July 1, 1941. H. M. FRISCHMAN 2,247,611

KNITTING MACHINE SINKER

Filed Dec. 12, 1939

Fig. 3.

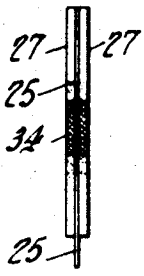


Fig. 2.

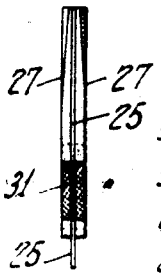


Fig. 1.

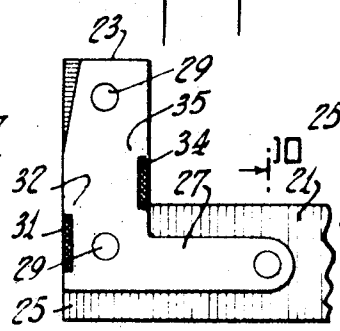


Fig. 10.

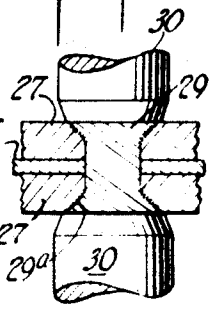


Fig. 11.

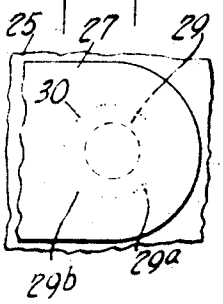


Fig. 9.

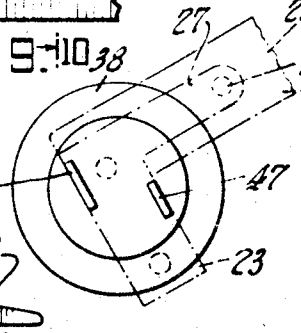


Fig. 4.

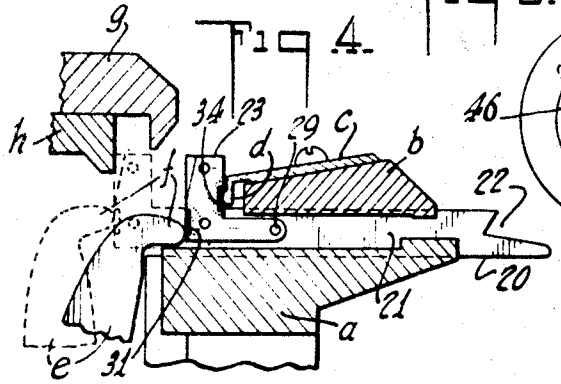


Fig. 6.

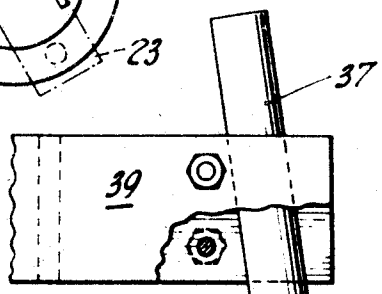


Fig. 5.

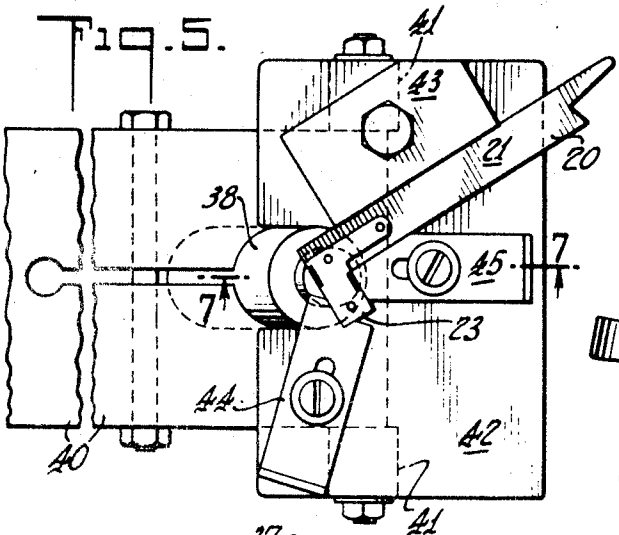


Fig. 8.

