Dec. 24, 1963 T. K. ALLISON 3,114,989

DOCTOR BLADE GRINDING MACHINE

Filed Oct. 30, 1961 4 Sheets-Sheet 1

Fig. 1

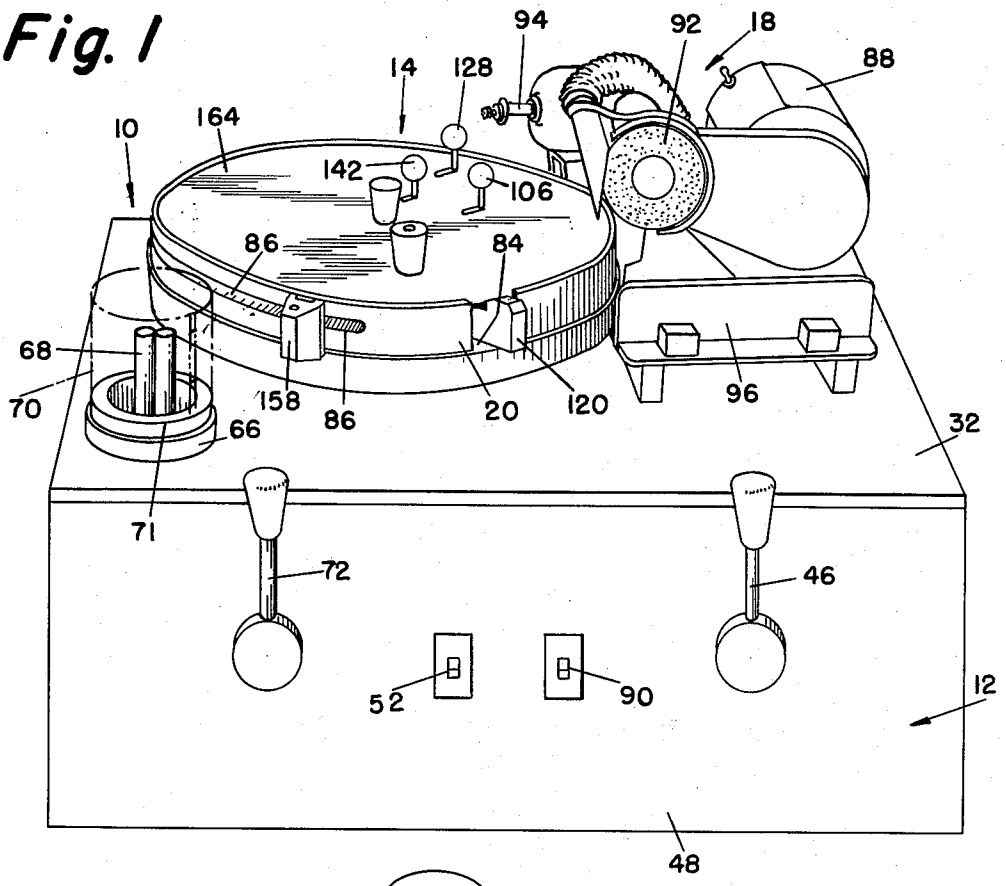
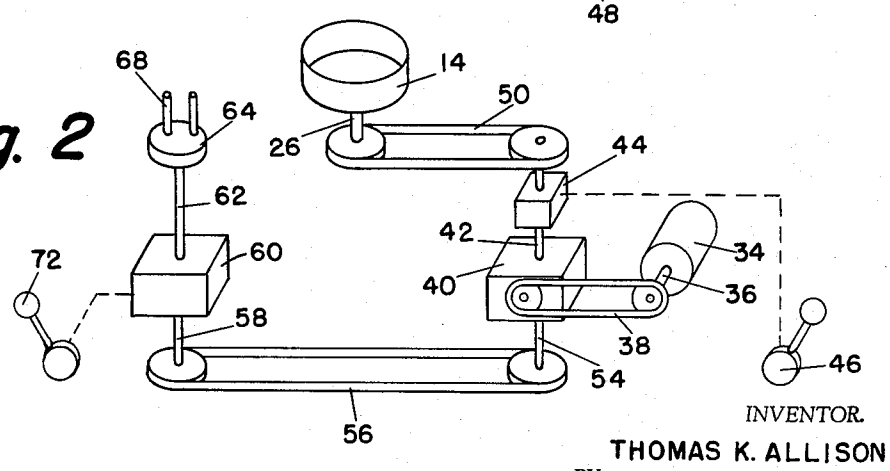


