Nov. 8, 1932. C. D. WRIGHT 1,886,859

MACHINE FOR SHARPENING DISKS AND THE LIKE

Filed Sept. 22, 1928 8 Sheets-Sheet 1

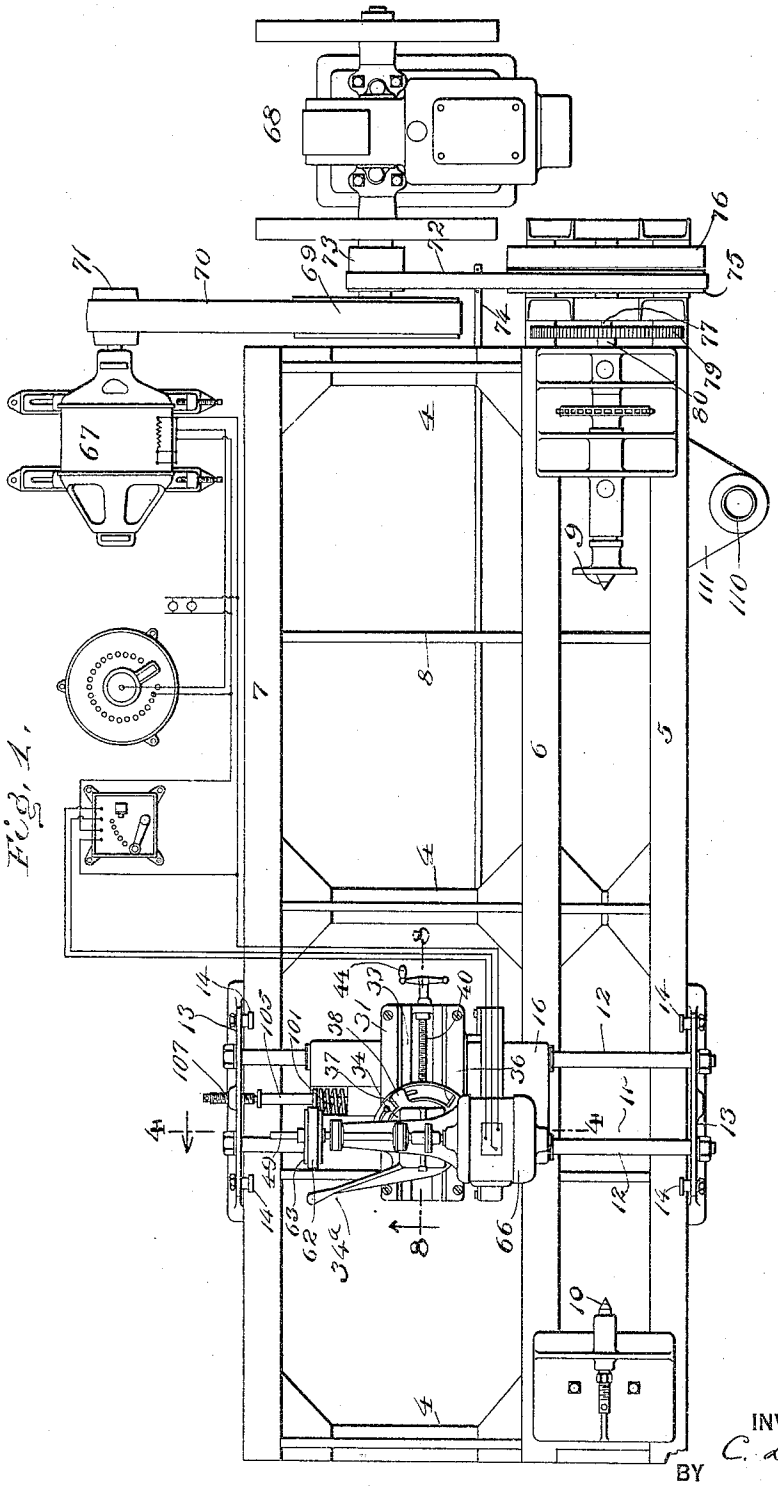


Fig. 1.

INVENTOR
C. D. Wright
BY
Morrison, Kennedy & Campbell
ATTORNEYS

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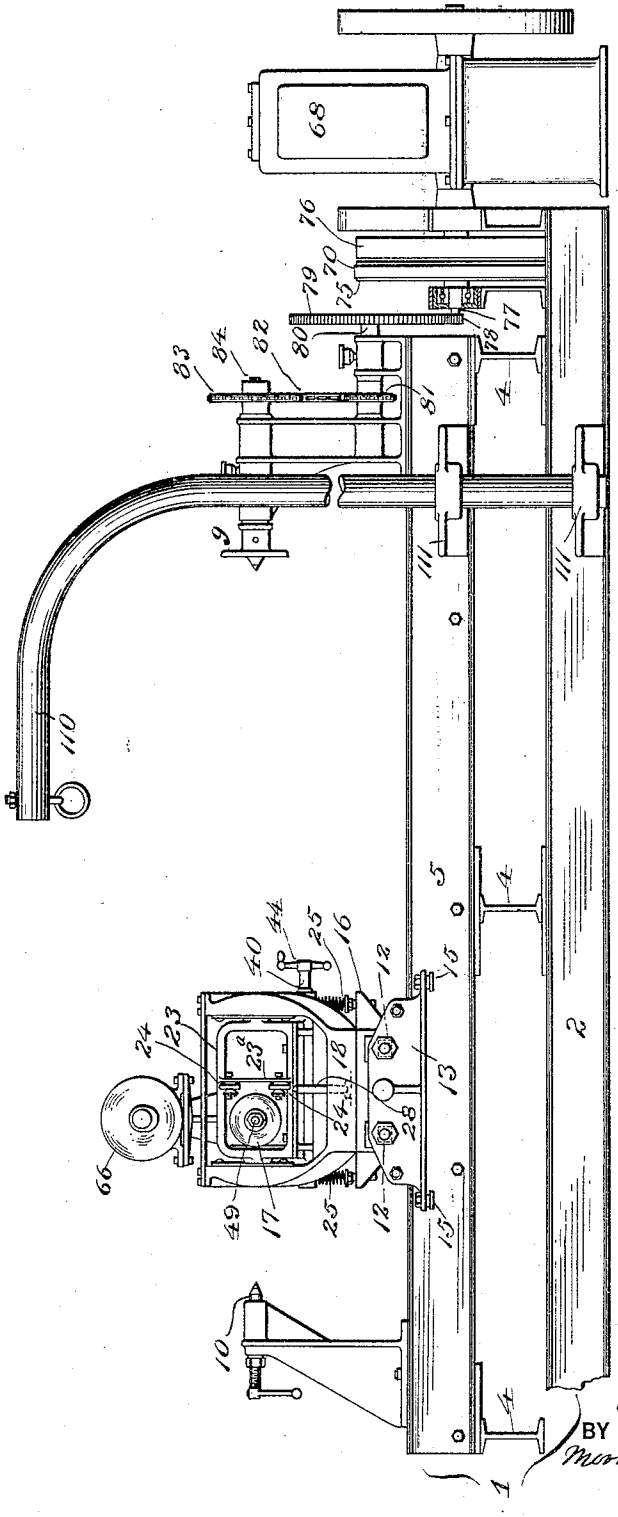


Fig. 2.

INVENTOR
C. D. Wright
BY
Morrison, Kennedy & Campbell
ATTORNEYS.

