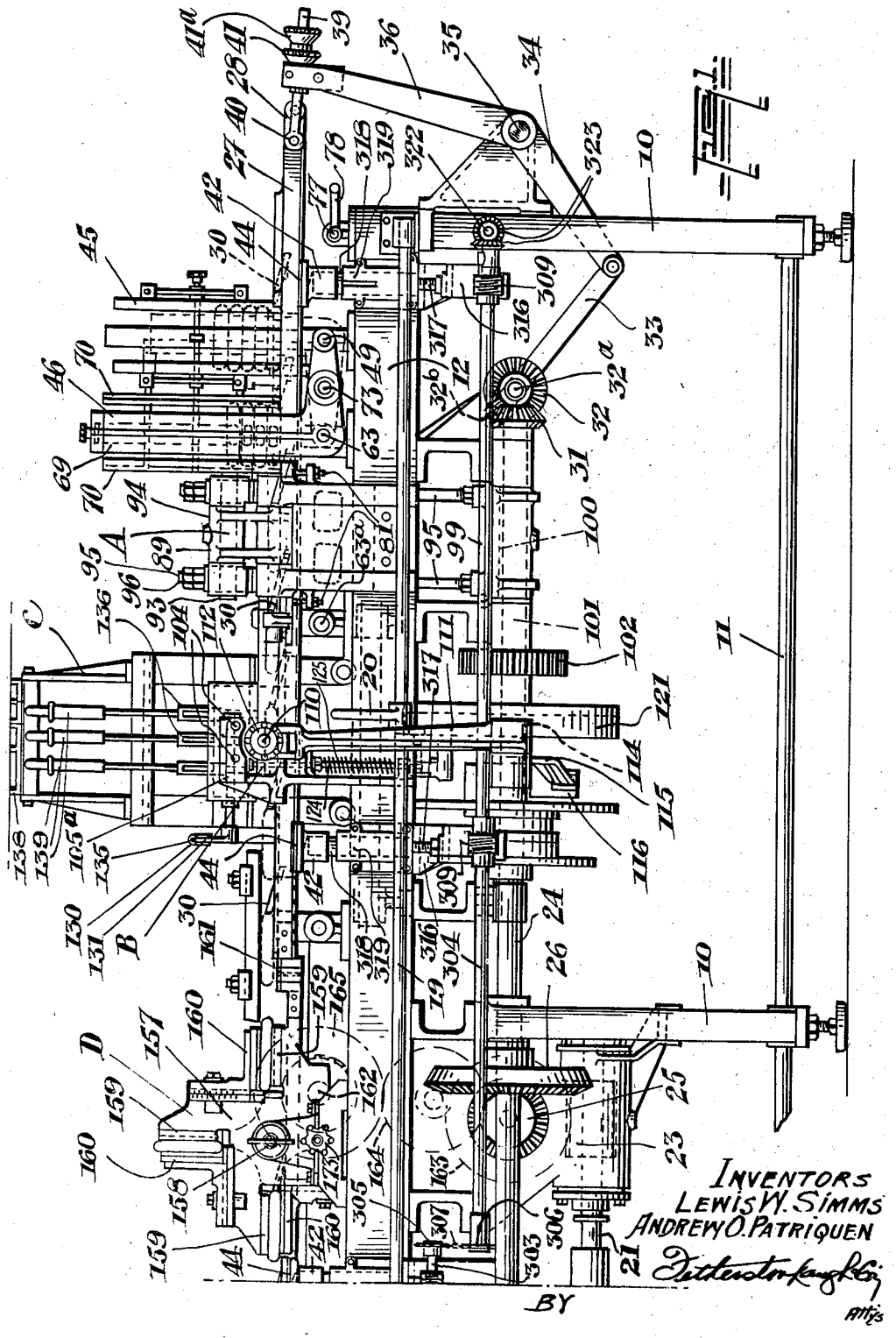
March 10, 1936. L. W. SIMMS ET AL 2,033,259

BRUSH FINISHING MACHINE

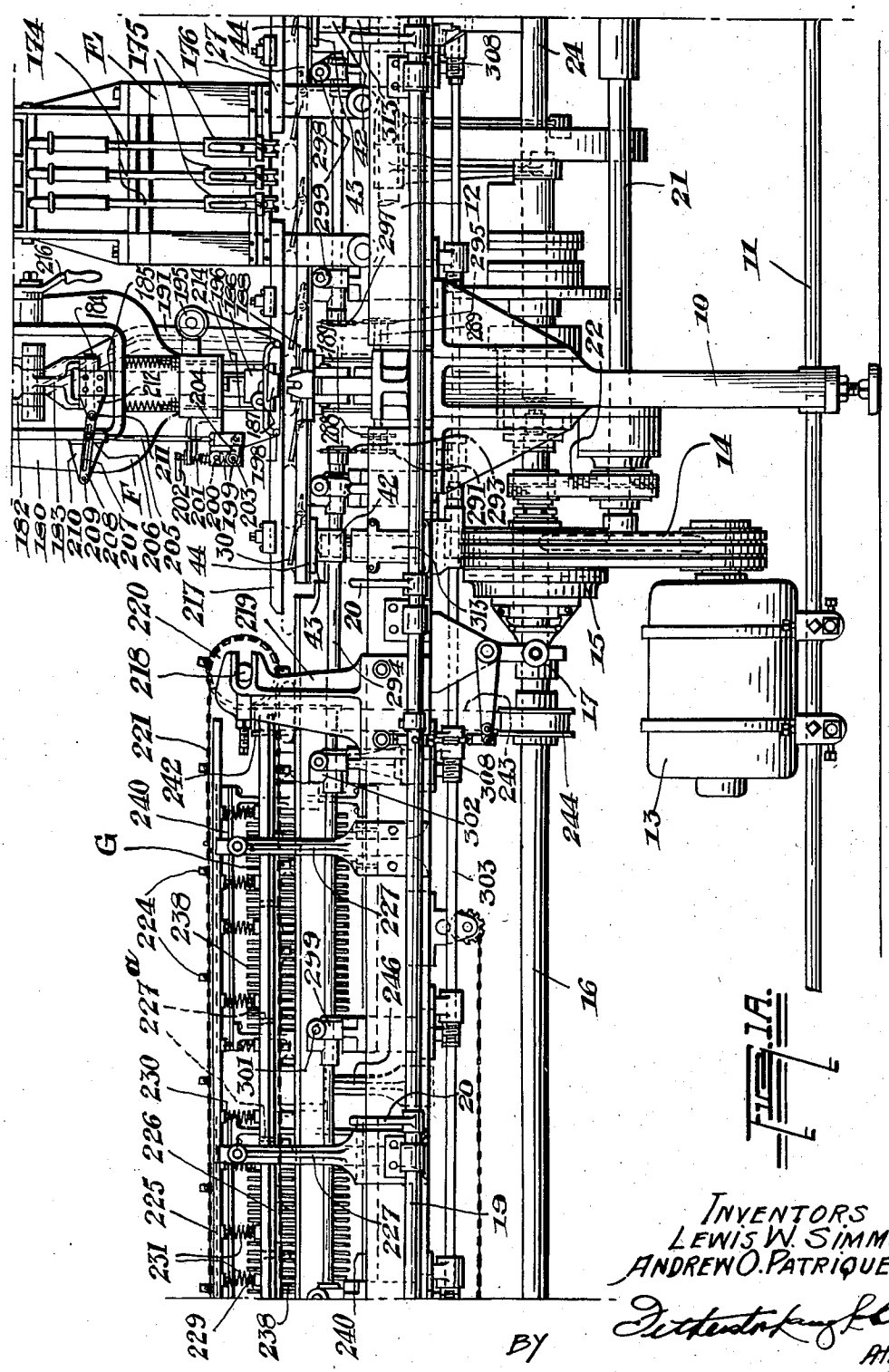
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March 10, 1936. L. W. SIMMS ET AL 2,033,259

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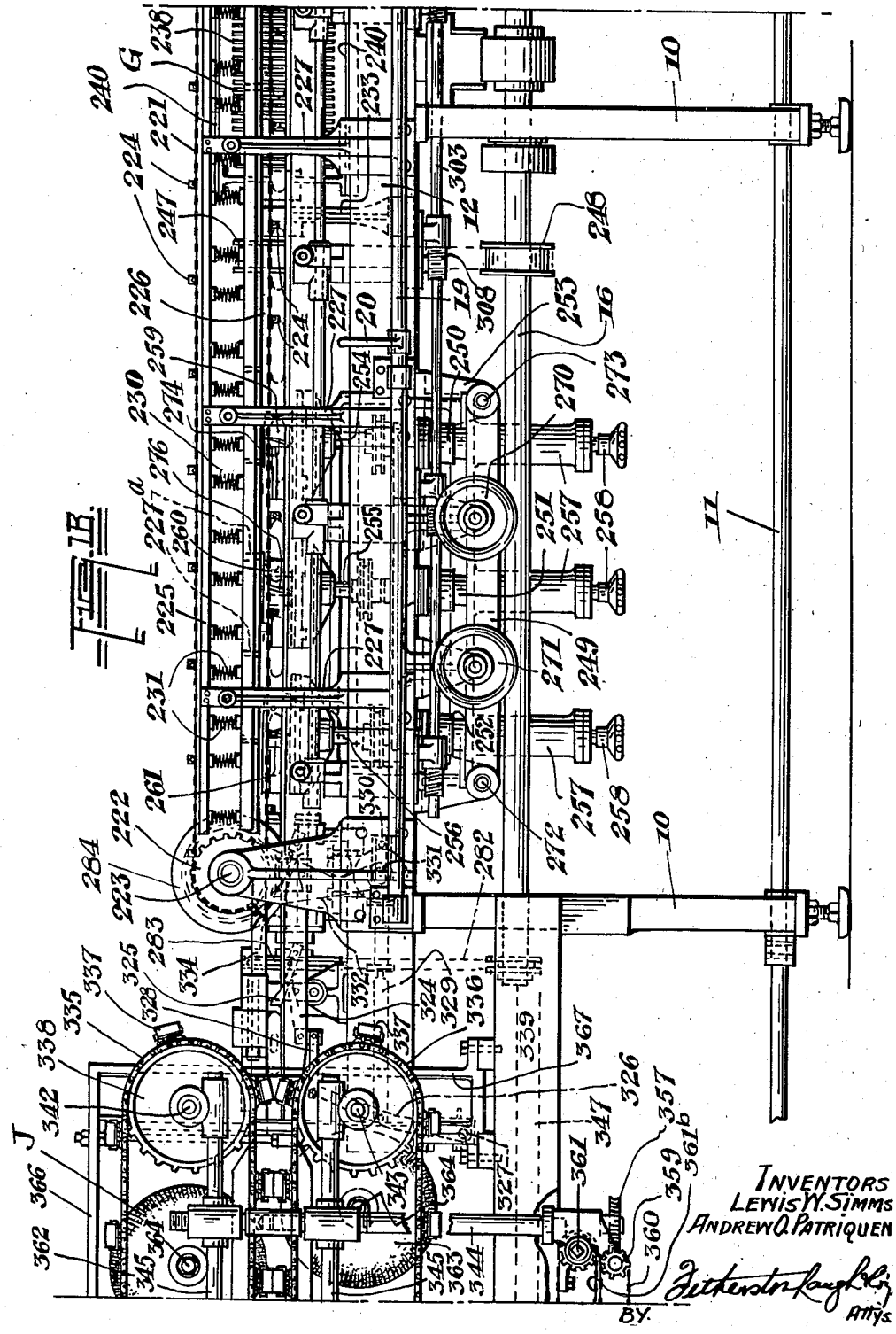


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March 10, 1936. L. W. SIMMS ET AL 2,033,259

BRUSH FINISHING MACHINE

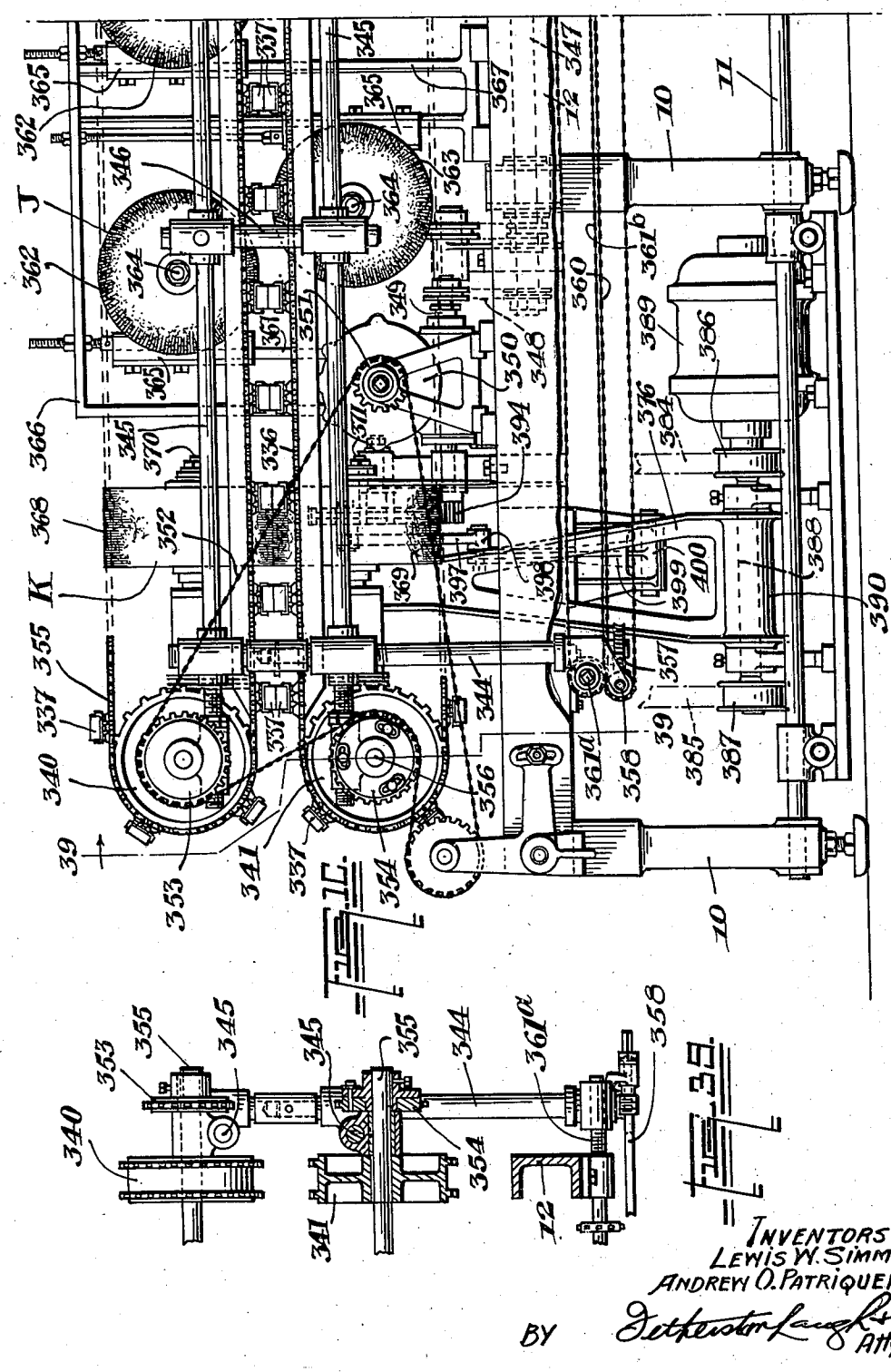
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March 10, 1936. L. W. SIMMS ET AL 2,033,259

BRUSH FINISHING MACHINE

Filed March 3, 1934 24 Sheets-Sheet 4



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March 10, 1936. L. W. SIMMS ET AL 2,033,259

BRUSH FINISHING MACHINE

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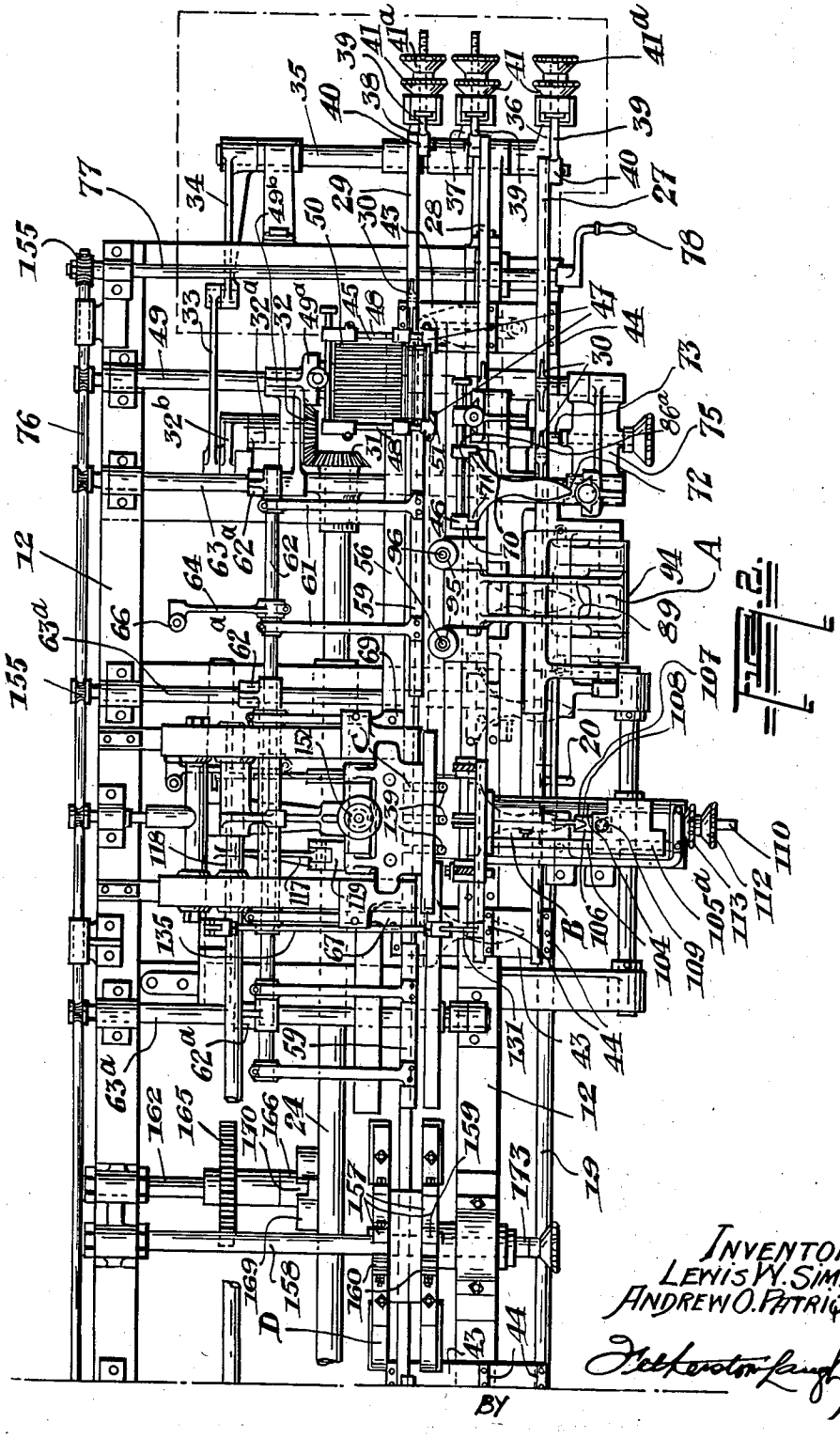


Fig. 2.

INVENTORS
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BRUSH FINISHING MACHINE

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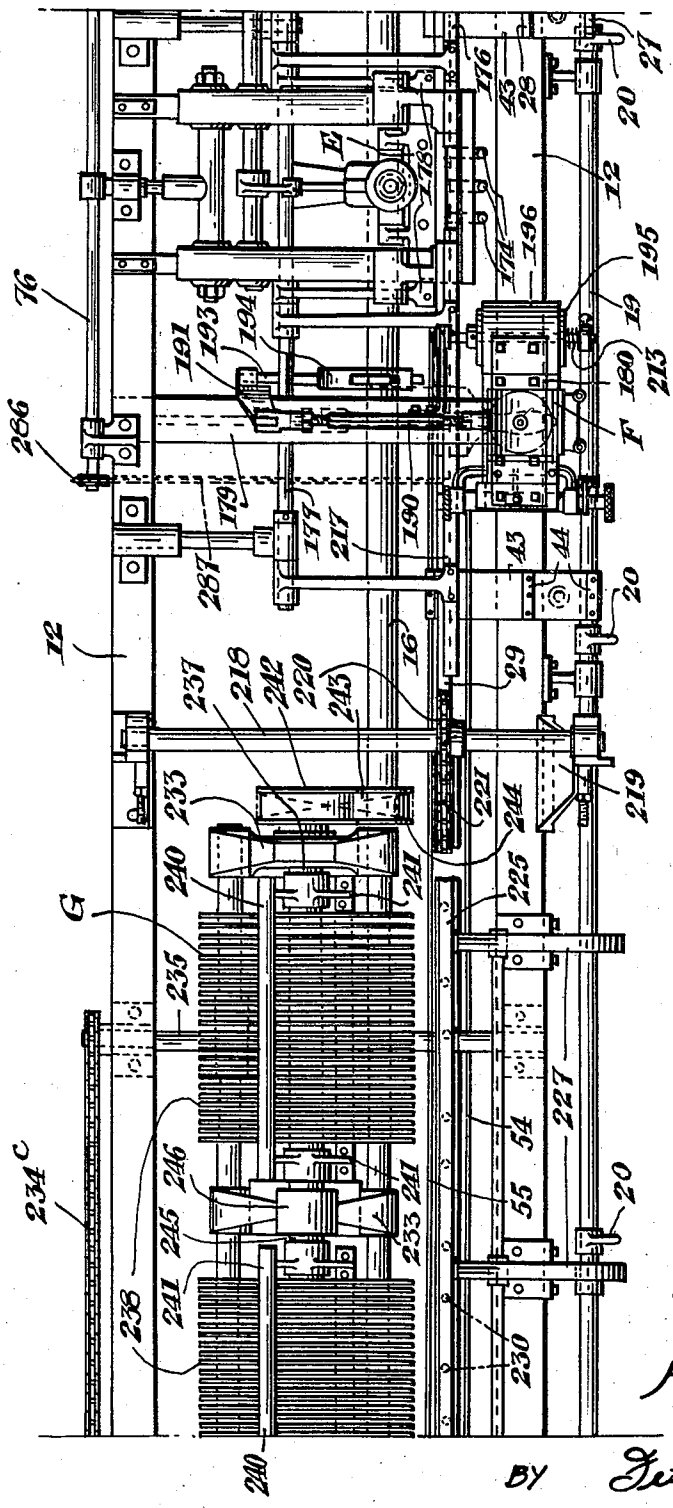


FIG. 2A.

