

Dec. 19, 1944.

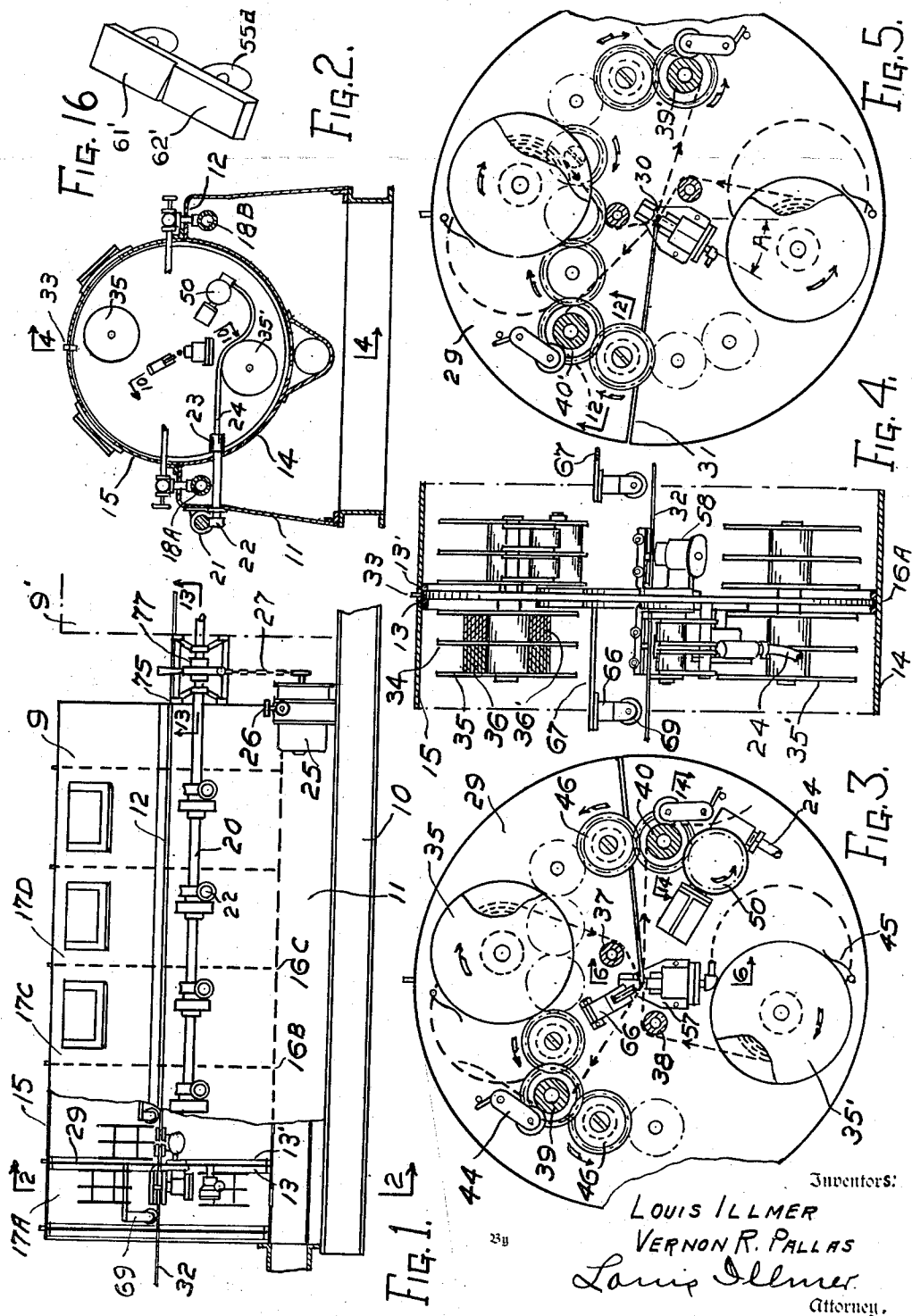
L. ILLMER ET AL

2,365,640

GRINDER HEAD APPURTENANCE

Filed March 13, 1942

2 Sheets-Sheet 1



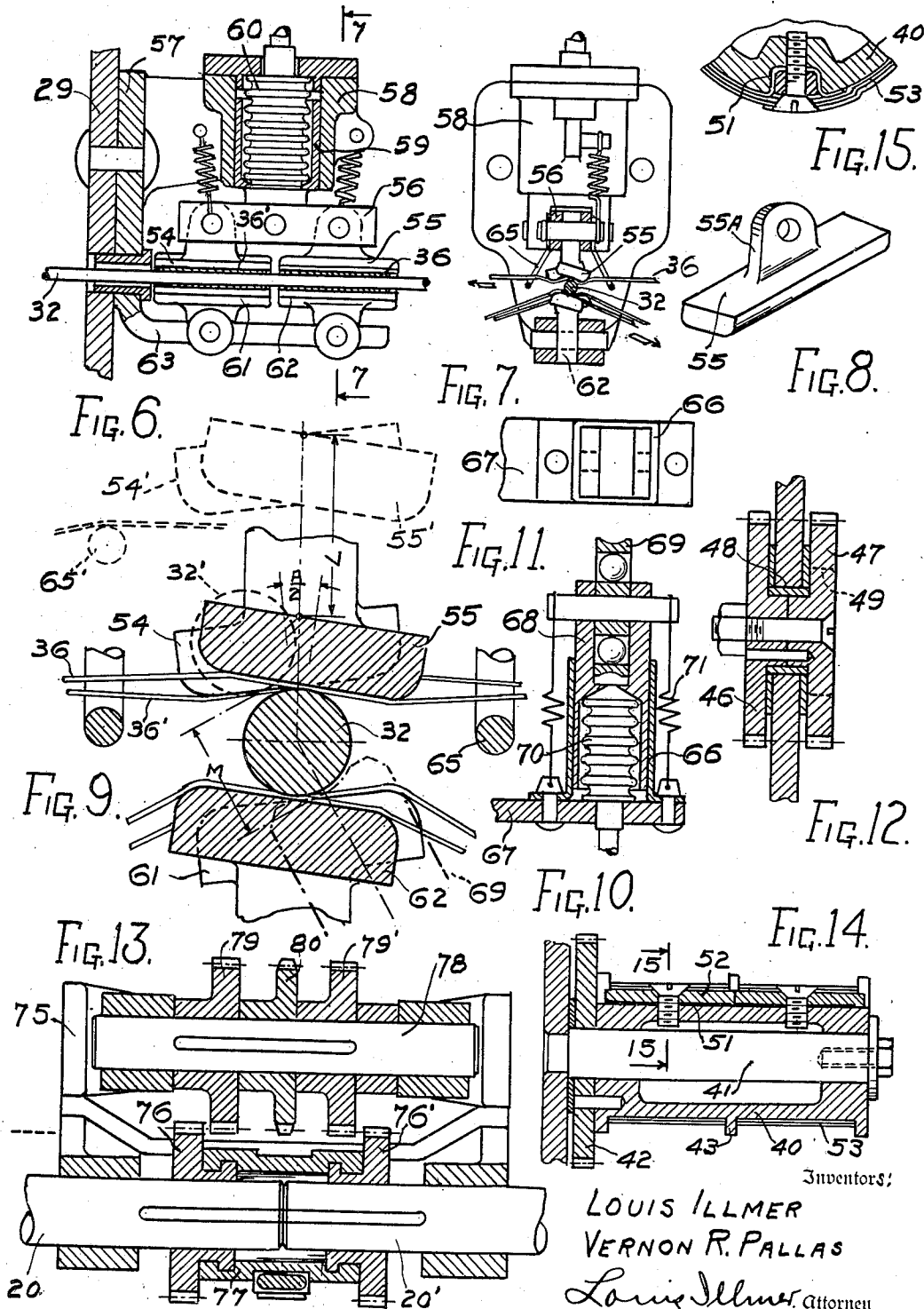
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UNITED STATES PATENT OFFICE

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GRINDER HEAD APPURTENANCE

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15 Claims. (Cl. 51—150)

The present invention broadly pertains to a simplified grinder machine for economically treating reelable round or ribbon stock on a rapid, low-cost productive basis by means of angularly distributed abrasive elements, and more especially relates to certain refinements directed to a unitary grinder head assembly such as is more explicitly set forth in our copending application Serial No. 402,352 filed July 14, 1941, and which head requires no fast moving parts except for the treated strip stock and its associated high speed reeling mechanism.