Fig. 2



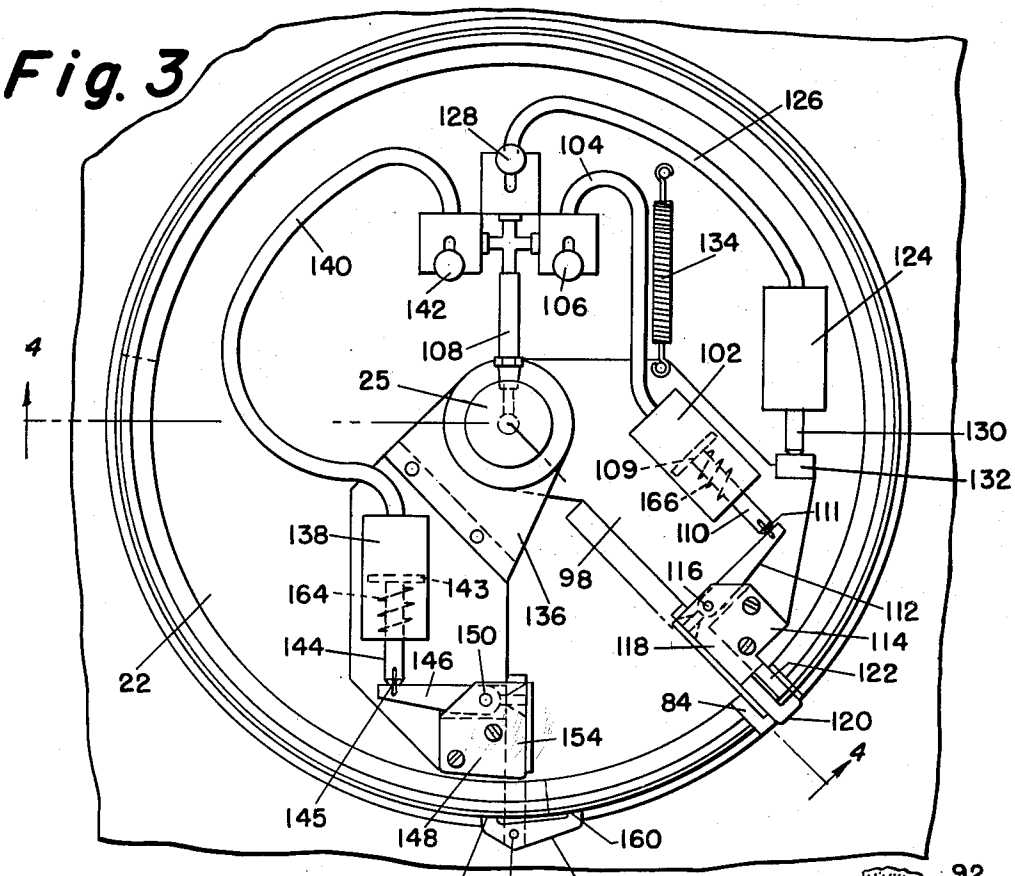
INVENTOR.
THOMAS K. ALLISON
BY
Millman and Jacobs
ATTORNEYS

