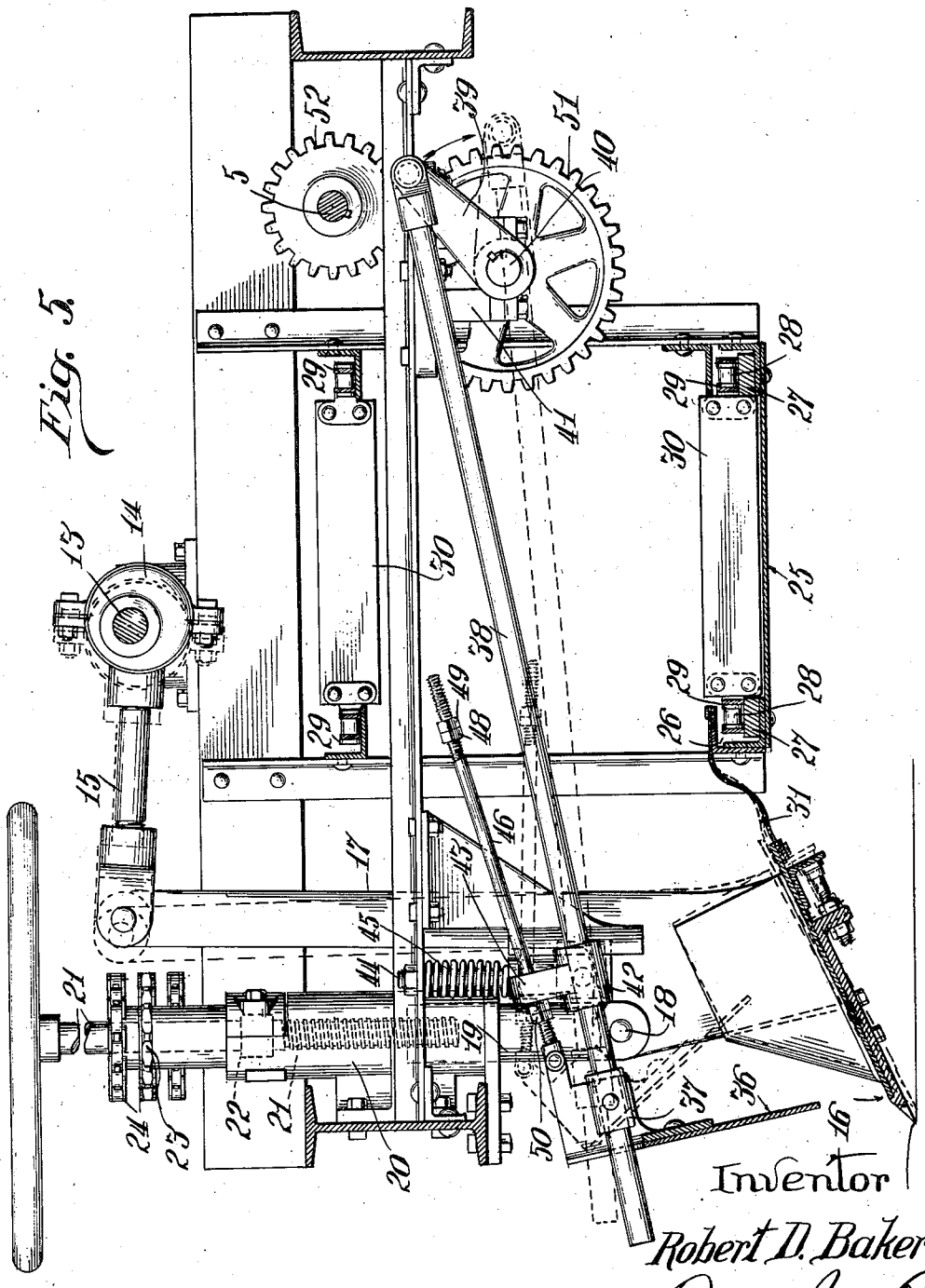
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July 1, 1930. R. D. BAKER 1,768,657

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Fig. 5.



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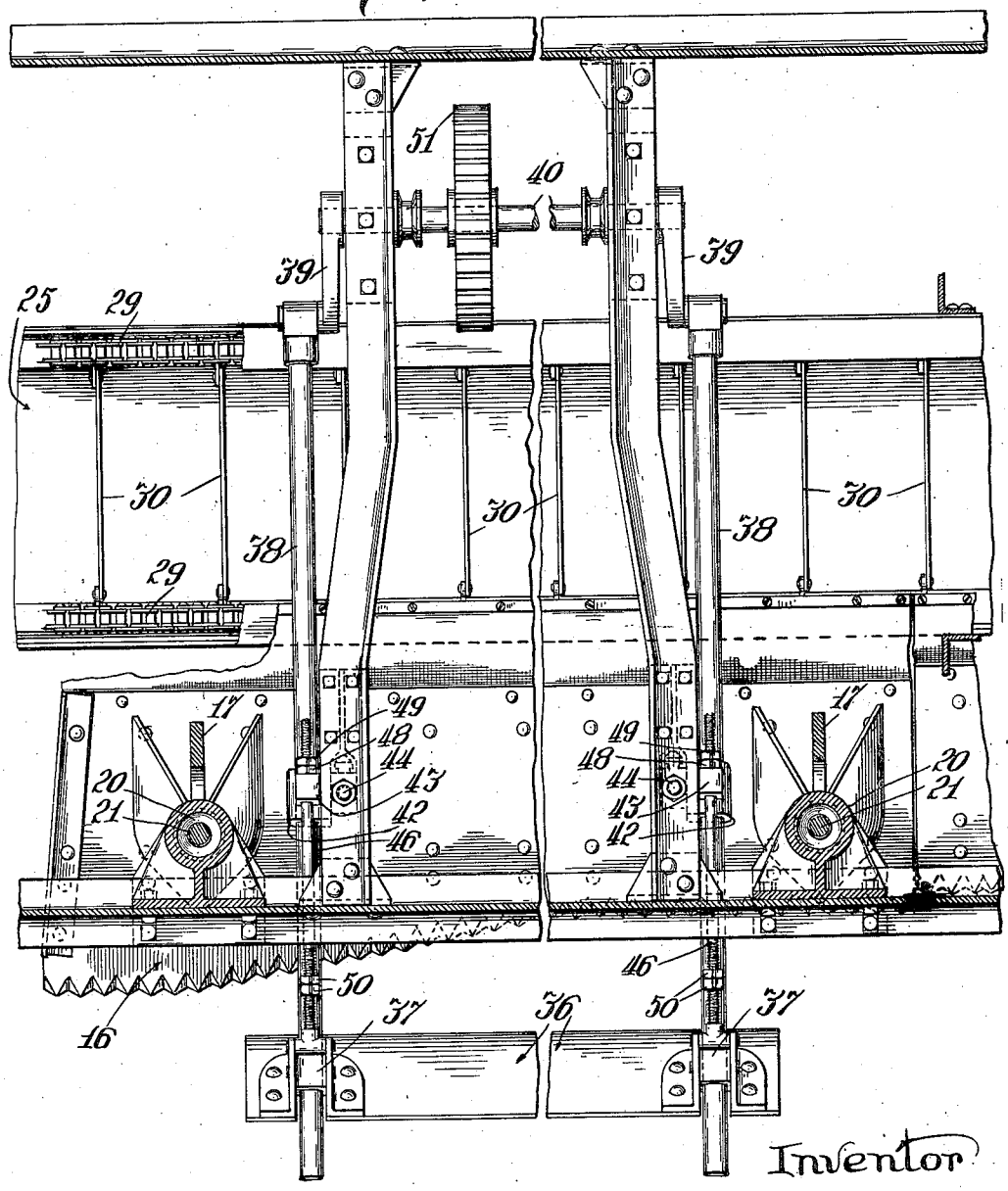
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Fig. 6.



