April 13, 1943. L. ILLMER ET AL 2,316,586

ABRASIVE MACHINE

Filed April 2, 1941 3 Sheets-Sheet 1

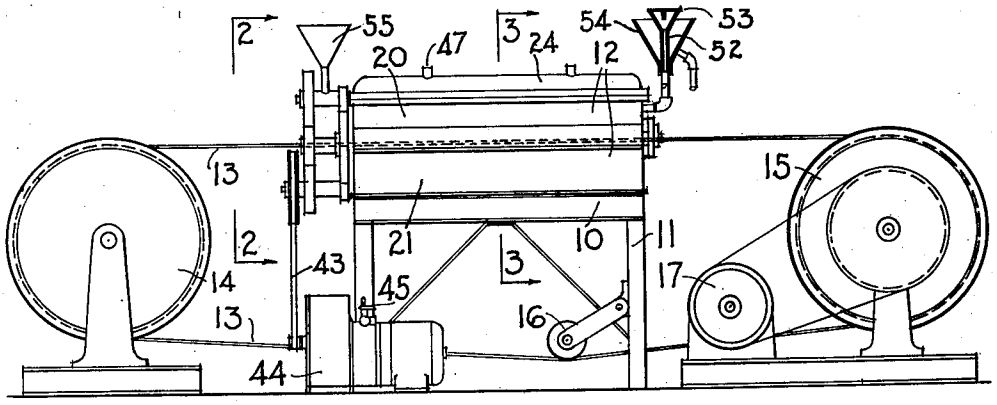


FIG. 1.

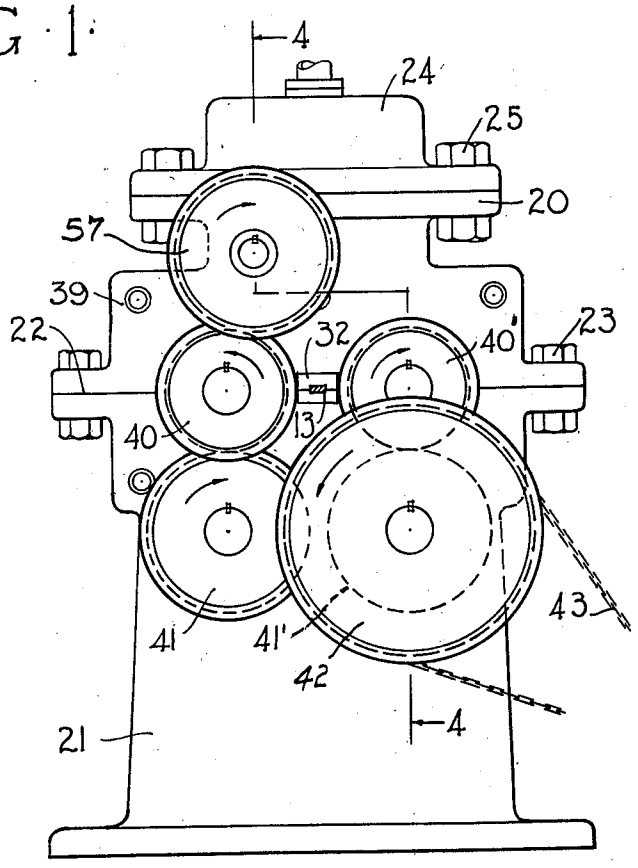


FIG. 2.

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April 13, 1943. L. ILLMER ET AL 2,316,586

