

Sept. 14, 1943.

L. ILLMER ET AL

2,329,376

WIRE MAKING PROCESS

Original Filed Nov. 20, 1940

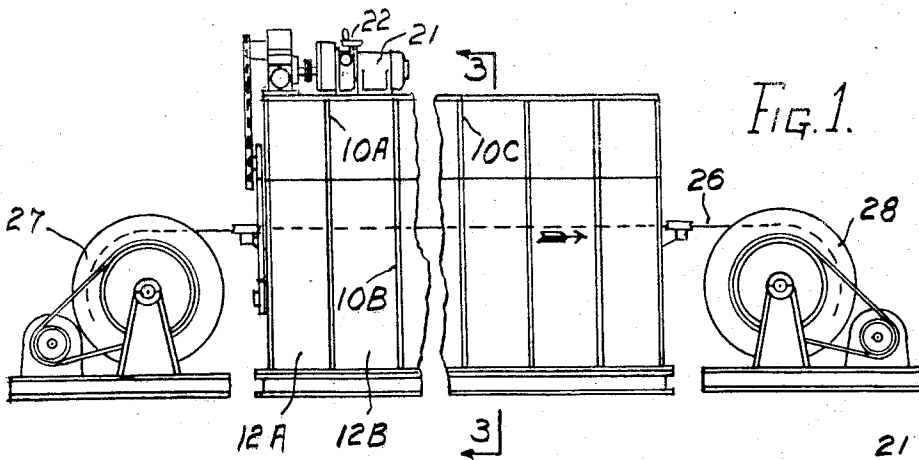


FIG. 1.

FIG. 3.

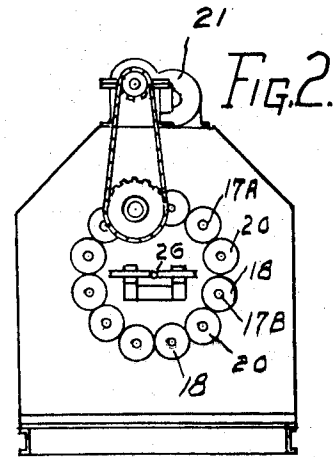
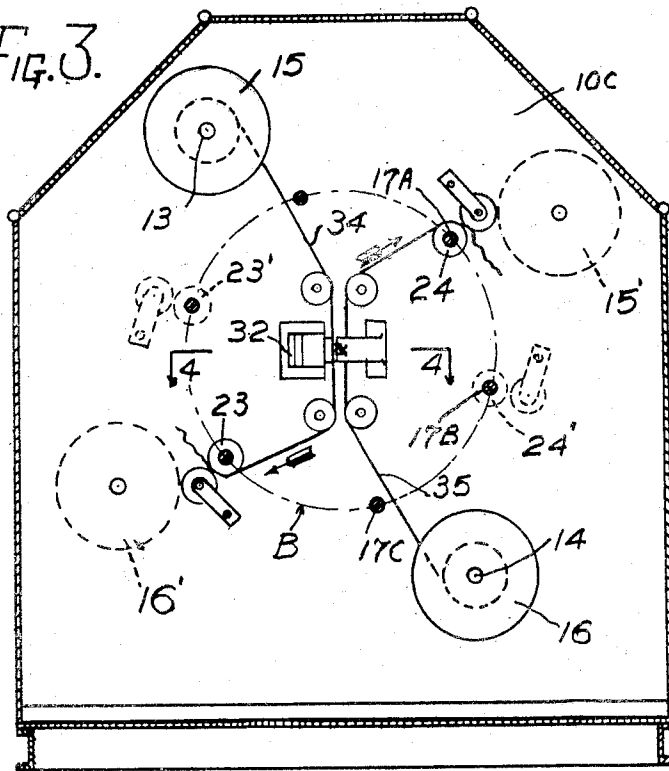


FIG. 2.

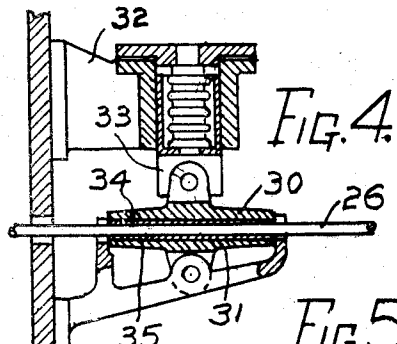


FIG. 4.