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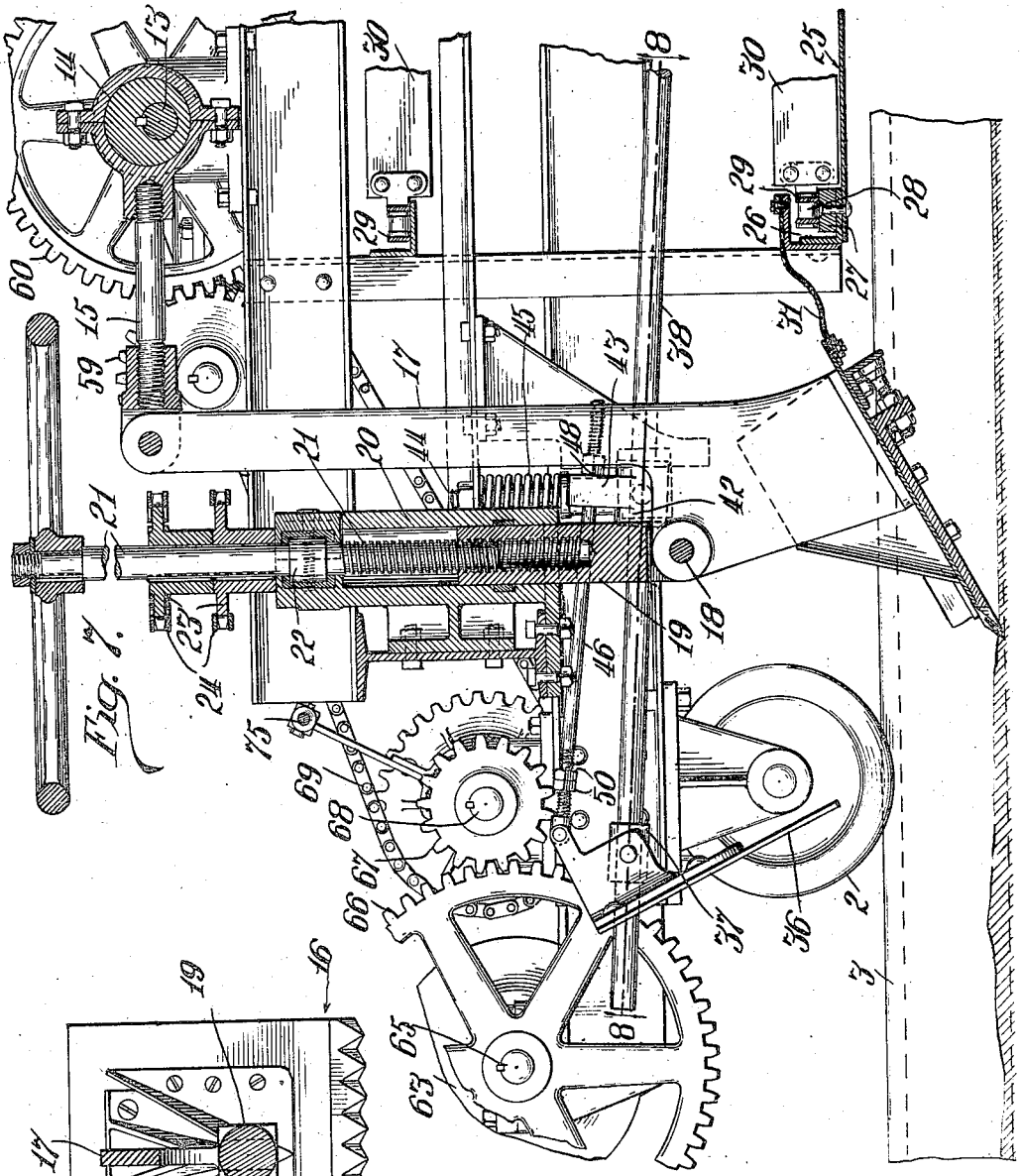


Fig. 7.

