Aug. 8, 1961 A. W. H. PORTER 2,995,022

WARP KNITTING MACHINES

Filed March 9, 1960 4 Sheets-Sheet 1

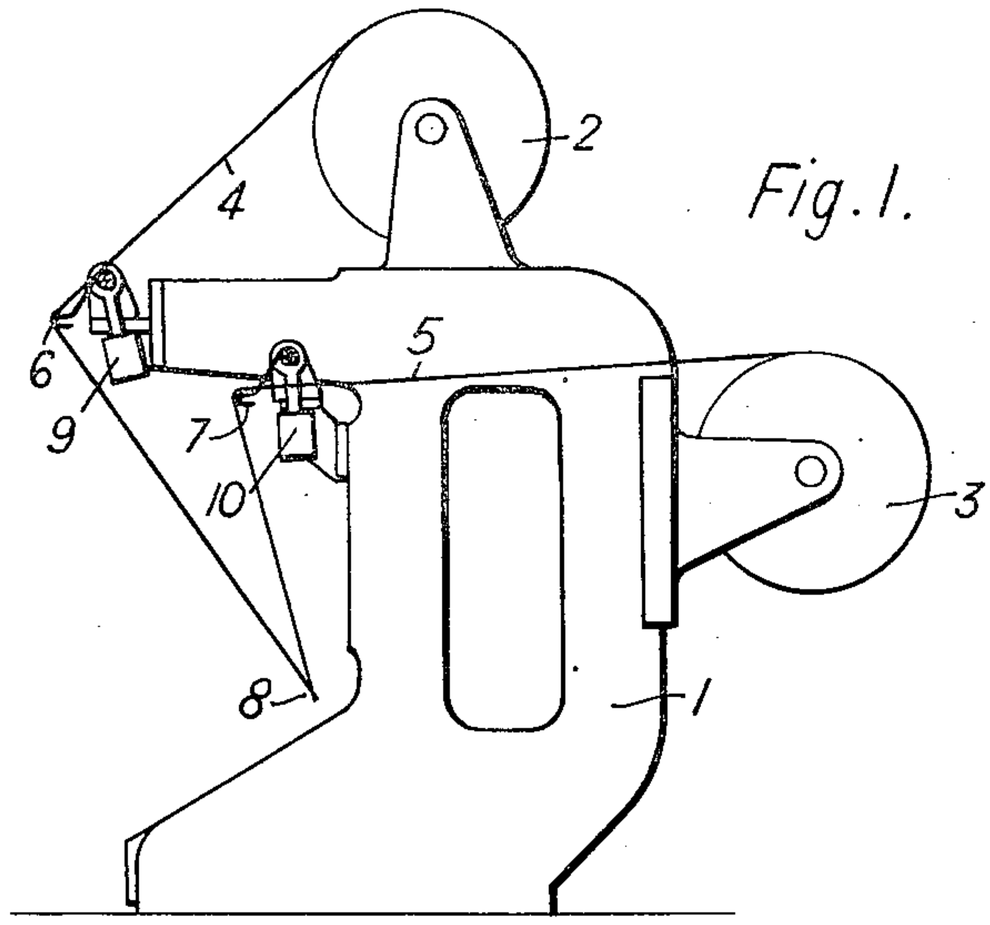

Fig. 1.

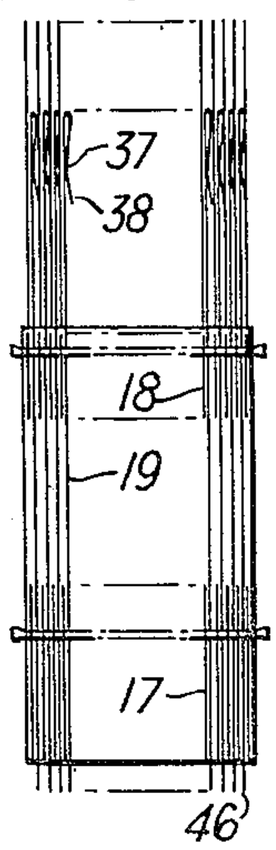

Fig. 8.

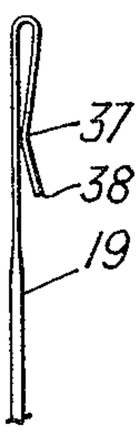

Fig. 9.

