

Nov. 20, 1962

E. R. BLEKE
BRUSHING MACHINE

3,064,290

Filed June 28, 1960

4 Sheets-Sheet 1

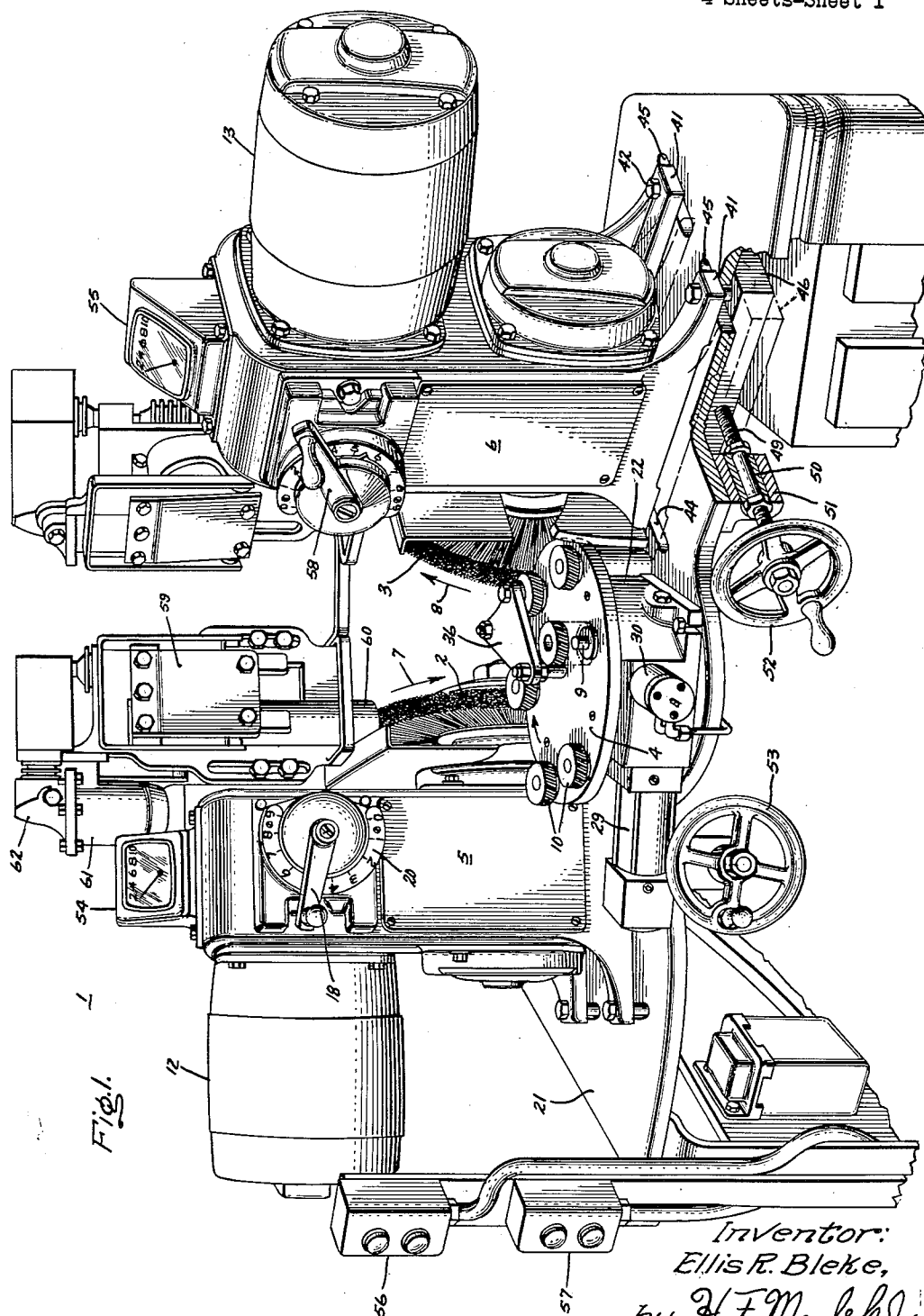


Fig. 1

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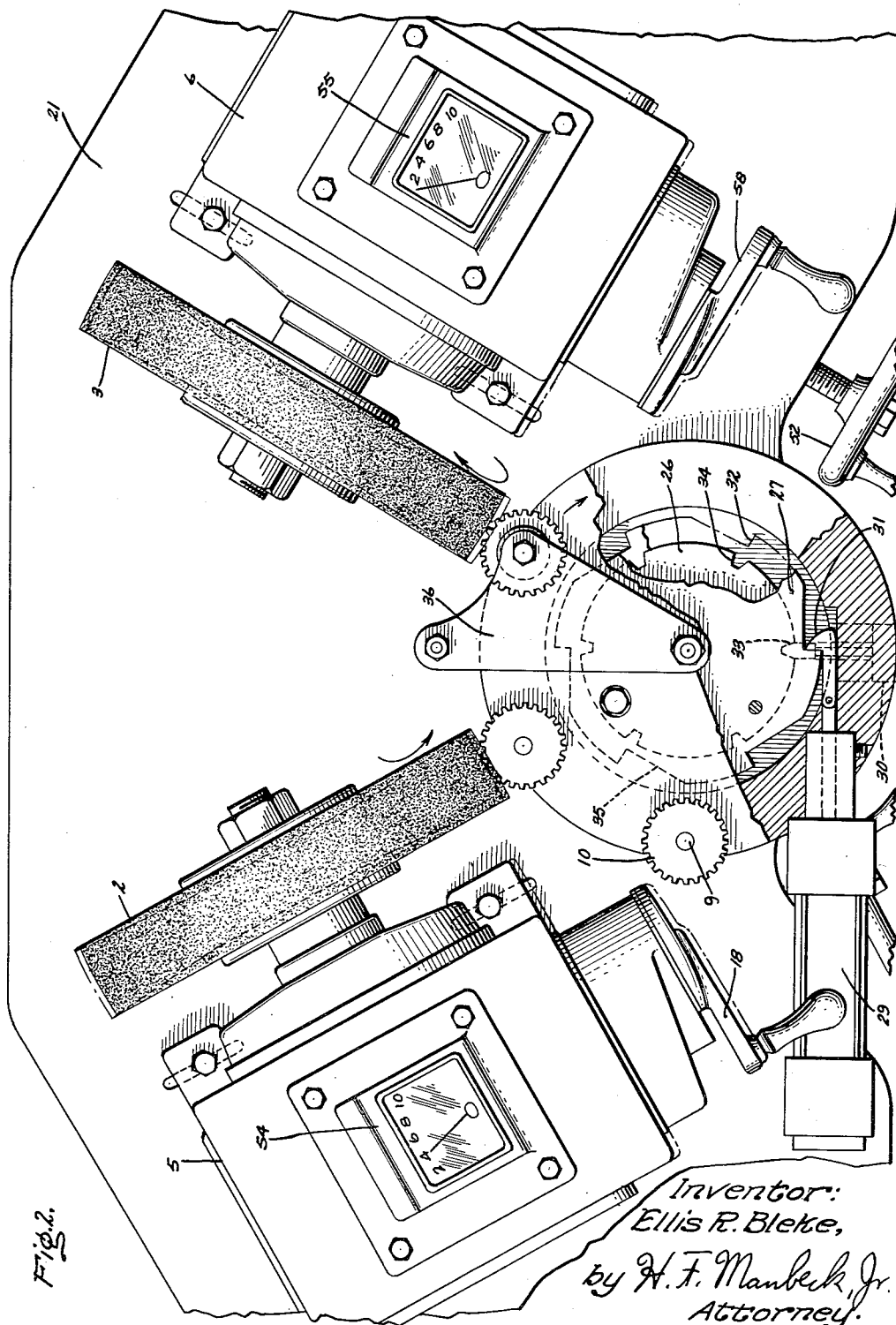