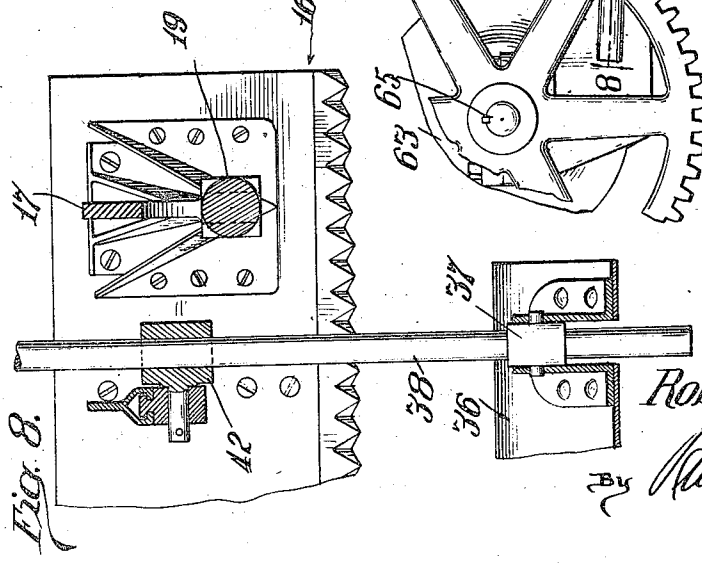


Fig. 8.

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FINE GRADING MACHINE

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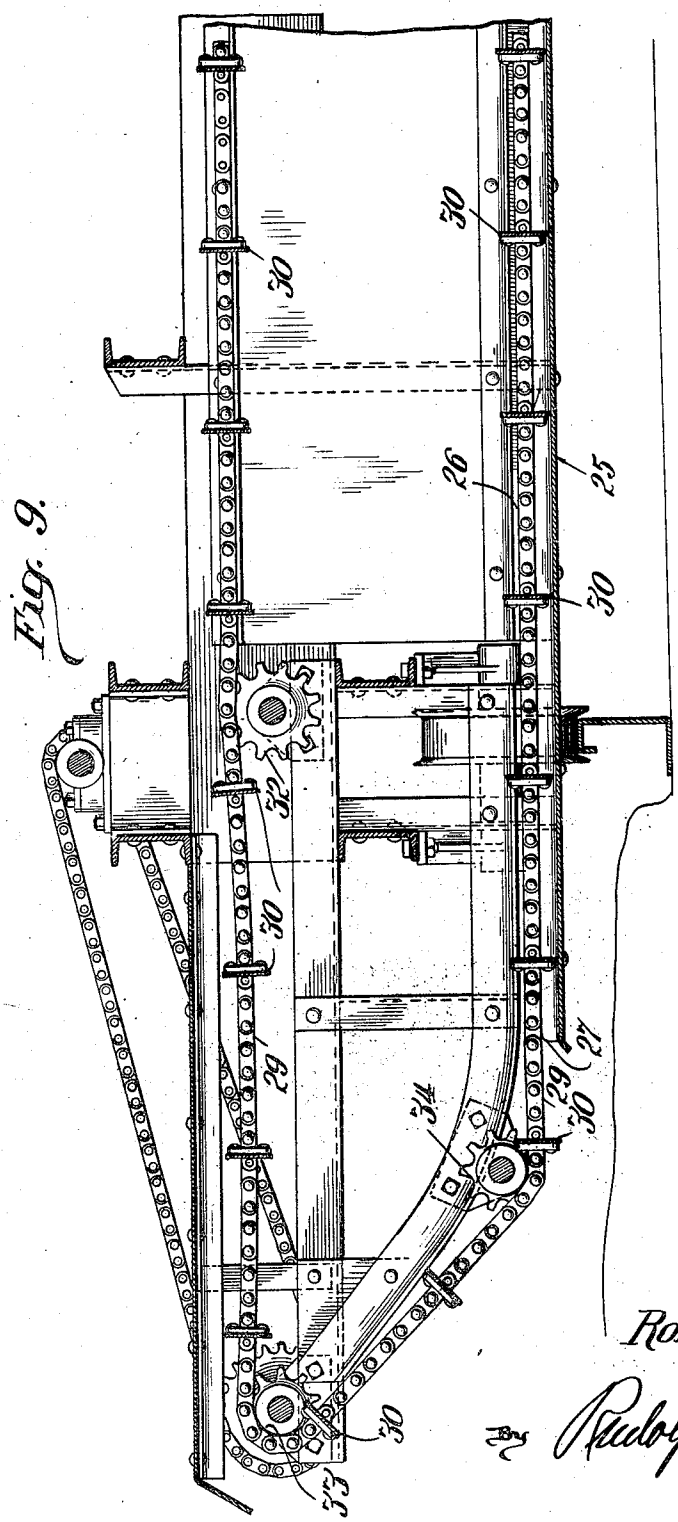


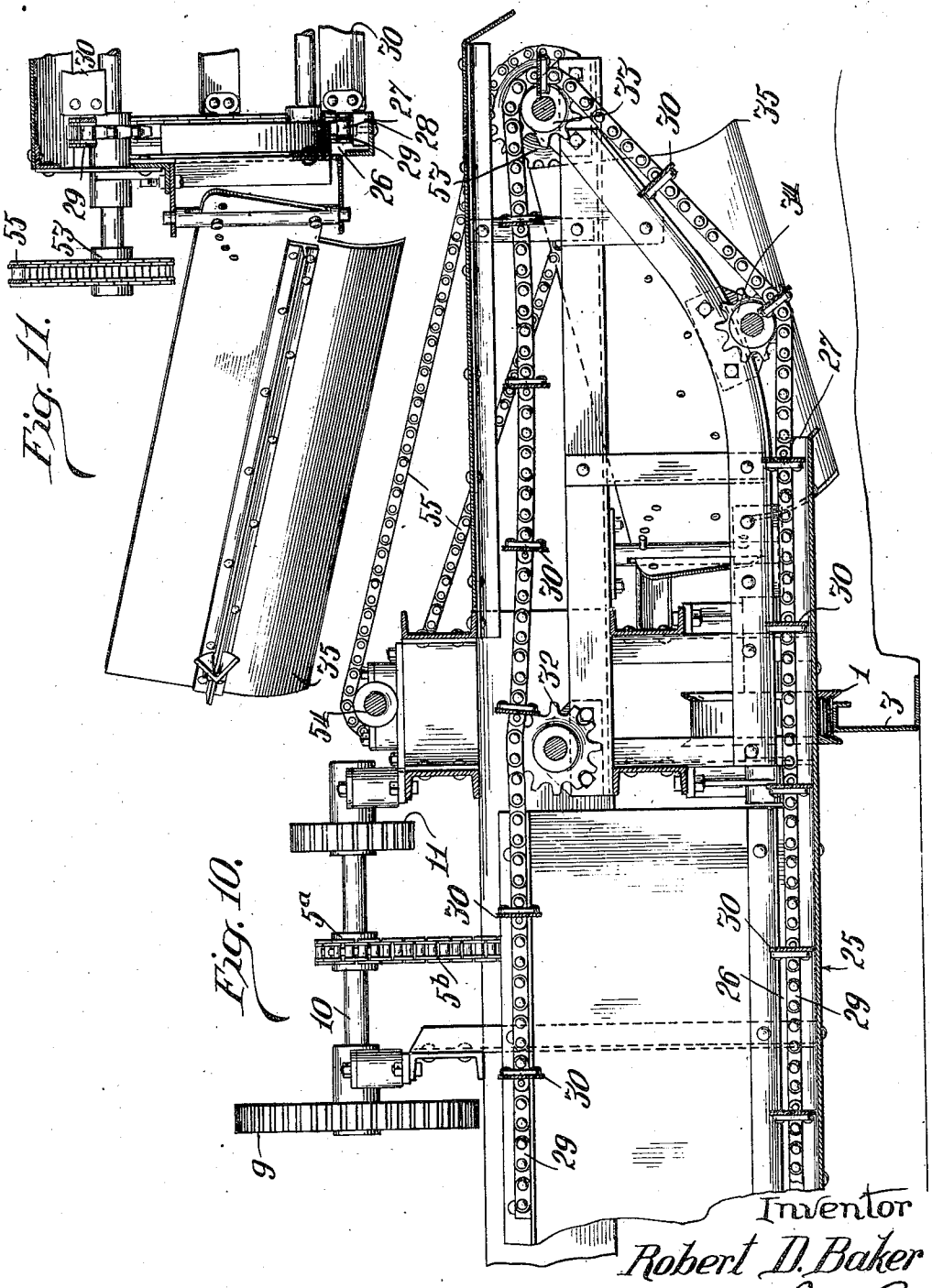
Fig. 9.