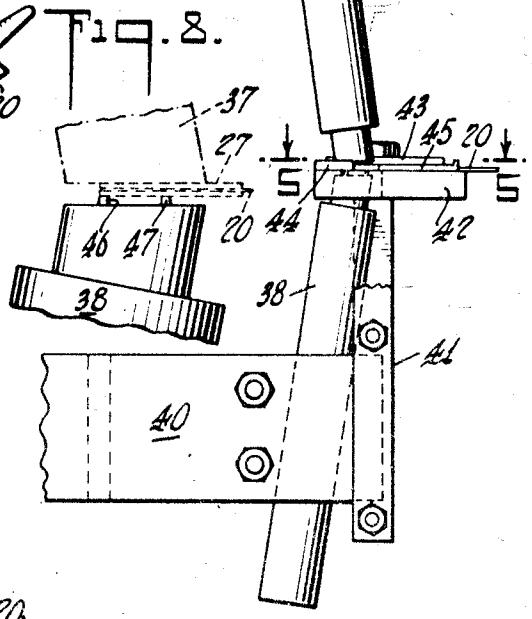
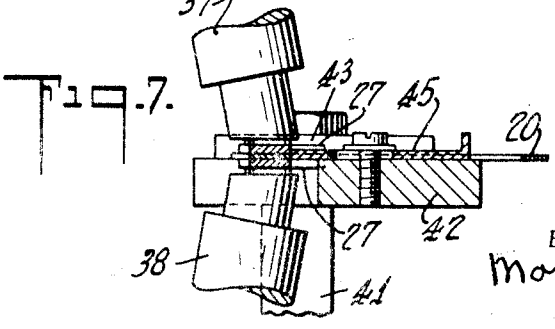


Fig. 7.



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KNITTING MACHINE SINKER

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Application December 12, 1939, Serial No. 308,754

6 Claims. (Cl. 66—110)

This invention relates to knitting machine sinkers, and involves a novel construction of sinker such, for example, as the type used in the knitting of hosiery, as one of the needle-cooperating elements in a straight knitting machine. A conventional type of sinker is shown in the prior patents of Hofmann, No. 1,817,822 of August 4, 1931, and Feustel No. 1,861,413 of May 31, 1932. For purposes of illustration, the present invention is shown embodied in sinkers of the type disclosed in said prior patents, but is not intended to be limited thereto, as the principles may be applied to other types of sinker with which similar conditions exist.

The conventional sinkers as prevailingly used are subject to certain serious drawbacks including liability to wear at certain points excessively and irregularly, as will be further described, thus impairing the accuracy of the sinker, decreasing its useful life, causing irregularities in the cooperation of the sinker with the cooperating jacks and other elements, and wear of those elements. The main object of the present invention is to afford a construction of sinker which will possess a longer working life than prevailing sinkers because suffering less impairment from wear in its cooperation with other mechanical elements of the machine. Another object therefore is to prolong the reliable cooperation of the sinkers with the adjacent mechanical elements.

A further object is to fortify the sinker against such mechanical wear at certain particular points, or wear spots, as will be described, by a hardening at such points and in a manner to avoid sacrificing the strength of the sinker. Incidental but important objects are the saving of sinker cost in the operation of a knitting machine and reduction of labor cost in frequent replacements of sinkers; at the same time improving the quality of the stocking or other hosiery product.

Other and further objects and advantages will be explained in the hereinafter following description of an illustrative embodiment of the invention, or will be understood by those conversant with the subject. To the attainment of such objects and advantages the present invention consists in the novel knitting machine sinker and the novel method of producing the same, herein illustrated or described.

In the accompanying drawing Fig. 1 is a face view of part of the blade and the entire butt end of a sinker embodying the present invention.

Fig. 2 is a left hand edge view, and Fig. 3 a right hand edge view of the sinker shown in Fig. 1.

Fig. 4, on a smaller scale, is an elevation view, partly in section, showing a complete sinker in its conventional environment, adjacent to certain cooperating elements.

Fig. 5 is a top view of a special apparatus for treating a sinker to harden it at certain wear points, the upper electrode of Fig. 6 being omitted, as on the line 5—5 of Fig. 6.

Fig. 6 is a side elevation view of the treating apparatus of Fig. 5.

Fig. 7, on an enlarged scale, is a side elevation of the central portion of the apparatus, taken partly in section on the line 7—7 of Fig. 5.

Fig. 8 is a still greater enlargement of the same, limited to a showing only of the electrodes and the sinker under treatment.

Fig. 9 is a top end view of the lower electrode, upon which the position of the sinker is indicated in dotted lines.

Fig. 10 is an enlarged section view of the sinker hereof, taken through one of its rivets, for example on the line 10—10 of Fig. 1.

Fig. 11 is a top view of so much of the sinker as is shown in Fig. 10.

Describing first the conventional sinker 20, as shown generally in Fig. 4 and others, this comprises the shank portion 21 having the yarn throat or notch 22 at its front end, and at its rear end the butt or upstanding lug 23.