Dec. 24, 1963 T. K. ALLISON 3,114,989

DOCTOR BLADE GRINDING MACHINE

Filed Oct. 30, 1961 4 Sheets-Sheet 2

Fig. 3



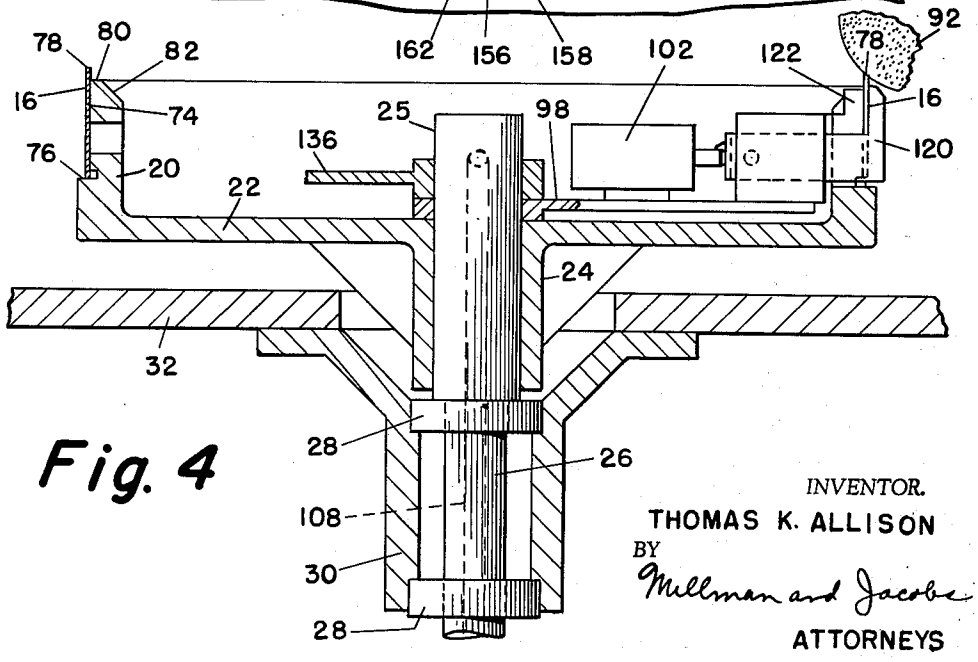


Fig. 4

INVENTOR.
THOMAS K. ALLISON
BY
Millman and Jacobs
ATTORNEYS

Dec. 24, 1963 T. K. ALLISON 3,114,989

DOCTOR BLADE GRINDING MACHINE

Filed Oct. 30, 1961 4 Sheets-Sheet 3

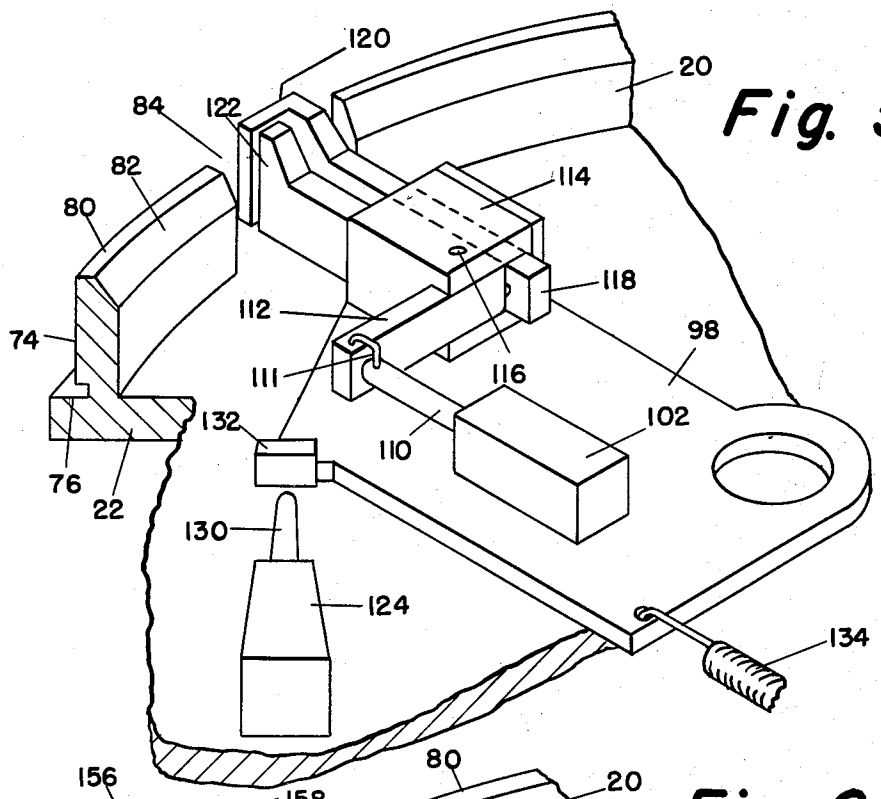


Fig. 5

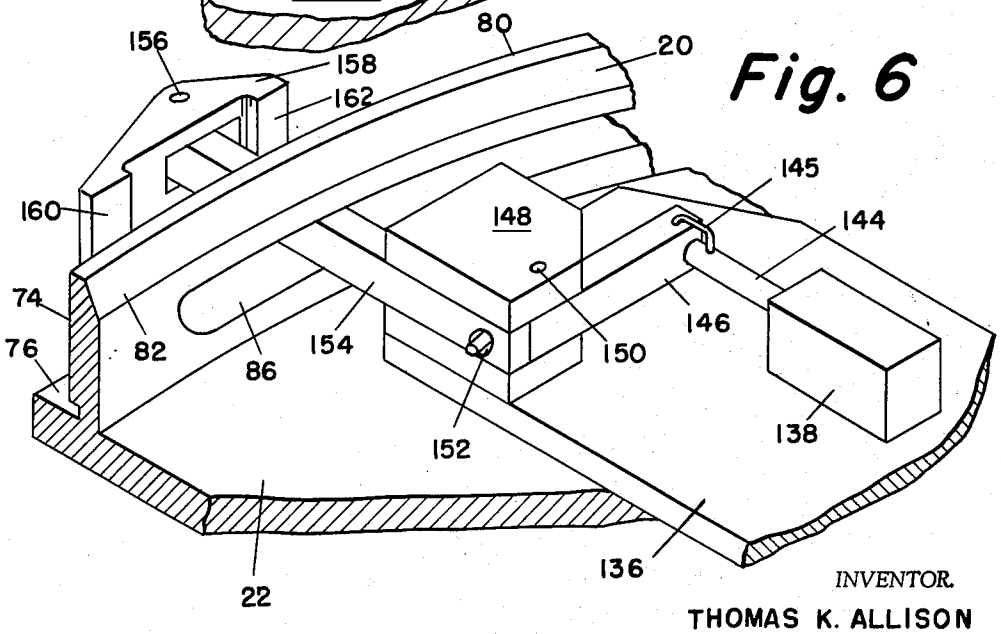


Fig. 6

INVENTOR.
THOMAS K. ALLISON
BY
Millman and Jacobs
ATTORNEYS

Dec. 24, 1963 T. K. ALLISON 3,114,989

DOCTOR BLADE GRINDING MACHINE

Filed Oct. 30, 1961 4 Sheets-Sheet 4

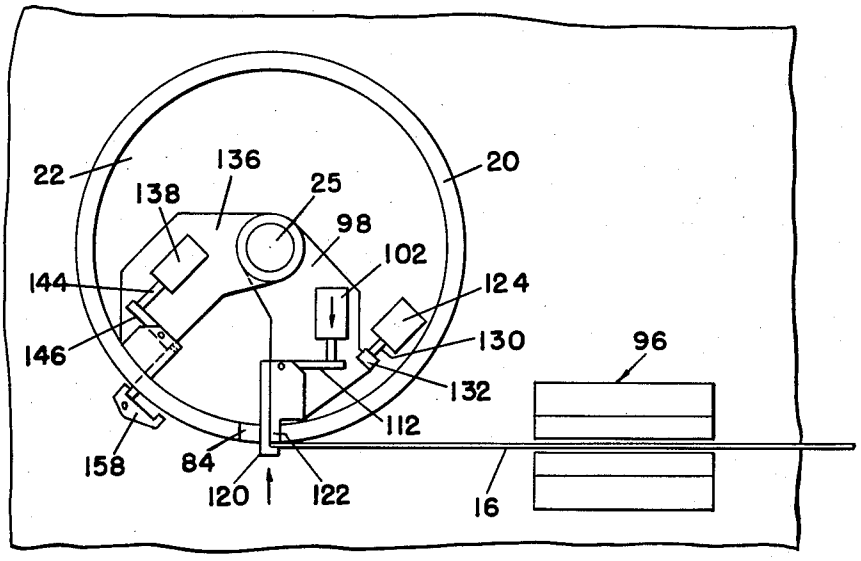


Fig. 7

Fig. 8

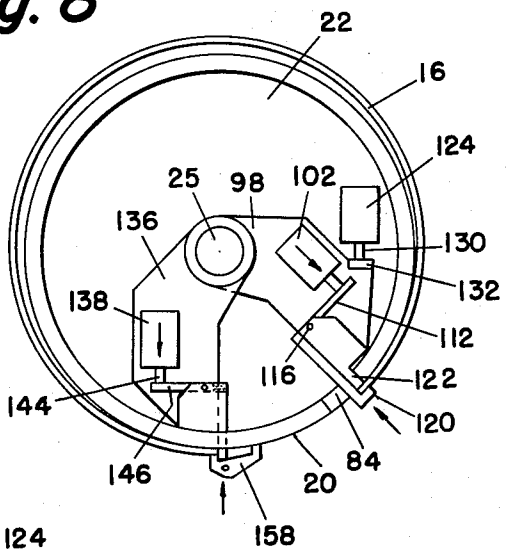
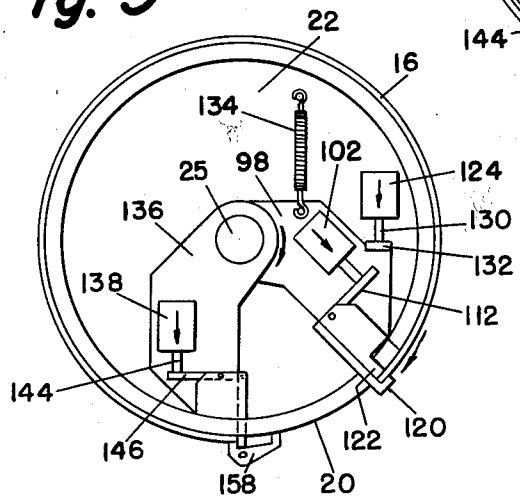


Fig. 9



INVENTOR.
THOMAS K. ALLISON
BY
Millman and Jacobs
ATTORNEYS

United States Patent Office 3,114,989 Patented Dec. 24, 1963

3,114,989

DOCTOR BLADE GRINDING MACHINE

Thomas K. Allison, 590 Camden Ave., Moorestown, N.J.

Filed Oct. 30, 1961, Ser. No. 148,571
12 Claims. (Cl. 51—105)

This invention relates to a machine for continuously honing or grinding, buffing or otherwise forming an edge of desired chamfer or contour on a relatively thin and long member, such as a doctor blade.

As is well known in the art, a doctor blade is an elongated relatively thin member adapted to wipe a fluid cleanly from a particular surface. In gravure or intaglio printing, especially rotogravure printing, the doctor blade is employed to wipe the printing ink or fluid from the surface of the engraving cylinder or plate. To do so cleanly and efficiently with a minimum of blade pressure against this plate requires the grinding or honing of the edge of the blade at a selected angle, which angle depends upon the intended use of the printing process, as, for example, in half-tone reproduction, the viscosity of the printing fluid, the nature of the plate, the material and construction of the blade, etc. The blade is thin and flexible (5 to 10 mils thick) is made of steel, nylon, brass or bronze, is purchased as a coiled ribbon and is cut, for use in rotogravure, to lengths of one or more feet. Heretofore the grinding or honing of new and used doctor blades was effected in the devices for holding the blades in the printing machines.