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FINE GRADING MACHINE

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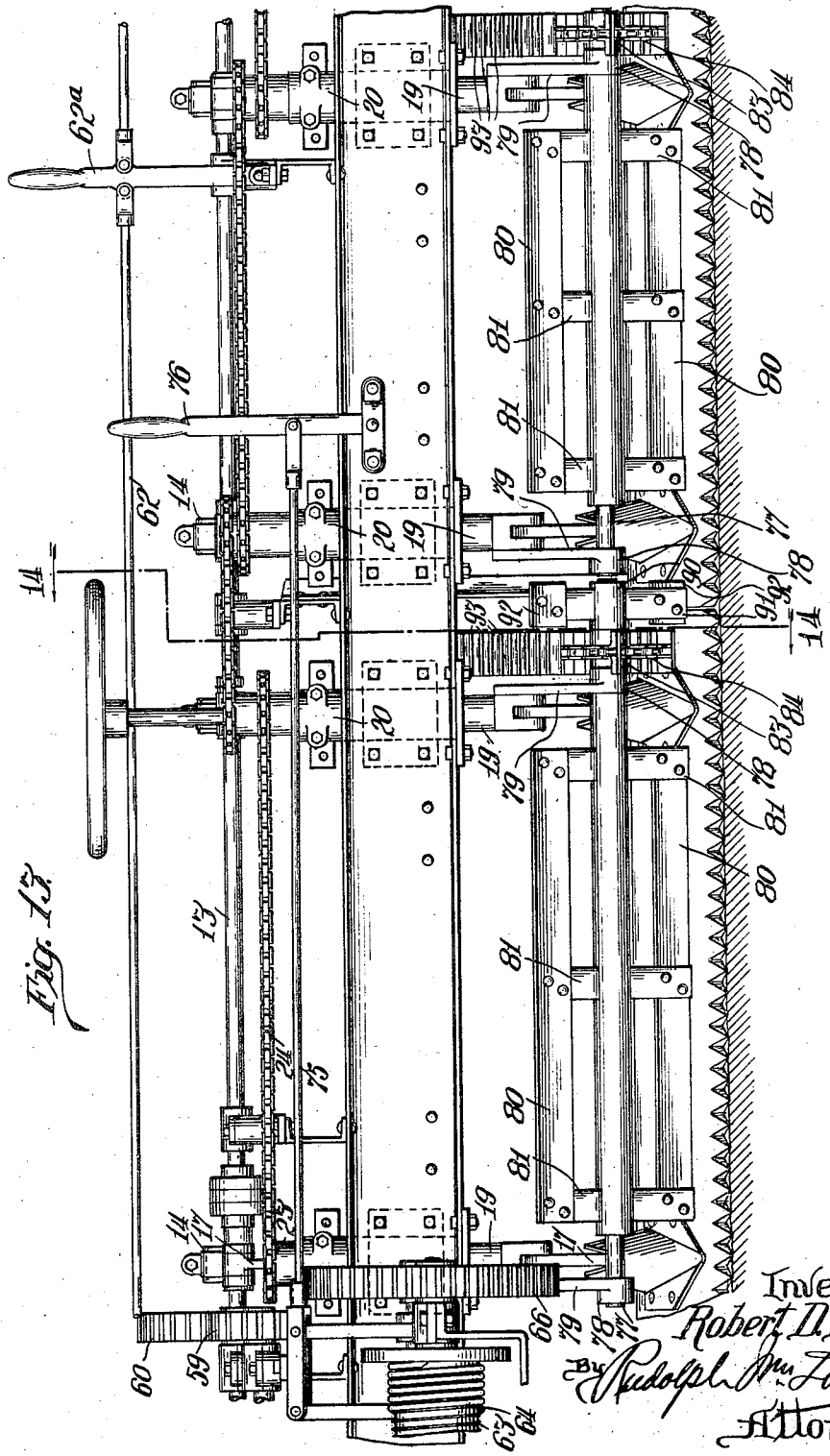


