Oct. 31, 1950

E. D. DEAN ET AL

2,528,042

MACHINE FOR GRINDING DOWN CONICAL POINTS OF DRAWN STEEL RODS

Filed April 1, 1947

4 Sheets-Sheet 1

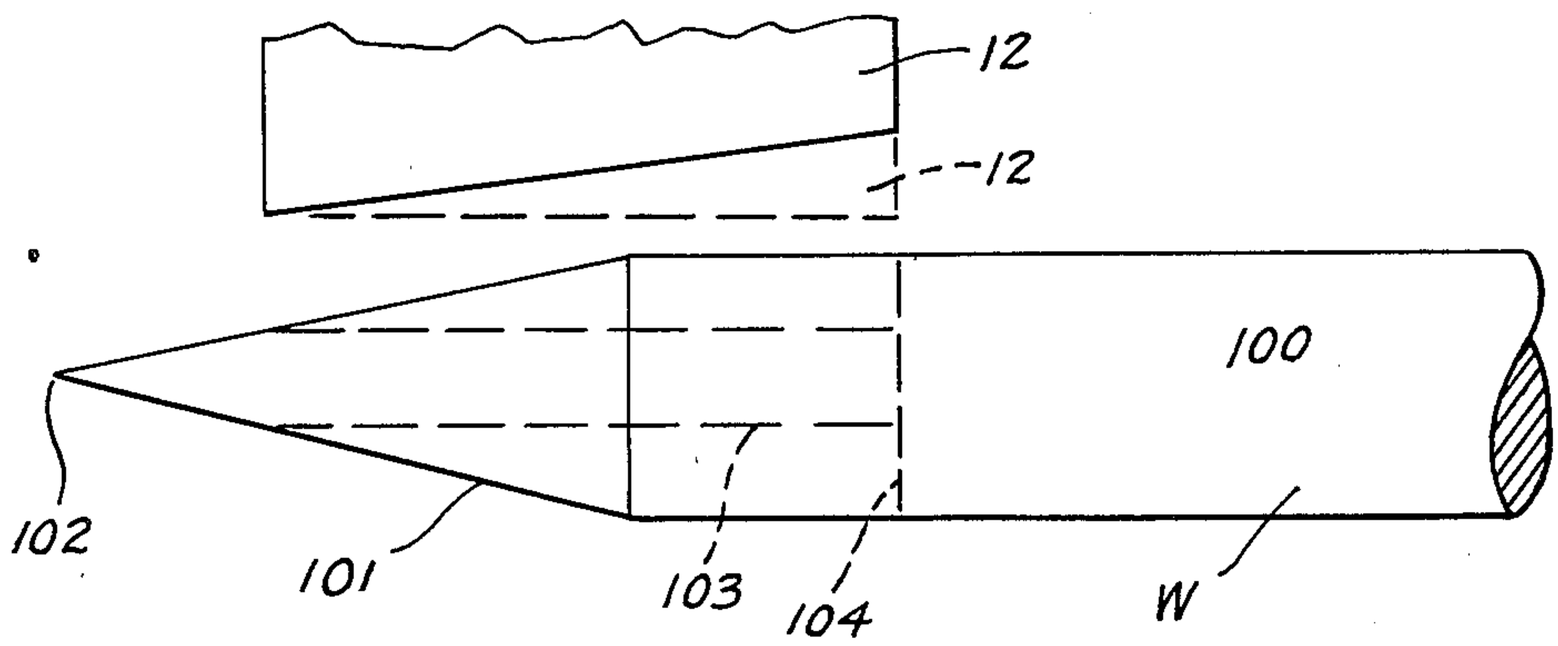

Fig. 1

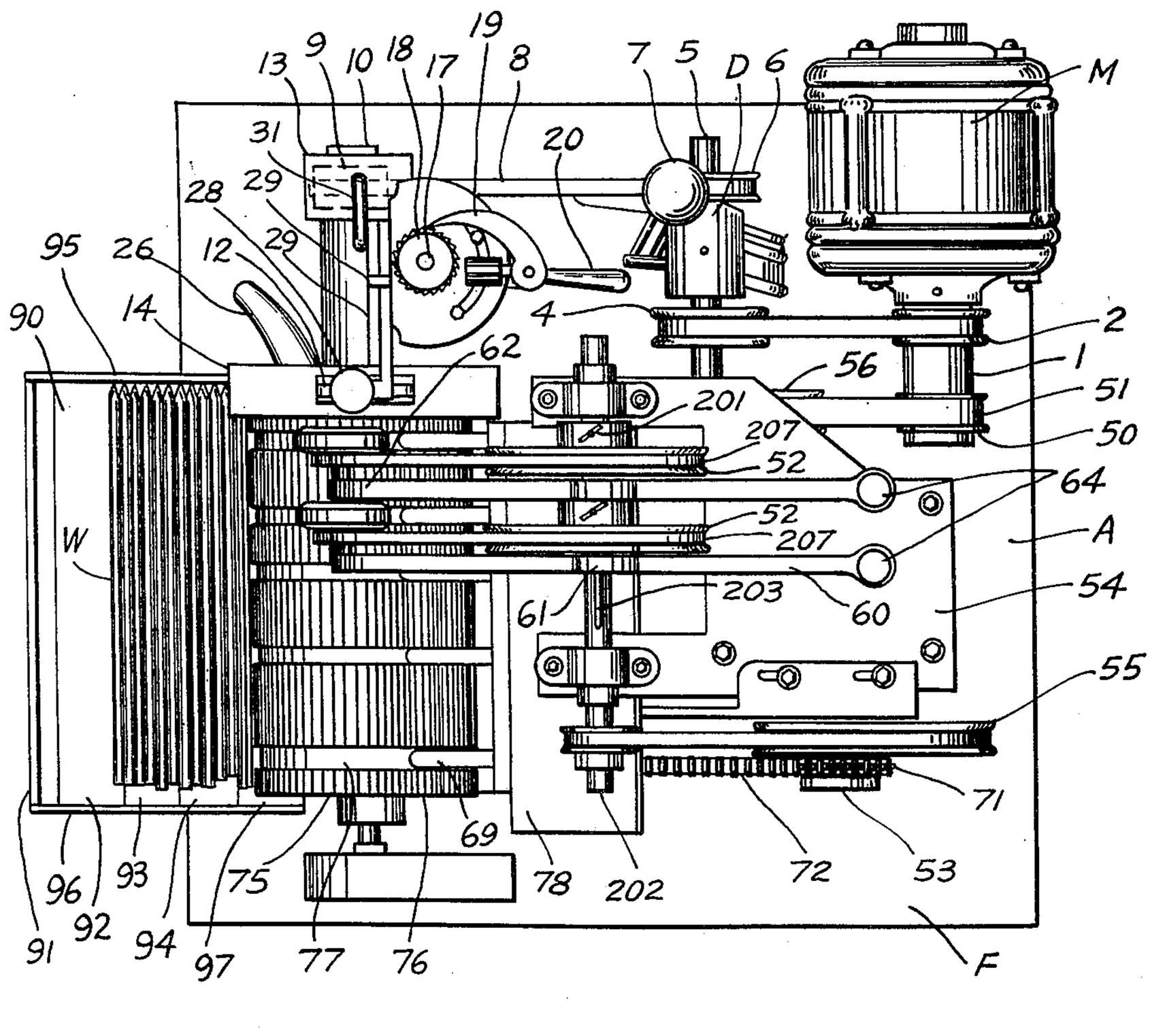

Fig. 2

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4 Sheets-Sheet 2

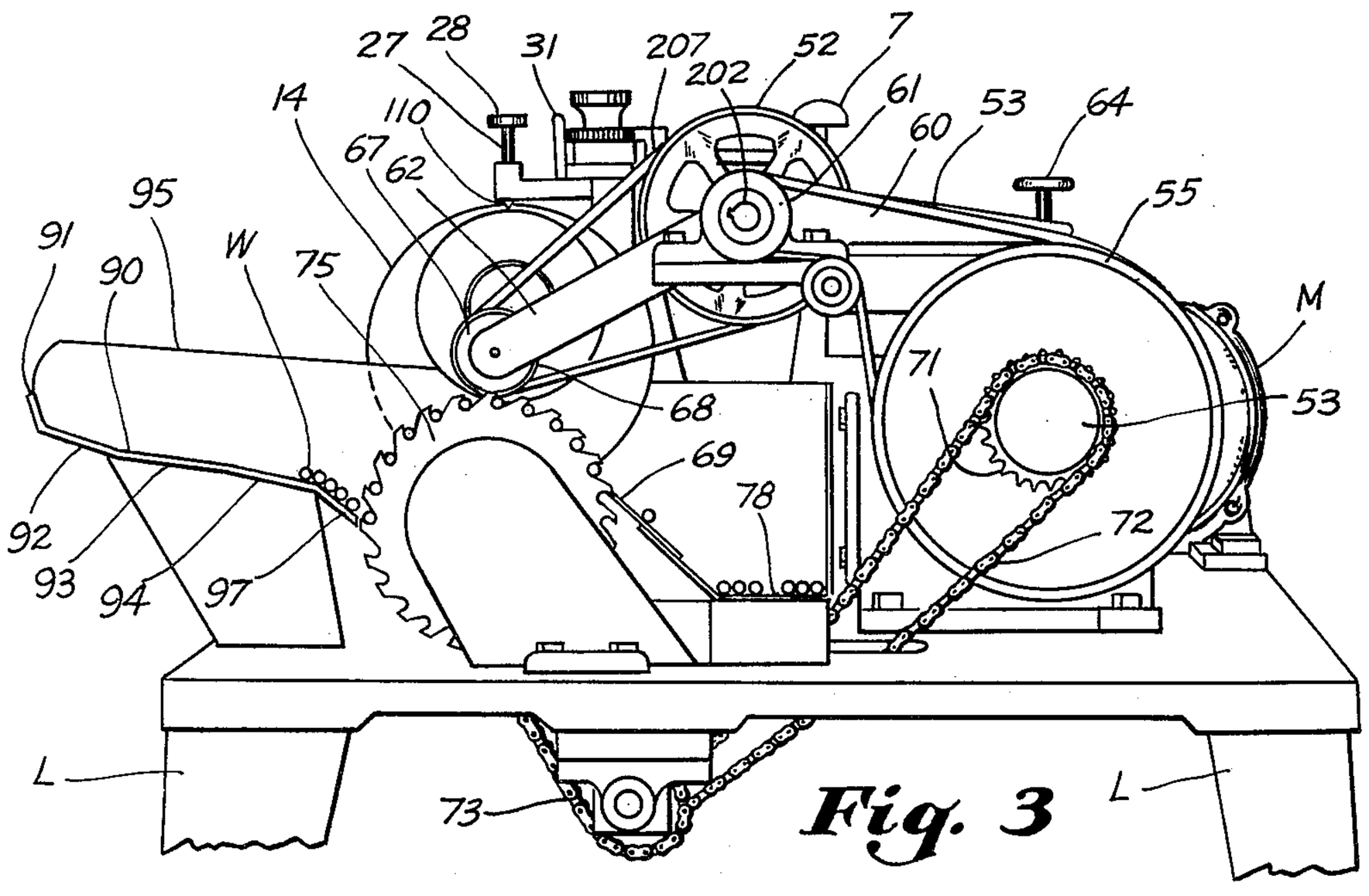