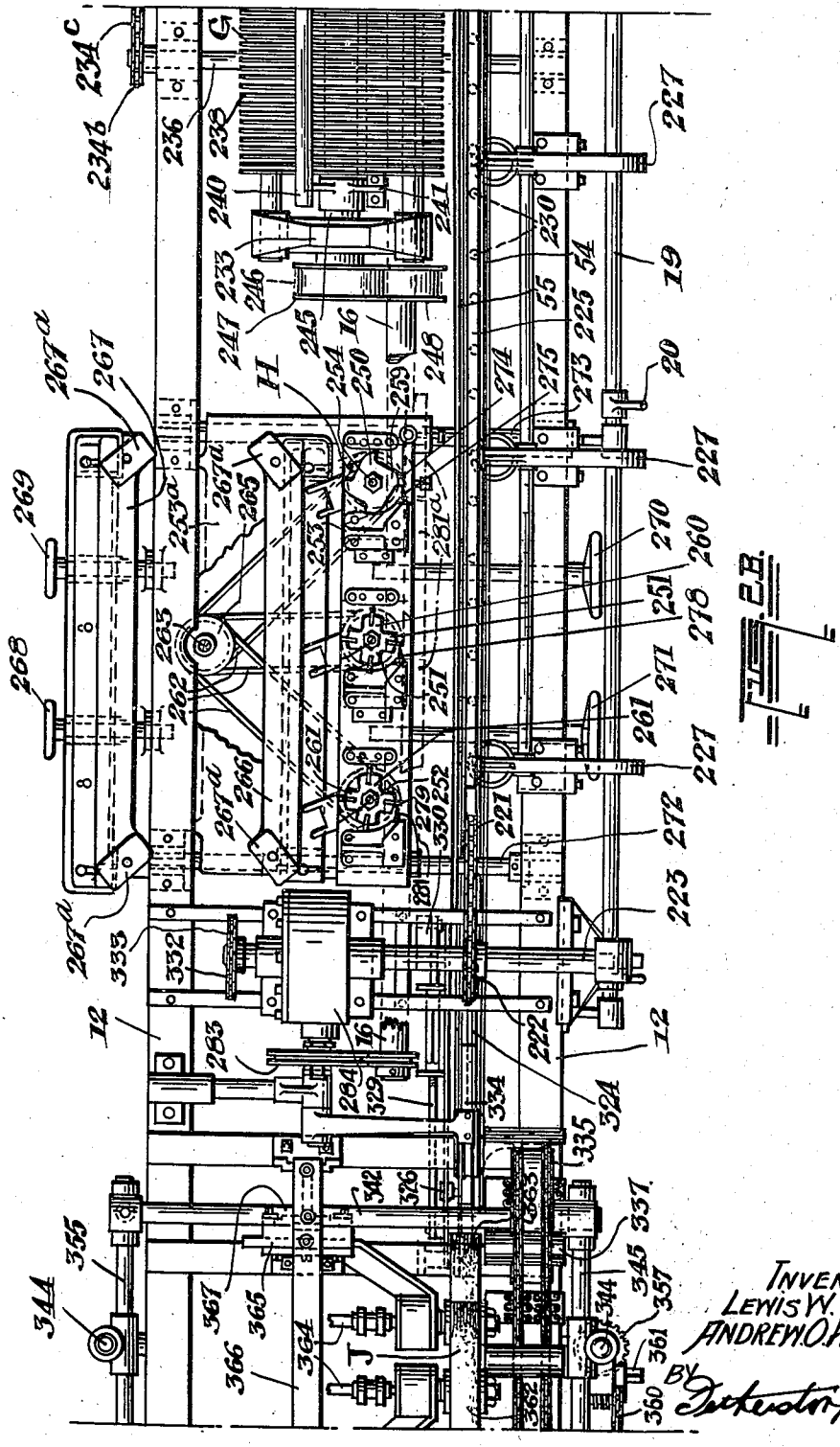
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March 10, 1936. L. W. SIMMS ET AL 2,033,259

BRUSH FINISHING MACHINE

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BRUSH FINISHING MACHINE

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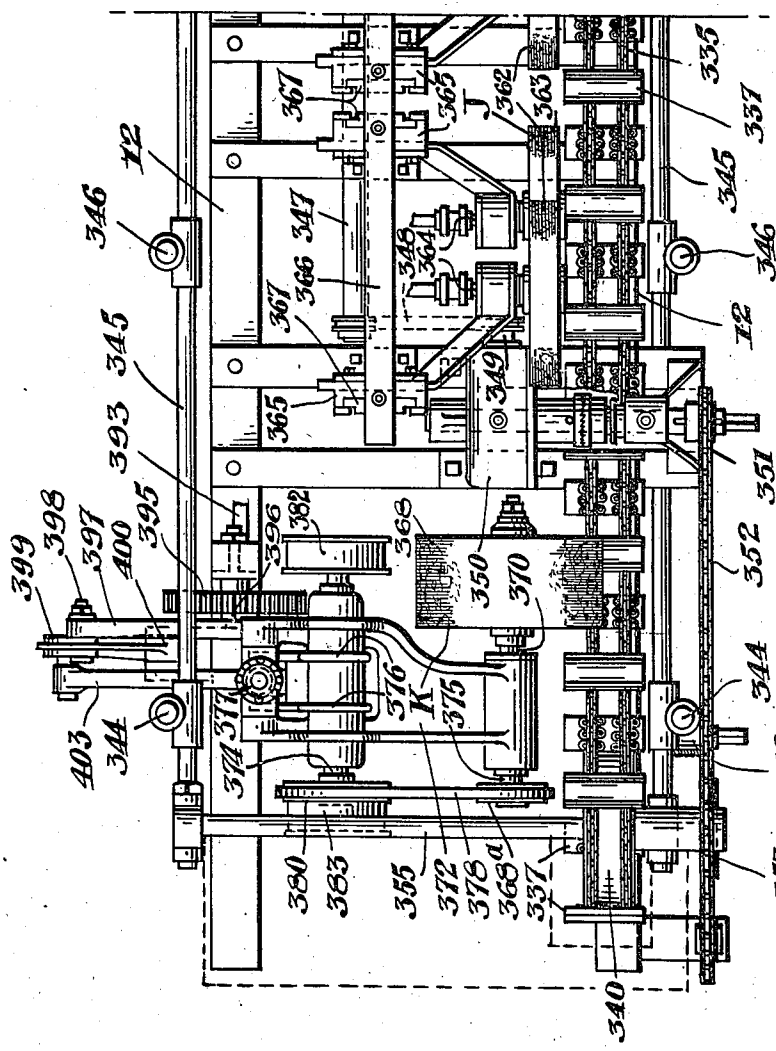


FIG. 2C.

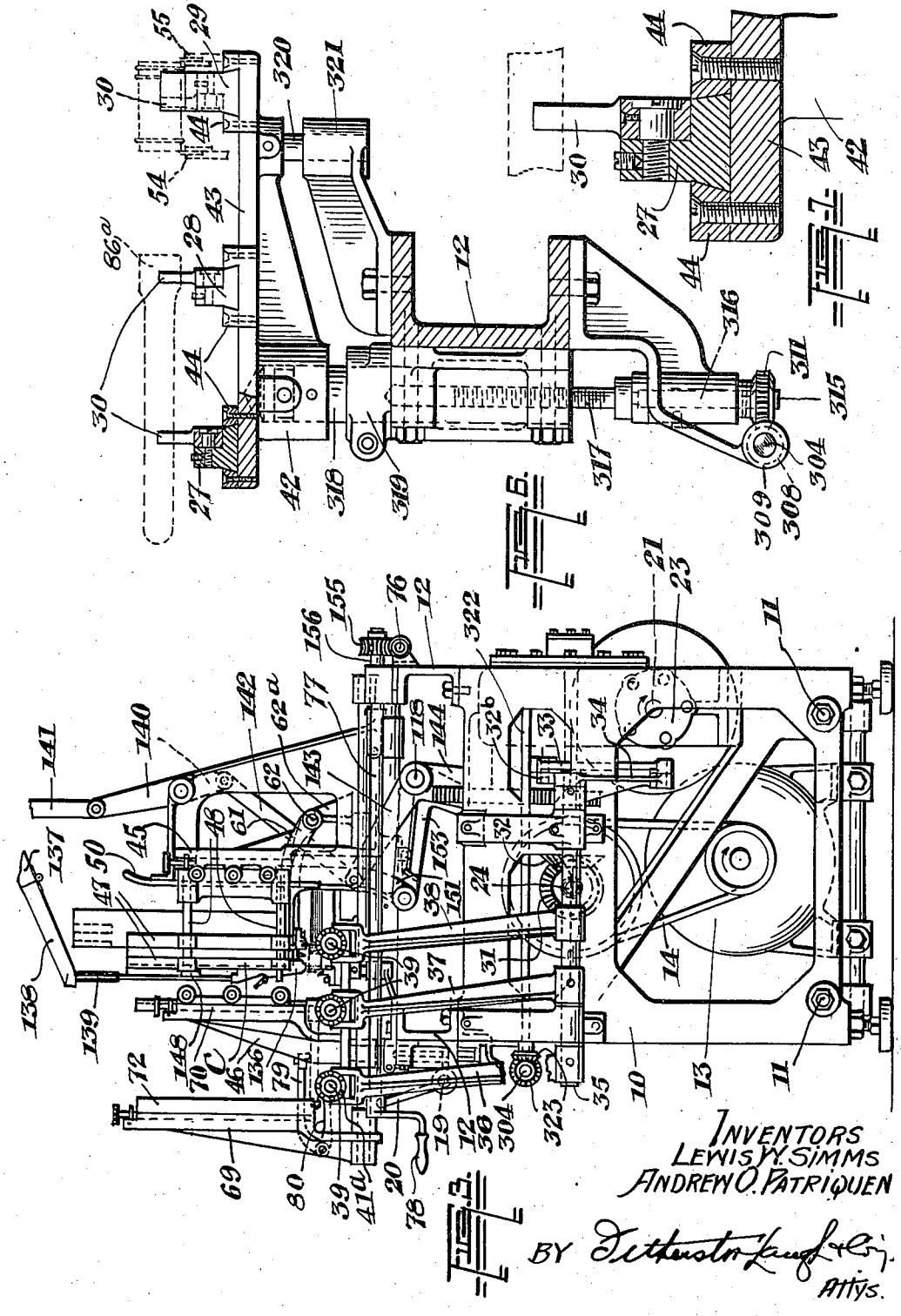
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March 10, 1936. L. W. SIMMS ET AL 2,033,259

BRUSH FINISHING MACHINE

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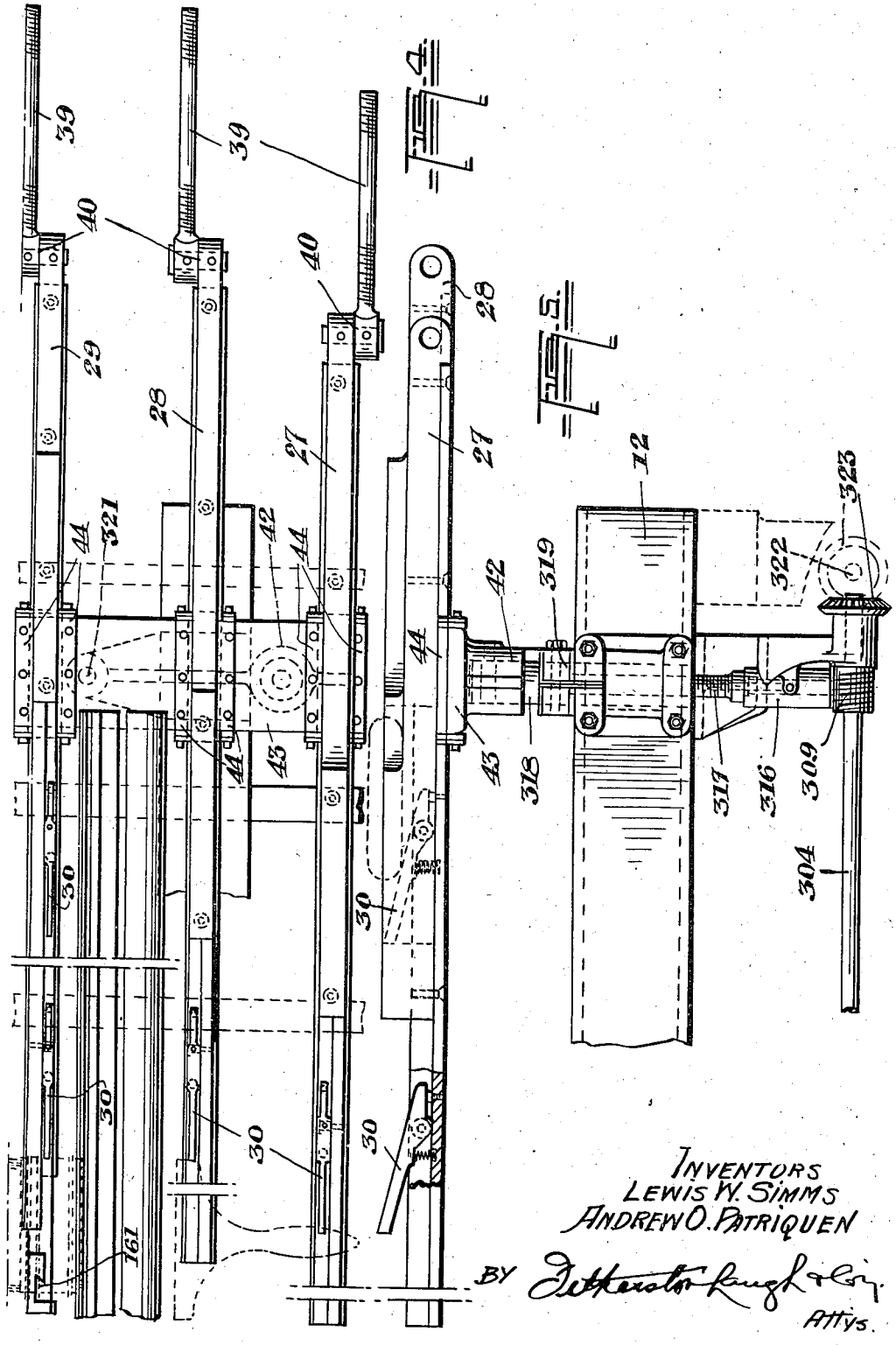


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March 10, 1936. L. W. SIMMS ET AL 2,033,259

BRUSH FINISHING MACHINE

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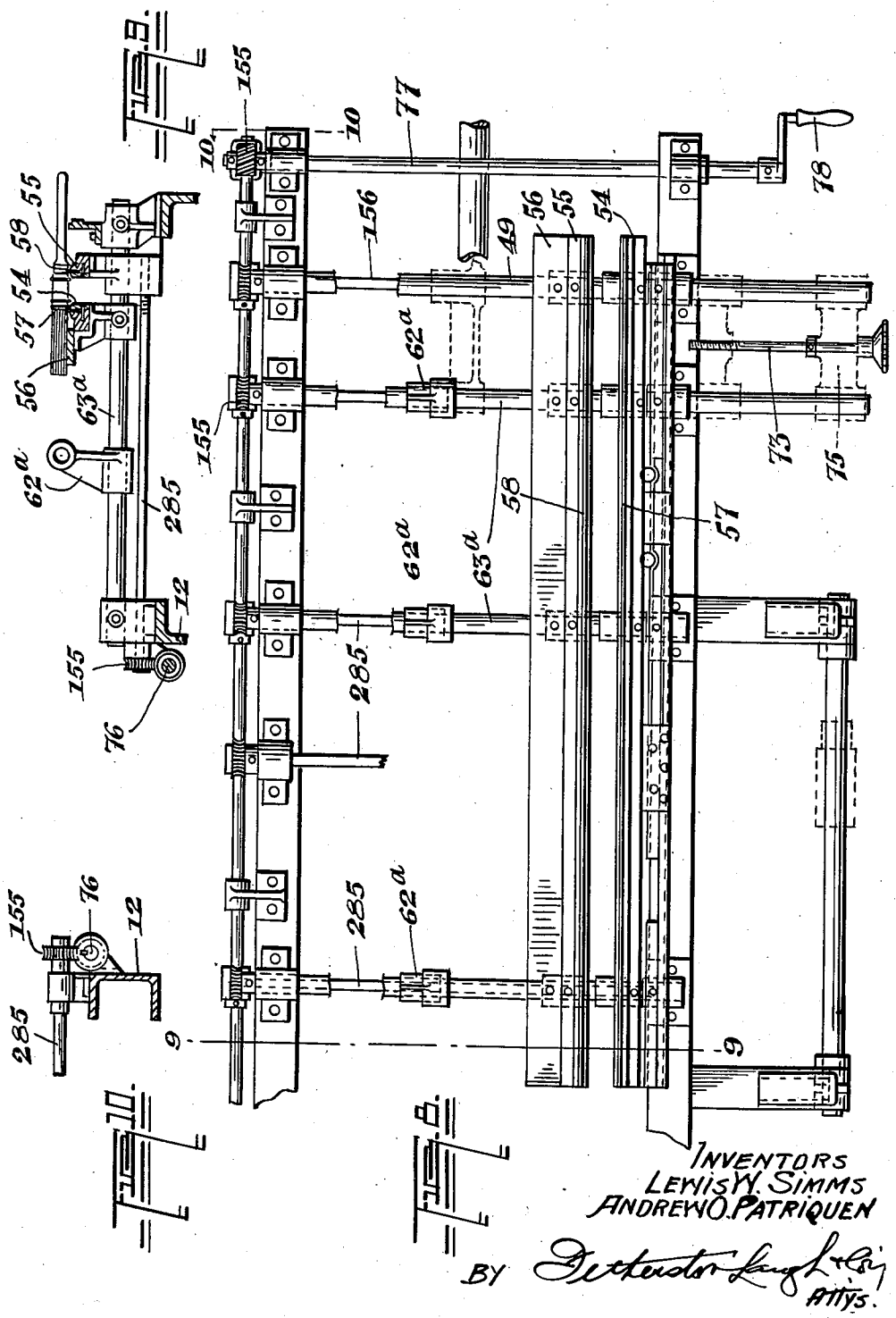


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BRUSH FINISHING MACHINE

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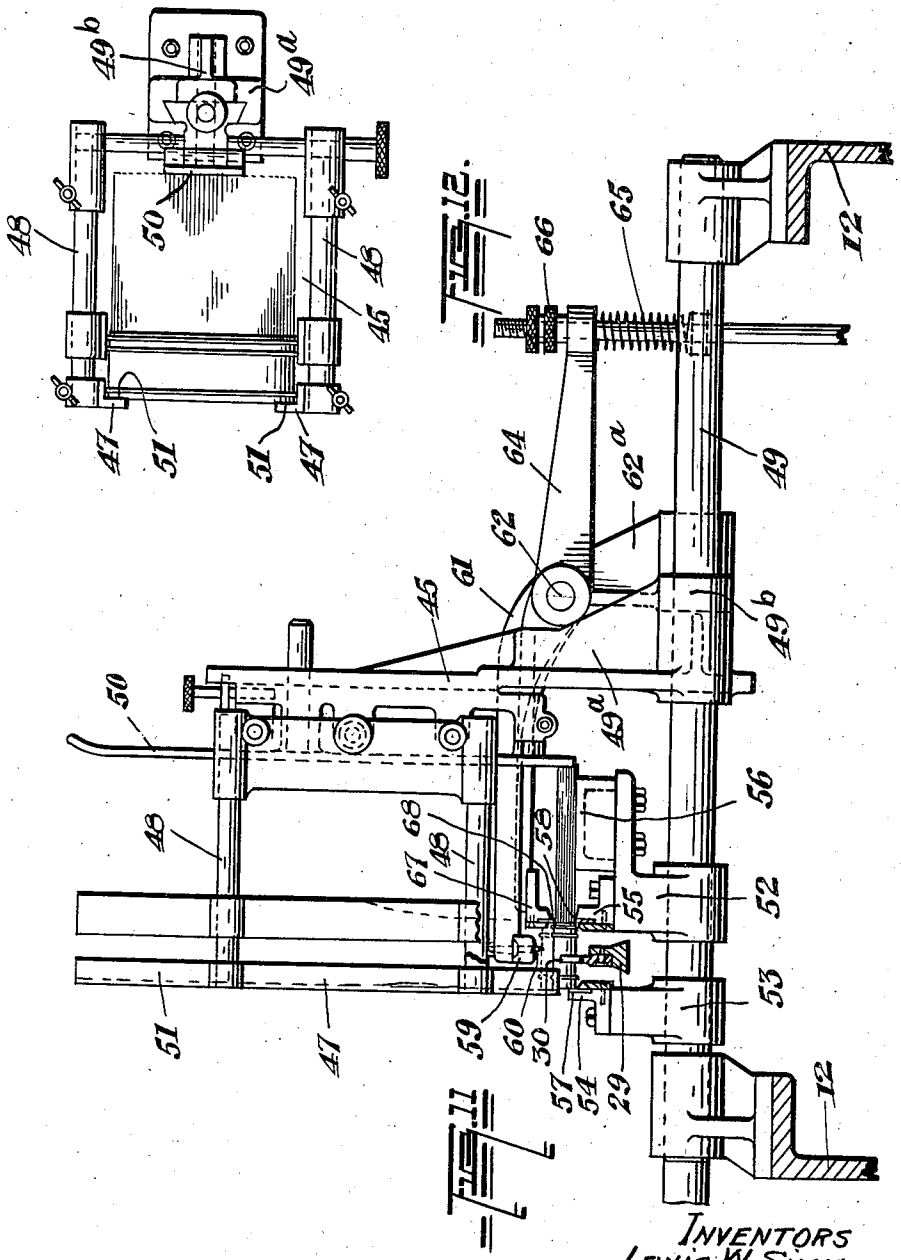


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March 10, 1936. L. W. SIMMS ET AL 2,033,259

