Sept. 2, 1958 E. A. SNAPE, JR 2,849,844

CARD CLOTHING GRINDING HEAD

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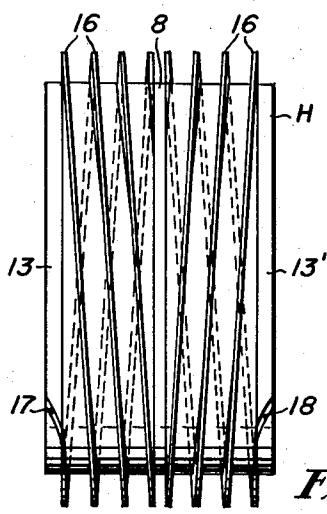

Fig. 1.

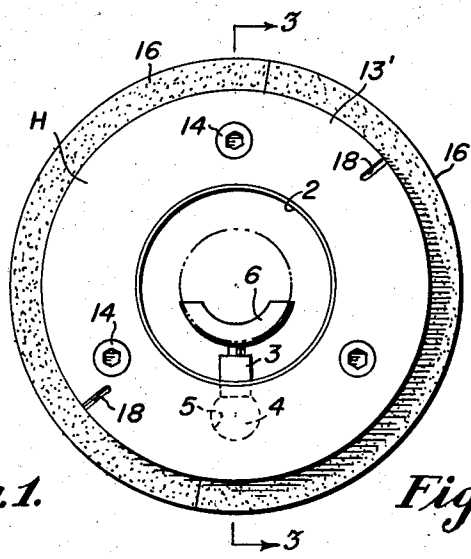

Fig. 2.

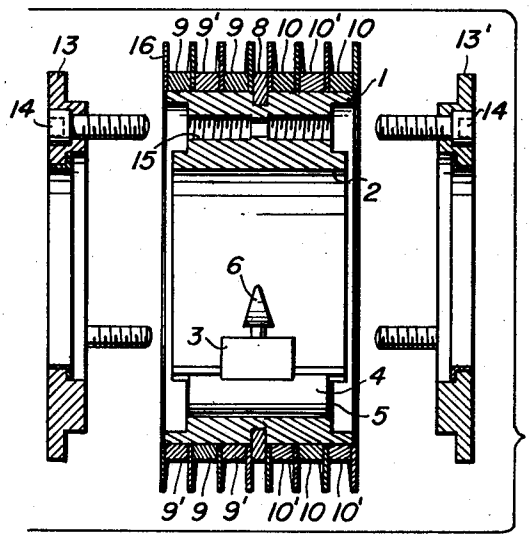

Fig. 3.

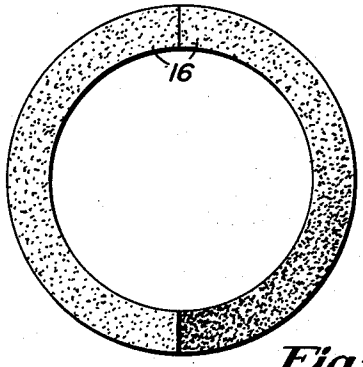

Fig. 5.

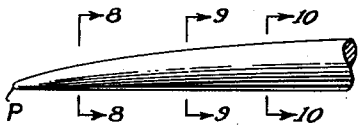

Fig. 6.

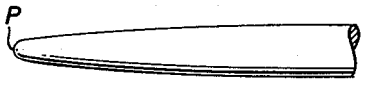

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

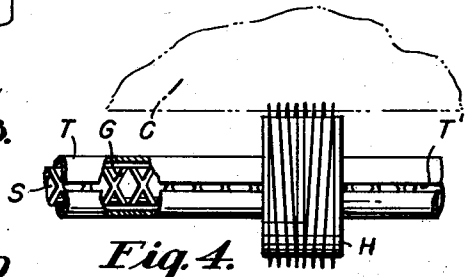

Fig. 4.

