Oct. 21, 1941. J. MORTON 2,259,655

NEEDLE AND SUCHLIKE OF KNITTING MACHINERY

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Fig. 1.

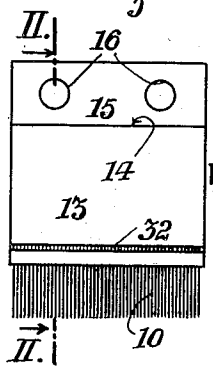


Fig. 3.

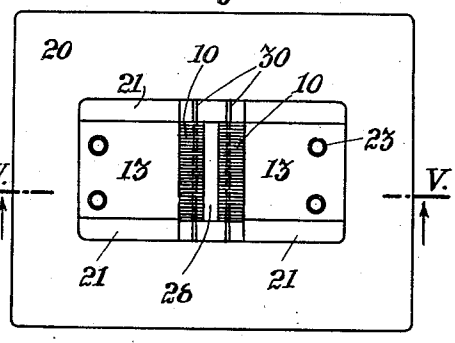


Fig. 2.

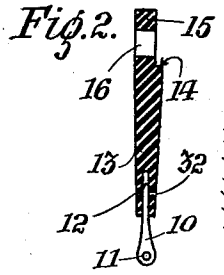


Fig. 4.

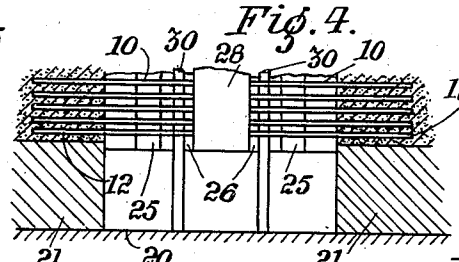


Fig. 5.

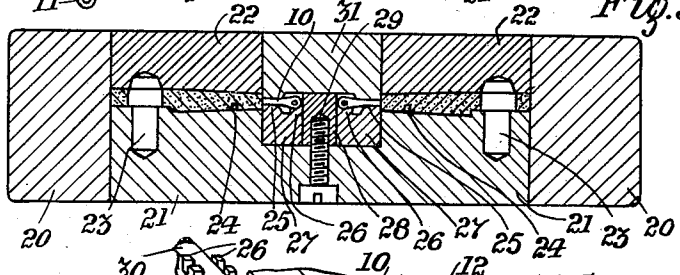


Fig. 6.

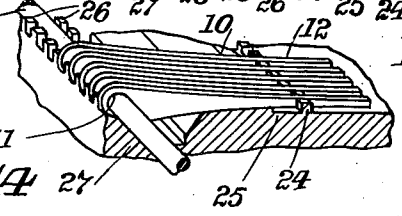


Fig. 13

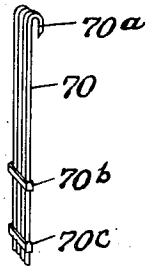
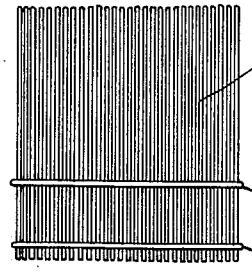


Fig. 14



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Fig. 8.

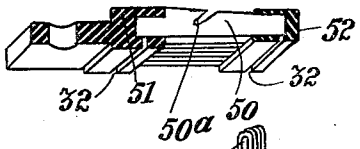


Fig. 7.

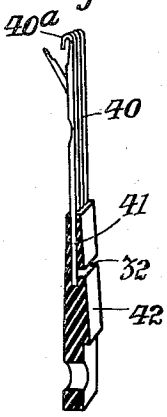


Fig. 9.

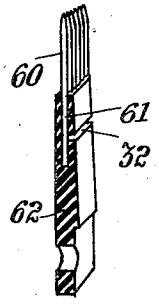
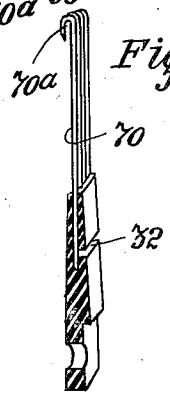


Fig. 10.



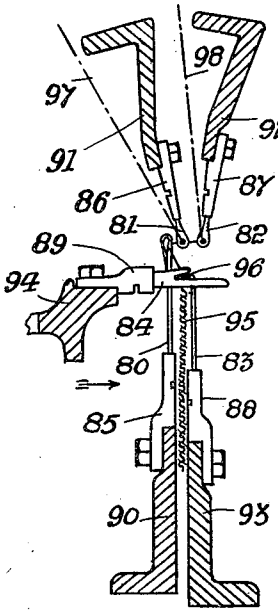
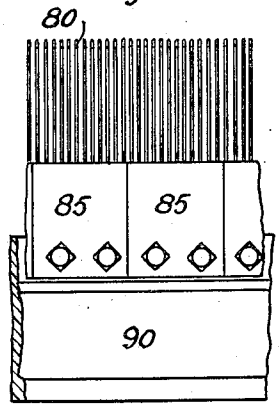


Fig. 11.