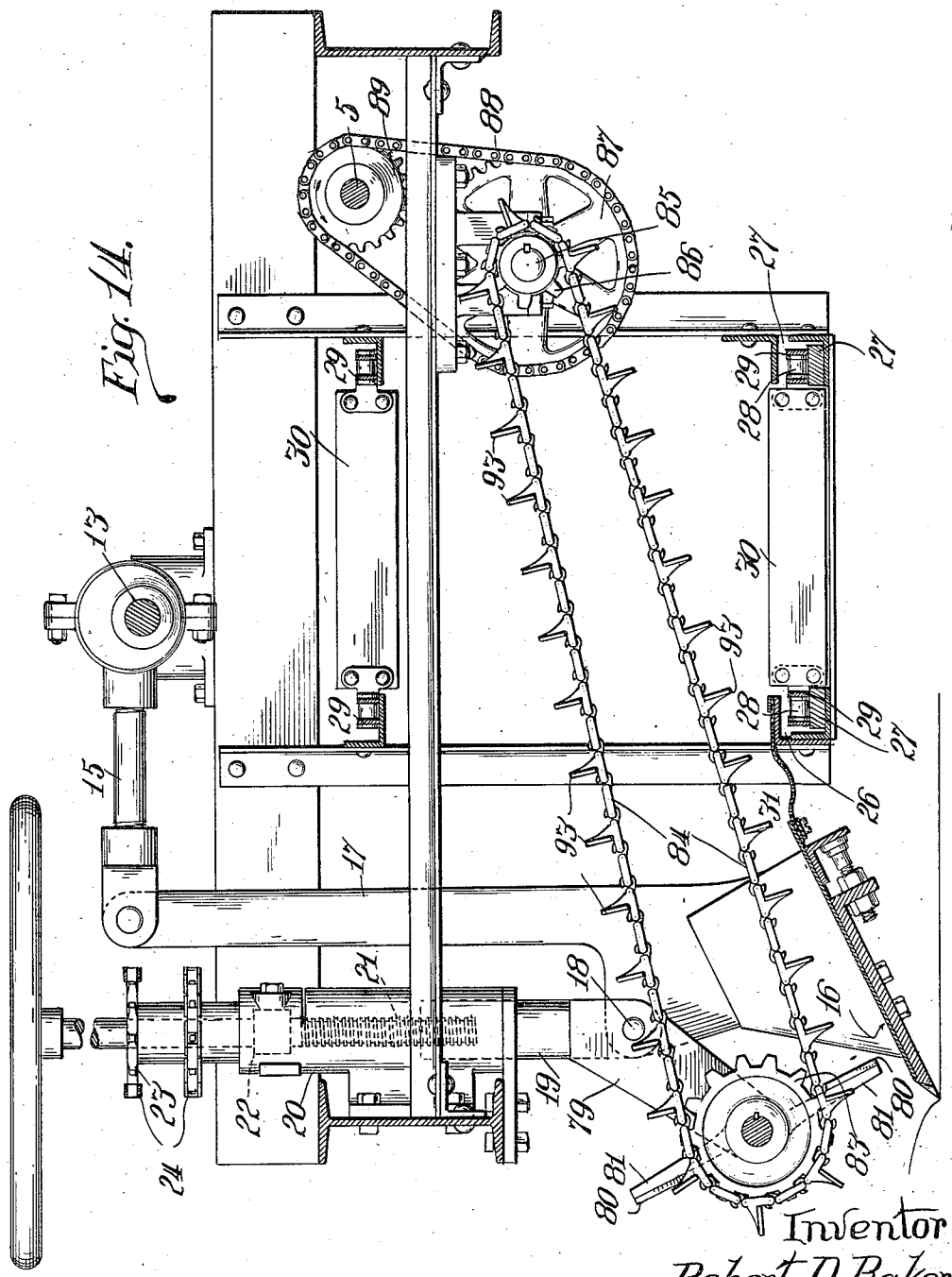
Fig. 13.

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FINE GRADING MACHINE

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Fig. 14.



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Patented July 1, 1930 1,768,657

UNITED STATES PATENT OFFICE

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FINE-GRADING MACHINE

Application filed November 28, 1927. Serial No. 236,067.

This invention relates to improvements in road building machines of the type known as "fine graders" which are used for the purpose of producing an accurate subgrade surface upon which concrete or other paving materials are deposited to produce a paved road or highway.

The present day practice prevailing in the art of paving highways consists in first "rough-grading" the road bed, this being usually accomplished by means of ordinary plows. Upon completion of the rough-grading which is intended to remove all earth in excess of from about one-half to two inches in depth above the ultimate fine-grade plane, the side-form supporting surfaces are produced and the side-forms mounted in place thereon. The surface supporting the side-forms may be said to constitute the extreme side-edge portions of the ultimate fine-grade, said rails serving to support and guide the fine-grade scrapers or other machines which precede the concrete finishing machines, the present machine being exemplary of the first machine to be carried and guided by said rails or forms. As the tread surfaces of the latter are necessarily substantially parallel with the plane of the ultimate fine-grade, they determine the accuracy of the latter.

The machine illustrated in the accompanying drawings and hereinafter fully described constitutes an improvement upon the machine illustrated and described in my co-pending application, Serial No. 753,560, which has, since the filing of the instant application, resulted in the issue of Letters Patent No. 1,653,333, dated December 20, 1927, and is equally well and even better adapted to carry out the method defined in and by certain claims of the said Letters Patent.

The main objects of the present invention are, first, to provide earth cutting means which are adjustable bodily substantially vertically of the plane of the ultimate fine-grade and present earth cutting edges which reciprocate substantially entirely within the earth cutting plane which may be coincident with or above that of the ultimate fine-grade depending upon the depth and nature of the soil to be removed following the rough-grading above referred to, and, second, to divide the earth cutting elements of the machine into a plurality of parts of which alternate portions reciprocate simultaneously in opposite directions to thereby decrease resistance to progress of the machine longitudinally of the road-bed.

Other objects of the invention relate to details of construction which are of minor importance and will be well understood from the following specification.

A suitable embodiment of the invention is illustrated in the accompanying drawings wherein:—

Figures 1 and 1ª constitute a plan view of a machine constructed in accordance with the invention.

Figs. 2 and 2ª together constitute a front elevation of the said machine.

Fig. 3 is a side elevation looking at the right hand end with respect to facing the front of the machine or the left hand end when facing the rear of the same.

Fig. 4 is a vertical transverse section of the machine on the line 4—4 of Fig. 1.

Fig. 5 is a view similar to Fig. 4 showing the same parts in respectively different positions.