INVENTOR
EDWIN ALLEN SNAPE, JR.
BY
ATTORNEY

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CARD CLOTHING GRINDING HEAD

Edwin Allen Snape, Jr., Philadelphia, Pa.

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4 Claims. (Cl. 51—242)

This invention relates to grinding mechanism especially adapted for grinding or regrinding the points on the teeth or staples of card clothing and the like used in the textile industries.

It has been customary in the manufacture of card clothing and generally comparable materials and in its refinishing after a period of use to mount grinding apparatus in a position with relation to the moving clothing suitable for pointing the ends of the projecting wire teeth. One apparatus for this purpose, disclosed in United States Letters Patent 2,710,500, June 14, 1955, is intended to achieve more or less tapered formation of the tooth points through causing the teeth while revolving on a drum to be pushed away or deflected laterally from their normal position by contact with a moving abrasive-coated belt set at an angle to the drum axis thereby to grind the sides of the teeth slightly while they are so deflected. Others have suggested using an abrasive-coated cylinder or a series of spaced annular flat rotating abrasive wheels axially reciprocated across the clothing by a rotating grooved shaft or double-way screw having a right and left hand thread and in turn driven by suitable differential mechanism at a speed different from that of the cylinder, suitable adjustments for positioning the cylinder or wheels as the case may be in appropriate relation to the staple ends being provided. But apparatus of this kind produces on the teeth formations which have been designated "chisel" points due to grinding the individual teeth only from the rear toward the front, or on their sides only, considering them in relation to their direction of movement while in service, and as far as I am aware no apparatus has heretofore been devised for grinding them to produce elongated roundly tapered needle points while they remain in normal or substantially normal position in the card clothing.

It is thus a principal object of this invention to provide an improved grinding head for a card clothing grinder or the like in which by a novel arrangement of abrasive surfaces the individual teeth of card clothing may be ground to relatively long-tapered uniform, extremely fine and accurate points.

Another object is to provide a card clothing grinding head in which preferably somewhat resilient clamping members or spacers arranged spirally with opposite leads are disposed at axially spaced zones of the head for retaining substantially annular abrasive elements projecting outward from said spacers in mutually opposed spiral relationship whereby as the head is rotated in the vicinity of the moving drum carrying the card clothing the teeth of which are to be sharpened and simultaneously traversed parallel to the drum axis the edges of the abrasive elements penetrate between adjacent rows of wires and progressively grind the sides and back thereof to elongated rounded tapers, for example tapers in length up to eight to ten times the wire diameter, with the outer extremity of the tapered end portion of each approaching substantially as closely to a true mathematical point as is practical to attain.

A further object is to provide a grinding head of the character described in which attack of an abrasive on a card clothing tooth in a direction substantially normal to its axis is eliminated and all contact of the tooth by abrasives is along lines forming small angles with that axis, whereby an elongated taper to a true point is attained on each tooth of the card clothing and the effectiveness of the latter in service thereby appreciably enhanced.

A still further object is to provide a grinding head in which expansible spiral grooves are provided for reception of substantially annular grinding elements which when tightly held in said grooves upon setting up of appropriate clamping means define opposed pairs of helical grinding surfaces of opposite inclination or pitch whereby when the rotating head is traversed across the face of the card clothing while the latter is being rotated independently on a substantially parallel axis of its own the said surfaces lightly and briefly attack each tooth many times at small angles converging toward its extremity in such manner that the relative motion of any abrasive particle with respect to a tooth while in contact with it has vector components in three planes, one normal to the tooth axis and the others normal to each other and paralleling said axis, the latter two being of considerably larger values than the first.

Another object is to provide on a card clothing grinding head abrasive surfaces defined by spiral revolution of parallel radii about the head axis in spirals of opposite hand whereby during traverse of the rotating head in opposite directions parallel to the axis of the rotating drum or the like carrying the clothing its individual teeth are ground at their extremities to rounded-taper, extremely sharp points with their tapered end surfaces receding therefrom in smooth and gradual curves to zones remote from said extremities, the end of each tooth being defined by a point substantially on the original outer surface of the staple wire, considered as a cylinder.

