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MAY 4, 1943.
BY A. P. C.

M. NEBEL

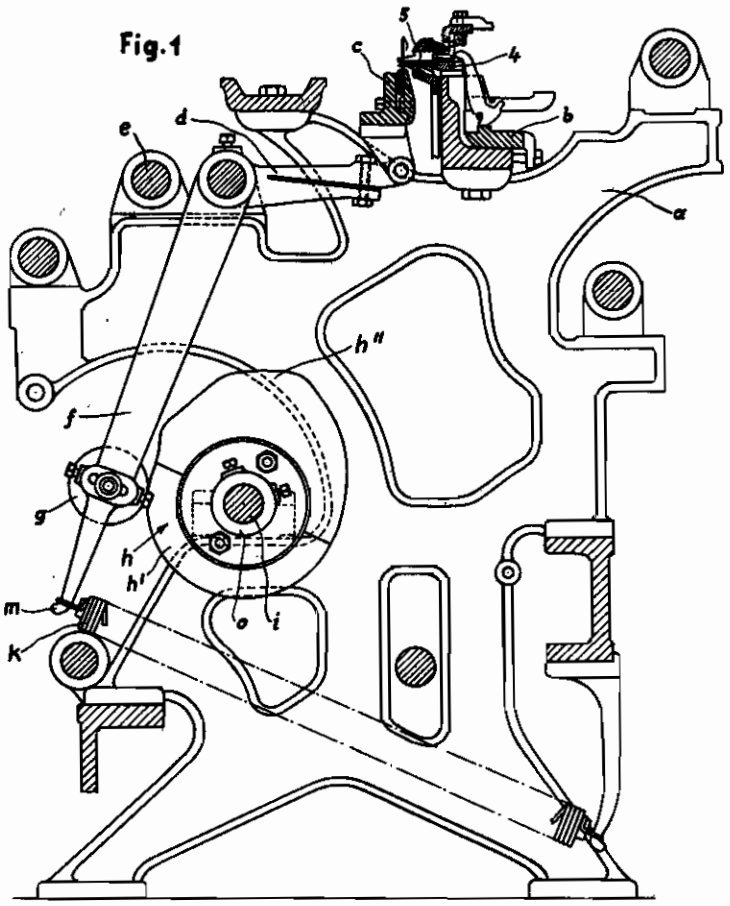
FLAT KNITTING MACHINE

Filed Nov. 18, 1938

Serial No.
241,255

3 Sheets-Sheet 1

Fig.1



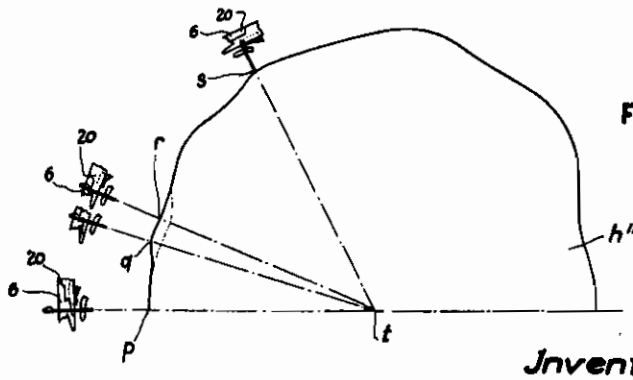


Fig.2

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Fig. 3

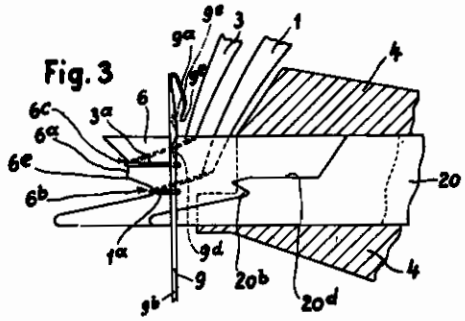

Fig. 4

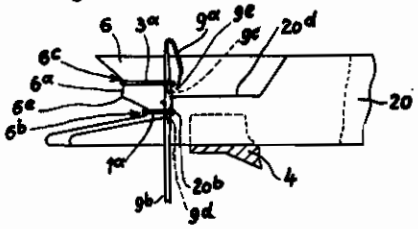

Fig. 5

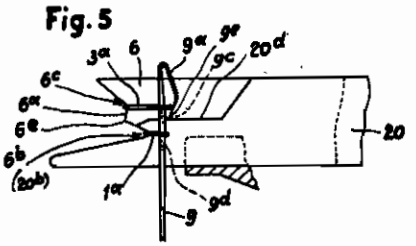

Fig. 8

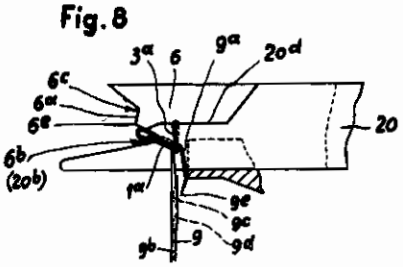

Fig. 9

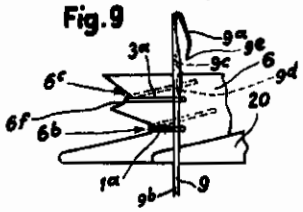

Fig. 6

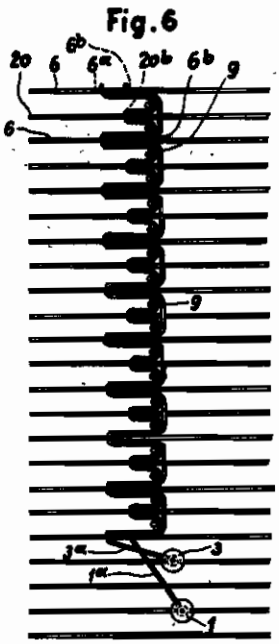

Fig. 7

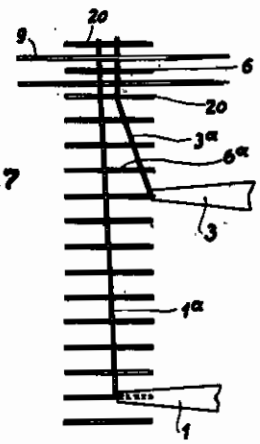

Fig. 15

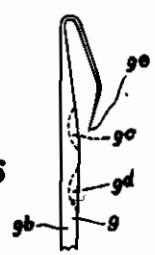

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Fig.10

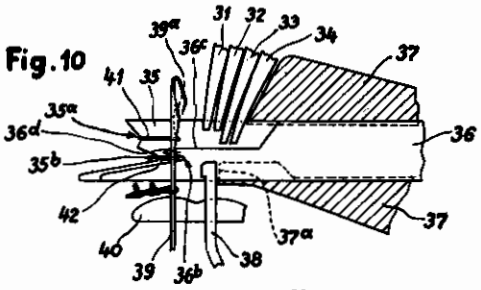


Fig.11

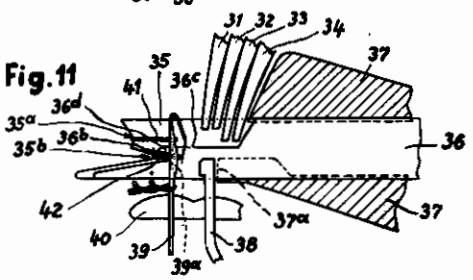


Fig.12

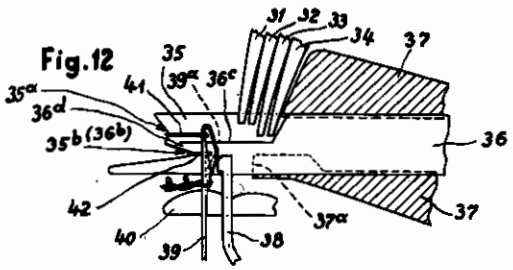


Fig.13

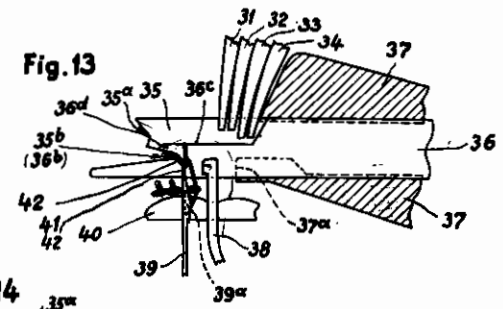
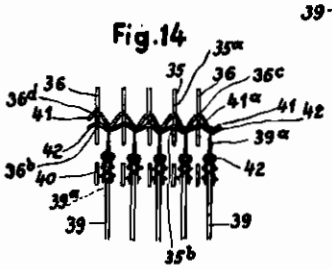


Fig.14



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ALIEN PROPERTY CUSTODIAN

FLAT KNITTING MACHINE

Max Nebel, Chemnitz, Germany; vested in the Alien Property Custodian

Application filed November 18, 1938

This invention relates to flat knitting machines for making piled fabric, with a plush loop for each sinker loop, or with plush loops for selected sinker loops only.

In such machines, the loops of the plush thread are sunk longer than the loops of the base thread by the jack sinkers and are then divided together with the base thread loops by the dividing sinkers and the descending frame needles. The jack sinkers are each provided with a throat for the plush thread and with a throat for the base thread. A vertical, or substantially vertical, edge extends downwardly from the plush throat. The dividing sinkers have two throats which are superimposed vertically, or substantially so, with a short projection between them whose upper edge is inclined in downward direction.