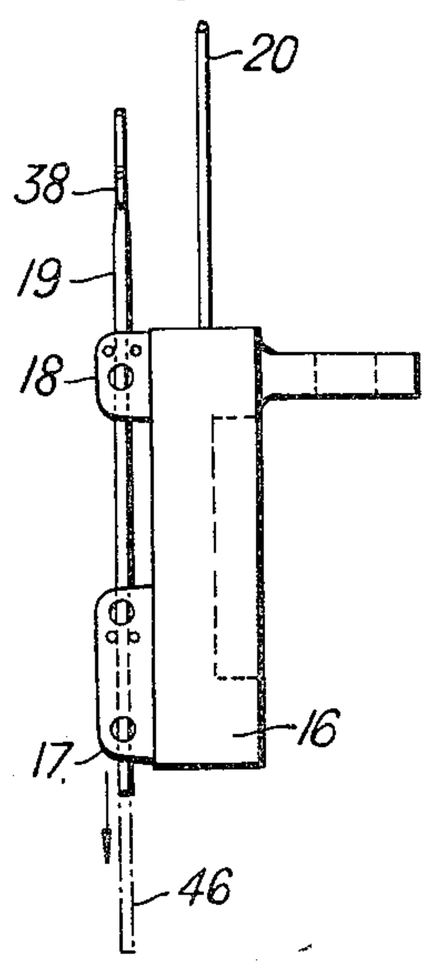

Fig. 7.

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WARP KNITTING MACHINES

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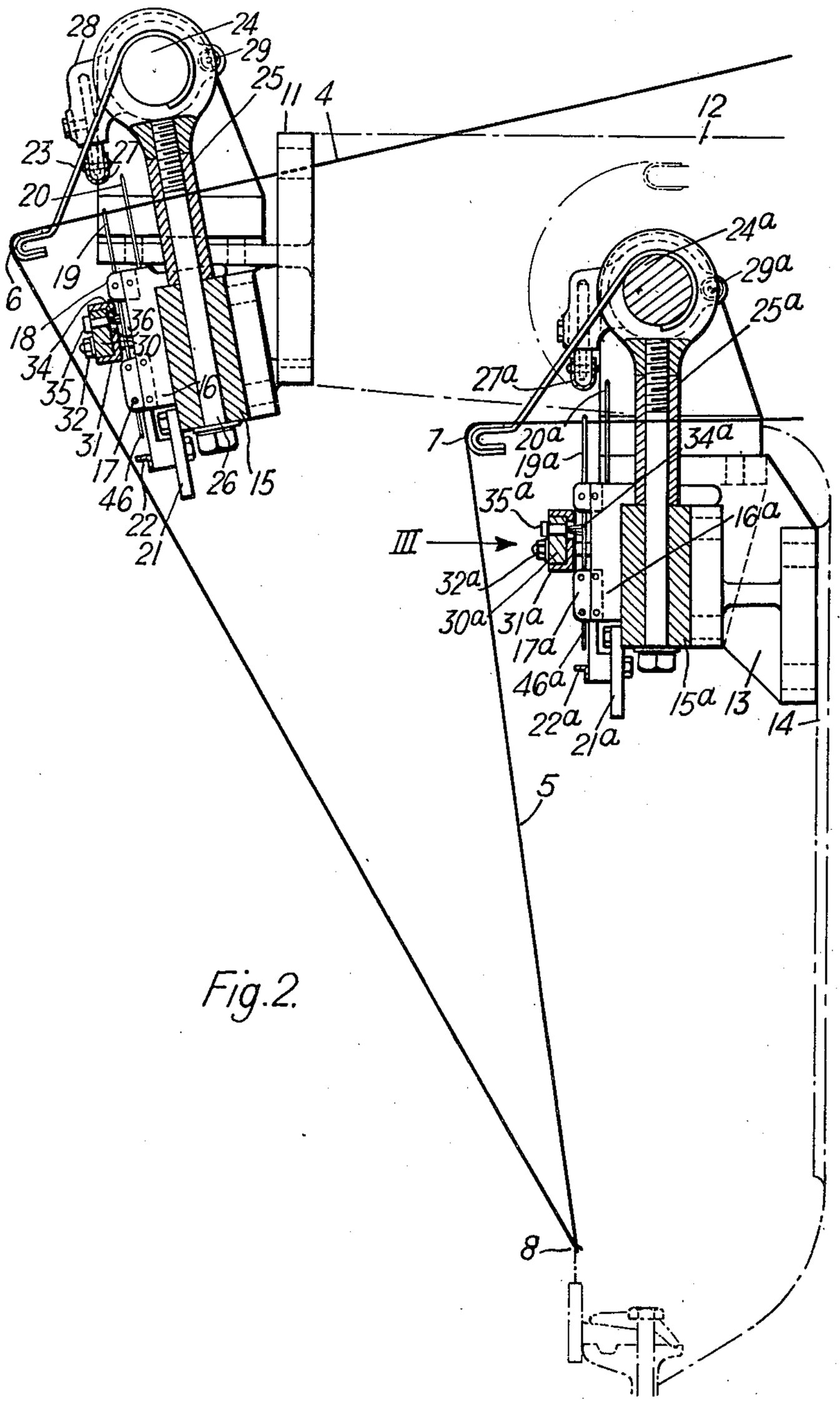