Fig. 6 is a fragmentary plan section on the line 6—6 of Fig. 4.

Fig. 7 is a vertical transverse section on the line 7—7 of Fig. 1.

Fig. 8 is a fragmentary detail section on the line 8—8 of Fig. 7.

Fig. 9 is a section on the line 9—9 of Fig. 1.

Fig. 10 is a section on the line 10—10 of Fig. 1ª.

Fig. 11 is a section on the line 11—11 of Fig. 1ª.

Fig. 12 is a fragmentary plan view of one of the shovel elements of the machine, shown partly in section.

Fig. 13 is a fragmentary front elevation of the machine showing rotary means for effecting delivery of earth to the conveyor mechanism.

Fig. 14 is a transverse section on the line 14—14 of Fig. 13.

The machine comprises a suitable frame

work which is carried upon flanged wheels 1 and 2 adapted to travel upon the side-forms or side-rails 3 of the roadway to be fine-graded therebetween. This fine-grade usually presents a convex middle or ridge portion, and side portions which slope slightly from the side-forms to meet the side edges of the convex middle portion, the meeting lines of these two portions constituting the deepest portions of the finished fine-grade. The side-form supporting grade is horizontal and meets the sloping side portions of the ultimate fine-grade at the inner lower corners of the said side-forms.

Suitably mounted on said frame is the engine 4, preferably of the internal combustion type which, by means of suitable gearing controlled by suitable clutches, may be associated with and dissociated from the several operative mechanisms included in the machine. These mechanisms include the following:—

First. Drums and cables for effecting forward travel of the machine.

Second. Means for driving the wheels 1 for effecting reverse travel of the machine.

Third. The earth cutting mechanism.

Fourth. Conveyor mechanism for removing earth beyond one side edge of the road-bed.

Fifth. Mechanism for throwing loose earth from the earth cutting devices into the conveyor mechanism. This earth throwing is preferably effected by what is termed "hoe-mechanism," the latter, per se, constituting no part of the present invention, the same being particularly illustrated and described in the application of Alfred W. French, Serial No. 303,320, filed the 31st day of August, 1928, said hoe-mechanism being herein illustrated and described in its particular adaptation to the present machine as a desirable and preferable part thereof as distinguished from the rotary mechanism of my invention shown in Figs. 13 and 14.

The engine shaft 4^a (Fig. 1^a) is associated with and disassociated from a spur-pinion 8 thereon by means of a suitable clutch 6 controlled by the lever 7. The spur-pinion 8 meshes with the spur-gear 9 on a shaft 10. The latter is, by means of gears 11 and 12, associated with the shaft 13 extending over the entire width of the frame (Figs. 1 and 1^a and 2 and 2^a). Shaft 10 carries a sprocket 5^a which is geared by means of chain 5^b to sprocket 5^c on shaft 5.

The shaft carries a series of pairs of eccentrics 14, alternate pairs being disposed in diametrically opposite relation to each other. Pitmen or eccentric rods 15 associate the respective pairs of eccentrics 14 with the several sections of the shovel or earth cutting member 16, each of said sections being carried by suitable framing disposed at the lower ends of the pairs of oscillating levers 17. The latter are pivotally mounted by means of pins 18 on the lower ends of vertically adjustable sleeves 19 disposed in suitable guides or bearings 20 carried by the machine frame. Each sleeve 19 is internally threaded to engage a screw shaft 21 (Fig. 7) on which is an annular collar 22 held against vertical movement in the upper end portion of the bearing 20. Two of said shafts 21 are equipped at their upper ends with hand wheels and all are equipped just above the bearing 20 with one or more sprocket wheels 23 so that, by means of sprocket chains 24, each of the hand wheel actuated shafts 22 is associated with three shafts 21 for simultaneously adjusting two shovel sections at one side of the machine.

By means of the above described mechanism, the shovel or earth cutting elements 16 have a very short oscillatory movement imparted to them, the oscillation of the serrated shovel edges being in an arcuate plane substantially tangential to the horizontal plane constituting substantially the ultimate fine-grade plane, the movement of said serrated cutting edges being from a vertical radius of said arc intersecting said fine-grade plane forward and slightly upwardly, the slight upward movement serving to break up the earth to be removed.

It will be appreciated by those skilled in the art that the removal of earth down to substantially the ultimate fine-grade plane is followed by rolling to compact the earth and produce a smooth surface upon which the concrete is subsequently deposited. Hence, the plane of travel of the cutting edges of the shovel elements is actually slightly above the ultimate fine-grade plane.

To the rear of the shovel elements or members 16 there is provided a trough 25 to receive the earth loosened by said members and disposed, at least in part, upon the same. The sides of said trough 25 present opposed channeled guideways 26 at the bottom of each of which is a rail 27 upon which the idle rolls 28 travel, said rolls 28 being prevented from moving appreciably upwardly by the top walls of said guideways. The said rolls 28 constitute portions of sprocket chains 29 which carry the scraper blades 30 traveling longitudinally of the trough 25. The latter projects at its ends beyond the side-forms 3 so the earth deposited in said trough will be moved by the blades 30 beyond said side-forms. Between the trough 25 and the adjacent rear edges of the shovel members 16, I provide flexible connecting or bridge elements 31 (Fig. 4).

The sprocket chains 29 are trained over sprockets 32, 33 and 34 at each side of the machine, the association of the said sprockets with the power plant being such that the direction of travel of the scraper 30 may be re-

versed, this being accomplished by suitable manually operable clutches.

The earth delivered from either end of the trough 25 is spread by means of the inclined spreader blade 35 which is detachably secured to either side of the machine frame.