In order reliably to separate the plush and ground threads, and reliably to distribute them, extra separating members are provided in front of each dividing sinker and between the frame needles, for separating and/or distributing the threads issuing from the respective thread guides.

It is an object of the invention to so improve a flat knitting machine of the kind referred to, that the separating members are dispensed with.

Another object of the invention is to do away with the horizontal press motion of the needles so as to insure safe working during the production of pile fabrics, this object being attained by making the press itself horizontally movable in known manner and causing it during the pressing step to approach the needles which up to pressing time move up and down only in vertical direction.

To this end, in combination with a jack sinker of the kind described—which is old in the art—for sinking longer loops from the plush thread than from the ground thread, and for dividing the ground thread in forward direction means are provided for subsequently dividing the plush thread in downward direction only.

In such a machine, the ground and plush threads are sunk together in forward direction, and the plush thread is divided in the same direction, as usually, but the plush thread is not divided together with the ground thread by the dividing sinkers and the descending frame needles, the plush thread being divided completely and only in downward direction after the dividing of the ground thread.

In the accompanying drawings, a machine embodying the invention is illustrated more or less diagrammatically by way of example.

In the drawings

Figure 1 is a cross section of a complete machine;

Fig. 2 is a diagram showing the eccentric portion of a cam by which the needle bar of the machine is operated;

Figs. 3 to 8 are views drawn to a larger scale and showing various relative positions of the frame needles, jack and dividing sinkers, as follows:

Fig. 3 shows the sinkers in sinking position, and the corresponding frame needle at the upper end of its stroke;

Fig. 4 shows the sinkers and the needle at the moment the dividing throat of the dividing sinker begins to engage the ground thread previously to dividing it;

Fig. 5 shows the sinkers and the needle in dividing position;

Fig. 6 is a plan view of Fig. 5;

Fig. 7 is an end elevation, viewed from the left in Fig. 5, and

Fig. 8 shows the sinkers and the needle at the completion of the dividing operation;

Fig. 9 shows the loop forming tools in the same position as in Fig. 3, with the difference, however, that the edge of the plush throat extends in an oblique and not in a vertical, or substantially vertical, direction;

Fig. 10 shows the loop forming tools at the completion of the sinking operation;

Fig. 11 shows the loop forming tools at the beginning of the dividing operation;

Fig. 12 shows the loop forming tools during the pressing operation;

Fig. 13 shows the loop forming tools while the plush thread is divided in downward direction at the beginning of the putting-on movement;

Fig. 14 is a front view of the position of the loop forming tools shown in Fig. 13; and

Fig. 15 is a view drawn to a larger scale and shows a needle having two grooves and being arranged in the relative position of the loop forming tools shown in Fig. 4.

