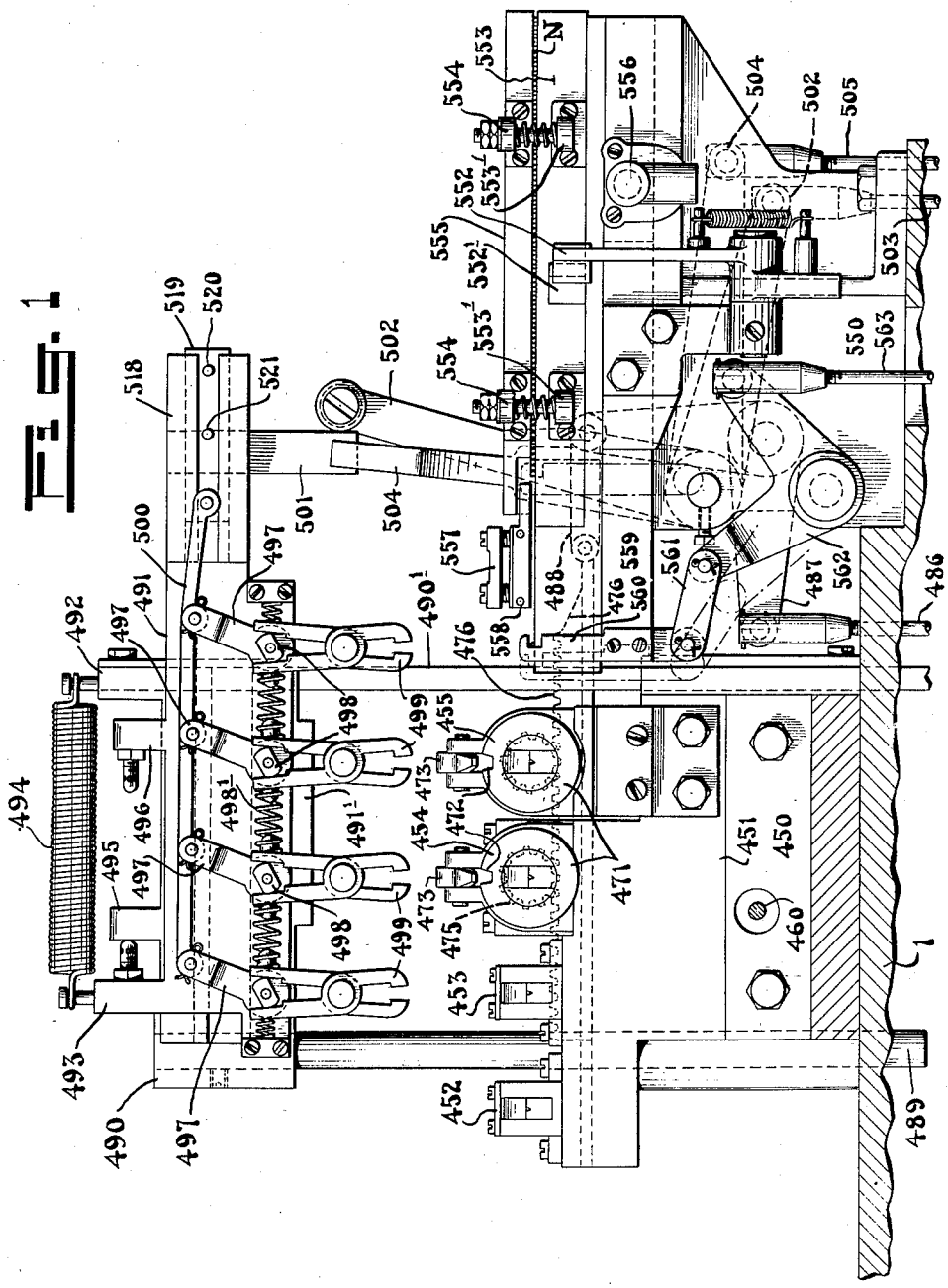
Sept. 22, 1936. A. HOFMANN 2,055,199

COMBINATION POLISHING AND COLLECTING MECHANISM

Original Filed June 20, 1934 5 Sheets-Sheet 1



Alfred Hofmann INVENTOR

BY

Darby & Darby

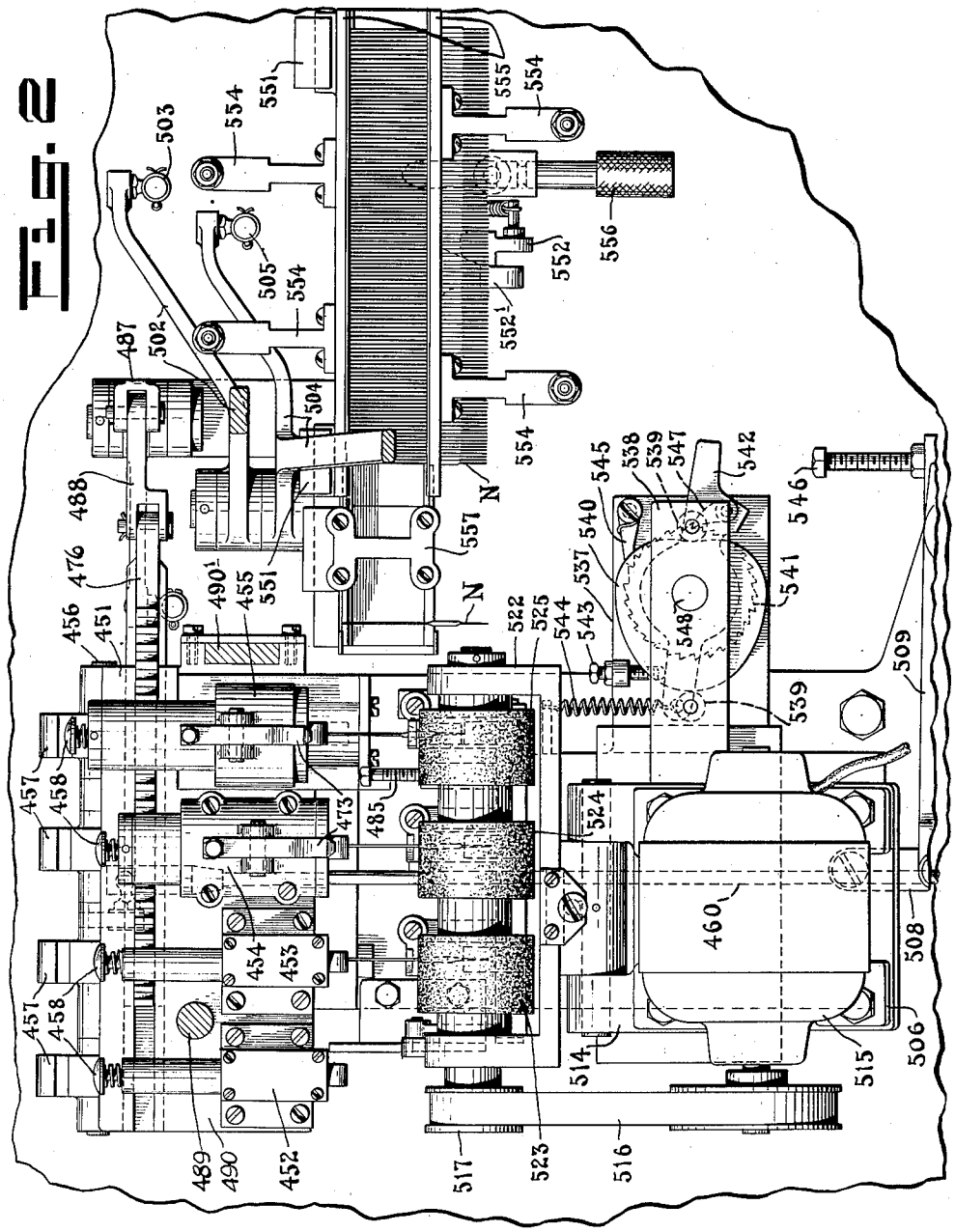