Fig. 12.



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UNITED STATES PATENT OFFICE

2,259,655

NEEDLE AND SUCHLIKE OF KNITTING MACHINERY

James Morton, Carlisle, England

Application June 11, 1938, Serial No. 213,266
In Great Britain January 19, 1935

3 Claims. (Cl. 66—86)

This application is a continuation-in-part of my prior application, Serial No. 58,176, filed January 8, 1936.

This invention relates to the manufacture of knitting-machine needle or the like assemblies (or so-called "sections") each consisting of a group of needles or the like secured in a support, such an assembly constituting a single unit. By the term "needles or the like" is meant knitting needles, hooked or otherwise, thread-guides (sometimes called "pillar-fingers"), sinkers, and like thread engaging parts of knitting machines—particularly those known as "warp knitting machines" these working parts co-operating to perform the knitting operation and constituting the usual thread engaging parts of the machine.

Such needle or the like assemblies are usually arranged side-by-side along some form of carrying bar (such as a guide bar, needle-bar or a sinker-bar) to which the supports are attached, the needles or the like extending in a closely spaced series. The said supports are usually moulded of lead or a lead alloy, in which the needles or the like are embedded while the metal is molten but zinc alloys have also been proposed having a specific gravity as low as 4.6. The supports are removably attached to the carrying bars to facilitate replacement of any assembly having a broken needle or the like. It has heretofore been considered essential to employ metal, or a metallic alloy, for supporting the needles or the like on account of the necessity for securing them rigidly in precise co-relationship and maintaining such co-relationship throughout their life.

A disadvantage associated with the use of metallic supports is that their weight is a factor requiring to be taken into serious consideration when designing the machines and materially limits the speed of operation and consequently the output of the machines. Experiments made with knitting machinery, particularly with warp knitting machinery, embodying various improvements directed towards the attainment of speeds of operation and outputs materially higher than heretofore, have indicated that owing to the considerable weight of the rapidly moving masses, stresses of such magnitude are set up in the machine as to neutralise the benefit of the improvements and prevent the realization of the high speeds and outputs for which the machinery was designed.

In warp knitting machines having oscillatory needles, guides or other thread engaging parts these and their supports are, under ordinary working conditions, subjected to stresses arising, firstly, from the action of the thread on these parts, and secondly, from the accelerations to which the masses of the parts and their supports are subjected. In the case of thread guides, additional lateral stresses are experienced from the rapid shogging of these elements from side to side. The forces causing the stresses are transmitted to the supports and the actuating mechanisms.

The supports being rigidly secured to the carrying bars at their rear ends, project outwardly from these bars and, during the operation of the machine, the action of the threads and of the forces of acceleration of the masses of the elements and of their supports, subject these supports to rapidly alternating bending stresses. Consequently, the material selected for these supports must be of a nature that will not only contribute as little as possible towards these stresses, by virtue of its mass, but must be also capable of withstanding them without danger of fracture or distortion. With the lead alloys usually employed for these supports it has been found impracticable to design an assembly using this material capable of running at the speeds desired. This is due to the high specific gravity of the material, its relatively low fatigue limit and its relatively low modulus of elasticity.

In order to overcome the difficulties hereinbefore experienced I use, in accordance with this invention, supports made of a composition incorporating a light-weight organic plastic in which composition the shanks of the needles or the like are set or embedded by a moulding operation under heat and pressure. The needles or the like are accurately positioned in correct order and co-relationship in the supports and are positively held therein, the supports being strong and hard and being capable of retaining their strength and hardness under normal working conditions so that they can be used effectively in machines designed to run at high speeds.

It might be objected that supports made of light-weight material embodying an organic plastic would be liable to fracture or distortion under the action of rapidly alternating stresses such as set up in a knitting machine; but it has now been determined, by careful experimental tests, that for organic plastic compositions, such as the phenolic resin compositions, the important ratio between the fatigue limit and specific gravity is not only high enough for knitting machines, but it is very much in excess of the same ratio applicable to the usual lead alloy supports. This is a most surprising and unexpected result and

consequently it is obvious supports made of compositions incorporating an organic plastic can be used with the greatest confidence in knitting machines designed to run at very high speeds.