The invention further comprises as an object the provision of a novel method of grinding the teeth of card clothing and the like.

Oher objects, purposes and advantages of the invention will hereafter appear or be understood from the following description of a preferred embodiment of it illustrated in the accompanying drawing, in which:

Fig. 1 is a side elevation of my improved card clothing grinding head;

Fig. 2 is an end elevation thereof;

Fig. 3 is an exploded axial section of the head;

Fig. 4 is a fragmentary diagrammatic view showing on a reduced scale the head mounted on a head traversing machine in operative relationship to a series of card clothing teeth the location of the ends of which is indicated in broken lines;

Fig. 5 is a reduced diagrammatic side elevation of two segmental abrasive elements a plurality of which may be employed in the head;

Fig. 6 is a greatly enlarged fragmentary side elevation of the point section of a typical card clothing tooth after sharpening with the aid of my grinder;

Fig. 7 is a similarly enlarged back view thereof considered in its direction of motion when in operation, i. e., showing the surface opposite that which first encounters the fiber during carding or a generally similar operation, and

Figs. 8, 9 and 10 are sectional views of the tooth shown in the preceding figures taken normal to its axis respectively on lines 8—8, 9—9 and 10—10 in Fig. 6, looking in the direction of the arrows.

Referring now more particularly to the drawing, the grinding head generally designated H in Figs. 1, 2 and 4 comprises a substantially hollow cylindrical metal core

or body 1 having an axial bore 2 adapted to receive a slotted drive tube T (Fig. 4) having a slot T' in which projects a key 3 extending radially inward in bore 2 from a pin 4 positioned in an eccentric bore 5 extending parallel to the axis of body 1 and communicating with bore 2, the key also supporting a spring pressed pivoted fork 6 constituting a nut of slightly less than one-half an internal thread engageable in the reversing spiral groove G of an axial shaft S within tube T. Thus through relative rotation of the shaft and tube effected by operation of a differential mechanism (not shown) the head H as it is rotated by tube T through engagement of key 3 in slot T' is simultaneously reciprocated along the sleeve through engagement of fork 6 in thread groove G.

My grinding head may be used either for grinding the teeth in the card clothing during its initial manufacture or for regrinding them after they have become dulled from use in carding; it is therefore so designed that it readily may be substituted for rotatable grinding heads of other types presently employed in card clothing grinding machines without material change or modification thereof. It will therefore be understood that the foregoing description of mechanism for reciprocating the head across the face of the clothing is but typical of those largely used in the industry for either kind of grinding.

The body 1 of my grinding head has an annular rib 8 projecting radially outward from its cylindrical surface approximately midway between its ends either formed integrally with the body or, as shown, by a ring seated and secured in a suitable groove therein, and extending spirally toward the adjacent ends of the body from either face of this ring is a pair of intertwined resilient spiral spacers 9, 9' or 10, 10' as the case may be, each spacer having one end preferably welded or otherwise secured to rib 8 with the inner surfaces of its convolutions slidable on the body and its outer ends free of attachment thereto; if preferred, however, but a single spacer may be utilized on each side of the ring. These spacers lying on opposite sides of rib 8 are wound on opposite hands and cooperate to form corresponding pairs of narrow spiral grooves of opposite pitch somewhat greater than twice the thickness of the rectangular bar stock of which the spacers are made; when not under stress the latter extend axially from the rib slightly beyond the respective ends of the body, their outer extremities being tapered off substantially in a plane normal to the body axis and thus parallel to the adjacent end face of the body.