Fig. 3

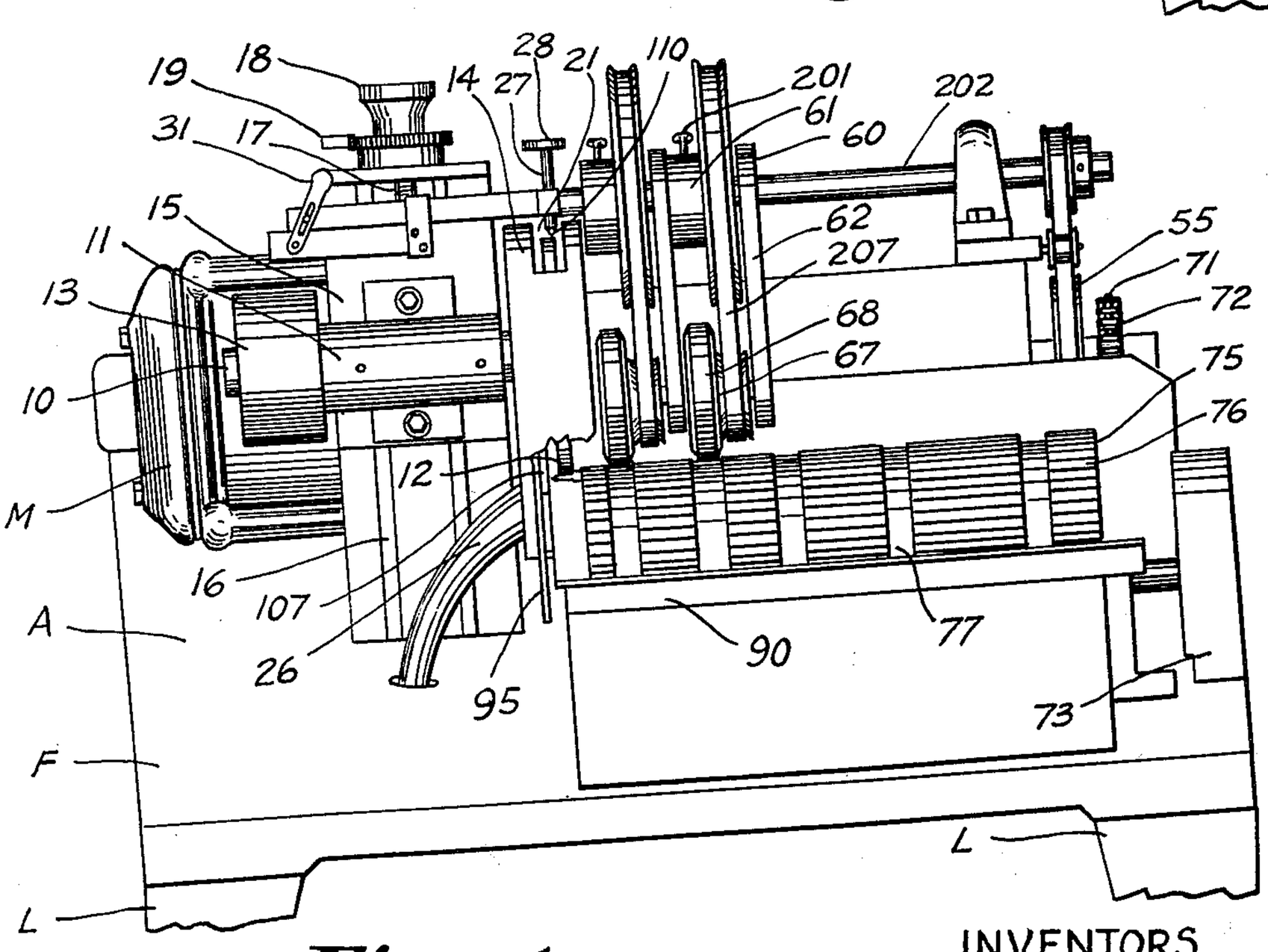

Fig. 4

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4 Sheets-Sheet 3

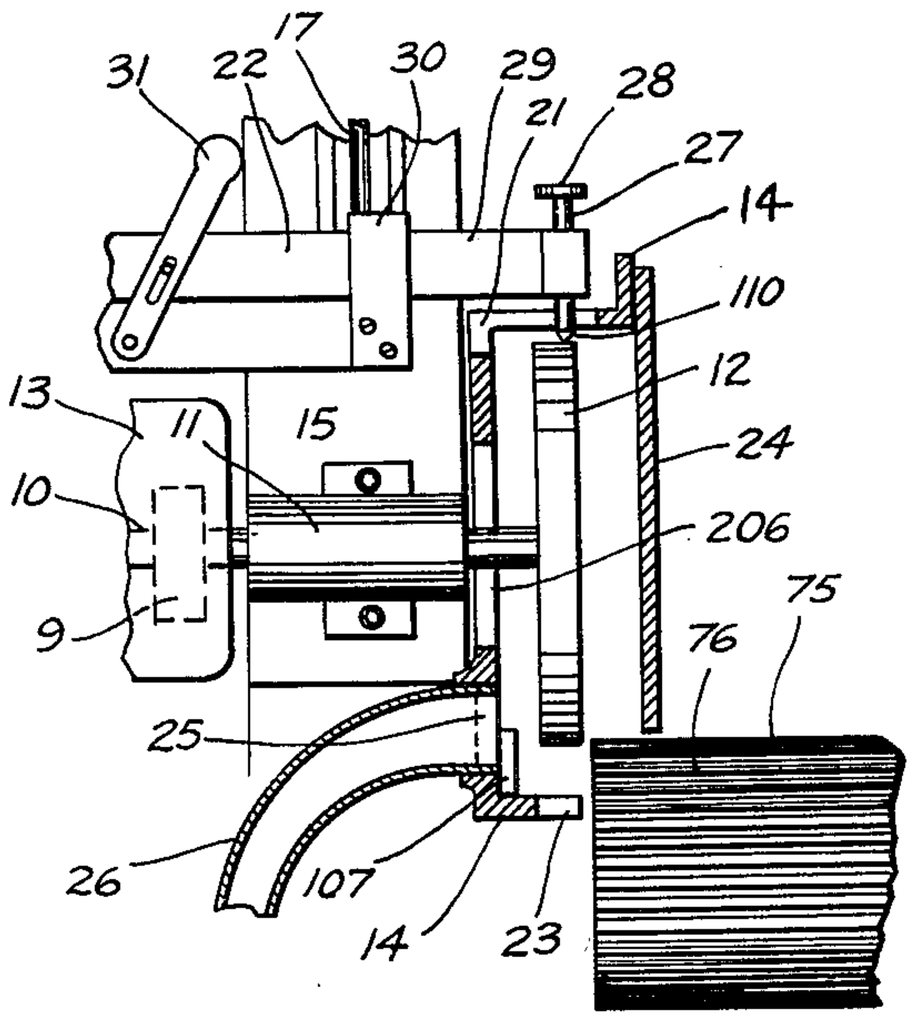

Fig. 5

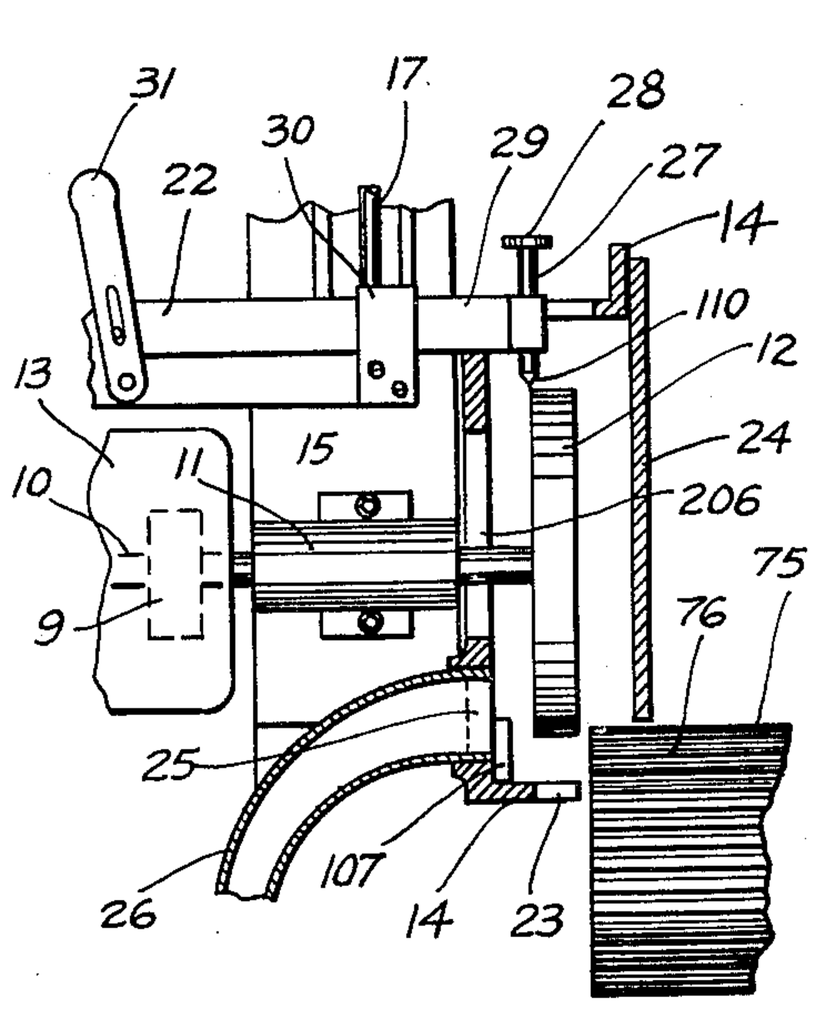

Fig. 6

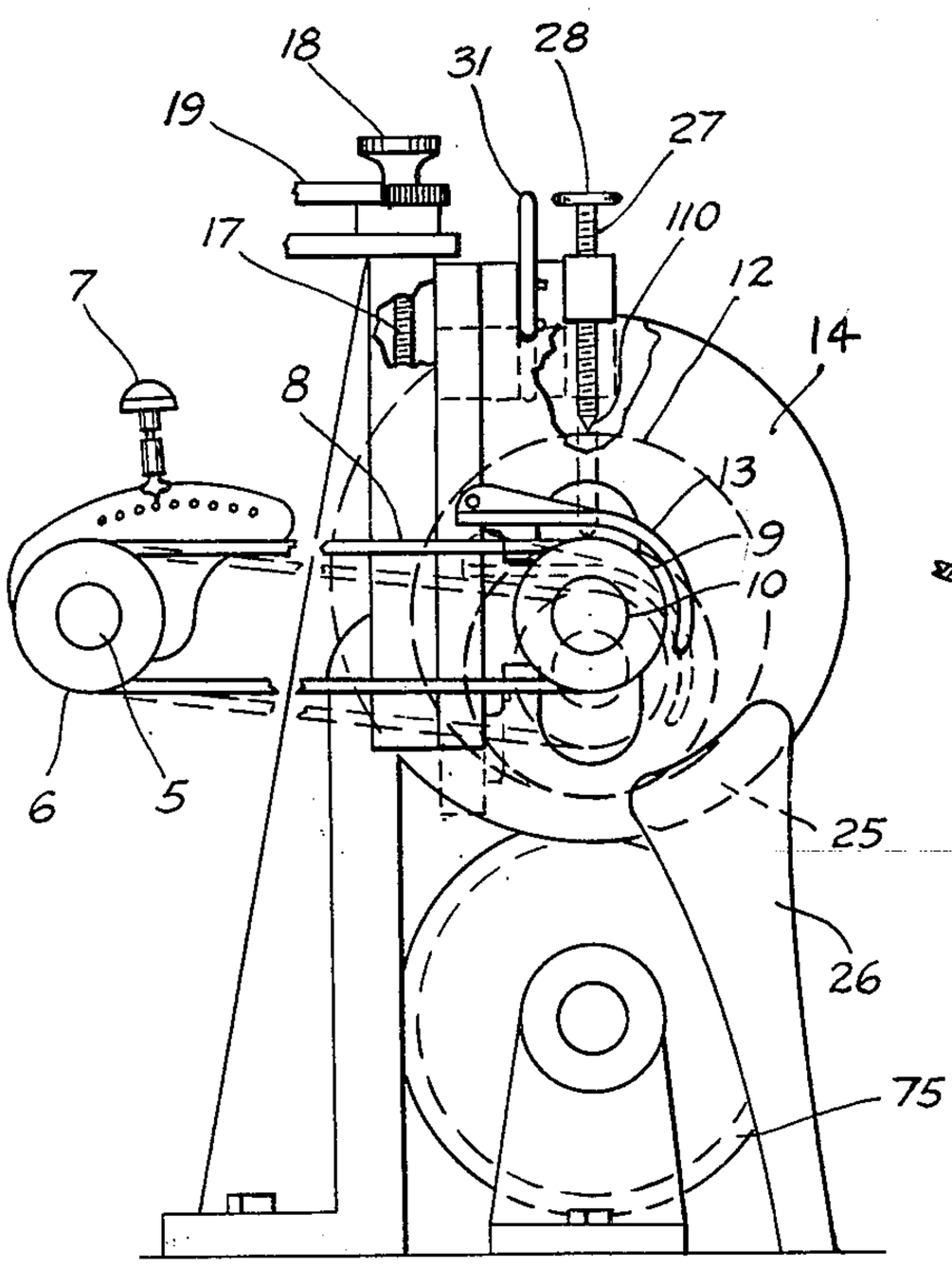

Fig. 7

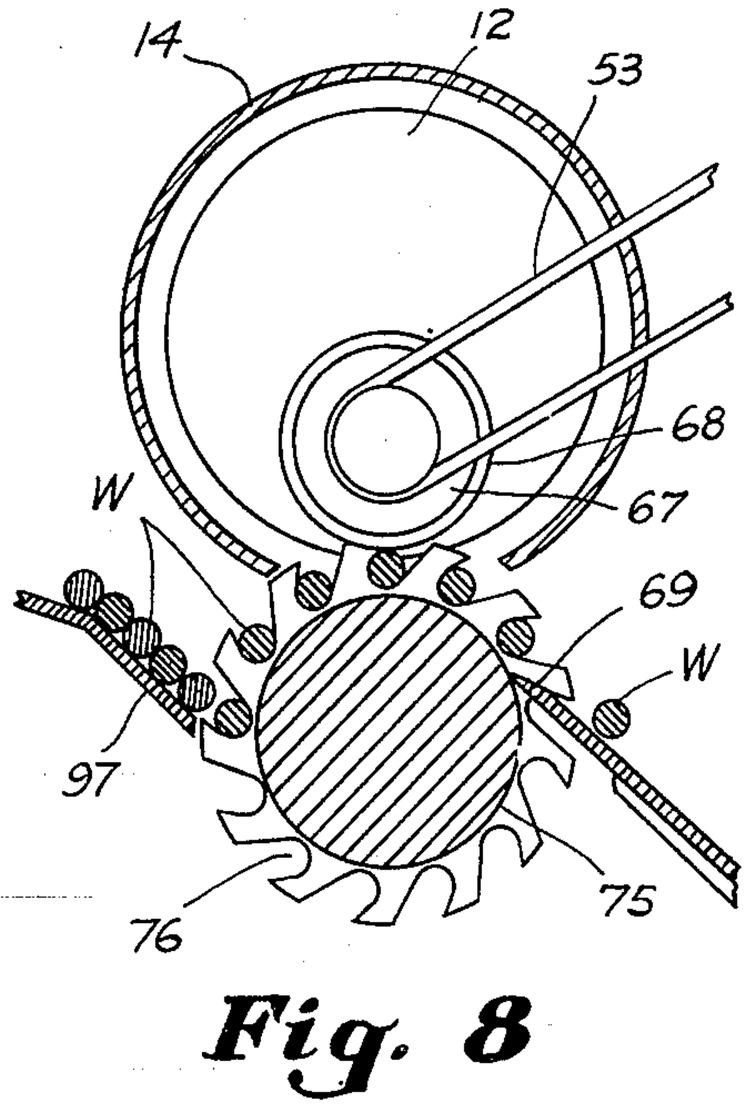