BRUSH FINISHING MACHINE

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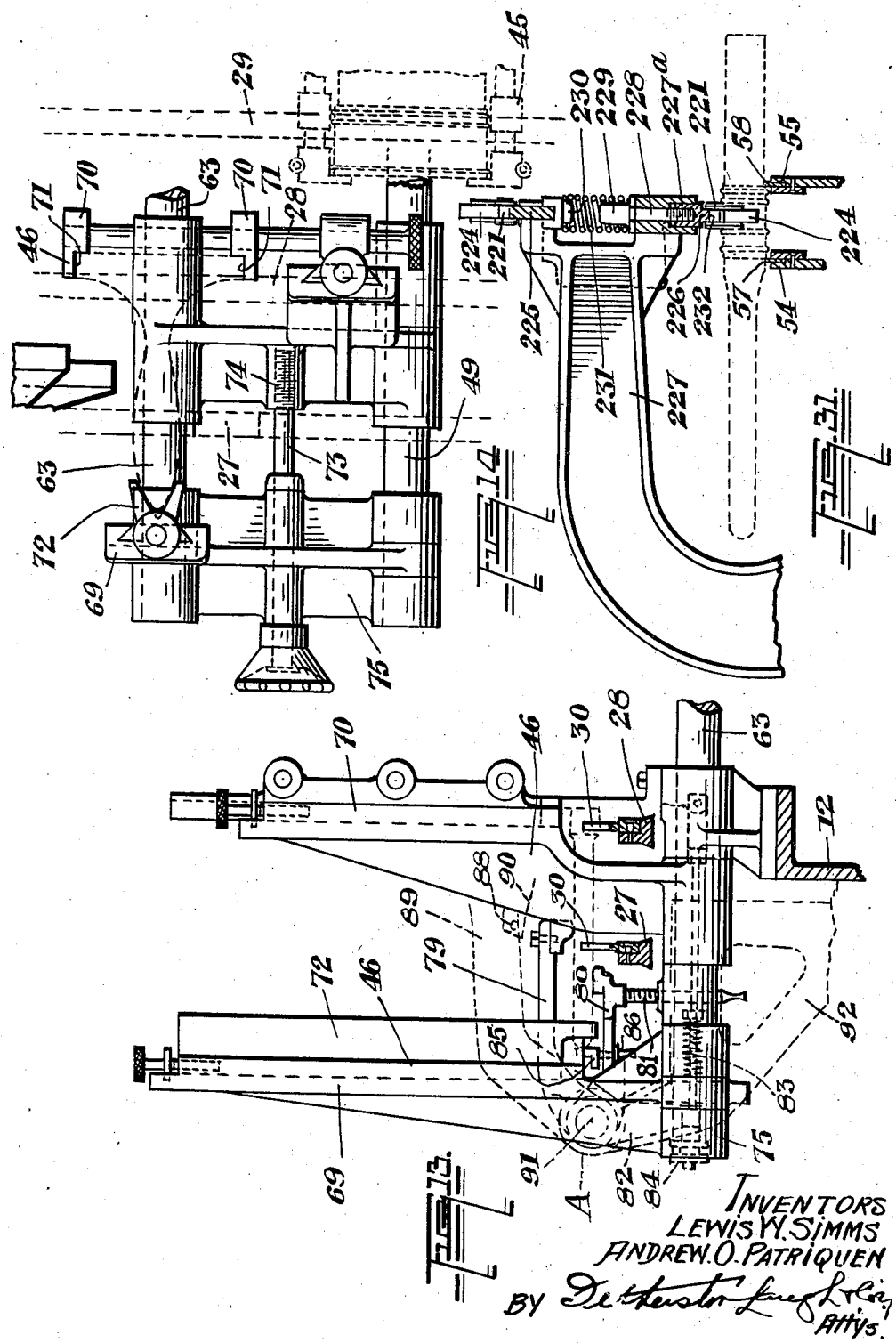


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March 10, 1936. L. W. SIMMS ET AL 2,033,259

BRUSH FINISHING MACHINE

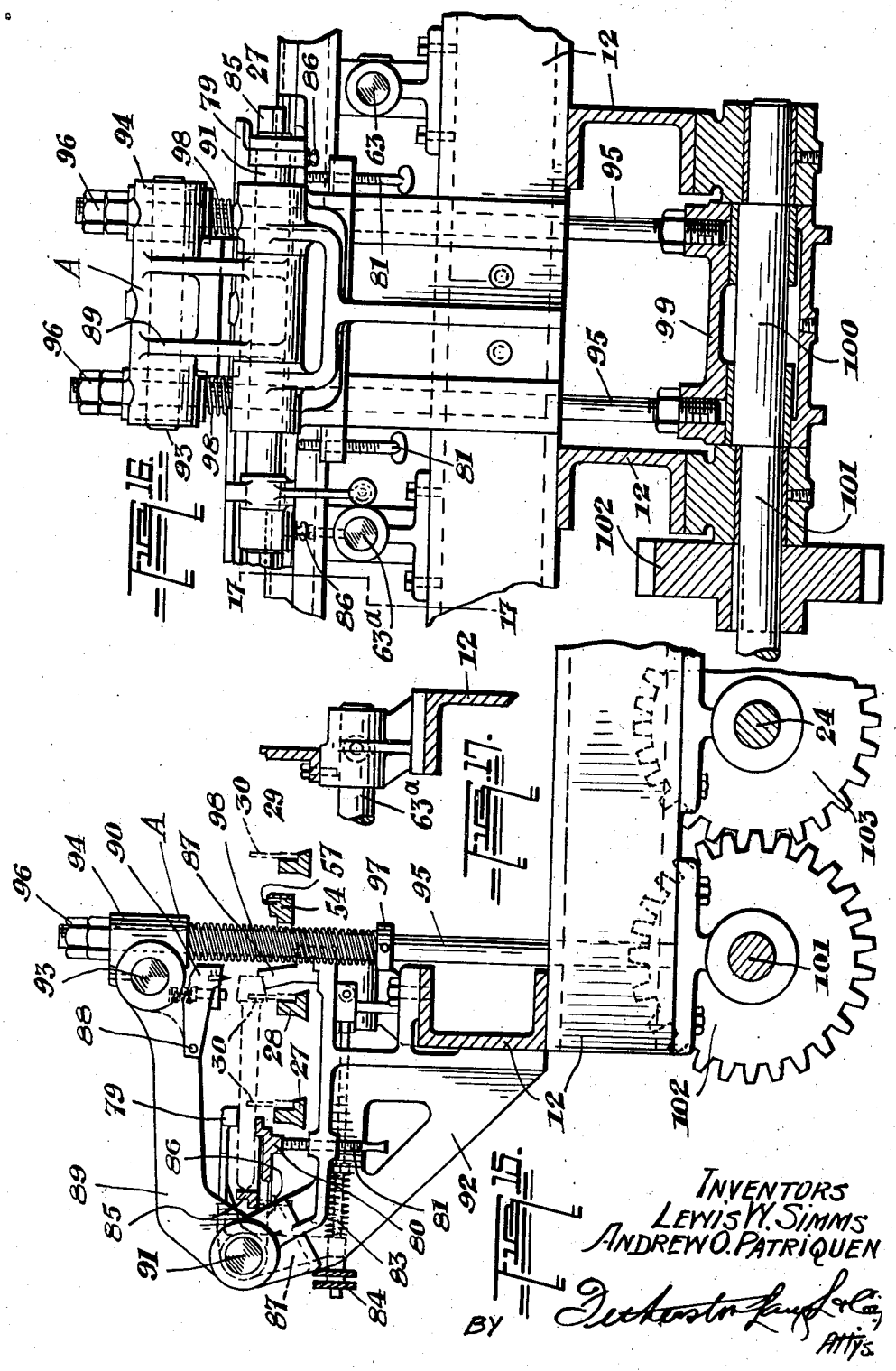
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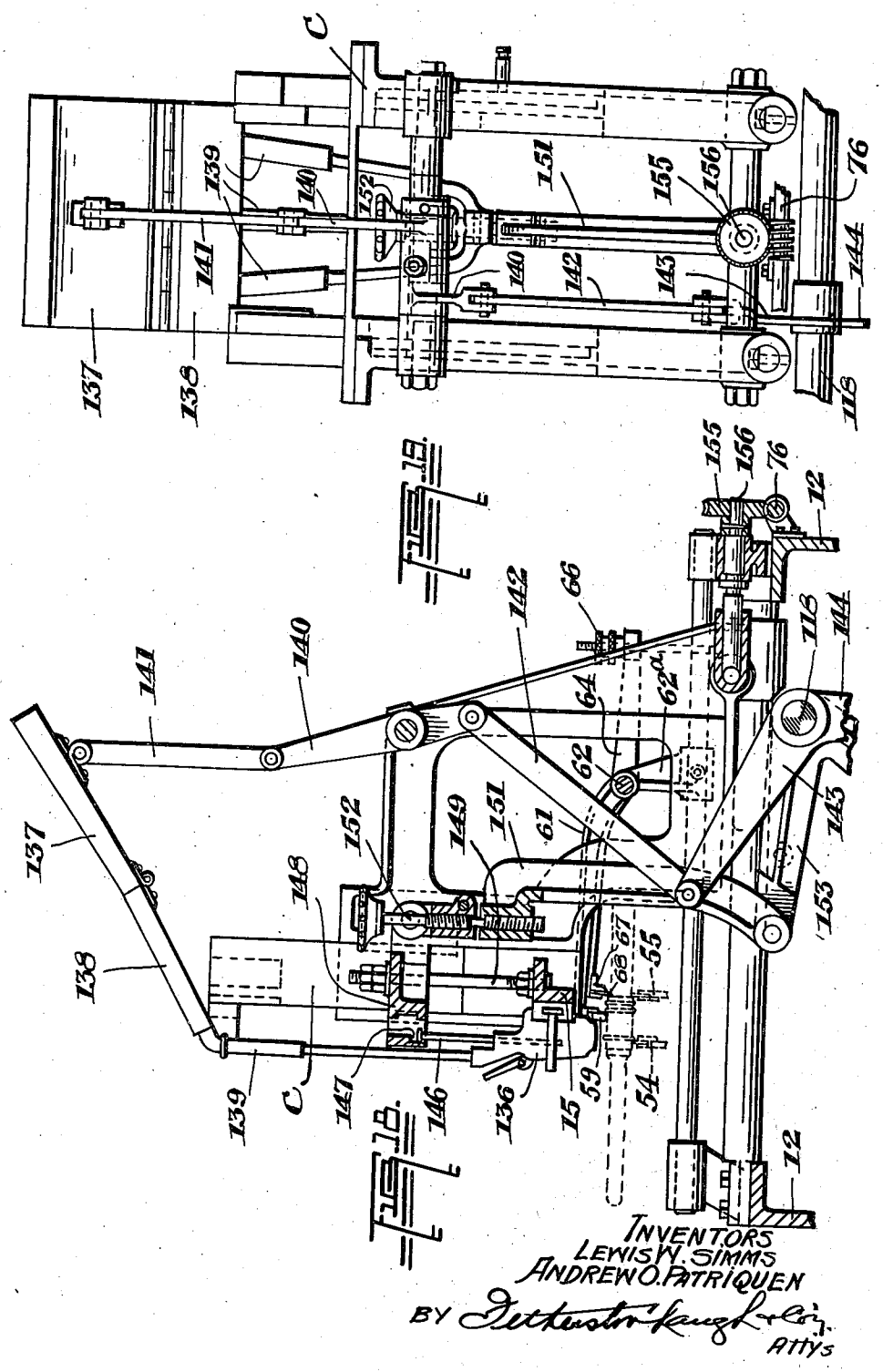
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BRUSH FINISHING MACHINE

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BRUSH FINISHING MACHINE

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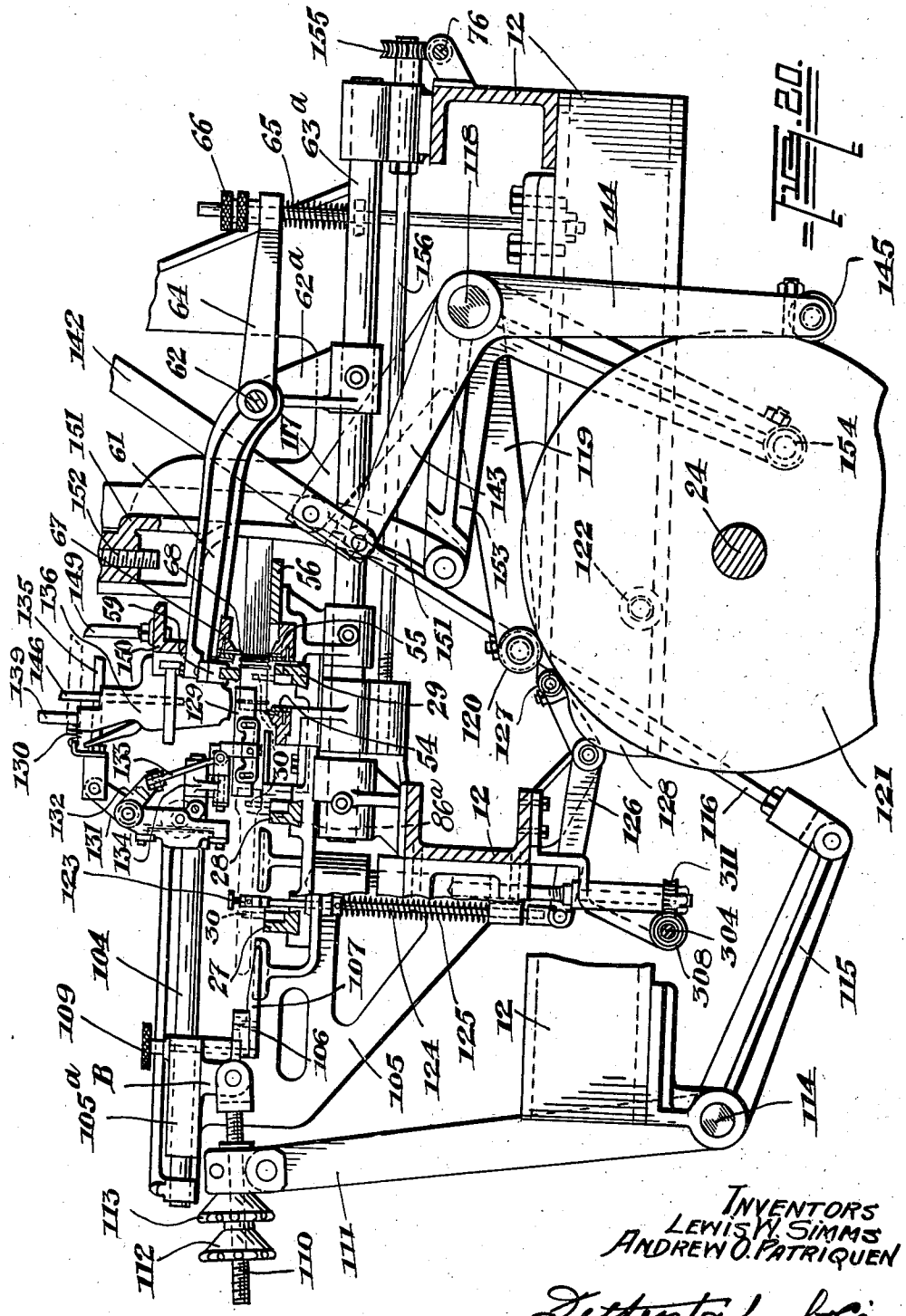


Fig. 20.

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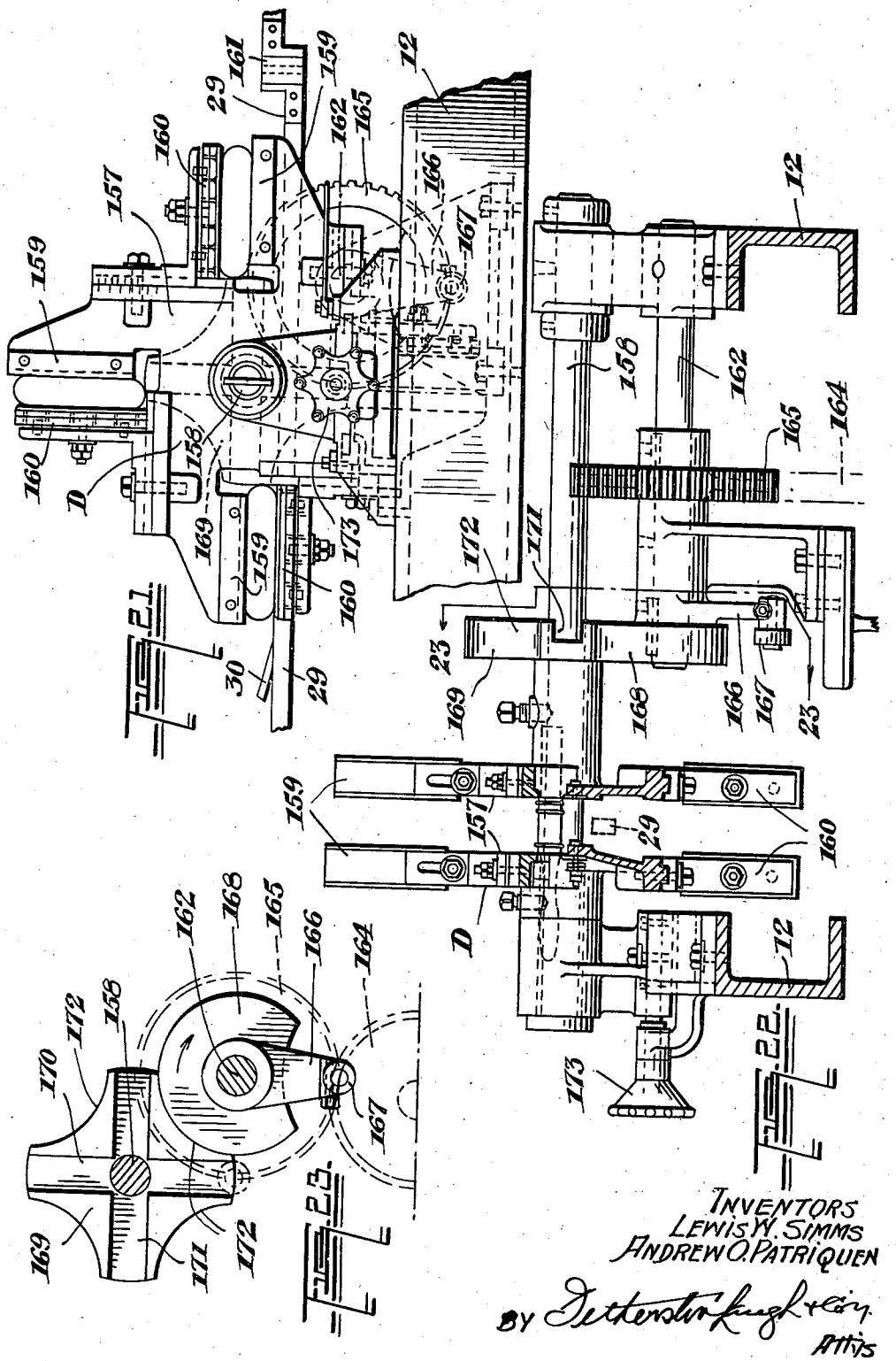
BY Dickerson Langhorne & Co.

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March 10, 1936. L. W. SIMMS ET AL 2,033,259