ABRASIVE MACHINE

Filed April 2, 1941 3 Sheets-Sheet 2

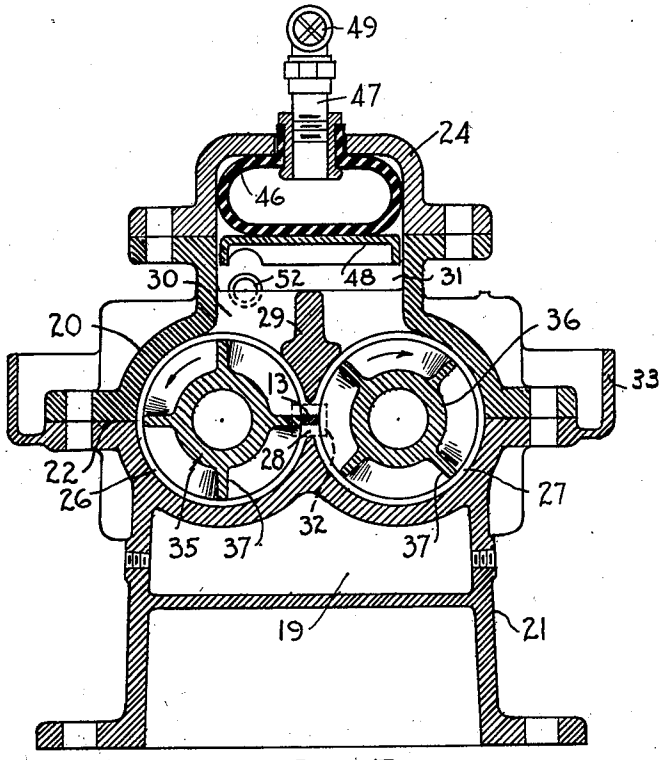


FIG. 3.

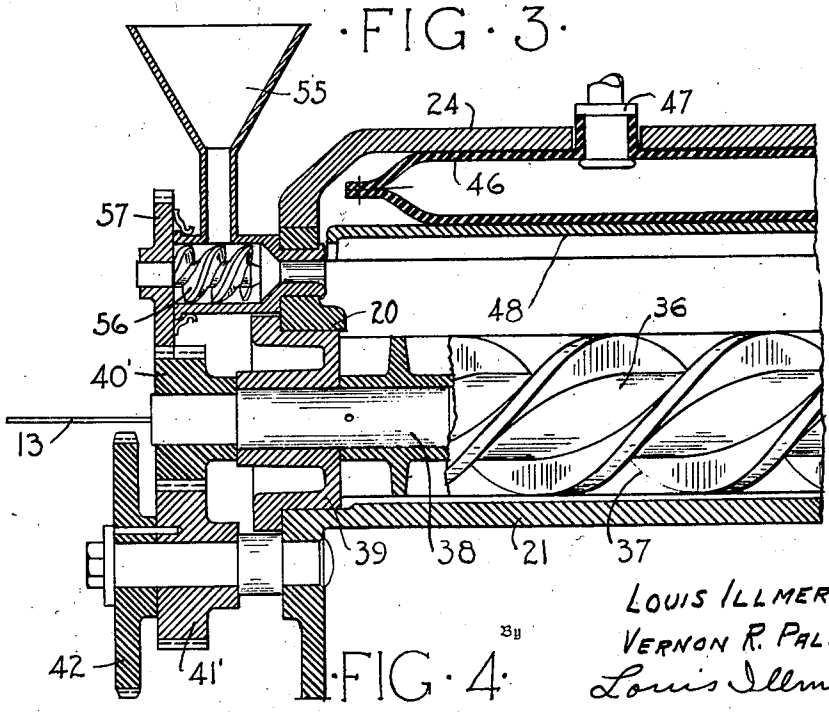


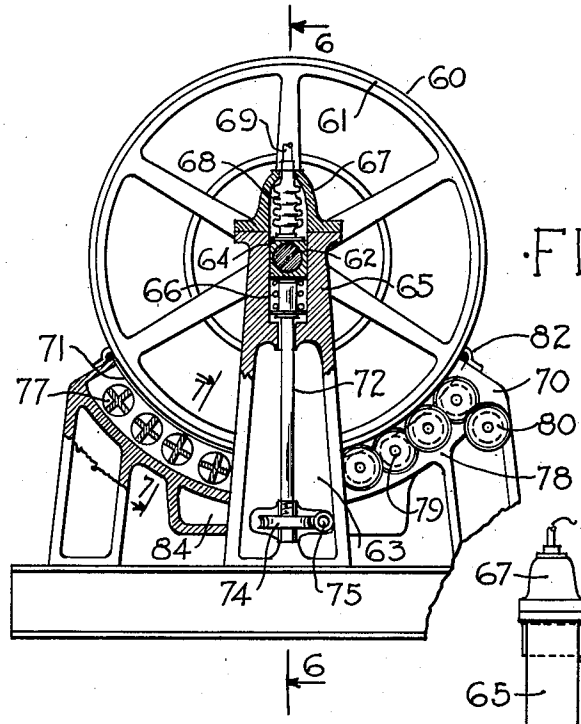
FIG. 4.

