A. B. LANDIS.

GRINDING MACHINE.

APPLICATION FILED DEC. 15, 1906.

945,464.

Patented Jan. 4, 1910.

4 SHEETS—SHEET 1.

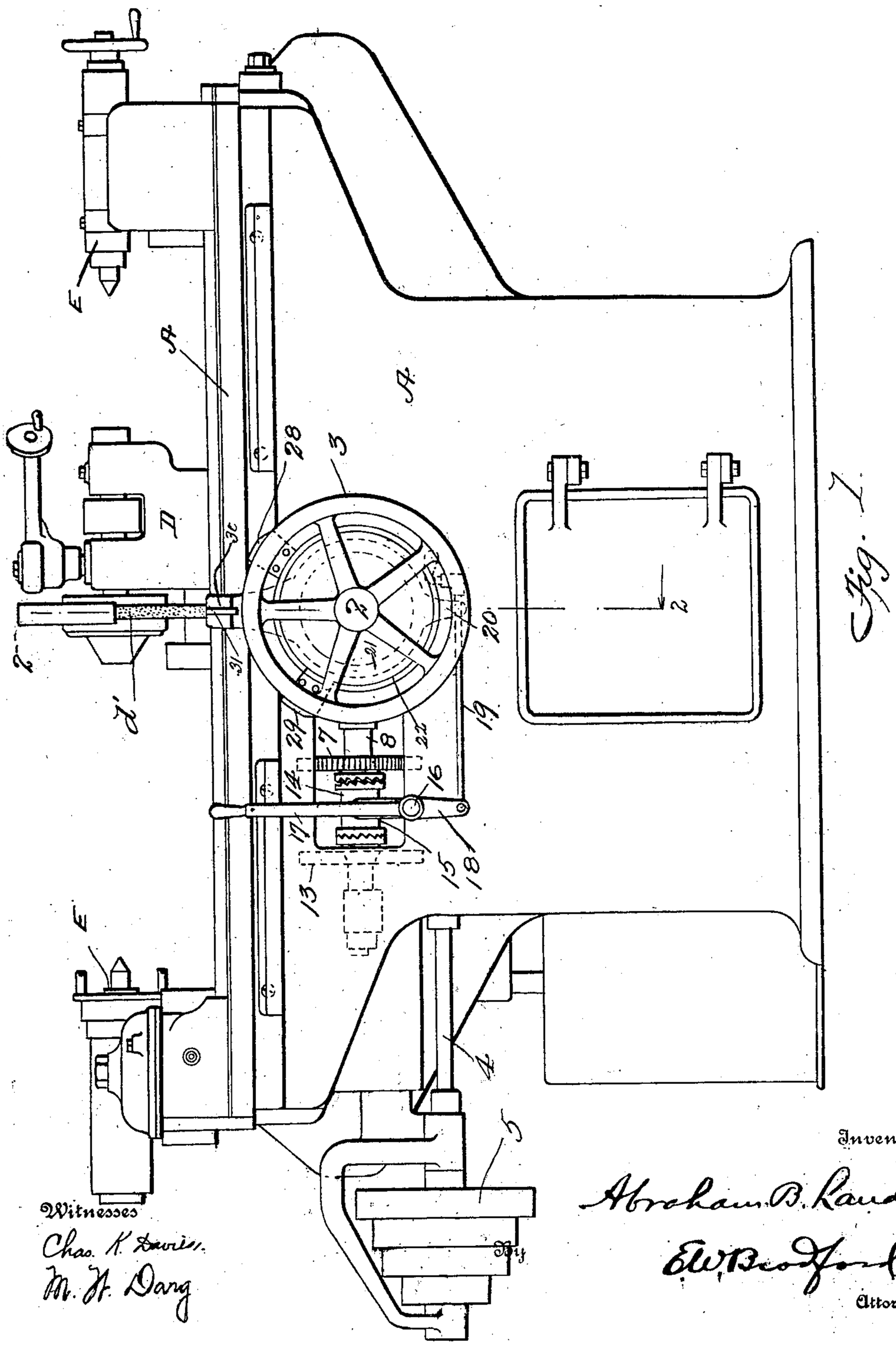

Fig. 1.