The sinker is a built-up structure comprising a blade or thin core plate 25, the rear portion of which, including the butt, is sandwiched between a pair of opposite cleats or thickening cheek plates 27. These three components are permanently secured into a unitary whole as by means of a series of rivets 29, three being shown, extending through the two cleats and the blade.

Before describing further the characteristics of the sinker components the environment or adjacent machine elements will be referred to. The entire bank or indepndent series of sinkers, alternated with dividers, is mounted in a sinker head which comprises a bottom or body *a* and a cover or cap *b*, between which the sinkers stand edgewise as they are shifted frontwardly and rearwardly during knitting and other operations; the two parts of the sinker head being grooved to accommodate slidingly the sinkers and dividers. When the sinkers are thrust frontwardly their extreme position is usually determined by a stopping means, the conventional verge plate *c* being shown for this purpose, this being mounted adjustably upon the head cap *b*

and having a contacting edge *d* against which the front edge of all the sinker butts may impact by their frontward movements.

The sinker frontward movements as usual are effected by a bank of independent actuators or jacks, the conventional jacks *e* being shown, usually spring-controlled, and operated in serial order or succession by a traveling slurcock, not shown. Each jack as it is operatively swung frontwardly first impacts by its nose *f* against the rear edge of its sinker butt, in the manner indicated in Fig. 4, the continued swing of the jack thrusting frontward the sinker while the contacting tip or nose of the jack slides relatively downward along the sinker butt edge. To cause the return rearwardly of all of the sinkers in unison there is shown the conventional catchbar *g* which may descend to engage the sinker butts and retract the sinkers rearwardly to the position shown in Fig. 4, in dotted lines, a catchbar lug *h* limiting the rearward shift of sinkers and dividers.

In order to explain the existing drawbacks encountered in the practical use of conventional sinkers and the operations in which they take part, the resulting disadvantages in hosiery manufacture and the impairment of quality of the product, the characteristics of prevailing sinkers will first be set forth. The thickness dimensions are extremely small, but are critical, as will be understood by the fact that the prevailing tolerance is .0005 inch, any substantial variation therefrom impairing the operations and the quality of the product. The sinker blade or body is much thinner than its cleats, typical dimensions being .005 inch for the blade and .025 inch for each cleat. The thin blade may be of high carbon hardened spring steel of about Rockwell C–50. The thicker cleats on the contrary, while of high carbon rolled steel and fairly hard, are kept relatively soft, for example about Rockwell B–101, so that they possess the essential property of toughness and strength. The conventional jack is somewhat thinner than the entire sinker, perhaps two-thirds as thick, or about .04 inch. These dimensions are merely examples. The jack is composed usually of a single piece of hard steel much harder than the material of the sinker cleats and with a hardness of approximately C–30.

These being the existing conditions, the present improvement may be first outlined, leaving its operation and advantages for subsequent explanation. The problem is one presented by a sinker structure in which a thin blade of a high order of hardness is confined, especially at the area of the butt, between the two enclosing cleats, of a lower order of hardness. The differential in hardness between the conventional soft cleats and harder jacks is the cause of the basic difficulties from which several drawbacks have resulted.

By the present invention the relatively low hardness of the cleats is converted, at the areas or spots of edge contact and wear of metal upon metal, to a much higher degree of hardness, so that at these wear spots, where impact and abrasion may occur, the cleats and jacks are rendered approximately alike in order of hardness, thus approximately equalizing to the hardness of the jack all parts of the thickness of the sinker butt at the edges where metallic rubbing and impact occur. The cleats may be considered as spot-hardened, their major areas remaining unhardened and strong.

Thus in the most troublesome case of the rear edge of the sinker butt, where innumerable contacts with the jack occur, marked out on the drawing by the checkered area **31**, the blade-enclosing cleats at this wear spot are hardened to a degree to approach the hardness of the sinker blade and equalizing it to that of the jack, so that the contacting face of the rear edge of the sinker at this point presents a hardened surface substantially across the whole width of the sinker butt. Such hardening is by a brief heat treatment, which may be referred to as spot-heating, performed preferably electrically in a manner similar to spot-welding, as will be described, including quenching. The treatment should be restricted to a minor local area, that which is indicated being adequate, and the hardening extends through the sinker, on both cleats, which thus become locally hardened. This equalizing treatment, materially changing the relation of the components and the structure of the sinker, is performed without sacrificing the previous toughness and strength of the remaining areas of the two cleats, necessary to provide a sinker which will possess durable strength and resistance to cracking or breakage. Locally surrounding the hardened wear spot **31** is shown a small discolored area **32**, of no utility, but representing a change or staining of the surrounding metal of each cleat due to the intensity of the instantaneous treating temperature.

