July 9, 1968 MORIICHI WATANABE 3,391,429

METALLIC WIRE FOR CARD CLOTHING

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Fig. 1-A

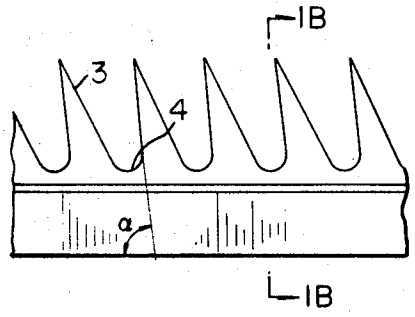

Fig. 1-B

Fig. 2-A

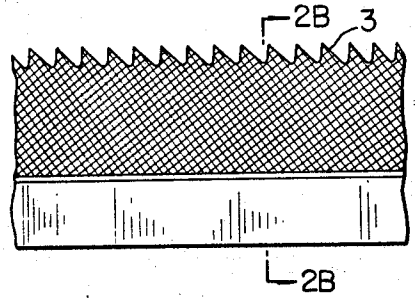

Fig. 2-B

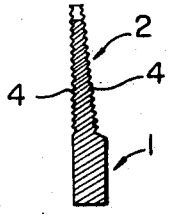

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Fig. 3-A

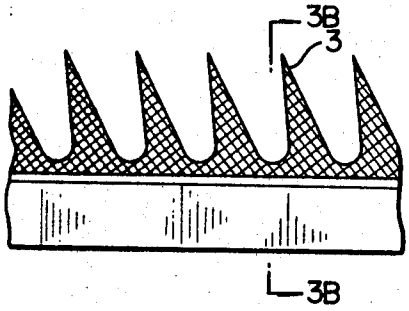


Fig. 3-B

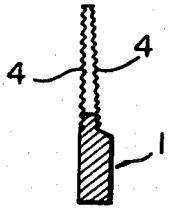


Fig. 4-A

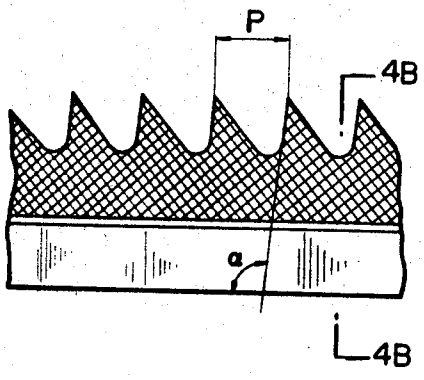


Fig. 4-B

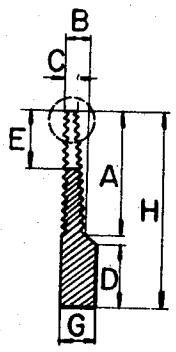
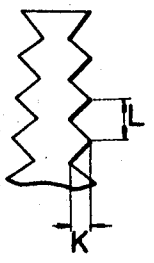


Fig. 4-C



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METALLIC WIRE FOR CARD CLOTHING

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1 Claim. (Cl. 19—114)

ABSTRACT OF THE DISCLOSURE

Metallic wire for card clothing consisting of a base portion and an upper working portion having teeth on the top thereof, integral with said base portion; knurls of 0.05–0.7 mm. in height being present at density 4–200 per square millimeter on a side of said working portion; and said wire having the following characteristics: teeth height of 0.1–2.6 mm., teeth pitch of 10–50 per inch, working height of 0.3–3.0 mm., base thickness of 0.6–2.0 mm., and tip thickness of 0.15–0.35 mm.

This invention relates to metallic wire of novel structure for card clothing, which performs excellent carding action. More particularly, the invention relates to metallic wire for card clothing with which the carding of fibers is performed at the side portion thereof.

It is heretofore known to apply saw tooth wire, that is, the metallic wire consisting of the working portion having saw tooth on the top and the base portion, onto the cylinder or doffer of a carding machine. In recent years considerable improvements have been achieved on the properties as well as the shape of the tooth of such metallic wire which is finding wide use in the field of spinning.