Fig. 2.

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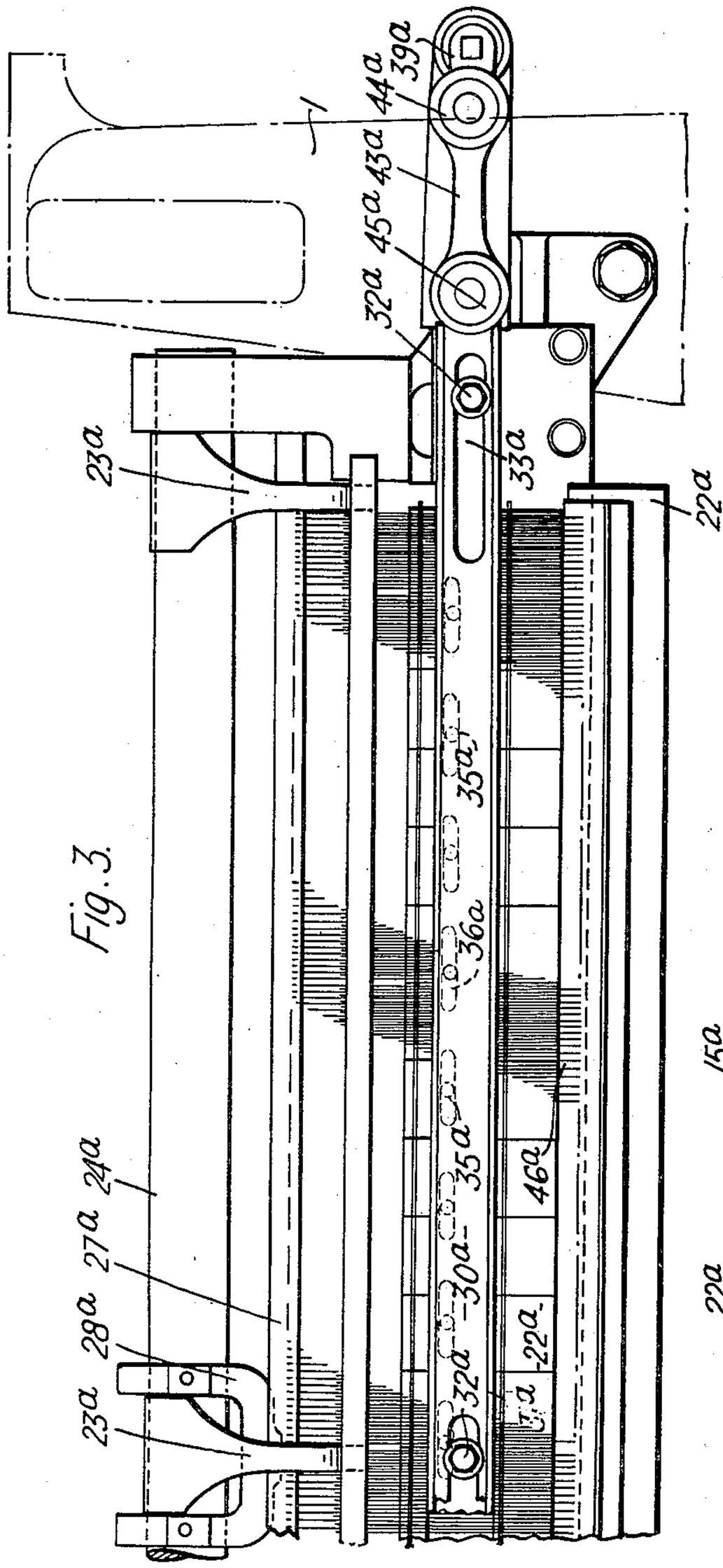

Fig. 3.