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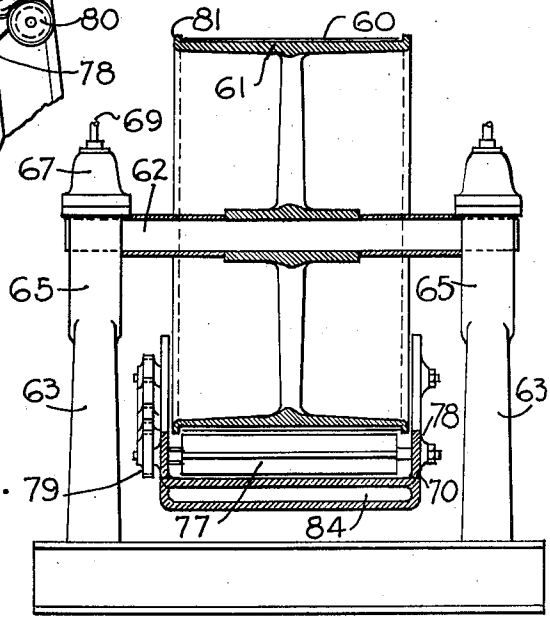
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ABRASIVE MACHINE

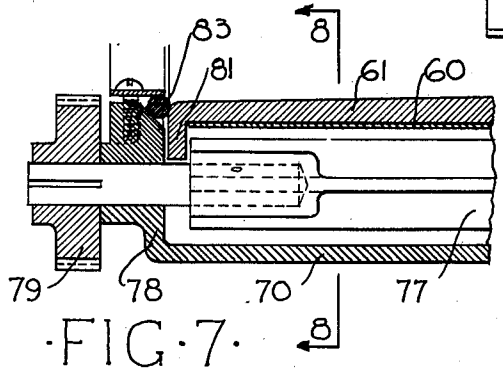
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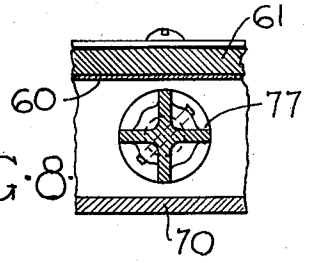
·FIG·5·



·FIG·6·



·FIG·7·



·FIG·8·

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UNITED STATES PATENT OFFICE

2,316,586

ABRASIVE MACHINE

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Application April 2, 1941, Serial No. 386,462

12 Claims. (Cl. 51—7)

The present invention broadly relates to the art of surface finishing equipment, and more especially pertains to an improved abrasive machine adapted to pregrind or impart a lustrous polish to a fast longitudinally moving product such as metallic round or flat strands, high tensile wire and also sheet material. The drag principle underlying our abrasive treatment is predicated upon practice with a stationary sanding box or non-rotating trough loaded with a batch of loose granular abrasive through which an embedded wire or the like treated strand is rapidly drawn lengthwise in one or more passes. However, such more primitive conventional agency lacks the essential controls requisite for perfected grinding and polishing operations such as are afforded by slowly fed abrasive tape appliances. In the case of ordinary sanding boxes, the abrasive action is not uniformly upheld for a protracted period in a restricted cutting zone becaues of localized grit deterioration by normal wear or loading with abraded material.

It is herein preferred to resort to a closed split box equipped with elongated twin rotor agitators of which the axes of rotation are parallelly mounted and arranged to have an abrasively treated strand drawn lengthwise therebetween while such trough is kept compactly filled with a batch of appropriate grit. Means have been provided to controllably impose pressure upon the confined batch, also to automatically replenish the supply of grit as fast as it becomes substantially spent.

The rotative rate of our agitators may be regulated through a speed transmission device which may be controlled to cease grit agitation when a final finish is desired after a treated strand has been preground for removal of surface imperfections. When needed, the product may be treated stepwise through a series of our sanding troughs, each containing successively finer grits. The preferred travel velocity of our treated product lies in the neighborhood of several thousand feet per minute, which in combination with a relatively large grit embracing cutting area, affords an adequate productive capacity at comparatively low labor attendance and installation costs.

As an alternative, our polishing method may be similarly applied to thinly rolled sheets of considerable width by snugly curling the same as a cover sheath or band about a driven cylindrical rim. Such endless sheet may herein be made to cooperate with a saddle type of controlled sanding box provided with grit agitator means which by churning automatically conveys grit from a remote batch region into an active localized superficial cutting zone and thereby recurrently vitalizes the cutting property of such zone.