Referring now to the drawings, and first to Fig. 1, *a* is one of the end plates of a flat knitting machine, *b* is its head bar, of angle section, on which the sinker bar 4 is mounted with its jack and dividing sinkers, as will be described, 5 is the presser bar, and *c* is the needle bar. The needle bar *c* is supported by arms *d* only one of which is shown, and which are secured to a rocker shaft *e* mounted in the end plates of the machine. A cam lever *f* is keyed to the rocker shaft and equipped with a roller *g* for cooperation with a cam *h* on a shaft *i*. A spring *k* is

attached to the free end *m* of lever *f* at one end, and anchored in the frame of the machine at the other end. The spring holds the roller *g* against the edge of the cam *h*. The shaft *i* is rotated anti-clockwise by any suitable means, not shown.

The cam *h* on the shaft *i* is subdivided into a concentric member *h'* and an eccentric member *h''* which are connected to each other and to the cam shaft *i* by a suitable sleeve o. The eccentric member *h''* is shown separately in Fig. 2. It has steps *p*, *q*, *r*, and *s* at various radial distances from the axis *t* of the cam shaft *i*. Since the arms *d* and the lever *f* together make up a bell-crank, it is obvious that the needle bar *c* is raised when the roller *g* on the cam lever *f* is on a depression of the cam *h*, and lowered when the roller is on an elevation. Thus, since the radius *p*—*t* of the step *p* is the shortest one of the cam, the frame needles are in their topmost position when the roller *g* is on the step *p*. Conversely, the radius *s*—*t* of the step *s* is longer than the radius *p*—*t*, and so the frame needles are lowered when the roller *g* is on the step *s*.

The jack sinkers **6**, and the dividing sinkers **20**, Figs. 3–8, are mounted to slide in the sinker head **4**, and are operated by any suitable means, not shown. The ground thread **1a** is delivered by a thread guide **1**, and the plush thread **3a** is delivered by a thread guide **3**. Figs. 6 and 7 show the thread guides **1** and **3** at the end of their forward movement.

The jack sinkers are plush sinkers of the usual kind. Each jack sinker **6** has a lower throat **6b** for the base thread **1a**, and an upper throat **6c** for the plush thread **3a**. The upper or plush throat **6c** is in advance of the lower or base throat **6b**, and a vertical, or substantially vertical, edge **6a** extends from the plush throat **6c** down to a point **6a** above the base throat **6b**. Preferably, the edge **6a** is slightly inclined in forward direction. Such jack sinkers are also used in the old flat knitting machines referred to, but in combination with dividing sinkers of the usual kind, and with the separating members referred to.

In the present machine, the dividing sinkers are modified, so that the separating members are dispensed with. Each dividing sinker **20** has only a throat **20b** for the ground thread **1a**, and its upper edge is stepped so that the dividing edge **20d** is below the upper edge of the rear portion of the dividing sinker. In the example illustrated, the dividing edge **20d** is at the level of the end **6e** at the bottom of the edge **6a**. However, this is only the upper limit, the condition being that the dividing edge must not be at a higher level than the lower end **6e** of the plush throat in the jack sinker **6**. This includes any position of the dividing edge at a lower level.

On account of the low-level position of the dividing edge **20d**, the outlet end of the thread guide **1** for the ground thread can be placed so low that shifting of the ground thread onto the plush throat **6c** of the jack sinker **6** is absolutely prevented. On the other hand, the outlet end of the guide **3** for the plush thread **3a** is placed at the normal level, i. e., just below the upper edge of the jack sinker **6**. Since the free length of the plush thread **3a** is appreciably shorter than that of the ground thread **1a**, see Figs. 6 and 7, jumping of the plush thread **3a** into the throat **6b** which is provided for the ground thread **1a** in the jack sinker **6**, is absolutely prevented.