Fig. 6.

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WARP KNITTING MACHINES

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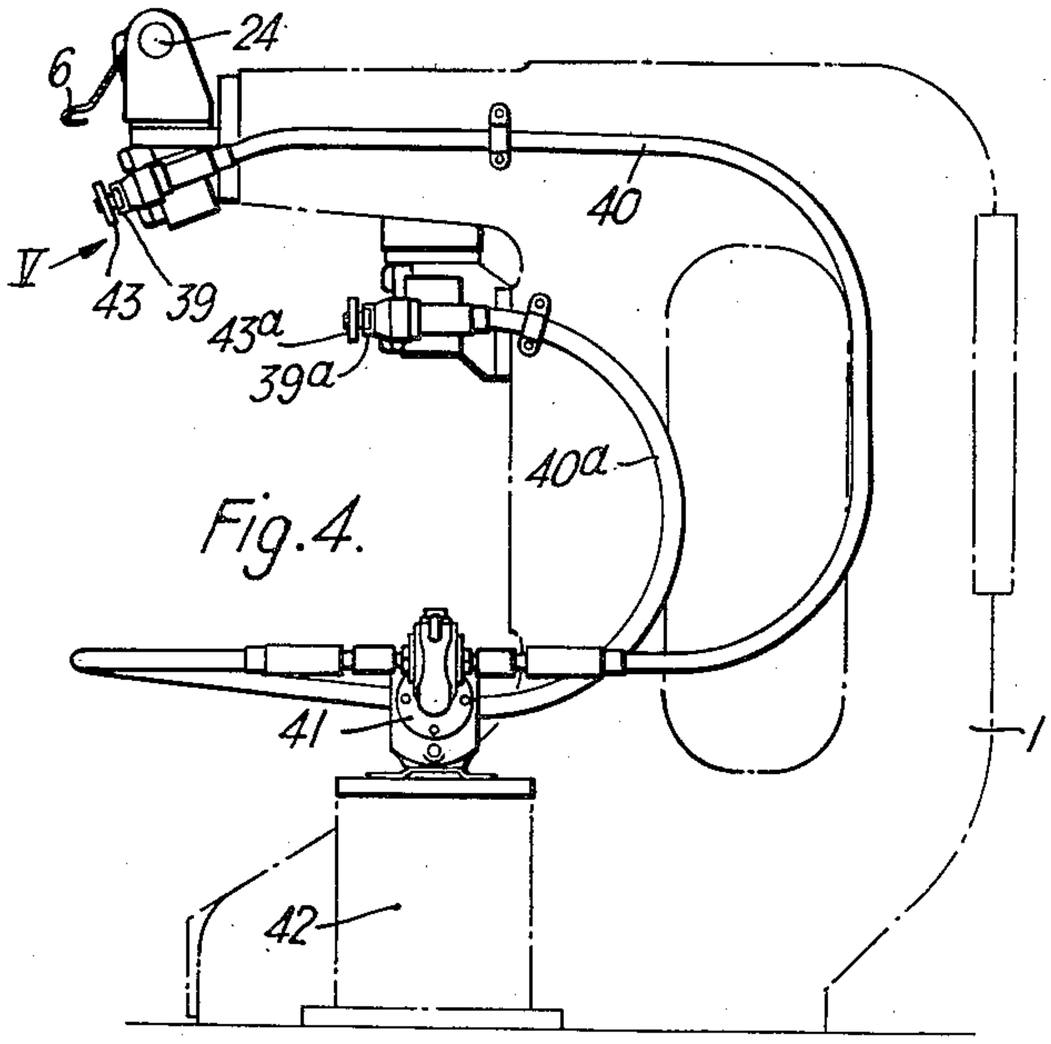

Fig. 4.