In our abrasive treatment, a metal sheet is preferably stroked in the direction of its rolled grain or lay and a high unidirectional sheath velocity is relied upon to obtain a relatively fast cutting action. Not only have the operative limitations of a reciprocative stroking movement been overcome, but the collective abrasive cuts may be held to a uniform depth over the whole treated plate face without producing a hollow-ground profile.

The object of our invention is to devise simple appurtenances of the indicated character capable of abrasively treating or polishing metallic or other products on a low cost output basis. Embodied herein are also structural refinements that promote the end in view.

Reference is had to the accompanying three sheets of drawings which are illustrative of different exemplifications of the instant invention, and in which drawings:

Fig. 1 schematically represents an elevational side view of one type of abrasive machine assembly equipped with associated reels for treating strand stock.

Fig. 2 shows an end view of such machine taken along 2—2, and Fig. 3 details a transverse cross-section taken along 3—3 of Fig. 1.

Fig. 4 is a fragmental longitudinal cross-section taken along the broken line 4—4 of Fig. 2.

Fig. 5 illustrates an end view of an alternative type of abrasive machine, and Fig. 6 is taken along 6—6 of Fig. 5.

Fig. 7 is taken along 7—7 of Fig. 5 to detail a modified agitator, and Fig. 8 is a transverse view thereof along 8—8 of Fig. 7.

Referring more specifically to the Figs. 1 to 4, this type of machine may be upheld on a skeletonized framework or table 10 having depending legs 11. A split sander box 12 is shown horizontally superimposed upon such frame to have a treated product passed therethrough. A long metallic strand or other strip stock 13 may have its ends butt welded into an endless product loop carried into belted engagement with the axially spaced drums 14 and 15. A belt tightener preferably comprising a weighted roller 16, may be linked to a table leg to tension such band and eliminate undue sag. A single motor 17 suffices to continuously drive one such drum at high peripheral speed.

In lieu of an endless strand, free strip stock or wire ends may respectively be wound about said drums in reel fashion and rotated to bring about successive product passes in reversed travel directions by alternately winding substantially the whole of the strand length from reel to reel. However, the use of the cited unidirectional endless band materially simplifies the motorized reeling equipment and saves operative delay in restarting the direction of high speed product movement between reversed passes. The drum diameters are preferably of a sufficient size not to kinkingly flex the reeled stock beyond its elastic limit.

Our elongated strand treating sanding box **12** may comprise separable upper and lower housing sections **20** and **21** as in Fig. 3 which are preferably split at **22** and flanged to provide for clamping bolts such as **23**. The open top of the upper housing section may be kept flat and flanged to attach a demountable header cover **24** thereto by the use of bolts such as **25**.

Within the housing confines there are formed a pair of cylindrical chambers **26** and **27** of which the respective bore axes extend in substantial parallelism with the parting face **22** and are laterally spaced apart further than their bore dimension. The sunken semi-circular bore profile components of one such housing register with those of the other housing. Along the line of nearest approach these split chambers are preferably slotted longitudinally to constitute opposed mated bore ports that are placed into communication through an interposed strand receiving passageway or channel **28**. Said chemical may extend from end to end of our sanding box in an intersecting relation to the several bore ports. A bridge piece **29** may be cast integrally with the upper housing section to partially complete the respective slotted chamber bores as shown. To each side of such bridge piece, the respective chamber bores may be provided with gates such as **30** arranged to lead into the grit access space **31**.

The strand product **13** is threaded lengthwise through the housing channel **28** and may be guided into place by split wear jaws such as **32** located at each box end. Said jaws may respectively be provided with suitable sealing means to prevent grit leakage. The closed housing interior including said chambers, said channel and the gated storage space are intended to be compactly filled with a batch of abrasive grit. This grit is loosely packed in flush alignment with the cover facing to operatively embed the entire product length extending between the respective mated end jaws.

The lower housing flange may be provided with an upturned apron **33** to further obviate grit spill when its upper section is dismounted. In addition, one or both such sections may be water jacketed as at **19** to absorb excess heat generated by a fast grinding of the strand **13**. It will be observed that the complete inclosure of such treated product renders our machine dustproof and free from fire hazard, also that such confined grit may be subjected to pressure to intensify its abrasive behavior in the cutting zone thereof.

Our cylindrical chambers may respectively be provided with twin rotors or agitators **35** and **36**, each having a plurality of radially outstanding paddle blades such as **37**. In the present instance, these blades are preferably given a reversed helical formation disposed around a tubular spindle and fabricated from cast iron or other hard material designed to obviate rapid abrasive wear. The respective teeth of our assembled twin rotators may be relatively staggered in profile as in Fig. 3. The spindle ends may each have a shank **38** affixed therein that may respectively be rotatably mounted between split duplex closure heads such as **39**.