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MACHINE FOR SHARPENING DISKS AND THE LIKE

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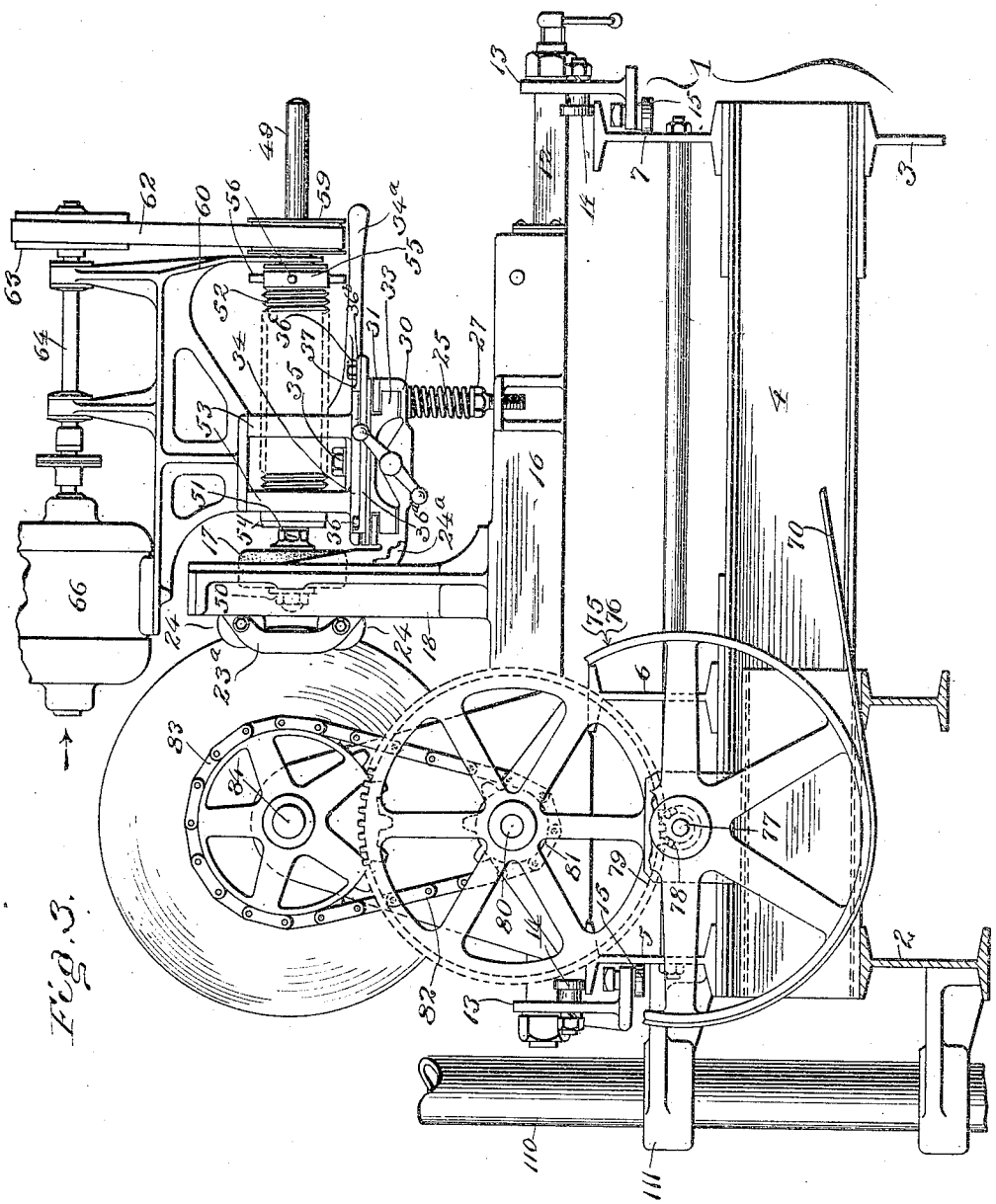


Fig. 3.

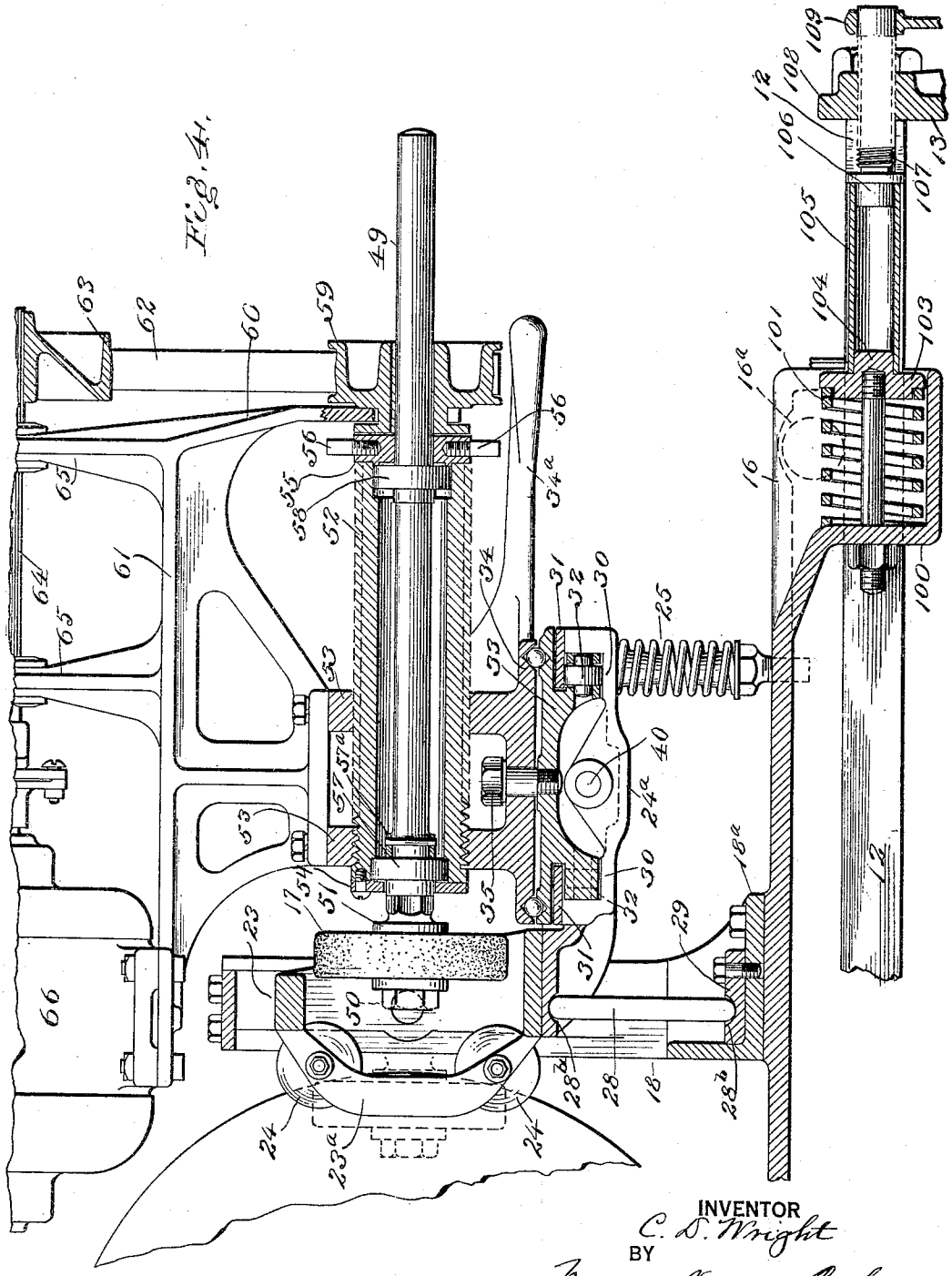
INVENTOR
C. D. Wright
BY
Morrison, Kennedy & Campbell
ATTORNEYS.

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MACHINE FOR SHARPENING DISKS AND THE LIKE

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Fig. 4.