Whereas, with all of the heretofore known types of such metallic wire the transporting and carding of the fibers is performed by the saw tooth only, and for the sure performance of the given function it has been generally believed that the tooth must have an acute working angle against the direction of movement of the wire, and also that the notch (trough) between any two teeth must be considerably deep. And, although such metallic wire has its advantage that it normally dispenses with stripping and grinding, the same also has its drawback that the fibers are damaged more or less by the carding action of the tooth having an acute working angle. Furthermore, with the known types of the metallic wire, it is essential that the working angle of the tooth, the number of teeth per unit area and the height of the tooth, etc. to be varied in accordance with the type of the fiber to be carded, and denier as well as length of the staple, for the optimum carding. Consequently, there is the inconvenience that from a carding machine mounted with any known type of the metallic wire, only single type of sliver is obtainable.

We now found, however, quite differently from the conventional technical concept of performing the transporting and carding of fibers simultaneously at the saw tooth portion of the metallic wire, that it is practicable to let the side portion of the metallic wire perform the carding of fibers instead of using the bite at the top portion thereof, and that when the transporting and the carding of the fibers are so performed at the different parts of the metallic wire, excellent carding effect is attained

without any appreciable damage on the fibers. It is furthermore found that with our novel concept the metallic wire is usable generally for the carding process of fibers, receiving no restriction from type and staple length of the fibers to be used.

Accordingly, the obect of this invention is to provide a novel type metallic wire for card clothing which has a structure entirely different from that of the known metallic wire for card clothing and exhibits excellent carding performance with respect to the fiber orientation as well as the number of neps in the sliver obtained, physical properties of the final product yarn and the fiber yield.

Another object of the invention is to provide metallic wire for card clothing of novel structure, with which the carding of fibers is performed at the side or sides thereof.

Still another object of the invention is to provide metallic wire for card clothing which is so designed that the transporting of fibers is performed mainly by means of the teeth cut on the top portion of the metallic wire, and the carding of the fibers is performed mainly at the side or sides of the metallic wire.

A further object of the invention is to provide metallic wire for card clothing which can be used for carding process of fibers in general, being subject to no restriction with respect to the type and staple length of the fibers to be used or the counts of the object yarn.

Other objects and advantages of the invention will become apparent from reading the following specification.

According to the invention, the foregoing objects are achieved by the metallic wire for card clothing, which consists of the working portion provided with teeth on the top and the base portion, and which is characterized in that at least one side of the said working portion is provided with knurls of 0.05–0.7 mm. in height, at a density of 4–200 per 1 mm.^{2}.

For a still better understanding of the invention, the following explanation is made with reference to the attached drawings, in which:

FIGS. 1A and 1B are respectively the side view and cross-sectional view showing the structure of a conventional metallic wire;

FIGS. 2A and 2B are respectively the side view and cross-sectional view showing one embodiment of the metallic wire of this invention;

FIGS. 3A and 3B are respectively the side view and cross-sectional view of another embodiment of the metallic wire of this invention; and

FIGS. 4A, 4B and 4C are respectively the side view, cross-sectional view and an enlarged cross-section of a part, of the metallic wire of this invention for the explanation of the dimensions of the parts of the wire.

Hereinafter the terms denoting the dimensions and numerical figures of the parts are used in the present specification and claims with the significance as defined with reference to FIGS. 4A, 4B and 4C as follows:

H=Total height
G=Base thickness
D=Base height
A=Working height
B=Medium thickness
C=Tip thickness

E=Tooth height
K=Knurl height
L=Knurl pitch
P=Tooth pitch
α=Working angle

For the sake of explanation, structure of a conventional metallic wire is shown by FIGS. 1A and 1B. The same wire consists of the base **1** and the working portion **2** on which the saw teeth **3** having a tooth height E of 0.8–2.6 mm. are notched. In the conventional metallic wire, the sides of the working portion **2** are smooth-surfaced and furthermore because the teeth **3** are notched as deeply as to the point close to the middle of the working portion **2** and the base **1**, the sides of the working portion **2** have but small areas. Thus no particular consideration has been given on the sides of the working portion. Again in the carding machine applied with this type of metallic wire, the transporting and carding of fibers are performed at the saw tooth portion having an acute working angle shown as α in FIG. 1A, and therefore the shape and dimension of the tooth is determined for each individual type of the fibers to be used as well as for each desired count of the object sliver for the optimum result. Few examples of such dimensions of the heretofore employed metallic wire are given as follows:

Type of fiber	Working angle of tooth, deg.	Tooth pitch, T/in.	Base thickness, mm.	Number of teeth, in.²	
				20 count	40 count
Cotton	78-83	10-20	0.7-1.0	400	600
Rayon staple	65-83	10-20	0.7-1.0	400	500
Synthetic fiber staple	78-83	10-20	0.7-1.0	300	----

Thus it should be clear that only single type of sliver is obtainable from a carding machine applied with such a conventional metallic wire.

The present invention is entirely independent of the technical concept underlying such conventional metallic wire, but is based on the novel discovery that when knurls of specific dimensions are densely provided on a side or sides of the metallic wire, very satisfactory carding action is performed also at the side portion of the wire. As shown in FIGS. 2A and 2B, the metallic wire of this invention consists of the base **1** and the working portion **2** which has teeth **3** on the top and plurality of small knurls **4** on at least one, preferably both, sides.

According to the invention, the knurls of 0.05–0.7 mm. in height are caused to be present at a density of 4–200 per 1 mm.². In order for the excellent carding action performed at the side or sides of the working portion of the metallic wire, the knurls should preferably have a height of 0.08–0.2 mm., and be present at a density of 4–100/mm.².

The said knurls can be imparted by notching the smooth surface of the side or sides of the working portion of the metallic wire, by any optional means such as knurling, grinding, chemical or electrochemical etching, etc. For instance, when knurling is employed for producing the knurls, the knurls can be readily formed by notching knurly grooves into the smooth side-surface at a frequent intervals, i.e., at intervals of no more than 0.5 mm., at crossing directions. At such a time, of course the knurly grooves must possess a depth of 0.05–0.7 mm. The directions of the knurly grooves may be optional.

Consequently the shape of the knurls on the side or sides of the metallic wire is not critical, but may be any such as of pyramid, cone, their truncated forms, or of indeterminate grain. The distribution thereof neither is critical, so far as the requirement than 4–200 knurls should be present per 1 mm.² is met.

The teeth provided on the top of the working portion of the metallic wire of this invention may have an optional shape and dimensions so far as the same serve to the intended purpose, i.e. to transport the fibers in the carding machine. Because with the metallic wire of this invention, the carding of the fibers is mainly performed at the side or sides of the working portion on which the knurls are present. Accordingly the shape of the said teeth is not limited to serration, but may be, for example, the notches imparted by grinding. The preferred dimensions of the teeth on the top of the working portion are normally 0.1–2.6 mm. in height, and 10–50/in. in tooth pitch. The working angle (α) may be acute or obtuse. Accordingly, this invention embraces within its scope such metallic wire of which working portion has the conventional saw tooth **3** and also the knurls **4** notched on its side or sides, as shown in FIGS. 3A and 3B. Of course it should be apparent that with this type of metallic wire, the carding of fibers is performed both at the side or sides of the working portion and the saw tooth **3**.

However, in a preferred embodiment of this invention, the dimensions of the teeth on the top of the working portion are made small to let them perform the transporting of fibers only. By so doing it becomes possible to use the metallic wire of this invention for carding process of fibers in general, without any restriction incurred upon by the type and staple length of the fibers to be employed or by the count of the spun yarn desired.

The working height A in the metallic wire of this invention is considerably variable depending on the density and height of the knurls notched on the side or sides of the working portion, and furthermore on the height and pitch of the teeth on the top. Generally speaking, however, the preferred working height is 0.3–3.0 mm., 0.5–2.0 mm. being particularly preferred.

Other dimensions of the metallic wire of this invention, for example, may be as follows, the right hand figures being the preferred dimensions.

	Dimension (mm.)	Preferred dimension (mm.)
Toals height, H	2.0–5.0	3.0–4.0
Base height, D	1.0–2.5	1.0–1.5
Tip thickness, C	0.15–0.35	0.2–0.3
Medium thickness, B	0.2–0.6	0.2–0.5
Base thickness, G	0.6–2.0	0.7–1.5

Incidentally, the medium thickness should be greater than the tip thickness by at least 0.05 mm.