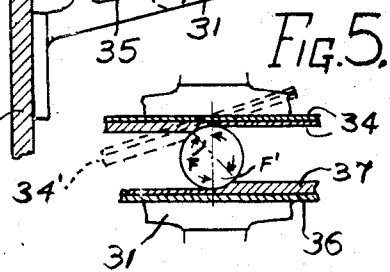


FIG. 5.

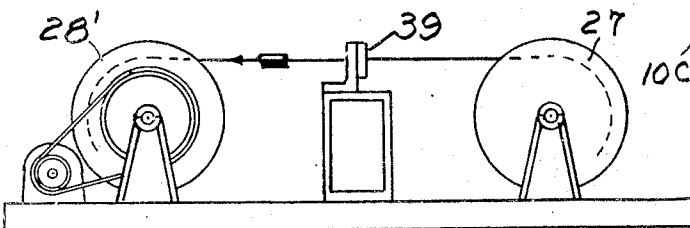


FIG. 6.

Inventors:
LOUIS ILLMER
VERNON R. PALLAS
Louis Illmer Attorney

UNITED STATES PATENT OFFICE

2,329,376

WIRE-MAKING PROCESS

Louis Illmer and Vernon R. Pallas, Cortland,
N. Y.; said Pallas assignor to Leota T. Pallas

Continuation of application Serial No. 366,596,
November 20, 1940. This application August
13, 1941, Serial No. 406,652

5 Claims. (Cl. 205-21)

Our improvements relate to the art of making polished high-tensile steel wire, ribbon or the like strip stock and are more especially concerned with certain coordinated steps for successively reducing an alloy billet in diametral size by initial hot rolling; then by an intermediate step, abrasively treating to brightly polish such rolled stock in a comparatively cold state prior to reaching its final finished size, the alloy steel wire being penetratively ground by multiple abrasive tapes and stroked solely in a longitudinal direction. Substantially all of the defective skin region is thereby removed to eliminate oxide scale or decarbonized metal together with ordinary pits, interstices or the like flaws that may have become superficially interspersed during the rolling or equivalent hot drawing operations.

Subsequent to such abrasive treatment, our highly polished wire may be cold drawn in stepwise reductions through one or more dies without materially disturbing the initiatory bright finish that has been imparted to the abraded wire. Such grinding is purposely applied lengthwise of the wire axis in order that any remaining fine scratch marks shall predominantly extend longitudinally and be readily closed or otherwise eradicated when the wire is further stretched and diametrically compressed by means of die drawing.

The common practice of grinding wire crosswise of its axis by centerless grinders or the like slow feed agencies, leaves transverse scratch marks that sharply deviate from the wire axis and generate a mat finish likely to vitiate the brilliant polish herein contemplated. Furthermore, incipient transverse scratch marks tend to inherently weaken the finished product as measured in terms of shock resistance or fatiguing vibratory stress resulting from long repeated reversed loading.

The object of the present invention is to devise an improved dry wire treating method of the indicated character capable of processing bright wire or the like product by drag means at a fast productive rate on a corresponding low labor and cost output basis preferably by utilizing slowly fed abrasive tapes without substantially cutting any transverse superficial scratch marks during an intermediate processing stage prior to completely reducing the wire to its final diametral size.

The instant application is a continuation of our copending Serial No. 366,596 filed November 20, 1940, which has matured into Patent No. 2,284,904, of June 2, 1942.

Reference is had to the accompanying one sheet of drawings which are illustrative of a preferred exemplification, and in which drawing:

Fig. 1 schematically represents an elevational side view of our grinder housing of which the ends are respectively equipped with a wire carrying reel.

Fig. 2 is an end view of such housing with its reel removed, and Fig. 3 shows a cross-sectional view taken along 3-3 of Fig. 1.

Fig. 4 details a tape backing jaw taken along 4-4 of Fig. 3, and Fig. 5 depicts an enlarged wire profile together with a preferred tangential embrace on part of mated tape pairs.

Fig. 6 is illustrative of the final cold drawing operation as applied to our abraded wire.