The angle of inclination of the shovel blades is, in the instant case because of the necessity for making the machine as compact and light as possible, so steep that the loosened earth will not, except when of a certain character and condition, move over the same into the trough 25 and it has, therefore, been found necessary to provide means for forcing or projecting said loosened earth over the shovel blades and bridge elements 31 into said trough. To accomplish this, hoe-blades 36 are provided, each of which is pivotally mounted on collars 37 of a pair of reciprocable rocking plungers or pitmen 38 which, at one end, are pivotally secured to the arms of cranks 39 of shafts 40 carried in the bearings of hangers 41 of the frame, said plungers or pitmen being slidably supported between their ends in bearings 42 pivotally mounted in the forked lower end of collars 43 slidably mounted on the vertical stud-shafts 44 and held at the lower limits of their movement by means of springs 45. Pivotally secured at one end each to frame members of the hoe-blades 36 above their pivotal connections with the collars 37, are rods 46 which, at their other ends, pass loosely through openings 47 in the collars 43. The adjustable nuts 48 and 49 constituting collars disposed on the inner ends of said rods 46 behind said collars 43, serve to limit the reciprocable movement of said rods in one direction so that upon forward or thrust movement of the plungers 38, the hoe-blades 36 will be swung on their pivots to extend substantially perpendicularly to the said plungers 38 as shown in dotted lines in Fig. 4. The stroke of the plungers 38 is greater than the length of the rods 46 between the collars 48 and similar adjustable nuts or collars 50 mounted upon the other end portions of said rods so that during the concluding portion of the reverse or pull stroke of the plungers 38, the collars 50 will strike the collars 43 and turn said hoe-blades 36 to the position shown in dotted lines in Fig. 5, this pivotal movement of the hoe-blades 36 being so quick as to effect projection or throwing of earth as distinguished from the dragging movement imparted thereto prior to such quick pivotal movement of said blades. It will be noted that at the moment of the quick pivotal movement, the hoe-blades are disposed at substantially the lowest point in their movement where their lower edges will engage the ridge of the earth pile usually collected above the shovel edges.

As previously stated, this hoe mechanism is the invention of A. W. French.

One of said shafts 40 is provided for each of the shovel blade sections and each shaft 40 is equipped at opposite ends with said cranks 39, the spur gears 51 on said shafts 40 meshing with the spur gears 52 on the shaft 5.

Referring now to Figs. 1 and 1ª, it will be seen that the shafts of the sprockets 33 carry sprockets 53 geared to sprockets on the shafts 54 by means of the chains 55. The shafts 54 are geared by means of bevel gears 56 and 57 to a shaft 58 which is equipped with a spur-gear 59 meshing with the spur-gear 60 on the shaft 13. The gear 57 is loose on shaft 58 and carries a clutch element adapted for cooperation with the slidable clutch members 61 on said shaft. The clutch members 61 of the two shafts 58 at opposite sides of the machine are connected by means of the rod 62 which is connected with the operating lever 62ª so that when one of said clutch members 61 is engaged with the companion member on the gear 57, the other member 61 is disengaged so that only one of said shafts 58 can be driven. If the shaft 58 at one side of the machine is driven the sprocket chains 29 and blades 30 will be moved in one direction whereas when the other shaft 58 is driven, this movement of the chains 29 and scrapers 30 will be reversed.

Forward travel of the machine is effected by means of the drums 63 and cables 64 wound upon the same and secured at one end thereto, the other ends of said cables being secured to stakes driven into the earth at points in advance of the machine. The drums 63 are rigid with shafts 65 each of which carries a large spur-gear 66 meshing with a spur-pinion 67 on a shaft 68 which is geared by means of sprocket chain 69, to the shaft 13. The shafts 68 are geared to the front wheels 2 by means of sprocket chains 70 through which said wheels 2 are driven to effect reverse travel of the machine. Clutch members 71 and 72 on the shaft 68 are arranged so that when the member 71 engages the companion member 73 on spur-pinion 67 the drum 63 will be rotated to effect forward travel of the machine, the clutch members 72 being then in neutral position, whereas when said members 72 are engaged with companion clutch members 74 rigid with the sprocket pinions on the shafts 68 over which the chain 70 is trained, the drums will be idle and the machine will be caused to travel backward. Both said members 71 and 72 may be held in neutral positions so that the machine will not travel in either direction. The members 71 and 72 at each side of the machine are coupled to move in unison by means of the rods 75 and clutch levers 76 associated therewith. This association is such that said levers 76 may be independently operated to operate the clutch members 71 and 72 at one side of the machine in order that only one of said drums may be momentarily rotated to pro-

ject one side of the machine in order to properly round curves in the side-forms or cause the machine frame to extend at right angles to the side-forms in case it shall have become otherwise disposed as frequently happens.

It is desirable that, upon throwing the clutch members 71 and 72 into neutral position, the drums 63 should be held against such free rotation as will permit slacking of the cables 64 and to this end brackets 77 are provided for said drums.

It is not objectionable that the shovel blades shall be kept in constant motion during both travel and idling of the machine frame and it is generally desirable that the earth conveying mechanism and hoe-blades be kept in operation when the machine frame is not traveling especially when a deep cut is being effected as, in such event, the earth may accumulate faster than the conveyor can remove it. It is then necessary to interrupt travel of the machine while permitting the hoe-blades and conveyor mechanism to operate until loosened accumulated earth has been cleared away, whereupon travel is continued until a further accumulation of loose earth necessitates another interruption of travel.

The clutch lever 7 obviously is the main controlling lever since it controls the association of the engine shaft with the drive shaft 13 from which all of the several mechanisms are driven as above described.

In Figs. 13 and 14 I have illustrated means of my own invention for causing accumulated loose earth to be removed toward and into the conveyor mechanism which, however, does not operate quite as efficiently as the hoe-mechanism above described though operating sufficiently well to be usable in place of said hoe-mechanism.

My said mechanism as applied to the machine above described, comprises shafts 77 journalled in bearings 78 mounted in brackets 79 integral with the vertically adjustable members 19 in which the pivot pins 18 for the levers 17 are mounted, each of the shafts 77 being carried by a pair of simultaneously adjustable members 19. Each of said shafts carries a plurality of paddle blades 80 mounted upon the arms 81 of sleeves 82 rigidly mounted on the shafts 77, said paddle blades being rotated in a direction to cause them to move earth accumulated upon the front portions of the shovel blades above a certain level toward the conveyor trough 25.

Each shaft is equipped at one end with a sprocket wheel 83 and is geared by means of a sprocket chain 84 trained over the wheel 83 with a shaft 85 corresponding to the shafts 40 but rotating in the opposite direction from the latter, each of said shafts 85 being provided with a sprocket 86 over which the sprocket chain 84 is trained and with a sprocket 87 over which the sprocket chain 88 is trained, the latter being also trained over a sprocket 89 on the shaft 5.

