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Mühlhäusler

[11] **3,852,979**

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[54] **NEEDLE BED CONSTRUCTION FOR KNITTING MACHINES**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **66/19,** 264/263, 29/460, 156/91, 66/115

[51] **Int. Cl.** **D04b 15/100**

[58] **Field of Search** 66/115, 110; 29/460; 264/263; 156/91

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[57] **ABSTRACT**

To guide lamellae-like elements, such as needles, selector jacks and the like in knitting machines, and particularly circular knitting machines, the cylinder and dial portions are formed with grooves into which locating combs fit, the locating combs having bar-like support portions interconnected by comb-like partition bridges; separating liners, in which the lamellae are adapted to slide, are fitted between the comb-like partitions, and an adhesive casting compound is injected behind the separating liners, which are preferably formed with hook-like extensions to be anchored in the casting compound, and the locating comb, to secure the locating comb and the liners in position in the grooves of the machine structure.

16 Claims, 11 Drawing Figures

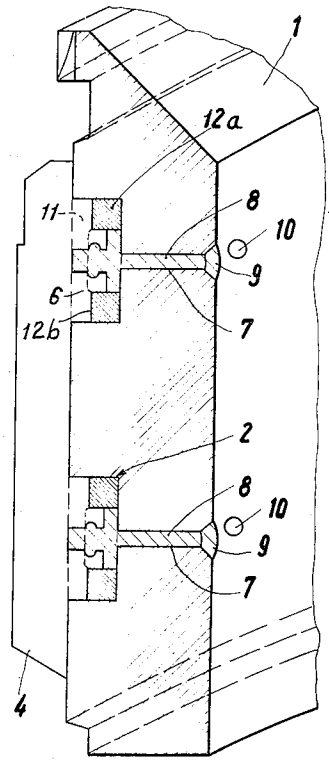


Fig. 1

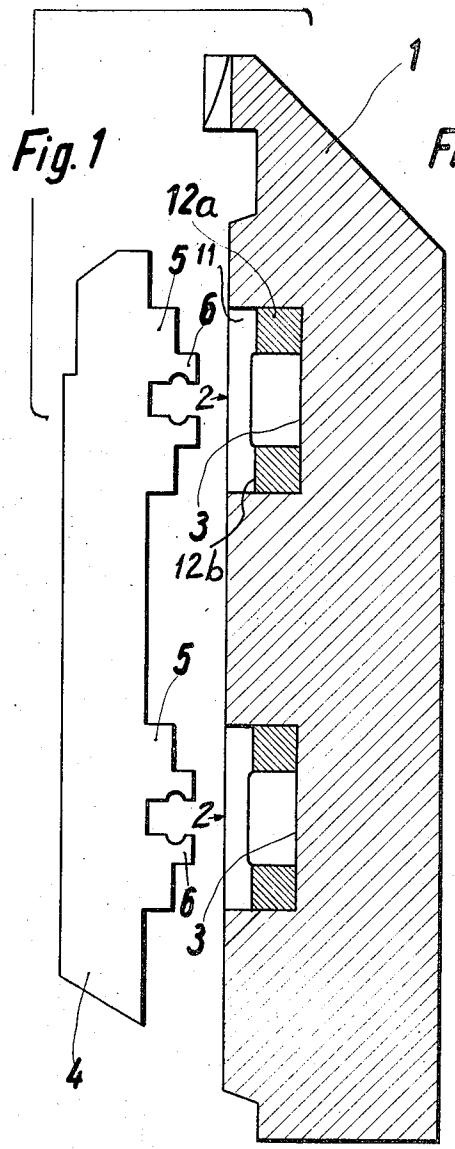


Fig. 2

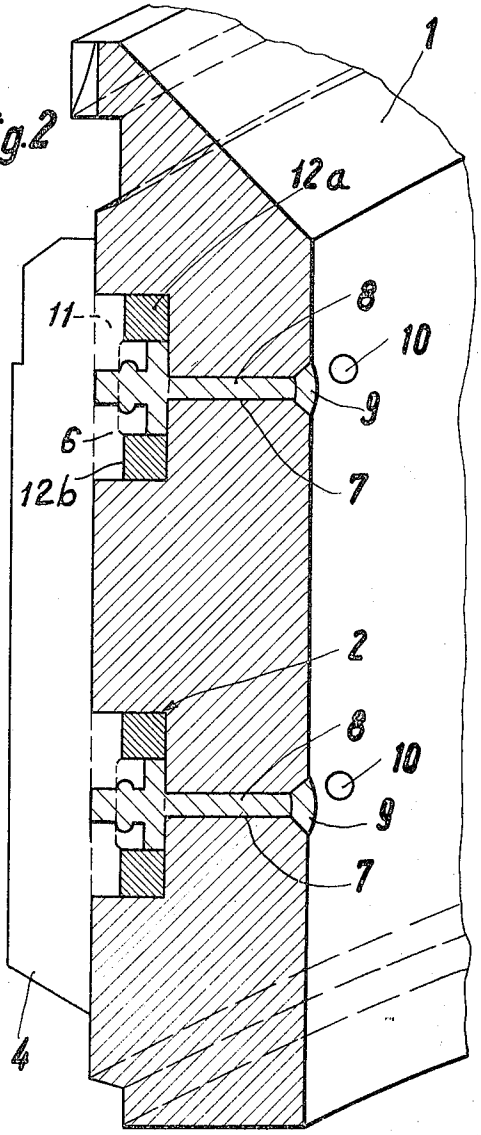


Fig. 5

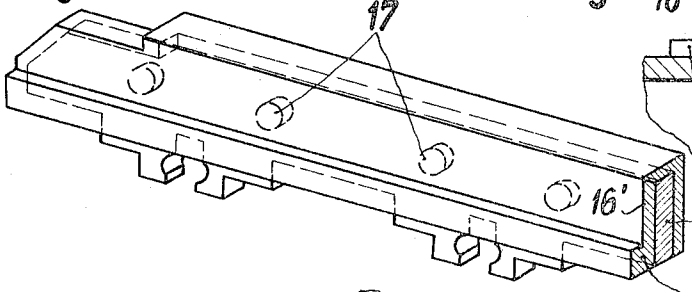


Fig. 6

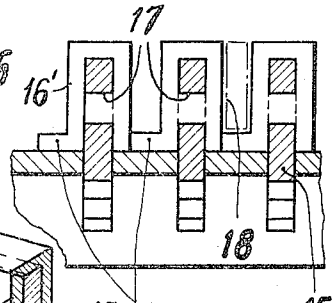


Fig. 4

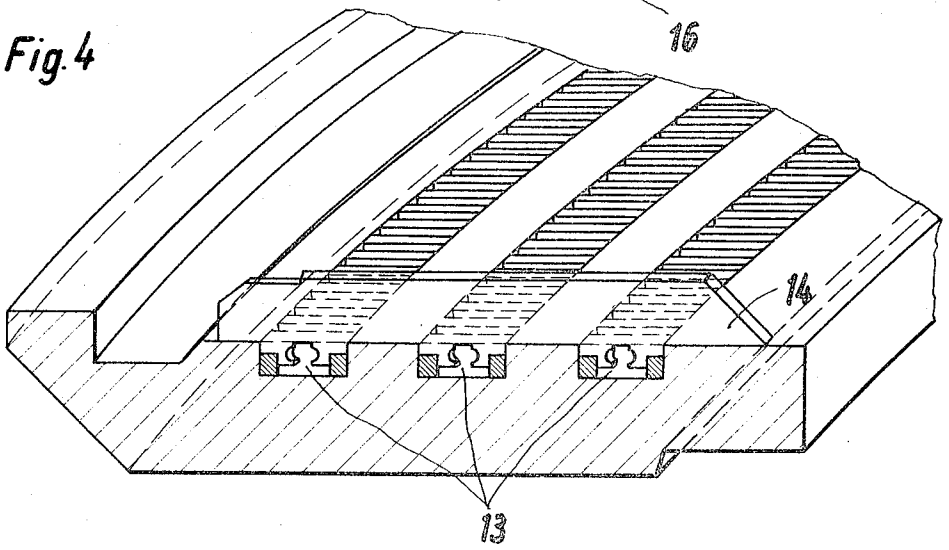


Fig. 3

