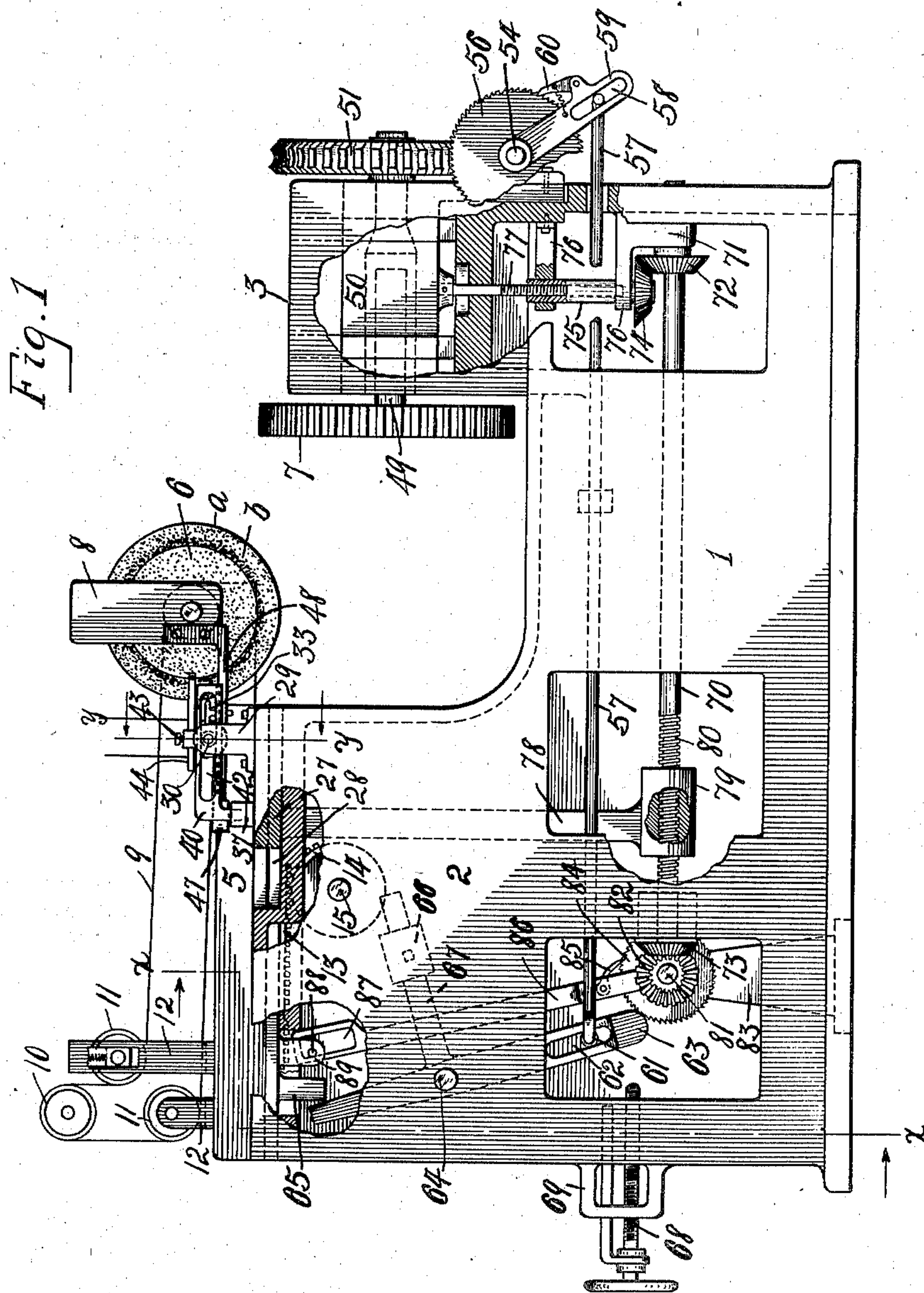


W. F. WAGNER.
GEAR GRINDING MACHINE OR THE LIKE.
APPLICATION FILED APR. 5, 1909.

966,967.

Patented Aug. 9, 1910.

3 SHEETS—SHEET 1.



WITNESSES.

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Hazel B. Hott

INVENTOR.