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COMBINATION POLISHING AND COLLECTING MECHANISM

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FIG. 2



Alfred Hofmann INVENTOR

BY

Darby & Darby

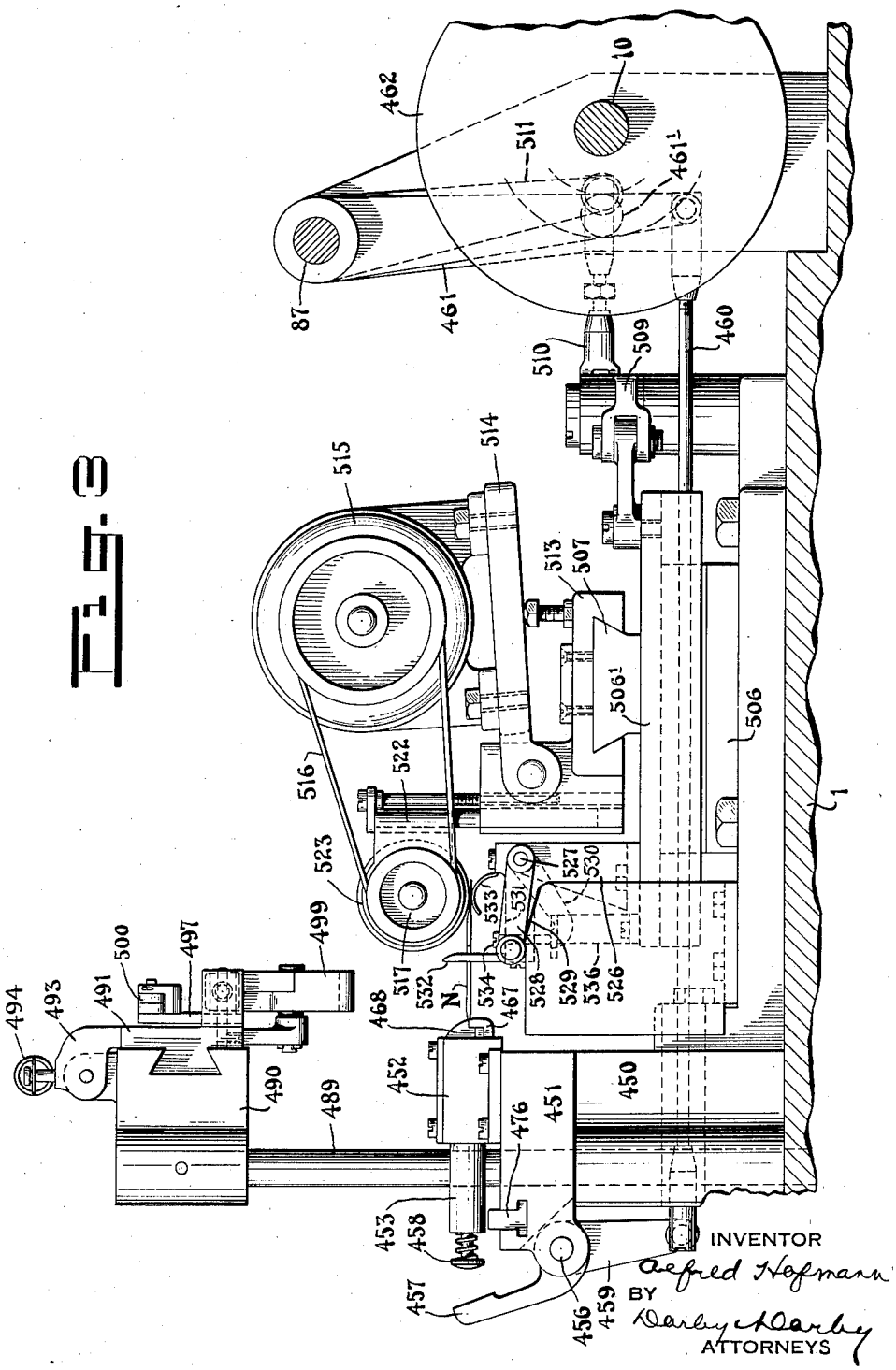
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COMBINATION POLISHING AND COLLECTING MECHANISM