Referring first to the Fig. 1 assembly, a boxlike abrading machine or housing is appropriate for present needs in that it provides for the mounting of the very considerable number of tapes that in aligned row formation, operatively bear upon a treated wire while being dragged therethrough. Such housing preferably comprises a series of stationary partition members or metallic plates 10A, 10B, 10C, etc. that may be laterally spaced to provide for compact tape receiving compartments therebetween such as 12A, 12B, 12C, etc. Other structural details have been more explicitly defined in our aforesaid copending application.

Fig. 3 reveals the typical disposition of the preferred duplex tape supply and positive feed appurtenances associated with each such partition plate face. The full-lined working parts lie forwardly of the plate 10C while the corresponding angularly shifted parts indicated in dotted outline by primed numerals, lie behind said plate. The forward face of plate 10C may have a pair of tape carrying spool studs or stanchions 13 and 14 erected thereon. Mated supply spools 15 and 16 together with a full complement of feed roller devices may respectively be installed upon each plate face. Evenly distributed around the intermediate circle B, are a plurality of tape feed control shafts such as 17A, 17B, etc. which may extend perpendicularly rearward through all or a portion of the remaining plates. The mated tapes respectively belonging to successive stationary plates are staggered angularly to constitute a series of tapes closely spaced edgewise and adapted to embracingly treat the entire perimeter of a common work piece.

Mounted at the forward end of the several shafts is a series of meshed drive gears such as 18 (see Fig. 2) respectively having an idler gear 20 interposed therebetween to constitute an endless train of gears adapted to simultaneously rotate all of the feed shafts. A motorized wide-range speed transmission unit 21 provided with a finger tip control 22 may serve to actuate said gear train. By manipulating the tip control, the speed of the several feed shafts may be altered in unison while the respective tape feed rollers 23 and 24 are kept running. Each component tape is positively and regularly fed onward into its cutting zone at an exceedingly slow rate to the end that each of our roll tapes of finite length may become substantially spent in a single pass through their aligned row of angularly staggered

cutting zones. These laterally flexible or floating tape components are self-compensating as regards diametral wire variations.

In the center region of the circle B, each housing plate may be apertured to have a common wire or the like work piece 26 slidably threaded therethrough. A motorized high speed supply reel 27 and a similar take-off reel 28 may respectively be located at opposed housing ends as indicated in Fig. 1. Said reels may each be equipped with level winder means and with clutch means whereby the treated wire may be reversely dragged through the housing in successive passes. It is the intent to pass the wire at a relatively high velocity, preferably at about two thousand feet per minute or faster. Such rapid travel rate in turn affords a correspondingly large productive capacity for a given collective width of active tapes and results in a proportionately low labor cost. For a definite superficial wire hardness, its tape cutting rate is in part fixed by the applied wire velocity and tape backing pressure. The use of a side by side tape width of some ten feet for each housing, compensates for the inherently slow cutting rate of abrasive tape and still attains adequate penetrative wire grinding depth in comparatively few passes.

In order to fully realize on the labor and other savings involved in pregrinding the drawn wire as described, it is preferred to butt weld adjacent terminals of a chain of rolled wire bundles into a sufficiently long batch length to keep our machine in operation for a protracted time period. Such overall length of stock may be initially run through a rotary straightener at a comparatively slow travel rate of less than 2000 feet per minute, dependent upon wire size, and then be prewound upon a demountable supply reel such as 27. When handling high tensile straightened wire or the like adjoined components in relatively heavy sizes from $\frac{1}{8}$ " to $\frac{1}{4}$ " in diameter, it is expedient to resort to corresponding large drum diameters that shall not impose a pronounced permanent set to the wound wire.

Fig. 4 shows a pair of opposed backing shoes or tape clamping jaws 30 and 31 attached to an adjacent upright plate. One jaw may be pivotally supported by a bored guide bracket 32 provided with a retractable plunger 33 that may be actuated by fluid pressure to exert an equalized clamping thrust upon the jaw interposed wire 26.

Such straightened reeled wire is then dragged through our machine housing in one or more passes to penetratively grind the surface metal to any required depth and also to leave the wire in a highly polished condition when ground. Our characteristic mode of abrasive treatment may be clarified by reference to Fig. 5. Here the dry mated roll tape components 34 and 35 may respectively comprise a paper backing strip 36 of which its inner face may be coated with the abrasive grit designated 37.