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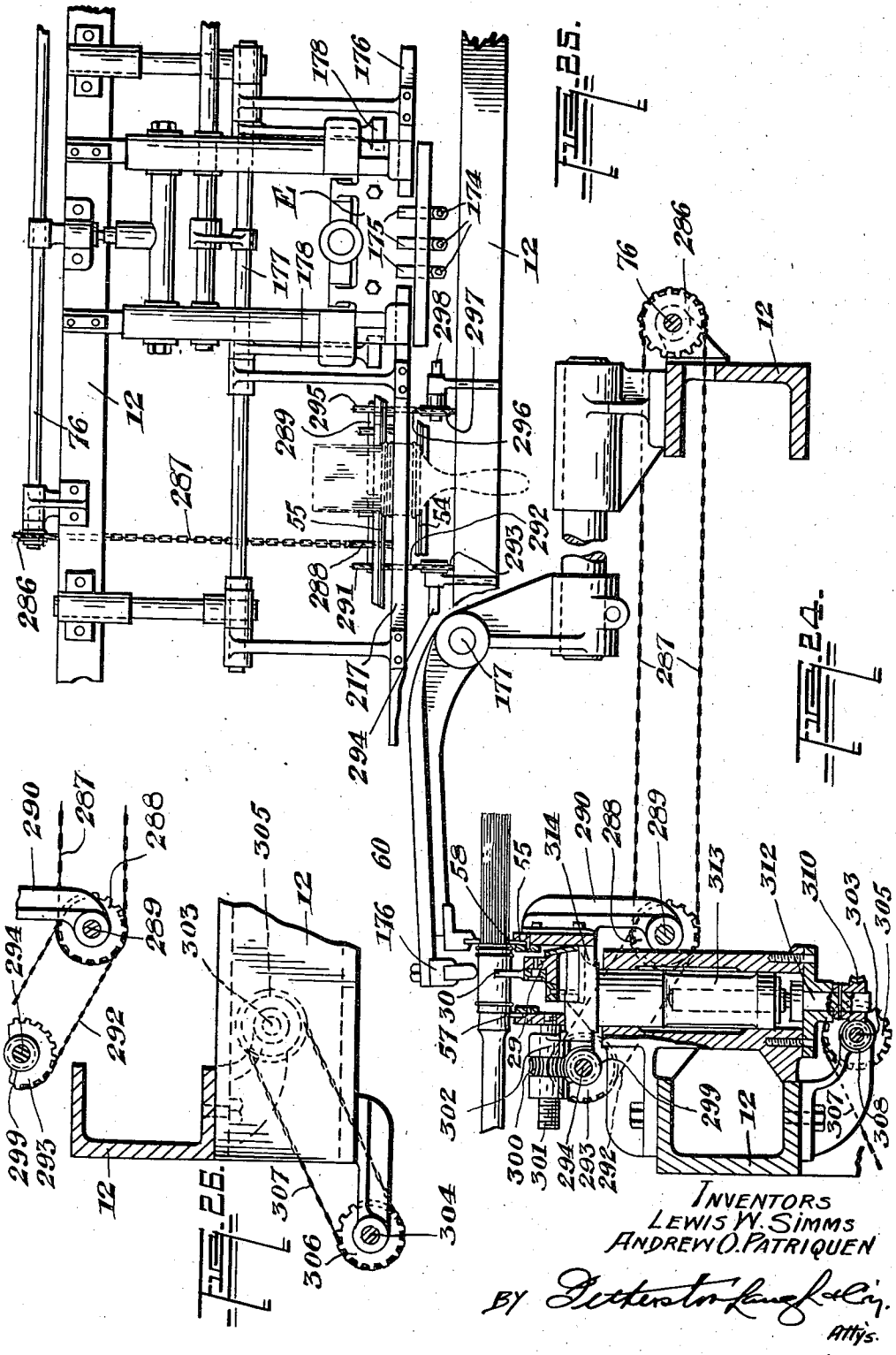
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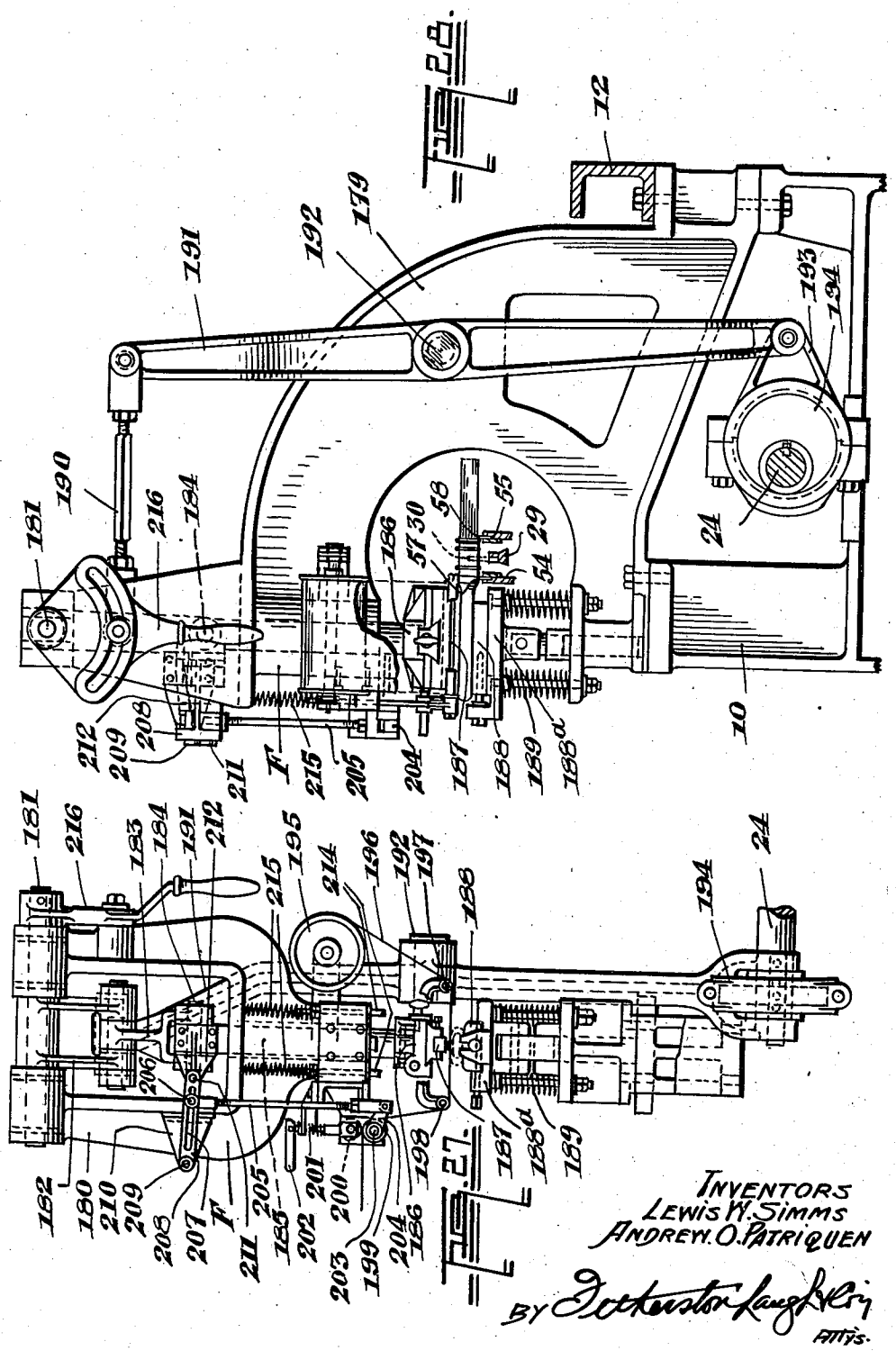


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BRUSH FINISHING MACHINE

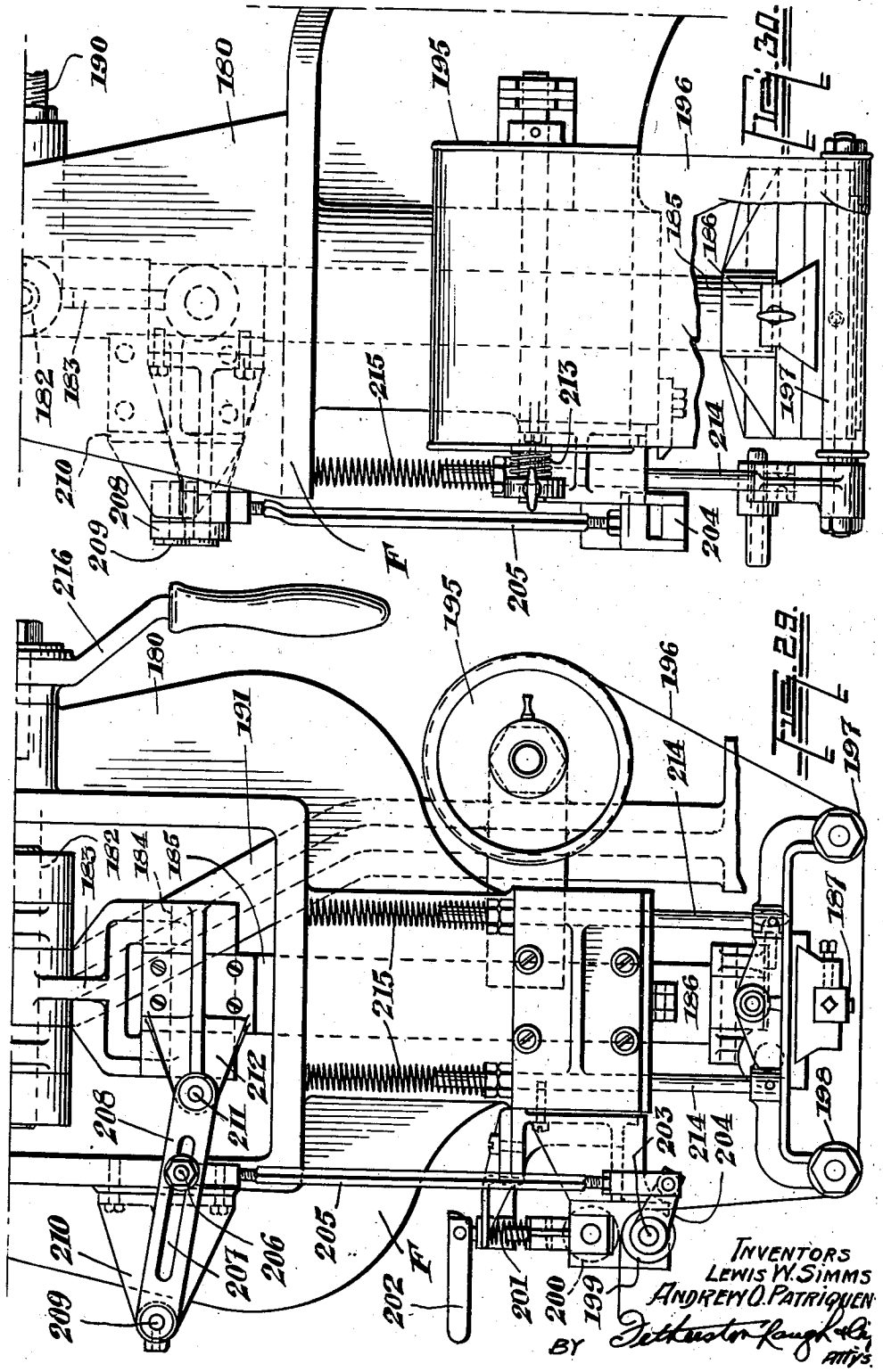
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March 10, 1936. L. W. SIMMS ET AL 2,033,259

BRUSH FINISHING MACHINE

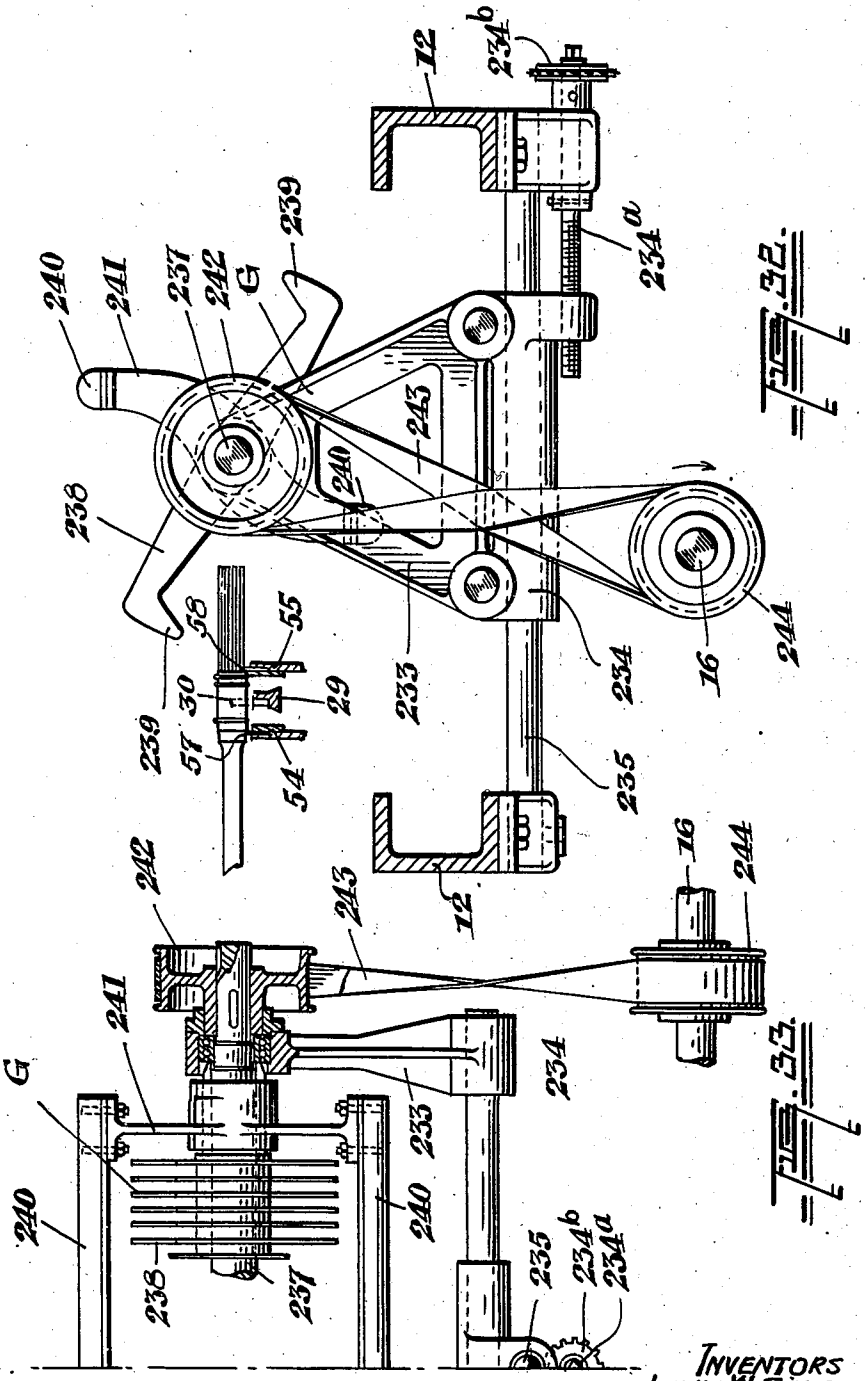
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BRUSH FINISHING MACHINE

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BRUSH FINISHING MACHINE

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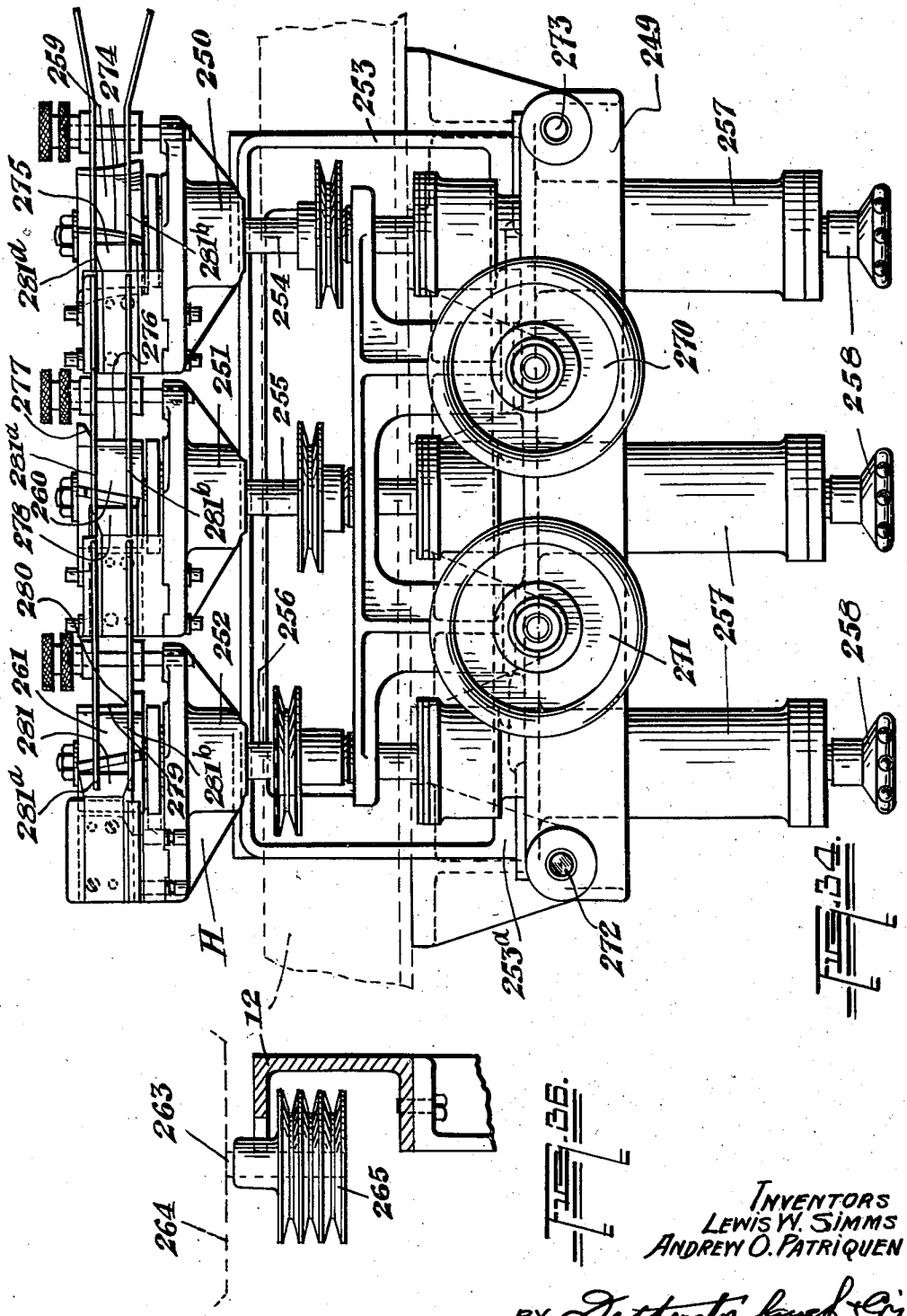


FIG. 34.

FIG. 36.

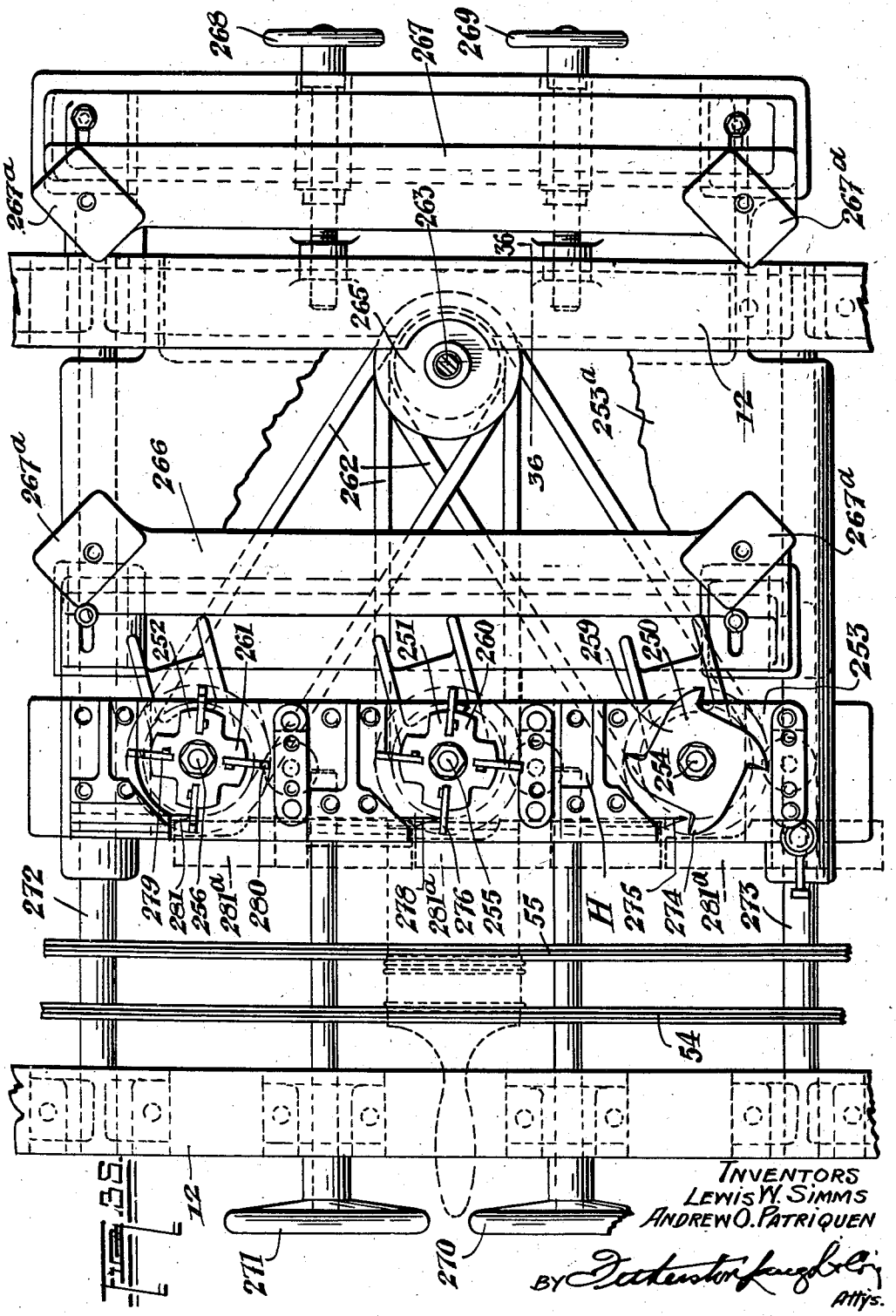
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March 10, 1936. L. W. SIMMS ET AL 2,033,259

BRUSH FINISHING MACHINE

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March 10, 1936. L. W. SIMMS ET AL 2,033,259

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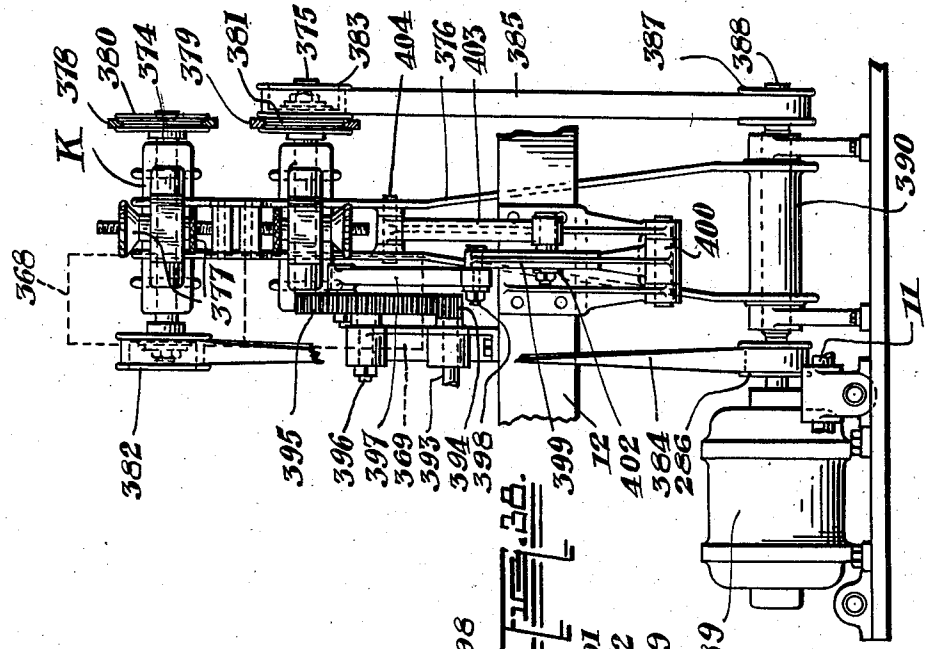


Fig. 56.