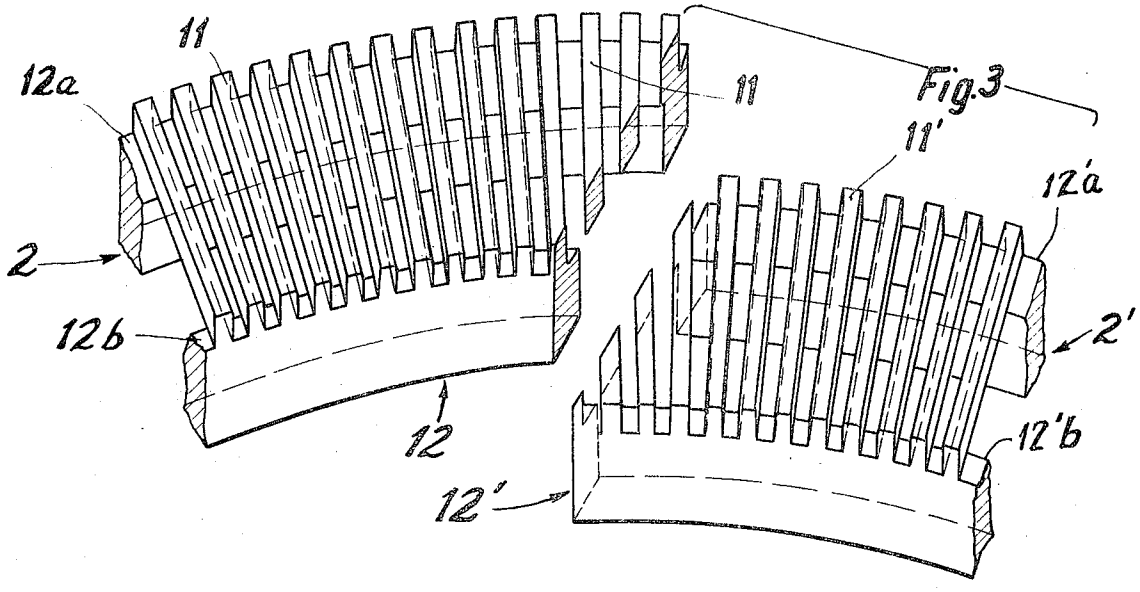


Fig.7

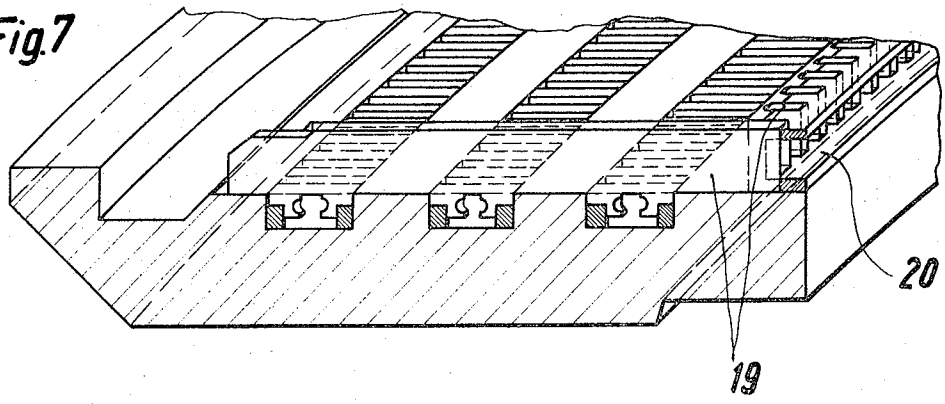


Fig.8

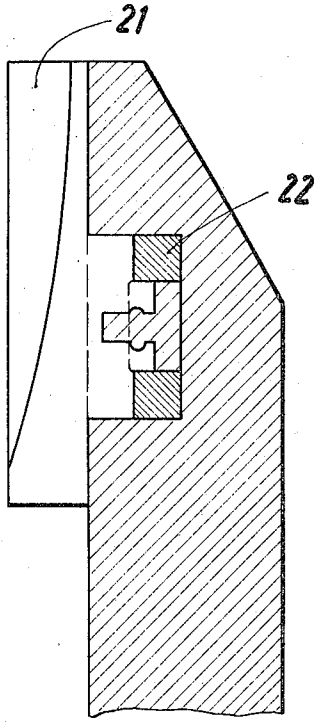


Fig.9

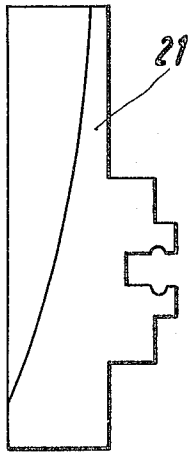


Fig. 10

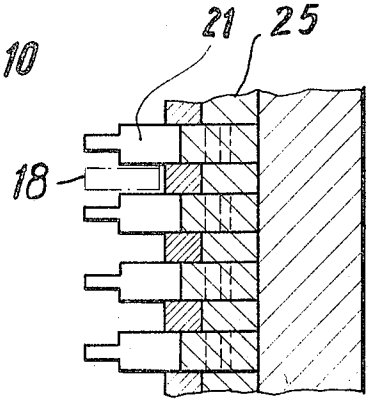
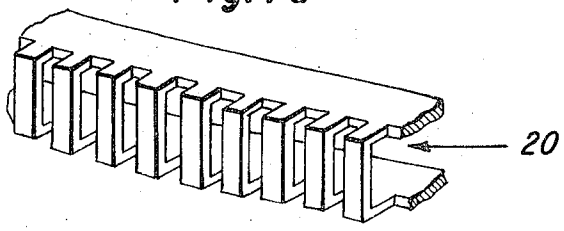


Fig. 7a



NEEDLE BED CONSTRUCTION FOR KNITTING MACHINES

The present invention relates to machines which have sliding lamellae-like elements therein, such as textile machines, and more particularly knitting machines such as circular knitting machines, in which the needles, needle jacks, selector jacks and the like slide in guide ways which maintain the lamella-like elements in position, and guide the elements in their movement in the course of the machine operation.

