May 23, 1961 K. LIEBRANDT ET AL 2,984,998

DRIVING MECHANISM FOR WARP KNITTING MACHINES

Filed Oct. 20, 1958 3 Sheets-Sheet 1

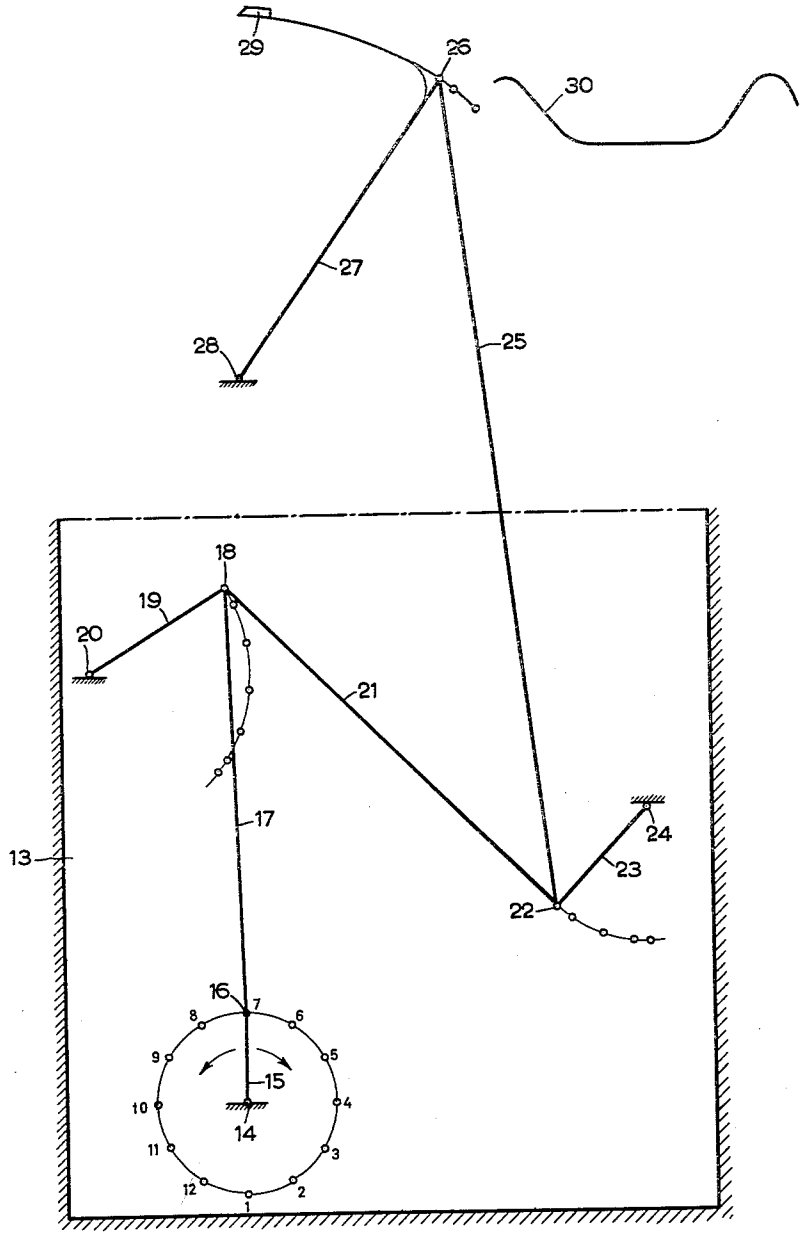


Fig. 1