As detailed in Figs. 2 to 4, corresponding overhanging shank ends may respectively have affixed thereto a drive gear **40** and **40'** of which the non-meshing teeth are kept spaced apart to unobstructedly clear the interposed fast moving product **13**. A pair of stanchion mounted intermediate gears **41** and **41'** respectively mesh with said drive gears and one such intermediate gear may be driven by the sprocket **42**. The latter may be regulatably rotated by the endless chain **43** which in turn is actuated by the motorized variable speed unit **44** (see Fig. 1) of a conventional type provided with a centralized finger tip control **45** whereby to manipulatively alter the speed rate of the agitators within wide limits. If desired, such gear feed may also be brought to rest to stop our agitators without interrupting the travel of the treated stock.

It is preferred to rotate said companion agitators in opposed arrowed directions at a comparatively slow rate and thus unremittently bring relatively virgin grit into the effective cutting zone of the treated product. The localized accumulation of loaded or otherwise dulled grit is thereby prevented from persistently lodging in the vicinity of such zone. Instead, our twin agitators are arranged to mechanically stir or churn the major portion of the grit batch whereby to cross sweep its resulting stream into and through the chamber interconnecting channel **28**.

The demountable cover **24** of our housing may be recessed to install therein a closed ended resilient tube or the like controllable impression grit compression means **46**. Such elongated tube may be made of rubber and provided with a nipple **47** that is pipe connected to a source of fluid pressure such as compressed air. When inflated, this initially flattened tube **46** tends to assume a cross-sectionally circular profile which correspondingly depresses the slidable ram plate **48** toward the grit batch to impose a sealed pressure throughout the mass thereof. A valve **49** allows of regulating the extent of such ram thrust. By raising the batch pressure, the cutting action of the crowded grit may be materially augmented to more rapidly pregrind the product for a given housing length. After pregrinding the tube inflation may be reduced to restrict the abrasive rate while finishing a treated surface.

As intimated, the rotor blades **37** may each be helically formed and thereby slowly convey the entrapped grit toward one chamber end where it may be gradually delivered through a tubular riser **52** schematically indicated in Fig. 1. The upturned mouth of such riser may be relieved through a loaded back-pressure valve **53** to spill into the drained discharge hopper **54**. The opposite chamber end may be equipped with a feed hopper **55** (see Fig. 4) containing surplus grit that is slowly advanced to continuously renew the loaded batch of grit. A conveyor screw **56** may be positively driven by the supplementary gear **57** to eject surplus grit into such chambers against prevailing batch pressure and thereby regulatably crowd spent grit out of the riser **52**. The advantage of such non-essential feed resides

in being able to maintain a substantially uniform abrasive action over a protracted grinding period that compensates for the gradual grit exhaustion. The grit loading may either be kept in a dry state or mixed with lubricant to form a sludge. In the case of grinding a ferrous product, the abraded material may be separated by magnetic means to revitalize a batch of partially spent grit.

The mode of operation of our abrading machine is thought obvious from its structural definition. In addition to being able to selectively replenish spent grit, the batch pressure is placed under adequate control to augment the grit cutting rate within a wide range. Because of the generous contact area provided for the treated product, such grit pressure may be held within moderate limits and still secure rapid abrasive action within comparatively small trough confines.

By suitably adjusting the tip control **45** an appropriate speed is attainable for favorable cutting treatment. The cited staggering of the rotor blades alternately transfer and tend to repeatedly whisk spent grit crosswise through the channel **28** and away from the superficial grinding zone of the treated product **13** to intermingle with remote portions of more virgin abrasive. Where an intensive pregrinding is sought, a batch of relatively coarse grit may be utilized. For ultimate polish, the rotors are intended to remain inactive to allow a localized grit portion to lie in listless contact with the treated strand surface and which grit by loading, will then induce a lustrous burnishlike effect.

The ability to both pregrind and polish with the same grit constitutes an important attribute of the present invention. For long continued heavy duty grinding performance, our batch of grit may by the use of the feed hopper **55**, be replenished as fast as it becomes substantially spent. It will be obvious that a single rotor or the use of multiple pairs of rotors may be likewise disposed to bring about an equivalent result; also that plural wires may be substituted in lieu of a single strand. The grit is not only thoroughly mixed throughout the batch confines but the laterally spaced rotor arrangement is such as to permit a sagging strand **13** to drop somewhat without rotor interference.