Textile machinery, and particularly the needles, selector jacks, operating jacks and the like are guided in guide channels, or tricks. The manufacture of the tricks is a problem and the cost of cutting the tricks into the machine parts is a major cost factor in the machines themselves. Various attempts have been made to decrease the manufacturing costs of this operation which requires great precision and accurate checking, and to lower the manufacturing time and hence the cost of these expensive machine elements. Circular knitting machines, particularly, require cylinder and dial structures, in other words the needle beds, which each may have more than 1,500 needle slots or tricks.

It has been customary to make the needle slots or tricks by first making the dial structure, or cylinder structure, respectively, and then to cut the slots therein in the form of grooves. The cutting is usually done on milling machines. The grooves are slightly wider and slightly deeper than the lamellae, for example the needles, or jacks which are to slide in the grooves. Particularly fine cuts require high precision work since the danger is particularly great that errors in the milling may arise, since the milling tool is not necessarily uniformly worn at both sides of the milling cutter, so that, as a result, the tricks or slots will not be perfectly straight and uniform throughout the machine. Cuts which do not extend exactly as designed require rejection of the respective part which is particularly disadvantageous if already a large number of grooves have been cut. The dimension of the lamellae to operate in the grooves require a certain depth of the milling cut. If the sub-division of the needles, that is, the "cut" of the machine is particularly fine, then the milling cutters themselves operate at lower speed since the operating speed of the corresponding thin cutting blades, in spite of the use of very hard metals, cannot be increased beyond a certain maximum. As a result, attempts have been made to make such machine parts in such a manner that as little as possible milling has to be undertaken. Investigations regarding the sliding of the needles in the grooves, and of the guide grooves themselves have led to the use of steel inserts or guide elements which only require milling cuts of comparatively small dimensions, since the depth of the cuts is determined solely by a consideration of strength and not by the height of the needle shaft. Thus, the steel inserts or steel guides may sit within the material of, for example, the dial or cylinder of a circular knitting machine only to the extent that they can be anchored or secured therein and that they can accept the lateral pressure arising during machine operation and needle movement.

Inserts have been proposed which have a projection which extends hook-like into a similar matching groove of the machine part in which the inserts are to be accepted and which are then secured at another point to the groove within the machine part by riveting or other metal connection, in order to fix the guide element securely therein. In spite of the greater simplicity of manufacture with respect to cutting a full needle slot or trick into a machine element, the insertion of the guide ways is still time consuming and overall manufacture of the machine part is not substantially simplified. Lining the needle slots or tricks with guide ways of various heights permits wider milling cuts. Guidance of the needle is also improved since the guide elements may be made of spring steel. Manufacturing time, however, is hardly less than in customary methods.

It has already been proposed to make needle beds in such a manner that the guide slots, or guide ways separately are cast into a plastic material. It has been found that this does not result in suitable machines since casting of large volume plastic bodies is difficult and the plastic itself changes dimensions, upon setting, or cooling with uncontrollable dimensional changes. Assembling and adhering a suitable number of guide ways on a tubular body, for example a knitting machine cylinder, can not practicably be carried out since the resulting tolerances are too great for machines of this type.

It has previously been proposed to make guide combs to place guide ways therein by introducing a plastic casting mass (see German Pat. No. 1,128,944, assigned to the assignee of the present application). While this is an improvement, the excess material above the level of the securing rings must be removed after the casting has hardened. This type of securing of guide ways can practicably, however, be carried out only in horizontal work pieces, and is thus not suitable to make, for example, the cylinder of a circular knitting machine. It has been found, however, that interconnecting guide ways by means of an adhesive casting mass over a totally surrounding enclosed duct is particularly desirable, since locating the guide ways is facilitated.

It is an object of the present invention to provide machine elements with guide ways for lamella-like devices, for example slots for the operating jacks, needles and the like of knitting machines, which can be manufactured easily, rapidly, and without requiring extensive removal of metal in large quantities, and with high precision.