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Fig. 3



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COMBINATION POLISHING AND COLLECTING MECHANISM

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FIG. 4

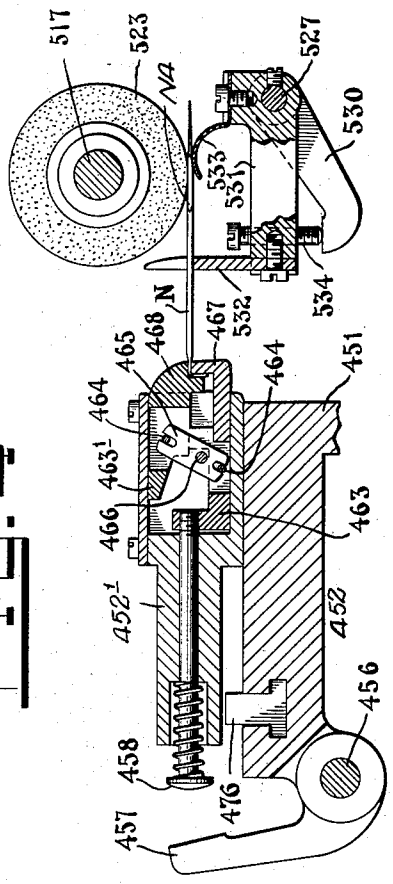


FIG. 6

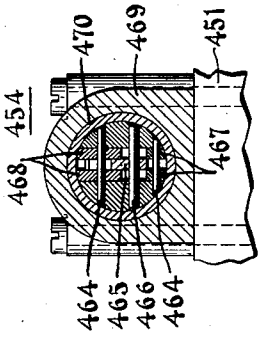
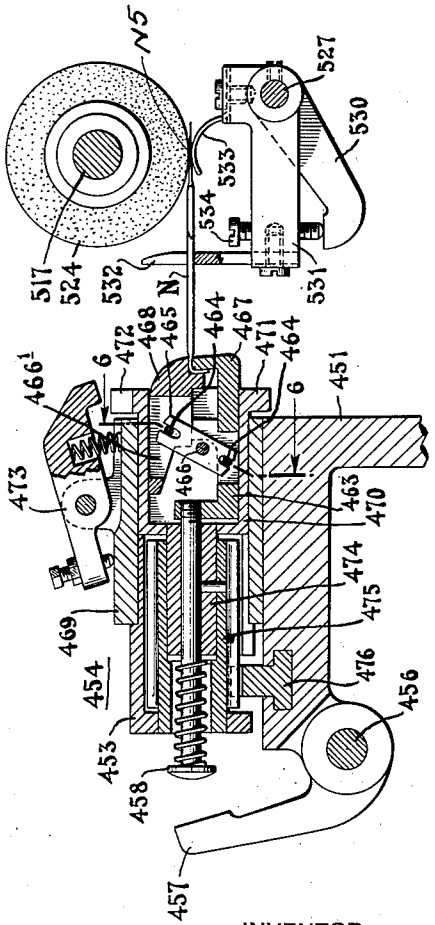


FIG. 5



INVENTOR
Alfred Hofmann
BY
Darby & Darby
ATTORNEYS

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Fig. 8

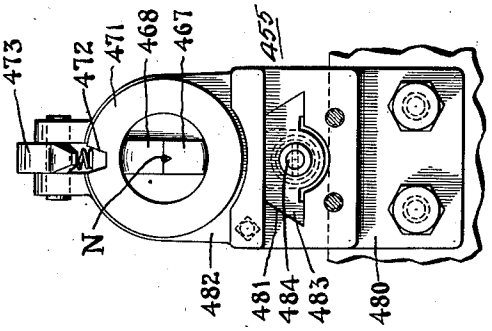


Fig. 10

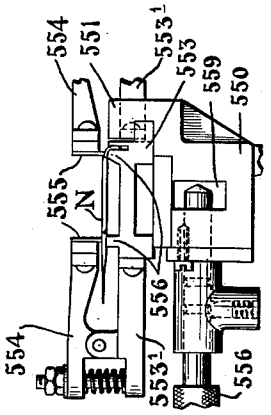


Fig. 7

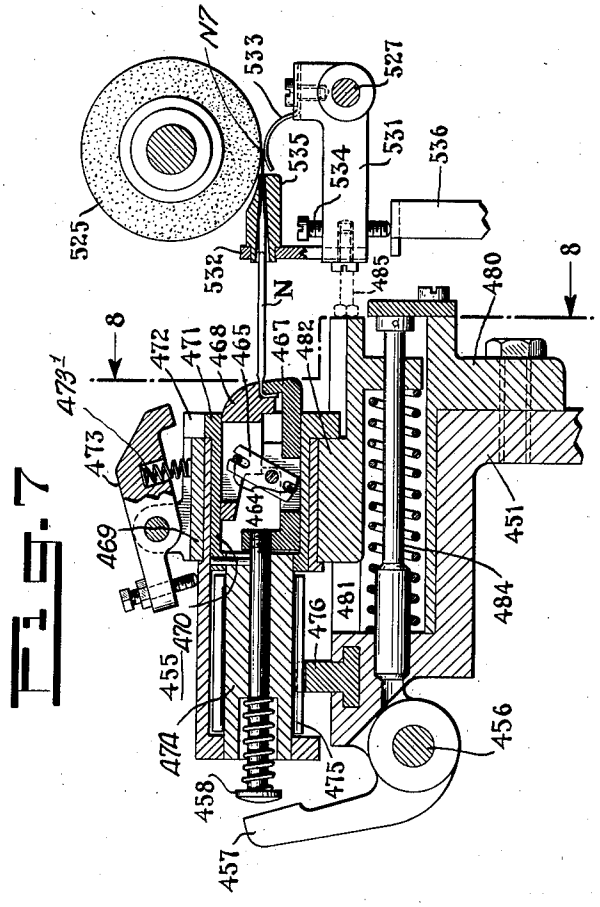
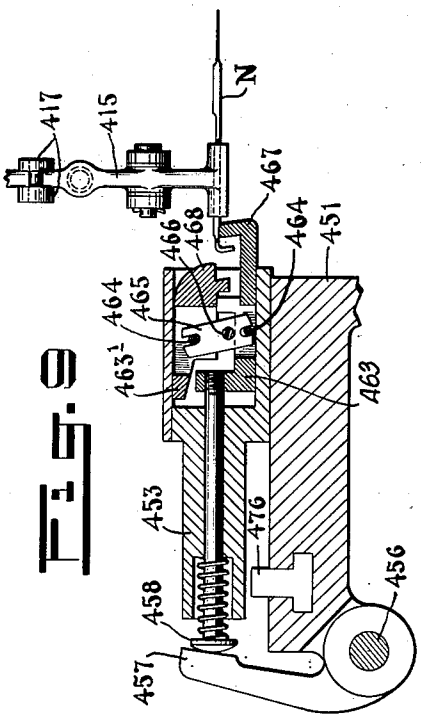