It is an object of the present invention to provide a machine for continuously grinding, honing or lapping the entire edge of a doctor blade thereby overcoming the difficulty inherent in the handling of the entire holder assembly with blade attached as required heretofore.

Another object of the invention is to provide a doctor blade grinding machine in which the blade is clamped to the peripheral rim of a circular table and rotated relative to a fixed grinding wheel in contradistinction to the mode of operation of the machine described in my copending application Serial No. 118,478 filed April 12, 1961 wherein the grinding wheel is reciprocated along the length of the fixed blade.

Another object of the invention is to provide a doctor blade grinding machine employing easily operable and adjustable means to readily mount any length of doctor blade on and hold the same in proper position against the rim of a circular rotary table relative to the grinding wheel.

Yet another object of the invention is to provide a rotary doctor blade grinding machine of the character above described in combination with a rotatable means for removing and re-coiling the ground doctor blade into a container for storage or shipment thereof.

According to the invention, there is provided a motor driven rotary circular table, a first clamp means associated therewith to hold one end of the doctor blade which is guidingly led thereto while the table is rotated to wrap the blade around the rim of the table, a second clamp means adjustable around the rim of the table to fixedly clamp the other end of the blade thereto and means operative to move the first clamp means in a limited arc and thereby apply tension to the blade and tighten its entire length against the rim, there being a grinding wheel or other tool which is mounted to operate continuously on the edge of the blade which protrudes above the rim. A spooling member may also be provided whereby the ground blade is readily removed from the table and coiled into a container. Thereafter, the sharpened blade may be inserted in a holder such as that described in my copending application Serial No. 102,525 filed April 12, 1961, now Patent No. 3,085,275, dated April 16, 1963.

These and other objects of the invention will become more apparent as the following description proceeds in conjunction with the accompanying drawings, wherein:

FIGURE 1 is a perspective view of the machine;

FIGURE 2 is a diagrammatic view of the motor and drive connections to the various parts of the machine;

FIGURE 3 is a top plan view of rotary table and associated parts with its cover plate removed;

FIGURE 4 is a sectional view taken on the line 4—4 of FIGURE 3;

FIGURE 5 is a discerpted enlarged perspective view of the first or tensioning clamp;

FIGURE 6 is a view similar to FIGURE 5 of the second or adjustable rim clamp; and

FIGURES 7–9 are diagrammatic views illustrating respectively the first stage in securing one end of the blade in place, the second stage wherein the table is rotated to wrap the blade therearound and fixedly clamp its other end to the rim and the third stage of applying tension to the first clamp and thereby tighten the blade over its entire length against the rim.

Specific reference is now made to the drawings wherein similar reference characters are used for corresponding elements throughout.

The overall machine is indicated at **10** and comprises a housing **12** for the motor and driving connections shown in FIGURE 2, a turntable **14** for mounting the doctor blade or equivalent thin flexible member **16** and a grinding member or equivalent tool **18**. The turntable is in the form of a dished out member having a circular peripheral rim **20** upstanding from a flat member **22**, the latter having a depending boss **24** which is secured to the upper enlarged end **25** of a shaft **26** that is, in turn, journaled in bearings **28** retained in a bell-shaped housing **30** which is secured to and beneath the upper plate **32** of the housing **12**.

A motor **34** is suitably mounted in the housing **12** whose drive shaft **36** is coupled via sheaves and an endless belt **38** to a conventional reduction gear unit **40**, the latter having a vertical driven shaft whose upper portion **42** is coupled via a conventional mechanical clutch **44** operable by a handle **46** at the front panel **48** of the housing **12** to the turntable shaft **26** via sheaves and an endless belt **50**. Thus by moving the handle **46** in one direction, the clutch **44** is engaged and drivingly connects the motor **34** to the turntable while movement of the handle in an opposite direction will break the connection, the motor being connected to an electric source via an energizing switch **52** operative at the front panel **48**.

The lower portion **54** of the vertical shaft extending from the gear reduction unit **40** is connected via sheaves and an endless belt **56** to another vertical shaft **58** which is connected by means of a mechanical clutch **60** to a further vertical shaft **62** appropriately journaled in housing **12**, the shaft **62** extending through the upper housing plate **32** at one corner thereof and being connected to a disk **64** rotatable in a fixed collar **66** on the upper plate **32**, the disk **64** carrying upstanding spaced adjoining rods, fingers or spools **68** forming a spooling or reeling member to receive therebetween one end of the blade after it has been made to pass through a vertical slit in a cylindrical open-ended container **70**. The container is removably received in a grooved stripper member **71** which is non-rotatably mounted in the collar **66**, the container surrounding the spooling fingers, the stripper member being removed with the container, blade and all. A further handle **72** is mounted on the front panel **48** and is operatively connected to clutch **60** to make and break the connection between the spooling member and motor **34**.