Before explaining the operation of the machine it is necessary to describe the special needle shown in Fig. 15. The novel feature of this needle is that it possesses two grooves **9c** and **9d** which are provided to prevent the extreme point of the dividing sinker entering between the needles from engaging any of them, the speed of the downward motion of the needle being so adjusted that the point of the dividing sinker located above the ground thread throat enters the needle row at the moment when it is positioned in front of the round shank portion **9b** between the upper groove **9c** and the lower groove **9d**, as indicated in Fig. 4. The upper groove **9c** is intended to receive the point **9e** of the needle hook, and the other groove **9d** serves for inserting therein covering needles for covering, narrowing, patterning, etc.

The operation of the machine will now be described. In Fig. 3, the jack and dividing sinkers **6** and **20**, and the corresponding frame needle **9**, with its hook **9a**, are in the sinking position. This occurs when the roller *g* of the cam lever *f* is engaged by the step *p* of the eccentric cam portion *h''*, and Fig. 3 is shown, on a much reduced scale, in line with the radius *p*—*t*, in Fig. 2. Since the step *p* is a depression, the needle bar *c* is elevated, and the hooks **9a** of all frame needles are in their topmost position, as shown in Fig. 3. The jack sinker **6**, through its throat **6c**, has sunk the plush thread **3a** into a loop which is longer than the loop into which the base thread **1a** is sunk by the lower throat **6b** of the jack sinker **6**. Both loops are horizontal, and slipping down of the plush thread **3a** after sinking is prevented by the forward inclination of the edge **6a** at the lower end of the plush throat **6c**.

After the sinking of the loops, the dividing sinker **20** advances into dividing position. During the first stage of the corresponding movement of the dividing sinker, the frame needles **9** deseend at a more rapid rate than in the old machines. In these, the frame needles, at the beginning of the dividing operation, have moved only through a short distance from their topmost position corresponding to the sinking operation. In the present machine, however, the step *q*, Fig. 2, whose radius *q*—*t* is longer than the radius *p*—*t* of the preceding step *p*, moves down the needles **9** so rapidly that, as shown in Fig. 4, the hook **9a** of the descending needle engages the loop which the jack sinker **6** has sunk from the plush thread **3a**, at the moment the throat **20b** of the dividing sinker begins to engage the ground thread **1a** to divide it between the needles **9**. It is necessary that the loops from the plush thread **3a** should be thus engaged by the needle hooks **9a** in order to prevent throwing-over beyond the upper ends of the needles, of the loops from the plush thread **3a** as they become slack upon the return movement of the jack sinkers **6**.

Fig. 5, and Figs. 6 and 7, illustrate the dividing position of the sinkers and the corresponding frame needle when the step *r* of the cam portion *h''* engages the roller *g*. The dividing operation involves only the ground thread **1a** which is engaged by the throat **20b** of the dividing sinker, and is in line with the corresponding throat **6b** of the jack sinker **6**. The plush thread **3a**, however, is not influenced on account of the low-level position of its dividing edge **20d**.

Upon further rotation of the cam *h*, the step *s*, whose radius *s*—*t* is longer than the radius *r*—*t* of the preceding step *r*, engages the roller *g* and moves the needles down into the final divid-

ing position, Fig. 8, and the needles now divide in downward direction the sunk plush thread 3^a.

By dividing the plush thread 3^a in downward direction only, it is possible to make the front ends of the dividing sinkers **20**, with their edges 20^d, as low as shown, the upper limit for the position of the dividing edge 20^d being the lower end 6^e of the plush throat 6^c, as described, permitting of the favorable position of thread guide **1**, as also described.