The wear between the conventional sinker and the jack is considerable since repeatedly, at every course of knitting, the edge of the jack impacts upon the rear edge of the sinker butt and then rubs or scrapes downwardly, and then upwardly thereon, under pressure. The softer cleats of the sinker are first worn, producing a double bevel contour of the sinker edge, with the blade centrally protruding. If the jack be off-center, as is frequent, then one cleat will wear faster than the other, especially since the jack tends to follow, rightward or leftward, the path of least resistance. The uniformity of the wear surface of the sinker is soon destroyed, causing inaccuracies in sinker operation. The drawback operates also upon the jack, since the protruding blade of the sinker by repeatedly contacting against the striking surface of the jack, tends to cut a groove in the jack striking edge, or if the jack be off-center then a bevel at one corner. The jack thus is caused to wear non-uniformly. When these irregularities of jack and sinker wear once commence they tend to continue with increasing rapidity toward deterioration of the sinker, requiring renewals with undesirable frequency.

These objections are very largely overcome by the present invention wherein the jack-striking or rubbing area of the sinker butt edge is spot-hardened so that the cleats are of substantially the hardness of the jack. By this improvement uniform wear conditions are secured, across the thickness of the butt. The even hardness of the butt edge tends to prevent the start of irregular wear upon the sinker. Protrusion of the blade is eliminated and this in turn preserves the jack against irregular wear. The spot-hardening of this invention substantially equalizes the hardness of the wear surface throughout the thickness of the sinker. This in turn insures even distribution of working contact between the sinker and jack. Not only is the wear rendered even, thus protecting the edge of the jack, but there is actually less wear on both of these elements;

and this is true even if the jack should be slightly off-center. The sinker therefore in its operation remains more accurate and has a longer life period.

The improved sinker may be described as characterized in that at a mechanical wear spot of the butt edge the cleats are hardened, only locally, to a hardness like that of the jack, rendering substantially uniform the hardness and wear across the thickness of the sinker edge; this more especially pertaining to the wear between sinker and jack.

The wear between the contact edge *d* of the verge plate and the front edge of the sinker butt is sometimes a material factor in life and accuracy of sinker operation, since the sinker repeatedly impacts the plate. As the verge plate lies at right angles to the sinker planes there is usually but little wear except what is uniform and can be taken up by adjustment. But when there has been excess or irregular wear between any sinker and its jack then the wear between the verge plate and sinkers becomes non-uniform, to the detriment of accuracy.

The present invention meets this condition by providing a second spot-hardened area **34**, namely, at the butt front edge where the verge plate contact occurs. This improvement saves the sinkers at the expense of the verge plate and is therefore a source of considerable saving in cost, since the verge plate in each section of the machine is easily replaceable and at a relatively negligible cost, upon becoming worn.

The hardening of the cleats at **34** is in one sense supplemental to their hardening at **31**, perfecting further the exact performance and durability of the sinker, and substantially reducing the cost of maintenance of each section of a knitting machine. The two spot hardenings are related in that both may be effected in a single treatment. The advantages already described in relation to minimizing sinker-jack wear apply largely also to the minimizing of sinker-verge-plate wear.

Figs. 5 to 9 show a typical apparatus adapted to carry out the preferred method for effecting the spot-hardening at the local areas **31** and **34** of the sinker. Upper and lower electrodes **37** and **38** are shown mounted on frame bracket members **39** and **40** respectively, the electrodes being adjustably clamped in the brackets, and the brackets, or one of them, being shiftable to bring about mutual contact of the electrodes with the upper and lower sides of the sinker to be treated. The circuits and current source for furnishing the necessary heating current are not shown, but will be well understood, and may be of similar character to those used for spot-welding.

By means of a pair of posts or legs **41** on one of the brackets **40** a table or fixture **42** is mounted in a convenient position to hold the work between the electrodes. The sinker is shown placed in its proper position on the table, where it may be gaged by a gage **43** for one side of the sinker shank and a gage **44** for one corner of the sinker butt and a gage **45** for the inside corner between the shank and butt; all of these gages being readily adjustable to position the sinker according to the work to be performed, with conventional means or set screws for holding them in their set positions.