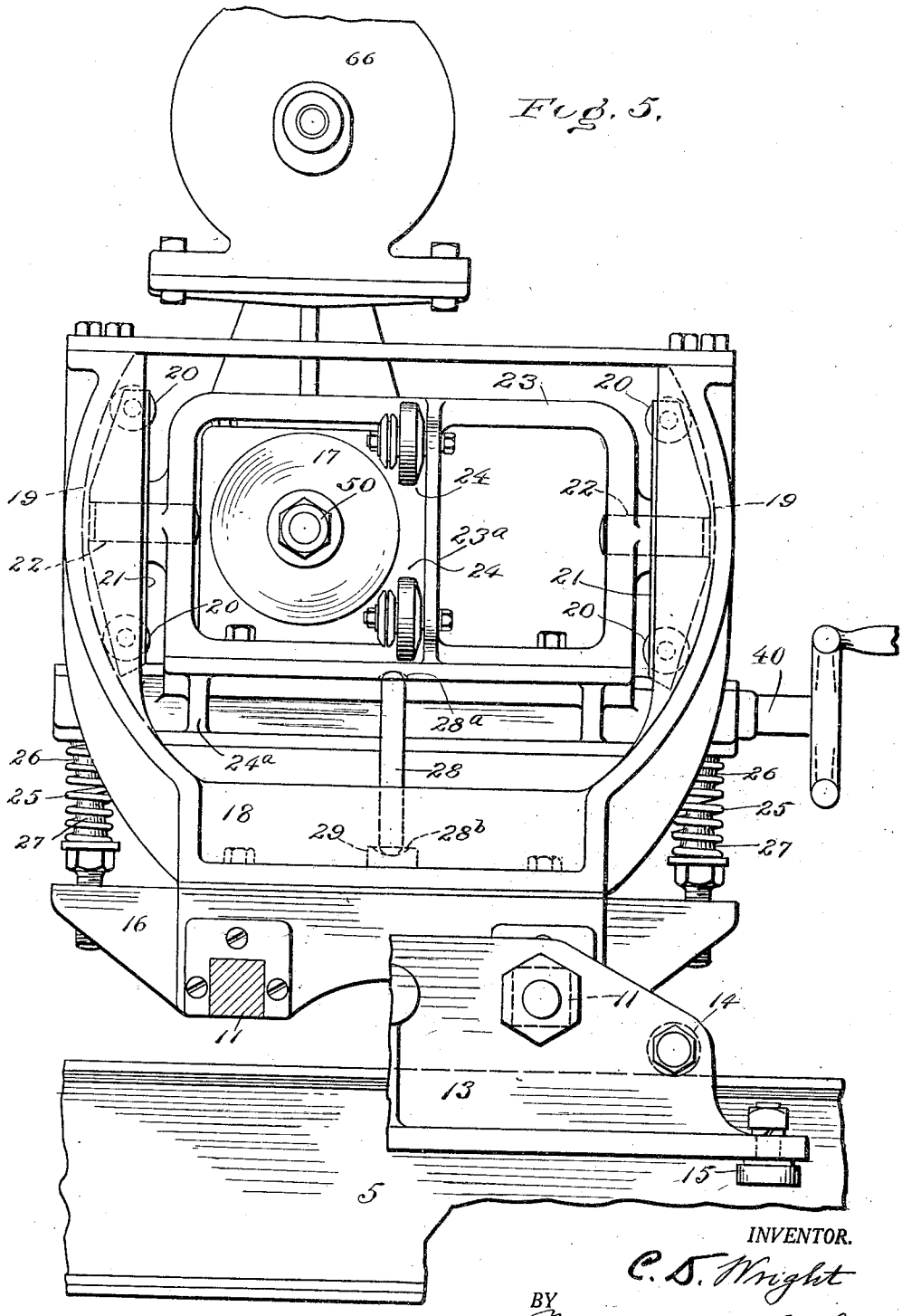
INVENTOR
C. D. Wright
BY
Morrison, Kennedy & Campbell
ATTORNEYS.

Nov. 8, 1932. C. D. WRIGHT 1,886,859

MACHINE FOR SHARPENING DISKS AND THE LIKE

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Fig. 5.



INVENTOR.

C. D. Wright

BY

Morrison, Kennedy & Campbell

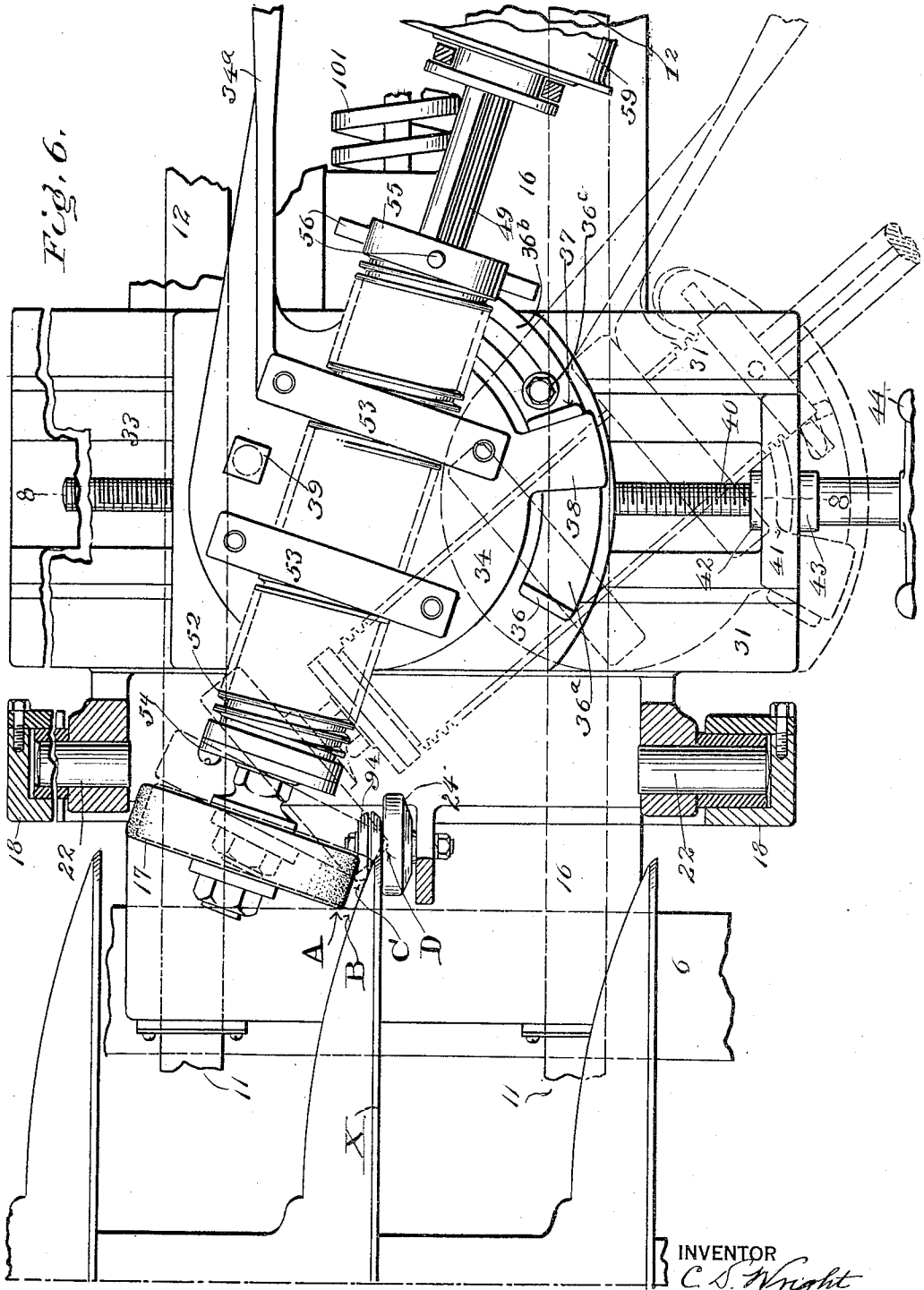
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Fig. 6.