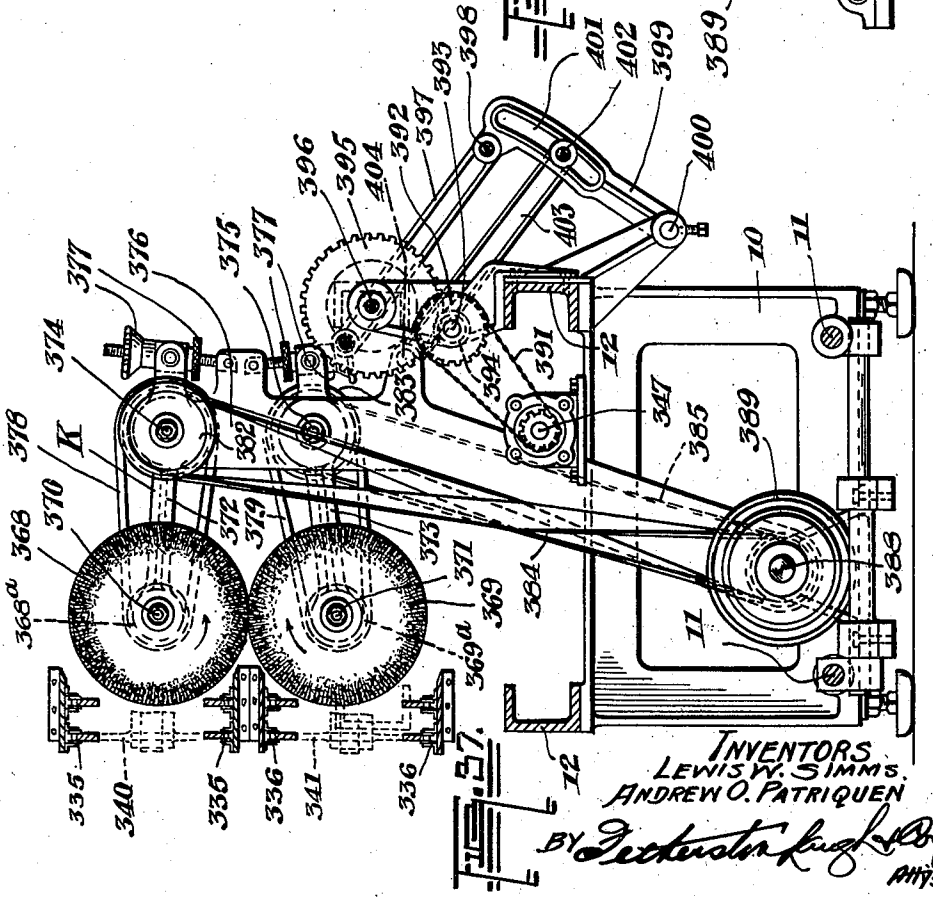


Fig. 57.

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Patented Mar. 10, 1936 2,033,259

UNITED STATES PATENT OFFICE

2,033,259

BRUSH FINISHING MACHINE

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Application March 3, 1934, Serial No. 713,934

51 Claims. (Cl. 300—2)

This invention relates to brush finishing machines designed to assemble and finish brushes of the paint brush type, the invention being concerned with the insertion and securing of handles in brush units (ferrules having bristles cemented therein) as completed by a brush making machine described in our copending United States application Serial No. 639,790.

An object of the invention is to provide a machine of comparatively large capacity which will rapidly assemble together and secure brush units and handles to form a complete brush.

A further object of the invention is to provide an automatically operable mechanism made up of a combination of cooperating units each successively acting to produce finally a high grade paint brush completely finished in all details.

A further object of the invention is to provide a machine of this character which will quickly produce paint brushes of any given size.

A further object of the invention is to provide a machine of this character having mechanism for handling the brush units and handles, that will co-operate to accurately position handles and brush units and insert the former in the latter with precision.

A further object of the invention is to provide for the preliminary processing of the butt of each handle so that it may be relatively smaller than the cross sectional area of the opening in the ferrule of the brush unit.

A further object of the invention is to provide a mechanism for nailing the ferrule to the handle of each brush from both sides with any given number of nails having regard to the size of the brush.

A further object of the invention is to provide a machine of this character which will produce an extremely good grade of product without marking or disfiguring the parts seriously in any way during their passage throughout the numerous units of the machine, with the provision of means for finally polishing bristles and ferrules to perfect the product.

A still further object of the invention is to provide relatively simple and efficient means for holding the handles and brush units as well as brushes in a definite and set position during their travel through the machine.

A still further object of the invention is to provide a combination of elements which, in addition to assembling brush units and handles, will eliminate loose bristles, trim the brush ends to proper length and shape and print a distinguishing mark on the handles during the passage of the brushes through the machine.

With these and other objects in view, the invention briefly comprises a series of co-operating units and associated mechanism acting to assemble brush units and handles to form a completely finished paint brush. The machine includes mechanism for feeding simultaneously handles and brushes into the machine in proper relation to one another, and associated with this mechanism in the preliminary stage of the assembling operation is provided a unit for swaging one end of the handle to reduce sharp edges on the butt so that the area of the end will be relatively smaller than the mouth of the ferrule, whereby it may be introduced clearly to the ferrule of the brush unit when in proper registration therewith.

A succeeding operating unit is provided for receiving each handle so processed to insert the handle forcibly within the waiting mouth of a ferrule held in proper registration and a co-operating unit functions at this point in the form of a nailer for driving nails through one side of the ferrule into the handle thus inserted. Also associated with the feeding mechanism and acting on the thus assembled brush is a unit for reversing each brush after nailing to present the unnailed surface upwards, which is engaged by a further nailing unit for driving a required number of nails through the unnailed side of the brush to provide for a proper and even securing of the handle.

The brushes thus assembled are then acted upon successively by a beating unit for eliminating loose bristles in the brush, a trimming or chiselling unit including means for cutting the end of the brush to a proper uniform length and for shaping the end of the brush. The brushes are then passed to a polishing unit including an arrangement first for buffing and polishing the ferrules and an arrangement for polishing and buffing the bristles to provide finally and rapidly high grade brushes completely finished in every detail.

The combination also includes a printing unit operable during the passage of the brushes through the machine to stamp or impress upon the handle a mark or name to distinguish each different type of brush which may be manufactured in the machine.

The invention willl now be fully outlined in the folllowing description in conjunction with the drawings forming part of this application.

Referring to the drawings:

Figures 1, 1A, 1B and 1C illustrate collectively a front elevation of the complete machine.

Figures 2, 2A, 2B and 2C illustrate collectively a top plan view of the complete machine.

Figure 3 is an end elevation of the right hand end of the machine as viewed in Figure 1.

Figure 4 is an enlarged top plan detail view of the pusher bars, showing the relative position of the dogs of each bar with a handle and brush unit illustrated in dotted lines in their carried position.

Figure 5 is an enlarged detail front elevation of the pusher bars illustrating part of the type of bed on which they are mounted, part of one of the bars being shown in section to illustrate the mounting of the dogs.

Figure 6 is an enlarged detail transverse sectional view showing the pusher bars mounted on the pusher bar bracket and a brush handle and ferrule in dotted lines in relative mounted position on the pusher bars, the adjusting means for the bracket being also illustrated.

Figure 7 is an enlarged sectional detail of the mounting of the pusher bars, showing the guideway in which they slide.

Figure 8 is an enlarged fragmentary plan of the general adjusting mechanism through which various parts of the machine may be adjusted to suit requirements.

Figure 9 is a sectional detail on the line **9—9** of Figure 8 showing the guide rails on which the brushes are moved and held during their passage through the machine, part of the adjustment mechanism being also illustrated.

Figure 10 is a section taken on the line **10—10** of Figure 8, showing the mounting of the adjusting members on the rear channel beam of the frame.

Figure 11 is a side elevation of the hopper for the brush units, also illustrating the relative position of the guide rails and the pressure member for holding the brushes and brush units on the rails, part of the machine frame being shown in section.

Figure 12 is a top plan view of the brush unit hopper.

Figure 13 is a side elevation of the handle hopper, with the following swaging unit illustrated in dotted lines, the guide brackets for holding the handles as well as the pusher bars being illustrated.

Figure 14 is a top plan view of the handle hopper, with the following handle guide brackets illustrated fragmentarily and the brush unit hopper shown in dotted lines.

Figure 15 is a section taken through the forward part of the machine showing the handle swaging mechanism and operating means.

Figure 16 is an enlarged front elevation, partly in section, of Figure 15 which also illustrates the drive.

Figure 17 is a section taken on the line **17—17** of Figure 16.

Figure 18 is an enlarged transverse sectional view taken through the machine just before the first nailer, illustrating part of the driving mechanism for the nailer and the relative position of the nailing chuck to the brush which is shown in dotted lines.

Figure 19 is a rear elevation of Figure 18.

Figure 20 is a further enlarged transverse sectional detail taken at the same point as in the case of Figure 18 but illustrating the lower part of the machine and showing driving cams for the levers actuating the nailer mechanism as well as illustrating the handle insert mechanism and drive therefor.

Figure 21 is an enlarged detail front elevation of the transfer for reversing the brushes during their travel through the machine, the changed formation of the pusher bar at this point being also illustrated.

Figure 22 is an enlarged detail transverse section taken through the machine to illustrate the transfer and its driving mechanism in side elevation, part of the transfer mechanism being shown in section.

Figure 23 is an enlarged detail elevation of the method of rotating the transfer.

Figure 24 is an enlarged transverse sectional detail taken through the machine to illustrate the pressure members and guide rails for the brushes as they pass through the machine, also illustrating mechanism for effecting vertical as well as horizontal adjustment of the handle guide rails.

Figure 25 is a plan view of the detail shown in Figure 24 and also illustrates part of the first nailing unit.

Figure 26 is an enlarged fragmentary detail of the driving connection for the adjustment of the frame parts as illustrated in Figure 24.

Figure 27 is an enlarged complete detail front elevation of the printing mechanism.

Figure 28 is an enlarged side elevation of the printing mechanism, illustrating the drive, part of the frame of the machine being shown in section.

Figure 29 is a fragmentary enlarged detail front elevation of the printing mechanism to illustrate clearly the movable part of the printer including the die head and the paper guides and ejector mechanism.

Figure 30 is a side elevation of Figure 29.

Figure 31 is an enlarged section of one of the chain rail supports showing a paint brush in dotted lines on the guide rails.

Figure 32 is an enlarged section taken through the machine just beyond the second nailer to illustrate the mounting and construction of the beaters.

Figure 33 is a front elevation, partly in section, of the mechanism shown in Figure 32.

Figure 34 is an enlarged detail front elevation of the chisellers mounted on the machine beyond the beaters.

Figure 35 is a plan view of Figure 34 showing the method of drive and the complete means for adjustment.

Figure 36 is a section on the line **36—36** of Figure 35.

Figure 37 is a transverse sectional view taken from the machine just to the right of the bristle polishers illustrating the position of the bristle polishers and the drive therefor.

Figure 38 is a rear elevation of Figure 37, the bristle buffers being illustrated in dotted lines, and,

Figure 39 is a section on the line **38—38** of Figure 1C to illustrate the construction of the frame and sprockets as well as the method of horizontal adjustment.

Referring to the drawings, the various units which cooperate and function together to act continuously upon the brushes passed through the machine are illustrated collectively in Figures 1 to 1C and 2 to 2C.

The handles and brush units are fed into the machine separately and the handles are acted upon first of all by the handle swaging mechanism A. The handles are then passed to the handle insert unit B while, at the same time, the brush units are fed, correspondingly to the

handles, to a position opposite the handle insert B where the handle is driven into the ferrule by the insert mechanism and both the handle and ferrule are then acted upon by the first nailing unit C to unite them. The brushes so formed are then fed to the transfer unit D where they are reversed to be fed to the second nailing unit E where they receive a second series of nails driven through the untouched surface. The pusher bars, reciprocating constantly, then feed the brushes through the printing unit F from which they are passed to the beating unit G where the bristles are acted upon by beaters to remove any loose bristles therefrom. The brushes are then passed on from the beating unit to the chiselling unit H where the bristles are brought into contact with the various chiselling heads to trim the bristles to proper length and shape, whereupon the brushes are transferred by suitable conveyor mechanism to the ferrule polishing unit J where the ferrules are highly polished and, following the polishing of the ferrules, the bristles are caused to pass to the bristle polishing unit K where they are buffed and polished so that when the brushes are ejected from the end of the machine a high grade article in every detail results.

As will readily be understood, a machine embodying these principles could take various forms both in respect to construction and operation of units and associated parts. Therefore, one complete and practical embodiment only of the invention is illustrated in the drawings which will now be described in detail to explain throughout the general construction and operation of this example of the invention.

Frame and drive

The foundation of the machine is a suitable framework made up of supporting castings **10** which are held together in a rigid unit by means of the longitudinally extending brace rods **11**. Upon the cast frame supports (particularly illustrated in Figure 3) channel bars **12** are mounted which in effect form the bed support for the various units and associated mechanism. Mounted on the brace rods **11** is a motor **13** which fully connects as at **14** to a pulley **15** on the main drive shaft **16** which is suitably journalled on the frame, the drive shaft having a normal speed of 1,000 R. P. M. and extending from the midpart of the machine to a point adjacent to its end. The pulley **15** is placed in driving connection with the main drive shaft **16** through suitable clutch mechanism **17** and by means of a suitable clutch control such as the rod **19** which extends completely along the length of the machine the clutch mechanism can be thrown out to stop the various parts from moving, the rod **19** being swingable by means of the hand levers **20** which are spaced along the length of the rod.

Also mounted on the frame is a second shaft **21** which is suitably journalled on the frame and driven through the belt drive **22** from the main drive shaft **16**. The shaft **21**, which has an average speed of 800 R. P. M., is designed to connect with the reducing unit **23** from which the cam shaft **24** is driven by means of the bevel gears **25** and **26**, the cam shaft having a normal speed of 20 R. P. M. The cam shaft is designed to operate the various timed mechanisms including the feeding of the brushes through the machine, while the main drive shaft **16** is designed to operate those parts which must be driven at a relatively high speed, such as the beaters.

Feeding mechanism

A plurality of pusher bars **27**, **28** and **29** (see particularly Figure 2 and Figures 4 and 5) are mounted on the frame to extend longitudinally thereof and in spaced apart parallel relation. These bars are designed to carry the handles and brush units into the machine in proper timed relation and include a plurality of spring pressed dogs **30** spaced along the length of the bars so that the dogs may engage the handles or the ferrules, as the case may be, push them a predetermined distance through the machine and then when the bars move backward the dogs will be depressed by these handles and ferrules, assuming their original position when they have passed them, as referred to more fully hereinafter. These pusher bars are driven as shown in Figure 1 by means of a crank drive. In this connection the bevel gear **31** on the end of the cam shaft **24** meshes with the bevel gear **32** to rotate the shaft **32***a* attached thereto, the crank **32***b* to which is connected the link **33** in turn pivotally connecting with the lever **34** which is designed to oscillate shaft **35**.

Rigidly mounted on shaft **35** are three levers **36**, **37** and **38** (see particularly Figure 3). The upper ends of these levers are bifurcated and are designed pivotally to connected with shanks **39** in turn pivotally connected to the pusher bars as at **40**, the levers **36**, **37** and **38** being adjustably secured on the shanks by means of the adjusting members **41** and the securing and locking members **41***a*.

The pusher bars are mounted on a plurality of transversely extending brackets **42** spaced along part of the length of the machine through which the bars pass, the bracket mounting being particularly illustrated in Figure 6 including a bed plate **43** on which are mounted the guideways **44** through which the pusher bars are designed to slide. As illustrated, the guideways may take the form of spaced apart blocks having one sloped face to provide with the flared base on the pusher bars a sliding dove tail fit. The bed plate is vertically adjustable to meet requirements, as generally referred to further on.

The pusher bars are designed, first of all, to feed the handles and brush units separately into the machine and later arrange for the continuous feeding of the united handles and brush units. To this end a brush unit hopper **45** and a handle hopper **46** are mounted on the frame in a position to extend above certain of the pusher bars.

On considering the brush unit hopper reference to Figure 11 is made. The hopper consists of a plurality of uprights **47** which may be slidably mounted on the connecting rods **48** so that the uprights can be adjusted laterally and longitudinally of the machine to accommodate any length and width of brush unit according to the size of the brush which is being made. As shown in Figure 11, the hopper **45** is mounted from the transverse shaft **49** by means of the single standard **49***a* which terminates in the mounting bracket **49***b*. The hopper includes a guide plate **50** which is positioned to abut the end of the bristles of the brush units, this plate extending from the top to the bottom of the hopper, and co-operates with the guideways **51** on the forward standards **47** which engage and guide the butt end of the ferrule of each brush unit so that the brush units

are dropped from the hopper in a definite predetermined position.

From the transverse shaft 49 brackets 52 and 53 are mounted extending above the shaft and carrying guide rails 54 and 55. These guide rails are designed to extend along the length of the machine through which the pusher bars extend to form a guide and bed for the brush units and brushes, as well as constituting means for maintaining the brushes and brush units in a set feeding position, the guide rails being spaced apart from each other as shown in Figure 11 so that the pusher bar 29 may extend therebetween and the dogs carried by the bar may engage the mid portion of the ferrule. A bar 56 is also carried on bracket 52 upon which the projecting bristles of the brush units may lie to provide for a firm base for the brush units and bristles throughout.

As illustrated in Figure 11, the guide rails include projecting lips 57 and 58 which engage respectively with the forward and rearward edge of each ferrule so that as the brush units are pushed through the machine they cannot swing from their original position and must travel at right angles to the axis of the pusher bars. To maintain the brush units, and likewise the brushes after they have been united with the handles, in proper position on these guide rails, pressure members such as 59 having a projecting bearing member 60 are mounted on the swingable arms 61 from the rod 62 rotatably mounted on the brackets 62*a* in turn carried on the transverse shafts 63 and 63*a*, the arms 61 being spring pressed so as to cause a downward pressure on the ferrule. This is effected through a lever 64 mounted on the rod 62 and under pressure of a coil spring 65, the setting of arms 61 being governed by an adjustment nut 66. The pressure member 59 and carried bearing member are mounted along the machine throughout the extent of the guide rails 54 and 55 to co-operate with the rails in maintaining the brushes in proper position during travel. The pressure members 59 are clearly illustrated in Figures 2 and 2A.

Associated with the pressure members 59 and guide rails 54 and 55 and positioned at a particular point on the machine is a guide rail 67 mounted through arms from rod 62 and provided with a projecting lip 68. This is designed to engage the inner edge of the ferrule similarly to lip 58 on guide rail 55. Thus, any foreign movement of the brush units or brushes is positively prevented and as the pusher bars push them through the machine they will always be in a given position.

In the preliminary feeding of the brush units and handles, each of these pieces is moved separately and in unison, pusher bar 29 functioning to move the brush unit through the contact of its dogs 30 with the ferrules while the pusher bars 27 and 28 are designed jointly to move the handles, as will be clearly shown in the following.

The handle hopper 46 is made up of the upright members 69 and 70, as shown in Figures 13 and 14, which are mounted from the transverse shafts 49 and 63. The uprights 70 are adjustable longitudinally of the machine though not adjustable transversely thereof and are formed with the guideway 71 with which the butt end of the handles are designed to engage so that when the tip of the handles is held in the guideway 72 in the upright 69 the handles are always held in one positive position, being fed to the pusher bars through gravity in this relation. The upright 69 is adjustable transversely of the machine through the medium of the adjustment rod 73 which is screw threaded as at 74 in a portion of the stationary framework of the hopper connecting with the uprights 70. Thus, the upright 69 and its carriage 75 may be moved towards or away from the uprights 70 sliding on the shafts 63 and 49 whereby brush handles of various sizes may be accommodated.

The pushers bars 27 and 28 are designed to pass through the handle hopper as shown in Figure 13 and form the base upon which the lowest handle in the hopper lies, the arrangement being such in the handle hopper as well as in the brush unit hopper that one of the side walls of the guideways 71 and 72 thereof, holding these members in a positive position, terminates a little more than the width of a handle or ferrule from the top of the pusher bars so that when the lowermost handle or ferrule is engaged by the pusher bars it may be moved out of the hopper into the machine without impediment of any kind. The handle hopper and brush unit hopper are both vertically adjustable to accommodate various sizes of handles and ferrules, in addition to the transverse and longitudinal adjustment referred to while adjustment of the guide rails, etc., may be generally effected by a general adjusting shaft 76 which runs along the back of the machine terminating substantially midway thereof, this shaft carrying a plurality of worms each of which is designed to mesh with a worm wheel carried on transverse shafts which are spaced along the length of the machine. The shaft 76 is rotated by means of the control shaft 77 provided with the crank 78 (see Figure 2) which will be described in detail later on.

Extending beyond the handle hopper 46 and associated with the next unit are the guide brackets 79 and 80, positioned above and below the plane of each handle as it lies on the pusher bars and arranged to contact with the handles as they are passed from the hopper to assure that they are not moved inadvertently from their proper position at right angles to the axis of the pusher bars. These brackets co-operate with the dogs 30 on the pusher bar 27 in this respect and will be more fully described shortly in connection with the swaging unit.

To arrange for an even feeding of the handles, it is necessary that the dogs contact with them at two points and, since the edge of the butt of the handle and the edge of the handle proper are spaced from each other transversely of the longitudinal axis of the handle, it is necessary that the dogs on pusher bar 27 be spaced differently to those on bar 28. This is illustrated in Figure 4 where it will be seen that the initial dog 30 on pusher bar 27 is positioned in advance of the initial dog 30 on pusher bar 28. Thus, the handles are moved with the pusher bars, their longitudinal axis being maintained in a position at right angles to the longitudinal axis of the pusher bars. On the other hand, it will be noted that, while the initial dog 30 on pusher bar 29 is positioned rearwardly of that on pusher bar 28, due to the fact that the brush unit hopper is positioned in a corresponding manner having regard to the handle hopper, the second dog on pusher bar 29 is positioned in alignment with the initial one on pusher bar 28 so that as the handles are pushed from their hopper a brush unit is being pushed into the machine in alignment with the handle and, due to the fact

that the pusher bars through the evenly spaced dogs move the handles and brush units at each sliding motion a corresponding distance in the machine, the ferrules and handles up to the point where they are united will always register with one another. Consequently, as a handle is fed from the handle hopper to the swaging unit, a brush unit will be fed along into the machine just opposite to the handle and, similarly, when the handle is fed from the swaging unit to the insert mechanism, the opposite brush unit will be correspondingly moved and in a position ready to receive the handle.

Swaging unit

As the pusher bars move a handle from the handle hopper, the full length of the stroke of the pusher bars brings the handle so fed into the swaging unit which is particularly illustrated in Figures 15 and 16. On referring to Figure 16, it will be seen that the handle so fed is held by the guide brackets 79 and 80 previously referred to, the guide bracket 80 being vertically adjustable through the adjusting member 81 while the guide bracket 79 is spring pressed by means of the lever arm 82 and spring 83, this bracket being adjustable through the adjusting nut 84. Rearwardly of the guide bracket 80 is an end guide 85 which is designed to abut the end of the handle and is adjustable to accommodate various lengths of handles by means of an adjustment member 86. The end of the handle is, therefore, very securely held when it passes into the swaging unit while the butt end of the handle lies upon the pedestal or jaw 87 which has a sloped seat to receive the butt end of the handle and co-operates in the swaging operation.

Directly above the jaw 87 swingably mounted as at 88 on the swingable head 89 is a swaging member or jaw 90 which is designed to engage with the upper surface of the butt end of the handle and, when brought into contact therewith under pressure, will, in co-operation with the jaw 87, swage the end of the handle so that sharp edges are eliminated from the butt of the handle and it will be definitely reduced to a cross sectional area slightly less than that of the mouth of the ferrule. Consequently, when the handle is inserted in the ferrule, there will be no possibility of splinters or the like being pulled up from the handle by the ferrule and the handle will pass into it cleanly.