The object of our improvements is to devise a series of head means respectively adapted to operatively carry one or more abrasive elements that are collectively brought to bear upon a common longitudinally movable work piece for intensively rough grinding or for superficially polishing such strand at a fast productive rate through radially distributed cutting zones. Embodied herein are also structural developments such as the use of twin tape backing shoes, strand lifting means and the like features that facilitate the end in view.

Reference is had to the accompanying two sheets of drawings illustrative of a preferred exemplification, and in which drawings:

Fig. 1 represents an elevational side view of a split housing unit equipped with our disc accessories, and Fig. 2 is a transverse view thereof taken along 2—2.

Fig. 4 shows an edge view of a demountable disc as seen along 4—4 of Fig. 2, while Figs. 3 and 5 respectively present opposed side faces of one such disc assembly.

Fig. 6 cross-sectionally details our retractable dual clamping jaws taken along 6—6 of Fig. 3, and Fig. 7 is an end view thereof as seen along 7—7 of Fig. 6.

Fig. 8 depicts a perspective view of one such jaw component.

Fig. 9 in enlarged scale, diagrammatically illustrates a certain inoperative shift position of our treated work piece relative to a retracted clamping jaw.

Fig. 10 is a cross-sectional view along 10—10 of Fig. 2 showing actuatable means for shifting said work piece, and Fig. 11 is a top view of such means.

Fig. 12 details an improved gear mounting for our disc taken through 12—12 of Fig. 5.

Fig. 13 details a clutch mechanism taken along 13—13 of Fig. 1.

Fig. 14 cross-sectionally reveals an improved feed roller taken along 14—14 of Fig. 3, and

Fig. 15 fragmentally represents a roller detail taken along 15—15 of Fig. 14.

Fig. 16 represents a perspective view of single backing shoe means equipped with relatively inclined twin faces.

Referring more specifically to these disclosures, the split housing unit 9 may be fabricated from sheet metal to include a pair of laterally spaced foundation rails such as 10 having a base member 11 mounted thereacross (see Fig. 2). The upright longitudinal side walls or base skirts may each be radially intumed toward the housing axis into aligned ledges 12 to constitute a horizontal parting plane for our housing. Bridging these ledges are a series of spaced flange strip pairs such as 13—13' that may be given a semi-circular shape and are interiorly secured to the vented trough shell 14.

A superimposed semi-cylindrical cover 15 may be demountably bolted or latched in place to span said ledges. This access cover member may be equipped with similar flange strips that successively register with the corresponding base elements 13 and 13' to complete a series of spaced disc receiving grooves or guideways 16A, 16B, etc. to form a succession of housing compartments or chambers 17A, 17B, etc.

A compressed air or the like fluid supply header such as 18A or 18B may independently run beneath the housing ledges and be provided with controlled branches leading to each housing chamber. Mounted exteriorly of one such ledge is a driven line shaft 20 of which the several bearing brackets may respectively carry a worm 21 for each chamber. A cooperating worm gear 22 may slowly drive a transversely disposed stub spindle or coupling 23 socketed for the reception of a laterally flexible shafting 24. A motorized variable speed transmission unit 25 having a finger tip control 26, may sprocket drive the line shaft through the chain 27. As will appear presently, the rate of tape advance to the work piece is controlled by the rotative speed given to said line shaft.

It is preferred to selectively operate a pair of similar tandem housing units 9 and 9', of which the latter is fragmentally indicated by Fig. 1 in dotted and dashed outline. All the disc assemblies comprised in one such housing unit may be provided with coarse grit tape for intensified rough grinding performance, whereas all the discs in a cooperating housing unit may be served by finer finishing grit. Such successive processing generally calls for diverse tape feed rates and also the release of one set of tapes while the

other set remains operatively engaged with the common work piece. Means for accomplishing this function will be described subsequent to defining our disc assemblies in further detail.