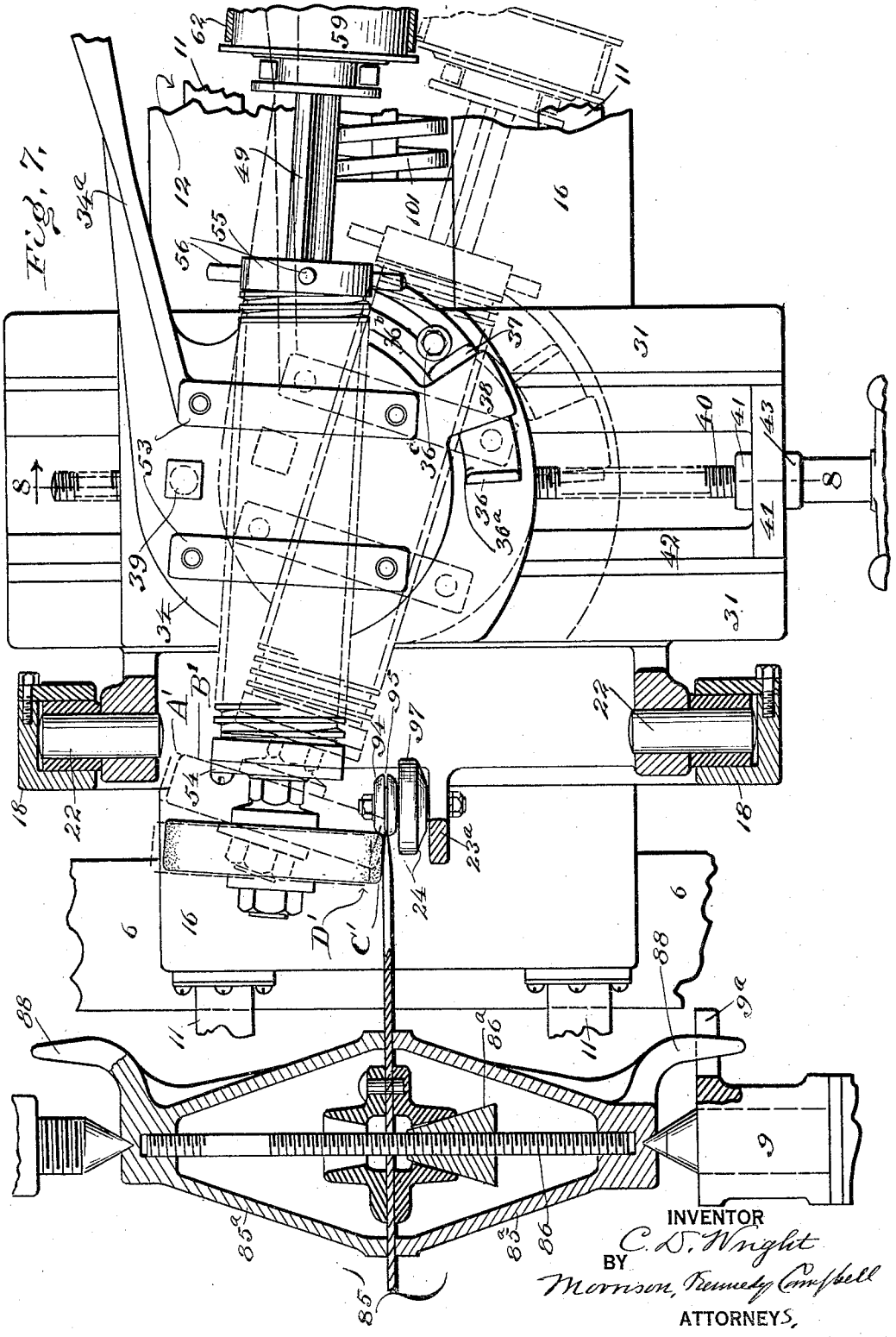
INVENTOR
C. D. Wright
BY
Morrison, Kennedy & Campbell
ATTORNEYS.

Nov. 8, 1932. C. D. WRIGHT 1,886,859

MACHINE FOR SHARPENING DISKS AND THE LIKE

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Fig. 7.



INVENTOR
C. D. Wright
BY
Morrison, Kennedy & Campbell
ATTORNEYS.

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MACHINE FOR SHARPENING DISKS AND THE LIKE

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Fig. 8.

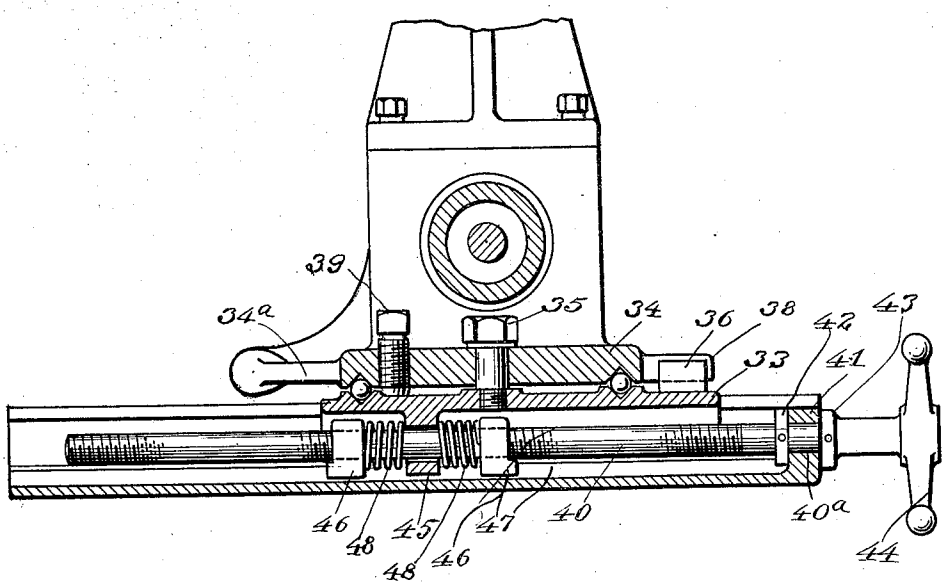
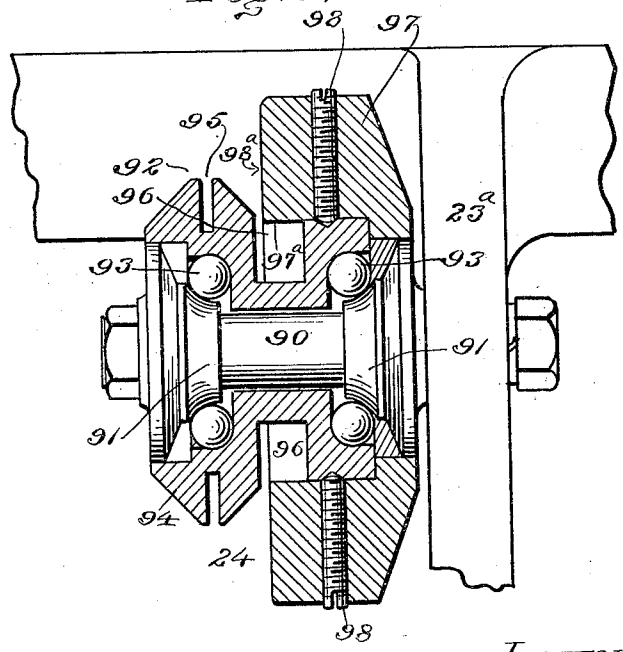


Fig. 9.



INVENTOR.
C. D. Wright
BY Morrison, Kennedy & Campbell
ATTORNEYS.