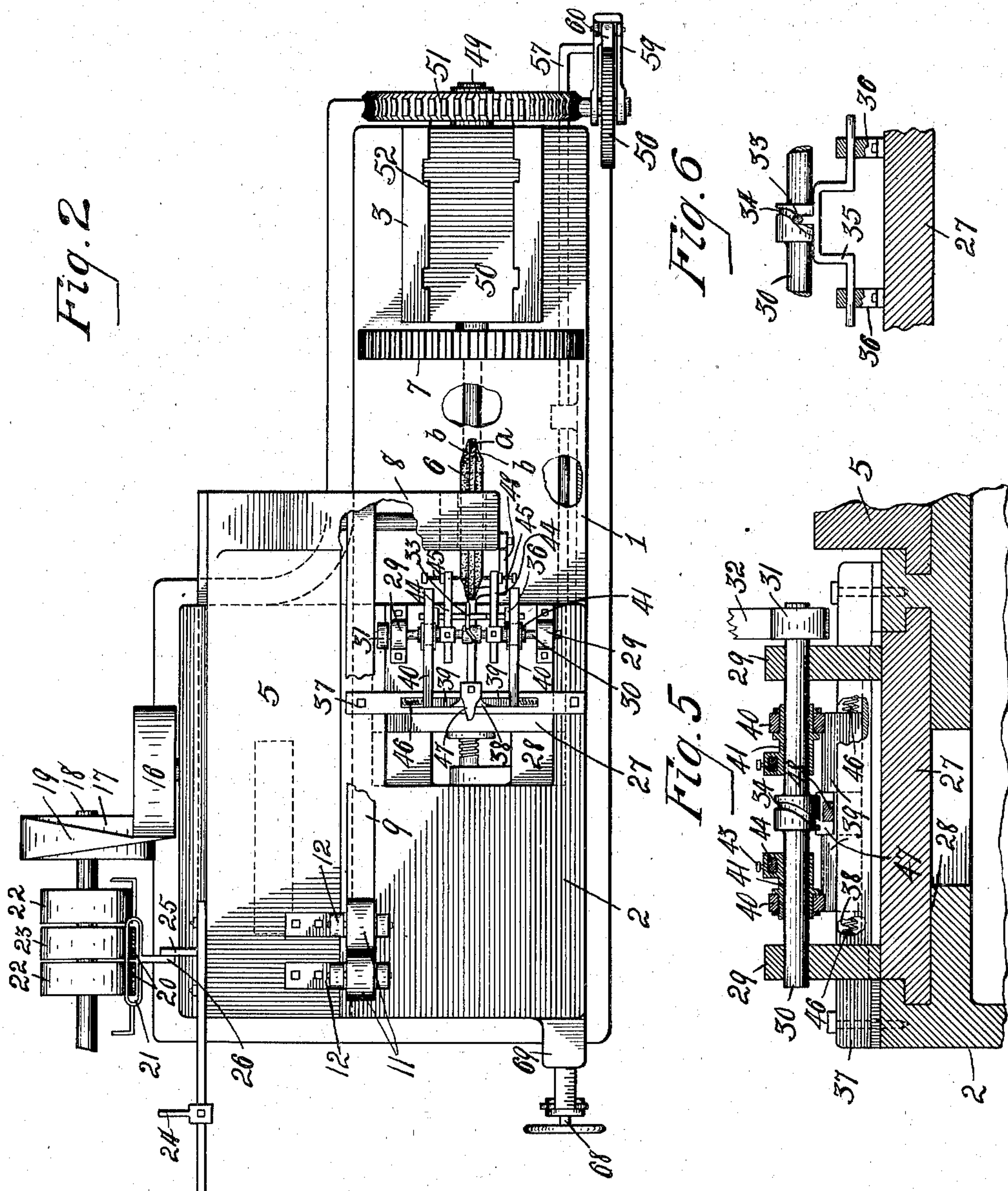
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3 SHEETS—SHEET 3.

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UNITED STATES PATENT OFFICE.

WILLIAM F. WAGNER, OF DETROIT, MICHIGAN, ASSIGNOR TO STANDARD GEAR GRINDING COMPANY, OF DETROIT, MICHIGAN, A CORPORATION.

GEAR-GRINDING MACHINE OR THE LIKE.

966,967.

Specification of Letters Patent.

Patented Aug. 9, 1910.

Application filed April 5, 1909. Serial No. 488,104.