The head 89 is swingably mounted on the stud shaft 91 which in turn is journalled in the bifurcated end of the bracket 92, extending upwardly from the bed of the machine. The inner end of the head 89 is pivotally connected as at 93 with a coupling member 94 through which the vertical rods 95 extend, being secured by the nuts 96. These vertical rods also extend through the lower bracket 97 and between the coupling 94 and bracket 97 are coil springs 98. The lower ends of the rods 95 connect with a sleeve 99 which is mounted on the eccentric portion 100 of the counter shaft 101 which is driven through the spur gear 102 designed to mesh, as shown in Figure 16, with the gear 103 carried on the cam shaft 24.

It will be apparent, therefore, that once in every revolution the head 89 will be pulled downwardly through the eccentric portion 100 of cam shaft 24 which will cause the swaging member or jaw 90 to contact with the upper face of the butt end or tenon 86*a* of the handle under pressure, thus compressing the extreme end of the butt or tenon 86*a* between the swaging jaws 87 and 90. The coil springs 87 will return the head 89 to normal position between each downward movement so that the handles may be moved into the swinging unit and out of it while the head is up and the head and swaging jaw carried thereby will be caused to moved into contact with the butt of the handle when it is stationary in the swaging unit. During the swaging operation, the brush unit fed into the machine with the handle remains directly opposite on the pusher bar 29 and in alignment with such handle and on the next forward movement of the pusher bars the handle is carried into the insert unit while the ferrule is carried to a corresponding opposite position just below the nailing unit.

Insert unit and first nailer

When the handle is moved to the insert unit it is ready to be moved tranversely in the machine and inserted in the ferrule of the waiting brush unit. At this point the pusher bars 27 and 28 terminate since their only function is to carry the handles into the machine and up to the insert.

The insert unit includes the guide rods 104 which are mounted parallel to one another to extend transversely of the machine from a bracket 105 projecting from the front of the frame. On the guide rods 104 a carriage 105*a* is mounted designed to slide back and forth on these rods. Projecting downwardly from the carriage is the insert member 106 which is formed with a bed 107 preferably sloped at its forward edge as shown and provided with a recess 108 (see Figure 2) which is designed to receive the end of a handle and to hold the handle to some extent during the transverse movement of the insert from moving out of position. By means of the set screw 109 the insert member 106 can be adjusted on the carriage 105*a* to accommodate different sized handles.

A screw threaded shank 110 is pivotally mounted on the carriage 105*a* and the free end of one arm of the angle lever 111 is secured to the shank by means of the securing member 112. By altering the position of this securing member on the shank 110 and operating the adjustment member 113 connected to the lever 111 the throw of the carriage may be adjusted.

The lever 111 is swingably mounted on the shaft 114 which in turn is mounted out in front of the frame and the short arm 115 of this lever is pivotally attached to the connecting rod 116, in turn pivotally connected to one arm of an angle lever 117 which is mounted on a supporting shaft 118. The lower arm 119 of this lever is provided with a roller 120 which is designed to contact with the cam 121 mounted on the cam shaft 24, the roller moving on a cam track formed in the cam so that it will throw inwardly to a position indicated in dotted lines at 122. Thus, when it reaches this position, the upper arm of lever 117 has been drawn downwardly so that through connecting rod 116 the arm 115 of lever 111 will be drawn downwardly and the other arm of this lever will be thrown inwardly towards the machine. This moves the carriage 105*a* along the guide rods 104 and the insert member 106 engages the end of the handle and moves it forcibly in the same direction to drive the butt end or tenon of the handle into the mouth of the waiting ferrule.

While the handle is being acted upon by the insert member, a guide 123 is designed to bear

against its side to hold it in its proper position, the guide 123 thus co-operating with the recess in the insert. Due to the fact, however, that this guide cannot remain in that position continuously, since it would be in the way of the brushes traveling through the machine, it must only be positioned to bear against the side of the handle momentarily during the insert operation. To this end, the guide is mounted on a depressible vertical rod 124 which is spring pressed to normal position by the cam spring 125 and drawn downwardly by means of an angle lever 126 the other end of which carries a roller 127 designed to be actuated by a cam 128 mounted on cam shaft 24. In this way the guide member is drawn downwardly out of the path of the handles for a moment while a handle is being fed to the insert and then released again to abut the side of such handle for the insert operation.

Further guide members are provided between the butt end of the handle and the waiting ferrule in the form of plates 129 which also must be positioned, as shown in Figure 20, for the moment when the handle is being moved into the ferrule and otherwise these plates are moved out of the way. A spring 130 is designed to hold the plates in their downward position, as shown in Figure 20, the spring acting upon lever 131 which, through a lever 132 mounted on the same shaft, is designed to act upon a connecting rod 133 which is connected to the lever 132 through a swivel connection. By means of a further swivel connection the connecting rod 133 connects with the lever 134, which is of the bell crank type, and connects with the mounting of the plates 129. Thus, the spring 130, by pulling forwardly on lever 131, tends to hold the plates in their downward position. However, through the connecting rod 135, which is mounted just below the spring and connected to the lever 131, the lever 131 may be pushed in the opposite direction by suitable cam action at the proper time so that the plates will be raised upwardly out of the path of the travelling handles and brush units.

It is apparent, from considering Figure 20, that as the brush handles are pushed forwardly into the mouth of the waiting ferrule the guide plates 129, which will bear upon the sides of the butt or tenon 86a of the handle as well as the ferrule, will assure that there is positive registration and, when it is considered that the sharp edges of the butt have been swaged, the butt of the handle must slide cleanly into the mouth of the ferrule.

The brush unit awaiting the handle, as is clearly seen in Figure 20, is, as previously explained, resting upon the guide rails 54 and 55 and the ends of the ferrule are firmly held by means of the projecting lips on these guide rails. Likewise, the guide rail 67, positioned above the ferrule carrying the lip 68 which engages the forward upper edge of the ferrule, provides for the firm holding of the brush unit and it will be noted that the guide rail 67 is only positioned on the machine in the area of the insert and nailers, this added guide rail being employed to make certain of the firm holding of the brush unit where it is acted upon forcibly through the insertion of the handle applies a force in the axial direction of the brush unit.

As will be noted in Figure 20, the ferrule of the brush unit projects just below the nailing chucks 136 of the first nailing unit C so that after the handle has been inserted in the ferrule nails can be driven through the ferrule and butt end of the handle to unite them securely.

The nailer mechanism in itself is not new, being of a generally known construction, but is incorporated in combination with the mechanism of the machine to provide for automatic timed nailing in co-operation with the other units and mechanism. The first nailing unit is best illustrated in Figures 18, 19 and 20 and reference is made first to Figure 18 to illustrate the operation. The nailer includes a nail pan 137 which is hingedly mounted upon a head member 138 which carries a plurality of channels registering with the nail tubes 139. Any required number of nail tubes and channels may be employed, having regard to the size of the nailer, the nail tubes communicating with the nailing chucks 136 as illustrated. The nailing chucks are also of known construction.

The nail pan 137 is designed to be oscillated upwardly and downwardly during the operation of the machine and, when in its upward position as shown in Figure 18, nails are fed into the chutes in head 138 so that these chutes always have a continuous supply of nails. The nails from the chutes are admitted to the tubes 139 in timed relation by means of a slide valve arrangement (not shown) which is inserted between the tubes and the chutes and operated in a suitable manner to drop nails into the chuck at the appropriate time. The nail pan is oscillated by means of the lever 140 pivotally connected to the connecting rod 141 which is in turn pivotally connected to the pan, the opposite end of lever 140 being pivotally connected to the connecting rod 142, in turn in pivotal connection with one arm of the angle lever 143, the full lever being more particularly illustrated in Figure 20. The lower arm 144 of this lever carries a roller 145 which is designed to be acted upon by the cam 121, the roller operating on a cam track in this cam. In this way the pan 137 is kept in oscillation during the operation of the machine.

In order to provide for insertion of the nails into the ferrules and tenon of the brush handles, a pin 146 extends within the chuck 136 and is designed to be acted upon by a hammer 147 which is formed in the cross fitting 148. This fitting also connects through the rod 149 and cross head 150 with the nailing chucks 136. Thus, when the fitting 148 is moved downwardly, the chucks are moved to bear against the upper surface of the ferrules and the hammer 147 contacts with the pin 146 to drive the nails forcibly into the ferrules and tenon of the handles. The close contact between the chucks and ferrules prevents the nails from being bent or distorted during the hammering operation.

The fitting 148 connects with the operating connection 151 through the left and right hand screw threaded adjusting rod 152 so that by adjusting the rod 152 the downward stroke of the fitting 148 may be regulated. One arm of an angle lever 153 pivotally connects with the operating connection 151. The opposite arm of this lever, as shown in Figure 20, carries a roller 154 which is designed to work in a cam groove formed in one face of the cam 121. Thus, the fitting 148 and connections are drawn downwardly at the proper moment for nailing and, likewise, these connections are returned to their normal position as soon as nailing has been effected.

As is clearly illustrated in Figure 20, various sizes of handles and brush units may be accommodated and through the general adjustment shaft 76 and the worm wheel 155 the transverse adjustment rod 156 may be rotated so that the guideway 54 may be moved in one direction or the

other to a point registering with the outer end of the ferrule. This adjustment is provided for along the length of the guideway **54**, to be generally referred to hereinafter, corresponding adjustment being provided for accommodating the handles as previously explained.

The operation of the nailer and the insert is very rapid and takes place during the pause between the delivery of a handle and brush unit to their position in the insert and nailer and the return of the pusher bars so that the dogs may engage other ferrules and handles. Upon forward movement again, the brush is moved from the nailer while a new brush unit and handle is positioned in the insert and nailer. The brush proceeding from the nailer passes along the guideways **54** and **55** and below the pressure member **59** positioned on the opposite side of the nailer, as shown in Figure 2, to be delivered to the transfer unit D.

Transfer unit

The transfer unit is illustrated in detail in Figures 21, 22 and 23. As previously explained, the pusher bars **27** and **28** terminate just beyond the first nailer but the pusher bar **29** continues on as the carrying medium for the brushes. The transfer unit consists of two fittings **157** mounted parallel to one another on the transverse shaft **158**, as clearly illustrated in Figure 22. Each fitting is provided with a pair of spaced jaws **159** and **160**, the jaw **160** in each case being adjustable relative to the jaw **159** so that the distance between these jaws may be regulated. Into these jaws the brushes are designed to be forced by the pusher bar **29** which, as shown in Figure 21, runs through the transfer unit between the fittings **157**, the pusher bar at this point being offset as at **161** to accommodate the difference in level between jaws on the opposite edges of the fittings as illustrated in Figure 21, it being noted that while the brushes are introduced to the transfer unit on one level, they are removed therefrom at a lower level.

There are four sets of jaws on the fittings **157** so that when a brush is introduced to the first receiving set of jaws the transfer is rotated so that the brush thus received is moved a quarter of a turn to a position in which the transverse axis of the brush is at right angles to the plane of the pusher bars. In this position a second brush is received by the transfer unit and on the next rotation the first brush referred to is positioned in its original plane but with its faces reversed and it is then ejected from the transfer by the pusher bar **29** and carried further along the machine with the nailed side downward and the unnailed side upward.

The quarter turn rotation of the transfer bars in timed relation to the operation of the pusher bars is effected through the transverse counter shaft **162** which is driven from the cam shaft **24** through a train of gears **163**, **164** and **165** (see Figure 1 and Figure 22). On the inner end of the shaft **162** is mounted a rotatable arm **166** carrying a roller **167** and a sector-like plate and mounted above on the shaft **158** is a grooved plate **169** having the grooves **170** and **171** which intersect each other at right angles, the intersection as shown in Figure 23 occurring in the centre of the plate and on the longitudinal axis of shaft **158**. The edges of the plate between the grooves are curved as at **172** and the circular edge of the plate **168**, as shown in Figure 23, is designed to bear in the curved surface **172** during the major portion of the revolution of shaft **162** so that the plate **169** is held against movement. In this position a brush is being fed from the pusher bars to the waiting jaws of the transfer unit on one side thereof while a brush is being ejected from the jaws on the opposite side of the unit. At the point, however, where a brush has been ejected and one has been received, the roller **167** enters the lower part of groove **170**, as shown in dotted lines in Figure 23, while the circular edge of plate **168** is moving out of engagement with the curved portion **172** of the fittings, and as the shaft continues its rotation the arm **166**, through contact of the roller **167** with the side of the groove it has entered, causes the plate **169** to rotate a quarter of a turn. At each revolution, therefore, of the shaft **162**, the plate **169** makes a quarter turn in timed relation with the feeding of the brushes so that a brush received in the waiting jaws of the plate is, after two turns of this shaft, positioned to discharge from the jaws at an opposite point to where it was received with its unnailed face upward.

The front plate **157** of the transfer unit may be adjusted transversely of its shaft **158** by means of the adjusting member **173** so that, while the rearward plate always remains at the same point having regard to the fact that the outer end of the ferrule of each brush is always in the same position, the front plate is moved to accommodate various sizes of brushes to be manufactured.

Second nailer and printer

The pusher bar **29**, after moving the reversed brush from the transfer unit, carries it along therefrom to the second nailer E, which is of similar construction to the first nailer and includes the nail tubes **174** and chucks **175**. The brushes, before passing to the second nailer, pass under a further pressure member **176** carried on the rod **177** similar to rod **62** which is similarly spring pressed. Also mounted on the rod **177** is a further guide rail **178** which is similar to the guide rail **67** and co-operates in the same manner with the guide rails **54** and **55** to hold the ferrule of the brush from above as well as from below during the second nailing operation when the chucks **174** come into contact with the ferrule through suitable mechanism similar to that described in connection with the first nailing unit. The chucks **174** are brought into contact with the ferrule and nails are driven through the unnailed side so that the handle is firmly and evenly secured in the ferrule with an appropriate number of nails driven in from each side. The brushes are then carried along by the pusher bar **29** to be brought into registry with the printing unit F.

The printer is mounted upon the main channels of the frame, as clearly shown in Figure 28, the printer being illustrated in all detail in Figures 27 to 30. This consists of a frame **179**, the upper part of which is bifurcated as at **180**, the arms of the bifurcated portion carrying the shaft **181**. Between the arms of the bifurcated portion **180** and from the shaft **181** is carried a swingable fitting **182** designed pivotally to connect with the connecting link **183**, in turn pivotally connected as at **184** to the shank **185** of the printing die head **186**. The die head carries the die **187** which is designed to be positioned directly over the platen **188**, the die being above the plane of the handles of the brushes as they pass through the machine while the platen is below, as clearly illustrated in Figure 28. Likewise the die and

platen are positioned to one side of the guide rails 54 and 55 and the pusher bar 29 so that only the handle of the brush is acted upon by the printer. The platen is on a yieldable mounting including the base 188a and coil springs and rods 189.

As will be understood, the die is designed to be moved downwardly to contact with the upper face of the handle under pressure and to perform this function a link 190 is connected to the link 183, the opposite end of link 190 being pivotally connected with an operating lever 191 pivoted midway of its length on the frame 179, as at 192, and at its opposite end with the arm 193 of the eccentric 194. The eccentric is mounted on the cam shaft 24 and, consequently, during rotation of the cam shaft the operating lever 191 will be oscillated to push forwardly on the swingable fitting 182 and connecting link 183, thus forcing the shank 185 and die head downwardly into contact with the waiting handle of the brush and likewise functioning to withdraw it from contact with the handle, the operation from the cam shaft being in timed relation with the feeding.

On the framework 179 to one side of the die shank 185 is mounted a spool or drum 195 which carries a roll of printing paper 196. This is led from the spool or drum 195 over a roller 197 on the frame which is also positioned to one side of the die and then the paper is led from the roller 197 across the face of the die 187 over a corresponding roller 198 on the opposite side of the die to be slotted through between the rollers 199 and 200 which are mounted on the framework. The arrangement of these rollers and the paper is more particularly illustrated in Figures 29 and 30. The roller 200 functions as a tension roller, being spring pressed downwardly by means of the coil spring 201, and may be removed upwardly through the operating lever 202. The roller 199 is preferably a rubber faced friction roller carried by the pin 203 to which is connected the arm 204 through a suitable ratchet arrangement. The arm 204 is in turn pivoted to the connecting link 205 which in turn connects through the pin 206 with the slot 207 in the link 208. This latter link is pivotally mounted as at 209 from a bracket 210 on the frame 179 and pivotally connected as at 211 to a projecting bracket 212 carried on the shank 185 of the die. Consequently, when the die is moved upwardly from contact with a handle through the medium of the link 208, the rod 205 is moved upwardly and arm 204, through its ratchet connection with the pin 203, will cause it to rotate thus drawing the paper 196 slightly across the die to present an unused portion to the die for the next printing operation.

As the die moves downwardly into contact with the handle, it first contacts with the paper and presses this into the handle so that an appropriate marking is made on the handle of the brush to identify it. The drum 195 is tensioned by means of a spring and collar fitting 213 so that the paper will always be under tension and will only move slightly when acted upon by the roller 199.

The die frame includes the rods 214, the ends of which enter the coil springs 215 which extend between these rods and part of the framework 179 so that the die head is always under spring pressure and a smooth and even operation results. The die head can be adjusted to gauge its throw and a suitable tensioning member 216 may be provided acting upon the shaft 181.

After the printing operation, the pusher bar 29 continues to feed the brushes along until they are brought into contact with the beating unit. During the passage of the brushes to the printer, however, and their passage therefrom, they are held on the guide rails 54 and 55 by a further pressure member 217 which is mounted on the rod 177.

Beating unit and associated conveyors

Beyond the end of the pressure member 217 and above the guide rails 54 and 55 a transverse shaft 218 is mounted, being carried by the brackets 219. The shaft 218 is designed to carry a sprocket 220 over which a conveyor chain 221 extends. The opposite end of the conveyor chain, as shown in Figure 1B, is carried on a sprocket 222 mounted on the transverse shaft 223. The chain 221 carries, as illustrated, a plurality of equally spaced projecting fingers 224 and these function in co-operation with the guide rails 54 and 55 continuing on to the machine to carry the brushes through the beating units and through the chiselling units to be described Therefore, at a point adjacent to the shaft 218 the pusher bar 29 terminates since its last function is to carry the brushes to the conveyor chain.

The conveyor chain 221, as illustrated in Figure 1B and Figure 31, is designed to pass over upper and lower chain rails 225 and 226 which are mounted above the bed of the machine on the chain rail brackets 227. These brackets are of curved form as illustrated in Figure 31, being bolted on the forward channel beam of the frame and extending along a length of the machine in spaced apart relation, as illustrated in Figures 1A and 1B. The chain rails are illustrated in detail in Figure 31, the upper rail consisting of a guide bar which the chain is designed to straddle while the lower chain rail is slotted in its lower face to receive a plurality of pressure bars 227a which extend completely along the length of this rail. These pressure bars connect with the vertical pins 228 which are spaced along the length of the bar 226 and have projecting shanks 229 above the rail which register with projecting studs 230 on the upper rail and between the studs 230 and the shanks 229 coil springs 231 extend so that the pins 228 are always under a pressure and, consequently, will serve to hold the brushes in firm contact with the guide rails 54 and 55.

The pressure bars, as will be understood, are mounted in a longitudinal slot formed in the lower face of the chain rail 226, the pressure bars having a projecting track 232 which is straddled by the chain. Thus, the brushes are carried along through this part of the machine and held firmly while, at the same time, the pressure bar arrangement provides for resiliency.

It will be seen, therefore, that the brushes are still held in a similar manner to that prevailing in other parts of the machine described and, in this case, the bristles project clearly from the guide rails 54 and 55 without any other mechanism or framework projecting adjacent thereto. This form of conveying, therefore, leaves the bristles of the brush free to be acted upon by the beating unit, which is illustrated in mounted position on the framework in Figures 2A and 2B while illustrated in detail in Figures 32 and 33.

The beating units are carried on a suitable framework 233 which is carried on sliding brackets 234 mounted on the transverse shafts 235 and 236. From the framework 233 a main horizontal shaft 237 is mounted designed to carry a series of closely spaced parallel blades 238 formed with projecting fingers 239, the blades projecting dia-

metrically opposed to one another on each side of the shaft **237**, as shown in Figure 32. Projecting on each side of the shaft **237** in between the blades and operating alternately with the blades **239** are beater bars **240** carried on the arms **241**. These bars **240** and the fingers and blades **239** and **238** project a distance from the shaft **237** so as to freely contact with the projecting bristles of the brushes as they pass by and the beating units may be adjusted transversely of the frame to contact with the bristles at the right point according to the size of the brush being made.

The beating unit includes two sets of rotating blades and beaters, as clearly shown in Figures 2A and 2B. The first set are rotated by means of the pulley **242** mounted on one end of shaft **237** by means of the belt **243** and pulley **244** which is mounted on the main driving shaft operating at 1,000 R. P. M. The second beater is mounted on a separate shaft **245** which is journalled in the central bearing **246** which also serves shaft **237** and the opposite end of shaft **245** carries the pulley **247** also driven from the main driving shaft through the pulley **248** and the connecting driving belt. It is pointed out, however, that the first beating unit is driven through the twisted belt **243** while the pulley **247** is driven through a straight belt. Consequently, the first beater and the second beater rotate in opposite directions.

In considering the first beater, it is understood that the blades **238** and fingers **239** pass through the bristles projecting adjacent to them while the beater bars **240** contact with the bristles substantially midway of their length and brush past them so that, in effect, a combing and beating operation takes place and loose bristles which may exist in the brush will be combed and beaten out as the blades **238** and beaters **240** contact with the bristles rotating in a counter-clockwise direction. Due to the fact that the beaters are driven at a high speed it will be apparent that the action on the bristles will be brisk and the combined combing and beating will ensure that the loose bristles are removed. This is doubly taken care of by the second beater which rotates in a clockwise direction so that the bristles are given a thorough treatment and when they pass the beating unit nothing but firmly set bristles exist in the brush.

The beating unit may be adjusted towards and away from the bristles of the brushes by means of the screw threaded adjusting rods **234***a* mounted in the main frame and designed to pass through a boss on the brackets **234**. A sprocket **234***b* is mounted on each of the adjusting shafts and placed in driving connection by means of the sprocket chain **234***c*. A suitable projection may be made on one of the adjusting shafts to receive a crank through which the adjusting shafts may be operated in unison to transversely move the beaters as a unit.