Patented Nov. 8, 1932 1,886,859

UNITED STATES PATENT OFFICE

CHARLTON D. WRIGHT, OF DAVENPORT, IOWA

MACHINE FOR SHARPENING DISKS AND THE LIKE

Application filed September 22, 1928. Serial No. 307,604.

This invention relates to a machine for grinding or sharpening cutting disks, more particularly those employed in agricultural implements, such as cultivator disks, grain drill disks, colter disks, and the like, the object of the invention being to produce a machine for this purpose in which the disks, either concaved or flat, may be mounted and rotated, either singly or in gang, and acted on by a sharpening tool, preferably in the form of a rotary grinding wheel which, while being rotated, may be presented in the proper position relative to the peripheral cutting edge of the disk or disks to grind the same in a uniform manner and effectively sharpen said edge, even though irregularities such as kinks, nicks and the like may exist in the edge of the disk, the disk may be eccentrically mounted, or it may be warped or sprung sideways, or the shaft or axle on which the disks are mounted may be sprung or bent, or other defects may be present.

In carrying out this object in accordance with my invention, the machine comprises a suitable supporting frame or base, a support or holder for the disks, by means of which the disks may be rotated, a disk sharpening tool, in the present instance in the form of a grinding or cutting wheel mounted in an improved manner to adapt it to be set in the proper operative relation to the peripheral edge of the rotary disk, and movable from one disk to another, when the disks are supported in gang, suitable power means, and driving connections therefrom to the work and grinding wheel, being provided to impart rotary motion thereto, all of which improvements will be described in detail in the specification to follow, and the novel features thereof set forth in the appended claims.

In the accompanying drawings;

Figure 1 is a plan view of the improved machine;

Fig. 2 is a side elevation of the same;

Fig. 3 is an end elevation of the same on an enlarged scale, as viewed from the right in Fig. 1;

Fig. 4 is a vertical sectional elevation, on an enlarged scale, on the line 4—4 of Fig. 1 as viewed in the direction of the arrows on said line;

Fig. 5 is a front elevation of the carriage and parts carried thereby, as viewed in the direction of the arrow in Fig. 3;

Fig. 6 is a detail plan view of the grinding wheel and the parts supporting the same, showing the positions of the wheel in acting on concave disks;

Fig. 7 is a similar view showing the adjustments of the wheel in acting on flat disks;

Fig. 8 is a vertical sectional elevation on the line 8—8 of Figs. 1, 6 and 7;

Fig. 9 is a longitudinal section on an enlarged scale through one of the disk guiding rolls.

Referring to the drawings;

The machine comprises a suitable base or supporting frame 1 of rectangular form, and made up in the present instance of lower front and rear longitudinal I-beams 2 and 3, transverse I-beams 4, seated on and secured to the longitudinal beams, upper front and rear longitudinal I-beams 5 and 7, and an intermediate I-beam 6, which three last mentioned beams are supported on and fastened to the beams 4, and are held braced and properly spaced from each other by bolts 8 extending through the beams and surrounded by spacer pipe sections disposed between the beams.

The two beams 5 and 6 at the front of the frame give support to a head stock 9 adapted to be rotatably driven in a manner to be described in detail later on, and a tail stock 10, which two stocks are provided with the usual centers between which the work to be acted on, is held, and has a rotative motion imparted to it. The tail stock is adjustable on the supporting beams to and from the head stock by the adjusting bolts shown, in order to accommodate work of different lengths.

Mounted to travel along the front and rear beams 5 and 7 is a carriage frame, comprising two bars 12, preferably square in cross-section and extending parallel to each other transversely of said bars 5 and 7, which bars 12 have fixedly bolted to their outer ends, bracket plates 13 which extend downwardly at the outer sides of the respective beams 5 and 7. Vertically disposed rollers 14 are

journalled on the inner sides of the bracket plates near their opposite ends and travel on the upper flanges of the I-beams 5 and 7, and horizontal rollers 15 are journalled on inward extensions of the bracket plates at opposite ends of the same, and travel along the outer sides of the webs of the respective I-beams 5 and 7, which two sets of rollers give movable support to the carriage frame on the base frame, whereby the carriage frame may be caused to traverse the base frame in a direction longitudinally of the latter and in the direction of the axis of the work held between the head and tail stocks. The several rollers may be journalled eccentrically on their supporting axes, and thus provision made for adjusting and setting them in their proper relation to the flanges and webs, so as to compensate for any unevenness in said parts or non-parallelism of the beams, etc.

The bars 12 of the carriage frame constitute tracks, on which is mounted to move transversely of the travel of the carriage frame, a carriage 16 carrying a grinding wheel 17 which is supported on the carriage in the detailed manner presently to be described, and is rotatable on an axis extending in the general direction of the travel of the carriage, which axis, it will be observed, is at right angles to the axis joining the head and tail stocks; whereby the grinder may, by the movement of the carriage 16, be brought up to the work held between the head and tail stocks, and by the movement of the carriage frame on the supporting frame, it may be caused to traverse the work, all in the manner to be described more in detail later on.

The carriage 16 is supported by rollers 16^a, journalled on the underside of the base of the carriage and traveling on the upper sides of the square bars 12, as best shown in Fig. 4, although other means for supporting the carriage slidably on the carriage frame may be adopted.

Arising from the base of the carriage near its front, is a yoke frame 18 which is fixed to said base by bolts extending through a horizontal flange 18^a on the lower end of the yoke frame and through said base.

The yoke frame is formed on its inner sides with opposed curved tracks 19, on which travel, rollers 20 journalled in the upper and lower ends of vertical blocks 21, by which means the two blocks are movable on the tracks about an axis situated midway between the blocks and extending in the direction of movement of the carriage 16. Midway between their ends, the blocks are formed with horizontal bearing holes, in which are rockingly mounted journal studs 22, extending outwardly in opposite directions from the ends of an open rectangular rocking frame 23 as shown in Figs. 5 and 6, whereby the frame 23 may rock relatively to the yoke frame about the axis of the journal studs 22, which axis may depart from the horizontal, more or less, according to the degree of movement of the rocking frame on the curved tracks of the yoke frame.

The rocking frame is formed with a vertical central frame bar 23^a, on which is journalled on parallel axes extending in the plane of the frame, upper and lower disk guiding rolls 24 of a detailed form to be described later on which will adapt them to furnish a guide for the peripheral edges of the disks being ground.

Extending rearwardly from the lower edge of the rocking frame 23, is a horizontal extension or bracket plate 24^a, the rear end of which is supported by two vertical coiled springs 25, having their upper ends seated around lugs 26 depending from the extension 24^a, and having their lower ends seated on vertical studs 27 screwed into the base of the carriage 16, by which means the rocking frame is yieldingly supported in its rocking motions on the studs 22 and in its oscillating movements on the curved tracks of the yoke frame about the axis of the grinding wheel, the said rocking frame in these motions being given support at its underside by a vertical prop 28, extending between the rocking frame and the base of the carriage, the upper end of which prop is rounded and seated in a socket 28^a in the underside of the rocking frame, and the lower end of which is similarly rounded and seated in a socket 28^b in a plate 29, seated on and bolted to a flange 18^a on the yoke frame, which plate 28^b can be adjusted vertically by the employment of shims or liners between it and the flange, and thus the vertical adjustment of the rocking frame relative to the yoke frame effected.

The rearward extension 24^a of the yoke frame is formed with horizontal parallel lower tracks or ways 30, extending transversely of the direction of movement of the carriage 16, and with similar upper tracks or ways 31 parallel to the lower ones, and between these tracks, rollers 32 on a slide 33 travel, there being a single roller at the front of the slide and two rollers at the rear, thereby securing a tripod principle of support, and insuring proper contact of the rollers with the tracks under all conditions.