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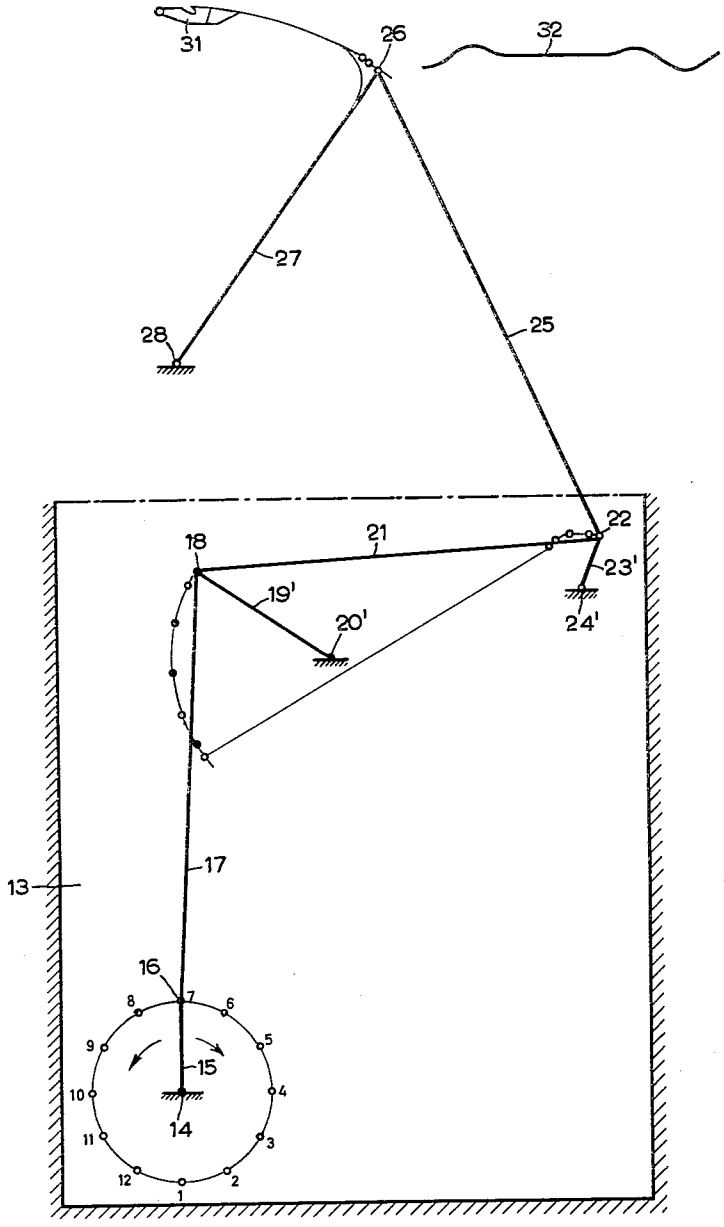


Fig. 2

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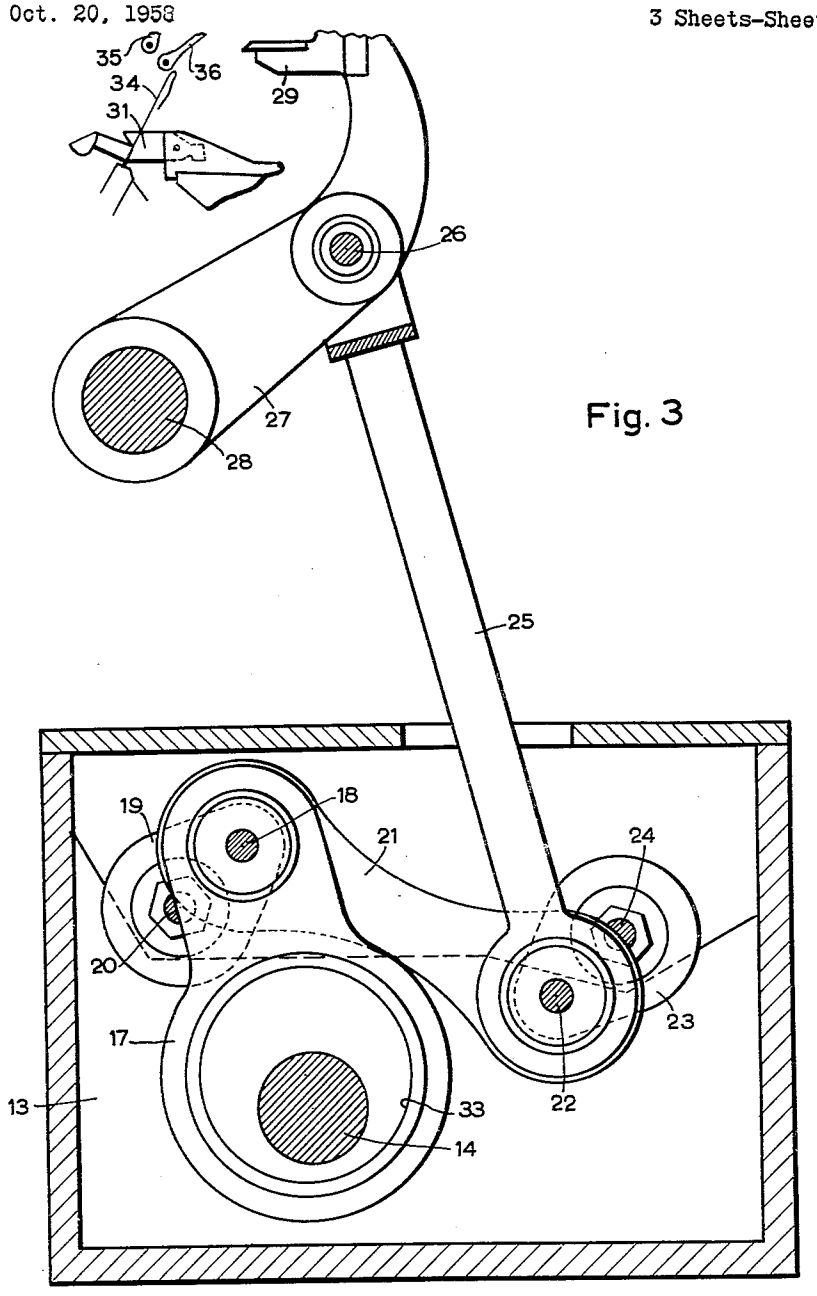