Fig. 8

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4 Sheets-Sheet 4

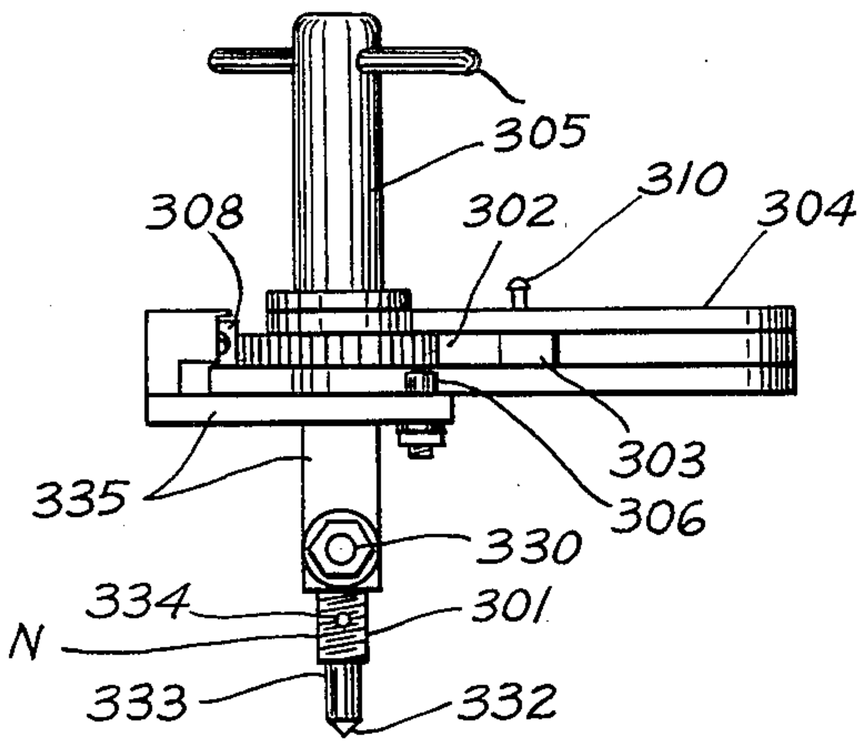

Fig. 9

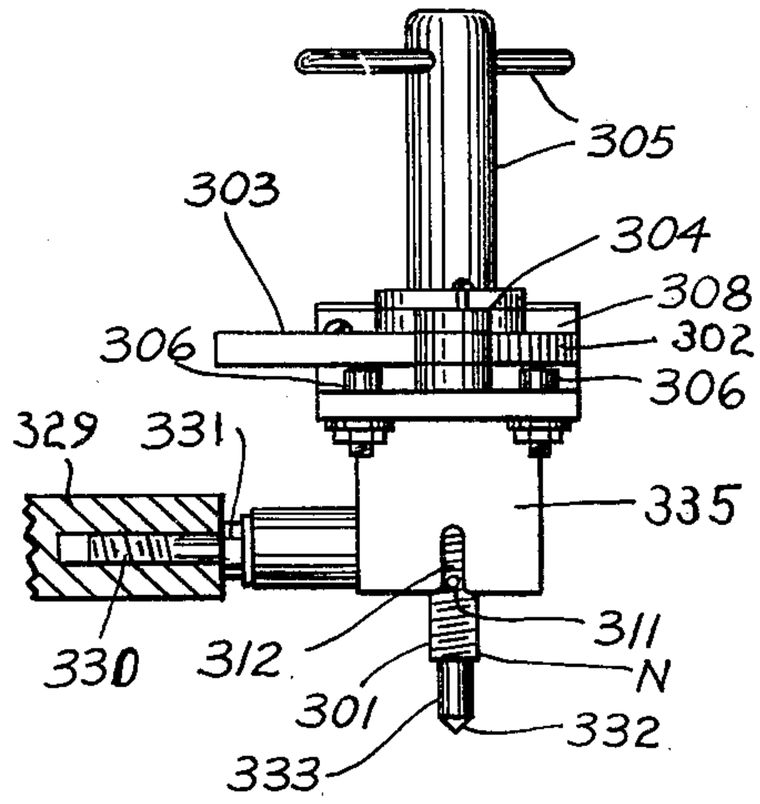

Fig. 10

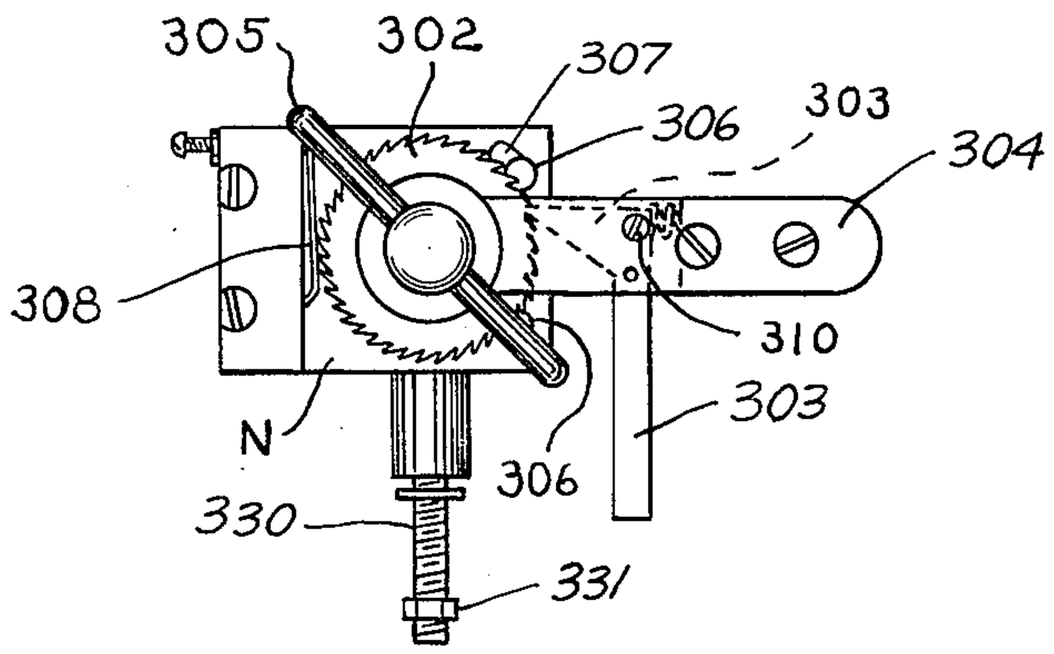

Fig. 11

PER

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Patented Oct. 31, 1950 2,528,042

UNITED STATES PATENT OFFICE

2,528,042

MACHINE FOR GRINDING DOWN CONICAL POINTS OF DRAWN STEEL RODS

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Application April 1, 1947, Serial No. 738,552

9 Claims. (Cl. 51—108)

1

This is a machine for grinding down the conical points of cylindrical drawn steel rods to make needles for use in phonographs, the resulting needles being cylindrical at the base or shank part, then having an annular shoulder at substantially right angles to the axis, then a middle portion of less diameter than the shank and then a relatively short conical point or tip. The purpose is to accomplish this grinding down in one continuous operation and at high speed.