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4 Sheets-Sheet 2



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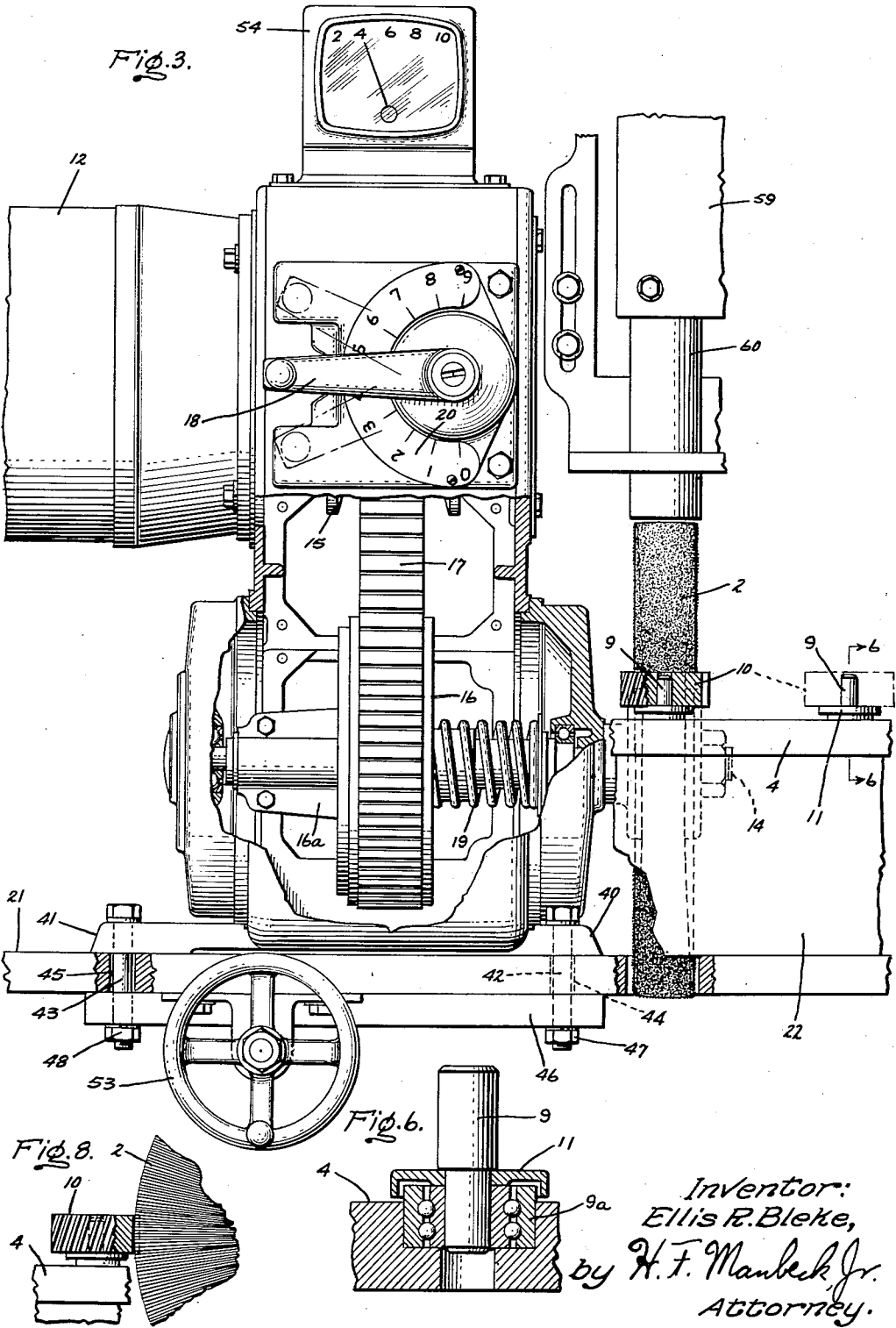
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4 Sheets-Sheet 3