Fig. 9 shows the same mode of operation as Fig. 3 for producing plush as described and by the same means. The only difference is that the jack sinker is fitted with a plush throat in which the edge of the sinking throat does not extend vertically, or substantially vertically, like the edge 6^a shown in Figs. 3–8 but in oblique direction so that the throat 6^c is limited by an acute angle. This sinking throat edge is designated 6^f in Fig. 9.

Figs. 10–14 serve to show that an increase in th speed of the downward motion of the needle to insure safe embracing of the plush thread at the beginning of the dividing operation may be rendered unnecessary by starting tlie dividing operation later than usual. This is possible, as will be described, when the needle does not carry out a horizontal press motion and the latter, as known per se, is performed by the press. This delay of the beginning of the dividing operation is not possible when the needle moves in the ordinary manner. Dividing must therefore be completed when the needles move toward the press and the sinkers are returning also.

By providing for vertical needle motion only, from the sinking to the pressing operations, in the production of pile fabric the dividing motion of tlie dividing sinker becomes independent of the pressing operation. It is thus possible to begin at this descent of the frame needles with the dividing of the ground thread at ordinary speed only when the frame needle is at so low a point that the plush thread is inside the needle hook.

The plush thread guides **31** and **32** and the ground thread guides **33** and **34** are so arranged that the guides **31**, **32** deliver their plush thread just below the upper edge of the jack sinker **35** and the guides **33** and **34** their ground thread barely above the upper edge of the dividing sinker **36**. The jack sinker **35** possesses the usual plush throat **35***a* arranged in front of and above the ground thread throat **35***b*. The dividing sinker **36** whose top edge **36***c* is located just below the plush throat **35***a* is provided only with a ground thread throat **36***b*. Both sinkers are disposed in known manner in a sinker head **37** which has no presser edge, as is known also, and the edge **37***a* which could serve as such is placed so far back that movable presser tools can be arranged instead of the presser edge. Various types of presser tools serving as means for producing a needle motion free from presser motion are known including for instance presser tools **38** which operate from below and are individually or jointly movable.

It is immaterial how such presser tools **38** are constructed, provided they are movable in horizontal direction. **39** are the needles and **40** is a knocking-over comb. **41** is the plush thread and **42** the ground thread.

According to Fig. 10, the sinking operation is completed and the forward movement of the dividing sinkers has begun. The actual dividing operation starts later than provided for by the known operating method of the dividing sinkers in the old machines. The movement of the dividing sinkers between the needle rows begins shortly before the needle groove **39***a* comes within range of the sinker nib **36***d* during the descent of the needles, i.e., the beginning of this movement is so timed that the point of the dividing sinkers cannot engage the needle groove and keeps the ground thread separated from the plush thread, whereas the subsequent retardation of the beginning of the actual dividing motion brings it about that prior to the actual distribution of the ground thread the needle occupies so low a position, see Fig. 12, that the plush thread is already in the hook. Farther descent of the frame needles **39** is effected at the regular downward speed, and the movement of the dividing sinkers is so adjusted that actual distribution of the ground thread and the return of the jack sinkers and needles connected therewith occur only when that portion of the plush thread **41** hugging the shank of the needle is positioned inside the hook, as indicated in Fig. 11.

Fig. 12 shows the known motion of the presser device **38** relative to the needle which is pressed without carrying out a horizontal motion towards the presser means. When the return motion is continued, as shown in Fig. 13, the press moves away again from the needles into initial position, and the sinkers begin their return motion R.

While the needle performs the movements shown in Figs. 12 and 13 the loops sunk from the plush thread **41** are divided to form plush loops **41***a*. The upper edge **36***c* of the dividing sinker **36** remains between the needles until the plush thread has been finally divided. As tlie return of the sinkers does not depend upon a presser motion of the needles, the plush loops may rest on the upper edge **36***c* up to the beginning of the putting-on operation.

Fig. 14 shows in a particularly clear manner the position of the thread during dividing in downward direction while the loop forming tools are in the position shown in Fig. 13.

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