Witnesses

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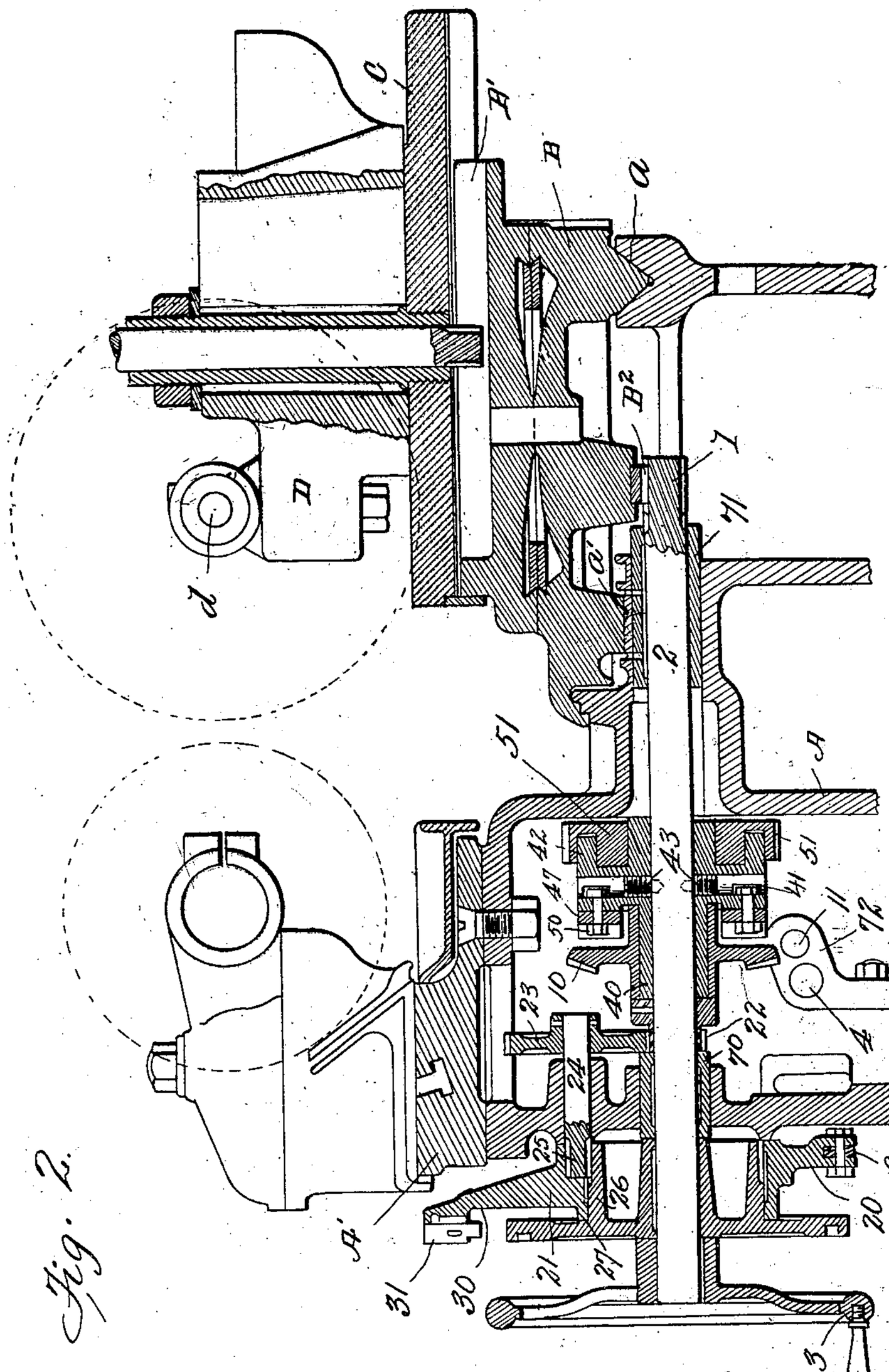

Fig. 2.

Witnesses

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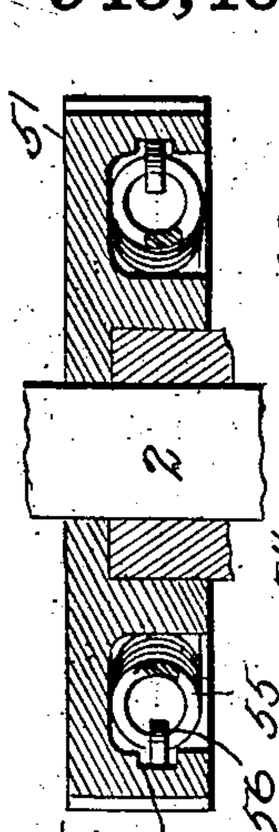

Fig. 5.

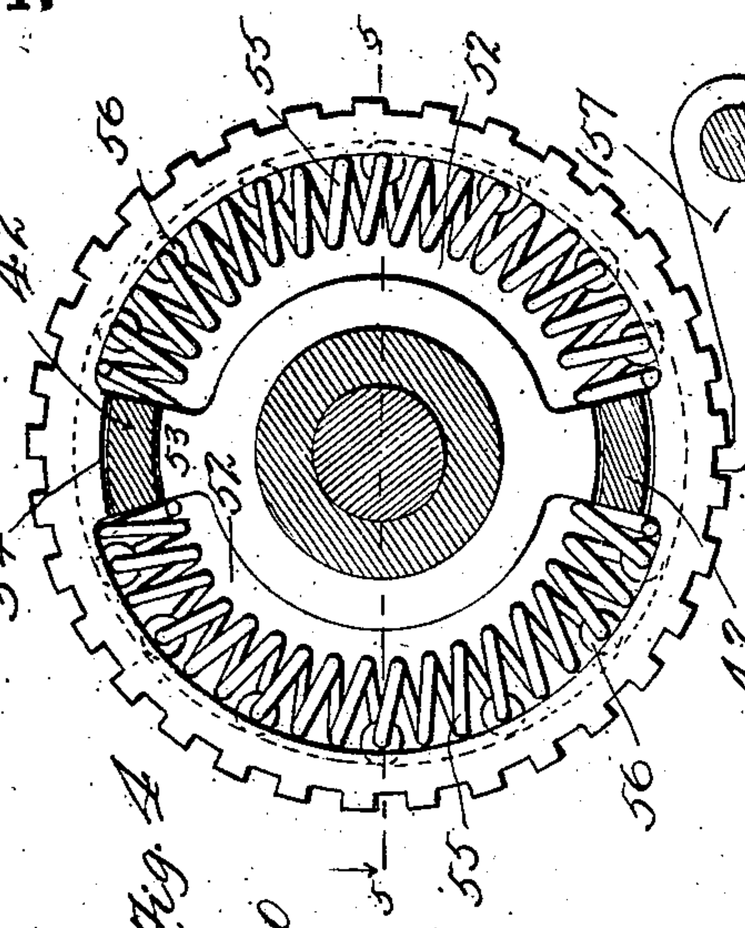

Fig. 4.