To all whom it may concern:

Be it known that I, WILLIAM F. WAGNER, a citizen of the United States, and a resident of Detroit, in the county of Wayne and State of Michigan, have invented a certain new and useful Gear-Grinding Machine or the Like; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures and letters of reference marked thereon, which form a part of this specification.

My invention relates to grinding machines of the class particularly applicable for the grinding of gears or other objects having irregular surfaces to be ground, but may be used in any connection for which it may be adapted.

The object of my invention is the provision of simple, efficient and improved mechanism which is automatically operative during a running of the machine to successively trim the grinding medium after each grinding operation to maintain the operative surface thereof in a constant predetermined shape.

A further object of my invention is the provision of simple means for automatically moving the trimming mechanism and work relative to the grinding medium to compensate for the material removed from such medium by the grinding and trimming operations.

The operation, construction and arrangement of the parts of the invention are fully described in the accompanying drawings, and while the invention in its broad aspect may be embodied in numerous forms a preferred form of the same is illustrated in the accompanying drawings, in which,—

Figure 1 is a side elevation of the machine with portions broken away. Fig. 2 is a plan view of the same with portions broken away. Fig. 3 is a vertical cross-section on the line $x x$ in Fig. 1. Fig. 4 is an elevation of the front end of the machine with portions broken away. Fig. 5 is an enlarged section on the line $y y$ in Fig. 1, and Fig. 6 is an enlarged front elevation of a portion of the mechanism for trimming the grinding-wheel edge.

Referring to the drawings, 1 designates the machine frame, which is formed with

the rear and front elevated portions 2 and 3, respectively. In the top of the frame portion 2, near one side thereof is provided a way 4 in which a carriage 5 is mounted for reciprocatory movements longitudinally of the frame to permit the grinding-wheel 6 carried at its forward end to be moved forward and backward across the top of a gear 7 or other work to be ground, which work is carried by the frame part 3 as hereinafter described. The wheel 6 is disposed at the inner side of the carriage 5, being mounted in the vertically-forked end of an arm 8, which projects upwardly and laterally of the forward end of the carriage, as shown.

The grinding-wheel 6 is driven in any suitable manner, as by a belt 9 connecting a pulley on the shaft therewith with a drive pulley 10 carried by an overhead line-shaft, the belt being guided in its course by idler pulleys 11, 11 carried by standards 12, 12 rising from the carriage 5.

The requisite forward and backward movements are imparted to the carriage 5 by any suitable reversing mechanism. A simple means of performing this consists in providing the bottom of the carriage 5 with a longitudinally-extending rack 13 with which a pinion 14 on the shaft 15 meshes. the shaft 15 has one end projected beyond its bearing in the frame side and carries a pulley 16, which is driven from a pulley 17 on a shaft 18 by a belt 19. The shaft 18 is shown as being disposed at one side of the frame 1, longitudinally thereof, and has reverse rotation successively imparted thereto from a continuously revolving line or other shaft (not shown) by the straight and crossed belts 20, 20, which are alternately moved by a belt-shifting eye 21 into engagement with one or the other of the fixed pulleys 22, 22 on the shaft 18 and the intermediate loose pulley 23 thereon, as is common in planing machines or the like. The shifter-eye 21 is automatically shifted first in one direction and then another due to lugs 24 and 25, which are carried by the carriage 5 at one side thereof, striking a registering lug 26 on such eye when the carriage is near the limits of its forward and backward movements, respectively.

The mechanism employed to trim the grinding-wheel is carried by a table 27, which is mounted for movements longitudinally of the frame in a guide-way 28 pro-

vided in the top of the frame part 2 at the inner side of the carriage 5, or in register with the reciprocatory movements of the grinding-wheel 6, as best shown in Fig. 2.

5 Disposed transversely above the table 27 near the forward edge thereof with its ends journaled in pedestal-bearings 29, 29 rising from the sides of such table is a shaft 30, carrying a pulley 31 at one end, which is

10 driven by a belt 32 from any suitable source of power, or in any other suitable manner. Disposed in advance of the shaft 30 in register with the reciprocatory movements of the grinding-wheel 6 in substantially the

15 plane of movement of its axis is a horizontal forwardly projecting finger 33, the forward end of which carries a diamond or other suitable trimmer medium for acting on the peripheral edge *a* of the grinding-wheel to

20 trim the same when at the limit of its rearward movements, while the rear end thereof projects into a cam-groove 34 formed peripherally in an enlarged part of the shaft 30, as shown, whereby a rapid lateral recip-

25 rocation is imparted to such finger when the shaft 30 is rotated. The finger 33 is shown as being carried by a forked support 35, see Fig. 6, the terminal ends of the arms of which project horizontally and work in

30 guides 36, 36 rising from the table 27 to permit the lateral reciprocatory movements of the finger 33.