An alternative machine embodying a similar underlying grit processing feature, is exemplified in Figs. 5 to 8. Here a comparatively wide metallic plate of non-reelable sheet stock is adapted to be treated by snugly curling the same sheet as a cover sheath **60** about a suitably sized cylindrical backing rim **61** which is power driven at a high peripheral velocity. Such rim may be provided with one or more cross-grooves (not shown) into which to abuttingly cleat opposed transverse plate edges to constitute an endless band of treated stock. Said sheathed rim may be rapidly rotated about its horizontal supporting axle **62** mounted between a pair of pedestals **63**.

As a result of initially rolling a metallic sheet or drawing strip stock during fabrication, an internal fibrous grain is set up of which the lay extends lengthwise of such product. To attain a highly lustrous superficial finish of the kind herein sought by supplemental treatment, the outer sheath face is preferably dragged at a fast rate in the direction of such rolled lay along an abrasive zone. Furthermore, our sheathed drum is purposely driven at a constant high speed to impart a unidirectional rotation as distinguished from an oscillatory beat about an axis or the like reciprocative work piece movement. The abrasive action of any oscillatory drum becomes inherently slow during the reversing periods. As a consequence, such variable cutting rate not only slows up production but tends to abrade a surface into an undulatory profile. By maintaining a constant rate of drum rotation as herein practiced, a cut of uniform depth is realized throughout the extent of the treated face, which in turn allows an evenly ground plate to be held to a definite gauge thickness.

Each of said pedestals is preferably provided with a squared journal block **64** that is slidably guided between spaced jaws such as **65**. Interposed adjustable spring means **66** floatingly uphold its associated block. A tubular bearing cap **67** houses therein a metallic bellows or the like sealed diaphragm **68** which controllably loads said axle in a counteracting direction to the thrust of the spring means to constitute a grit compression agency. A branched lead pipe **69** conveys actuating fluid to said bellows at each axle end.

By suitably regulating the fluid pressure, the sheathed rim **61** may be manipulatively raised or lowered with respect to the stationary sanding box or open trough **70** of the sectorlike shoe or saddle type. The upturned arcuate trough mouth defining the perimetric length of its active grit cutting surface **71** is preferably kept shorter than the rim diameter and located beneath the rotating band **60** as in Fig. 5. The bore radius of such open mouth may be made somewhat larger than the corresponding rim dimension to snugly embrace an impressed chord portion of the treated plate, as shown. An adjustable stop prop **72** may be placed beneath each block **64** to provide for a prescribed clearance gap that limits the drop of the rim axle. The lower shank of each such prop may be threaded and respectively provided with a manipulative worm gear **74** that may be operated in unison by a transverse worm shaft **75**.

As detailed in Figs. 6 and 7, the opposed arcuate side walls **78** of the trough **70** may be apertured to parallelly mount therebetween a series of metallic paddles or the like rotatable agitators **77** and which trough is intended to be kept fully loaded with suitable granular grit. In this instance, straight paddle blades are preferably set radially without helical formation. Corresponding shank ends of the respective paddle blades may be geared at **79** in mesh for unitary movement and motor driven through a common drive gear **80** intended to be actuated by a variable speed unit such as **44**.

Each edge of the rim **61** may be provided with a radially outstanding flange **81** and the respective trough end walls interiorly beveled as in Fig. 7 to seal the same against grit spill by a suitable perimetric packing **83**. Such resilient sealing agency may be transversely extended at **82** to embrace the entire perimeter of the sanding box mouth. If desired, a water jacket chamber **84** may be appended to cool the entrapped grit for heavy duty service.

When the sheathed rim **61** is allowed to drop into a lowered position, this rams the interposed grit into a more compact mass and creates a limited impression throughout the body thereof which correspondingly augments the cutting rate of the superficially embedded plate **60**. For a burnishlike finish, it is preferred to ease up on the pneumatic pressure leading to the bellows **68** to reduce the abrasive contact pressure on

the treated product. During such finishing period, the agitators 77 may be stopped to allow grit lying in the localized region of its dragged cutting surface to load with abraded material.