Fig. 3

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DRIVING MECHANISM FOR WARP KNITTING MACHINES

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Claims priority, application Germany Oct. 30, 1957

7 Claims. (Cl. 66—86)

The present invention relates to high-speed warp knitting machines and more particularly to improvements in the driving means of the knitting tools of such machines.

Since the knitting tools of warp knitting machines have to carry out certain movements which have to be coordinated in a very particular chronological sequence relative to each other, it has always been a difficult problem to design the necessary means for driving these tools. Prior to this invention, such driving means generally consisted of cam-type gears which had the disadvantage that, when operating at the high speeds required of modern knitting machines, they were extremely noisy and subject to excessive wear on the cam surfaces. Such cam-type gears have been disclosed in the cam mechanism of the warp knitting machine of U.S. Patent No. 2,427,394 of Sept. 16, 1947, to R. F. Eshleman. Consequently, the required accuracy of the gearing soon depreciated and the individual parts thereof had to be frequently replaced. There have also been warp knitting machines in which the movement of the knitting tools was derived from two eccentric rings which were rotated at different speeds. However this duplex. drive also required at least some cams and was thus subject to the same difficulties as described above when the machine was run at a high speed. In still other warp knitting machines, the knitting tools were operated by means of a crank gear which was driven by a main drive shaft. This gear consisted of a linkage gearing with seven joints which was formed by connecting two quadruple linkages in series with each other. However, it was found that such a gearing could not produce the desired movements of the knitting tools unless a further quadruple linkage was connected thereto. If such a gearing was mounted within a housing of smallest dimensions which was filled with oil, as is usually required for attaining high speeds, it was necessary to transmit the movement of the driven parts to the point of operation of the knitting tools by means of a further quadruple linkage, thus requiring a minimum of 13 joints and ten links for the entire driving system.

It is the principal object of the present invention to provide a driving mechanism for the knitting tools of warp knitting or similar machines which overcomes the above mentioned disadvantages and, while applying a seven-linkage gearing, requires a smaller number of links and also a smaller number of joints than previously required, and which thus requires less material as well as less energy to carry out the proper driving function, while transmitting the required movements more smoothly to the knitting tools.

The driving mechanism according to the present invention consists of a combination of two quadruple linkages which are connected to each other in such a manner that both linkages have a common central rocking lever which is pivotably mounted in a fixed position. These two interconnected linkages are designed so that one of the quadruple linkages operates as a crank drive, while the other quadruple linkage which only carries

out rocking movements transmits the driving power for the knitting tools at the articulated joint between the connecting rod and the fixedly mounted rocking lever of this linkage. The two rocking levers of the two quadruple linkages are preferably made of such dimensions and are mounted in such positions above or laterally of the drive shaft, and preferably at opposite sides thereof, that, when the driving crank is at least in one of its dead-center positions, these rocking levers will extend in opposite directions or inwardly toward each other, while the driving power for the knitting tools is transmitted from a point between the two pivots of the rocking levers. The articulated joints between the two rocking levers and the connecting rod will then be at different sides of their respective fixed bearings when the driving crank is in one of its dead-center positions. The two rocking levers may, however, also be of such dimensions and be mounted in such positions that both of them will extend outwardly from their fixed bearings in all positions of their movements.

The present invention permits the necessary driving movements of all the knitting tools of the machine, that is, of the presser bar, the sinker, the carrying guide, and also of the eye needle, to be carried out by means of a single drive shaft. The movements of the knitting tools which are attainable by the present invention by means of a very small number of links and joints are identitcal with those attainable by means of cams, and the number of freely suspended components of the driving mechanism has been reduced to a minimum so as to attain the most favorable dynamic conditions.