Demountably entered into each of the guideways 16A, 16B etc. is a partition plate or disc 29 preferably fabricated from sheet metal. The respective discs may be centrally apertured at 30 and provided with a radial slot 31 extending to the disc perimeter. An elongated work piece or treated strand 32 preferably of metallic round or ribbon stock, may be loosely threaded endwise through several aligned disc apertures. Each disc may be manually rotatable in its guideway when the cover 15 is removed and its position may be positively keyed by the top dowel 33 that registers with a corresponding cover hole. When in registry, these dowels are so distributed radially that next adjacent discs may be angularly advanced stepwise and thereby uniformly abrade the entire perimeter of a circular work piece. Said discs may also be appropriately doweled to handle narrow flat stock.

Any suitable means may be utilized for imparting a rapid longitudinal travel rate to said work piece through the respective disc cutting zones.

Directing attention to Figs. 3-5, our successive discs such as 29 may respectively carry independently rotatable dual supply spools 35 and 35' on each disc side face as shown. Duplex tapes in separate roll formation or other abrasive elements 36 and 36' may be carried about the hub of each such spool. These component elements provide for the desired multifold cutting zones with which to wholly and evenly embrace the entire perimeter of a treated product. Such compact installation requiring comparatively few discs, not only reduces the total first cost of our discs but economizes in the overall housing length and its gross weight. The same underlying principle may also be applied to endless abrasive belts or wheels. While it is preferred to work with tapes of about two inches width, duplex rolls of narrower tapes may likewise be mounted about the hub of the spool 35 by correspondingly increasing the thickness of the interposed loose spacer disc 34.

In the case of tapes, our disc face layouts may be kept substantially identical as shown, except for being shifted about the disc axis by the lead angle marked A (see Fig. 5). The corresponding rear spool position is indicated in dotted outline. Idler rollers such as 37 and 38 may serve to separately guide their respective tapes between opposed backing shoes or jaws in the Fig. 7 manner. The respective arrows show the reversed direction of the tape advance, and it will be noted that the cross drag on the treated wire is purposely kept counterbalanced.

Each abrasive tape component may be fed onward toward its particular cutting zone by an actuated feed roller 39 or 40 that may respectively be mounted by an overhanging pin such as 41 which may be affixed to its disc 29 as in Fig. 14. The feed roller end adjacent to said disc may be provided with a driven spur gear 42 and also with a medial guide ridge 43 to keep each pair of duplex tapes in proper alignment with their twin backing jaws. A spring retained clamping roller such as 44 serves to independently squeeze each tape into snug engagement with its feed roller. A drag clip 45 may be applied to each spool to maintain tension upon the fed tape.

The several feed roller gears lying on reversed side faces of our disc or in diametrically opposed regions of the same face, may be train interconnected by auxiliary spur gears. In order to cross over from one reversed disc face to the other, the Fig. 12 style of hub coupled idler gears 46 and 47 may be resorted to. Where a single idler gear only is required, this may be likewise centered through the bushed disc bore 48 and have a blind nut flange or fastening 49 applied thereto as indicated in dotted profile. The dotted and dashed tooth pitch lines in Figs. 3 and 5 denote gears which may be retained by such blind nuts. The respective gear centers 15 comprised in our meshing train layout may lie along a substantially yoke or the like U-shaped gear center line of which the legs straddle the plate aperture, all such component gears being preferably kept to an identical diametral size and pitch.

One disc side face may have bracketed thereto an angle head 50 that operatively drives one terminal gear of said train in mesh with its next adjacent feed roller gear such as 42. Said angle head may house a pair of reduction gears including a worm that is driven through the remote end of the coupled flexible shafting 24 shown in Fig. 2. When actuated, this shafting serves to simultaneously rotate all four of its cooperating feed rollers 39-40 and 39'-40'. Because of unpredictable tape slip, the compensating feed roller refinements illustrated in Figs. 14 and 15 may be resorted to. Here the feed roller 40 is longitudinally slotted at 51 to seat a fastened keeper 52 therein. In order to adjustably modify the diametral size of any one roller periphery, a few layers of paper or the like compensatory envelope 53 may be smoothly wrapped therearound and have the respective layer end regions retained by said keeper. Such expedient reduces tape wastage since it allows all supply spools to become equally exhausted at the time of reloading.