Fig. 9



INVENTOR
Alfred Hofmann
BY
Dana Byrd & Darby
ATTORNEYS

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UNITED STATES PATENT OFFICE

2,055,199

COMBINATION POLISHING AND COLLECTING MECHANISM

Alfred Hofmann, Palisade, N. J., assignor to Alfred Hofmann Needle Works, Inc., Union City, N. J., a corporation of New Jersey

Original application June 20, 1934, Serial No. 731,440. Divided and this application March 14, 1935, Serial No. 11,058

21 Claims. (Cl. 51—50)

This apparatus relates to improvements in mechanism by means of which work pieces may be ground, polished, and/or buffed and collected upon a receiving tray or platform in orderly array.

One of the objects of this invention is to provide an automatic machine by means of which work pieces may be successively transferred from a receiving point through several stations upon which the operations of grinding, polishing and/or buffing may be performed in succession.

A further object of this invention is to provide in conjunction with the above mechanism an automatically operating mechanism for receiving the work pieces after being processed and arranging them in orderly array upon a tray or receptacle.

These and many other objects as will appear from the following disclosure are secured by means of the invention herein disclosed.

This invention resides substantially in the combination, construction, arrangement and relative location of parts, all as will be set forth in full detail in the following specification in connection with the attached drawings, and pointed out in the appended claims.

This application is a division of my copending application Serial No. 731,440, filed June 20, 1934 for Method and machine for making knitting needles.

In the drawings,

Fig. 1 is a front elevational view with some parts broken away of the combined mechanism of this invention;

Fig. 2 is a top plan view thereof;

Fig. 3 is an end elevational view of the apparatus;

Fig. 4 is a longitudinal cross-sectional view of the chuck opposite the first polishing wheel;

Fig. 5 is a similar view of the chuck at the second polishing wheel;

Fig. 6 is a cross-sectional view taken on the line 6—6 of Fig. 5;

Fig. 7 is a longitudinal vertical central cross-sectional view through the chuck and the associated mechanism at the third polishing wheel;

Fig. 8 is a view taken on the line 8—8 of Fig. 7;

Fig. 9 is a cross-sectional view of the chuck of Fig. 4 with the chuck open; and

Fig. 10 is an end elevational view of the mechanism for receiving the finished work pieces.

The mechanism herein disclosed forms part of an automatic machine for manufacturing spring beard knitting needles and comprises a multiple polishing mechanism for polishing the beard end of the needle before it is bent and for collecting the finished needles and assembling them in orderly array upon a tray to facilitate their handling. The structure of the invention is of course adapted to many uses other than that of polishing and finishing the beard end of a knitting needle. However, for purposes of disclosure there has been illustrated in the drawings spring beard knitting needles which are representative of the type of work which may be operated upon with this mechanism.

It is equally clear to those skilled in the art that the mechanism may be employed independently of any other mechanism, or may be incorporated in, as a part of, a larger association of elements, as is illustrated for example in the parent application mentioned above, of which this application is a division.

It will be equally clear to those skilled in the art that the invention is not restricted to use as a polishing machine, but may be employed for such uses as grinding and buffing, depending upon the type of abrasive or friction wheel employed.

It is likewise within the scope of this invention to employ other forms of wheels adapting the device for operation upon work pieces of other physical form.

Referring to Fig. 1, this device consists of a support **450** secured to the table **1** and in turn supporting a table member **451** upon which the chuck assemblies **452, 453, 454** and **455** are secured in longitudinal spaced arrangement. Journaled on the member **451** to the rear of these chuck assemblies is a shaft **456** which has secured thereto a finger **457** for each of these chuck assemblies and positioned to engage the knob or button **458** on the operating rods for these chucks. Secured to shaft **456** is a depending lever **459** which is connected by the link rod **460** to a lever **461** which is freely and pivotally supported on the rod **87**. The lever **461** is provided intermediate its ends (see Fig. 3) with a cam follower **461'** which rides in a groove (partly indicated by dotted lines Fig. 3) on the cam **462** on the shaft **10** to effect operation of these connected parts in an obvious manner. The purpose of the fingers **457** is to open and close these chuck assemblies at the proper time to receive and discharge the needles.

The chuck assemblies **452** and **453** are the same and the nature of their construction is clear from Fig. 4. The casing **452'** of the chuck is shaped to form a chamber in which the relatively movable members **463** and **463'** are mounted. The forward ends of these members **468** and **467** provide gripping jaws which are relatively movable, as is clear in Fig. 9.