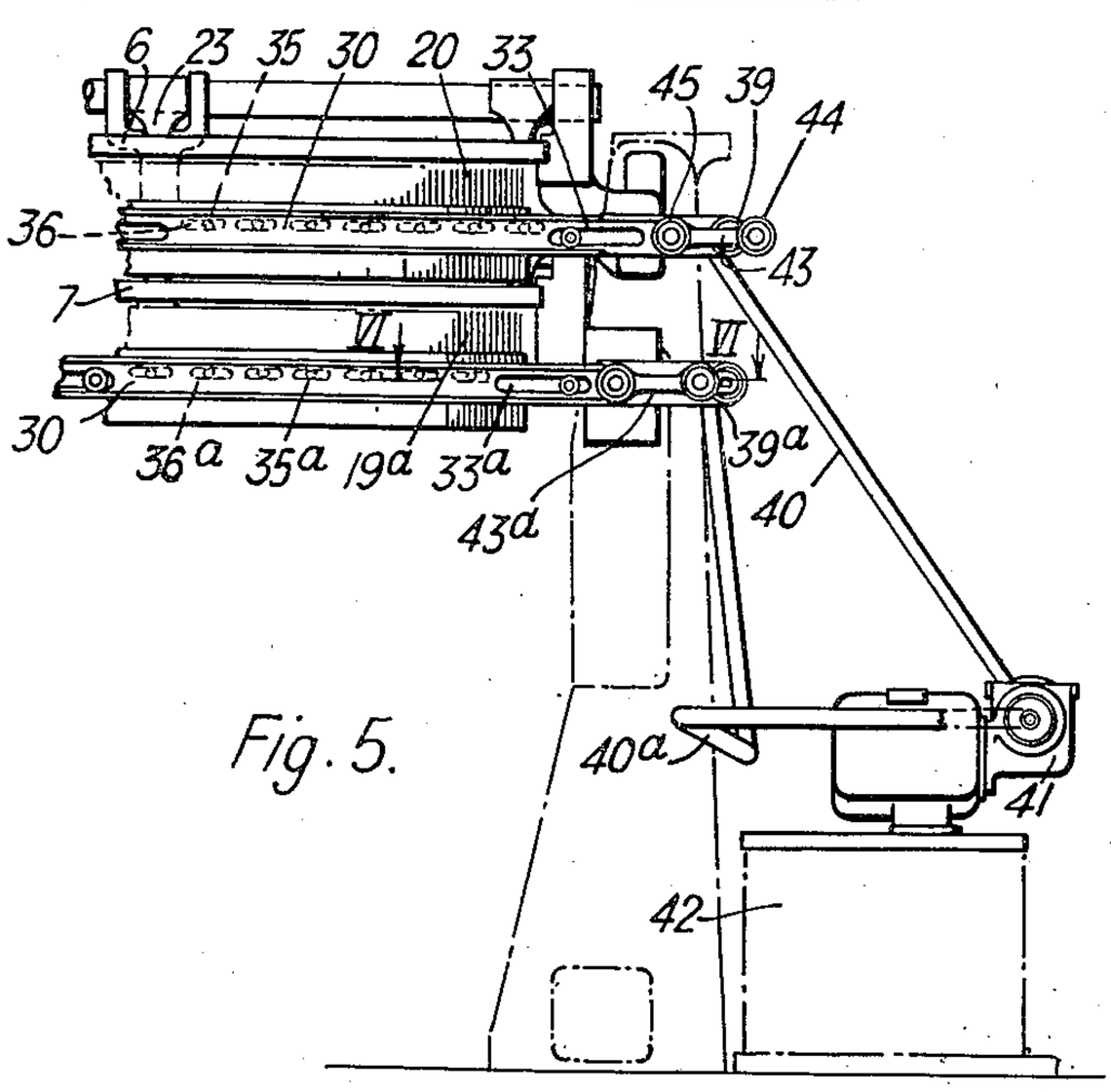

Fig. 5.