As will be seen in FIGURES 4–6, the vertical cross section of the rim **20** is such that it has an outside surface

portion 74 against which the blade 16 will be made to bear which is substantially planar and an outwardly extending shoulder or ledge 76 beneath said planar portion 74 upon which the lower edge of the doctor blade rests, the width of the blade being such that in this position its upper edge 78, which will be ground or otherwise worked upon, extends above the upper edge 80 of the rim, the latter also including a bevel 82 extending inwardly from said upper edge 80. At a predetermined location, the rim is discontinued for a short distance to provide a free space or gap 84 and at a location removed therefrom there is an elongated slot 86 which extends transversely through and circumferentially along the rim, the slot being closed at its ends, for a purpose soon to appear.

The grinding unit 18 is mounted as such on the upper housing plate 32 and consists of a motor 88 which is connected to an electric source via another switch 90 mounted on front panel 48 and is drivingly connected to an abrading wheel 92 whose rotational axis is horizontal as compared to the vertical axis of rotation of the turnable 14. The unit may also be provided with a further driven shaft 94 for mounting additional tools, such as a buffing wheel (not shown), etc. It will be understood that while a grinding member is here shown, the machine is capable of functioning with other tools as well which will shape the edge of the blade as it rotates before the tool, such as a heated shaped iron where the blade is plastic, a thread rolling member, an electropolishing member, a burnishing unit and the like.

Also mounted on the upper plate 32 is a member 96 for guiding the blade during the mounting thereof on the turntable, the same being an elongated slitted unit or a pair of elongated plates extending chordally adjacent the turntable and between which the blade passes on its way thereto to effect horizontal alignment of the blade with the rim.

The mounting of the blade on the rim is expeditiously and accurately effected by the use of two clamping means which will now be described. The first is comprised of a bar 98 which is loosely mounted on the upper enlarged end 25 of the turntable shaft and extends radially thereof. Mounted on the bar is a pneumatic cylinder 102 which, by a flexible hose 104, is connected via a manually operable conventional three-way valve 106 to a compressed air line 108 that leads through the shaft 26 to the pneumatic or compressed air source (not shown). Movable in the cylinder is a piston 109 on the end of a rod 110 which is pivotally joined at its free end by a U-shaped link 111 to a lever arm 112. The lever arm extends through a yoke block 114 mounted on the plate 98 and is pivoted between the furcations thereof around a vertical axis as at 116, the other end of the arm 112 being pivotally connected through a countersunk hole to a clamp bar 118 which extends radially through the gap 84 in the rim and carries a transversely extending jaw 120 opposite a cooperating clamping jaw or anvil 122 which is carried by the yoke block 114.

Mounted on the turntable plate 22 is a further pneumatic cylinder 124 which is connected by flexible hosing 126 via another manually operable three-way valve 128 to the compressed air line 108 leading to the pneumatic source. A piston (not shown) is movable in the cylinder and is carried at the end of a rod 130 which is connected at its free end to an abutment 132 secured to the bar 98. A coil spring 134 is terminally attached to the bar or plate 98 and the turntable and normally urges the bar 98 towards one end of the rim gap 84.

The second clamping means is similar in a number of aspects to the first and includes a radially extending flat bar 136 loosely mounted on the upper end 25 of the turntable shaft and upon which bar is mounted a pneumatic cylinder 138. The cylinder by means of a flexible hose 140 is connected via a manually operable three-way valve 142 to compressed air line 108. Movable in the cylinder is a piston 143 on the end of a rod 144 whose free end is

pivotally joined as by a U-shaped link 145 to a lever arm 146 which extends through a yoke block 148 mounted on bar 136, the arm being pivoted intermediate its ends about a vertical axis as at 150 between the furcations of the block. At its other end the arm is pivotally secured through a countersunk hole 152 to a clamp bar 154 which extends radially through the slot 86 in the rim, the free end of the bar outside the rim being pivoted about a vertical axis as at 156 intermediate the ends of clamping jaw or head 158 having two flat bearing surfaces 160 and 162.