The relatively movable members are provided with pins 464 which engage in open end slots in the link 465 which is pivotally supported on a fixed pivot pin 466. It will be apparent then that when fingers 457 move in to engage the buttons 458 of either chuck assembly 452 or 453 the members 463 and 463', having the gripping jaws at the end, will be moved away from each other to the position shown in Fig. 9, at which time a needle may be placed in a position to be gripped and held in the chuck assembly. Fingers 457 then recede so that the spring pressed rod upon which button 458 moves to the left (Fig. 9) bringing the gripping jaws 467 and 468 into relation with the needle, as is clear in Fig. 4.

The other two chuck assemblies 454 and 455 are of somewhat different construction since they must be rotated upon the longitudinal axis of the needle to effect oscillatory spinning movement thereof during the polishing operations for reasons to be described.

In this case the chuck assembly comprises a fixed bearing casing 469 (see Fig. 6) in which a circular sleeve 470 is rotatably mounted. The outer end of this sleeve is provided with a flange 471 having a notch 472 to be engaged by a finger 473 pivotally mounted at the top of the bearing member 469 and normally held in the position shown in Fig. 5 by a spring 473'. The sleeve 470 is provided with a tubular extension 474 to which is secured a gear 475. This gear meshes with a linearly movable rack 476 mounted in a track in the table 451. The rack is clearly seen in Figs. 1 and 2. When the rack moves back and forth it will be apparent that the sleeve 470 and the members attached thereto including the gripping jaws 467 and 468 will be oscillated on the axis of the needle. The gripping jaws are opened and closed by the fingers 457 for these two chuck assemblies in the same way that they are opened and closed for the chuck assemblies 454 and 453.

The chuck assembly 455 differs from the chuck assembly 454 only in that chuck assembly 455 is mounted upon a carriage which moves transversely of the support 451 (see Figs. 7 and 8). In this case a guide way bed 480 is secured to the support 451 having guide tracks 481 therein, in which a tongue 483, formed on the bottom of the housing 482 moves. A rod 484 is supported between the support 451 and the bed 480 and is encircled by a spring as shown in Fig. 7, which engages a lug depending from the housing 482, so as to normally urge the housing to the right. The chuck assembly itself is supported in the housing 482 and may be oscillated by the rack 476 as before, and the jaws may be opened and closed by the finger 457. The housing and the chucks mounted thereon normally lie at the extreme right position under the pressure of the spring and is moved back after it receives a needle by means of an adjustable set screw 485 which will be described later.

The rack 476 is oscillated by means of a connecting rod 486 which is operated in the proper timed relation with suitable and well known mechanism from the power source so that it will reciprocate up and down at a desired rate. This rod 486 is pivotally connected to a bell crank lever 487 which in turn is connected by the link 488 to the rack 476 (see Figs. 1 and 2).

At 489 is a rod which is operated from below the table from the power source so as to reciprocate up and down in the proper timed relation. Secured to the upper end of this rod is a plate 490 which is guided at its other end for vertical movement by the bar 490' (see Fig. 2). The plate 490 is provided with a dovetail groove as is clear from Fig. 3, in which the tongue of a reciprocal bar 491 rides. The plate 490 is provided with a lug 492 and the bar 491 is provided with a lug 493 between which a heavy coil spring 494 is connected to hold the bar 491 in the position shown in Fig. 1. Plate 490 also has a fixed ear 495 positioned to be engaged by an adjustable stop on the lug 493. The bar 491 likewise has an ear 496 with an adjustable stop screw positioned to engage the other side of the ear 495. Pivotally mounted on the bar 491 are the four levers 497 which have secured thereto, for movement therewith, the small cams 498 which lie between the arm and the fingers 499 which are pivotally connected intermediate their ends so that the lower ends may be operated towards and away from each other in an apparent manner. The fingers are pivotally supported from downward extensions on the bar 491 and have compression springs 498' between them to permit their operation. The short levers 497 are all pivotally connected to a single link 500 which in turn is pivotally connected to a small bar 519, which is slidably supported in a grooved extension 518 of the bar 491.

The small bar 519 is provided with a pair of spaced pins 521 and 520 which are to be engaged by one arm 504 of a bell crank lever which is pivotally supported, as is clear from Figs. 1 and 2, and which is operated from the other end by means of a rod 505 which extends below the table and is likewise operated from the power source by means of any suitable mechanism such as a cam. The bar 491 is likewise provided with a depending arm 501 positioned to be engaged by the roller on the arm 502 of a bell crank lever pivoted on the same shaft with the bell crank lever 504. The other arm of the bell crank lever 502 is pivotally connected to the rod 503 which extends below the table and is likewise operated by a cam or the like from the power source.

The supporting and operating mechanism for the polishing wheels will now be described. Referring to Fig. 3 this will be seen to comprise a base plate 506 secured to the table 1 having guide ways thereon for guiding the table or carriage 506' which is pivotally connected by the link 508 to a lever 509 pivotally supported from the base plate 506. The other end of lever 509 is pivotally connected by a link 510 to a lever 511 pivotally supported on the overhead rod 87. The lever 511 has operative engagement with a cam (not shown) mounted on the shaft 10 in back of cam 462, Fig. 1.

Supported from the carriage or table 506' is a transverse guide way 507 upon which a plate 513 may slide transversely of the carriage or table 506'. Pivotally supported on the plate 513 is a motor support 514 to which the small electric motor 515 is secured. This motor is operatively connected by belt 516 to a shaft, driven by pulley 517, journaled on the yoke 522 and adjustably supported from the plate 513. Secured to the shaft to which pulley 517 is attached in spaced relation so as to be in front of the chuck assemblies 453, 454 and 455, are the polishing wheels 523, 524 and 525 respectively. As shown in Fig. 3, a pair of standards 526 are secured to the table 506 and support at rotatable shaft 527 to which is secured a lever 528 having a roller on the end positioned to engage the cam surface 529 of a fixed member which is supported from the base plate 506. Thus, when the table 506' is oscillated back and forth on the base plate 506 by means of the

lever 509, arm 528 will be raised as its rollered end moves up the cam surface 529 of the fixed member.