The means provided for locating and maintaining the needles or the like in correct order and co-relationship preparatory to and during the moulding operation, consist of accurately spaced serrations or rack members or a light frame in, or adapted to fit in, the mould, in which serrations, members, or frame, the needles or the like are arranged, the plastic composition being supplied as a moulding powder to the mould interior so as closely to surround the shanks of the needles or the like and, when the material is set, under heat and pressure, to hold them permanently and securely in position. The said serrations or serrated members may be provided not only internally but also externally of the mould.

Supports made in accordance with this invention of a composition consisting of about 50% wood flour filler, about 50% of resin (phenol-formaldehyde) as a binder together with such an amount of lubricant (stearic acid) as made the composition free flowing when in the mould, have been tested in high speed knitting machines and have given very good results. The composition, which is supplied to the mould in the form of a fine powder, flows closely round and between the shanks of the closely placed needles or the like and, when set under heat and pressure, fixes them all firmly in position. There may be a small amount of accelerator included in the composition. The composition is subjected in the mould to a pressure of about 3000 lbs. to the square inch and a temperature, inside the mould, of from 300 to 350° F.

It is important the composition should be free flowing as it has been found, if the moulding powder is not free flowing, that the needles or the like are not properly held and are apt subsequently to work loose in the support.

The moulding is performed in known manner and the operation is carried on for about five minutes from the time the ram of the moulding machine comes down.

Supports made of a phenolic resinoid composition as aforesaid, are found, when thoroughly tested, to have an extraordinarily high fatigue limit which it is essential they should have so as to withstand the bending stresses set up during the running of the machine. Samples of the supports when tested in a Woehler type fatigue testing machine gave the remarkable endurance under bending stresses for 2.0 million cycles at ± 1.65 kg./mm.^{2} without breaking. This endurance is more than twice as high as for good lead-base alloys.

In the preferred method of manufacturing a needle or like assembly, and when a phenolic resinoid composition is used for the support, the needles or the like are first arranged in at least one group in a mould provided with serrations and are accurately held in place thereby, then the moulding powder, in fine condition, is charged into the mould and closely pressed round the shanks of the needles or the like, then the mould is closed and placed in a steam or electrically heated press and, finally, subjected to the required heat and pressure as to convert the powder into a hard solid body constituting the support which, when removed from the mould, has the group of needles or the like securely embedded therein ready to be utilized as a section in a knitting machine.

By this method of manufacture, the needles or the like are positively held in correct position and relationship by the serrations of the mould while the composition attaches itself to and supports them so that when the moulding operation is finished the needles or the like are held very securely in place and project regularly and evenly from the support.

Each support may be moulded with two holes permitting it to be removably attached by screws, or otherwise, to its carrying bar or the like.

It is to be understood that the expression "a light-weight organic plastic" composition as used herein is intended to cover such mouldable synthetic resinous compositions as are thermo-plastic and thermo-setting but it is not confined thereto as other well known organic plastic compositions which are thermo-plastic and of a specific gravity appreciably less than the aforesaid metallic alloys and which, when moulded under heat and pressure, will be strong and set hard and will retain their strength and hardness under normal working conditions, can be used.

Of course as required for strength and lightness suitable light-weight fillers would be chosen for the moulding compositions, a variety of such fillers being obtainable. It has been found that wood flour or flaked fabric gives good results.

The invention will now be described simply by way of example and with reference to the accompanying drawings, as applied to needles and like working parts of warp knitting machines. On the drawings—

Fig. 1 is an elevation of an assembly comprising a group of thread-guides and their support.

Fig. 2 is a section on the line II—II of Fig. 1.

Fig. 3 is a plan of a mould with parts thereof removed to expose thread-guides embedded in the support, and Fig. 4 is a corresponding sectional fragmentary plan drawn to an enlarged scale.

Fig. 5 is a section on the line V—V of Fig. 3, Fig. 5 being drawn to a larger scale than Fig. 3.

Fig. 6 is a diagrammatic perspective view, drawn to an enlarged scale, showing how the thread-guides are located in the mould.

Figs. 7, 8, 9 and 10 are sectional perspective views of assemblies comprising groups of latch knitting-needles, sinkers, plush-needles (i. e. pile-forming needles) and bearded knitting-needles, respectively, and their supports.

Fig. 11 is a diagrammatic sectional elevation showing co-operating warp-knitting-machine parts respectively mounted in groups in supports, and Fig. 12 is a fragmentary view in the direction of the arrow of Fig. 11.

Fig. 13 is a perspective view showing knitting needles held together by cross metallic members.

Fig. 14 is a front view of the same.