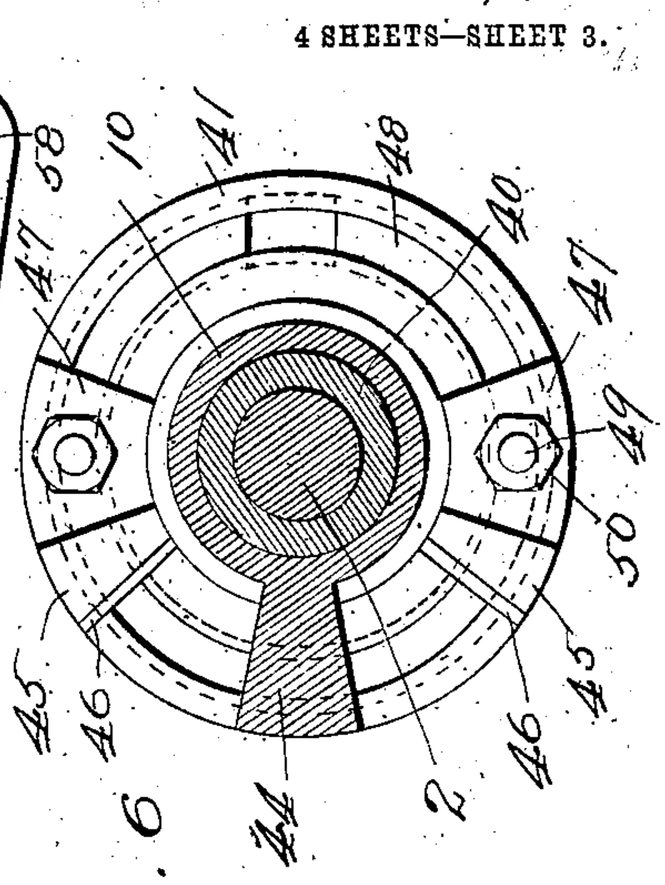

Fig. 6.

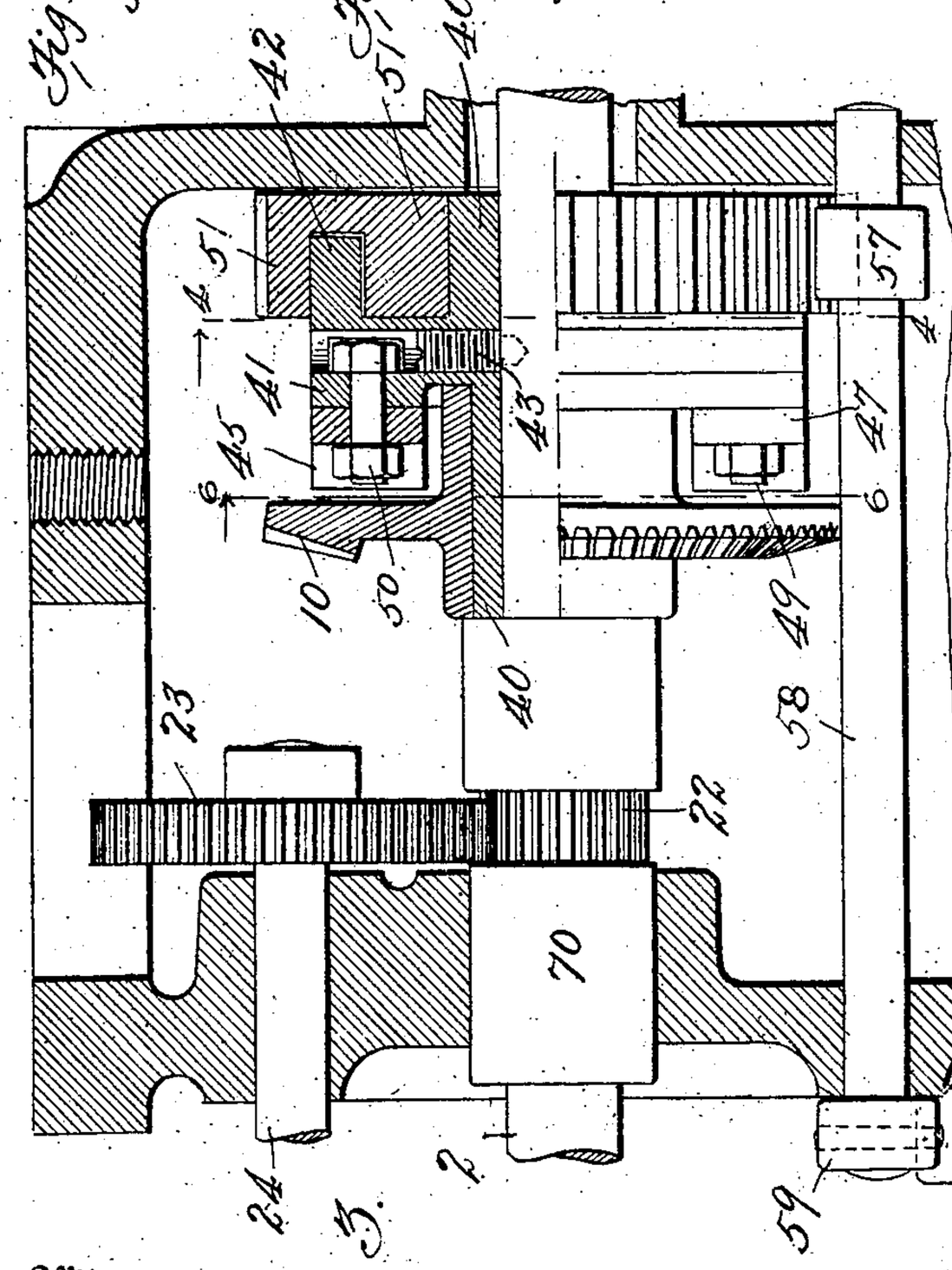

Fig. 3.