In making such phonograph needles, the drawn steel rods are now ordinarily first formed with a conical point at one end and then this point with a portion of the cylindrical shank which is to be held in the phonograph are cut off at the desired length. The cut end of the cylindrical rod is tapered usually by being ground down to form a conical point. This new pointed end and part of the shank is cut off and the process is repeated until almost the entire length of the rod has been used up.

We have found however that with some sound reproducing machines, such as phonographs, it is desirable to make a needle with a cylindrical shank or holding part which may be the untreated part of the original rod and to form between it and the pointed tip a middle cylindrical portion of less diameter than the shank and to accomplish this by first making a conical point of the angle desirable for the finished tip and to then cut away, as by grinding, the metal between what is to be the finished tip and the base of the original cone and usually part of the shank or holding portion so that the middle part remaining will have a cylindrical form and between it and the shank or holding part there will be an annular shoulder or collar between the shank and the middle portion which lies in a plane substantially perpendicular to the axis of the rod and of the finished needle.

With such a needle it is possible to have a more delicate vibration or tone than can be obtained by the usual type of conically pointed needle.

To produce such a cylindrical middle portion of reduced size has been difficult because of the amount of material that must be removed at and near the base of the conical point and usually at the adjoining part of the shank as such grinding results in the rim or face of the grinding wheel wearing away faster at that side which is doing the grinding near the base than at the other side of the face which is not required to remove as much material and in fact does not reach the smaller part of the original conical point until after the other side of the face has done a great deal of grinding.

To procure the desired result has required a large number of processes which took time, were expensive and slowed production.

With this machine the rods with the pointed ends are placed on an apron, the points being

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substantially lined up on a side feed guide, the apron being so arranged that the rods will move down by gravity to the lower end which is specially constructed and ends proximate a feed roll provided with longitudinal grooves specially made so as to cooperate with the lower end of the apron whereby a single rod is picked up as the roll turns, there being no separating guard to prevent more than one rod from being picked up in each groove.

The feed roll carries these rods along past a finishing guide which causes each point as it comes up to be alined each in exactly the same position below and before a grinding wheel travelling at a surface speed of from six to seven thousand feet per minute so set as to grind down the conical point and if desired, part of the cylindrical holding shank to form the cylindrical middle portion specified.

At the same time there are a plurality of rod revolving wheels each of which enters an annular groove in the feed roll and each of which is so positioned that while the point is being ground, these wheels revolve the rod which is being ground so that all its parts are equally treated but the points are not in contact with anything.

By our machine and method of revolving each rod from 25 to 100 times while it is moving and being ground down, we can finish over 5000 treated rods per hour.

As the edge of the rim of the grinding wheel must do more grinding near the base of the conical point than near the tip, it wears down much more rapidly and one of the main purposes of this device is to reshape the rim or face after such wearing down so that the desired portion of the original conical point will be a cylinder instead of a cone.

We are aware that there are machines having an automatic feed associated with a grinding wheel to reduce the ends of cylindrical members such as shown in patent to Anderson, No. 2,170,672, and we are aware that there are other machines of a similar automatic type to produce cones with conical points on the ends of cylindrical members such as are particularly useful in making skewers and toothpicks as in patent to Spinney, No. 1,175,831, but the particular difficulty of producing the results desired in this case by means of a substantially automatic machine was the fact that the face of the grinding wheel would constantly wear down on the side nearest the base of the cone.

To overcome this difficulty, we provide a dresser which includes a very hard cutting point, such as a diamond, so carried by a cutter holder that it can move in a direction parallel with the axis and across the face of the grinding wheel while it is in motion, such axis being parallel with the axis of the feed roll and with the axis of the rods. As this alignment is always main-

tained, the grinding face of the wheel is kept cylindrical, instead of conical, and it therefore grinds down the middle portion of each rod so as to be a cylinder instead of a cone.

By radial and axial, we mean with reference to the axis of the rod being ground which is parallel to the axis of the grinding wheel and of the feed roll.

As the reshaping gradually cuts down the diameter of the grinding wheel, it is necessary that the dresser cutter carrier should have a radial as well as an axial motion and it is also necessary that the cutting face of the grinding wheel should be moved towards the rods on which it is being operated, and it is further desirable that the speed of the grinding wheel should be so adjusted that as its diameter becomes smaller, its speed can be increased.

These various movements such as the axis parallel motion of the dresser cutting member, its radial movement, the radial movement of the grinding wheel towards the work and its speed must all cooperate with the feed roll and rod turning mechanism.

Other provisions are plows, which enter the annular grooves in the face of the feed roll to plow out or throw out the finished rods and preferably the grinding wheel is entirely enclosed and is provided with a suction mouth connected with air exhausting mechanism to carry off the dust from the grinding wheel and from the points.

Figure 1 is an enlarged elevation of the end of a drawn steel rod showing in dotted lines the portion cut out by our new machine and a portion of a grinding wheel.

Figure 2 is a plan view of our machine with certain parts exaggerated in size for clarity.

Figure 3 is a side elevation of our device.

Figure 4 is a front elevation of our device shown as slightly tilted.

Figure 5 is an enlarged detailed front elevation showing one form of our dresser device partly in section.

Figure 6 is a view similar to Figure 5, showing the dresser device in a different position and

Figure 7 is a side elevation of the dresser device shown in Figures 5 and 6.

Figure 8 is an enlarged detailed side elevational view showing the relation of our rod revolving wheels, feed roll and grinding wheel guard.

Figure 9 is a side elevation of a preferred form of dresser device.

Figure 10 is a front elevation and

Figure 11 is a plan view of the device shown in Figure 9.

In Figure 1, W is a drawn steel rod, having a base portion **100** and a conical tip **101** which ends in a point **102**. The dotted lines define the portion of conical tip **101** and **100** which is to be ground out by our device, leaving a cylindrical middle portion **103** and shoulder **104**, each substantially perpendicular to the other.

After passing through our device and being ejected therefrom, the newly ground tip of rod W together with a desired length of base portion **100** is cut off from the remainder of the base, the cut off portion forming a phonograph needle. Rod W is then given a new conical point, by any well known means, and may be again inserted in our device until such time as it becomes too short to be effectively held in grooved feed roll **75**.