Referring to Figs. 1 and 2, the assembly therein shown consists of a group of thread-guides 10 each formed with a thread-guiding eye or hole 11 and each including a stem 12, the guides being arranged side-by-side and being precisely equi-spaced. The support consists of a thin block 13 of resinoid from one side of which the guides 10 all project to the same extent. The support 13 is formed with a shoulder 14 and flange 15 having screw holes 16 and is thereby adapted for removable attachment in the usual manner to a guide-bar (not shown in this

view) to which a number of side-by-side guide-holding supports similar to the support 13 would be likewise attached.

In Figs. 3 to 6 a suitable form of mould has been shown which is adapted to mould at one operation resinoid supports for two separate groups of thread-guides 10. The mould structure includes an outer shell 20, into which the mould proper fits. The chief elements constituting the mould proper are a lower die 21 and duplicate upper dies 22, these elements being separable. Core pins 23 driven tightly into holes in the lower die 21 and registrable with holes in the upper dies 22 serve to form the screw-holes 16.

The thread-guides 10 are spaced apart by series of internal serrations 24 provided at both sides of the die 21. The thread-guides are additionally supported by a plain external rest-face 25 and an external serrated rest 26 on each of two members 27 inserted into the die 21. The members 27 are spaced apart by a distance-piece 28 held by a screw 29 to the die 21. A pin 30 fitted neatly through the thread-guiding eyes 11 of each group of thread guides and adapted to seat itself on the external serrations 26 serves to maintain the heads of said guides in precise alignment. The members 27 and distance-pieces 28 co-operate with an upper clamp 31 which holds the heads of the guides securely in place.

The serrations are accurately made so as to ensure that the needles or the like shall be held in correct relationship during the moulding operation.

In the use of the mould, the lower die 21 with the members 27 and distance-piece 28 thereon is fitted into the shell 20. The thread-guides 10 are arranged in two groups, with the pins 30 threaded through the eyes 11 of the guides of the respective groups, the guides being accurately disposed between and laterally supported by the serrations 24 and 26 and also supported by the faces 25. The resinoid composition in the form of a moulding powder is carefully packed upon both sides of the die, the thread-guides 10 thus becoming embedded in the powder. The dies 22 and the clamp 31 are placed in position. The completely assembled mould is put into a known form of moulding press, and pressure and heat are applied so as to convert the composition into the required hardness. After the composition has been subjected to the required "cooking," the mould is removed from the moulding press and dismantled and the pins 23 are withdrawn from the thread-guides, whereupon the newly formed supports 13, with the stems 12 of the thread-guides securely and permanently embedded therein, are removed.

The provision of the serration 24 results in the formation of an open slot 32 in each support 13, said slot exposing a short portion of each stem 12. The effect however of this slot is negligible as regards the security and rigidity with which the thread-guides are held in place.

If desired, serrations similar to the serrations 24 might also be provided in the faces 25.

If desired, a series of double moulds, each similar to the mould proper above described, may be provided so that several assemblies may be produced at one moulding operation.

If desired, instead of forming serrations integral with the elements of the mould as in the construction illustrated, light metallic or other frame members in which the thread-guides are located may be inserted into the mould and embedded along with the thread-guides in the composition.

In Figs. 13 and 14 two cross members 70^b and 70^c are shown. These may be of suitable metal and are adapted to hold the shanks of the needles 70 (or other knitting elements) in spaced position when inserted in the mould so that when the support is being moulded, the elements will be in correct position and alignment in the support. These cross members also serve as a metallic reinforcement to the finished support while holding the needle shanks securely therein.

If desired, reinforcing material may be incorporated in the support. For example, such reinforcing material may comprise a strip of fabric or a thin metallic or other member—if desired, serrated—arranged across the shanks and in engagement therewith.

With reference to Figs. 7, 8 and 9, the working parts therein shown may be incorporated in the same warp-knitting machine to work in combination with the thread-guides.

Fig. 7 shows members of a group of latch knitting-needles 40 whose shanks 41 are securely embedded in a composite support 42 removably attachable to a needle-bar (not shown in this view) to which other similar supports would also be attached side-by-side.

Fig. 8 shows members of a group of sinkers 50 which in the construction shown are embedded at opposite ends in a main support 51 and an auxiliary support 52. This auxiliary support may, if desired, be dispensed with. These sinkers 50 pass between the knitting needles to control the loops formed in the threads being knitted and hold down the fabric in the usual manner. The main support 51 is removably attachable, side-by-side with other similar supports, to a sinker-bar (not shown).