Instead of merely clamping the work between the reduced extremities of the electrodes **37** and **38**, these are arranged to apply the current locally to the wear spots **31** and **34**. For this purpose at least one of the electrodes, is provided with a raised contact or teat **46** in a position corresponding with the spot **31** and a second such teat **47** corresponding with the spot **34**. In Fig. 8 such teats are shown on the lower electrode only; on Figs. 6 and 7 they are indicated on both the lower and upper electrodes. When the sinker is properly gauged and set in place the two spots to be hardened come directly above the contact teats **46** and **47** of the lower electrode, as best shown in Fig. 9. The operation is merely that, when the work is positioned and the electrodes are brought into contact with it, the current is then applied for a brief instant, this giving a flash heating, of such short duration as not to fuse the metal of the sinker cleats but so to raise their temperature that when the current is discontinued, and quenching occurs, the spots **31** and **34** of each of the cleats become hardened to the degree already explained.

As a further cooperative improvement, indicated particularly in Figs. 10 and 11, it is desirable to perfect the sinker by eliminating rivet loosening troubles. Occasionally the continual pounding of the sinker between the jack and the verge plate tends to create looseness of the three or more rivets connecting the components of the sinker, and when this occurs it may develop rapidly into a condition where parting of the components is apt to occur, with impairment of operation or even damage to the knitting machine. This is herein taken care of by rendering the sinker unitary, against possible loosening, by welding the rivets in place. This may be done by a spot-welding action, preferably before the spot-hardening of the sinker cleats. Thus Fig. 10 indicates a rivet **29** which has been spread or clinched and which has been thereafter welded or fused integrally to the cleats. The process is indicated merely by the showing of spot-welding electrodes or contacts **30** above and below, held against the ends of the rivet. When the welding current is applied, for sufficient duration, the outer ends of the rivet become fused and welded to the outer portion of the respective cleats. This fusing and uniting operation need not proceed to full depth, and the welding lines of union **29a** between the rivet and each cleat are shown extended to approximately but one-half of the thickness of the cleat. As shown on the face view, Fig. 11, this heating operation may cause a discoloration **29b** extending somewhat outwardly from the area of welding.

Having described a practical embodiment of the invention hereof, without intending to limit it to details other than recited in the claims, what is claimed and desired to be secured by Letters Patent is:

1. A knitting sinker with butt and comprising as metallic components the relatively hard and thin central blade the butt portion of which is confined and stiffened between the opposite pair of relatively soft and thick enclosing cleats of high strength; the said sinker characterized in that at a mechanical wearing spot at an edge of the butt portion the two cleats are spot-hardened to have a local hardness substantially greater than that of the unhardened strong general portion of the cleats and substantially approaching the hardness of the blade; whereby the wear upon the sinker by a cooperating metal part, by impact or rubbing contact upon the edge of the sinker butt, is not only materially reduced but is rendered substantially uniform across the thickness of such edge.

2. A knitting sinker with butt and comprising as united metallic components a relatively hard and thin central blade and an opposite pair of relatively soft and thick butt-enclosing cleats of high strength; the said sinker characterized in that at a mechanical wearing spot at an edge of the sinker butt portion the confining cleats are heat-hardened to have a local hardness much greater than that of the unhardened strong general portion of the cleats and of like order to the hardness of the blade; whereby the wear between the sinker and a cooperating metal part which contacts upon the edge of the sinker butt is rendered substantially uniform across the thickness of such edge.

3. A sinker as in claim 2 and wherein the differential hardening of the cleats is at the front edge of the sinker butt at a spot corresponding with its repeated contacts with a fixed stop or verge plate.

4. A knitting sinker having at its butt a pair of cleats confining the thin blade, and wherein at the edge area of wear between sinker butt and jack the sinker side cleats, elsewhere strong and tough, are spot-hardened substantially to the same order of hardness as that of the central blade of the sinker, thereby to reduce substantially and render more uniform the wear across the thickness of the sinker edge caused by impact or friction of the jack.

5. A sinker as in claim 4 and wherein the sinker cleat spot hardening is a heat hardening effected after assembling of sinker blade and cleats.

6. In a knitting machine, in combination, a knitting sinker and a jack, the sinker having a rear butt and comprising as components a thin central blade the butt portion of which is sandwiched between an opposite pair of relatively thicker and softer confining cleats of high strength; the jack having a hardness substantially greater than that of the general portion of the sinker cleats; and the sinker at the jack wearing spot of its butt having its two cleats locally hardened to a hardness relatively much greater than that of the unhardened general portion of the cleats, and of the same order as that of the jack; whereby the wear between the sinker butt and the jack, by impact or rubbing contact, is rendered substantially uniform across the thickness of the sinker edge.

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