As shown in Figure 2, we provide a hopper with a feed apron **90**, a side feed guide **95** and opposite side **96**, the apron being approximately

the same with as the grooved feed roll **75**. To facilitate the passage of rods W toward the feed roll, we prefer to use a feed apron in which the bottom is divided into sections, each at a different inclined plane, as at **91**, **92**, **93** and **94**, with one section **97** at a decided slope adjacent to the feed roll.

F represents the frame of our device, comprising legs L and a top plate A to which the various parts are bolted or otherwise fastened. We may use any convenient source of power but prefer to use an electric motor M, having a shaft **1** to which are keyed two power pulleys **2** and **50**.

Pulley **50**, by means of belt **51** and pulley **56** drives a gear reduction box **54**, having a power shaft **53** which carries a large pulley **55** and a sprocket **71**. Sprocket **71** is connected by chains **72** and sprocket **73** to grooved feed roll **75** thereby revolving it in a clockwise direction.

We provide a plurality of longitudinal grooves **76** in feed roll **75**, of a width and depth sufficient to accommodate only one rod W, the rod when in groove **76**, being buried so that its top surface is proximate the outer surface of feed roll **75**. Each groove **76** is milled out at a slight angle from the radius of the feed roll so that it rakes forward in the direction of rotation and so that its trailing edges will form a hook for better picking up and retaining of each rod W as shown in Figure 8.

We also provide a plurality of annular grooves **77** in each feed roll **75**, into which plows **69** as well as rod revolving wheels **67** extend. Plows **69** are of springy sheet metal and reach under each rod W, after its tip has been ground, and lift it out of its groove **76** channeling it into the collecting bin **78**.

Each pick up groove **76** is of a size to allow a rod to revolve freely without binding and to be pushed down by the rod revolving wheels **67** against its inner face so that it cannot come out but can turn freely. Each groove **76** is of such a depth measured from the inner face of an annular groove **77** that a small segment of rod projects into groove **77** and is in contact with the wheels **67** but the complete depth of each pick-up groove **76** from its opening should be greater than the diameter of one rod but less than the diameter of two rods, and the slope or pitch should be such that, as shown in Fig. 8, the outer face of groove **76** will be substantially in extension of the bottom front or feed section **97** of the feed apron when approaching its edge.

Rod revolving wheels **67** are driven in a clockwise direction by large pulley **55** by means of pulleys **52** on shaft **202** and belts **207** and are carried at the ends **62** of rocker levers **60**, journaled in bearings **61**.

Because after the desired needle shape has been made, and the needle end of the rod cut off, it is desirable to use up the rest of that rod as far as possible. The cut end can be tapered in the usual manner but as the rod is constantly getting shorter, we found it desirable to have the annular grooves **77** on the feed roll **75** and the rod revolving wheels **67** so arranged that the wheels can be moved axially to engage any one or two of the series of annular grooves so as to take care of the short sections as they are fed by the feed apron and roll.

We therefore provide thumb screws **201** in the hub of each pulley **52** for tightening said pulleys at the desired point along shaft **202**, and provide a slot **203** in shaft **202** to which each pulley **52** is keyed in a well known manner.

We also provide thumb screws 64 on the opposite end of levers 60 which bear against the flat top of gear box 54 to adjust the pressure on rod revolving wheels 67. We can thus cause rods W to revolve at varying speeds depending on the slippage permitted between the rod and the rubber surface 68 of wheels 67.

As shown in Figure 4, top A of frame F may be horizontal but we prefer to tilt it at an angle of 5°, more or less, so that the rods W will tend to slide toward side feed guide 95 by gravity.

The rods leave side guide 95 and then engage a finishing guide 107 which after each one is picked up by the feed roll correctly lines up their points with reference to the grinding wheel 12 but releases them before they are engaged by the rod revolving wheels 67 and just before they are engaged by the grinding wheel 12. Their points are therefore correctly lined up before the rods are being turned by the rod revolving wheels and as they are being ground down or being reshaped by the grinding wheel. The rod revolving wheels 67 may turn clockwise or anti-clockwise.

Powered by the same motor M, as drives the feed mechanism, is a pulley 2 which is connected to a speed changing device D of a well known type. D comprises a shaft 5, pulleys 4 and 6 and hand adjusting knob 7, which when turned slides the pulleys on intermeshing inclined planes thereby changing the speed of revolution of the driven pulley 6.

A belt 8 connects pulley 6 with a pulley 9 keyed to a shaft 10, journaled in a bearing 11, the shaft 10 carrying at its opposite end the grinding wheel 12. We provide a pulley guard 13 fixed at one end of shaft 10 to a bearing carrier 15 which slides vertically in a carrier track 16. Also fixed to carrier 15 is a dressing device 22 so that the grinding wheel and dresser may be lowered gradually as the diameter of the grinding wheel is reduced by use. Carrier 15 is threaded on a worm 17, having a ratchet 18 operated by a pawl 19 and handle 20, whereby a movement of the handle will lower the carrier 15 a measured amount.

Grinding wheel guard 14 is fixed to carrier track 16, is not slidable and is slotted at the top at 21, to accommodate the dresser 22, at the bottom, at 23, to accommodate feed roll 75 and in the middle, at 206, to accommodate shaft 10. We provide a face plate 24, which extends close to feed roll 75 to protect the operator and to confine the products of the grinding.

At the other side of guard 14 is an opening 25, proximate the point of grinding, to which is attached a suction pipe 26, leading to an exhausting pump not shown, for the purpose of pneumatically by suction removing the particles of ground material from the machine.

Our dressing device as shown in Figs. 2–7 may comprise a diamond point or tip 110, held by a threaded tube 27 having an adjusting knob 28 adapted to raise or lower the diamond cutting tip when the knob is turned. Tube 27 is carried at the end of a sliding member 29, operating in a guide 30, and slidable by means of pivoted handle 31.

In operation, our grinding wheel while working on the conical tip of rod W, tends to acquire a tapered or beveled surface, as shown in Figure 1. By occasionally working the handle 31 of our dressing device, however, the operator can move diamond tip 110 slowly across the face of the grinding wheel as it revolves at high speed, thus recutting a cylindrical surface.

It is obvious that if, a tapered cut on rod W was desired, rather than a cylindrical cut, we could use our dresser to make and maintain a tapered surface on the grinding wheel 12.

We may use, in place of the dresser previously shown at 110, 27 and 28, a preferred form of dresser shown at N in Figs. 9–11. Dresser N is carried by a sliding member 329, operating in a guide 30 and is slidable by means of a handle 31 across the face of the grinding wheel 12.

Dresser N is attached to 329 by a bolt 330 and may be tightened by lock nut 331 in a position perpendicular to the face of grinding wheel 12 or at various angles from the perpendicular if it is desired to bring into contact with the grinding surface, a particular face of the diamond cutting point 332.