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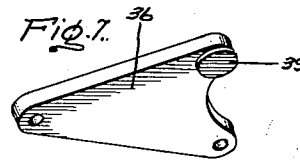
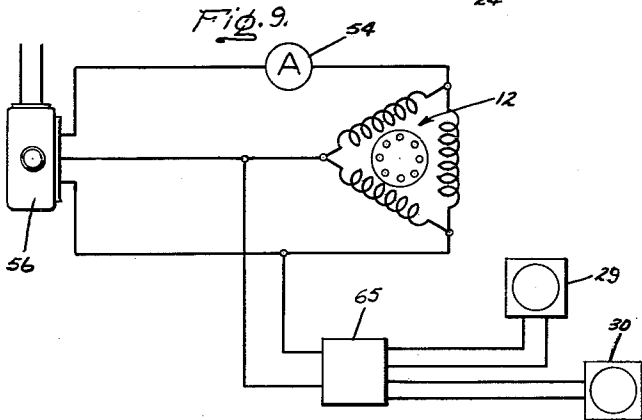
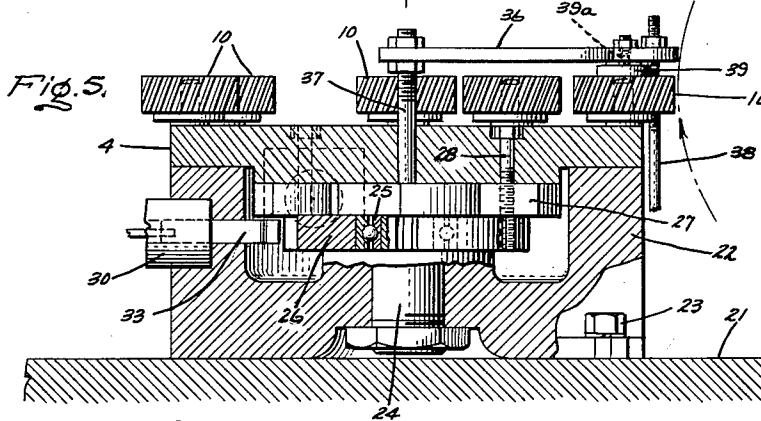
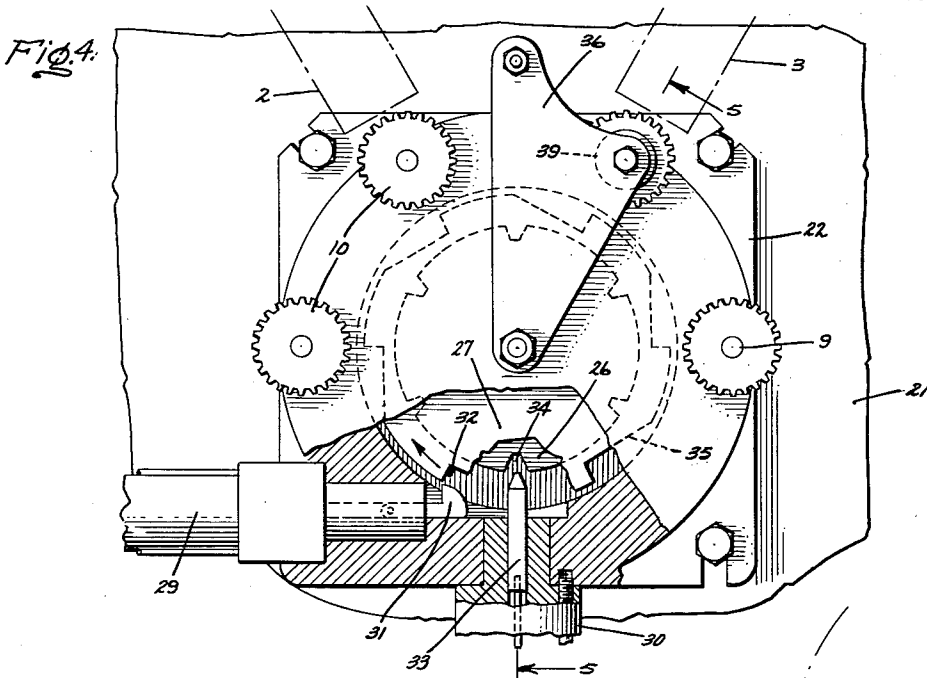
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4 Sheets-Sheet 4



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1

3,064,290

BRUSHING MACHINE

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Filed June 28, 1960, Ser. No. 39,248

7 Claims. (Cl. 15—21)

My invention relates to automatic brushing and buffing machines and more particularly to an improved machine for brushing newly formed gears.