Annular end plates 13, 13' are provided for cooperation with the spacers, each plate having countersunk holes for reception of socket-head cap screws 14 extending into corresponding threaded bores 15 in the body whereby the plates may be set up against the spacer ends to thereby axially compress the spacers and firmly clamp in the spaces defined by their convolutions abrasive elements 16, each of which may, as illustrated, comprise semi-annular segments of appropriate inner and outer diameter, although if manufacturing facilities permit but a single continuous spiral strip of suitable length may be used instead. To guide and assist in placement and removal of the abrasive elements, particularly when but a single integral one is employed, the end plates are provided with opposed angular peripheral slots 17, 18 in substantial prolongation of, but with sharper pitch than, the grooves formed by the spacers, whereby the abrasive elements may be wound or threaded into the grooves through slots 17, 18 when the end plates are backed off slightly and so without removing them entirely from the body.

The abrasive elements are desirably fairly rigid, preferably made from plastic materials with opposite abrasive coated plane surfaces and project spirally outward for about a half inch in a grinding head intended for grinding card clothing back from the ends of the wires to points tapering for up to ten times the wire diameter, and in the embodiment of the invention illustrated each of the spacers makes a spiral of about one and one-half turns, affording about three complete turns of abrasive material of each spiral pitch, although of course any other desired number of turns may be employed.

In operation the grinding head is mounted as described in properly adjusted relation to the card clothing, either installed on a carding machine, or in the case of newly manufactured clothing temporarily applied to a cylinder similar to the main drum of such machine. The traverse mechanism, differential drive and other usual components of wheel or drum type card clothing grinding machines, as hitherto mentioned, may be of conventional character as diagrammatically illustrated in Fig. 4, adjusting mechanism (not shown) whereby the spacing of the head relatively to the card clothing C is controlled being utilized to afford the desired "bite" of the grinding head abrasive elements.

When all components have been duly positioned, and required adjustments made, the machine is set in motion, the grinding head rotating in the direction opposite to that of the card clothing drum and concurrently reciprocating along the tube, usually at about 2–3 cycles per minute. The head is preferably rotated at a peripheral speed of about 3600–5000 F. P. M. (feet per minute) and the card clothing moved on the rotating cylinder at about 2160 F. P. M. for cotton cards, or about 1260 F. P. M. for wool cards but of course the speeds indicated may be varied.

As the grinding head rotates and traverses across the face of the card clothing it progressively removes the metal of the teeth adjacent their ends by small increments, ultimately producing on each a more or less rounded "needle" point having gradually tapered and smooth finished surfaces converging in a compound curve with a line paralleling the axis of the tooth and corresponding to one such as would generate the wire considered as a cylinder so that at the extremity an almost geometrically true point is formed as distinguished from the oval flats at the ends of the teeth formed by plane abrasive surfaces paralleling the card clothing cylinder axis as used on some machines, and from the relatively flat-sided points described and shown in said Patent 2,710,500.

More specifically the abrasive elements arranged in opposed spirals cooperate to grind a somewhat rounded sharp point on each tooth by respectively and successively contacting distinct although perhaps slightly overlapping areas. Thus, for example, the elements to the right of the center of the head in Fig. 5 apparently grind one side *a* of a typical point of a single tooth while the head is traversing to the right in Fig. 5 and the elements on the other end of the head which spiral to the opposite hand grind only the side *b*, *a* and *b* mutually overlapping at the back of the tooth but distinctly separated at the front by a portion *c* of the original peripheral cylindrical surface of the wire which after grinding converges to the point P of the tooth but is otherwise unappreciably changed by the grinding operation. It is moreover apparent that the tapered formation thus produced on the individual teeth is not attained by bending them as a flat abrasive surface is brought against their back faces at a wide angle to their axes but results from the lateral faces of the substantially flat grinding elements contacting their surfaces at a small angle to their axes and moving relatively thereto in a direction to abrade gradually to a relatively long tapered point such as has heretofore been earnestly sought but until now impossible to attain.