SUBJECT MATTER OF THE PRESENT INVENTION

Briefly, the machine element is formed with a groove or recess, shaped to receive the base portion of a locating comb. In a preferred form, a pair of base portions are provided bridged by a comb-like partition element. Guide liners, forming separating liners, preferably formed with projections extending adjacent the base portions of the locating comb are then inserted between the comb-like partitions to form the liners and guide ways for the lamellae to run therein. After assembly, an adhesive casting compound is introduced in the space beneath the guide separating liners, in a preferred form surrounding the projections which are preferably hook-shaped to anchor the projections within the casting compound. Introduction of the casting compound, in a preferred form, is from the other side of the machine element through specially prepared casting openings or holes; air bleeding holes are also preferably provided.

The separating or guide liners can thus be secured to the machine elements in an inexpensive and simple manner, so that particularly needle beds for textile machinery can be inexpensively made. The partition combs may be made from endless bands in which an endless sheet metal ring is punched and thereafter deformed, or rolled into generally U-shape and thereafter rounded. For large machine parts, various such locating comb structures are made, joined next to each other with butt joints without any intervening gap. Such rings can be pre-fabricated in requisite diameters. They are then tested and machined for the later necessary diameter to accurate dimensions and milled to provide the comb-like partitions. The depth of milling is much less than the depth of milling of entire guide slots or tricks for needles, jacks and the like, so that the time taken for the milling operation is much less than that in usual constructions. The locating combs are then inserted in suitable grooves formed in the machine elements, for example the cylinder and dial structures. The locating combs are fitted into the grooves with adhesives, casting compounds, or by interference fit with slight stock removal during the insertion step. After insertion, it is preferred to accurately align the locating combs, so that the intervening gaps, that is the milled slots are accurately positioned. Bands which are not endless, or the junction of bands preferably are joined not at one specific junction point, but rather by a slanting cut, since the initial milling of the locating combs can then be carried out with less accuracy. Any gaps can readily be filled later.

The invention will be described by way of example with reference to the accompanying drawings, wherein:

FIG. **1** is a fragmentary longitudinal cross-sectional view through a portion of the cylinder structure of a circular knitting machine with a pair of locating combs and, in exploded position, a separating guide insert;

FIG. **2** is a sectional and perspective view of the cylinder of FIG. **1** with the separating insert assembled to the cylinder structure;

FIG. **3** is an enlarged, offset view illustrating joining of two sections, or the ends, of a locating comb;

FIG. **4** is a perspective view, with the end in section, of the dial of a circular knitting machine with three locating combs and illustrating insertion of a single needle separating and guide way;

FIG. **5** is a needle guide way, encapsulated in plastic, partly in perspective and partly in section;

FIG. **6** is a longitudinal cross-sectional view through three plastic-covered guides according to FIG. **5** and illustrating abutting lateral engagement of the guide elements;

FIG. **7** is a view of a dial structure, partly perspective and the end in section, in which the ends of the needle guides are fixed;

FIG. **7***a* is a fragmentary perspective view of a support band bearing against the terminal ends of the separating liners;

FIG. **8** is a cross-sectional view of the end portion of a circular knitting machine cylinder in which the separate comb elements are secured by means of a locating comb, and separated from each other thereby;

FIG. **9** is a highly schematic side view of a separate comb element of FIG. **8**; and

FIG. **10** is a transverse cross-sectional view of a group of comb elements and illustrating their attachment in the locating comb by means of an adhesive casting compound.

The invention will be described with specific reference to the elements of a circular knitting machine, for which it is particularly applicable; it may be used, however, with other types of machines in which lamellae are to be guided accurately in a given path. Referring to FIG. **1**, a knitting cylinder **1** has locating combs **2** inserted in ring-shaped circumferential grooves **3**, the latter forming recesses in a portion of the cylinder having a smooth surface. The locating combs **2** have a base **12**, formed as ring portions **12***a*, **12***b* and connecting bars **11** (FIG. **3**). The locating combs **2** are secured in the grooves **3** by means of adhesives. The guide and separating elements **4** for the cylinder needles, or the respective needle jacks are so shaped that they have projections **5** fitting between the ring-shaped portions **12***a*, **12***b* (FIG. **3**) of the locating comb **2**. The projections **5** are additionally formed with hook-shaped ends so that adhesive introduced between the ring-shaped elements **12***a*, **12***b* of the base **12** of the locating comb **2** will also securely anchor the separating guides **4** in position. The separating guide **4** is secured at its backside by adhesive casting compound **8** (FIG. **2**) introduced from the back through bore **7** communicating with groove **3**. To assemble a complete cylinder structure, locating comb **2** is placed in groove **3**, the separating guides **4** are placed between the bars **11**, and then temporarily secured by an encircling tension tape. Adhesive casting compound of suitable consistency is then injected by fitting a suitable injection press against the conical end portions **9** of bores **7**. Ventilating openings **10**, likewise communicating with grooves **3**, permit escape of air and indicate when the groove **3** and the space beneath the separating and locating guides **4** is completely filled with casting compound. To prevent escape of casting compound material, auxiliary, removable sliders can be inserted parallel to the separating and guide elements which, themselves, may be formed as single lamellae. The slider may extend to the base of the groove **3** in order to prevent escape of adhesive casting compound through an opening **10** before the duct **3** is completely filled. This slider may be made similarly to the separating and guide element **4**. The consistency of the casting compound is so selected that it should be viscous enough so that it will not escape laterally adjacent the separating and guide lamellae **4**.