In the production of gears for use in gear motors and the like, it is customary to perform a brushing operation on the gears after they have been formed in the gear cutting machine. The brushing operation is desirable in order to remove burrs, sharp corners and other imperfections from the gears. The brushing operation traditionally has been done manually by an operator placing a gear on a loose fitting shoulder mandrel and then holding the gear against a revolving brush. The brush as it operates against the gear rotates the gear by its action on the teeth so that the entire top side of the gear exposed to the brush is contacted by the bristles. When the top side of the gear is brushed sufficiently, the operator removes the gear from the brush, turns it over on the mandrel and repeats the brushing on the second side. This is obviously a rather time consuming and costly process due to the high labor content involved.

In order to reduce the cost of the operation, and also to get a uniform brushing action on each gear, it would be desirable if the brushing operation could be performed on an automatic machine. Such a machine should be adjustable so as to provide for varying size gears and also to provide for different brush pressures on different gears, i.e., different brush loads. Also, since the brushes wear considerably during use, it would be necessary that the machine be so arranged that the wear on the brushes will not adversely affect the brushing action. Further, the machine should be so constructed and arranged that it could be run by a relatively unskilled operator with little set-up or adjustment time being required.

Accordingly, it is a primary object of my invention to provide a new and improved brushing or buffing machine which is especially useful for brushing newly formed gears.

Another object of my invention is to provide an improved brushing machine having indicating means for showing the brush pressure or load and means for adjusting the brush position so as to obtain the desired load.

A further object of my invention is to provide an improved brushing machine in which the brush speed may be readily varied to provide the same peripheral speed of the bristles regardless of the condition of brush wear.

A still further object of my invention is to provide an improved automatic brushing machine in which no manual actions are required after the brush position and speed are set other than the loading and unloading of the machine.

In carrying out my invention in one form thereof, I provide a gear brushing machine having at least one rotatable brush and an adjustable speed drive mechanism for driving the brush. An indexing table is included having a plurality of spindles for mounting the gears to be brushed, and means are provided for moving the table in a step by step fashion to bring the spindles progressively in front of the brush. Thereby the gears are progressively brought into contact with the brush for the brushing action, and the desired peripheral speed of the brush for the correct brushing action is obtained regardless of the condition of brush wear by the adjustment of the drive mechanism.

2

In order that a predetermined brush pressure may be maintained on the gears, the machine includes means whereby the brush and the indexing means may be moved relatively toward and away from each other. Thus, the machine may be adjusted for different sizes of gears and also to compensate for brush wear. By a further aspect of my invention, the machine includes means whereby the pressure or load on the brush may be measured thereby to insure that the proper brushing action is obtained. This measuring means comprises an ammeter which measures the input current to the drive motor of the adjustable speed drive mechanism. This current is determined by the load on the brush and thereby the ammeter, in effect, indicates the magnitude of the brushing action taking place. The desired brushing action in each instance may thereby be obtained by adjusting the brush position until the input current corresponding to the desired brushing action appears on the ammeter.

The subject matter which I regard as my invention is particularly pointed out and distinctly claimed in the concluding portion of this specification. My invention, however, both as to organization and method of operation together with further objects and advantages thereof may best be understood by reference to the following description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a perspective view from the front of one embodiment of my gear brushing machine;

FIG. 2 is a top view of the machine, with certain parts removed and partially broken away so as to show details of the indexing table and of the brush and gear contact;

FIG. 3 is a front elevation view showing the drive mechanism for one of the brushes, the view being partially broken away to illustrate inner details of the drive mechanism;

FIG. 4 is a top view of the indexing table, partially broken away to show the indexing drive and detent means for the table;

FIG. 5 is a sectional view of the indexing table and its drive taken on the line 5—5 of FIG. 4;

FIG. 6 is a sectional view taken on the line 6—6 of FIG. 3 showing one of the gear mounting spindles carried by the indexing table;

FIG. 7 is a perspective view of a backing member disposed over the indexing table;

FIG. 8 is a fragmentary view showing the gear brushing action occurring at one of the brushes; and

FIG. 9 is a schematic circuit diagram illustrating the electrical connections for energizing the drive motor for one of the drive mechanisms and the timer for controlling the indexing table.

Referring now to FIG. 1, I have shown therein a preferred embodiment of my new and improved gear brushing machine 1. This machine includes a pair of brushes 2 and 3 which are arranged for rotation adjacent to an indexing table or carrier 4. The brushes 2 and 3 are driven respectively by mechanically adjustable, variable speed drive mechanisms 5 and 6 and they rotate in opposite directions with regard to the indexing table. Specifically, the brush 2 is driven in a counterclockwise direction as indicated by the arrow 7 so that it moves downwardly past the indexing table, while the brush 3 is driven in a clockwise direction as indicated by the arrow 8 so that it moves upwardly past the indexing table.

As shown in FIGS. 1, 2 and 4, the indexing table 4 is provided with a plurality of rotatable spindles 9. In particular, the table is provided with six of these spindles which are supported thereon in a generally circular pattern by means of ball bearing assemblies 9a (FIG. 6). The spindles 9 are arranged to receive the gears 10 to be brushed and a flange 11 is provided on each spindle

3

immediately above its ball bearing mount 9a for supporting the gear once it is placed on the spindle.

The indexing table 4 is moved in a step by step fashion to bring the spindles 9 progressively in front of the brushes 2 and 3, this movement being in a clockwise direction in the illustrated machine. As each spindle is brought in front of either brush 2 or brush 3, the gear mounted on it is brought into contact with the brush so that a brushing action occurs. The gear mounted on any spindle is thus first brushed by the brush 2, with the brush moving in the downward direction past it, and then is moved into contact with the brush 3, with brush 3 moving upwardly past it. The means for moving the table in this step by step fashion will be explained hereinafter and it will be noted that there are, in effect, six stations of the table corresponding to the six spindles. In two of these stations, the gears 10 are being brushed by the respective brushes whereas in the other four stations the gears may be freely removed and replaced on the spindles. These other four stations may, of course, be used for loading and unloading gears from the table.