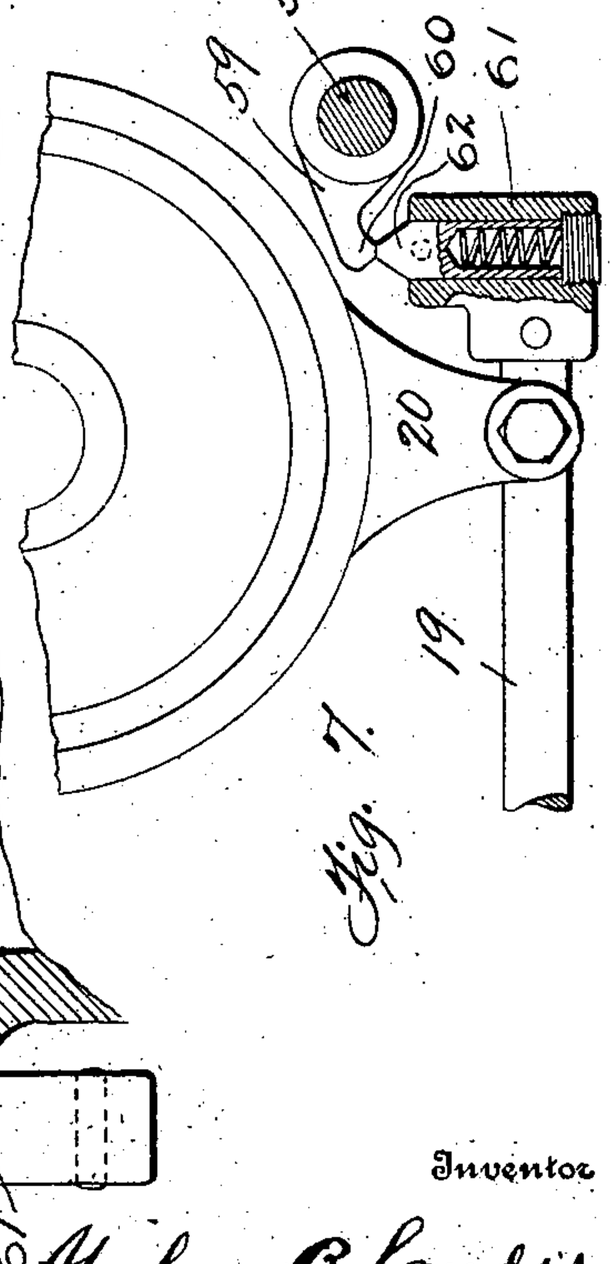

Fig. 7.

Witnesses

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4 SHEETS—SHEET 4.

Fig. 9

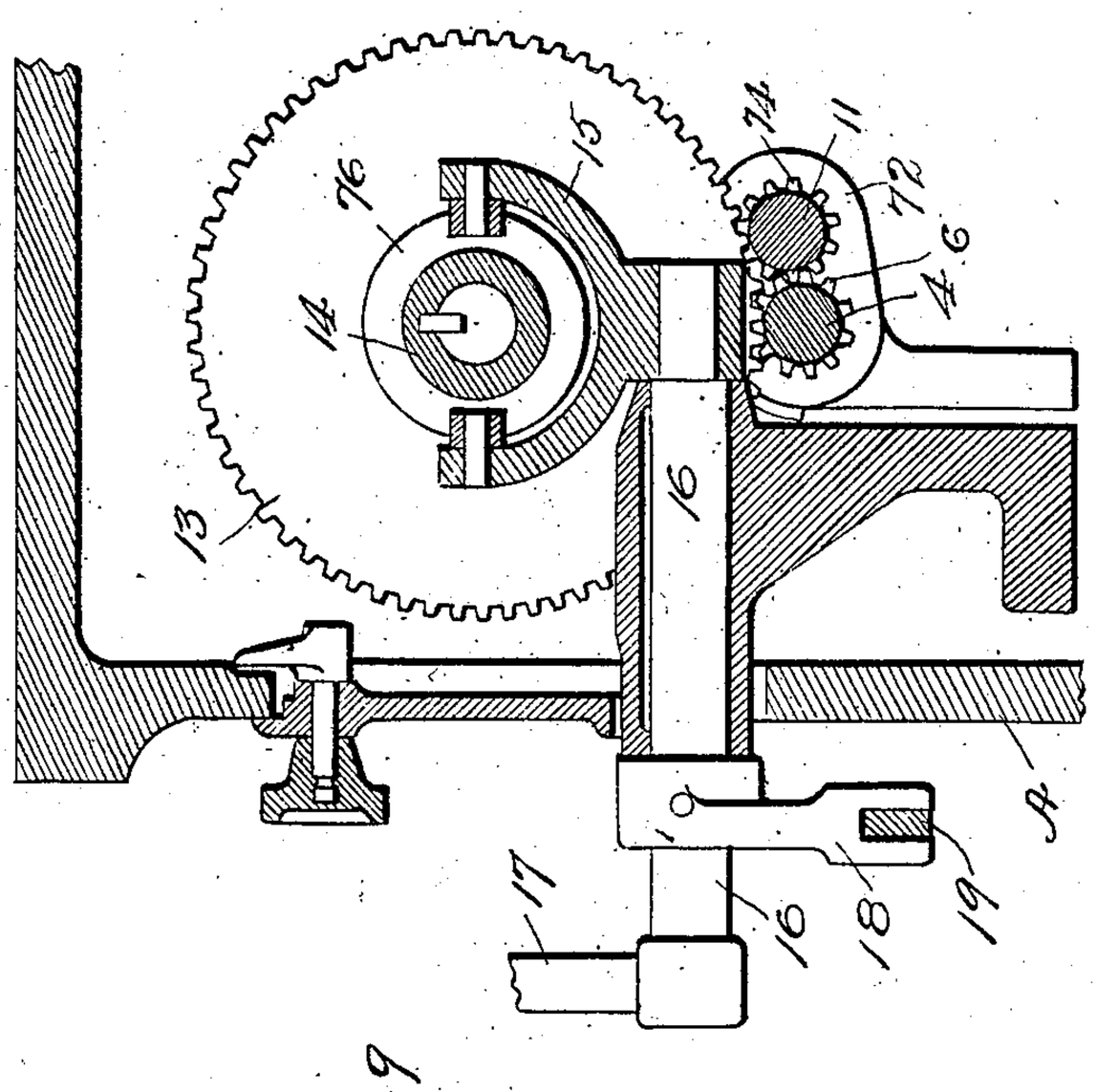


Fig. 12.

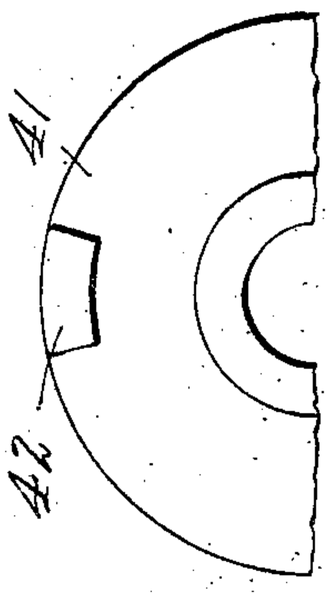


Fig. 10.