The slide 33 gives support to a turn table 34 pivoted to the slide by a vertical pivot bolt 35, the adjacent faces of the slide and turn table being formed with circular ball races containing anti-friction balls to prevent undue friction and binding of the parts. The turn table is turned on its pivot bolt by an operating handle 34^a extending horizontally from the side of the table, and the table is limited in its oscillating movements by two stops 36 and 37, extending upwardly from the slide 33, between which stops, a lug 38 on the turn table extends and is adapted to

engage. The two stops are carried respectively by plates 36ª and 36ᵇ which rest one upon the other on the upper side of the slide 33 and are held adjustably thereon by means of a clamping bolt 36ᶜ extending through slots in the plates and screwed into the slide, by which means, the two stops may be adjusted as a unit in the direction of the turning movement of the table, or may be adjusted to and from each other relatively.

The turn table is adapted to be locked fixedly on the slide against oscillating movement, by means of a locking bolt 39 screwed in the table and adapted to bear on the upper face of the slide and thereby bind the table against oscillating movement on its pivot bolt, the purpose of which detailed form of these parts will be more fully described hereinafter.

The movement of the slide 33 in its guides on the extension 24ª, is effected by means of a horizontal feed screw 40 formed with a journal 40ª mounted to rotate in a bearing in a vertical lug 41 on the front of the extension 24ª, said screw being held against endwise movement by collars 42 and 43 fixed to it and bearing respectively on the opposite sides of the lug, said feed screw having fixed to its outer end a hand wheel 44 for turning it. The feed screw passes freely through a hole in a lug 45 extending downwardly from the underside of the slide 33, and is screwed in two nuts 46 disposed on opposite sides of the lug, which nuts slide at their lower ends in a guideway 47 in the extension 24ª, and are thus held from turning on the feed screw. Spiral springs 48 surround the feed screw between the nuts and the lug 45, and are compressed under initial tension, so that the slide can yield relatively to the feed screw in the direction of its feeding movement. The rotation of this feed screw in either direction, will cause the two nuts to advance or retreat, while maintaining their set relations to the two springs, and corresponding motions will be imparted to the slide, and the latter will be thus set in the desired position subject at all times to the yielding pressure of the springs, which will act with a compensating effect on the slide.

The grinding wheel 17 before alluded to, is clamped to the forward end of a horizontal shaft or arbor 49 by nuts 50 and 51 screwed on the threaded end of the shaft and bearing against the opposite sides of the wheel. The shaft is mounted for rotation in an adjusting sleeve 52 threaded exteriorly and screwed in threaded openings in two standards 53 extending upwardly from the turn table 34, the said adjusting sleeve having fixed to it at the front and rear, caps 54 and 55 surrounding the shaft, the cap 55 being furnished with a number of pins 56 for turning it, and thereby the threaded adjusting sleeve.

The shaft 49 is loosely encircled near its front end by a collar 57 situated within the forward end of the adjusting sleeve and is held engaged with the cap 54 by a sleeve 57ª pinned to the shaft in rear of the collar. A second collar 58 loosely encircles the shaft within the adjusting sleeve at its rear end and affords a support for the shaft at this point. The shaft extends at its rear end some distance beyond the rear end of the adjusting sleeve, and has splined to it a driving pulley 59 mounted in a bearing in the lower end of a bracket arm 60 extending downwardly from the rear end of a frame 61 extending upwardly from the standards 53. By this means the shaft is rotated to impart rotary motion to the grinding wheel, which latter, by the adjustment of the sleeve 52, may be moved in the direction of its axis in order to present the wheel in its proper relation to the work to be ground.

The pulley 59 is driven by a belt 62 passing around a pulley 63 on the rear end of a horizontal motor shaft 64 mounted in bearings 65 on the frame 61, and connected at its front with an electric motor 66 sustained by the frame 61 at its front. The motor receives its operating current from an electric generator 67, which is driven in the present instance by a main motor in the form of a gasoline engine 68 suitably sustained at the end of the supporting frame 1.

The shaft of the gas engine has fixed to its end, a pulley 69 around which passes a driving belt 70, which drives a pulley 71 on the generator shaft, whereby the generator is driven by the gas engine.

The gas engine also drives the head stock 9, by means of a belt 72 passing around a pulley 73 on the engine shaft and adapted by the belt shifter 74 to be shifted on fast and loose pulleys 75 and 76 mounted on a shaft 77 journalled in bearings on the supporting base frame of the machine at one side of the same. The shaft 77 has a pinion 78 fixed to its end, which pinion meshes with a larger pinion 79 on a shaft 80 mounted in bearings in the supporting frame at a point above and inward of the shaft 77. The shaft 80 carries a sprocket wheel 81, which is connected by a sprocket chain 82 to a sprocket wheel 83 on the end of the shaft 84 carrying the head stock 9, by which connections said head stock is rotated.

The work to be ground is, as before stated, mounted in the machine between the head and tail stocks, and is rotated by the rotary motion of the head stock. This work may be in the form of a single disk or colter, or gang of disks, and the disks may be either of flat form, such as colter disks, or of dished or concave form, such as are employed in disk cultivators and the like, and in accordance with the present invention, while a gang of disks may be held for rotation between the head and tail stocks by mounting the shaft

carrying the disks between the head and tail stock centers and fastening to the shaft a driving dog adapted to engage in one of the notches 9^a with which the face plate of the head stock is provided, a special form of holder will be required when working on a single disk or colter.

For instance, in operating on a colter or other disk as a single unit, such as shown in Fig. 7, the disk is held in a disk holder 85 comprising two conical members or castings 85^a which are screwed on the ends of a threaded rod 86, extending through the center of the disk, whereby the adjacent edges of the conical members will be clamped against the opposite sides of the disk, and the latter will be held in fixed relation to the holder; and a cone shaped block 86^a is screwed on the rod and its smaller end entered in the central hole of the disk structure, thereby centering the disk between the parts of the holder. The ends of the holder are formed with center sockets to receive the centers of the head and tail stocks; and the tail stock 10 is adjusted along the frame towards the head stock and set at the proper point to support the holder between the two stocks. The disk holder is provided at opposite ends with driving dogs 88, one of which, when the holder is centered between the head and tail stocks, will extend in one of the notches in the face plate of the head stock and the holder will in this way be rotated by the head stock. The provision of a driving dog at each end of the disk holder, enables the holder when the grinding of the cutting edge on one side has been completed, to be reversed end for end between the head and tail stocks and be rotated in its reversed position, the driving dog which before was inactive, being in the reversed position of the parts, engaged with the face plate of the head stock.

With the disks held between the head and tail stocks and rotated as described, the grinding wheel is in the manner to be described later on in detail, presented to the peripheral edge of the disk to grind down and sharpen the same on one side, and the disk or disks are then reversed, and the other side ground and the sharpening operation thus completed. In this operation, the peripheral edge of the disk which is being ground will engage and be guided by the disk guiding rolls 24, at circumferentially spaced points on opposite sides of the point where the grinding wheel is acting, whereby the disk will be held and guided in such manner that the grinding wheel will be enabled to function with the maximum efficiency.

The two rolls 24 are adapted to guide both flat and dished disks, and as these rolls are identical in form and construction, a detailed description of one will suffice.