It will be noted that the six spindles 9 are preferably staggered slightly from the center lines which would place them exactly equidistant from each other. This is done so that the gears mounted on any two spindles will not contact the brushes at the same portions of their respective widths. This "off-centering" gives greater brush life and prevents the brushes from wearing to a concave contour. It would, of course, be difficult to bring the gears 10 into and out of contact with the brushes if they were worn to a concave configuration.

Referring now to the drive for the brushes 2 and 3, it will be remembered that they are driven respectively by the adjustable speed drive mechanisms 5 and 6. Each of these mechanisms is provided with its own drive motor as indicated at 12 and 13 respectively and they are identical in construction and arrangement. Thus, only the mechanism 5 will be described in detail herein. As shown in FIG. 3, the drive mechanism 5 comprises an adjustable speed belt and pulley drive connecting the output shaft of the motor 12 (not shown) to an output shaft 14 on which the brush 2 is mounted. The drive includes a pair of adjustable pitch pulleys 15 and 16, the pulley 15 being mounted on the motor or drive shaft and the pulley 16 being mounted on the output shaft 14. The pulleys 15 and 16 are connected together by means of a drive belt 17 and the output speed of the mechanism, i.e., the speed of the shaft 14, is adjusted by changing the relative effective diameters of the pulleys 15 and 16.

The pulley 15 comprises the control pulley of the arrangement and its two halves may be adjusted relatively toward or away from each other by means of a mechanical linkage (not shown) which is controlled by a manually operated rotatable handle 18. Actually, the position of the right-hand pulley half is fixed on the shaft, and the left-hand half is moved along the shaft when the handle 18 is turned. As the one half of the pulley 15 is moved toward or away from the other half, the effective diameter of the pulley 15 is changed. Depending upon the direction that the effective diameter of the pulley 15 is changed, the belt 17 either slackens or pulls harder with regard to the pulley 16. The left-hand half or section of the pulley 16 is fixedly mounted on the shaft 14 by the collar 16a but the right-hand section is movable axially on the shaft, being biased toward the left-hand section by means of a coil spring 19. As the belt slackens or pulls harder against the pulley 16, depending upon the direction of adjustment of the pulley 15, the movable section of the pulley 16 moves either toward or away from the fixed section so as to vary the effective diameter of pulley 16. In particular, as the effective diameter of the pulley 15 is changed in one direction, the effective diameter of the pulley 16 is changed in the other direction. If the effective diameter of the pulley 15 is increased, the effective diameter of the pulley 16 is de-

4

creased, whereas if the effective diameter of the pulley 15 is decreased, that of the output pulley 16 is increased. Thus, as the adjusting crank is moved to its various positions, the speed of the output shaft 14 is changed relative to that of the motor shaft so that the output speed is adjustable over a wide range. For example, in the illustrated machine at the low speed adjustment of the crank 18 as indicated by the numeral 1 on the scale 20 the output shaft will be driven at a speed of 525 r.p.m. assuming a motor speed of 1725 r.p.m., and at the high end adjustment as indicated by the numeral 9 on the scale 20 the output shaft will be driven at 3675 r.p.m.

It will be understood that various types of mechanically adjustable variable speed drives may be used to drive the brushes of my gear brushing machine and, therefore, the mechanism 5 has not been described herein in exhaustive detail. A preferred form of an adjustable speed drive corresponding to the mechanism 5 is, however, described in detail and claimed in the copending application of Julius A. Kohn et al., Serial Number 857,872, filed December 7, 1959, now Patent No. 3,009,363 for ("Variable Ratio Transmission Mechanism" and assigned to the same assignee as the present invention. Reference may be had to the aforesaid Kohn application for a complete description of the control linkage utilized between the handle 18 and the control pulley 15 in the illustrated drive 5 and for other details of the mechanism.

Turning next to the indexing table 4, it is mounted on the base 21 of the machine by means of a base member 22 which is secured to the frame by bolts 23. The frame 22 carries a central pedestal 24 at the top of which is mounted a ball bearing assembly 25 (see FIG. 5). The inner race of the ball bearing assembly 25 is attached to the pedestal 24 and the outer race of the assembly carries a rotatable detent plate 26. Immediately above the detent plate 26 and carried by it is an actuating plate 27 for the table 4 and disposed on top of the actuating plate 27 is the table 4 itself. The detent plate 26, the actuating plate 27 and the table 4 are all attached together into a unitary assembly by means of a plurality of vertical bolts 28, with the entire assembly being mounted for rotation by the ball bearing mount 25.

In order to rotate the table 4 in a step by step fashion, a pair of air cylinders 29 and 30 are provided in the machine (see FIGS. 1 and 4). The movable piston of cylinder 29 drives a longitudinally movable dog 31 which is arranged to engage suitable shoulders 32 provided on the actuating plate 27, while the piston of cylinder 30 controls a detent pin 33 which is arranged to engage recesses 34 provided in the detent plate 26. As shown in FIGS. 2 and 5, there are six of the shoulders 32 provided on the plate 27 and six of the detent recesses 34 provided in the plate 26.