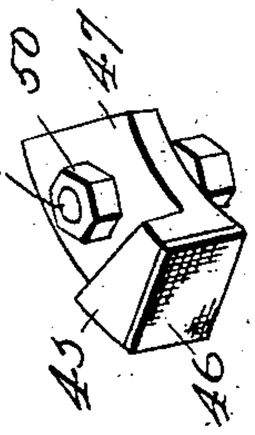
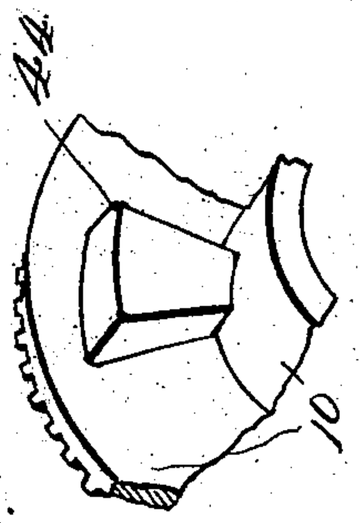


Fig. 8.

Fig. 11.



Witnesses

Chas. K. Davies

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UNITED STATES PATENT OFFICE.

ABRAHAM B. LANDIS, OF WAYNESBORO, PENNSYLVANIA, ASSIGNOR TO LANDIS TOOL COMPANY, A CORPORATION OF PENNSYLVANIA.

GRINDING-MACHINE.

945,464. Specification of Letters Patent. **Patented Jan. 4, 1910.**

Application filed December 15, 1906. Serial No. 347,977.

To all whom it may concern:

Be it known that I, ABRAHAM B. LANDIS, a citizen of the United States, residing at Waynesboro, in the county of Franklin and State of Pennsylvania, have invented certain new and useful Improvements in Grinding-Machines, of which the following is a specification.

In the operation of grinding machines where a carriage is employed which traverses back and forth across the machine, extra power is required at the end of each movement to overcome the momentum of the carriage and start it back in the reverse direction, particularly when the carriage and the mechanism carried thereby are of a heavy character. The stopping of the motion of the carriage in one direction and starting it in the reverse direction not only requires power in excess of that required for the straight away operation in either direction but causes a shock and heavy strain and wear upon the parts of the gear and reversing mechanism employed and also a vibration in the machine sometimes affecting the work, necessitating that they be made of extra weight and strength.

The object of my said invention is to provide means whereby this shock is not only cushioned and the strain thereof on the mechanism relieved, when the carriage is brought to a stop and started in the opposite direction but also whereby the power required in stopping the carriage may be stored and used to assist in overcoming the inertia of the carriage and to start it in the reverse direction, thereby not only relieving the machine of a great deal of the ordinary strain and wear but enabling the work to be performed with less power, the parts to be of less weight and strength, and the vibration in the machine incident to the shock be avoided, thus not only reducing the expense of operation but the expense of construction and increasing the life and efficiency of the machine as well, all as will be hereinafter more fully described and claimed.

Referring to the accompanying drawings which are made a part hereof and on which similar reference characters indicate similar parts, Figure 1 is a side elevation of the work supporting side of a grinding machine embodying my said invention, Fig. 2 a transverse section through the machine on the dotted line 2—2 in Fig. 1, Fig. 3 a detail view on an enlarged scale of a part of the mechanism illustrated in Fig. 2, being shown partly in section and partly in elevation, Fig. 4 a cross section looking in the direction indicated by the dotted line 4—4 in Fig. 3, Fig. 5 a cross section looking in the direction indicated by the dotted line 5—5 in Fig. 4, Fig. 6 a cross section looking in the direction indicated by the arrow 6—6 in Fig. 3, Fig. 7 a detail view on an enlarged scale of a portion of Fig. 1, Fig. 8 a detail view of the reversing gear, Fig. 9 a cross section thereof as seen when looking in the direction indicated by the arrows from the dotted line 9—9 in Fig. 8, and Figs. 10, 11 and 12 detail views showing the form of separate parts of the structure shown particularly in Fig. 6 more clearly.

In said drawings the portions marked A represent the bed of the machine, B the carriage, C the slider, D the grinding wheel base and E E′ the head stock and foot stock respectively.

The general construction of the machine is similar to that shown in my Patent No. 639,900 of December 26, 1899, and a brief description only of the main structure will, therefore, be sufficient herein, as the details of the construction and operation can be readily ascertained by reference to said former patent, the machine shown therein being in general use and familiar to those skilled in the art.

The bed A is a hollow casting of suitable form to support the several parts and bearings, provided on one side with ways *a* and *a′* on which the carriage B is mounted to travel and on its opposite side with a work supporting table A′ on which is mounted the head stock E and foot stock E′ adapted to support the work in position to be ground. The slider C is mounted in the usual or any approved manner on the top of a transverse slide B′ on the top of table B and has the grinding wheel base D supported and adapted to be operated thereon, as shown in several of my former patents, or in any approved manner. Said grinding wheel base D carries the bearings for the grinding wheel spindle *d* on which the grinding wheel *d′* is mounted.