On reference to Fig. 9, it will be seen that the roll comprises an axle 90, fastened to and projecting from the side of the central bar 23^a of the rocking frame 23, before referred to, and having two ball race cones 91, and an outer cup or shell 92 rotatable about the axle, and anti-frictionally supported therefrom by balls 93 arranged between the cones and shell. The shell 92 is in two parts, an inner part 94 containing a straight narrow peripheral circumferential recess 95, in which the edge of flat disks is guided, and containing also a wide peripheral circumferential recess or groove 96; and an outer part 97 which is detachably connected with the inner part by fastening pins 98, and which overhangs the groove 96, as at 97^a, and presents a flat circumferential surface 98^a extending outwardly from the overhanging portion. This flat surface 98^a, in cooperation with the wide open recess 96, adapts the roller for guiding the edge of concave disks, which edge is received by the roller as shown in Fig. 6, where it will be seen that the straight side of the disk bears flatly against the surface 98^a, and the curved side is received in the recess 96. From this it will be understood that, due to the clearance which exists in the recess 96 around the edge of the disk, there is no danger of the contact of any part of the guiding roll with the side of the peripheral edge of the disk being ground, and consequently, there is no liability of the sharpened edge being dulled by the guiding action of the roll. By making the part of the shell containing the flat surface 98^a detachable, it may be renewed, when, by contact with the disk, it becomes so worn as to impair its efficiency in affording a proper guide for the edge of the disk.

The carriage 16 is movable on the carriage frame from a rearward position, in which the disk guiding rolls 24 are free of the work, to a forward position to engage the rolls with the work, and this in order that the work may be set in place between the head and tail stocks without interference with the rolls; and when the carriage is at its forward position, with the guiding rolls engaged with the work, the carriage will be held in such position under spring tension.

To effect this object, the base of the carriage is formed as shown in Fig. 4, with a horizontal socket 100, in which is seated a spiral spring 101, whose front end bears against the front wall of the socket, and whose rear end bears against a washer 103 slidable in the socket and formed with a central rearwardly extending stud 104. A spacer sleeve 105 is seated at its front end removably on the stud 104, and at its rear end it is seated removably on a stud 106 on the front end of a screw bolt 107 screwed through a lug 108 extending upwardly from the rear bracket plate 13 on the carriage frame 11, the outer end of which screw bolt is provided with a handle 109 for turning it.

In setting the carriage in operative rela-

tion to the work, a length of spacer sleeve 105 is employed which will, when inserted between the screw and spring, hold the carriage at such point on the carriage frame that the guiding rolls 24 will engage the edge of the disk, it being observed that this position of the carriage will be determined by the diameter of the disk or disks to be ground, and that different lengths of spacer sleeves will be employed with different diameters of work.

After the sharpening operation is completed, the carriage must be retracted to disengage the guiding rolls from the work and permit a new disk to be set in place if disks are being ground as individual units or, to permit the carriage to be moved laterally for the next disk if the disks are being ground in gang. This retraction of the carriage is effected by removing the spacer sleeve and drawing the released carriage back on its tracks, the carriage being set in its former position by first moving it back and engaging the guiding rolls with the work, and then reinserting the spacer sleeve between the spring and feed screw. It will be understood that in the adjustment and setting of the carriage as above described, the length of the spacer sleeve and the adjustment of the feed screw will be such that when the guiding rolls are engaged with the work, the carriage will be held by the spacer sleeve with spring 101 compressed and under tension, so that the guiding rolls will be held yieldingly engaged with the work.

From the construction and arrangement of the parts employed in the mounting of the grinding wheel and associated parts, it will be seen that, aside from the rotating movement of the wheel, it is capable of movements in various relatively different directions while subject to the driving motion applied to rotate it. For instance, the wheel is capable of the following different motions;

First:—The wheel is movable horizontally, together with the disk guiding rolls, in the direction of the axis of the head and tail stocks to cause the wheel to traverse the work, which movement results from the travel of the carriage frame 11 on the base frame of the machine.

Second:—The wheel is movable horizontally, together with the disk guiding rolls, and with the carriage 16 to and from the work in a direction at right angles to the first movement, so as to engage and disengage the disk guiding rolls with the work, which second movement results from the travel of the carriage 16 on the carriage frame including the bars 12.

Third:—The wheel is movable horizontally relatively to the carriage 16 and relatively to the disk guiding rolls, in a direction at right angles to the movement of said carriage, and in relation to the same, which movement is brought about by the travel of the slide 33 in its guides on the extension of the rocking frame.

Fourth:—The wheel is movable relatively to the carriage 16 and to the disk guiding rolls, horizontally to and from the rocking frame 23 and in the direction of movement of the carriage 16, which is effected by the horizontal adjustment of the threaded sleeve 52.

Fifth:—The wheel is swingable horizontally in relation to the rocking frame 23 and the disk guiding rolls, about a vertical axis, which motion results from the oscillating movement of the turn table 53 on the slide 33.

Sixth:—The wheel is rockable vertically with the rocking frame 23 and with the disk guiding rolls, about a horizontal axis extending transversely of the axis of the wheel and coincident with the axes of the journal studs 22 of the rocking frame, which movement results from the rocking of the rocking frame in the yoke frame 18 on the vertical curved guides thereof. Certain of these movements are subjected to spring action, or in other words are yielding movements, such as the second movement as controlled by spring 101, the third movement as controlled by the compensating springs 48, and the sixth movement as controlled by the vertical springs 25.

Due to these various relative movements of the parts and the action of the springs thereon, the disk guiding rolls on the rocking frame 23 will engage the edge of the rotary disk with yielding pressure, and will therefore, hold to and follow said edge and thereby effectively support and guide the same during the grinding action, so that the grinding wheel will act with the greatest efficiency in performing its grinding operation, and this without regard to irregularities which may exist in the edge of the disks, the eccentric mounting of the disks, the warped condition of the disks, or to other imperfections. And the grinding wheel will be likewise yieldingly pressed to its work, and will faithfully follow the surface being acted on without regard to irregularities therein, and the edge of the disk will be sharpened evenly and uniformly.

Also, the grinding wheel may be adjusted relatively to the work and presented to the same at the proper angles to act on the edge to be sharpened, either the straight side of a flat disk, or the curved side of a concave disk. And further, the guiding rolls may be readily engaged with and disengaged from the work, and the grinding wheel readily changed from one disk to another on the completion of the sharpening operation of the individual disks in the gang.

In the use of the machine for sharpening concave disks, either a single disk may be mounted in the machine, or a gang of disks,

as before stated. In the case of a single disk, it is mounted in the two-part disk holder 85 shown in Fig. 7, and the holder is centered between the head and tail stocks, and the driving dog 88 at that end of the holder nearest the head stock, is engaged in one of the notches 9ª in the face plate of the head stock, so that the rotating movement of the latter will be imparted to the work holder and the disk held therein. Or, if a gang of such disks are to be operated on, the axle carrying the gang is similarly mounted between the head and tail stocks, and a suitable driving dog is clamped to the axle and engaged with the face plate of the head stock.

The carriage 16 is now rolled up to engage the disk guiding rolls with the edge of the disk, a spacing sleeve 105 of appropriate length, as determined by the diameter of the disk, is set in place between the spring 101 and the screw 107, and the latter is screwed up to compress and apply tension to the spring and thereby hold the guiding rolls with yielding pressure against the edge of the disk.

The grinding wheel is now by the adjustment of the slide 33, turn table 34, and threaded sleeve 52, brought to idling position A, and the handle 34ª on the turn table is pushed to the right to cause the lug 38 on the turn table to bring up against the stop 37. The work is now rotated by its driving mechanism, and the grinding wheel brought up to full speed, and the hand wheel 44 is turned to retract the carriage and bring the grinding wheel to position B in grinding contact with the curved side of the disk near its peripheral edge, the handle 34ª being still held to the right with the lug 38 abutting against stop 37. As the grinding operation proceeds, the parts are adjusted to advance the grinding wheel along the curved surface of the disk towards its peripheral edge, until the wheel reaches position C. When this position is reached, the parts are adjusted to momentarily disengage the wheel from the work and the wheel is then adjusted to position D at the proper angle to act on the flat cutting edge X at the peripheral extremity of the disk, this final adjustment of the wheel being effected by swinging the handle 34ª to the left until the lug 38 brings up against stop 36. In this position of the parts in effecting the final cut, the turn table is locked to its carrying slide by the locking bolt 39, thereby bringing into action the compensating springs 48, which will compensate for any slight variations in the periphery of the disk which the guiding rolls may not take care of.