A newly sheathed rim is intended to be replaced into operative position after each completed abrasive run, at which time any needed grit may readily be added to the trough supply. For a highly lustrous, non-glazed burnish, such sheathed rim 61 is preferably transferred bodily to a different framework equipped with a saddle box filled with buffing compound or the like fine grit and in which our rotors may each be equipped with a stack of fabric buffing discs. Instead of adjustably lowering the rim 61, the saddle 70 may be correspondingly raised to attain a similar result. As a further equivalent, a suitable abrasive zone may likewise be located in a different perimetric rim region in lieu of being disposed therebeneath as shown.

The foregoing disclosures will it is believed, make apparent to those skilled in this art, the commercial advantages and improvements afforded over the prior grinder art, it being understood that we reserve the right to modify the specific structural features disclosed in our illustrative embodiments, all without departing from the spirit and scope of our invention heretofore described and more particularly characterized in the appended claims.

We claim:

1. An abrasive machine for treating elongated metallic stock, said machine comprising sealed stationary trough means adapted to be confinedly charged with a batch of abrasive grit and which batch is arranged to provide for a localized superficial cutting zone exposed to and brought into active engagement with a portion of said stock, regulatable grit compression means imposing an elevated pressure in the grit batch and thereby augmenting the grit impression toward the engaged portion of said stock, grit agitator means serving to slowly convey a portion of such grit from a remote batch region and transfer a supply of grit into said cutting zone, and power driven means dragging the impressed stock lengthwise through said zone at a substantially uniform velocity materially higher than that corresponding to the rate of conveyed grit transfer.

2. An abrasive machine for treating elongated metallic stock, said machine comprising sealed stationary trough means adapted to be confinedly charged with a batch of abrasive grit and which batch is arranged to provide for a localized superficial cutting zone brought into active engagement with a portion of said stock, grit compression means imposing an elevated pressure in the grit batch, actuated grit agitator means operatively mounted within said trough serving to convey a portion of such grit from a remote batch region and transfer a fresh supply of grit into said cutting zone, power driven means dragging the impressed stock lengthwise through said zone, and manipulative control means for adjusting the grit compression means.

3. An abrasive machine for treating strand stock, said machine comprising an elongated stationary housing provided with a longtiudinally ported tubular chamber adapted to be confinedly loaded with a batch of abrasive grit and having a strand receiving channel extending exteriorly alongside the chamber and placed in communication through the chamber port, actuated grit stirring means operatively mounted within said chamber and by churning serving to slowly sweep a stream of grit through said port for delivery into said channel, the strand being embedded in said stream and directed lengthwise of said channel in parallelism with the chamber axis, grit compression means imposing an elevated pressure throughout the grit batch, and power driven means dragging the embedded strand longitudinally in the direction of said axis.

4. An abrasive machine for treating strand stock, said machine comprising a sectionalized split housing of which the sections provide therebetween for a pair of substantially parallel tubular chambers whose respective perimetric confines each have a bore port therethrough, said ports being cooperatively cross-connected by a strand receiving channel interposed lengthwise between said chambers and which chambers and channel are respectively adapted to be loaded with a common batch of stowed abrasive grit, actuated grit agitator means operatively installed in each such chamber and which means by churning recurrently sweep a stream of grit through said ports in reversed directions, the strand being entered lengthwise through said channel and embedded in said stream, and power driven means for dragging the embedded strand longitudinally.

5. An abrasive machine for treating strand stock, said machine comprising a sectionalized stationary housing having separable sections that provide therebetween for a pair of substantially parallel tubular chambers whose respective perimetric confines each have a bore port therethrough and which ports are cross-connected by a strand receiving channel interposed lengthwise between said chambers, said chambers and channel being respectively adapted to be loaded with a common batch of stowed abrasive grit, a covered grit access space arranged to bridge the respective chambers and communicating therewith through open gates, actuated grit agitator means operatively installed in each such chamber and which means by churning sweep a stream of grit through said ports, the strand being entered lengthwise through the channel and embedded in said abrasive stream, power driven means for dragging the embedded strand longitudinally of the chamber axes, and loaded impression means including a ram plate interposed between the space cover and the stowed grit to augment the pressure throughout the grit cutting zone.

6. An abrasive machine for treating strand stock, said machine comprising an elongated stationary housing provided with a longitudinally ported chamber adapted to be loaded with a batch of abrasive grit and having a strand receiving channel extending exteriorly alongside the chamber and placed in communication through the chamber port, actuated grit agitator means provided with a helical blade operatively mounted within said chamber and which blade by churning serves to slowly feed a stream of grit through said port for delivery into the channel, the strand being slidably carried lengthwise of said channel and embedded in said stream, power driven means dragging the embedded strand longitudinally, and means injecting a supplementary grit supply at one blade end region for ejection at its opposed end region.