In use, a desired length of the thin flexible blade (usually one or more feet) is secured and fed to the turntable between the plates of the guide member 96. One end of the blade is placed between the jaw 120 and anvil 122 of the first clamping means and the knob of the valve 106 is pushed to a position in which communication is made with compressed air line 108 and the pressure behind the piston in cylinder 102 is applied. It will be observed at this point that the knobs of all three pneumatic valves 106, 128 and 142 extend exteriorly of a cover plate 164 for the turntable. When the valve 106 is moved to the aforementioned positon, rod 110 rocks lever arm 112 which pulls back clamp bar 118 urging jaw 120 against anvil 122 in the rim gap 84, thereby securely retaining the end of the blade 16 between the jaw and anvil at this location as shown in FIGURE 7. Thereafter, the turntable is rotated, preferably manually, wrapping the blade around the rim until the other end of the blade is positioned against the bearing surface 162 of the jaw 158 of the second clamping means and against the outer surface of the rim. The movability of the clamp bar 154 in the rim slot allows the clamp means to be adjusted along the rim in accordance with the selected length of the blade. Upon operation of the knob associated with valve 142 to a position where the pressure behind the piston in cylinder 138 is applied, the rod 144 pushes lever arm 146 pulling clamp bar 154 and jaw 158 towards the rim and thereby firmly clamping this end of the blade against the rim as shown in FIGURE 8. Then in order to apply tension to the blade and urge it firmly against the rim, the knob associated with valve 128 is pushed to apply pressure behind the piston in cylinder 124 whereby rod 130 pushes bar 98 in a clockwise direction towards the second clamping means with the jaws 120 and 122 moving in the gap 84 while gripping the end of the blade and thereby exerting a pull thereon. In this condition, rotation of the turntable with the blade so mounted thereon will permit continuous and proper grinding of the entire length of the blade edge.

When the working operation has been completed and the turntable has been stopped by moving handle 46 to a clutch disengaging position, the knob of valve 128 is pushed to a position to vent cylinder 124 thereby permitting spring 34 to retract bar 98 and release tension from the blade. Then the knob of valve 142 is pushed to vent cylinder 138 permitting the internal spring 164 (which is wound about the piston rod 144 and terminally bears against the piston 143 and the end wall of the cylinder) to retract the piston rod 144 and pull lever arm 146 thereby opening the clamping jaw 162. That end of the blade which was engaged by jaw 162 is then inserted through the slitted container 70 and between spool rods 68. Holding the container 70 with one hand, handle 72 is moved to cause clutch 60 to engage thereby causing the rods 68 to rotate and reel the blade inside the container. To free the end of the blade which is still attached to the machine by jaws 120 and 122, the clutch 60 is disengaged with handle 72 and then the knob of valve 106 is moved to vent cylinder 102 permitting the internal spring 166 therein (of the same type as spring 164) to retract the piston rod 110 and pull lever arm 112 opening jaw 120 and thereby releasing the other end of the blade. The stripper member and container are pulled off the collar 66 as a unit thereby stripping the blade from the spool rods 68.

While a preferred embodiment of the invention has been shown and described herein, it will be understood that minor variations may be made by a skilled artisan without departing from the spirit of the invention and the scope of the appended claims.

I claim:

1. A machine for continuously grinding one longitudinal edge of an elongated flexible blade having a pair of opposed longitudinal edges and ends comprising a support, a turntable mounted on said support, means for rotating said turntable about an axis and having a circular rim terminating at one side and a circumferential shoulder extending radially from the opposite side thereof, a first means on said turntable for clamping one end of the blade and having a clamping surface extending substantially from said shoulder to said one side of said rim, a second means on said turntable for clamping the other end of the blade and having a clamping surface extending substantially from said shoulder to said one side of the blade with the blade wrapped around said rim, said one longitudinal edge of the blade extending a relatively short distance beyond said one side of said rim and the opposite longitudinal edge of the blade bearing on said shoulder, means for moving said first and second clamping means relative to each other to apply tension on the blade in a direction to tighten it against said rim, and a grinding wheel adapted to act on said one longitudinal edge of the blade.

2. The combination of claim 1 wherein said first and second clamping means and said means for moving them relative to each other are pneumatic.

3. The combination of claim 1 wherein said first clamping means includes an opening provided in said rim, an anvil mounted on said turntable inwardly of said rim at said opening, a jaw opposite said anvil disposed outwardly of said rim, and means to move said jaw radially towards and away from said anvil to selectively clamp said one end of said blade between said jaw and anvil and to release said blade therefrom.

4. The combination of claim 3 wherein said means to move said jaw includes a lever rockably mounted on said turntable intermediate its ends, said jaw being connected to one end of said lever, and a pneumatically operated rod operatively connected to the other end of said lever.

5. The combination of claim 3 wherein said means for moving said first and second clamping means relative to each other includes a bar mounted on said turntable to move relative thereto around the axis thereof, said anvil and jaw being carried by said bar, and a pneumatically operable rod connected to said bar.

6. The combination of claim 1 wherein said second clamping means includes an elongated circumferentially extending slot through said rim, a lever arm extending through said slot, a jaw pivoted to one end thereof exteriorly of said rim, means mounting said arm for movement circumferentially of said turntable and means to move said arm radially through said slot to selectively clamp said other end of the blade between said jaw and said rim and to release said blade therefrom.

7. The combination of claim 6 wherein said arm mounting means includes a bar mounted on said turntable to move relative thereto about the axis of rotation of said turntable.