The quality of the material steel for the metallic wire of this invention is not critical, but the steel may be that which is conventionally used for known metallic wire. Of course it is possible to increase the hardness of the working portion, particularly the tip, in accordance with the accepted practice, and such is recommended.

For mounting the metallic wire of this invention onto the cylinder or doffer of a carding machine, the conventional techniques for metallic wire mounting well known in the art can be adopted without any alteration. To wit, the metallic wire under a suitable tension is applied onto the cylinder or doffer while pressed to the correct position. After mounting of the wire is completed, the so mounted surface of the cylinder or doffer may be subjected to grinding, if necessary.

Thus mounted metallic wire on the cylinder or doffer has preferably 500–1200 teeth per square inch.

The performance of the carding machine in which the metallic wire of this invention is employed is quite satisfactory compared with that of the carding machine using the conventional metallic wire, with respect to the fiber orientation and number of neps in the sliver obtained, physical properties of the final product yarn, and also the yield of the fibers.

In case of increasing the number of revolution per unit time of the cylinder or doffer for the purpose of increased output, with the conventional metallic wire the staple length of the fibers often tends to be shortened, while such is apparently objectionable. In contrast, when the metallic wire of this invention is used, the increase

in r.p.m. of the cylinder causes none of such objectionable phenomenon.

Furthermore, there is such an advantage that the carding machine mounted with the metallic wire of this invention can be used in general for producing spun yarns of varied counts from widely varied types of laps of varied staple length.

Hereinafter the achievement of the metallic wire of this invention will be illustrated by the following example.

A metallic wire of the following dimensions:

Total height, m.m.	3.3
Base thickness, m.m.	0.75
Base height, m.m.	1.5
Working height, m.m.	1.5
Medium thickness, m.m.	0.3
Tip thickness, m.m.	0.2
Tooth height, m.m.	0.6
Knurl height, m.m.	0.1
Knurl pitch, per m.m.^{2}	20
Tooth pitch, per in.	30

was mounted on the cylinder and doffer of a conventional carding machine for carding process for the production of a 40 count cotton yarn.

The results of the machine running as to the waste, number of neps and yarn quality are shown in the tables below, in comparison with those of using the same type of carding machine mounted with a conventional metallic wire.

TABLE 1.—WASTE TESTING

	This invention, percent	Cylinder and doffer mounted with conventional metallic wire, percent
Taker-in waste	1.53	1.85
Cyl. & Dof. waste	0.04	0.0681
Flat strip	1.46	1.53
Clearer waste	0.018	0.0195
Invisible waste	0.10	0.134
Total	3.148	3.60
Sliver waste	0.148	0.193
Sliver production	96.14	95.56

TABLE 2.—NEPS TESTING

	This invention	Cylinder and doffer mounted with conventional metallic wire
Nep per 50 in. sq. after stripping	8.5	9.5
Hours:		
0.5	7.9	7.3
1	7.0	8.3
1.5	7.3	8.6
2	6.8	8.4
2.5	6.4	8.0
3	8.1	8.7
3.5	6.9	8.5
Average	7.35	8.4

TABLE 3.—YARN QUALITY TEST

	This invention	Conventional metallic wire
Skein Test (lbs./lea)	49.86	49.89
U percent	15.7	17.81
Fiber orientation	96.7	96.7
Naps per 10 g.:		
L	0	0
M	2	3
S	4	6
Length of effective (in.) fiber	1.28	1.26

I claim:

1. A metallic wire for card clothing consisting of a working portion and a base portion integral therewith, said working portion having teeth on a top portion thereof, said metallic wire being characterized by the presence of knurls of 0.05–0.7 m.m. in height at a density of 4–200 per square millimeter on at least one side of said working portion, said teeth being 0.1–2.6 m.m. in height and present at a pitch of 10–50 per inch, said metallic wire having a height of the working portion of 0.3–3.0 m.m., a thickness of the base portion of 0.6–2.0 m.m., and a thickness of the teeth at the top portion of the working portion of 0.15–0.35 m.m.

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DORSEY NEWTON, *Primary Examiner.*