7. An abrasive machine for treating strand stock, said machine comprising a stationary housing provided with a pair of substantially parallel tubular chambers whose ends are closed by heads and which chambers respectively have

a port in the perimetric confines thereof, said ports being cross-connected by a strand receiving channel interposed lengthwise between said chambers and which channel and chambers are adapted to be loaded with a common batch of abrasive grit, a grit agitator rotatably installed in each such chamber and respectively provided with spindles mounted in the chamber heads, the strand being dragged through said channel in a direction lengthwise of said spindles, a drive gear for each corresponding spindle end, the teeth of said gears being spaced apart to unobstructedly admit said strand therebetween, a gear train rotating said drive gears in unison, and a motorized variable speed transmission device actuating said gear train.

8. An abrasive machine for treating elongated metallic sheet stock, said machine comprising cylindrical rim means rotatably mounted upon an axle and which rim means is adapted to have a sheath of stock affixedly curled about the perimeter thereof, chambered saddle means including a mouth region shaped to conform to the curled sheath and located radially about said rim means, the saddle interior being adapted to be charged with a batch of abrasive grit and which batch is arranged to provide for an arcuate superficial cutting zone, actuated grit stirring means installed within the saddle confines, means for actuating said stirring means and serving to recurrently vitalize the cutting properties of the grit in said zone, regulatable means bringing said zone into impressed operative engagement with the exterior sheath face, power driven means unidirectionally rotating the impressed sheath at a substantially constant velocity, and control means regulating the degree of impression exerted between the cutting zone and the sheath exterior.

9. An abrasive machine for treating elongated metallic sheet stock, said machine comprising bodily demountable cylindrical rim means concentrically carried by an axle and which rim means is adapted to have a sheath of sheet stock affixedly curled about the rim perimeter, pedestal means provided with vertically slidable journal block means mounting said axle, chambered saddle means including a mouth region shaped to conform to the curled sheath and installed exteriorly about said rim means, the saddle interior being adapted to be charged with a batch of abrasive grit and provide for an arcuate superficial cutting zone, adjustable means for shifting said block means and thereby selectively bring the sheath into impressed active engagement with said zone, and power driven means unidirectionally rotating the impressed rim sheath at a substantially constant velocity.

10. An abrasive machine comprising bodily demountable cylindrical rim means carried upon an axle, journal block means arranged to floatingly mount said axle, said rim means being adapted to have a sheath of stock affixedly curled about the rim perimeter, chambered stationary saddle means located about said rim to include opposed arcuate side walls defining a mouth therebetween that snugly conforms to the exterior shape of the curled sheath, the saddle interior being charged with a batch of grit to provide for a superficial cutting zone that spans said side walls, a series of actuated grit agitators respectively having spindles that extend through said walls in substantial parallelism with the axle, meshing drive gears respectively affixed to corresponding spindle ends, power driven means for rotating the sheathed rim means, and variable speed transmission means for controllably actuating the drive gears.

11. An abrasive machine comprising cylindrical backing rim means mounted to rotate about its axis, said rim means being adapted to have a sheath of stock affixedly curled about the perimeter thereof, a cutting zone of initially virgin abrasive grit arranged to operatively embrace a portion of the sheath exterior, adjustable thrust means impressing said grit radially inward into intensified contact with said sheath, driven control means for replenishing said virgin grit as fast as it becomes substantially spent, adjustable means driving said control means and serving to selectively alter the rate of grit replenishment, and power driven means unidirectionally rotating the rim means to drag its grit impressed sheath at a substantially uniform peripheral velocity for repeated treatment through said cutting zone.

12. An abrasive machine comprising cylindrical backing rim means mounted to rotate about its axis, said rim means being adapted to have a sheath of stock affixedly curled about the perimeter thereof, a cutting zone of initially virgin abrasive grit arranged to operatively embrace a portion of the sheath exterior, thrust means impressing said grit radially inward into intensified contact wtih said sheath, driven control means for replenishing said virgin grit as fast as it becomes substantially spent, power driven means unidirectionally rotating the rim means to drag its grit impressed sheath at a substantially uniform peripheral velocity, and cooperating artificial cooling means serving to conduct away a portion of the abrasive heat generated in the sheath cutting zone.

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