Mounted upon the shaft 527 and secured thereto by means of set screws are the arms 530 adjacent the polishing wheels 523 and 524. Loosely mounted on the shaft 527 are the arms 531 which support the notched guide plates 532 upon which the needle rests intermediate its length during the polishing operations by these two wheels.

A spring finger 533 is also secured to the arm 531 directly under the polishing wheels to urge the needle against the polishing wheels. Arm 531 is provided with an adjusting screw 534 which contacts with the arm 530 so that the position of arm 531 with respect to shaft 527, and hence the movement that it undergoes with respect to the polishing wheels and the final position thereof, may be accurately determined. The arm 531 adjacent the polishing wheel 525 (see Fig. 7) is positioned by means of the set screw 534 which coacts with a fixed stop 536 attached to the movable table 506' (see Figs. 3 and 7). In this case the plate 532 is provided with a guiding member 535 having a tapered bore therethrough so as to guide the needle to the operating position between the wheel and the spring finger 533. As is clear from Fig. 2, the adjustable screw 485 is mounted above the front of the table 506', so that as the table moves in this screw will engage the housing 482 (see Fig. 7) to move it back as the table moves in, so that the polishing wheel 525 will operate at the very point of the needle only. This operation of the housing 482 is desirable so that when the movable table 506' moves back the housing and the chuck assembly parts mounted thereon may move out to a position so as to be in alignment with the other chuck assemblies 452, 453, and 454, and to likewise be in proper alignment with the fingers 499 so that they may insert and remove needles from all of these chuck assemblies simultaneously. However, since the polishing wheel 525 only operates on the point of the needle, it is necessary that the chuck assembly which supports it move back since all of the polishing wheels are on the same axis of rotation.

Referring again to Fig. 2, it will be seen that the movable table 506' is provided with a transverse extension 537 and the plate 513 is provided with an extension 538 which overlies the extension 537. Rotatably mounted between these extensions is a short shaft 548 to which is secured the heart shaped cam 540 and the ratchet wheel 541. Pivotally mounted on the short shaft 548 is a lever 542 which is connected at one end by a spring 544 to the yoke 522. The other end of lever 542 has pivotally supported thereon a small pawl 547 which engages with the teeth of the ratchet wheel. A spring pressed pawl 545 is pivotally supported on the extension 537 in a position so as to engage the teeth of the ratchet wheel. Secured to the under surface of extension 538 are a pair of rollers 539 which engage the periphery of the heart shaped cam 540. Extension 537 is provided with a lug in which is mounted an adjustable stop screw 543 positioned to engage the lever 542. At 546 is an adjustable stop screw mounted on any suitable fixed support so that it is positioned to engage the right hand end of lever 542. When the table 506' is moved back by lever 509 a predetermined distance the fixed screw 546 engages the lever 542. Further movement of the table and of course the extensions will cause lever 542 to rotate in a counterclockwise direction on the shaft 548. This relative movement of the lever will cause rotation of shaft 548 through the action of pawl 547 on the ratchet 541 attached to shaft 548. Simultaneously with the movement of ratchet wheel 541 the cam 540 moves shifting the plate 513 with the motor, yoke and polishing wheels thereon, a slight distance to the right or left, depending upon the shape of the cam and its coaction with the cam rollers 539.

As soon as table 506' moves back, lever 542 moves in a clockwise direction under the action of spring 544 until that lever engages the fixed stop screw 543. Reverse rotation of ratchet 541 and cam 540 is prevented by the fixed pawl 545. Thus, as the motor and polishing wheels are moved back and forth for successive engagement with the needles the motor and polishing wheel support will be given a succession of small transverse movements which will continue back and forth between limits as determined by the shape of cam 540. Thus the polishing wheels are continually presenting fresh surfaces to the needles so that they will not become grooved or uneven thereby insuring accurate polishing of the needles.

It might be noted, as is clear from Fig. 4, that the first polishing wheel 523 merely polishes the top of the grooved portion N4 of the needle. The second polishing wheel 524, as is clear from Fig. 5, polishes the needle at the point between the very tip and the slotted portion, or in other words, the part N5 of the needle. During this operation the needle is spun on its longitudinal axis since this chuck assembly is given a spinning movement through the oscillation of the rack 476. The final polishing operation accomplished by the wheel 525, as illustrated in Fig. 7, takes place at the very tip or point N7 of the needle, at which time the needle is again spun on its longitudinal axis. The spinning during these two operations insures a smooth cylindrical surface for the needle at these points.

The manner in which the needles are transferred from chuck to chuck will now be described in connection with Fig. 1. It will be assumed that the chuck assemblies 452 to 455 inclusive each hold a needle. Bell crank lever 502 will be given a counterclockwise movement to cause the bar 491 to slide to the left on the plate 490. This will bring the fingers 499 from the position shown in Fig. 1 over to the left so that each pair of fingers is directly over one of the chuck assemblies. The accurate positioning of the fingers is determined by the adjustment of the set screws on the lugs 493 and 496, and their cooperation with ear 495. Rod 489 then descends carrying with it the plate 490 and all the parts mounted thereon. This brings the fingers 499 down so that each pair lies on opposite sides of a needle. With this position of the parts pin 520 will be to the left of arm 504 and in the range of action thereof. This arm then moves over, causing all of the short levers 497 to swing to the left through the link 500 so that the cams 498 move to a position permitting springs 498' to close the fingers 499. Fingers 457 (Fig. 3) then move in to open the chuck assembly, releasing the needles. Rod 489 then moves up carrying plate 490 and all attached parts including the fingers 499 with it. It may be noted here that the fingers will always remain closed under the action of the springs in view of the shape of the cams 498 and even though pin 520 moves out of contact with lever 504.