As a further structural refinement, reference is made to Figs. 6 and 7 in which are disclosed the use of self-aligning twin clamping shoes or conjoined tape backing jaws 54 and 55 that may be tiltably pivoted to opposed end regions of a spring returned equalizing bar 56. The respective faces of such unitary jaw means are preferably kept planiform and angularly inclined to provide for a combined cross-sectionally V-shaped formation having a dihedral angle therebetween of which the planes are adapted to straddle the work piece axis. A bracket flange 57 may be attached to the center region of each disc side face as shown and respectively provided with an overhanging bored jacket 58 in which is retractably mounted a tubular slide or plunger 59. Said plunger may be pneumatically actuated by a metallic bellows or the like diaphragm agency 60 that receives its fluid supply from the controlled header 18A.

Said agency is preferably pivoted to the mid region of the counterbalanced bar 56. That is to say a single remote control herein serves both twin shoes and as indicated in Fig. 9, the transverse profile of such shoe faces may respectively be staggered by a shift angle marked A/2. Accordingly, the points of tangential contact with a circular work piece may be angularly advanced to correspondingly increase the number of radially distributed cutting zones served by said agency. Because the clamped abrasive tapes 36 and 36' tend to become slightly tilted when fed

through our relatively inclined shoe faces, each twin clamping shoe may be independently pivoted to permit a non-cocking seating on its opposing backing jaw.

A pair of such mated backing jaws 61 and 62 may be pivotally carried by a fixed arm 63 projecting outwardly from its bracket flange but both of these opposing jaws may also be integrally formed with said arm. Such substitute means are shown in Fig. 16 in which a unitary jaw is provided with the conjoined faces 61' and 62'.

As indicated in Fig. 8, each of the mated shoes 54 and 55 may be kept identical in shape to include a flat tape backing face together with an integrally attached lug such as 55A that is obliquely inclined with respect to its face and provided with a pin receiving aperture whose axis is correspondingly inclined. It is preferred to simultaneously feed the interposed dual tapes underlying the shoes 54 and 55 in a substantially straight line extending perpendicular to the axis of the plunger 59 without exerting pronounced counteracting component thrust directed lengthwise of said axis. The dual tapes respectively associated with the opposed jaws 61 and 62 may be inclined relative to the rigid arm 63 as shown. Such disposition affords room for air injection nozzles (not shown) by which to dislodge any abrasive material that might otherwise accumulate.

In the employment of tandem housings for successive rough grinding and polishing purposes, a laterally pliable work piece may herein be lifted off the tapes in the one housing not in active use. When the controlled air pressure in the supply header 18A is reduced or shut off, the movable jaws 54 and 55 assume their retracted plunger relationship 54' and 55', being then lifted to the extent marked "L" in Fig. 9. In order to loosely carry the tapes 36 and 36' therewith, a follower loop such as 65 may be linked to engage the equalizing bar 56 as shown in Fig. 7 and have one of the abrasive tapes threaded therethrough.

The means for deliberately raising the work piece 32 out of cutting zone contact may be centered in retractable thrust means such as is detailed in Figs. 10 and 11. Said means may comprise a tubular guide 66 upheld by a stanchion 67 which may be overhangingly affixed to a disc face in the Fig. 4 manner. Such guide retractably mounts the piston 68 therein of which the exposed plunger end may be forked for installation of the auxiliary roller 69. The piston may be controllably actuated against the return spring 71 by the pneumatic bellows 70, the several bellows of a common housing being controllably interconnected to receive their fluid supply from a separate header 18B. The roller piston 68 may be obliquely disposed with respect to an axis of its cooperating plunger 59 and thus carry the work piece through the distance M into its freed or inactive position designated 32'. A stationary or rapidly moving strand is thereby suspended to run freely upon several of such rollers but may by pressure release in the header 18B be simultaneously dropped into cutting engagement with all tapes comprised in any one housing.

Instead of being radially withdrawn from the wire axis as in Fig. 4, adjacent roller perimeters may also be kept fixedly inset with respect to the level of the backing jaws 61 and 62 such that when the opposed shoes 54 and 55 are retracted,

the suspended strand 32 will automatically follow up and disengage itself from the abrasive tapes that are backed by said jaws without having to actuate the piston 68.