Whenever the table 4 is in one of its stations with two spindles positioned respectively in front of the gears 2 and 3, the pin 33 is in an extended position seated within a recess 34 as shown in FIG. 2. At the same time, the dog 31 is in an extended position engaging one of the shoulders 32. To move or index the table to the next station bringing a new gear into contact with the brush 2 and moving the previous gear in front of the brush 2 to contact with the brush 3, the detent pin 33 is first retracted by the cylinder 30 to its position shown in FIG. 4 so that it clears the detent plate 26. Then the cylinder 29 retracts the dog 31 to its position shown in FIG. 4 moving the table to the next position. At this time, the cylinder 30 releases the pin 33 so that it engages the next recess 34 locking the table 4 in position, and thereafter the dog 31 is returned to its extended position by the cylinder 29 ready for the next movement of the table. It will be noted that sloping surfaces 35 are provided on the actuating plate 27 between the shoulders 32 so as to allow the dog 31 to ride backwardly from one shoulder 32 to the next as it returns to its extended position.

To reiterate this sequence of actuation for the indexing

5

table, it will be understood that each time the table is to be indexed to the next station, the following sequence occurs. First, the pin 33 is retracted so as to release the table for movement, then the dog 31 draws the table to the next position. The indexing pin then reseats in the next detent recess locking the table in position, and the dog 31 returns outwardly ready for the next movement of the table.

The control of the air cylinders 29 and 30 to accomplish this indexing action is effected by means of suitable electrically actuated valving means which is controlled by means of a sequence timer 65. As shown schematically in FIG. 9, the timer 65 may be energized from one phase of the power supply for motor 12, and it may be connected to the valves for the air cylinders in any suitable manner as also indicated schematically in FIG. 9. It will be understood that the particular form of timer and actuating means used with the indexing table is not essential to this invention and that other suitable means may be used to move the table in a step by step fashion to the various stations.

As the table 4 is moved in a step by step fashion, it, of course, brings the gears 10 on the spindles 9 progressively in front of the brushes 2 and 3. Since the brush 2 moves downwardly past the table, it does not tend to throw the gear off the spindle 9 in front of it, but rather, causes the gear and the spindle to rotate together. In fact, the gear is seated on the rotatable flange 11 of the spindle by the force of the brush as this rotation occurs. The brush 3 does not, however, tend to force the gear downwardly onto the spindle flange 11 as does the brush 2. Rather, since the brush 3 moves upwardly past the table 4, it tends to lift the gear 10 off the spindle in front of it. It causes the gear in front of it to rotate on a spindle 9 but at the same time provides an upward force which would lift the gear off the spindle if means were not provided to prevent this. In order to retain the gear on the spindle in front of the upwardly moving brush 3, a backing member or plate 36 is positioned over the indexing table. As shown in FIG. 5, this plate is supported by means of two stationary rods 37 and 38, the rod 37 extending downwardly through the rotatable indexing table 4 into the stationary pedestal 24 and the rod 38 extending downwardly outside of the frame 22 to the base 21 of the machine. It will be noted that the plate 36 is generally triangular in shape and that the supporting rods 37 and 38 engage it at two of its corners. The third or unsupported corner of the plate lies directly in front of the brush 3 and as the table indexes so as to carry a gear 10 from the brush 2 to the brush 3, the gear moves under the plate until it reaches the unsupported or right-hand corner as viewed at FIG. 1. When the gear reaches this corner, the table 4 then stops moving and the gear is in position to be brushed by the brush 3.

Mounted on the bottom side of the plate 36 in front of the brush 3 is a rotatable disc 39. The disc is carried by a stub shaft 39a journaled in the plate 36 and when a gear is brought into position to be brushed by the brush 3, the disc overlies the gear. Thus, as the brush 3 tends to lift the gear as it brushes it, the gear is engaged by the disc 39 and is thereby retained on the spindle. Thereby, during the brushing action, the gear is really rotated on the spindle by the brush but yet cannot fly off the spindle. The disc 39 rotates readily with the gear and spindle so that it does not interfere with the rotation of the gear, which rotation is necessary if all parts of the periphery of the gear are to be brushed. Sufficient clearance is provided between the disc and the top of the spindles 9 so that the gear being brushed may be freely moved from the brushing station upon the next indexing of the table just as it moved freely under the disc during the previous indexing.

To provide for brushing the gears of different sizes, and to compensate for brush wear and to provide for setting the proper brush pressure on the gears, the machine 1

6

includes means whereby the brushes 2 and 3 and the table 4 may be moved relatively toward and away from each other. In particular, the drive mechanisms 5 and 6 for the brushes are mounted so that they may be moved as units so as to move the brushes toward or away from the table. The mounting for the drive units 5 and 6 is best shown in FIGS. 1 and 3. Referring to these figures, it will be seen that each of the drive units is provided with a pair of front feet 40 and a pair of rear feet 41. These feet carry bolts 42 and 43 respectively which extend through front and rear slots 44 and 45 in the base plate 21. Mounted on the bolts 42 and 43 on the under side of the base plate are cross members 46, these members being retained on the bolts by means of suitable nuts 47 and 48. With this arrangement, the drive mechanisms 5 and 6 are free to slide on the base plate 21 with the 42 and 43 moving in the slots 44 and 45 so as to guide the direction of movement. It will be noted that the slots 44 and 45 extend at an angle such that the movement of the drive units carries the brushes radially toward or away from the indexing table.