A rack-bar B^2 is mounted on the underside of carriage B to extend longitudinally

thereof and is engaged by a pinion 1 on the inner end of a transverse shaft 2 mounted in suitable bearings 70 and 71 in the frame and having a hand wheel 3 on its outer end by which it may be turned to rotate said shaft and traverse said carriage back and forth by hand. The power driving mechanism comprises a main shaft 4 mounted in suitable bearings 72 and 73 in the frame or bed of the machine and has a cone-pulley 5 by which it may be belted to any suitable power. It is provided with a long gear 6 adapted to mesh with a loosely mounted pinion 7 on a counter shaft 8, which counter shaft has a pinion 9 adapted to mesh with a gear 10 on the shaft 2. Another shaft 11 alongside shaft 4 has a pinion 12 which also meshes with pinion 6 on shaft 4 and another pinion 74 which meshes with a loosely mounted gear 13 on shaft 8. A double-faced clutch 14 is mounted between clutch parts 75 and 76 on the adjacent faces of the hubs or gears 7 and 13, being secured to shaft 8 by means of a spline. A shifting fork 15 mounted on a rock-shaft 16 is adapted to engage and throw said clutch part 14 back and forth into one or the other of the clutch parts on said wheels 7 and 13. A lever 17 is provided on said shaft 16 by which said shifting fork may be thrown by hand and an arm 18 extends downwardly from said rock-shaft and is connected by a link 19 to an arm 20 on a wheel 21 mounted around shaft 2 near its outer end. Another small gear 22 is mounted on shaft 2 adjacent to gear 10 and adapted to mesh with a gear wheel 23 on a short shaft 24 mounted in a bearing in the frame A alongside said shaft 10. The outer end of said shaft 24 is provided with a pinion 25 adapted to mesh with teeth on the exterior of a circular flange 26 on the rear side of a wheel 27 mounted on said shaft 2. The wheel 21 is mounted to rock on said flange 26 between said teeth and the rear side of said wheel 27. Said wheel 27 is provided with adjustable dogs 28 and 29 on its periphery and the wheel 21 is provided with an upwardly projecting arm 30 carrying a strike 31 with which said dogs are adapted to contact. Thus as said shaft 2 rotates it operates through the gear just described to slowly move the wheel 27 until one of the dogs 28 or 29 contacts with the strike 31 which operates to rock the wheel 21 around its bearing on flange 26 of wheel 27, and lower arm 20 thereof, operates the rock-through the link 19 connected with the shaft 16 to shift the clutch part 14 from engagement with one of the wheels 13 or 7 to the other and thus, through the train of gearing before described, shift the direction of the travel of the carriage. Thus far the construction, arrangement and operation of the mechanism is substantially the same as that shown in the above mentioned Letters Patent and is thus briefly described to enable the invention to be more readily understood.

The gear wheel 10 instead of being mounted directly upon the shaft 2 is loosely mounted upon a sleeve 40, which sleeve has a circular flange 41, which has a rearwardly projecting arm 42 at its outer edge at two diametrically opposite points. Said sleeve is secured to the shaft 2 by means of screws 43 which project through radial perforations in said flange 41, the lower end of each of which is screw-threaded and contains a screw 43 adapted to screw into sockets or radial holes in said shaft, thus securing said sleeve rigidly in position on said shaft. On the rear side of wheel 10 is a projecting segmental lug 44 which is cast in piece or may be rigidly secured to the back side of said wheel. Projecting strikes 45 having their adjacent faces provided with cushions 46, preferably of leather, and formed with right angular flanges 47 are adjustably secured in a circumferential T-shaped groove 48 in the front of flange 41 on said sleeve 40 by means of bolts 49, the heads of which are mounted in said groove and the outer ends of which are provided with nuts 50 by which said strikes may be clamped in any desired position in said groove around said flange. By this means as will be readily seen, said wheel 10 may be given a limited movement independent of said sleeve 40, the extent of which may be regulated by the adjustment of said strikes 45. A wheel 51 having teeth on its periphery is mounted loosely upon the rear end of said sleeve 40 and is formed with two pockets 52 in its inner face on opposite sides and near its periphery, each of which extends in a circular direction so that the two pockets nearly form a circle being separated from each other by sections 53 through which are cut slots 54 of sufficient width to receive the arms 42 on the rear side of the flange 41 on sleeve 40. Heavy coiled springs 55 are mounted in said pockets, the ends of said springs resting against the ends of the pockets formed by the sections 53. The arms 42 are normally positioned between said springs in the slots 54. Rollers 56 are preferably mounted on part of the coils of said springs suitable distances apart and are adapted to rest in a narrow groove 57 in the outer wall of each of said pockets, thus serving to prevent any cramping of the coils of the springs and permit them to expand and be compressed without undue friction upon the walls of the pockets containing them. Said wheel 51 thus is normally held to revolve with said sleeve 40 by means of the arms 42 projecting between the ends of said springs 55, the tension of the springs being sufficient to carry said wheel without compressing them. A pawl 157 is mounted upon a rock-

shaft 58 adjacent to the periphery of said wheel 51 and adapted to engage with the teeth thereof. Said shaft 58 extends parallel with the shaft 2, being mounted in suitable bearings, and extends to the outside of the machine and has an arm 59 on the outer end thereof having a double cam face 60 on its outer end. On the adjacent end of link 19 is mounted a vertical socket 61 containing a double-faced cam 62, which is adapted to pass back and forth under the double-faced cam 60 on the arm 59 and thus rock shaft 58 as the wheel 21, with the arm 20 thereon, is moved back and forth.