The formation of the point just described as illustrated in Figs. 8–10 results in areas *a* and *b* being separated by a more or less rounded zone *d* at the back of the tooth where it is perhaps lightly abraded by both sets of spiral disks alternating as they favor or oppose the direction of traverse, the zones *a* and *b* themselves, less convexly rounded, converging toward the point in a gradual taper the precise form of which may vary somewhat from that shown depending on operating conditions including the relative speeds of the head and staples, the speed of tra-

verse of the head and the depth of penetration of the abrasive elements into the spaces between the staple ends.

It is not practical to observe in minute detail the precise relative motion of each particle of abrasive in relation to a selected tooth in the course of a card clothing sharpening operation but microscopic examination of the teeth after the operation has been carried out indicates the points formed by my grinder are produced by abrasive particles moving angularly from the shank of the tooth toward its end in paths forming only small angles with parallels to its axis and that each particle of abrasive acting on the point, producing what appears in the microscope as a scratch thereon, remains in contact with the wire for a relatively long period, many such "scratches" extending along the wire point substantially the full length of its taper and in approximately straight lines paralleling or nearly paralleling its axis.

While I have herein described and illustrated in the accompanying drawing with considerable particularity one embodiment of my invention, it will be understood I do not desire to be limited or confined thereto in any way as changes and modifications in the form, structure, arrangement and operation of the several elements and components other than as herein suggested will readily occur to those skilled in the art and may be made if desired without departing from the spirit and scope of the invention as defined in the appended claims.

Having thus described my invention, I claim and desire to protect by Letters Patent of the United States:

1. A grinding head for card clothing grinding apparatus comprising a substantially cylindrical head adapted for rotatable mounting in the apparatus, said head comprising a hub providing on its cylindrical outer surface a pair of grooves each of a plurality of convolutions extending helically from a central zone of said surface toward each end thereof, the pitch of the grooves of the respective pairs being equal and opposite with respect to the head axis, and a thin flat abrasive faced element in each groove projecting radially outward therefrom a substantial distance beyond the peripheral surface of the hub.

2. A card clothing grinding head comprising a substantially cylindrical body having an axial bore and a peripheral annular projecting rib intermediate its ends, a pair of flat sided elongated compressible members proximate each side face of the rib, extending spirally therefrom in a plurality of convolutions in coaxial relation with the body toward the proximate end of the latter and defining continuous helical grooves between their adjacent convolutions, the pitch of said convolutions to said rib being

mutually opposed on opposite sides of the latter, means associated with the ends of the body for compressing said members axially toward the rib, and thin flat abrasive faced elements disposed in said grooves projecting outwardly therefrom a substantial distance and secured therein by endwise compression of the members by said compressing means.

3. A grinding head as defined in claim 2 in which each compressible member is substantially rectangular in cross section and extends from said rib helically in engagement with a cylindrical surface of the head and in uniformly spaced relation with an adjacent compressible member to define therewith a continuous helical groove for reception of one of the abrasive-faced elements.

4. A grinding head adapted for operative association with card clothing apparatus including a traverse shaft and mechanism for reciprocating a grinding head thereon, said head comprising a hollow cylindrical body for receiving the shaft and means for interconnecting the head with said mechanism, a radially projecting abutment disposed midway of the ends of the body, a pair of intertwined compressible spacers substantially rectangular in cross section each comprising a plurality of convolutions on each side of the abutment, each spacer having one end seating thereagainst and the other when the spacer is uncompressed extending slightly beyond the proximate end of the body, a plate associated with each end of the body and overlying the adjacent ends of the spacers, a thin flat element having an abrasive face seated in the groove defined between the convolutions of each pair of spacers and projecting a substantial distance outwardly therefrom, and means for drawing each plate toward the end of the body to thereby compress the spacers and clamp the adjacent abrasive elements firmly in said grooves, the spacers on the respective sides of the abutment being of opposite but equal pitch, whereby when so clamped the elements respectively lying on opposite sides of the abutment extend spirally in opposite directions about the axis of the body.

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