It will be noted that each shovel blade is mounted upon the lower ends of two of the rocking levers 17 and that there is a free space between levers 17 at the opposed end portions of adjacent shovel blades. To prevent accumulation of earth in this space and the clogging thereof in the event that the earth is moist or lumpy as in the case of dry clay and the like, each shaft is preferably provided with a hub member 90 at one end which is equipped with arms 91 and blades 92 operating in said space. The sprocket chains 84 are also provided with blades 93 which will serve to move earth from the said free space.

I claim as my invention:

1. A fine-grading machine including earth cutting devices, levers for operating the same, bearings associated with said levers between their ends, and reciprocable devices associated with said levers for oscillating the same.

2. A fine-grading machine including earth cutting blades, levers secured at their lower ends to said blades, bearings associated with said levers between the ends thereof, and power actuated means for oscillating said levers.

3. A fine-grading machine including a plurality of substantially vertically disposed levers pivotally associated with the machine frame between their ends, power actuated means for oscillating said levers, and earth cutting blades mounted upon the lower ends of said levers.

4. A fine-grading machine including earth cutting devices, levers for operating the same, bearings associated with said levers between their ends, manually operable means associated with said bearings for raising and lowering the same, and reciprocable devices associated with said levers for oscillating the same.

5. A fine-grading machine including a plurality of substantially vertically disposed levers pivotally associated with the machine frame between their ends, power actuated means for oscillating said levers, earth cutting blades mounted upon the lower ends of said levers, and manually operable means for raising and lowering said levers.

6. A fine-grading machine including a carriage, power driven means for effecting travel thereof, a plurality of levers pivotally mounted on said carriage between their ends, earth cutting devices mounted upon the lower ends of said levers, power actuated means for oscillating said levers, and means for raising and lowering said levers to thereby vary the plane of operation of the earth cutting devices relatively to the plane of travel of the carriage.

7. A fine-grading machine including a car-

riage, power driven means for effecting travel thereof, earth cutting blades, and means for imparting to said blades a forward and back movement in an approximate plane substantially parallel with the plane of travel of the carriage.

8. A fine-grading machine including a carriage adapted for travel longitudinally of a roadway to be paved, earth cutting blades associated with said carriage, and mechanism for imparting a forward and back movement of said blades, the forward movement thereof being in the direction of travel of the carriage.

9. A fine-grading machine including a carriage adapted for travel longitudinally of a roadway to be paved, inclined earth cutting blades associated with said carriage, and mechanism for imparting a forward and back movement of said blades, the forward movement thereof being in the direction of travel of the carriage, earth conveying mechanism disposed behind and below the rear raised edges of said blades, and flexible material connecting the rear edges of the said blades with the earth conveying mechanism.

10. A fine-grading machine including a carriage adapted for travel longitudinally of a roadway to be paved, earth conveying mechanism on said carriage for delivering earth to one side of the said roadway, shovel blades disposed in advance of said conveying mechanism, mechanism for imparting movement to said shovel blades, and mechanism associated with said blades and said conveying mechanism for delivering loosened earth to the latter.

11. In a fine-grading machine, a carriage, earth conveying mechanism thereon arranged to deliver earth beyond one side of said carriage, earth cutting mechanism on said carriage, mechanism associated with the earth cutting and conveying mechanisms for feeding earth loosened by the former into the latter, a single engine common to all of said mechanisms and for effecting travel of the carriage, and manually controlled gearing between the engine and the earth cutting, feeding and conveying mechanisms for controlling operation thereof, and manually controlled gearing between the engine and carriage for controlling travel of the latter.

12. In a fine-grading machine, a carriage, earth conveying mechanism thereon arranged to deliver earth beyond one side of said carriage, earth cutting blades, mechanism for imparting movement to said blades and said conveying mechanism for transferring loosened earth from the former to the latter, a source of power, and manually controlled gear sets controlling the operation of said mechanisms and travel of the carriage, respectively.

13. A fine-grading machine comprising a carriage, a conveyor trough extending laterally of and projecting beyond the sides of the carriage, a conveyor chain equipped with scraper blades arranged for travel through and above said trough, earth cutting mechanism on said carriage in advance of said trough, mechanism for transferring loosened earth from said cutting mechanism to said trough, a source of power common to the several mechanisms, and manually controlled gearing between the latter and the source of power for controlling the operation of said mechanisms.

14. A fine-grading machine comprising a carriage, a conveyor trough extending laterally of and projecting beyond the sides of the carriage, a conveyor chain equipped with scraper blades arranged for travel through and above said trough, earth cutting mechanism on said carriage in advance of said trough, mechanism for transferring loosened earth from said cutting mechanism to said trough, a source of power common to the several mechanisms, and manually controlled gearing between the latter and the source of power for controlling the operation of said mechanisms, said gearing including means permitting the travel of the chain to be reversed.

15. In a fine-grading machine, a carriage, a series of vertically adjustable bearings thereon, manually operable means for raising and lowering said bearings, levers each pivotally associated between its ends with one of said bearings, earth cutting blades mounted upon the lower ends of said bearings, an engine on the carriage, a counter-shaft common to all of said levers geared to said engine, eccentrics on said shaft, and connecting rods associating the respective eccentrics with the respective levers.

16. In a fine-grading machine, a carriage, a series of vertically adjustable bearings thereon, manually operable means for raising and lowering said bearings, levers each pivotally associated between its ends with one of said bearings, earth cutting blades mounted upon the lower ends of said bearings, earth conveying mechanism disposed behind said earth cutting blades, mechanism associated with the said blades and the conveying mechanism for delivering loosened earth to the latter, an engine, a counter-shaft geared thereto common to said mechanisms and said levers for simultaneously actuating the same.

17. In a fine-grading machine, a carriage, a series of vertically adjustable bearings thereon, manually operable means for raising and lowering said bearings, levers each pivotally associated between its ends with one of said bearings, earth cutting blades mounted upon the lower ends of said bearings, earth conveying mechanism disposed behind said earth cutting blades, mechanism associated with the said blades and the con-

veying mechanism for delivering loosened earth to the latter, mechanism for propelling the carriage, an engine, and a counter-shaft geared thereto common to all of said mechanisms and said levers for simultaneously actuating the same.

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