Fig. 9 shows members of a group of plush-needles 60. Such needles can be provided in warp knitting machines adapted to form pile loops in the fabrics knitted by them, these pile loops extending from the knitted chains produced by the individual knitting-needles. The shanks 61 of these plush-needles are embedded in a support 62 securable to a plush-bar (not shown) corresponding to the needle-bar 43.

Referring to Fig. 10, the knitting-needles 70 therein shown are bearded needles. Such needles constitute a well known alternative to the latch needles shown in Fig. 7.

The thread engaging parts above described with reference to Figs. 7 to 10 are all assembled as groups in their supports in substantially the same manner as already described with reference to Figs. 1 to 6, the moulds employed being modified in so far as necessary to suit the dimensional and other differences between the different parts. In the case of the knitting needles 40 and 70, a positioning pin corresponding to the pin 30 can be threaded through the hooks 40^a and 70^a of each group of needles; and in the case of the sinkers 50, a positioning pin may be placed in the recesses 50^a in the sinkers of each group.

Fig. 11 shows a co-operating set of warp-knitting-machine thread engaging parts comprising a row of latch-knitting needles 80, two rows of thread-guides 81, 82, a row of plush-needles 83 and a row of sinkers 84, only one member of each of these several rows of parts being shown. Each of these rows is composed of groups of parts, and the parts forming each

group are embedded in a support. The supports of the parts 80 to 84, one of each of which supports are denoted by 85 to 89 respectively, are secured to a needle-bar 90, guide-bars 91, 92, a plush-bar 93 and a sinker-bar 94, respectively.

Fig. 12 shows knitting-needle supports 85 attached side-by-side to the needle-bar 90, the several groups of needles 80 constituting a single series. The supports 86—89 of the other parts are similarly secured to their respective bars 91—94.

The sinkers 84 in the construction illustrated are adapted to introduce, for incorporation as wefts in the fabric 95 being knitted, cross-threads supplied successively to the sinker recesses, one such cross-thread being indicated at 96. These sinkers are mounted in their supports in the manner already described with reference to Figs. 1 to 6.

The thread-guides 81 lead warp threads, one being indicated by 97, to the knitting-needles; and the thread-guides 82 lead pile warp threads, one being indicated by 98, to the knitting-needles and the plush-needles.

In the operation of the knitting-machine parts shown, the needle-bar 90 receives a vertical reciprocatory motion; the guide-bars 91, 92 receive a compound motion during which the guides lap their threads around the needle hooks; the plush-bar 93 receives a vertical reciprocatory motion during which the plush-needles, when raised, are looped with pile threads 98 by the guides 82 and, when lowered, cast off the loops; and the sinker-bar 94 receives a horizontal reciprocatory motion during which the sinkers receive and transfer to the needles a cross-thread 96.

In the construction shown in Fig. 11 two guide-bars are shown. There may however be more than two guide-bars, some warp-knitting machines having as many as six, and some even more.

The invention is suitable for application to the manufacture of needle and like assemblies including groups of needles and the like of standard form, as heretofore used in knitting machines; but, if desired, the shanks of the needles or the like may be formed with overturned end projections which would help to lock the shanks in the plastic composition.

I have particularly referred to the use of organic plastic compositions with a phenol-formaldehyde binder but I may use other compositions with, say, a cresol-formaldehyde binder or a urea-formaldehyde binder, these compositions being thermo-plastic and thermo-setting; but I may also use, in certain cases, thermo-plastic compositions containing organic derivatives of cellulose such as cellulose-acetate or benzyl cellulose; or I may use a composition containing an organic derivative of rubber, such as ebonite.

The specific gravity of the new light weight supports incorporating organic plastics such as the phenolic resins, organic derivatives of cellulose, or rubber derivatives is generally of the order of 1.3 to 2 in contrast with previously proposed supports made of metallic alloys having specific gravities from 4 to 6.

The term "thread" wherever used herein is to be understood as including knitting yarn and fibre.

I claim:

1. A support for an assembly of thread engaging parts of knitting machines made of a composition incorporating a lightweight organic plastic and also incorporating a metallic reinforcement adapted to hold the shanks of the thread engaging parts in position in the support.

2. A support for an assembly of thread engaging parts of a knitting machine made of a composition incorporating a lightweight organic plastic and moulded under heat and pressure, the support having a metallic member incorporated therein which is adapted to hold the shanks of the thread engaging parts in correct position and alignment in the support.

3. A support wherein are embedded the shanks of an assembly of thread-engaging parts adapted to work at high speed in a warp knitting machine in operation of which said support is subjected to alternating bending stresses, such support being a composite moulding which incorporates a phenol-formaldehyde resin and a light weight filler and which is both light in weight and highly resistant to fatigue under such stresses.

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