FIG. **3** illustrates a locating comb structures **2**, **2'** for the dial of a knitting machine. The separating partitions are seen at **11**, **11'**, secured to two base portions **12**, **12'** having ring portions **12***a*, **12'***a* and **12***b*, **12'***b*. The base portions **12**, **12'** of the locating combs are first made so that they will fit in diameter and shape into respective grooves **13** (FIG. **4**) in the dial structure. The comb-like partition elements **11**, **11'** are then milled. Free passage of the milling cutter, as well as chip removal can be readily provided. In the manufacture of locating combs for cylinders which, in contrast to dials, do not have divergent slots since the slots are formed as generatrices of a cylinder, a number of such locating combs can be made in a single operation by extending the longitudinal cut of the milling cutter.

The locating comb of FIG. **3** was originally made as an extrusion and thereafter cut and worked as shown. To join more than one element **2**, **2'** together, a butt joint is made which, however, extends at an angle with

respect to a diameter line of the needle slots or tricks. This angle can be selected at random but, as shown, preferably extends over several partition elements **11, 11'**. The advantage of such an inclined junction, illustrated in exploded form in FIG. **3**, is the lower accuracy required at the junction line, since a certain gap may remain between the ends of the abutting separating partition elements without interfering with accuracy of subdivision. Before the casting compound is injected, remaining small gaps between abutting partition elements can be filled by suitable materials, such as adhesive tapes or the like. It is preferred to cut, upon milling the various comb-like partitions **11, 11'**, somewhat deeper than the thickness of the wall so that complete bridging, that is, free space between the comb-like partitions **11, 11'** is ensured. The locating combs may, of course, also be made by different manufacturing processes, such as casting, shaping and punching, and the like.

An assembled dial structure for a circular knitting machine is illustrated in FIG. **4**. Three grooves **13** are cut into the smooth surface of the dial structure itself, into which grooves **13** the locating combs of FIG. **3** are then inserted by means of adhesives or other methods of joining. The dial guide ways or separators **14** are then inserted. Casting compound injection openings, and air bleeder holes have been omitted from FIG. **4** for clarity.

The separating or guide elements **4** (FIG. **1**) or **14** (FIG. **4**) may be covered with a plastic coating. FIG. **5** illustrates a separator **15** totally surrounded by a plastic material which has a low coefficient of friction. The plastic is carried out on the side to form a lip **16** which, after assembly, fits against the plastic of an adjacent separating element **15** (see FIG. **6**). This structure is particularly capable of accepting lateral forces. The surrounding, covering plastic material **16'** is simply secured to the metal or other strong guide or separating element **15** by forming the element **15** with a suitable number of cross apertures **17**, through which the plastic can penetrate to bind the covering tightly around the separating elements. FIG. **6** also illustrates a knitting needle **18**, in chain-dotted lines to illustrate the position of a needle **18** within the thus formed guide way. The needle bed is formed by plastic at three sides of the needle. This plastic coating of the needle guides can be kept extremely thin, which is particularly desirable for fine cuts of knitting machines. The showing of the plastic coating **16'** in FIGS. **5** and **6** is highly exaggerated for clarity of illustration.

FIG. **7** illustrates an arrangement somewhat similar to that of FIG. **6**, and in which the separating and guide elements **19** are additionally supported at their ends by an upwardly projecting band **20** (FIG. **7***a*). Band **20** is so arranged that lateral forces arising during knitting machine operation can be accepted thereby, in order to stabilize the guidance of the needles. Only a single separating or guide element **19** is illustrated in FIG. **7** for clarity, and the remaining ends of adjacent guide elements which seat on the end band **20** are only schematically indicated.