Co-operating with the beating unit a suitable hood arrangement may be provided operating in conjunction with a suction fan so that loose bristles removed from the brushes will not be scattered. The conveyor chain **221**, being in continuous movement, carries the brushes on past the beating unit and to the chiselling unit.

Chiselling unit

The chiselling unit is designed to give the ends of the bristles a proper shape and to provide a plurality of bristles of uniform length having regard to their position in the brush. The bristles of the brush, when fed to the chiselling unit, as in the case of the beating unit, project in the same relation so as to be brought into contact with the chiselling heads carried by the chiselling unit.

The chiselling unit includes a suitable framework **249** on which are carried three chisellers **250**, **251** and **252** illustrated in detail in Figures 34 and 35, the mounting in conjunction with the machine being illustrated in Figures 1B and 2B. As seen particularly in Figure 35, the chisellers are carried on a slidable framework **253** including the base plate **253***a* and each is operated through a drive shaft **254**, **255** and **256** on which is mounted a suitable driving pulley. The lower ends of each of these shafts are carried in casings **257** which may constitute part of the framework **253** and, through the adjustment members **258** operating in conjunction with a screw threaded connection, the shafts may be vertically adjusted so that the chiselling heads **259**, **260** and **261** may be placed at proper elevation to contact with the bristles of the brushes.

As seen in Figure 35, each of the shafts **254**, **255** and **256** is driven through the belts **262** from the driving shaft **263**, preferably extending from a separate driving motor **264**, as illustrated in dotted lines in Figure 36, and carrying the grooved drive pulley **265**. The motor is mounted on the beams **266** and **267** which are adjustable on the base plate **253***a*. The beams **266** and **267** carry the motor mounting brackets **267***a* and when the motor is mounted the beams may be moved relative to the base plate **253***a* to tension the drive belts **262** by means of the adjusting members **268** and **269** while the framework **253** and base plate **253***a* carrying the chisellers, beams **266** and **267** and motor **264** are adjusted through the adjusting members **270** and **271**.

The framework **253**, as shown in Figure 35, is slidably mounted on the transverse bars **272** and **273**. Consequently, the chisellers may be moved transversely to accommodate the bristles of various sized brushes. The drive for the chisellers may be taken from the main drive shaft operating at 1,000 R. P. M. but preferably to provide for simple adjustment it is better to drive them by a separate motor as referred to.

The chiselling heads are of particular importance since these gauge the final shape of the end of the bristles. The chiselling head **259** includes the small curved projecting blades **274**, illustrated in plan in Figure 35 and designed to be rotated at high speed to shear off any projecting bristles and make the bristles of each brush of a uniform length. This chiselling head operates in conjunction with the guide knife **275** which projects adjacent to the edge of the blade so that the bristles passing are caught between the knife **275** and the knives **274** of the chiseller head and evenly sheared. They then pass to be acted upon by the chiselling head **260** which is provided with a plurality of blades having a straight edge **276** and an upper inclined edge **277**, the blade **276** functioning in conjunction with the small curved blade **274** of head **259** to shear off the ends of the bristles to practically a straight edge at the tip while the blade **277** functions to bevel off the outer bristles and provide a bevel tip on one side necessary for brushes of this character. The knives **277** and **276** co-operate with the stationary guide knife **278** and a cleanly cut brush end results.

The chiselling head **261** to which the brush is next passed includes the straight edge blades **279** formed with the inclined blade edge **280** at the bottom which provides a formation exactly op-

posite to the construction of chiseller head 260. The blades 279 and 280 operate in conjunction with the stationary guide knife 281 and it will be noted that the blades of chiseller head 261 are inclined in one direction while the blades of head 260 are inclined in the opposite direction. It will be apparent, therefore, that the chiselling of the ends of the bristles is done in a gradual manner as between chiseller heads 259, 260 and 261 so that, while a clean cut chiselled end is provided for the brushes, wear on the knives due to their gradual action is kept to a minimum. The blades of the chiselers may be removably mounted as shown in Figure 35 so that when replacement is necessary it is only a matter of changing blades.

In order to maintain the bristles of each brush from being disturbed from their set position during contact with the chisellers as well as to present a firm and compact brush end to the chisellers, trimmer guides 281*a* and 281*b* are mounted from the framework 253 to extend outwardly therefrom into contact with the bristles adjacent to the brush end being trimmed. These guides extend above and below the projecting bristles being spaced apart according to the thickness of the brush being made so that the tip part of the bristles is held compactly together. The end of the brush, therefore, may be cleanly trimmed by the chisellers.

When the chiselling operation has been completed, the brushes continue to pass from the chisellers under movement of the conveyor chain 221 the drive for which is effected from the main drive shaft, as shown in Figure 1B, by means of a chain 282 extending from a sprocket on the drive shaft 16 to a sprocket 283 mounted on the drive shaft of a reducing unit 284. The brushes are then transferred from the conveyor 221 to the ferrule polishing unit and bristle polishing unit by means of an intermediate conveyor to be referred to hereinafter.

General adjustment of parts

The general adjustment of parts is effected chiefly through the crank 78, transverse shaft 77 and longitudinally extending shaft 76 previously referred to. As has been indicated, the longitudinal shaft 76 extends along the back of the machine and by means of spaced worms operates a series of transverse shafts and other connections through the machine. The general mounting of this shaft 76 and some of the transverse shafts to show the adjusting arrangement is illustrated in detail in Figure 8.

One of the main adjustments necessary throughout the length of the major part of the machine to accommodate various sized brushes is the adjustment of the guide rails. In the right hand end of the machine this is effected generally through a series of transverse shafts 285, one of these being indicated in Figure 20 by the numeral 156 wherein the transverse adjustment of the guide rail 54 is illustrated along the major parts of the machine at the point where the handle is inserted into the brush unit. In Figure 9 a detail illustration of this is shown. This same system applies for the vertical adjustment of the guide rails 54 and 55 as well as for the pusher bars 27, 28 and 29.

On referring to Figure 2A, it will be seen that the inward extremity of shaft 76 carries a sprocket 286 chain connected by a chain 287 (see particularly Figures 2A and 25) to a drive sprocket 288 on the short adjustment operating shaft 289 which, as shown in Figure 24, is supported from the framework of the machine by means of the brackets 290. On one end of the shaft 289 is a sprocket 291 which through the chain 292 drives a sprocket 293 on the shaft 294 (see Figure 26). On the opposite end of the shaft 289 is mounted a sprocket 295 chain connected as at 296 with the sprocket 297 on shaft 298. The shafts 294 and 298 extend along the forward part of the machine, as shown in Figures 1 and 1A, and are designed to form the adjusting means for moving one of the guide rails transversely in the machine so as to set the guide rails a proper distance apart to accommodate a given size of ferrule.

The mode of adjustment is clearly illustrated in Figure 24. In this instance, the shaft 294 similarly to the shaft 298, through a plurality of worms 299 spaced along the length of the shaft, drives the worm wheels 300 mounted on the screw threaded shafts 301. These are carried in the fixed fittings 302 which are internally screw threaded, the shaft 301 in turn connecting with the guide rail 54 so that on rotation of the shaft 294 the guide rail 54 is moved transversely in one direction or the other according to the rotation of the driven shaft since, upon rotation of the worm wheel 300, the screw threaded shaft will axially move through the fittings 302. The shaft 298, as shown in Figure 1A, is relatively short, being provided only with two worms and connecting only with two adjusting constructions on each side of the second nailing unit E, the transverse adjustment of the guide rails along the forward part of the machine, as previously described, being effected through the shafts 285 driven from the main adjustment shaft 76.

The vertical adjustment of the guide rails and the pusher bar brackets is effected through the general adjustment shaft 303 which extends throughout a major portion of the machine and is clearly illustrated in Figure 1A as well as in Figure 24. This shaft also drives a second shaft 304 which extends along the frame approximately from a point adjacent to the transfer D to the forward or right hand end of the machine, the drive being effected through the sprockets 305, 306 and chain 307 (see Figure 1). The shafts 303 and 304 carry a plurality of spaced apart worms 308 and 309 which are designed to mesh with worm wheels 310 and 311 respectively (in the first instance see Figure 24 and in the second Figure 6).

On referring to Figure 24 first of all, it will be seen that the worm wheels 310 are carried on a shaft 312, the upper end of which is screw threaded and fits into the pedestal 313 which is internally screw threaded, the upper end of the pedestal carrying the bed 314 upon which the pusher bar construction 29 and the guide rails 54 and 55 are mounted. Thus, on operation of the shaft 303, the various pedestals 313 extending along the machine and connected with the shaft through the gearing described may be operated in unison to adjust vertically either upward or downward. In this instance it will be noted that the pedestals 313 are slidably carried in the cylindrical housings or brackets 313*a* which are rigidly supported from the machine frame.

In the case of the adjustment through the shaft 304 (see Figure 6), the worm wheels 311 are mounted on the shafts 315 which pass through a suitable bearing bracket 316, being screw threaded in their upper extremity as at 317, and fit into the internally screw threaded pedestals 318 slidably carried in the brackets 319

rigidly supported from the machine frame. The pedestals 318 are connected at their upper ends with the brackets 42 which, as previously described, carry the bed plates 43. In this instance it will be noted that to accommodate the three pusher bars the bed plate 43 is of considerable length and, to support the inner end, a sliding guide rod 320 extends from the bracket 42 and is designed to slide in the bracket fitting 321 mounted on the frame. Thus, simultaneously with the vertical adjustment of the guide rails 54 and 55 the several pusher bars 27, 28 and 29 are adjusted together while in that part of the machine where the pusher bar 29 extends along alone, adjustment is taken care of by smaller brackets, as generally illustrated in Figure 24. In this connection, it is pointed out that the adjustment of the guide rails 54 and 55 and the adjustment of the pusher bars is effected separately through correspondingly similar adjustment brackets, as described, positioned adjacent to one another. The operation of the shafts 303 and 304 may be effected through any suitable operating means such as a crank connection which may be operated through the horizontal shaft 322 driving shaft 304 through the meshing bevel gears 323 (see Figure 3).

In the manner described uniform adjustment of the guide rails transverse bars is provided for throughout those parts of the machine through which they extend.

Ferrule polishing unit

The final processing of the brushes is the polishing of the ferrules and the buffing of the bristles, taken care of by the ferrule polishers J and the bristle buffers K. From the conveying chain 221 the brushes are transferred to these polishing units. This is taken care of by means of any suitable intermediate conveyor which will co-operate to deliver the brushes to the receiving conveyors for carrying them through the two units referred to. One arrangement which may be used is a short pusher bar 324 carrying spring pressed dogs 325, as shown in Figure 1B. This is operated through a swingable lever 326 which is pivoted on the frame as at 327 and connects through the link 328 with the pusher bar 324. Intermediate of the length of the lever 326 is pivoted a connecting rod 329 which in turn is pivotally connected to the eccentric 330 (see Figure 2B) which is mounted on the end of a short transverse shaft 331 (see Figure 1B). The shaft 331 is driven through a chain 332 from the sprocket 333 on the shaft 223 (see Figure 2B) so that shaft 331 is driven in timed relation to the movement of conveyor chain 221, and through rotation of the shaft 331, the eccentric will cause the lever 326 to reciprocate, thus causing a timed reciprocation of pusher bar 324 which receives and feeds the brushes from conveyor 221 by means of the dogs 325. During each reciprocation of the pusher bar 324 the dogs 325, as in the case of the other pusher bars described, will be depressed by the brush ferrules on the backward motion of the bar and will snap upward after passing under a ferrule to engage its side and push it further through the machine on forward motion of the pusher bar.

The pressure member 334 is positioned above the pusher bar 324 to bear against the upper surface of the ferrule in a similar manner to other pressure members described in other parts of the machine and the brushes move upon guide rails in a similar manner, being gripped and held by their ferrules. Thus, the brushes are passed from the conveyor 221 with their handles freely projecting towards the front of the machine and in a position to register with the upper and lower co-operating conveyors 335 and 336 which function to carry the brushes through the ferrule polishing unit and the bristle buffing unit. The conveyors 335 and 336 carry the gripping blocks 337 which are spaced equidistant from one another along the length of the conveyor chains and securely fastened in suitable mountings each connected to the conveyor chains. The gripping blocks are formed of a readily compressible sponge rubber.

The blocks 337 in one chain register with a corresponding block on the opposite chain, as clearly illustrated in Figures 1B and 1C, and as the brushes are fed to these conveyors by the pusher bar 324 the handle projecting therefrom is moved to a position in registry with the blocks so that, when a pair of these blocks come together, they will grip between them the handle of each brush so fed and, holding the handle firmly under pressure, will proceed to carry the brush along, the handle only being contacted with. Therefore, the bristles and ferrule of each brush project from these conveyors towards the rear of the frame, the ferrules to be engaged by the ferrule polishers and the bristles by the bristle buffers.

The conveyor chains 335 and 336 are mounted on the sprockets 338, 339, 340 and 341 (see Figures 1B and 1C). The sprockets 338 and 339 are carried respectively on the shafts 342 and 343 which are mounted from a general superstructure made up of vertical standards 344 and horizontal connecting rods 345, the vertical spacing rods 346 being connected to the rods 345 intermediate the standards 344.

The conveyor is driven through the medium of the shaft 347 which in turn may be driven in any suitable manner, such as from the main shaft 16 or from a separate motor as desired, the shaft 347 connecting through the driving connection 348 with the shaft 349 of a reducing unit 350. From the reducing unit a sprocket 351 drives through the chain 352, the sprockets 353 and 354 mounted on the shafts 355 and 356 respectively which carry the drive sprockets 340 and 341 for the conveyors. In this manner the conveyor is operated to carry the brushes through the polishing and buffing units J and K.

The sprockets 338, 339, 340 and 341 are of special construction having a double set of teeth, as shown in Figure 39, designed to engage with the conveyors which are in the form of two chains held together by the blocks 337, as shown in Figure 2C.

The conveyor chains may be moved towards and away from each other to correspondingly space the blocks vertically from one another, thus to accommodate various sizes of brushes. This is effected through the vertical standards 344 which are rotatably mounted in suitable fittings being provided with the worm wheels 357 operated by worms on the shafts 358 and 359, shaft 358 being the driving shaft. Sprockets are provided on the shafts 358 and 359 connected by sprocket chain 360 so that on operating the shaft 358 to raise or lower the frame the shaft 359 will also be operated. Thus the standards may be adjusted together.

The superstructure may be adjusted trans-

versely of the machine to position the brushes relatively to the buffing and polishing units according to the sizes of the brushes being made by means of the shaft 361 and 361a which are screw threaded and rotate in the main frame, as indicated in Figure 39. These shafts also carry sprockets chain connected by chain 361b so that when the operating shaft 361 is rotated by means of a suitable crank the front standards 344, carrying the conveyor structure, may be moved towards or away from the polishing and buffing devices.

The ferrule buffing members of the ferrule polishing unit consist of a plurality of buffing wheels 362 and 363 positioned in the machine to extend above and below the plane of the brushes being fed, so as to contact with the upper and lower faces of the ferrules. These buffing wheels are mounted on suitable shafts 364 which are journalled in bracket members 365 on an additional framework 366. The additional framework includes the uprights 367 to which the brackets 365 are slidably secured. Thus, the buffing wheels 362 and 363, as clearly illustrated in Figure 1C, may be vertically adjusted relatively to the horizontal plane of the brushes being fed through the machine.

It will be further noted, on referring to Figure 1C, that through adjustment the lower buffing wheel will buff a part of each side of the ferrule as well as the lower surface while the upper buffing wheels will correspondingly buff a part of each side of the ferrule as well as the upper surface so that the ferrules are very thoroughly buffed and it is apparent that if any of the ferrules have been slightly marked during their travel through the machine these markings will be eliminated apart from the fact that the comparatively dull product will be given a fairly high polish to provide, as a result of the various steps of processing, a high grade, completely finished product.

The buffing wheels 362 and 363 may be rotated in any suitable manner preferably by separate electric motors, one for each unit, operating at a speed of about 1,800 R. P. M. After passing from the ferrule polishing unit J, the conveyors 335 and 336 carry the brushes to the bristle buffing unit K.

Bristle buffing unit

The buffing unit K is particularly illustrated in Figure 37 and includes upper and lower buffing wheels 368 and 369 which are positioned in vertical alignment with each other. These buffing wheels are carried from the spindles 370 and 371 on arms 372 and 373 which in turn are mounted on the shafts 374 and 375 carried on the framework 376. The arms 372 and 373 are swingably mounted on the shafts 374 and 375 and, by means of the adjusting members 377, the arms may be swung towards and away from each other to vary the distance of the buffers one to the other. The buffers 368 and 369 are driven at a relatively high speed by means of pulleys 368a and 369a mounted on each shaft 370 and 371 and driven by the belts 378 and 379 from drive pulleys 380 and 381 mounted on each of the shafts 374 and 375. This arrangement is clearly shown in Figures 37 and 38. The shafts 374 and 375 are in turn driven from the pulleys 362 and 363, the former by means of a twisted belt 384 and the latter by means of a straight belt 385, so that the buffing wheels may be caused to rotate in opposite directions. The belts 384 and 385 are driven, as shown in Figure 38, by the pulleys 386 and 387 respectively carried on the drive shaft 388 and driven from a motor 389.

It will be noted in Figure 37 that the buffing wheels rotate in a position just adjacent to the conveyor chains 335 and 336 so that the brushes projecting from the blocks on these chains will be engaged by the buffers. The manner in which they are applied to the bristles consists in an oscillating motion being imparted to the framework so that the buffing wheels 368 and 369 are moved to a position adjacent to the chains and are drawn backwardly from the butt of the bristles to the tip so that through this action, coupled with the constant rotation of the buffing wheels, efficient buffing of the bristles is provided for. In this connection the framework 376 is swingably mounted on the shaft 388 as at 390 so that it may pivot about the shaft to provide for an oscillating movement while the movement is taken care of through the shaft 347 which is chain connected by the chain 391 with the sprocket 392 mounted on the shaft 393. The opposite end of this shaft, as shown in Figure 38, carries a small pinion 394 meshing with the gear 395 on the stub shaft 396. Pivotally mounted on the gear 395 is a connecting arm 397 which pivotally connects, as at 398, with a link 399. This in turn is pivotally mounted as at 400 from a bracket extending from the frame. The link 399 is provided with an arcuate slot 401 in which is designed to slide the roller 402 carried on the end of the connecting link 403. The connecting link 403 is pivotally secured as at 404 to the frame 376 so that on rotation of the shaft 393 the connecting link 397 is caused to reciprocate through the gear 395 imparting reciprocating motion to link 399. This in turn imparts a similar motion to the lever 403 which results in the frame 376 being oscillated backward and forward to contact the buffing wheels with the bristles in a sliding motion.

The buffing wheels 368 and 369, while giving a finishing polish to the bristles, will also polish to some extent the ferrules and thus a completely finished and high grade product is finally ejected from the machine.

General operation

The machine is, first of all, set to receive the particular size of brush which is to be made, the adjusting crank 78 being operated so that through the main adjustment shaft 76 the guide rails 54 and 55 are moved relatively to accommodate accurately the particular size of ferrule. At the same time the guide rails and pusher bars 27, 28 and 29 are elevated to a proper height according to the width of the ferrules, while the hoppers 45 and 46 are likewise adjusted as well as other parts of the machine such as the disposition of the beaters, the chisellers and the polishing units. These latter adjustments are taken through the various adjusting devices associated with each unit.

When the machine is set in motion, the pusher bars 27 and 28 are reciprocated in timed relation, having a definite length of stroke according to the size of the brush being made, this being taken care of by adjusting the pusher bar operating levers in respect to the pusher bars through the adjusting members 41. As soon as the pusher bars commence to reciprocate, the dogs 30 thereon will, in the case of the pusher bars 27 and 28

carry the lowermost handle from the handle hopper to its first position within the swaging unit A while the pusher bar 29 will at the same time carry the lowermost brush unit from the hopper 45 and leave it to rest on the guide rails 54 and 55 at a point opposite to the swaging unit and in registration with the handle.

As the handles and brush units are moved from their respective hoppers, the former will be held from foreign movement by means of the guide brackets 79 and 80 while the latter, apart from being held by the projecting lips on the guide rails, will be positively maintained in position by means of the first pressure member 59. These devices engage firmly with the handles, brush units, and assembled brushes, as the case may be, so that at the completion of the forward stroke of the pusher bars, when the carried members have been moved to a new position, the dogs 30 will depress and slide under them, during return movement of the bars, without moving them from position and will project upwardly on the other side of the handle, ferrule, etc., to engage with their sides during the next forward movement of the bars. This action brings about the intermittent timed feeding of the material through the machine.

As the handle is received in the swaging unit the lower face of the butt end lies upon the pedestal 87 on which is formed the lower swaging jaw constructed with a sloped surface designed to act in the swaging operation while the upper swaging member or jaw 90 positioned just above the pedestal 87 is immediately brought down to contact with the upper face of the butt of the handle, this operation being effected through the eccentric portion 100 of shaft 101 which is operated in timed relation from the cam shaft 24 by gears 102 and 103 (see Figure 15) causing the vertical rods 95, connected with the head 89, to draw it downwardly. The butt end of the handle is, therefore, squeezed under pressure in the swaging unit, the swaging jaws removing sharp projecting edges and leaving the butt end with a relatively smaller cross sectional area than that of the mouth of the corresponding ferrule.

As soon as the swaging operation has been completed, the springs 98 return the upper swaging jaw 90 to its original position, the swage being then ready for the reception of another handle, as the pusher bars 27 and 28 carry the now swaged handle a step further through the machine to the insert unit B. At the same time, the pusher bar 29 acting in unison carries the brush unit through to its next position directly opposite the handle in the insert unit and directly below the chucks 136 of the nailing unit C. As soon as both these members reach this position, the cam 121 causes the lever 117 to move which, through the connecting rod 116, swings the lever 111 inwardly. Thus, the carriage 105a is caused to move inwardly on the guide rods 104 so that the bed 107 of the insert member 106 contacts with the tip of the handle in the insert unit which is then engaged in the recess 108. Just previous to this, however, the cam 128 through the lever 126 has raised the guide member 123 so that it bears against the side of the handle while the guide plates 129 have been brought downwardly to the position illustrated in Figure 20 so that the butt of the handle will bear against the sides of these plates and, thus, as the carriage 105a moves the full length of its inward stroke, the handle is forcibly projected into the mouth of the ferrule, being accurately guided by the members referred to which, when taken with the fact that the butt of the handle has been swaged and is further held at its tip by the walls of recess 108, assures that the handle is inserted cleanly within the ferrule. During this time, the ferrule has been firmly held in its position by the lips on the upper and lower guide rails 67, 54 and 55 respectively which engage with the edges of the ferrule, as well as pressure member 59 bearing upon the upper surface of the ferrule.