A manually actuated screw is provided for moving each of the drive units. Referring in particular to FIG. 1, it will be noted that the actuating means for the drive mechanism 6 are shown therein, and it will be understood that generally this same arrangement is used with the drive mechanism 5. As shown in FIG. 1, the actuating member for the drive mechanism 6 comprises an elongated rod 49 which is threaded at its outer end into the cross member 46 of the support for the drive mechanism 6. Outwardly from the member 46 the rod 49 is journaled in a bearing 50 which is carried by a hanger 51 mounted on the bottom of the base plate 21. The mounting of the rod 49 in the bearing 50 is such that it may rotate freely with regard to the bearing 50 but does not move axially with regard thereto. At the outer end of the rod 49 a handwheel 52 is provided whereby the rod may be turned for moving drive mechanism 6. It will be understood that as the handwheel is turned, the rod 49 rotates in the bearing 50 and the threaded engagement between the outer end of the rod and the cross member 46 causes the drive mechanism 6 to move in one direction or another depending upon the direction in which the handwheel is turned, thereby moving the brush 3 toward or away from the table. As mentioned above, a similar arrangement is provided for moving the drive mechanism 5 to adjust the brush 2 toward or away from the table 4, this arrangement being actuated by the handwheel 53.

For any particular type of gear, it is desirable that a particular brushing pressure be maintained, in other words, that the brushes be loaded to a predetermined amount. In my improved machine, the desired brush pressure or load is readily obtained by adjusting brushes toward or away from the table 4. In particular, the handwheel 53 of the drive 5 is turned so as to adjust the pressure of brush 2 on the gears coming in front of it, and the handwheel 52 is turned to adjust the pressure of brush 3 on the gears coming in front of it.

In order that the pressure or load on the respective brushes may be readily determined, I have included indicating means in my machine 1 which will give a visual indication of that load. In particular, I have connected an ammeter in the energizing circuit for each of the drive motors 12 and 13. The current drawn by the motors is, of course, proportional to the brush load and thereby the current shown on the ammeters gives an indication of the brush load. Referring to FIG. 1, it will be seen that the drive unit 5 has mounted thereon an ammeter 54 and this meter measures the current in the motor 12. Likewise, the drive unit 6 has an ammeter 55 mounted thereon and this meter 55 measures the current in the motor 13. When the machine is set up to brush any particular size and configuration of gear, the position of the brushes is adjusted until the proper brush pressure or

7

load is obtained. This load, of course, draws a particular current to the motors 12 and 13 as indicated by the ammeters. Thereafter, the operator merely adjusts the handwheels 52 and 53 to keep this same current flowing to the motors and thereby he is assured that the proper brushing pressure is being applied to the gears.

In FIG. 9, I have shown in schematic form the connections for energizing the motor 12. As there shown, the motor 12 is a three-phase induction motor and the ammeter 54 is connected in one phase of the supply. It will be understood that a single phase motor could be used to drive the adjustable speed drive unit 5 and in that case the ammeter would be connected serially in one of the two energizing leads. The same connection of the ammeter 55 is, of course, used for the motor 13 and therefore it has not been illustrated herein. It will be noted that the timer 65 for the air cylinders of the indexing table is energized across one phase of the motor supply voltage and that the entire circuit is controlled by a start switch indicated at 56. Any suitable switch may be used and therefore no details will be shown herein. A similar switch 57 (FIG. 1) is provided for the motor 13 of the drive unit 6.

Besides maintaining the proper brush pressure at all times, it is also desirable that the peripheral speed of the brushes past the gears be maintained relatively constant for any given type of gear to be brushed. As the brushes wear down, it is, of course, necessary that the revolutions per minute of the brush carrying shafts be increased if the peripheral speed of the brushes is to be held constant. This is accomplished by means of the adjustable speed drive mechanisms 5 and 6. As the brushes wear down, the respective adjusting handles 18 and 58 of the mechanisms are gradually moved from their low speed position toward their high speed position thereby increasing the rotational speed of the brushes to keep the same peripheral speed. It will be noted that with the illustrated type of drive mechanisms, the speed variation is continuous rather than step by step as the handles are turned. Thus, no matter what the condition of brush wear, the desired peripheral speed of the brushes may be maintained. Also, it will be noted that the adjustable speed drive mechanisms allow for the holding of different peripheral speeds for different types of gears. That is, a different constant speed may be held for one type of gear than for another type of gear, where it is advantageous to do so.

To explain in further detail the operation of my improved gear brushing machine, it will be understood that the indexing table 4 is moved continuously in a step by step fashion during the operation of the machine. As the table moves, the spindles 9 are continuously brought in front of the brushes 2 and 3 so that the gears mounted thereon are contacted by the brushes and brushed thereby. The table moves in a clockwise direction and the operator continuously removes the gears leaving the brush 3 and places on new rough gears for brushing. The operator maintains the correct brushing pressure at all times merely by adjusting the brush pressure so as to maintain a predetermined current on the ammeters 54 and 55. The drive mechanisms 5 and 6 are, of course, moved as a whole by means of the handwheels 52 and 53 to accomplish this result. Also, in the event it is desirable to brush a different size of gear, the handwheels 52 and 53 provide for adjustment of the brushes for contacting the different sizes of gears. As the brushes wear down, the operator adjusts the ratios of the drive mechanisms 5 and 6 by means of the cranks 18 and 58 and thereby maintains the desired peripheral speed of the brushes. In the event a different peripheral speed is needed for a different type of gear, this is also readily obtained by adjusting the ratios of the drive mechanisms.

It will be noted that during the brushing action the brush 2 moves the gears downwardly onto the flange of the spindle 9 in front of it so that the gears do not fly

8

off, while rotatable disc 39 of the backing member 36 retains the gears on the spindle in front of the brush 3. Due to the angle at which the brushes contact the gears, they are rotated on the spindle 9 during brushing so that the brushes contact each tooth of the gears. The contact between the gears and the brushes is best shown in FIG. 8. The movement of the indexing table 4 is, of course, automatic as controlled by the timer 65 and thus the only task that the operator has once the machine is in operation is to unload the finished gears and put on rough gears. Of course, he will from time to time, adjust position and ratio of the drive units so as to maintain the desired brush load and peripheral brush speed but this may be readily done without taking the machine out of operation and without any particular loss of brushing time.