Knitting machine cylinders and dials, besides the guide grooves, usually are also provided with so-called end or transfer combs located in the vicinity of the needle heads. Such end comb-like structures usually were made by milling. In accordance with the present invention, and as illustrated in FIGS. **8** and **9**, such end combs can be separately made by shaping elements **21** corresponding to the cast-off comb in such a manner that they can be inserted into locating combs **22** especially provided therefor. These elements **21** are shaped, as required by the knitting machine structure, and are known by themselves. The contour of the element **21** in that portion which engages the locating comb **22** may be similar to the projecting portions **5, 6** of the guide elements **4** (FIG. **1**). FIG. **10** illustrates a cross-sectional view through a plurality of such cast-off end comb elements **21**, illustrating also the casting mass **25** and a needle **18** in position, the latter being shown in chain-dotted lines and in highly schematic outline only.

The present invention may be utilized in any type of machine in which lamellae, or other similar elements are to be guided in a longitudinal path, by means of guide slots or guide grooves or the like.

The adhesive casting compound preferably is in somewhat pasty condition, or of a thick, highly viscous flowable consistency. Upon injection of the compound, which is indicated by air escaping from the air bleeder holes **10** (FIG. **2**), the separating sliders or other separating elements preferably introduced temporarily to prevent premature escape of filling mass through the air bleeder openings **10**, may be eliminated and replaced by a guide or separating element **4** (FIG. **1**). The adhesive mass may be introduced under pressure whereby its volume is compressed, or additionally, with application of centrifugal forces, by rotating the machine part. In the latter case, an accurately measured quantity is introduced in a container to the injection openings and the machine part, already completely assembled with the guide elements, is rotated. Any elements which become damaged in use can be replaced by local heating since, in accordance with a preferred form, the compound utilized is thermoplastic so that, upon re-heating, damaged single guide elements **4** can be removed and new ones inserted, alignment of the new guide element being automatically ensured by the separating portions **11, 11'** of the locating comb.

The locating combs **2** (FIG. **1**) may be made of various types of materials, since the needle itself does not contact the locating comb elements themselves, particularly if they are recessed below the needle path. The needle then is guided in its trick on the back of the needle carrier, that is, the cylinder or the dial element itself, and laterally, by the guide elements. The connecting bars or rings **12***a*, **12***b* (FIG. **1**) may be recessed by, for example 0.1 mm below the surface on which the needle itself rides, the locating comb only serving to ensure accurate lateral guidance of the needle through the guide elements which it supports.

Since the milling cut which is necessary to form the locating combs is comparatively shallow, milling can be carried out by rotating milling cutters rapidly and inexpensively, particularly when using hobbing cutters. The bridge elements **11, 11'** may, also, be made by punching in view of the thinness of the remaining comb-like portions **11, 11'** which are to stand free.

The end bands or supports **20** (FIG. **7**) may, like the guide elements **15, 16** of FIGS. **5, 6** be totally covered by plastic material or the like. The plastic selected preferably should have low coefficients of friction, that is, permit easy gliding of the needles. By utilizing modern low-friction materials, oiling of the needle paths is not necessary, which greatly contributes to cleanliness of

operation, and freedom from spotting of the fabric being knitted on the machine. Experiments have shown that the lateral forces arising in operation of the machine are substantially evenly distributed throughout the machine so that lateral guidance of the separating elements by lateral wings **16** (FIG. **6**) may, for certain machines, be unnecessary.

A suitable material for plastic covering of the guide elements is a material known under the trademark "Teflon," or nylon. Suitable adhesive casting compounds are metals and various types of epoxy resins, epoxy-amine, epoxy-amide, epoxy-silicone in addition to such compounds as methylacrylate, polyester, polyvinylacetal-phenol, ethylene vinyl-acetate and araldite.

Various changes and modifications may be made within the inventive concept.

I claim:

1. Machine having a machine element provided with guide ways for lamellae or similar sliding elements (**18**) comprising

at least two locating combs (**2**) each including a base portion (**12**) and a comb-like partition element portion (**11**) secured to the base portion extending from the base portion (**12**) to leave an unobstructed space beneath the partition element portion (**11**), the partition element portion (**11**) defining the direction of movement for the sliding elements;

the machine element (**1**) being formed with at least two spaced channel-like recesses (**3, 13**), each shaped to receive the base portion of a locating comb (**2**), and to secure at least the base portion in said channel-like recesses;

spaced separating liners (**4, 14, 19**) inserted between the partition element portions (**11**) adapted to have the sliding elements slide in the spaces between the liners, said liners each having at least two projecting portions (**5, 6**) extending into the recesses (**3, 13**) of the machine element (**1**) alongside the comb-like partition element portions (**11**) of the combs (**2**) and being located adjacent the base portions (**12**) of the combs (**2**) within the recess;

and an adhesive settable compound (**8, 25**) filling the recesses and securing the base portions (**12, 12***a*, **12***b*) of the locating combs (**2, 11, 20, 22**) and the projecting portions (**5, 6**) of the liners (**4, 14, 19**) in position in the machine element (**1**);

and wherein each of the locating combs within the machine are formed in several adjacent sections, the junction lines of adjacent sections being slanted with respect to the orientation of the comb-like partition elements.