The present invention provides a drive mechanism for operating the usual knitting tools such as those indicated in the patent to Zwingenberger 2,686,409. The usual tools include a spring beard needle which is oscillated upwardly and downwardly, a sinker which is moved in substantially a horizontal plane backwardly and forwardly, a pair of eye needles which are rocked backwardly and forwardly to move through the location of the spring beard needles and a presser plate which is moved downwardly to compress the beard of the needle. The invention is concerned with a basic driving mechanism for operating any one of these knitting tools, and the tools function in the same manner as is well known in the prior art, as shown in the patent to Zwingenberger.

Further objects, features, and advantages of the present invention will appear from the following detailed description, thereof, particularly when read with reference to the accompanying drawings, in which—

Figure 1 shows diagrammatically the linkage mechanism according to the invention for driving the presser bar of a warp knitting machine;

Figure 2 shows diagrammatically the linkage mechanism for driving the sinker of such a machine; while

Figure 3 shows the constructive details of a linkage mechanism similar to that as illustrated in Figure 1.

Referring to the drawings, Figure 1 diagrammatically shows a general view of the driving mechanism according to the invention for operaing the presser bar of a warp knitting machine. This driving mechanism is submerged within an oil-filled housing **13** and comprises a drive shaft **14** which is rotatably mounted in housing **13** and a crank **15** which is rigidly but adjustably secured to drive shaft **14** and terminates at its outer end in a crankpin **16**. A connecting rod **17** is rotatably mounted at one end on crankpin **16** and pivotably connected at the other end by an articulated joint **18**, on the one hand, to a rocking lever **19** which is pivotably mounted in a fixed position at **20** in housing **13**, and, on the other hand, to a connecting rod **21**. This connecting rod **21** is, in turn, pivotably connected by an articulated joint **22** to a rocking lever **23**, which is pivotably mounted in a fixed posi-

tion at 24 in housing 13, and also to a connecting rod 25. Thus, we have a combination of two quadruple linkages 14, 16, 18, 20 and 20, 18, 22, 24. The first quadruple linkage operates as a crank assembly, and both quadruple linkages have a common rocking lever 19. Connecting rod 25 serves as a driving rod and is pivotably connected by an articulated joint 26 to a rocker 27 which is pivotably mounted at 28 on a stationary machine part to operate the presser bar 29. Figure 1 also illustrates the curved path 30 described by the presser bar 29 in accordance with the angle of rotation of drive shaft 14.

The combination of two quadruple linkages according to the invention results in a very advantageous and compact construction which only requires a small number of links and joints and operates very smoothly and reliably. This is especially due to the particular manner of mounting the two rocking levers 19 and 23 with relation to the drive shaft 14 and to the particular dimensions of these rocking levers and of the two connecting rods 17 and 21. As indicated in Figure 1, the two rocking levers 19 and 23 are preferably mounted and designed so as to be located at opposite sides of their stationary bearings 20 and 24 and to extend inwardly when the driving crank 15 is in its upper dead-center position, while in the lower dead-center position of crank 15 both rocking levers 19 and 23 extend downwardly and are located at the same side of bearings 20 and 24. The different stages of movement of crankpin 16 and the corresponding stages of joints 18 and 22 are indicated by points 1 to 12.

Figure 2 shows the linkage mechanism for driving the sinker of the knitting machine. Although in this embodiment of the invention the desired movement is likewise attained by a combination of two quadruple linkages, the positions of rocking levers 19′ and 23′ and of bearings 20′ and 24′ of these levers differ from those illustrated in Figure 1 in that both rocking levers 19′ and 23′ extend outwardly from bearings 20′ and 24′. The driving rod 25 is also in this case actuated directly by the articulated joint 22. The path of movement of sinker 31 in accordance with the angle of rotation of drive shaft 14 is indicated by the curve 32. After the driving rod 25 has again moved downwardly by a certain extent of its stroke, the idling position will extend in a perfectly straight line. Such a movement is required for a proper operation of the sinker and it is attained in a very simple manner by means of a linkage system similar to that as illustrated in Figure 1 and by making the rocking levers 19′ and 23′ of suitable dimensions and by mounting them in suitable positions. During a part of its movement at the joint 18, connecting rod 21 describes almost the same arc as that described by rocking lever 19′ and then covers an area as indicated in Figure 2. During the movement of rocking lever 19′ within this area, the other rocking lever 23′ will remain almost stationary.