It will be understood that in obtaining the several positions of the grinding wheel relative to the disk as above described, the threaded sleeve 52 will be screwed up to maintain the wheel in proper relation to the work; and further, it will be understood that the stop 37 governs the depth of the cut down the curved side of the disk, and that the stop 36 governs the angle of the finishing cut on the peripheral extremity of the disk.

When the final cut, with the wheel in position D is completed, the screw 107 is backed out to release the spacer sleeve 105 and the latter is removed, whereupon the carriage 16 is retracted, so as to disengage the guiding rolls and grinding wheel from the disk, in order to permit another disk to be set in place for operation, or where a gang of disks is operated on, to permit the carriage frame 11 to be moved to the next disk, whereupon the foregoing operations are repeated.

In grinding straight or flat disks, such as colter disks, while the procedure with reference to the mounting of the disk and the engagement therewith of the disk guiding rolls is the same as just described in connection with concave disks, the setting of the grinding wheel relative to the work is slightly different.

As shown in Fig. 7, the grinding wheel is adjusted to four different positions; first, an idling position A′, with the wheel disengaged from the work, but at an angle corresponding to that which the peripheral extremity of the disk is to be ground; second, a position B′, in grinding contact with the disk and at the same angle as in its former position, the lug 38 in this position of the wheel being held engaged with the stop 36; third, a position C′, in which the angle of the grinding wheel is changed, so that its plane will be nearly perpendicular to the plane of the disk, this change of angle being effected by swinging the handle 34ª to the right to engage lug 38 with stop 37; and fourth, a position D′, in which the grinding wheel, when the grinding operation in position C′ is completed, is moved back to disengage the work.

When under these various adjustments of the grinding wheel, the grinding of the peripheral edge of the disk at one side is finished, the carriage 16 carrying the disk guiding rolls, is retracted as before explained, in order to disengage the rolls from the disk, whereupon the disk holder 85 is reversed in its position between the head and tail stocks, and the dog 88 which had before been idle, is engaged with the face plate of the head stock, and the carriage 16 is again rolled up to the work and the grinding wheel adjusted successively to the different positions described.

From the foregoing description, it will be understood that if the shaft or axle on which the gang of disks is mounted is sprung or bent, or if the disks are mounted eccentrically, or have large nicks or breaks in their periphery, these conditions will be taken care of by the motion of the carriage 16 to and from the work, and by the motion of the

rocking frame 23 and the parts connected therewith, about the axes of the journal studs 22. If the disks are warped or sprung sidewise, or there are kinks in their periphery, these conditions will be taken care of by the rocking motion of the frame 23 carrying the disk guiding rolls, in the yoke frame about the axis of the grinding wheel, and by the motion of the carriage frame and parts carried thereby, in the direction of the axis of the head and tail stocks; and if the cutting edge of the disks is bent or turned over, the disk guiding rolls will roll out the irregularities to a large extent; and if the disks are loose on their shaft, this condition will be taken care of by all of said motions of the carriage in combination.

In the foregoing description and accompanying drawings, I have set forth my invention in the particular detailed form and construction of the parts which I prefer to adopt, and which in practice have been found to answer to a satisfactory degree the ends to be attained. It will be understood however that these details may be variously changed and modified by the skilled mechanic without departing from the limits of the invention; and further, it will be understood that the invention is not limited to any particular form or construction of the parts, except insofar as such limitations are specified in the claims.

In order to handle the work in mounting the same between the centers of the head and tail stocks, a crane 110 is provided, as shown in Figs. 1 and 2, which is mounted to swing on a vertical axis in bearing blocks 111 fixed to the upper and lower longitudinal beams 5 and 2. This crane will be furnished with a suitable tackle not shown, and may be swung out from the frame and hitched to the work, and then swung in to mount the work between centers.

Having thus described my invention, what I claim is:—

1. In a disk sharpener, the combination of a supporting frame, means thereon for rotatably supporting the disk to be sharpened, a carriage movable on the frame to and from the disk, a frame mounted on the carriage to rock about an axis parallel with the axis of the disk, and also about an axis extending transversely of the axis of the disk, disk guiding devices mounted on said rocking frame and adapted to engage the peripheral edge of the disk at circumferentially separated points, and a disk sharpening tool carried by the carriage and adapted to act on the edge of the disk between said guiding devices.

2. In a disk sharpener, the combination of a supporting frame, means thereon for rotatably supporting the disk to be sharpened, a carriage movable horizontally on said frame to and from the disk, a yoke frame fixed on the carriage, a frame rockable in said yoke frame about a horizontal axis, disk guiding devices on the rockable frame adapted to engage the peripheral edge of the disk at points spaced circumferentially from each other, and a disk sharpening tool mounted on the carriage and adapted to act on the edge of the disk between said guiding devices.

3. In a disk sharpener, the combination of a supporting frame, means thereon for rotatably supporting the disk to be sharpened, a carriage movable horizontally on said frame to and from the disk, a yoke frame fixed on the carriage, a frame rockable in said yoke frame on two horizontal axes at right angles to each other, disk guiding devices on said rockable frame adapted to engage the peripheral edge of the disk at points separated circumferentially from each other, and a disk sharpening tool mounted on the carriage and adapted to act on the edge of the disk between said guiding devices.

4. In a disk sharpener, the combination of a supporting frame, means thereon for rotatably supporting the disk to be sharpened, a carriage movable on the supporting frame to and from the disk, a yoke frame fixed on the carriage, a frame rockable in the yoke frame about two horizontal axes at right angles to each other, disk guiding devices on the rockable frame adapted to engage the peripheral edge of the disk at circumferentially spaced points, and a grinding wheel rotatably mounted on the carriage and adjustable relatively to the rockable frame in the direction of the axis of rotation of the wheel.

5. In a disk sharpener, the combination of a supporting frame, means thereon for rotatably supporting the disk to be sharpened, a carriage movable on the supporting frame to and from the disk, a yoke frame fixed on the carriage, a frame rockable in the yoke frame about a horizontal axis, a vertical prop rockably supported by the carriage and giving support to the underside of the rockable frame, disk guiding devices on the rockable frame to engage the peripheral edge of the disk at circumferentially spaced points, and a disk sharpening tool mounted on the carriage and adapted to engage the edge of the disk between the guiding devices.

6. In a disk sharpener, the combination of a supporting frame, means thereon for rotatably supporting the disk to be sharpened, a carriage movable on the supporting frame to and from the disk, a frame rockable on the carriage about a horizontal axis and movable horizontally relatively to the carriage in the direction of the axis of the disk, disk guiding devices on the rockable frame to engage the disk at circumferentially spaced points, a spring acting on the carriage to urge it toward the work, a spring acting on the rockable frame to restrain its rocking movements and thereby hold the guiding devices engaged with the disk, a spring acting on the rocking frame to restrain its movements in the direc-

tion of the disk axis, and a disk sharpening tool mounted on the carriage and adapted to act on the edge of the disk between the guiding devices.

7. In a disk sharpener, the combination of a supporting frame, means thereon for rotatably supporting the disk to be sharpened, a slide movable on the supporting frame, a turn table rotatable on the slide, a sharpening tool on the turn table adapted by the turning movements of the table to be adjusted in proper operative relation to act on the edge of the disk, and means for limiting the turning movement of the turn table on the slide, said means comprising two plates, one resting upon the other and fastened to the slide and adjustable as a unit in the direction of the turning movement of the table, and also adjustable relatively to each other in a like direction, and provided respectively with stops, and a lug on the turn table extending between said stops.

In testimony whereof, I have affixed my signature hereto.

CHARLTON D. WRIGHT.