It now remains to describe in detail, the clutch mechanism illustrated in Fig. 13. In the case of tandem housings 9 and 9' respectively equipped with the Fig. 10 thrust means, the tapes of the inactive housing need not be regularly fed by the transmission unit 25. To meet this contingency, we may provide for a skeletonized clutch framework 75 of the gear-shift type adapted to be interposed between adjacent housing ends (see Fig. 1). Contiguous split ends of the aligned line shafts 20 and 20' may be respectively equipped with a sliding gear such as 76 or 76' that are interconnected by a manipulative shift sleeve 77. A parallel countershaft 78 may be driven by the sprocket 80 through the chain 21. Mounted on said shaft are the laterally spaced driver gears 79 and 79' which selectively mesh with the sliding gears 76 and 76'. By shifting said sleeve axially, the line shaft of one housing alone will be actuated and leave the other idle. In neutral or mid sleeve position, both line shafts will be brought to rest. Such clutch control allows a single transmission unit to serve plural housings.

By advancing each next adjacent disc by a lead angle 2A, the cutting zones underlying our multiple tapes may be uniformly staggered by an angle A/2. Since our tapes are preferably disposed in opposed pairs, all the shoe plungers 59 may be confined within a 180° angle. Larger wire diameters generally require an increased number of component tapes. The described disposition of our duplex tape assemblies is such as to establish pairs of next adjacent discs in unitary groups and which groups may be progressively advanced until the entire work piece perimeter becomes wholly embraced with overlapping merged abrasive zones.

The effect of such helically distributed cutting zones is equivalent to working with a rotating work piece or with rotatably mounted heads but without having to actually rotate either the work piece or the head means to obtain a like result. Because of such numerous compactly stowed tape components, our active facetlike cutting zones complete their perimetric wire embrace within a comparatively short housing length. In a preferred style of fresh abrasive tape, its grit projects materially beyond the bonded root region thereof. When slowly fed to become substantially spent in a single pass through a particular cutting zone, said tape possesses a characteristic loading behavior in that its virgin cutting property remains substantially constant at its original rate while being infed for a considerable distance from the entrant edge of a cooperating zone. By distributing such successive entrant regions in the Fig. 9 manner and restricting the angular spacing thereof to a fractional portion of the zone width, the entire perimeter of a readily reelable wire may be evenly subjected to an intensive cutting rate without raising interposed ridges between next adjacent cutting zones. Such primary treatment may be supplemented by one or more partially spent tape contact regions likewise adapted to keep the resultant pregrinding action substantially uniform. The overlapping behavior of our successively superimposed virgin and partially spent coarse grit contact regions is closely analogous to the use of a symmetrical rosette tape pattern or densely faceted type of

combined cutting agency of endless contour. This same agency may also serve to polish a preground wire by suitably retarding the rate of tape feed when embodied in a single pregrinding housing.

The considerable stock of stored tape herein provided is ample to last for days of continuous operation and suffices to treat tons of wire without tape reloading. The lateral spacing between adjacent discs may be kept ample for convenient servicing. When the roll tapes need reloading, our uncovered discs may be manually rotated in their guideways to individually bring a particular spool into an accessible top position without having to bodily remove any serviced disc from its base groove or necessarily breaking the flexible shafting coupling 23. For tape replacement purposes, the spool flange components may be kept separable from their hubs and thus allow our narrow tape rolls to readily slip endwise over a hub end. In addition, the rate of tape feed which should be varied with the size and tensile strength of the treated wire, is placed under separate control for each housing and may be altered at will while the wire is being abrasively treated. The gross abrasive capacity per minute or rate of production is measured by the aggregate tape area that can be brought into effective cutting contact with the work piece of a given diametral size without allowing the corresponding drag to subject the work piece to excessive tension.

The foregoing disclosure will it is believed, make evident to those skilled in this art, the more outstanding commercial advantages afforded by our novel improvements. It will be obvious that certain structural aspects of our twin backing shoe means are likely to find application to purposes other than the superficial grinding of strip stock with abrasive tape and we reserve the right to correspondingly modify the illustrative disclosures, all without departing from the spirit and scope of our invention heretofore described and more particularly characterized in the appended claims.