8. The combination of claim 7 wherein said means to move said arm includes a second arm pivotally mounted intermediate its ends upon said bar, said first arm being connected to one end of said second arm, and a pneumatically operated rod connected to the other end of said second arm.

9. A holder for an elongated flexible blade having a pair of opposed longitudinal edges and ends comprising a support, a turntable mounted on said support, means for rotating said turntable about an axis and having a circular rim terminating at one side and a circumferential shoulder extending radially from the opposite side thereof, a first means on said turntable for clamping one end of the blade and having a clamping surface extending substantially from said shoulder to said one side of said rim, a second means on said turntable for clamping the other end of the blade and having a clamping surface extending substantially from said shoulder to said one side of the blade with the blade wrapped around said rim, said one longitudinal edge of the blade extending a relatively short distance beyond said one side of said rim and the opposite longitudinal edge of the blade bearing on said shoulder, and means to adjustably move said first and second clamping means circumferentially relative to each other.

10. A machine for continuously grinding one longitudinal edge of an elongated flexible blade having a pair of opposed longitudinal edges and ends comprising a support, a turntable mounted on said support, means for rotating said turntable about an axis and having a circular rim terminating at one side and a circumferential shoulder extending radially from the opposite side thereof, a first means on said turntable for clamping one end of the blade and having a clamping surface extending substantially from said shoulder to said one side of said rim, a second means on said turntable for clamping the other end of the blade and having a clamping surface extending substantially from said shoulder to said one side of the blade with the blade wrapped around said rim, said one longitudinal edge of the blade extending a relatively short distance beyond said one side of said rim and the opposite longitudinal edge of the blade bearing on said shoulder, means for moving said first and second clamping means relative to each other to apply tension on the blade in a direction to tighten it against said rim, a grinding wheel adapted to act on said one longitudinal edge of the blade, and means to remove said blade from said turntable including a slitted spooling member mounted on said support adjacent to said turntable for rotation about an axis parallel to the axis of rotation of said turntable, and a slitted container sleeve removably but non-rotatably mounted on said support about said spooling member whereby after release of one of said clamping means to free one end of said blade for feeding through said slitted sleeve and into said slitted spooling member, winding of the blade around said spooling member and in said sleeve being effected by rotating said spooling member and said turntable while the other clamping means still holds said blade and until said other clamping means moves around to a point adjacent to said spooling member.

11. A holder for an elongated flexible blade having a pair of opposed longitudinal edges and ends comprising a support, a turntable mounted on said support, means for rotating said turntable about an axis and having a circular rim terminating at one side and a circumferential shoulder extending radially from the opposite side thereof, a first means on said turntable for clamping one end of the blade and having a clamping surface extending substantially from said shoulder to said one side of said rim, a second means on said turntable for clamping the other end of the blade and having a clamping surface extending substantially from said shoulder to said one side of the blade with the blade wrapped around said rim, said one longitudinal edge of the blade extending a relatively short distance beyond said one side of said rim and the opposite longitudinal edge of the blade bearing on said shoulder, and means to adjustably move said first and second clamping means circumferentially relative to each other, and means to remove said blade from said turntable including a slitted spooling member mounted on said support adjacent to said turntable for rotation about an axis parallel to the axis of rotation of said turntable, and a slitted container sleeve removably but non-rotatably mounted on said support about said spooling member whereby after release of one of said clamping means to free one end of said blade for feeding through said slitted sleeve and into said slitted spooling member, winding of the blade around said spooling member and in said sleeve being effected by rotating said spooling member and said

turntable while the other clamping means still holds said blade and until said other clamping means moves around to a point adjacent to said spooling member.

12. A machine for continuously grinding one longitudinal edge of an elongated flexible blade having a pair of opposed longitudinal edges and ends and inner and outer faces comprising a support, a turntable mounted on said support, means for rotating said turntable about an axis and having a circular rim terminating at one side and a circumferential shoulder extending radially from the opposite side thereof, a first means on said turntable for clamping one end of the blade and having a clamping surface extending substantially from said shoulder to said one side of said rim, a second means on said turntable for clamping the other end of the blade and having a clamping surface extending substantially from said shoulder to said one side of the blade with the blade wrapped around said rim, said one longitudinal edge of the blade extending a relatively short distance beyond said one side of said rim and the opposite longitudinal edge of the blade bearing on said shoulder, means for moving said first and second clamping means relative to each other to apply tension in the blade in a direction to tighten it against said rim, and a grinding wheel adapted to act on said one longitudinal edge of the blade, each of said clamping means including a member bearing against the outer face of the blade and movable radially inward to pull the blade against the rim.

References Cited in the file of this patent

UNITED STATES PATENTS

1,781,674	Ashworth	Nov. 18, 1930
2,082,832	Hansen	June 8, 1937
2,252,892	Kottmann	Aug. 19, 1941