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WARP KNITTING MACHINES

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9 Claims. (Cl. 66—163)

Conventional stop motions which are commonly used in various textile machines such as warping machines, consist of a row of U-shaped members each one of which is individually placed over and supported by a section of a single thread which runs substantially horizontally over a pair of supports which are spaced apart. If any thread breaks whilst the textile machine is in operation, its associated dropwire is no longer supported and falls across a pair of bare electrical conductors arranged below it. The dropwire then completes an electrical circuit through the two conductors and the closure of this circuit causes the machine to be stopped.

The placing of the individual dropwire in position is a long operation which greatly increases the total time necessary to thread up the machine and bring it into operation. Flat warp knitting machines can be threaded up quite quickly with warp threads which have been fixed in position side by side by adhesive tape in the usual way. The placing of individual dropwire for a stop motion would, therefore, take a particularly long time in comparison with the remainder of the threading up. For this reason, stop motions have rarely been used in practice in flat warp knitting machines in spite of their obvious advantage which is that they enable the machine to be stopped much more quickly and independently of manual operation when a thread breaks than is possible if the machine operator must first see the flaw produced by the broken thread and then stop the machine manually.

According to the present invention a flat warp knitting machine has a stop motion comprising a row of hooked members which are arranged to engage one over each thread and an electrical conductor in an electrical circuit which on closure stops the machine, the hooked members being held spaced apart in guides in which they are movable upwards and downwards, the hooked members coming into contact with the conductor to close the circuit on being allowed to move downwards in their guides due to thread breakage.

When the machine is threaded up, the threads, fixed in groups by the adhesive tape, can readily be passed downwards between the tops of the hooked members and then under the hooks of the hooked members. This is possible because the hooked members, instead of being entirely separate from each other are mounted in guides which maintain their spacing. In consequence, the total time taken to thread up a knitting machine having a stop motion in accordance with the invention is little greater than that necessary to thread up a similar machine without a stop motion.

To help maintain the lateral spacing of the threads and to make the threading up of the stop motion still simpler, a reed may be fixed adjacent and parallel to the row of hooked members and in the path of the threads between the warp beam and the hooked members.

There is a tendency for interference between or intermingling of adjacent threads to cause a hooked member to be held up by an adjacent thread when its associated thread has broken. This tendency is, however, largely overcome by the provision of the reed. The hooked members may, however, be prevented from dropping when their associated threads break not only by an adjacent thread, but also by the sticking of adjacent hooked members to each other or to their guides due to oil, suction effects between flat surfaces in contact with each other

or static electrical charges built up on the members due to the passage of the threads through their hooks. To overcome this difficulty according to a further feature of the invention, a brushing member extends along the row of hooked members. This brushing member has a driving mechanism by which it is movable along the row and a series of projecting fingers which engage with the shanks of the hooked members as they are moved past them and impart to the members a slight twisting movement relative to their guides.

The twisting movements to which the members are continuously subjected greatly helps to prevent the members sticking to their guides or to each other. The projecting fingers may for example be light cantilever springs or may be resilient bristles which may be natural or be made of nylon.

The brushing member is preferably reciprocated to and fro along the row of hooked members by a crank or eccentric mechanism so that the hooked members are twisted first in one direction and then back again.

An example of a knitting machine constructed in accordance with the invention is illustrated in the accompanying drawings in which:

FIGURE 1 is a diagrammatic end elevation of the machine;

FIGURE 2 is an end elevation of part of the machine to a larger scale showing two stop motions;

FIGURE 3 is a front elevation of one stop motion and the adjacent parts of the machine as seen in the direction of the arrow III in FIGURE 2;

FIGURE 4 is a further end elevation of the machine showing driving mechanisms for reciprocating brushing members which extend along the rows of hooked members of the stop motions;

FIGURE 5 is a front elevation of the machine shown in FIGURE 4, the upper stop motion being shown as seen in the direction of the arrow V in FIGURE 4;

FIGURE 6 is a sectional plan as seen in the direction of the arrows on the line VI—VI in FIGURE 5;

FIGURE 7 is a side elevation of a part of the stop motion;

FIGURE 8 is a front elevation of the part of the stop motion shown in FIGURE 7; and

FIGURE 9 is a detail of one of the hooked members.

The machine is of a conventional type and has at one end a frame **1** and at the other end a similar frame, which is not shown. A bed, also not illustrated, extends longitudinally between the two end frames and carries the knitting elements and their driving mechanism. All these parts of the machine are conventional and since they form no part of the present invention they are not illustrated.