Spanning the table 27 to the rear of the shaft 30 with its ends fixed to the top of the

35 frame part 2 at the sides of the table is a bar 37, the central top portion of which is longitudinally grooved, as at 38, to provide a guide-way for blocks 39, 39 to work in. Projecting forwardly from each block 39 is

40 an arm 40 which engages with a registering boxing or sleeve 41, mounted loosely on the shaft 30 at one side of the cam-groove 34, in a manner to permit the arm to have free

45 movements transversely of the shaft relative to such sleeve and to cause them to move together longitudinally of the shaft. The means shown for accomplishing this consists in providing the arm 40 with a longitudinal slot 42 (Fig. 1) for receiving a

50 grooved portion of the boxing or sleeve 41. Mounted in a socket or opening on the top of each boxing or sleeve 41 and secured in adjusted position therein by a set-screw 43 is a horizontally-disposed finger 44, which

55 has its forward end projected at the contiguous side of the path of reciprocation of the grinding-wheel and carrying a transversely-disposed trimmer member 45, the inner end of which is faced with a diamond

60 or other suitable trimmer means and adapted to act on the contiguous side working surface *b* of the grinding-wheel to trim the same when such wheel is substantially at the limit of its rearward movement. The mem-

bers 45 are shown in the present instance as 65 comprising screws, which are threaded through the fingers 44. The blocks 39, 39 are caused to have relative contracting movements within the groove 38 due to the action thereon of the coiled contraction-springs 46, 70 46, the end thrusts of which are against the end walls of the groove and the outer ends of the blocks.

The trimming movements of the members 45 are controlled by the movement of a form 75 47 between the inner ends of the blocks 39, said form being removably carried at the rear end of an arm 48, which projects rearwardly from the end of the bearing arm 8 so that it moves forward and backward with 80 the grinding-wheel. As the nose of the form 47, which is fashioned to conform exactly to the size and shape of the surface to be ground, enters between the inner ends of the blocks 39, such blocks are moved as the co- 85 acting surfaces of the form may require or permit and like movements are communicated to the trimmer-members 45 due to the parallel movements of said members and blocks, thus causing the working surfaces *b* 90 of the grinding-wheel, which enter and pass between the trimmer members 45, 45 simultaneously with the entering and passing of the nose of the form between the blocks, to be trimmed into a duplicate shape to that 95 of the form.

The provision of a form which corresponds exactly in shape and size to the surface to be ground is a very important feature as it is only necessary to furnish the 100 user of the machine with the form of a tooth or other surface to be ground, and he can then either place such form on the end of the arm 48, if adapted for such purpose, or can make the necessary form 47 of exact 105 shape and size as the sample.

The index mechanism which carries and controls the movements of the gear or other work 7, comprises a mandrel 49, which is 110 mounted in a block 50 and carries the work 7 at its inner end and a worm-wheel 51 at its outer end. The block 50 is mounted for vertical adjustment in a guide-way 52 of the frame part 3 and is adjusted as herein- 115 after described. Meshing with the worm-wheel 51 is a worm 53, the shaft 54 of which is journaled in bearings 55, 55, carried by the block 50, and carries a ratchet-wheel 56 at one end thereof at the side of the frame. This ratchet-wheel has intermittent rotation 120 imparted thereto by the reciprocation of a rod 57, which has an end bent and working through a slot 58 in a lever 59, which lever is forked to adapt it to straddle the ratchet-wheel and loosely fulcrum on the shaft 54 125 and carries a dog 60 in engagement with the teeth of the ratchet-wheel. The rod 57 has bearings in suitable lugs provided on the in-

ner side of one frame side, and has its rear end provided with a roller 61 for working in a longitudinal slot 62 in the lower end of a lever 63, which is fulcrumed as at 64. The upper end of the lever is normally disposed in position to be engaged and rocked by a boss 65, projecting down from the bottom of the carriage 5, when such carriage is near the limit of its rearward movement. The lever 63 is normally held in one position of its movement, with its upper end forward, due to the action thereon of a weight 66, which is carried by an arm 67 projecting forwardly from the lever at its fulcrum point. The throw of the lever 63 is regulated by means of a stop-screw 68, which is threaded through a bracket 69 at the rear end of the frame in position to coact with the lower end of the lever 63 on its rearward movement.