In the position shown in Figs. 4 and 7 the pawl 57 is shown in engagement with the notches of the periphery of wheel 51, which position the parts will occupy just as the mechanism is beginning to operate to rock wheel 21 and shift clutch part 14 to reverse the travel of the carriage and at the point when said clutch part is being moved away from the clutch with which it has just been engaged. During the time that the point of cam 62 is passing over the point of cam 60 the pawl 57 is held in engagement with the teeth on the rim of wheel 51 and said wheel is thus locked from rotation while the wheel 10 and the sleeve 40 continue their movement for a short distance until the clutch part 14 is entirely freed from engagement with the clutch part on that one of the wheels 7 or 13 with which it is in engagement and the momentum of the carriage is overcome and said carriage brought to a stop. This continued movement of wheel 10 and parts connected therewith after the locking of the wheel 51 throws the arms 42 on the flange 41 against the adjacent ends of springs 55 in the pockets 52 which springs thus serve as a cushion to receive the shock and strain of stopping the carriage, which compresses said springs, which thus take up and store the power required to overcome said momentum. As the carriage is thus brought to a stop and before the clutch part 14 engages with the opposite wheel 7 or 13 from the one with which it has just been disengaged, said springs begin to expand and exert the power thus stored to start the sleeve 40 and shaft 2 in the reverse direction so that the clutch part 14 meets the clutch part on the wheel 13 or 7 opposite from the one with which it has just been disengaged without any load except the gearing itself and when said parts are just ready to start in the reverse direction, the inertia of the carriage being largely overcome by the force of the springs thus exerted, which relieves the reversing gear and mechanism of the shock and strain which would otherwise result from this operation. The cams 60 and 62 have in the mean time been moved so that the points thereof will have passed each other and the pawl 57 allowed to fall out of engagement with the wheel 51, which is thus permitted to rotate with the sleeves 40 as before described, and wheel 10 will have been turned to bring the opposite side of the lug 44 against the opposite strike 45 and the reverse movement will thus be continued under the positively driven gearing, as before described. Thus at each reversal of the carriage, wheel 51 is momentarily locked and the force of the movement of the carriage is momentarily thrown against the springs 55 and thus the movement of the carriage is stopped by the resistance of said springs, which, immediately upon the momentum of the carriage in one direction being overcome, start to expand and exert the power required to stop the carriage and compress them, toward starting it back in the opposite direction. The wheel 10 being mounted with limited independent movement must be turned to bring the opposite side of the lug 44 against the opposite strike 45 before the power by which the machine is driven is brought into service to drive the carriage, thus affording the time required for the operation of the springs as above set forth, which operation takes place at each reversal of the carriage at each end of the machine, as will be readily understood.

The strikes 45 are adjustable to different positions for the purpose of giving a varied delay or stop to the carriage at the time of reversing in order to allow the work to revolve a fraction or whole revolution before the grinding wheel carriage starts in the opposite direction, this being some times desirable for some kinds of work. By this arrangement the shock and strain on the mechanism incident to reversing the carriage is overcome and the need of extra power and strength of parts to provide for the reversing operation is obviated.

Having thus fully described my said invention, what I claim as new and desire to secure by Letters Patent, is:—

1. In a grinding machine, the combination of the carriage, means for traversing said carriage, means for reversing the travel of the carriage, and means for cushioning the stopping of said carriage at each reversal, which means comprises a compressible cushion adapted to expand as soon as the carriage is stopped and connected to the driving shaft to exert its power thus stored by the stopping of the carriage toward starting it back in the reverse direction, substantially as set forth.

2. In a grinding machine, the combination of the bed, the carriage, a shaft geared to traverse said carriage back and forth, gearing connected with said shaft for operating it in either direction, said gearing comprising a gear wheel mounted to have a limited independent movement on a sleeve, said

sleeve secured rigidly to said shaft, a part mounted to rotate with said shaft carrying a compressible cushioning device with which said sleeve is connected, and means for locking said part carrying the cushion momentarily at each reversal of the carriage, whereby said carriage is operated to compress said cushion until the carriage stops and then said cushion may expand to assist in starting the carriage in the reverse direction, substantially as set forth.

3. In a grinding machine, the combination of the bed, the carriage, mechanism for traversing said carriage, means for reversing the travel of the carriage, and a cushioning device for relieving the shock and strain upon the gearing comprising a part mounted upon the carriage driving shaft and connected to the gear for driving said shaft, which part is formed with projections adapted to extend between springs mounted in suitable pockets in another part mounted on said shaft and adapted to normally rotate therewith, means for locking said part containing the pockets and springs temporarily at each reversal of the carriage, and means for releasing said part when the driving mechanism is reëngaged to drive the carriage in the reverse direction, substantially as set forth.

4. The combination, with the driving shaft of a traversing carriage, of reversing mechanism for changing the direction of motion of said carriage at predetermined points, and a cushioning device mounted on said shaft comprising springs mounted in pockets in a part mounted to rotate with said shaft and connected with a driving gear thereon, and means for locking said part containing said springs momentarily at each reversal of the carriage, substantially as set forth.

5. The combination with the carriage driving shaft, of a grinding machine, of gear for reversing the motion of said shaft at predetermined points, a cushioning device mounted on said shaft comprising a part adapted to rotate with the driving wheel and formed with pockets containing springs between the ends of which project arms or lugs driven by said driving wheel; means for locking said part containing the springs at each reversal of the movement of said shaft, means for momentarily disconnecting the driving gear from said shaft, and means for unlocking said part when the driving gear is reëngaged with said shaft, whereby said springs are compressed by the momentum of the carriage in stopping and allowed to expand to assist in reversing the motion thereof after it has stopped, substantially as set forth.

6. The combination with the carriage driving shaft, of a grinding machine, of a gear for reversing the motion thereof, a cushioning device mounted on said shaft for taking up the shock and strain incident to stopping the carriage at the end of each movement, said cushioning device comprising a part mounted to revolve with the driving gear wheel on said shaft and containing pockets in which are mounted springs, said driving gear wheel having a part connected therewith, having arms which project between the ends of said springs, means for locking said part carrying said springs when the carriage reaches the end of its movement, means for releasing the driving gear from the driving shaft at the same point, whereby the momentum of the carriage is thrown upon said springs and compresses them, and means for unlocking said part when the driving gear becomes reëngaged to drive the shaft in the opposite direction, substantially as set forth.

7. In a grinding machine, the combination with the carriage driving shaft, of the driving gear thereon, the driving mechanism connected therewith, means for reversing the direction of said gear, said driving gear wheel being mounted on a sleeve to have a limited independent movement thereon, said sleeve rigidly secured to said shaft and formed with a circular flange having rearwardly projecting arms, a second wheel or disk mounted on said sleeve and having pockets containing springs, said arms extending between the ends of said springs, means for locking said wheel or disk at the moment the reversing gear is operated, whereby the strain of overcoming the momentum of the carriage is thrown upon said springs and tends to compress them and as soon as the carriage is stopped their power of expansion is exerted to start the carriage in the opposite direction, and means for unlocking said wheel or disk carrying the springs when the driving gear is reëngaged, substantially as set forth.