We claim:

1. In a grinder machine adapted to abrasively treat an elongated work piece, said machine comprising equalizer bar means having a clamping shoe at the respective end regions thereof, each such shoe including a backing face and which conjoined faces are angularly disposed in V-shaped formation having a dihedral angle therebetween of which both planes lie approximately tangent to the work piece perimeter and non-overlapping duplex abrasive elements respectively being interposed between said work piece and one such backing face to constitute a pair of angularly spaced cutting zones through which to longitudinally advance the work piece.

2. In a grinder machine adapted to abrasively treat an elongated work piece, said machine comprising equalizer bar means having a clamping shoe at the respective end regions thereof, each such shoe including a backing face and which conjoined faces are angularly disposed in V-shaped formation having a dihedral angle therebetween of which both planes lie approximately tangent to the work piece perimeter, retractable mounting means controllably sustaining the medial region of the equalizer bar means, and duplex abrasive elements respectively interposed between the work piece and one such backing face to constitute a pair of angularly spaced cutting zones through which to longitudinally advance the work piece.

3. In a grinder machine adapted to abrasively treat an elongated work piece, said machine comprising equalizer bar means having a clamping shoe pivoted to the respective end regions thereof, each such shoe including a face and which conjoined faces are angularly disposed in V-shaped formation having a dihedral angle therebetween of which both planes lie approximately tangent to the work piece perimeter, a retractable plunger serving to suspend the bar means intermediate the shoe pivots thereof, backing jaw means mounted in opposition to the aforesaid shoe faces, and non-overlapping abrasive elements respectively interposed between said work piece and one such shoe face to constitute a pair of angularly spaced cutting zones through which to longitudinally advance the work piece while the work piece is backed by said jaw means.

4. In a grinder machine adapted to abrasively treat an elongated work piece while being dragged longitudinally, said machine comprising equalizer bar means having a clamping shoe at the respective end regions thereof, each such shoe including a backing face and which conjoined faces are angularly disposed in V-shaped formation having a dihedral angle therebetween of which both planes lie approximately tangent to the work piece perimeter, duplex abrasive elements respectively cooperating with the work piece and one such backing face to constitute a pair of angularly spaced cutting zones through which to longitudinally advance the work piece, a controlled plunger mounted to releasably retract said bar means radially away from the work piece axis.

5. An abrasive machine comprising plate means adapted to have a work piece entered therethrough, dual tape supply spools carried upon each side face of the plate means in diametrically opposed face regions thereof and which tapes are directly brought into abrasive engagement with the work piece, separate tape feed roller means cooperating with each such spool, said means respectively extending perpendicularly outward from a side face in correspondence with and in an angularly advanced relation to its mated spool, a spur gear affixed to each inner end of said several roller means and operatively interconnected by idler gears to constitute a gear train of which the respective gear centers are disposed along a substantially U-shaped line, and control means for driving one of the gears in such train whereby to regulatably feed all of said tapes in unison from their respective spools toward the work piece.

6. An abrasive machine comprising plate means adapted to have a work piece entered therethrough, dual tape supply spools carried upon each side face of the plate means in diametrically opposed face regions thereof and which tapes are directly brought into abrasive engagement with the work piece, separate tape feed roller means cooperating with each such spool, said means respectively extending perpendicularly outward from a side face in correspondence with and in an angularly advanced relation to its mated spool, a spur gear affixed to each inner end of said several roller means, and idler gears operatively interposed between said spur gears to constitute a gear train, one such idler gear comprising a pair of cross-over spur gears that are interconnected by a hub coupling and rotatably upheld by the plate means.

7. In a grinder machine adapted to abrasively treat an elongated work piece while being ad-

vanced lengthwise, tandem housing means through which said work piece is entered for successive treatment, each such housing means comprising an abrasive tape element brought into cutting zone engagement with the work piece, a driven separate line shaft for each housing serving to controllably feed its abrasive element toward the cutting zone thereof and which shafts are respectively arranged to provide for axially aligned contiguous ends, shiftable clutch means disposed to bridge said shaft ends, and a common motorized transmission unit including speed change means serving to selectively drive either of such shafts in response to a corresponding shift on part of the clutch means.