At the end of the upward movement of these parts, lever 502 recedes so that spring 494 may move the bar 491 and all its attached parts back to the right hand position which is shown in Fig. 1. Rod 489 again descends so that the needles in the three pairs of fingers at the left are placed in position to be gripped by the chucks 453, 454 and 455. Fingers 457 then recede and the chucks close on the needles. Lever 504 is then in position to engage pin 521 and moves to the right causing cams 498 to open the fingers 499. Thus the needles have been shifted one position to the right and rod 489 again moves upwardly to the position shown in Fig. 1. The mechanism as illustrated includes no device for automatically feeding the work pieces to the first chuck 452. It is sufficient for the purposes of this disclosure to state that the needles may be delivered to this chuck by hand, one at a time, as it opens to receive them. In the complete machine illustrated in the parent application above mentioned, mechanism is provided for automatically feeding the needles, one at a time, to the first chuck. The fingers 499 at the extreme right deliver, at the time the other fingers deliver, needles to the chucks, a needle into the range of action of the mechanism in which the needles are collected, and which will now be described.

Mechanism for receiving the needles from the last pair of fingers 499 comprises a support 550 which has a pair of grooved lugs 551 on one side thereof as is clear from Figs. 2 and 10. These lugs are engaged by ears on the base plate 553 as shown in these figures. When these ears are slipped in place in the grooved lugs the base plate is held in place on the support by means of a spring pressed lever 552 which engages with a lug 552' on the base plate.

The base plate is provided with a pair of transversely extending arms 553' on each side thereof, upon which are pivotally mounted spring pressed arms 554 having the bars 555 positioned over the ways 556 on the base plate. One of the ways is provided with a groove as shown to receive the hook end of the needles, as is clear from the figures. The needles are grouped against the rolls by means of the spring pressed arms 554 which permit of the needles being forced thereunder. By the arrangement of the grooved lugs and the spring pressed arm 552 and the lug 552' the base plate may be detachably secured to the supporting table. At 559 is a longitudinally slidable bar which moves in a groove in the support 550 and is limited in its movement by means of a detent controlled plunger 556 positioned to be engaged by the end of the bar 559. This bar supports a pair of fingers 560 having notches at their upper ends adjacent the portion of the support upon which the needles are deposited by the right hand set of fingers 499. The fingers 560 and the bar 559 are caused to slide back and forth by means of the link connection 561, the bell crank lever 562 and the rod 563, which is operated in any suitable manner from the power source below the table. Thus, as the rod 563 moves up and down the fingers 560 and bar 559 move back and forth. In their forward movement these fingers engage the needles deposited in front thereof and force them under the spring pressed gripping plate 558 which is supported from above the needle slide by means of the plate 557. This gripping plate holds the needles down against the needle guides and the fingers 560 move over to the dotted position shown in Fig. 1 at the extreme right to deliver the needles under the plates 555 which are resiliently supported as described.

Each succeeding needle is moved up to engage the preceding needle so that they are gradually fed forward in a neatly arranged row, and held firmly on the way, as will be apparent. When a tray is full of needles it is removed by hand and an empty tray inserted in its place by moving back the spring urged arm 552.

The various operating mechanism mounted below the table 1 and by which power is delivered to the various operating levers and arms as above described have not been shown in detail since their construction and arrangement will be obvious to those skilled in the art of machine design. The driving mechanism merely consists of cams and the like so formed as to impart to the various levers and arms movements in accordance with the above description. The shaft 10 of course is driven from any suitable power source to effect rotation of the cam 462.

What I seek to secure by United States Letters Patent is:

1. A device of the type described comprising a support, a plurality of chucks mounted on said support, some of said chucks being rotatably mounted, means for simultaneously opening and closing the chucks, means for carrying the work successively from one chuck to the next, means for imparting rotation to the rotatable chucks, a plurality of polishing wheels mounted adjacent said chucks, means for rotating said wheels, means for effecting linear movement of the wheels towards and away from said chucks, and means for effecting axial movement of the polishing wheels in small increments.

2. In an apparatus of the type described the combination comprising a support, a plurality of work holding chucks mounted along said support, means for automatically and simultaneously transferring the work pieces in said chucks successively and progressively from chuck to chuck, a second support reciprocally mounted, a plurality of polishing wheels rotatably mounted on said support, means for rotating said polishing wheels, means for reciprocating said second support to bring the polishing wheels into contact with the work when held in said chucks, and means for slightly reciprocating said second support at right angles to its first mentioned line of reciprocation in a step-by-step movement.

3. In an apparatus of the type described the combination comprising a support, a plurality of chucks mounted on said support, metal working heads associated with said chucks, a receiving tray mounted in alignment with said chucks, means for advancing work pieces successively from chuck to chuck and finally to said tray, said tray including resiliently mounted shoes and automatic means for moving the work pieces under said shoes.

4. In an apparatus of the type described the combination comprising a support, a plurality of chucks mounted in alignment on said support, polishing heads adjacent said chucks, a work piece receiving table, a tray mounted in alignment with said table, means for automatically and progressively advancing work pieces from chuck to chuck and finally delivering them onto said table, and means for automatically delivering the work pieces onto said tray, said tray including resiliently mounted shoes for holding the work pieces on said tray.

5. In a metal working attachment of the type described the combination comprising a fixed

support, a plurality of chucks mounted in alignment on said support, means for simultaneously opening and closing said chucks, a vertically and horizontally reciprocable carrier above said chucks, a plurality of pairs of fingers, one for each chuck, mounted on said carrier, means for simultaneously opening and closing all of said pairs of fingers, means for effecting vertical reciprocation of said carrier, means for effecting horizontal reciprocation of said carrier whereby work pieces are successively transferred from chuck to chuck from one end towards the other, and a plurality of metal working attachments one for each of said chucks.

6. In a metal working attachment of the type described the combination comprising a fixed support, a plurality of chucks mounted in alignment on said support, means for simultaneously opening and closing said chucks, a vertically and horizontally reciprocable carrier above said chucks, a plurality of pairs of fingers, one for each chuck, mounted on said carrier, means for simultaneously opening and closing all of said pairs of fingers, means for effecting vertical reciprocation of said carrier, means for effecting horizontal reciprocation of said carrier whereby work pieces are successively transferred from chuck to chuck from one end towards the other, a longitudinally reciprocable table, and a plurality of metal working devices mounted on said table so as to be aligned with said chucks.