Diamond 332 is fixed in a tubular holder 333, the latter being held in a threaded shaft 301 by set screw 334. Shaft 301 is slidable in frame 335 and is prevented from turning therein by lugs 311 operating in slots 312. A ratchet 302 is threadedly connected to shaft 301 and is operable by a spring pressed pawl 303 pivoted to a handle 304. A handle 305 is also provided, for raising or lowering shaft 301 when pawl 303 is held out of contact with ratchet 302 by the tightening of set screw 310. Stops 306, 306, adjustable in slots 307, 307, are provided to limit the movement of handle 304 to the extent desired and a leaf spring 308 bears against ratchet 302 thereby maintaining it in position.

We claim:

1. In a machine for forming a cylindrical section from proximate the base to proximate the tip of the drawn steel conical point of a rod; the combination of feed apron to support a plurality of such rods; a feed roll having a plurality of pick up grooves parallel with its axis each to pick up a rod and a plurality of annular grooves; means to aline the tips of the rods at a point before they are to be revolved and ground; means to revolve each rod comprising a plurality of rod revolving wheels, each entering an annular feed roll groove; grinding means comprising a grinding wheel for grinding the points of each rod as it is being revolved; dresser means including a cutting point and carrier therefor, said carrier being slidable parallel with the axis of the feed roll and the pick up grooves and means to move it radially towards the axis of the feed roll to keep the grinding face of the grinding wheel as a cylinder with an axis parallel with the axis of the feed roll and of the axis of the rod being ground; means to move the grinding wheel radially towards such rod axis; means to increase the speed of said grinding wheel as it is reduced in diameter; and means to remove the finished rods from the feed roll including plows engaging the annular grooves in the feed roll.

2. In a machine for forming a cylindrical section from proximate the base to proximate the tip of the drawn steel conical point of a rod; the combination of feed apron to support a plurality of such rods; a feed roll having a plurality of pick up grooves parallel with its axis each to pick up a rod and a plurality of annular grooves; means to aline the tips of the rods at a point before they are to be revolved and ground; means to revolve each rod comprising a plurality of rod revolving wheels, each entering an annular feed roll groove; grinding means comprising a grinding wheel for grinding the points of each rod as it is being rovolved; dresser means to keep the grinding surface of the grinding wheel as a cylinder with an axis parallel with the axis of the feed

roll and of the rod being ground; means to move the grinding wheel towards such rod axis; means to increase the speed of said grinding wheel as it is reduced in diameter; and means to remove the finished rods from the feed roll including plows engaging the annular grooves in the feed roll.

3. In a machine for forming a cylindrical section from proximate the base to proximate the tip of the drawn steel conical point of a rod; the combination of feed apron to support a plurality of such rods; a feed roll having a plurality of pick up grooves parallel with its axis each to pick up a rod and a plurality of annular grooves; a side guide to aline the tips of the rods at a point before they are to be revolved and ground; means to revolve each rod comprising a plurality of rod revolving wheels, each entering an annular feed roll groove; grinding means comprising a grinding wheel for grinding the points of each rod as it is being revolved; means to move the grinding wheel radially towards such rod axis; means to increase the speed of said grinding wheel as it is reduced in diameter; and means to remove the finished rods from the feed roll including plows engaging the annular grooves in the feed roll.

4. In a machine for forming a cylindrical section from proximate the base to proximate the tip of the drawn steel conical point of a rod; the combination of feed apron to support a plurality of such rods; a feed roll having a plurality of pick up grooves parallel with its axis each to pick up a rod and a plurality of annular grooves; means to aline the tips of the rods at a point before they are to be revolved and ground; means to revolve each rod comprising a plurality of rod revolving wheels, each entering an annular feed roll groove; grinding means comprising a grinding wheel for grinding the points of each rod as it is being revolved; means to move the grinding wheel towards such rod axis; means to increase the speed of said grinding wheel as it is reduced in diameter; and means to remove the finished rods from the feed roll including plows engaging the annular grooves in the feed roll.

5. In a machine for forming a cylindrical section from proximate the base to proximate the tip of the drawn steel conical point of a rod; the combination of a feed apron which slopes laterally toward the points of such rods to support a plurality of such rods; a feed roll having a plurality of pick up grooves, the walls of each of which grooves slope forward and are of a greater depth than the diameter of a rod, parallel with its axis each to pick up a rod and a plurality of annular grooves; a side guide to aline the tips of the rods at a point before they are to be revolved and ground; means to revolve each rod comprising a plurality of rod revolving wheels, each entering an annular feed roll groove; grinding means comprising a grinding wheel for grinding the points of each rod as it is being revolved; dresser means to keep the grinding surface of the grinding wheel as a cylinder with an axis parallel with the axis of the feed roll and of the rod being ground; means to move the grinding wheel towards such rod axis; means to increase the speed of said grinding wheel as it is reduced in diameter; and means to remove the finished rods from the feed roll including plows engaging the annular grooves in the feed roll.

6. In a machine for forming a cylindrical section from proximate the base to proximate the tip of the drawn steel conical point of a rod; the combination of a feed apron which slopes laterally toward the points of such rods to support a plurality of such rods; a feed roll having a plurality of pick up grooves, the walls of each of which grooves slope forward and are of a greater depth than the diameter of a rod, parallel with its axis each to pick up a rod and a plurality of annular grooves; means to aline the tips of the rods at a point before they are to be revolved and ground; means to revolve each rod comprising a plurality of rod revolving wheels, each entering an annular feed roll groove; grinding means comprising a grinding wheel for grinding the points of each rod as it is being revolved; means to move the grinding wheel as it is reduced in diameter; and means to remove the finished rods from the feed roll including plows engaging the annular grooves in the feed roll.

7. In a continuous action machine for forming a cylindrical section from proximate the base to proximate the tip of the drawn steel conical point of a rod; the combination of a feed apron which slopes laterally towards the points of such rods to support a plurality of such rods and slopes downward and forward at its inner bottom and at a predetermined angle; a feed roll having a plurality of pick up grooves, the walls of each of which grooves slope forward and are of greater depth than the diameter of a single rod and less than the diameter of two such rods, whereby the outer face of the wall of each roll groove will be substantially in extension of the bottom front section of the feed apron when proximate thereto, such grooves being parallel with the axis of said roll, each to pick up a single rod, there being a plurality of annular revolving wheel grooves in the feed roll; means to revolve each rod at a predetermined position, such means comprising a plurality of rod revolving wheels, each entering an annular feed roll wheel groove; grinding means comprising a grinding wheel for grinding the point of each rod at a predetermined position as each rod is being revolved by the rod revolving wheels and is moving with the feed roll; and means to revolve the feed roll, the rod turning wheels and the grinding wheel in the same direction at different speeds.

8. In combination with the subject matter of claim 7, means to align the tips of the rods before they are to be revolved and ground.

9. In combination with the subject matter of claim 7, together with means to align the tips of the rods before they are to be revolved and ground; and means to dress the cutting face of the grinding wheel while it is turning and grinding.

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ARTHUR H. ROGERS.

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