2. Machine according to claim **1,** wherein the machine element is formed with casting openings (**7**), communicating with the recesses (**3, 13**), and with air bleeder means (**10**).

3. Machine according to claim **1,** wherein the projecting portions (**5, 6**) include at least one hook-shaped portion (**6**).

4. Machine according to claim **1,** wherein the base portion (**12**) of any locating comb comprises a pair of spaced bars (**12***a*, **12***b*), and the partition element portions are comb-like connecting elements (**11**) interconnecting said spaced bars (**12***a*, **12***b*).

5. Machine according to claim **4,** wherein the projecting portions (**5, 6**) of the separating liners (**4**) fit in the space between the spaced bars (**12***a*, **12***b*).

6. Machine according to claim **1,** wherein the separating liners are covered with plastic material having a low coefficient of friction.

7. Machine according to claim **6,** wherein the plastic material is formed with an extending lip (**16**) abutting adjacent separating liners to provide for lateral support of the separating liners.

8. Machine according to claim **1,** including an end supporting band (**20**) bearing against the terminal ends of the separating liners (**4**) and securing said elements in position.

9. Machine according to claim **1,** wherein said machine is a knitting machine having a cylinder part and a dial part, and said machine element comprises at least one of said parts.

10. Machine according to claim **9,** wherein the base portion of the locating comb extends below the upper edge of the recess (**3, 13**) formed in the machine element by a slight distance, so that the sliding element will ride on the smooth surface of said machine element and not on the base portion.

11. Machine according to claim **1,** wherein the compound (**8, 25**) filling the recess comprises at least one material selected from the group which consists of: plastic resins, thermoplastics, adhesives, and metals.

12. Machine according to claim **1,** wherein the compound (**8, 25**) filling the recess is compressed in volume.

13. In a knitting machine, a guide structure for needles, needle jacks, selector jacks, and other lamella-like elements, in which the machine has a cylinder part and a dial part,

the improvement wherein

at least one of the parts is formed with a smooth surface and at least two spaced channel-like grooves (**3, 13**) are formed in at least one of the parts, the grooves extending in said part inwardly of the smooth surface, said grooves extending essentially transversely to the direction of movement of the lamella-like elements;

the guide ways for the lamella-like elements comprise at least two locating combs (**2**), each having comb-like partition elements (**11**) oriented to define the direction of guide ways for said lamella-like sliding elements, and made as a separate sub-assembly, each locating comb (**2**) having a base portion (**12**) wholly received within a groove (**3, 13**) and separating liners (**4**) located alongside the comb-like partition elements (**11**) and each having a projecting portion fitting into a respective groove (**3, 13**), the separating liners projecting from the smooth surface in planes perpendicular to said surface;

a casting compound (**8, 25**) filling said groove and securing said separate sub-assembly forming the locating comb, as well as said separating liners, in position within, and on said at least one of the knitting machine parts;

wherein each of the locating combs within the machine are formed in several adjacent sections;

and the junction lines of adjacent sections are slanted with respect to the orientation of the comb-like partition elements.

14. Knitting machine according to claim **13,** wherein the base portion (**12**) of at least one of the locating

combs comprises a pair of spaced bars (**12***a*, **12***b*), and the partition elements are comb-like connecting elements (**11**) interconnecting said spaced bars (**12***a*, **12***b*);

the projecting portions (**5, 6**) of the separating liners (**4**) fit in the space between the spaced bars (**12***a*, **12***b*);

and the grooves are of a width and depth to accomodate at least the spaced bars (**12***a*, **12***b*) of the locating comb (**2**) and the projecting portions (**6**) of the separating liners (**4**) therein.

15. Knitting machine according to claim **13,** wherein the separating liners are covered with plastic material having a low coefficient of friction and the plastic materials are formed with an extending lip (**16**) abutting adjacent separating liners to provide for lateral support of the separating liners.

16. Knitting machine according to claim **13,** including an end supporting band (**20**) bearing against the terminal ends of the separating liners (**4**) and securing said elements in position.

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