70 designates a shaft, which is disposed within the frame 1 longitudinally thereof with its ends journaled in bearings 71, 71, and carries the bevel-gears 72 and 73 at its forward and rear ends, respectively. The forward gear 72 meshes with a companion gear 74, which is carried at the lower end of a hollow vertical shaft 75 that is journaled in bearing-arms 76, 76, and has the lower end of a stem or rod 77 threaded therein, the upper end of said rod being fixed to the under side of the block 50, thus adapting a turning of the hollow-shaft 75 to effect a vertical adjustment of said block. A turning of the shaft 70 also communicates a forward adjusting movement to the table 27, carrying the trimming mechanism, through the medium of the arm 78, which projects downwardly from such table and has its lower end provided with a sleeve 79 through which a portion 80 of the shaft 70 is threaded, as shown in Fig. 1. The shaft 70 is driven by a countershaft 81 through the medium of a bevel-gear 82 in mesh with the gear 73, said shaft 81 being journaled in a pedestal-bearing 83 and in one frame side, see Figs. 1 and 3, and carrying a ratchet-wheel 84, with which a dog 85, which is carried by a lever 86, engages. The lever 86 has its lower end loosely fulcrumed to the shaft 81 and its upper end slotted, as at 87, for a pin 88, which is carried by a boss 89 on the bottom of the carriage 5, to work in, thus causing the lever to move positively with the carriage 5 in both directions of its movement. The gears and threads of this adjusting mechanism are so arranged and proportioned that the table 27 is moved forwardly and the block 50 moved upwardly a desired distance at each forward movement of the carriage 5 to compensate for the wear of the grinding-wheel.

The operation of my machine is as follows:—The work 7 to be ground being placed on the mandrel 49 and a form of the required shape and size secured to the end of

the arm 48, the reversing mechanism is set in motion and a forward and backward movement thereby communicated to the carriage 5, thus moving the grinding-wheel across the face of the work to grind the same. When the carriage 5 is near the limit of its rearward movements the form 47 and edge of the grinding-wheel simultaneously enter between the blocks 39, 39 and the trimmer members 45, 45, respectively, the form acting on said blocks to move the same outwardly as the shape of the form may require, and the trimmer-members 45 moving with such blocks to trim the surfaces *b* of the grinding-wheel to conform to the form 47. When the grinding-wheel reaches its limit of rearward movement its edge *a* moves into contact with the trimmer end of the finger 33, which is being rapidly reciprocated due to its contact with the cam-groove 34 of the shaft 30, thus effecting a trimming of such edge. At the limit of each rearward movement of the carriage 5 the work 7 is rotated the distance of one tooth or sufficiently to move the next surface to be ground into register with the grinding-wheel due to the boss 65 striking and effecting an oscillation of the lever 63, which in turn communicates a slight rotation to the mandrel 49 through the medium of the rod 57, lever 59, dog 60, ratchet-wheel 56, worm-shaft 54 and worm-wheel 51. The oscillation imparted to the lever 86 on each forward stroke of the carriage effects a partial rotation of the shaft 81, due to the engagement of the dog 85 with the ratchet-wheel 84, and a consequent partial rotation to the shaft 70 through the medium of the bevel-gears 73 and 82. The rotation of the shaft 70 causes a very slight forward adjustment of the table 27 and associated trimmer parts due to the turning of the threaded portion 80 of said shaft within the sleeve 79 carried by the table-arm 78, thus compensating for the material removed from the grinding-wheel during the previous grinding and trimming operations. The rotation of the shaft 70 also effects a slight raising of the block 50 to raise the work relative to the grinding-wheel to cause the wheel to take the same bite at each operation, due to the bevel-gears 72 and 74 communicating rotation to the hollow shaft 75 in which the rod 77, which projects downwardly from the block 50, is threaded. It is thus apparent that during a running of the machine both the trimming mechanism and the work are automatically adjusted relative to the grinding-wheel to cause a uniform trimming of the grinding-wheel and grinding of the successive surfaces or grooves of the work. If it is desired for any cause to work the grinding-wheel forward and backward without at the same time effecting an adjustment of the

trimming mechanism and work-support, it is only necessary to throw the dog 85 up out of engagement with the ratchet-wheel 84.