The opposed clamping jaws 30 and 31 respectively bear upon the smooth strip faces to reversely press opposed abrasive tapes toward each other. The resulting twin cutting zones are angularly defined as F and F' and their arcuate contact is in part dependent upon the wire diameter and the allowable jaw pressure for a given grit. As indicated, the original thickness of our slowly advanced virgin grit is thereby gradually reduced in such zone into a thinner commercially spent state prior to leaving the treated wire. The successively staggered inclination given to the other mated tapes such as 34' are arranged to bring

about an overlapping tape embrace that will evenly abrade and polish the entire profile of an annular work piece.

While wires have heretofore been drawn through so-called sanding boxes or through a coil of abrasive saturated rope, such primitive agencies make no provision for controllably feeding a fresh supply of virgin abrasive into the respective cutting zones thereof; accordingly, the abrasive action is not uniformly maintained and soon becomes sluggish by localized loading or grit wear. In the case of treatment by an impinging sand blast, the result is a mat finish of which the superficial profile readings are devoid of a clearly defined direction extending lengthwise of the treated wire in the manner herein practiced. For intensive cross grinding by abrasive wheels or endless belts, the wire surface usually suffers from serious cross-scratch faults that are difficult to eliminate by a subsequent wire die draw.

The present method teaches how to obtain a combined penetrative grinding and high grade polish by lengthwise wire stroking when using fast cutting coarse tapes such as 30 mesh grit and thereby effect at least a five percent weight reduction by grinding. For one pass operations, multiple housing units may be placed in tandem and stocked with different grits so as to improve the character of profile finish when leaving the last of such units. Profilometer readings for high tensile piano wire when treated in accordance with our process, showed a mean superficial irregularity of about five millionths of an inch when treated with 320 grit tape; for 80 grit, the corresponding measurement was about ten micro-inches; and for 30 grit, about twenty to thirty micro-inches. Even the last named fast cutting tape grit may be localized loading, cause a portion of its deteriorated grit to take on the abrasive behavior of finer grit. As a result, a superficial smoothness is attainable that possesses a relatively high brilliancy approaching a virtual burnishlike finish and of which the longitudinal scratch marks are hardly visible to the naked eye. Said scratch marks need not necessarily extend truly parallel with the wire axis, since a slightly spiral inclination produces a substantially identical result.

Our subsequent die drawing operation further improves the surface condition of such tape treated wire and provides for rapid low cost fabrication of brightly polished wire without requiring any additional grinding treatment after being die drawn. The fact that any surface decarbonization has also been removed, insures a uniformly distributed tensile strength substantially free of internal stress throughout the cross-sectional area thereof. At the stipulated processing travel rate of 2000 feet per minute and for high tensile stock treatment, the corresponding normal timed rate of tape advance into their respective component cutting zones approximately equals per minute the perimetric length of the treated wire. By proper adjustment of the centralized finger control 22, the cross feed of all tapes in any one housing may be selectively set at a relatively fast advance to accelerate its abrasive rate or may be set at a retarded rate during the last wire pass to enhance and otherwise promote a virtually burnished wire polish. For any given tape setting, said wire will invariably be uniformly polished throughout its treated length and made ready for a final die drawing in one or more stages.

Fig. 6 schematically indicates a die drawing bench 39 equipped with driven supply and take-off reels 27' and 28'. As will be understood, the wire batch after having been wound in layers on the Fig. 1 takeoff spool 28 may be bodily and interchangeably transferred to serve in the capacity of a supply spool for said bench. Depending upon diametral size, the preground wire may now be cold drawn through one or more successive dies at a relatively slow travel rate to complete a highly polished wire product without having allowed scratch marks to be cut substantially transverse of its axis. The combined processing cost of such treatment primarily resides in the cited penetrative abrasive step and in order to economize on material wastage by stock removal, it is preferred to grind rolled alloy wire in larger sizes of around $\frac{1}{8}$ to $\frac{1}{4}$ " in diameter having a comparatively small surface per unit of wire weight which in turn promotes economical abrasive treatment. In order to materially elongate the overall length of such larger sizes, the wire would be die drawn at a travel rate materially slower than 2000 feet per minute stipulated for our abrasive treatment.