At the moment that the handle is inserted within the ferrule, the cam 121 through the lever 119 causes the cross fitting 148 to move downwardly. Consequently, the chucks 136 are moved into firm contact with the upper face of the ferrule and the hammer forces the pins 146 downwardly so that the waiting nail within each chuck, which has been received through the tubes 139, is projected from the chuck through the ferrule and into the butt end of the handle. At the same time during operation the cam 121 through the lever 143 and associated lever and connecting links 140, 141 and 142 causes the pan 137 to oscillate constantly so that a continuous supply of nails for the nailing chucks will be assured (see Figure 18). When this nailing operation has been completed, the cam 121 returns the lever 111 to its original position, the guide member 123 is withdrawn downwardly from the path of the next handle by means of the cam 128 and its associated lever 126, while the guide plates 129 are removed upwardly out of the path of the next handle as well as the next brush unit continuously fed from the magazines by the three pusher bars. At this point, the pusher bars 27 and 28 terminate and the brush now formed is carried along on the guide rails 54 and 55 by means of the pusher bar 29 alone, which carries the brush to the transfer unit D where the pusher bar 29 inserts the brush between the previously adjusted waiting jaws 159 and 160 of the transfer unit which is held stationary during this part of the operation. As soon as a brush has been received, however, within the jaws of the transfer unit, it is caused to move through a quarter of a turn through the arm 166 and co-operating plate member 168 which are constantly rotated from the shaft 162 driven in timed relation with the pusher bars from the cam shaft 24 by means of a train of gears including gear 165 carried by shaft 162.

The arm 166 at the proper moment enters one of the slots 170 and 171 while the circular part of plate 168 is moving out of contact with the curved surface 172 of the plate 169 which is then free to move, the roller of arm 166 withdrawing from the same end of the particular slot either 170 or 171 as the case may be, which is horizontally positioned, when the plate is moved through a quarter turn. Through continuous operation of this character, the brushes held in the jaws are turned over so that the nailed surface is held downwardly and the unnailed surface presented upwardly. As soon as the reversed brush reaches a position to lie again upon the guide rails 54 and 55, the pusher bar 29 ejects it from the jaws of the transfer unit and carries it along to the second nailing unit E where, through a similar operation that has taken place in the first nailing unit, nails are projected through the unnailed surface of the ferrule into the butt end of the handle, thus providing for the complete securing of the handle within the ferrule.

On completion of the second nailing operation, the brushes are then carried to the printer where the handle, as shown in Figure 28, is projected directly below the die 187 carried in the die head

186. Through the eccentric 194, the lever 191 and the associated pivotal connections to the shank 185 of the die head, the die head is caused to move downwardly to press the die 187 through the paper 196 stretched across the face of the die from the rollers 197 and 198 into the handle of the brush, thus to provide it with an appropriate marking. The cam shaft and eccentric 194 along with associated connections then raise the die head upwardly to normal inoperative position and the brush is then carried along past the printer by the pusher bar while, at the same time, as the shank 185 of the die head moves upwardly, the friction roller 199 through its associated ratchet mechanism, the rod 205 and the link 203 pivotally connected to shank 185, cause the paper to be drawn forward from its former position to present an unused surface to the die for the next printing operation.

As soon as the brush has passed the printer, it continues along the guide rails 54 and 55 under movement of the pusher bar 29 until it is finally delivered to the conveyor chain 221 where it is engaged by the fingers 224 thereof and firmly pressed between the conveyor chain and guide rails 54 and 55 by means of the pressure bars 227*a* and is moved along in a continuous feed past the beating unit G, the bristles projecting into the path of the blades 238 and the beater bars 240, as shown in Figure 32, so that in the first beater the blades are caused to pass down continuously between the bristles as the brush moves continuously along while the beater bars are caused to strike the bristles and brush down past them. On the other hand, the second beater, rotating in the opposite direction, passes its blades upwardly through the bristles and the beater bars move upwardly against the bristles so that through these oppositely rotating members setting up an opposed combing and beating action any loose bristles which might exist in the brush are positively removed.

The conveyor chain in continuously feeding the brush along the guide rails 54 and 55 causes it to pass the chiselling unit F where the ends of the projecting bristles are gradually trimmed to a final shape, being preliminarily trimmed by the several blades 274 of the chiseller 259 to bring them to substantially uniform length, the blades contacting with the bristles projecting over the guide knife 275 to shear the projecting ends. The straight edge of the sloped blades 276 of chiseller 260 then contacts with the bristles to assure that they are cut off to a uniform length while the inclined knife edge 277 of these blades serves to chisel off or bevel the upper end edge of the group of bristles, thus to provide them with a natural taper.

The straight edge of the sloped blades 279 of chiseller head 261 co-operates with chiseller 260 to bring about a uniformity of length in the bristles positioned in the middle of the brush while the inclined edge 280 of these blades chisels or bevels off the lower end edge of the brush so that the bristles in the middle of the brush are of uniform length and the outermost bristles are cut to form a brush end of wedge-like formation.

The trimmer guides 281*a* and 281*b* function during the passage of the brush past the several chisellers to contact with the upper and lower surface of the brush to present a firm and compact brush end to the chiseller heads providing for a cleanly trimmed brush end.

The separate motor as referred to, if such is used, functions to drive all three chisellers at a rapid rate necessary to perform this function, while through a gradual processing of the brushes by means of a plurality of rapidly rotating chisellers, the possibility of leaving untrimmed bristles is avoided.

At the completion of the chiselling operation, the brush is transferred from the conveyor or pusher bar 324 in a step by step motion to the conveyors 335 and 336 where the freely projecting handle is gripped by the spaced co-operating blocks 335 and 336 of these conveyors and is carried along thereby. The ferrule, now freely projecting to one side of these conveyors, moves between and contacts with the upper and lower sets of buffing wheels 362 and 363 which co-operate to polish the upper and lower surface of the ferrule as well as the sides thereof, the buffers being driven at a rapid rate of speed through separate motors or other driving means as described. During the polishing, the ferrule is held firmly to meet the buffers by means of the blocks 337 since they contact under firm pressure with the major portion of the handle.

The brush, still gripped by the co-operating blocks 337 of conveyors 335 and 336, is then brought into contact with the bristle buffing unit K where the bristles are passed between the oppositely rotating buffers 368 and 369 operating at a high rate of speed through the motor 389, the buffers being moved above and below the projecting bristles and drawn so as to pass over them, moving in their axial direction, while rotating, this operation continuing as each brush passes along to be finally ejected from the conveyors as a completely finished high grade product. As explained, the bristle buffing unit K is reciprocated back and forward to fulfill the necessary operation by means of the connecting arm 396 which is reciprocated by the gear 395 operated through shaft 393 which is in turn driven from the shaft 347, the arm 396 imparting an oscillating motion to the swingable link 399 connected through link 403 with the frame of the bristle buffing unit K. The buffing wheels 368 and 369 are at the same time kept in constant rotation through the driving belt connections 384 and 385 from shaft 388 operated by motor 389 and the pulleys 382 and 383 which are in operative connection with the shafts 370 and 371 carrying the buffing wheels.

The finished brush finally ejected from the buffing unit K may be received on any suitable receiving tray or the like to be counted and stacked for shipment.

Various modifications may be made in the invention without departing from the spirit thereof or the scope of the claims and, therefore, the exact forms shown are to be taken as illustrative only and not in a limiting sense, and we desire that only such limitations shall be placed thereon as are imposed by the prior art or are specifically set forth in the appended claims.

We claim:—

1. A brush finishing machine comprising means for synchronously feeding brush units and handles into the machine, means for inserting said handles in said brush units, and means for nailing said brush units to said handles.

2. A brush finishing machine comprising means for synchronously feeding brush units and handles into the machine, means for inserting said handles in said brush units, and co-operating means for nailing said brush units to said handles from both sides.

3. A brush finishing machine comprising means for feeding brush units and handles into the machine, means for inserting said handles in said brush units, means for nailing said brush units to said handles, and means for polishing the ferrules of the brush units after they have been secured to said handles.

4. A brush finishing machine comprising means for synchronously feeding brush units and handles into the machine, means for inserting said handles in said brush units, means for nailing said brush units to said handles, means for removing loose bristles from said brushes, and means for trimming the ends of the bristles of each brush to a final and uniform shape.

5. A brush finishing machine comprising means for feeding brush units and handles into the machine, means for inserting said handles in said brush units, means for nailing said brush units to said handles, means for removing loose bristles from said brushes, means for trimming the ends of the bristles of each brush to a final uniform shape, means for polishing the ferrules of each brush, and means for polishing the bristles.

6. A brush finishing machine comprising means for synchronously feeding brush units and handles into the machine, said handles having tenons to engage with brush units and cooperating means for automatically inserting and securing the tenons of said handles in said brush units.

7. A brush finishing machine comprising means for synchronously feeding brush units and handles into the machine, said handles having tenons to engage with brush units, means for automatically inserting and securing the tenons of said handles in said brush units, and means for maintaining said handles and brush units in a set relative position during the feeding.

8. A brush finishing machine comprising means for synchronously feeding brush units and handles into the machine, said handles having tenons to engage with brush units, means for automatically inserting and securing the tenons of said handles in said brush units, and means for adjusting the machine to accommodate brush units and handles of a relative given size.

9. A brush finishing machine comprising means for synchronously feeding a brush unit and handle into the machine, said handle having a tenon to engage with a brush unit and cooperating means for automatically inserting and securing the tenon of said handle in said brush unit.

10. A brush finishing machine comprising means for feeding brush units and handles into the machine to a nailing unit and an insert unit respectively, means acting upon the insert unit when a handle is received to project said handle into the brush unit, and means for operating the nailing unit on insertion of the handle for projecting nails through said brush unit into said handle to secure the handle in the brush unit.

11. A brush finishing machine comprising means for feeding brush units and handles into the machine to a nailing unit and an insert unit respectively, means acting upon the insert unit when a handle is received to project said handle into the brush unit, means for guiding the handle into the brush unit, and means for operating the nailing unit on insertion of the handle for projecting nails through said brush unit into said handle to secure the handle in the brush unit.

12. A brush finishing machine comprising means for feeding brush units and handles into the machine to a nailing unit and an insert unit respectively, means acting upon the insert unit when a handle is received to project said handle into the brush unit, means for holding the brush unit against axial movement, and means for operating the nailing unit on insertion of the handle for projecting nails through said brush unit into said handle to secure the handle in the brush unit.

13. A brush finishing machine comprising means for feeding brush units and handles into the machine, means for automatically inserting and securing said handles in said brush units to form a brush, means for holding said brushes with their handles freely projecting, means for engaging the projecting handles, and co-operating means including a printing die for projecting said die against one face of the handle to mark it.

14. In a brush finishing machine, means for synchronously feeding a handle and brush unit relatively to one another, said handle having a tenon to engage with the brush unit, means for inserting the tenon of said handle within the brush unit, means for guiding the handle during its feeding to the brush unit, and means for securing the tenon of said handle in the brush unit.

15. In a brush finishing machine, means for synchronously feeding a handle and brush unit relatively to one another, said handle having a tenon to engage with the brush unit, means for holding the brush unit against axial displacement, means for inserting the tenon of said handle within the brush unit, and cooperating means for securing the tenon of said handle in the brush unit.

16. In a brush finishing machine, means for synchronously feeding a handle and brush unit relatively to one another, said handle having a tenon to engage with the brush unit, means for holding the brush unit against axial displacement, means for axially moving the handle towards the brush unit, means for guiding the tenon of said handle into the brush unit, and cooperating means for securing the tenon of said handle in the brush unit.

17. A brush finishing machine comprising means for synchronously feeding brush units and handles into the machine, means for automatically inserting and securing said handles in said brush units to form brushes, and means for finally beating and combing said brushes to remove loose bristles therefrom including a beating unit having a plurality of projecting blades and alternately disposed beating bars brought into rapid contact with the bristles.

18. A brush finishing machine comprising means for feeding brush units and handles into the machine, means for automatically securing and inserting said handles in said brush units to form brushes, and means for removing loose bristles from said brushes including a rotary member having blades and beating bars designed to contact with the bristles and means for rotating said member at a rapid rate of speed.

19. A brush finishing machine comprising means for feeding brush units and handles into the machine, means for automatically securing and inserting said handles in said brush units to form brushes, and means for removing loose bristles from said brushes including oppositely rotating beating members designed to contact

with the bristles and means for rotating said beating members at a rapid rate of speed.

20. A brush finishing machine comprising means for feeding brush units and handles into the machine, means for inserting said handles in said brush units to form brushes, means for projecting nails through said brush units into said handles from one side, means for reversing the brushes, and means for projecting nails through the brush units into the handles from the opposite side.

21. A brush finishing machine comprising means for feeding brush units and handles into the machine relatively to one another, said handles having a tenon to engage with said brush units and means for inserting said handles in said brush units including a slidable carriage to engage the handles, means for holding a brush unit opposed to said carriage, and means for moving said carriage towards said brush unit to insert the tenon of said handle therein.

22. A brush finishing machine comprising means for feeding brush units and handles into the machine relatively to one another and means for inserting said handles in said brush units including a slidable carriage to engage the handles, means for holding a brush unit opposed to said carriage, means for moving said carriage towards said brush unit to insert said handle therein, and means for adjusting the throw of said carriage according to the size of the handle being acted upon.

23. A brush finishing machine comprising means for feeding brush units and handles into the machine relatively to one another, means for inserting and securing said handles in said brush units including a swingable lever, a slidable carriage connected thereto to engage handles, a handle engaging device carried by said carriage, means for holding a brush unit opposed to said carriage, and means for moving said carriage towards said brush unit to insert said handle therein.

24. In a brush finishing machine, means for positioning a handle and brush unit relatively to one another, said handle having a tenon to engage with the brush unit, means for holding the brush unit against displacement, a slidable carriage to engage the handle, and means for moving said carriage towards said brush unit to insert the tenon of said handle therein.

25. In a brush finishing machine, means for positioning a handle and a brush unit relatively to one another, said handle having a tenon to engage with the brush unit, means for holding the brush unit against displacement, a slidable carriage to engage the handle having a handle engaging device, means for guiding the handle, and means for moving said carriage towards said brush unit to insert the tenon of said handle therein.

26. In a brush finishing machine, means for positioning a handle and brush unit relatively to one another, said handle having a tenon to engage with the brush unit, means for holding the brush unit against displacement, a slidable carriage to engage the handle, means for moving said carriage towards said brush unit to insert the tenon of said handle therein, and co-operating means for securing the tenon of said handle within the brush unit.

27. A brush finishing machine comprising means for feeding brush units and handles into the machine, means for inserting the handles in said brush units, and co-operating means for securing said handles in the brush units including nailing chucks, means for engaging said chucks with the ferrule of each brush unit and means for projecting nails fed to said chucks through said ferrules into the handles.

28. A brush finishing machine comprising means for feeding brush units and handles into the machine to a nailing unit and an insert unit respectively, a slidable carriage in the insert unit to engage the handles, means for holding each brush unit momentarily in said nailing unit, means for moving said carriage towards said brush unit to insert a handle therein, and means for nailing said handle within said brush unit including chucks on the nailing unit and co-operating means for projecting nails fed to said chucks through said brush unit and into the handle.

29. A brush finishing machine comprising means for feeding brush units and handles into the machine, means for inserting said handles in said brush units, means for nailing said brush units to said handles to form brushes, means for holding said brushes with their handles freely projecting, means for engaging and marking the handles, means for trimming the ends of the bristles of each brush to a final uniform shape, means for polishing the ferrules of each brush, and means for polishing the bristles.

30. A brush finishing machine comprising means for feeding brush units and handles into the machine, means for inserting said handles in said brush units, means for nailing said brush units to said handles to form brushes, means for holding said brushes with their handles freely projecting, means for engaging and marking the handles, means for removing loose bristles from said brushes, means for trimming the ends of the bristles of each brush to a final uniform shape, means for polishing the ferrules of each brush, and means for polishing the bristles.

31. A brush finishing machine comprising means for feeding brush units and handles into the machine, means for inserting said handles in said brush units, means for nailing said brush units to said handles to form brushes, means for holding said brushes with their handles freely projecting, means for engaging and marking the handles, and means for trimming the ends of the bristles of each brush to a final uniform shape.

32. A brush finishing machine comprising means for feeding brush units and handles into the machine, means for inserting said handles in said brush units, means for nailing said brush units to said handles to form brushes, and means for trimming the ends of the bristles of each brush to a final uniform shape.

33. A brush finishing machine comprising a brush unit hopper and a handle hopper designed to feed brush units and handles under gravity, means for feeding brush units and handles into the machine from said hoppers, and means for inserting and securing said handles in said brush units.

34. A brush finishing machine comprising a handle hopper and a brush unit hopper, means for feeding brush units and handles from said hoppers into the machine, means for inserting said handles in said brush units, means for nailing said brush units to said handles to form brushes, a beating unit, means for operating said beating unit to contact forcibly with the bristles of each brush, a chiselling unit, and cooperating means for operating said chiselling unit to trim the brush ends to a final uniform shape.

35. A brush finishing machine comprising a

handle hopper and a brush unit hopper, means for feeding brush units and handles from said hoppers into the machine, means for inserting said handles in said brush units, means for nailing said brush units to said handles to form brushes, a beating unit, means for operating said beating unit to contact forcibly with the bristles of each brush, a chiselling unit, cooperating means for operating said chiselling unit to trim the brush ends to a final uniform shape, a ferrule polishing unit and a bristle polishing unit, means for carrying said brushes through said ferrule polishing and bristle polishing units with their ferrules and bristles freely projecting to be engaged thereby, and co-operating means for operating the ferrule and bristle polishing units.

36. In a brush finishing machine including means for uniting brush units and handles to form brushes, means for trimming the ends of the brushes to a final uniform shape including a plurality of chiselling units successively acting on the bristles, said chiselling units having cutting edges positioned to engage with a portion of the sides and ends of the bristles of the brush units whereby a uniform substantially wedge-shaped brush tip is gradually provided.

37. In a brush finishing machine including means for uniting brush units and handles to form brushes, means for gradually trimming the bristles to a final uniform shape, and means for holding the bristles compactly from each side of the brush unit during the trimming operation.

38. In a brush finishing machine including means for uniting brush units and handles to form brushes, means for trimming the bristles to a final uniform shape including a plurality of rotatable chiseller heads having blades to engage the sides and end of the brush, the blades of each head being differently constructed to act successively on the bristles whereby a uniform substantially wedge shaped brush tip is gradually provided.

39. In a brush finishing machine including means for uniting brush units and handles to form brushes, means for trimming the bristles to a final uniform shape including a plurality of rotatable chiseller heads having blades to engage the brush ends, the blades of each head being differently constructed to act successively on the bristles whereby a uniform brush tip is gradually provided, and means for compactly holding the bristles during engagement with the chiseller heads.

40. The device as claimed in claim 39, in which the means for compactly holding the bristles comprise trimmer guide rails positioned above and below each other and spaced to receive a given thickness of brush.

41. In a brush finishing machine including means for uniting brush units and handles to form brushes, means for gradually trimming the brush ends to a final uniform shape including a plurality of rotatable chiselling heads each having a plurality of blades, the blades of one chiselling head being shaped to trim the bristles to substantially uniform length and the blades of another chiseller head including an inclined blade structure to bevel off the tip of the brush.

42. In a brush finishing machine including means for uniting brush units and handles to form brushes, means for gradually trimming the brush ends to a final uniform shape including a plurality of rotatable chiselling heads each having a plurality of blades, the blades of one chiselling head being shaped to trim the bristles to substantially uniform length and the blades of another chiseller head including an inclined blade structure to bevel off the tip of the brush, and trimmer guide rails positioned above and below each other adjacent to said chiseller heads to hold the ends of the bristles compactly during contact with the chiseller heads.

43. In a brush finishing machine including means for uniting brush units and handles to form brushes, means for polishing the ferrules including spaced apart rotatable buffing wheels positioned to engage the upper and lower surface of the ferrule, and means for carrying said brushes into contact with said buffing wheels with the ferrule clearly projecting in the path of said wheels.

44. The device as claimed in claim 43, in which the buffing wheels are vertically adjustable from one another.

45. The device as claimed in claim 43, in which the means for carrying the brushes into contact with the buffing wheels with their ferrules clearly projecting includes co-operating endless conveyors having corresponding compressible blocks to engage and grip the handles of said brushes.

46. In a brush finishing machine including means for uniting brush units and handles to form brushes, means for polishing the bristles of said brushes including spaced rotatable buffing wheels, means for carrying said brushes into contact with said buffing wheels with the bristles clearly projecting in the path of said buffing wheels, and means for oscillating the rotating buffing wheels to move over said bristles in their axial direction.

47. The device as claimed in claim 46, in which the means for carrying the brushes into contact with the buffing wheels with their ferrules clearly projecting includes co-operating endless conveyors having corresponding compressible blocks to engage and grip the handles of said brushes.

48. The device as claimed in claim 46, in which the buffing wheels are rotated in opposite directions to one another.

49. A brush finishing machine comprising a handle hopper and a brush unit hopper, means for intermittently feeding brush units and handles from said hoppers into the machine, means for inserting said handles in said brush units, means for nailing said brush units to said handles to form brushes, a beating unit, means for operating said beating unit to contact forcibly with the bristles of each brush, a chiselling unit, co-operating means for operating said chiselling unit to trim the brush ends to a final uniform shape, and means for constantly feeding brushes past said beating and chiselling units.

50. A brush finishing machine comprising a handle hopper and a brush unit hopper, means for intermittently feeding brush units and handles from said hoppers into the machine, means for inserting said handles in said brush units, means for nailing said brush units to said handles to form brushes, a beating unit, means for operating said beating unit to contact forcibly with the bristles of each brush, a chiselling unit, co-operating means for operating said chiselling unit to trim the brush ends to a final uniform shape, means for constantly feeding brushes past said beating and chiselling units, a ferrule polishing unit and a bristle polishing unit, means for operating each of said units to contact respectively with the ferrules and bristles of each brush, and means for constantly feeding said brushes

past said ferrule polishing and bristle polishing units.

51. A brush finishing machine comprising means for intermittently feeding brush units and handles into the machine, means for inserting and securing said handles in said brush units to form brushes, means for engaging said brushes through the ferrules to maintain them in a set position during feeding, a beating unit and a chiselling unit, means for constantly feeding the brushes past said beating and chiselling units, ferrule polishing and bristle polishing units, and means contacting with the handles of the brushes for constantly feeding said brushes through the ferrule polishing and bristle polishing units.

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