I wish it understood that my invention is not limited to any specific construction or arrangement of the parts except in so far as such limitations are specified in the claims.

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

1. In a machine of the class described, the combination of a horizontal reciprocatory grinding-wheel, and mechanism disposed in substantially the plane of movement of the axis of such wheel and operative to trim the working surface of the wheel when at the limit of its rearward movement.

2. In a machine of the class described, the combination with a grinding wheel, of a trimming mechanism, means for imparting relative to and fro movements to said wheel and mechanism, said mechanism having trimmer members movable toward and away from each other in parallelism, and means acting on such mechanism at a predetermined point in the relative movements of such wheel and mechanism to guide the trimming movements of such members.

3. In a machine of the class described, the combination of a grinding wheel, a trimming mechanism for such wheel, means for imparting relative reciprocatory movements to said wheel and mechanism, said mechanism having trimming members operative to have opposed movements in parallelism to simultaneously trim the opposed working surfaces of the wheel, and a form movable to act on such members at a predetermined point in the relative movements of such wheel and mechanism to guide their trimming movements.

4. In a machine of the class described, the combination of a grinding-wheel and a trimmer mechanism capable of relative reciprocatory movements, said trimmer mechanism comprising two parallel parts carrying inwardly projecting trimmer means at one of their ends for passing on opposite sides of the working surface of the grinding wheel, and a form adapted to act on said parallel parts to impart parallel trimming movements to said trimmer means at a predetermined point in the relative movements of the wheel and mechanism and means for causing said wheel and mechanism to have relative movements.

5. In a machine of the class described, the combination of a reciprocatory grinding-wheel, a trimmer mechanism disposed in the path of movement of such wheel, said mechanism having trimmer parts capable of lateral reciprocatory movements in parallelism, and means adapted to enter between and to coöperate with such parts to impart trim-

ming movements thereto at a predetermined point in the movement of the wheel.

6. In a machine of the class described, the combination of a reciprocatory grinding-wheel, a trimmer mechanism associated with such wheel and having opposed reciprocatory trimmer parts movable in parallelism toward and from each other to trim the working-surface of the wheel, and a form movable with the wheel and adapted to act on the trimmer parts to impart predetermined trimming movements thereto at a predetermined point in the movement of the wheel.

7. In a machine of the class described, the combination of a reciprocatory grinding-wheel, a trimmer mechanism comprising a set of reciprocatory blocks mounted for relative movements toward and from each other, arms projecting from each of said blocks, and trimmer members carried by said arms in position to act on opposite sides of the wheel to trim the same, and a form movable with the wheel and adapted to act on said blocks at a predetermined point in the movement of the wheel to impart opposed lateral reciprocatory movements to said arms and trimmer members in parallelism to trim the wheel.

8. In a machine of the class described, the combination of a grinding-wheel, a trimmer member associated with the wheel for trimming the edge thereof, and a shaft having a cam-groove therein which acts on the trimmer member to impart rapid lateral reciprocation thereto when the shaft is rotated.

9. In a machine of the class described, the combination of a reciprocatory grinding-wheel, a shaft disposed near one end of the reciprocatory movements of such wheel, said shaft having a cam-groove therein, and a trimmer member movable laterally of the wheel and having one end adapted to act on the edge of the wheel to trim the same and its other end working in said cam groove to cause said finger to be rapidly reciprocated across the face of the wheel when the shaft is rotated.

10. In a machine of the class described, a grinding-wheel and a trimmer mechanism associated therewith, said wheel and mechanism being capable of relative to and fro movements and said mechanism having a pair of spaced trimmer parts, a form conforming exactly to the shape of the surface to be ground and adapted to coöperate with said trimmer parts to impart trimming movements thereto to intermittently trim the working surface of the grinding-wheel to conform to the surface to be ground and means for imparting relative movements to said wheel and mechanism.

11. In a machine of the class described, the combination of a grinding-wheel, a trimmer mechanism adjustable relative to said

grinding-wheel to compensate for wear and having opposed reciprocatory trimmer parts movable in parallelism, means for moving said trimmer parts in parallelism to trim the working surface of the wheel, and means for effecting an adjustment of the trimmer mechanism.