The foregoing disclosure will it is believed, make evident to those skilled in this art, the more outstanding commercial advantages afforded by first pre-reeling a long work piece at slower travel speeds, then abrasively processing the work piece at relatively higher speeds, and finally die drawing the abraded work piece at a reduced travel speed, it being understood that we reserve the right to modify our 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. A method for brightly finishing a drawn metallic product and which method consists in initially rolling bar stock into elongated strip stock having a comparatively small cross-sectional size of which the superficial contour region has become deteriorated, affixedly linking contiguous ends of a series of similar strips into a straightened chain and prereeling said chain at a certain rate of longitudinal travel, then unreeling to bring said superficial contour of such linked strips into successive operative engagement with a row of abrasive zones and penetratively stroking the linked strips lengthwise through said zones at a faster longitudinal travel rate than said certain prereeling rate to abrasively reduce the perimetric size of said strip stock and deliver the same in a substantially polished condition with minute scratch marks predominantly extending longitudinally, and without having cut scratch marks substantially transverse of the product axis during a prior processing stage, finally die drawing to increasingly stretch and diametrically compress said polished stock into a materially reduced size whereby to substantially close said scratch marks and enhance the superficial finish quality of the product.

2. A method for brightly finishing drawn ferrous stock and which method consists in initially hot rolling bar stock into elongated strip stock having a comparatively reduced cross-sectional area of which the superficial contour region has become deteriorated with respect to its core region, then bringing said superficial contour into operative engagement with a succession of abrasive zones and stroking the strip stock lengthwise through said cutting zones at a rate of longitudinal travel of more than one thousand feet per

minute to penetratively remove the deteriorated contour region of said strip stock and simultaneously finish its perimetric surface into a brightly polished condition having scratch marks predominantly extending longitudinally, and finally die drawing in successive stages to increasingly stretch and diametrically compress said polished stock into a materially reduced size whereby to substantially close said scratch marks and maintain the original brightness quality in each such stage.

3. A method for brightly finishing drawn ferrous wire and which method consists in initially hot rolling bar stock into wire stock of which the superficial contour region has become deteriorated with respect to its core region, then bringing said superficial contour into operative engagement with a succession of abrasive zones of which the grit mesh is kept relatively coarse and stroking the wire stock lengthwise through said zones to penetratively grind away the deteriorated portion of said contour region and correspondingly reduce the perimetric wire surface into a substantially polished condition leaving penetrative scratch marks whose mean profile depth does not exceed fifty micro-inches and predominantly extend longitudinally of the wire axis, and finally die drawing to increasingly stretch and diametrically compress said polished stock into a materially reduced size whereby to substantially close said scratch marks in the finished wire product.

4. A method for brightly finishing drawn ferrous stock and which method consists in initially hot rolling bar stock into elongated strip stock having a comparatively reduced cross-sectional area of which the superficial contour region has become decarbonized with respect to its core region, bringing said superficial contour into operative engagement with successive abrasive zones, and then stroking the strip stock lengthwise through such several cutting zones at a rate of longitudinal travel of more than one thousand feet per minute to penetratively remove the decarbonized contour region of said strip stock and impart a virtually burnished finish to its perimetric surface to leave scratch marks predominantly extending longitudinally, and finally die drawing such previously treated stock in a comparatively cold state at a relatively slower travel rate to increasingly stretch and diametrically compress said polished stock into a materially reduced size whereby to substantially close said scratch marks and provide for a brightly finished product materially longer than the original strip stock length.

5. A method for finishing a metallic product and which method consists in initially hot rolling bar stock into wire of approximately one-fourth inch diametral size having a length of considerable magnitude, spanningly coiling a straightened wire length about a pair of driven drums of sufficient diameter to prevent the coiled wire from suffering a pronounced set deformation, dragging a spanning wire portion from drum to drum without rotating the wire about its axis and thereby superficially grind said portion with abrasive means disposed to solely cut longitudinally of the wire axis, and thereupon die drawing said wire in a comparatively cold state to increasingly stretch and diametrically reduce the abraded wire into a smaller size having a materially enlarged surface.

LOUIS ILLMER.
VERNON R. PALLAS.