7. In the combination of claim 6 means for rotatably supporting some of said chucks, and means for effecting oscillation thereof.

8. In the combination of claim 6 means for effecting step by step movement of said table, and metal working devices mounted thereon.

9. In the combination of claim 6 means for effecting step by step transverse movement of said table and the metal working devices mounted thereon including means operated by the longitudinal reciprocation of said table.

10. In a metal working attachment of the type described the combination comprising a fixed support, a plurality of chucks mounted in alignment on said support, means for simultaneously opening and closing said chucks, a vertically and horizontally reciprocable carrier above said chucks, a plurality of pairs of fingers, one for each chuck, mounted on said carrier, means for simultaneously opening and closing all of said pairs of fingers, means for effecting vertical reciprocation of said carrier, means for effecting horizontal reciprocation of said carrier whereby work pieces are successively transferred from chuck to chuck from one end towards the other, a longitudinally reciprocable table, a plurality of metal working devices mounted on said table so as to be aligned with said chucks, and means for receiving and aligning work pieces including a removable tray.

11. A device of the type described for polishing work pieces comprising a support, a plurality of chucks mounted on said support, some of said chucks being rotatably mounted, means for simultaneously opening and closing the chucks, polishing wheels mounted in alignment with said chucks, means for simultaneously carrying the work pieces successively from one chuck to the next when the chucks are opened, and means for imparting rotation to the rotatable chucks when the work pieces are held thereby against the polishing wheels.

12. An apparatus of the type described comprising the combination of a fixed support, a plurality of chucks mounted on said support, a receiving tray mounted in alignment with said chucks, polishing heads aligned with said chucks, means for advancing work pieces successively from chuck to chuck and finally to said tray, and means operating intermittently for assembling and holding the work pieces on said tray in a single layer.

13. A device of the type described for polishing a plurality of work pieces at one time, comprising a support, a plurality of chucks mounted on said support, some of said chucks being rotatably mounted, means for simultaneously opening and closing the chucks, means for simultaneously carrying all the work pieces successively from one chuck to the next while the chucks are open, a plurality of polishing wheels mounted adjacent said chucks, means for rotating said wheels, means for imparting rotation to the rotatable chucks when the work pieces held therein engage the polishing wheels, and means for effecting linear movement of the wheels towards and away from said chucks.

14. In an apparatus of the type described the combination comprising a support, a plurality of chucks mounted on said support in a row, a second support mounted for reciprocation towards and away from said chucks in a direction parallel to and in alignment with the longitudinal axes of said chucks, means for effecting reciprocation of said second support, a plurality of polishing wheels rotatably mounted on said second support, and motive means mounted on said second support for effecting rotation of said polishing wheels.

15. In an apparatus of the type described the combination comprising a support, a plurality of chucks mounted on said support, some of which include means for supporting them for rotation on their longitudinal axes, means for simultaneously opening and closing said chucks, means for simultaneously transferring work pieces from each chuck to the next while all chucks are open, metal working devices mounted adjacent said chucks, and means for effecting oscillation of said rotatably mounted chucks when the work pieces therein engage the metal working devices.

16. In an apparatus of the type described the combination comprising a fixed support, a plurality of chucks mounted on said support, some of which include means for supporting them for rotation on their longitudinal axes, means for simultaneously opening and closing said chucks, polishing heads mounted in front of said chucks, means for effecting oscillation of said rotatably mounted chucks on their longitudinal axes when work pieces held therein engage the polishing heads, and means for automatically and simultaneously transferring the work pieces in succession and progressively from chuck to chuck.

17. In an apparatus of the type described the combination comprising a fixed support, a plurality of work holding chucks mounted on said support in a row, a carrier supported for movement towards and away from said chucks along a line parallel to said chucks and in alignment therewith, means for effecting movement of said carrier, power operated polishing wheels rotatably mounted on said carrier so as to engage work pieces held by said chucks, some of said chucks being mounted for oscillation on their axes, and means for oscillating said chucks when the work held therein is in contact with the associated polishing wheels.

18. In an apparatus of the type described the

combination comprising a support, a plurality of chucks mounted in alignment with said support, polishing heads adjacent said chucks, a work piece receiving table, a tray mounted in alignment with said table, means for automatically and progressively advancing work pieces from chuck to chuck, and finally delivering them onto said table, intermittently operating means for automatically and successively advancing the work pieces onto and along said tray, and means for resiliently holding the work pieces in delivered sequence.

19. In an apparatus of the type described the combination comprising a support, a plurality of chucks mounted in alignment with said support, means for simultaneously opening and closing said chucks, polishing heads mounted adjacent said chucks, a work piece receiving table, a tray mounted in alignment with said table, means for automatically and progressively advancing work pieces from chuck to chuck and finally delivering them onto said table, intermittent means for automatically and successively advancing work pieces onto and along said tray, and means for clamping the work pieces on the tray in delivered sequence.

20. In an apparatus of the type described the combination comprising a fixed work supporting chuck, a movable carriage, a power driven polishing wheel mounted on said carriage, means for moving said carriage towards and away from said chuck longitudinally of the chuck and in a path in alignment therewith, and means operated by and in accordance with the movement of said carriage for effecting step-by-step movement of said polishing wheel transversely of the line of movement of said carriage.

21. In an apparatus of the type described the combination comprising a plurality of chucks mounted in a row on a fixed support, a carriage mounted for movement towards and away from said chucks in a path aligned with the chuck axes, a plurality of power driven polishing wheels rotatably supported on said carriage, means for effecting movement of said carriage, and means actuated by and in accordance with the movements of said carriage for effecting an additional movement transversely to the first line of movement thereof.

ALFRED HOFMANN.