To obtain the proper brushing action, to remove sharp corners, burrs, etc., from the gears, it is desirable that an abrasive compound be applied to the bristles of the brushes. In my improved machine, the abrasive is applied automatically to the brushes, the same type of applicator being used for each of the brushes. Referring particularly to the applicator used with the brush 2, as shown in FIG. 1, the applicator comprises a reciprocating mechanism 59 which carries a hollow tube 60 within which is positioned a bar of abrasive compound. The applicator reciprocates approximately 14 strokes a minute and simultaneously feeds the compound bar mounted within the tube 60 toward the brushes at a rate which is adjustable, for example, from .0015 inch to .015 inch per stroke. The applicator is driven by means of a gear motor 61 which drives a crank mechanism indicated at 62. The mechanism 62 is connected to the applicator 59 so as to cause it to reciprocate back and forth as mentioned above. It will be understood that any suitable means may be used for applying the compound to the brushes and that the illustrated mechanism is intended only to be exemplary of such means.

While in accordance with the patent statutes I have described what at present is considered to be the preferred embodiment of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore, aimed in the appended claims to cover all such variations as fall within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A brushing machine comprising a pair of rotatable brushes, a pair of adjustable speed drive mechanisms each for driving one of said brushes, said drive mechanisms each including manually operable control means for adjusting the output speed thereof whereby a constant peripheral speed of said brushes may be maintained at varying conditions of brush wear, one of said brushes being driven in a clockwise direction and the other of said brushes being driven in a counterclockwise direction, a rotatable indexing table having a plurality of stations for mounting the articles to be brushed, means for moving said table in a step by step fashion to bring said stations progressively in front of said brushes and thereby bring said articles into contact with said brushes, means for moving said brushes separately toward and away from said indexing table for independent adjustment of the pressure of each of said brushes against said articles, a separate electric motor for driving each of said adjustable speed drive mechanisms and separate ammeters for measuring input current to each of said motors thereby to indicate the pressure of each of said brushes against said gears.

2. A brushing machine comprising at least one rotatable brush, a carrier means having a plurality of stations for mounting the articles to be brushed, means for moving said carrier means to bring said stations progressively in front of each brush and thereby bring said articles into

contact with each brush, and an adjustable speed drive mechanism for driving each brush, whereby a constant peripheral speed of each brush may be maintained at varying conditions of brush wear, each adjustable speed drive mechanism including a drive motor, an input shaft driven by said drive motor, an output shaft carrying one brush, pulley and belt means connecting said shafts, and means for adjusting the input to output speed ratio of the belt and pulley means thereby to vary the speed of the output shaft.

3. A gear brushing machine comprising a pair of rotatable brushes positioned at spaced apart locations, a rotatable indexing table having a plurality of spindles for mounting the gears to be brushed, means for moving said table in a step by step fashion to bring said spindles progressively in front of said brushes and thereby to bring said gears into contact with said brushes, a separate adjustable speed drive mechanism for driving each of said brushes, with one of said brushes being driven upwardly past said table and the other of said brushes being driven downwardly past said table, manually operable control means for adjusting said drive mechanisms for maintaining a constant peripheral speed of said brushes at varying conditions of brush wear, a backing member mounted above said table in front of said upwardly moving brush for holding said gears on said spindles as they are engaged by said upwardly moving brush, said backing member including a rotatable disc arranged to engage said gears during brushing by said upwardly moving brush whereby said gears are free to rotate during brushing thereby, and means for moving said brushes separately toward and away from said indexing table for independent adjustment of the pressure of said brushes against said gears.

4. A gear brushing machine comprising a pair of rotatable brushes positioned at spaced apart locations, a rotatable indexing table having a plurality of spindles for mounting the gears to be brushed, means for moving said table in a step by step fashion to bring said spindles progressively in front of said brushes and thereby to bring said gears into contact with said brushes, said spindles being staggered slightly from equi-distant positions on said table whereby the gears on different spindles contact different areas on said brushes to avoid wearing said brushes to a concave contour, a pair of adjustable speed drive mechanisms each for driving one of said brushes, and said drive mechanisms each including manu-

ally operable means for adjusting the output speed thereof whereby a constant peripheral speed of said brushes may be maintained at varying conditions of brush wear.

5. A gear brushing mechanism comprising a base, a rotatable table mounted on said base and having a plurality of spindles for mounting the gears to be brushed, a pair of unitary adjustable speed drive mechanisms movably mounted on said base at spaced apart locations adjacent to periphery of said tables, each of said drive means including a drive motor, an input shaft driven by said drive motor, an output shaft, and pulley and belt means connecting said shaft, and means for adjusting the input to output speed ratio of the belt and pulley means whereby the speed of said output shaft may be varied, a pair of brushes mounted respectively on the output shafts of said drive mechanisms and located adjacent said table, carrier means for moving said table to bring said spindles progressively in front of said brushes and thereby to bring said gears into contact with said brushes, and manually operable means for moving said unitary drive mechanisms separately toward and away from said indexing table for independent adjustment of the pressure of said brushes against said gears.

6. The mechanism of claim 5 wherein one of the brushes is driven upwardly past the table and the other of said brushes is driven downwardly past said table, and a rotatable disc is supported from said base in front of the upwardly moving brush for holding said gears on said spindles as they are engaged by the upwardly moving brush.

7. The mechanism of claim 6 wherein said spindles are staggered slightly from equi-distant points along the periphery of said table thereby to prevent concave wearing of said brushes.

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