8. In a grinding machine, the combination with the carriage driving shaft, of the driving mechanism, the reversing mechanism, the driving mechanism being geared to a driving wheel on said carriage driving shaft, said driving wheel being mounted upon a sleeve to have a limited independent movement thereon, said sleeve secured rigidly on said shaft and formed with projecting parts, a disk or a wheel also mounted on said sleeve having pockets and having springs mounted in said pockets, said arms extending between the ends of said springs, and means for locking said disk or wheel controlled by the operation of the reversing mechanism, substantially as set forth.

9. In a grinding machine, the combination with the carriage driving shaft, of the driving mechanism, the reversing mechanism, means for automatically operating said reversing mechanism, comprising ad-

justable strikes adapted to contact with and operate the shifting clutch, said adjustable dogs mounted on a part operated by a train of gear from said carriage driving shaft, the gear wheel on said carriage driving shaft, the cushioning device mounted on said carriage driving shaft, and means for momentarily locking the parts carrying the cushion at the time of the reversal of the carriage, said locking device being operated by the same part which operates the reversing gear, whereby said cushioning device is adapted to receive the shock and strain incident to stopping the carriage and assist in reversing its motion, substantially as set forth.

10. In a grinding machine, the combination, with the carriage driving shaft, of the driving mechanism, the reversing mechanism, means for operating said reversing mechanism comprising a rocking lever adapted to be operated by adjustable dogs on a wheel mounted on the carriage driving shaft and operated by a train of gearing from said shaft, and a cushioning device mounted on said carriage driving shaft comprising a disk having pockets containing compressible springs, projections carried by the operating gear wheel extending between said springs, teeth on said disk, a pawl mounted on a rock shaft adapted to engage with the teeth on said disk, said rock shaft being provided with a cam arranged to be operated by a cam on the locking part which operates the reversing mechanism, substantially as set forth.

11. In a grinding machine, the combination with the carriage operating shaft, of the reversing mechanism, means for operating said reversing mechanism, a cushioning device mounted on said shaft and connected with the driving gear wheel thereon by means of projections on one part extending between the ends of compressible springs contained in pockets in another part, a pawl for locking said part carrying the springs temporarily, said pawl being mounted upon a rock-shaft, a cam also on said rock-shaft positioned to be operated by the means which operates the reversing mechanism, substantially as set forth.

12. In a grinding machine, the combination with the carriage driving shaft, of the driving mechanism, the reversing mechanism, means for operating said reversing mechanism, means for disengaging the driving mechanism from the carriage driving shaft temporarily at each reversal thereof, a cushioning device adapted to receive the shock and strain incident to the stopping of the carriage while said gear is released and then expand to assist in starting the carriage in the reverse direction, substantially as set forth.

13. In a grinding machine, the combination of the carriage driving shaft, the driving mechanism, the reversing mechanism, means for operating said reversing mechanism, the main driving gear wheel mounted on said shaft to have a limited movement independent thereof, a cushioning device connected therewith, and means for disengaging the driving mechanism from the carriage driving shaft at each reversal thereof, whereby the thrust of the carriage is thrown against said cushioning device, substantially as set forth.

14. In a grinding machine, the combination with the carriage driving shaft, the driving mechanism, the reversing mechanism, means for operating said reversing mechanism, a gear wheel on said carriage driving shaft adapted to mesh with said driving mechanism, said gear wheel being mounted to have a limited movement independent of said shaft, a sleeve secured to said shaft and having projecting arms, a disk or wheel mounted on said sleeve and having pockets coincident with said arms, springs in said pockets adapted to bear on each side of said arms, means for locking said disk or wheel temporarily at each reversal of the carriage, and means for releasing said wheel when the gear engages for driving the carriage in the reverse direction, substantially as set forth.

15. In a grinding machine, the combination with the carriage driving shaft, of the driving mechanism, the reversing mechanism, means for operating said reversing mechanism, and a cushioning device arranged to receive the thrust of the carriage at each operation of the reversing mechanism, substantially as set forth.

16. In a grinding machine, the combination, of a traversing carriage, a reversing and drive mechanism, and means by which the momentum is stored at the point of reversal at each end of each movement and used to start the carriage in the opposite direction, substantially as set forth.

17. In a grinding machine, the combination, of a traversing carriage, a reversing and drive mechanism, means by which power required to stop the carriage is stored at the point of reversal and used to start it in the opposite direction, and means for stopping the carriage at the reversing point a given time, substantially as set forth.

18. In a grinding machine, the combination, of a traversing carriage, a reversing and drive mechanism, means by which the power required to stop the carriage is stored at the point of reversal and the carriage prevented from moving beyond the reversing point in case of high traverse speed, and a traverse stop at point of reversal of said carriage, substantially as set forth.

19. In a grinding machine, the combina-

tion, of a traversing carriage, a reversing and drive mechanism, means by which inertia is stored at the point of reversal, by which the carriage is prevented from moving beyond the reversing point in case of high traverse speeds, and a traverse stop at point of reversal of said carriage, said stop being variable, substantially as set forth.

20. In a grinding machine, the combination, of a traversing carriage, a reversing and drive mechanism, means to delay motion for a given period of said carriage at the point of reversal, and means to prevent shock in starting said carriage in the opposite direction, substantially as set forth.

21. In a grinding machine, the combination, of a traversing carriage, a reversing and drive mechanism, means to delay motion of said carriage at the point of reversal, means for varying the delay of motion, and means to prevent shock in starting said carriage in the opposite direction, substantially as set forth.

22. In a grinding machine, the combination, of a traversing carriage, a reversing and drive mechanism, means to delay motion of said carriage at the point of reversal, means for varying the delay of motion, and means to prevent shock in starting said carriage in the opposite direction comprising means for storing inertia nearly equal the power required to drive the carriage, said means embodying springs, substantially as set forth.

In witness whereof, I have hereunto set my hand and seal at Waynesboro, Pennsylvania, this 10th day of December, A. D. nineteen hundred and six.

ABRAHAM B. LANDIS. [L. S.]

Witnesses:

GEORGE BREZLER,

GEO. H. RUSSELL.