8. In a grinder machine adapted to treat an elongated work piece while being advanced lengthwise, said machine comprising rotatably upheld spool means having multiple supply rolls of abrasive tape coaxially mounted alongside each other and the respective outer end regions of which rolls are independently brought into abrasive engagement with said work piece to constitute separate cutting zones therealong, and single feed roller means serving to simultaneously advance said tapes toward their respective cutting zones.

9. In a grinder machine adapted to treat an elongated work piece while being dragged lengthwise, said machine comprising rotatably upheld spool means equipped with spacer disc means interposed between the spool flanges and having duplex rolls of abrasive tape respectively mounted along opposed side faces of the disc means with the outer roll end regions respectively brought into operative engagement with said work piece to constitute separate cutting zones therealong, and common feed roller means parallelly disposed to the spool axis for advancing said tapes toward their respective cutting zones, said roller means being provided with a medial guide ridge that aligns with the plane of the spacer disc means.

10. In a grinder machine adapted to abrasively treat an elongated work piece while being advanced longitudinally, said machine comprising duplex abrasive tapes disposed in side by side adjacency and respectively brought into operative engagement with said work piece to constitute separate cutting zones therealong that are angularly spaced about the work piece axis, and common clamping shoe means compressing angularly inclined backing faces disposed in V-shaped formation having a dihedral therebetween and serving to impress both of said duplex tapes toward the respective cutting zones thereof.

11. In a grinder machine adapted to abrasively treat a pliant elongated work piece while being advanced lengthwise, said machine comprising superimposed laterally pliable abrasive elements adapted to have said work piece operatively interposed therebetween, backing means urging the respective elements into opposed cutting zone engagement with said work piece, means retracting one such element outwardly away from the other element in a direction counterwise to the urge of said backing means and thereby freely release one of the aforesaid zones, and cooperating follow up means adapted to shift said work piece laterally out of engagement with the other cutting zone.

12. In a grinder machine adapted to abrasively treat a suspended strand while being advanced axially, said machine comprising a pair of abrasive tapes adapted to have said strand operatively interposed therebetween, a fixed backing jaw and a retractable backing jaw cooperatively arranged to urge said tapes into opposed cutting zone engagement with the strand when the last named jaw assumes its non-retracted position, and follower loop means linked to move in unison with the retractable jaw and having a contiguous tape entered through said loop means whereby to carry the last named tape outwardly away from the fixed jaw.

13. In a grinder machine adapted to abrasively treat a suspended strand while being advanced axially, said machine comprising a pair of abrasive tapes adapted to have said strand operatively interposed therebetween, backing jaw means for each such tape arranged to urge said tapes into opposed cutting zone engagement with the strand, means for retracting the backing jaw means of one such tape, and controllable auxiliary means arranged to follow up the retracted jaw means and thereby laterally shift the strand out of cutting engagement with the other of said tapes.

14. In a grinder machine adapted to treat a circular strand with abrasive tape, said machine comprising equalizer bar means provided with a transverse pivot pin at each end region thereof, and a pair of shoes respectively including a substantially flat tape backing face together with an upstanding lug having a pin receiving aperture whose axis is obliquely inclined with respect to the shoe face thereof, said faces when respectively assembled upon the bar pins being angularly inclined in V-shaped formation having a dihedral angle therebetween of which both planes lie approximately tangent to the strand perimeter.

15. In a grinder machine provided with a series of stationary partition means adapted to have a common strand axially dragged therethrough for superficial abrasive treatment, said machine comprising means for mounting on a side face of each such partition means a multifold supply of virgin abrasive tape of which the grit projects materially beyond the bonded root region thereof and which tapes are collectively brought into crosswise operative engagement with said strand to constitute successive localized cutting zones therealong that are respectively advanced angularly with respect to the strand axis, equalizer bar means having a tape backing shoe face affixed to each bar end region, said faces being angularly inclined in V-shaped formation and respectively brought into operative engagement with certain next successive cutting zones, and means simultaneously feeding each such tape into the cutting zone thereof, the aforesaid angular zone advance being restricted to effect a combined endless facet type of cutting agency arranged to maintain a substantially uniform abrasive intensity around the entire strand perimeter.

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