As seen diagrammatically in FIGURE 1 the machine has two warp beams **2** and **3** from which warp threads **4** and **5** extend over spring tension bars **6** and **7** respectively to a knitting point **8**. A stop motion **9** is mounted adjacent the tension bar **6** and a similar stop motion **10** is mounted adjacent the tension bar **7**. These stop motions are illustrated in detail in FIGURES 2 to 9 of the drawings. The two stop motions are generally similar to each other and only the stop motion **9** is therefore described in detail.

The stop motion **9** is fixed by a bracket **11** to an upper member **12** of the frame **1** and the stop motion **10** is fixed by a bracket **13** to a vertical member **14** of the frame **1**. The stop motion **9** comprises a longitudinal bar **15** which extends between the bracket **11** and a similar bracket on the other end frame of the machine. Fixed to this bar are a number of die cast metal sections **16**, one of which is shown in detail in FIGURES 7 and 8 and in each of the sections **16** a number of plates **17** and **18** are cast side by side. The plates **17** and **18** form guides be-

tween which hooked members **19** are freely slidable upwards and downwards. A row of vertical spikes **20** are cast into the top of each of the sections **16** to form a reed immediately behind the row of hooked members **19**.

A plate **21** is bolted to the bottom of the bar **15** and to this is fixed a rail **22** which extends below the bottoms of the row of hooked members **19**. The rail **22** forms an electrical conductor and is electrically insulated from the remainder of the structure. The tension bar **6** is supported at intervals on cantilever spring arms **23** from a rod **24** which is in turn supported at intervals by columns **25** from the bar **15**. The rod **24** is clamped in position at each column **25** by a bolt **26** which passes through the column **25** and through the bar **15**. A keeper rail **27** extends along the length of the machine above the top of the row of hooked members **19**. The keeper rail **27** is supported at intervals on arms **28** which are pivoted on the rod **24**. Each arm **28** is normally held in the position shown in FIGURE 2 of the drawings by a spring-loaded catch **29**. To enable the machine to be threaded up the arms **28** can be rotated in a clockwise direction as seen in FIGURE 2 of the drawings so that the keeper rail **27** is raised into a position well clear of the top of the reed **20**.

Mounted in front of the stems of the hooked members **19** in between the plates **17** and **18** is a brushing member in the form of a bar **30**. The bar **30** extends along the whole length of the row of hooked members **19** and is supported in a channel-shaped guide **31** in such a way that it can slide to and fro along the row of hooked members **19**. The bar **30** is held in position within the guide **31** by bolts **32** which pass through slots **33** in the bar **30** and pass through the sections **16** and are screwed into the bar **15**. Tufts of nylon bristles **34** are held in caps **35** which are removably mounted in bores in the bar **30**. When the caps **35** are in position within their bores, as shown in FIGURE 2 of the drawings, the bristles **34** project through elongated openings **36** in the guide **31** into contact with the fronts of the shanks of the hooked members **19**.

When the machine is in operation the warp threads **4** pass, as shown most clearly in FIGURE 2, through the reed **20**, through the hooks of the hooked members **19**, over the tension bar **6** and thence to the knitting point **8**. As shown most clearly in FIGURES 7 and 9 the hooked members **19** are formed from flat resilient metal strip, the hooks of the members being crook-shaped. The reverse curved portions **37** of the hooks lie in contact with the shanks of the members. The hooks lie in the plane of the row of the shanks of the members.

With this arrangement the stop motion is particularly easy to thread up. The ends of the warp threads **4** are stuck together side by side at an even spacing by sticky paper in the usual way. The keeper rail **27** is raised and groups of threads are passed downwards between the spikes of the reed **20** and in between the hooked members **19**. The threads pass downwards until they lie below the tips **38** of the hooks and are then moved upwards again. As they are moved upwards they pass between the shanks of the hook-shaped members and the reverse curved portions **37** of the hooks into the hooks themselves. Because of the springiness of the hooks, the reverse curved portions **37** move back into contact with the shanks and the threads are held in position within their hooks. The threads are then drawn over the tension bar **6** and down to the knitting elements in the usual way.

When the machine is in operation the bar **30** is reciprocated to and fro by a mechanism shown most clearly in FIGURES 4 to 6 of the drawings. FIGURE 6 is a section through a bar **30'** in the stop motion **10**, but a corresponding section through the bar **30** is similar.