12. In a machine of the class described, the combination of a grinding-wheel, a trimmer mechanism therefor, said wheel and mechanism being capable of relative reciprocatory movements, and said mechanism having trimmer parts for acting on opposed surfaces of the wheel, a mount for the wheel, and means fixed relative to said mount and adapted to act on said trimmer parts at a predetermined point in the relative movements of said wheel and mechanism to impart trimming movements in unison to such parts.

13. In a machine of the class described, the combination of a reciprocatory carriage, a grinding-wheel carried thereby, a trimmer mechanism having a set of movable trimmer parts between which the edge of the wheel intermittently passes as it reciprocates, and a templet fixed relative to the carriage and adapted, at a predetermined point in the movement of said carriage, to cooperate with said trimmer parts to impart trimming movements thereto.

14. In a machine of the class described, the combination of a reciprocatory carriage, a grinding-wheel carried by the carriage, a trimmer mechanism having a set of spaced trimmer parts, an arm projecting from such carriage, and a form carried by such arm and adapted to cooperate with such trimmer parts to impart trimming movements thereto to intermittently trim the working surface of the grinding-wheel to conform to the surface to be ground.

15. In a machine of the class described, the combination of a grinding-member, mechanism operative to trim the working surface of such member, means for imparting relative movements to said member and mechanism, and a templet conforming exactly to the surface to be ground and adapted to cooperate with said mechanism to intermittently trim the working surface of said member to conform to the surface to be ground.

16. In a machine of the class described, the combination of a grinding-wheel, a reciprocatory mount therefor, mechanism adapted to act on the wheel to trim the same at a predetermined point in the movement of the mount, and means automatically actuated by the movement of the mount to effect a movement of the trimmer mechanism toward the wheel.

17. In a machine of the class described, the combination of the grinding-wheel, a reciprocatory carriage therefor, a reciproca-

tory table, mechanism carried by said table for trimming the wheel, and means actuated by a movement of the carriage for moving said table to advance the trimmer mechanism relative to the wheel.

18. In a machine of the class described, the combination of a grinding-wheel, a reciprocatory carriage therefor, a table movable longitudinally of the direction of movement of the carriage, a trimmer mechanism carried by such table, means actuated by a movement of the carriage for acting on the trimmer mechanism to impart trimming movements thereto, and means movable by the carriage for intermittently advancing said table.

19. In a machine of the class described, the combination of a grinding-wheel, a reciprocatory carriage for the same, a pair of laterally reciprocatory members capable of movements in parallelism, a finger adjustably projecting from each of said members and movable therewith, means carried by said fingers for acting on opposed surfaces of the wheel to trim the same, and a form movable with the carriage and adapted to act on said laterally reciprocatory members at a predetermined point in a movement of the carriage whereby to impart predetermined trimming movements to said trimmer means.

20. In a machine of the class described, the combination of a grinding-wheel, a reciprocatory carriage for the same, a shaft disposed transversely of the wheel at one end of its reciprocatory movement, said shaft having a cam-groove therein, sleeves movable longitudinally on said shaft, a pair of members carried by said sleeves and capable of opposed reciprocatory movements in parallelism, trimmer means adjustably carried by said members for acting on opposed sides of the grinding-wheel, a trimmer member adapted to act on the edge of the wheel to trim the same and having rapid reciprocatory movements imparted thereto laterally of the wheel by said cam-groove, and means carried by the carriage and adapted to act on said pair of members to move the same to communicate predetermined trimming movements to the trimmer means at a predetermined point in the movement of the wheel.

21. In a machine of the class described, the combination of a grinding-wheel, a reciprocatory carriage therefor, a table, a trimmer mechanism carried by such table, a worm coacting with a part on said table and adapted to have an adjustment thereof when turned, and mechanism actuated by the movement of the carriage for imparting intermittent rotation to the worm.

22. In a machine of the class described, the combination of a grinding-wheel, a reciprocatory carriage therefor, a table having

a part projecting therefrom, a wheel-trim-
ming mechanism carried by the table, a
shaft having a part threaded through said
table part whereby a turning of the shaft
5 effects a movement of said table, a lever
movable by the movement of the carriage for
imparting intermittent rotation to said
shaft.

In testimony whereof, I have hereunto
signed my name to this specification in the 10
presence of two subscribing witnesses.

WILLIAM F. WAGNER.

Witnesses:

C. W. OWEN,
HAZEL B. HIETT.