Figure 3 illustrates the linkage system according to Figure 1 as applied in actual practice for driving the presser arm 29. The knitting tools of the illustrated machine consist essentially of knock-over bits or sinker plates, such as the one shown at 31, a set of spring-beard needles, one of which is shown at 34, a pair of eye needles 35 and 36 for each beard needle, and the mentioned presser or presser bar 29 for periodically closing the spring beards during the loop-forming operation. It will be understood that, as conventional in such machines, a large number of spring-beard needles 34, sinker plates 31, and eye needles 35 and 36 are arranged in respective rows which extend longitudinally of the machine, that is, perpendicularly to the plane of illustration in Figure 3.

A drive shaft 14 is rotatably mounted in a fixed position in the oil-filled gear housing 13 and, through an eccentric ring 33 which takes the place of crank 15 in Figure 1, it acts upon a connecting rod 17 which is connected by a pivot pin 18 to a rocking lever 19 which is rotatably mounted in a fixed position at 20.

The second quadruple linkage is formed by the same rocking lever 19 and by a connecting rod 21 which is connected by a pivot pin 22 to the rocking lever 23 which, in turn, is rotatably mounted in a fixed position at 24. Pivot pin 22 also serves as the connection of a driving rod 25, the other end of which is connected by a pivot pin 26 to a rocker 27 which is capable of reciprocating about a pivot 28 on a stationary part of the machine.

Similarly as illustrated in Figure 1, the two stationary pivots 20 and 24 of rocking levers 19 and 23 are preferably mounted so as to be disposed above and at opposite sides of drive shaft 14. Levers 19 and 23 and connecting bars 17 and 21 should be made of a length so that, when the driving crank or eccentric 33 is in its upper dead-center position, the two levers will be on different sides of pivots 20 and 24 and both will be directed inwardly. However, the particular location of pivots 20 and 24 may also be varied and they may also be disposed above the drive shaft 14 or laterally thereof, as illustrated, for example, in Figure 2. The essential feature of the driving mechanism according to the invention therefore consists in the combination of two quadruple linkages which are interconnected by a rocking lever which is common to both linkages, and in the fact that the driving power is transmitted by the articulated joint 22 which connects the connecting rod 21 with the rocking lever 23 which is pivotable about a stationary bearing.

Although our invention has been illustrated and described with reference to the preferred embodiments thereof, we wish to have it understood that it is in no way limited to the details of such embodiments, but is capable of numerous modifications within the scope of the appended claims.

Having thus fully disclosed our invention, what we claim is:

1. In a warp knitting machine having knitting tools adapted to move in proper sequence to perform the usual knitting operations, the improvement comprising a drive mechanism for said knitting tools including a single drive shaft, crank means connected to said drive shaft, first and second rocking levers, fixed bearing means pivotally mounting each of said first and second levers, a first connecting rod pivoted to and connecting said first and second rocking levers, a second connecting rod connected to said crank means and to said first rocking lever at the pivotal connection of said first rocking lever and said first connecting rod, and means for transmitting driving power to at least one of said knitting tools, said means being connected at the pivotal location of the joint between said first connecting rod and said second rocking lever.

2. In a warp knitting machine, the improvement as defined in claim 1 wherein said bearing means for the first and second rocking levers are spaced apart and positioned above said drive shaft, and at least one of said bearing means is located to one side of said drive shaft.

3. In a warp knitting machine, the improvement as defined in claim 1 wherein said bearing means for the first rocking lever is located above and to one side of said drive shaft and said bearing means for the second rocking lever is located above and to the opposite side of said drive shaft.

4. In a warp knitting machine, the improvement as defined in claim 1, wherein said first and second rocking levers are disposed above and laterally of said drive shaft, have such dimensions and are mounted in such positions that, when said driving crank is in at least one dead-center position, said levers will extend in opposite directions to each other relative to their associated bearing means, said power transmitting means being connected at the pivotal location of the joint between said first connecting rod and said second rocking lever.

5. In a warp knitting machine, the improvement as defined in claim 1, wherein said bearing means for

said first and second rocking levers are disposed above and at both sides of said drive shaft.

6. In a warp knitting machine, the improvement as defined in claim 1, wherein said first and second rocking levers have such dimensions and are mounted in such positions that, when said driving crank is in one dead-center position, the articulated joints at the pivotal connections between each of said levers and said first connecting rod will be disposed at different sides of the respective bearing means, while in the other dead-center position of said driving crank said joints will be disposed at sides of the respective bearing means.

7. In a warp knitting machine, the improvement as defined in claim 1, wherein said two rocking levers have such dimensions and are mounted in such positions that both levers will be directed outwardly in opposite directions from their respective bearing means in all positions of said levers.

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