The driving mechanism comprises a crank **39** which is rotated by a flexible shaft **40** driven by an electric motor **41** mounted on a pedestal **42** on the end frame **1**. A connecting rod **43** is pivotally mounted on the crank **39** by a ball bearing **44** and the connecting rod **43** is similarly pivotally attached to the end of the bar **30** by a second ball bearing **45**. Thus when the crank **39** is rotated the bar **30** is moved to and fro through a distance equal to twice the throw of the crank **39**. As the bar **30** is moved the tufts of bristles **34** press against the shanks of the hooked members **19** and so tend to rock the hooked members to and fro about an axis extending along their shanks. This continuous brushing against the hooked members prevents their sticking to their guides or to each other.

Normally when the machine is running correctly the hooked members **19** are substantially in the position shown in FIGURE 2 of the drawings. As the tension in the warp threads **4** varies the tension bar **6** will move upwards and downwards and the hooked members **19** will move upwards and downwards also. The magnitude of this movement is small, however, so that the bottoms **46** of the hooked members **19** are maintained clear of the rail **22**. The hooked members are prevented from being flicked upwards off the threads **4** by any sudden upward movement of the tension bar **6** by the keeper rail **27**. If one of the threads **4** should break, its associated hooked member **19** is no longer supported and moves downwards in its guide formed by the plates **17** and **18** into the position shown in chain dotted lines in FIGURE 7 of the drawings. In this position its bottom end **46** comes into contact with the rail **22**. This completes an electrical circuit which passes through the rail **22** and the bar **15** and the sections **16** which closes a relay and stops the machine. The electrical circuit of the stop motion may be any one of a number of conventional circuits which are used with other stop motions and it is not therefore illustrated.

To facilitate the initial threading up of the machine already described, the tension bar **6**, which as seen in FIGURE 2 is of U-shape cross-section, may be detachably mounted on the ends of the cantilever arms **23** over which it is a push fit. To thread up the reed **20** and the hooked members **19** the tension bar **6** is removed, but after this it is replaced under the warp threads **4** and pushed back into the position shown in FIGURE 2 of the drawings.

As already stated the stop motion **10** is generally similar to the stop motion **9** and corresponding parts are given the same reference numerals as the parts of the stop motion **9** but with the suffix *a*.

I claim:

1. A flat warp knitting machine having a stop motion comprising a row of hooked members each of which is arranged to engage over and be supported by one of said threads, a row of guides mounting said hooked members in side by side spaced apart relation for up and down movement, a brushing member extending along said row of hooked members, a driving mechanism for moving said brushing member along said row, a series of fingers projecting from said brushing member and engaging with said hooked members as said brushing member moves to impart a slight twisting movement to said hooked members relative to said guides to maintain freedom of up and down movement of said hooked members in said guides, an electrical conductor below said hooked members positioned to be contacted by one of said hook members whenever that hook member is permitted to fall consequent upon breakage of the thread supporting it, an electrical circuit passing through said conductor and closed by contact between said conductor and a hook member, and means actuated by closing of said circuit for stopping said machine.

2. A machine according to claim 1, in which the driving mechanism reciprocates the brushing member to and fro along the row of hooked members.

3. A machine according to claim 1, in which the fingers are bristles.

4. A machine according to claim 3, in which the bristles

are mounted in tufts in caps which are removably fixed to the brushing member.

5. A machine according to claim 1, in which the hooked members are resilient sheets of metal formed into shanks and crook-shaped hooks, said hooks comprising reverse curved portions adjacent their tips which are in contact with said shanks.

6. A machine according to claim 5, in which the hooks of the hooked members lie in the plane of the row of shanks of said hooked members.

7. A machine according to claim 1, in which a keeper rail is provided above the tops of the hooks of the row of hooked members.

8. A machine according to claim 7, in which the rail is mounted on pivoted arms which allow the rail to be swung upwards clear of the hooked members for threading up to take place, the arms having spring detents which hold them in the upper and lower positions.

9. A machine as claimed in claim 1 which carries a pair of spring cantilever arms, each formed with an upwardly projecting spigot, and a tension bar which fits detachably over said spigots to tension said threads.

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