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CAMSHAFT OPERATED KNITTING MACHINE

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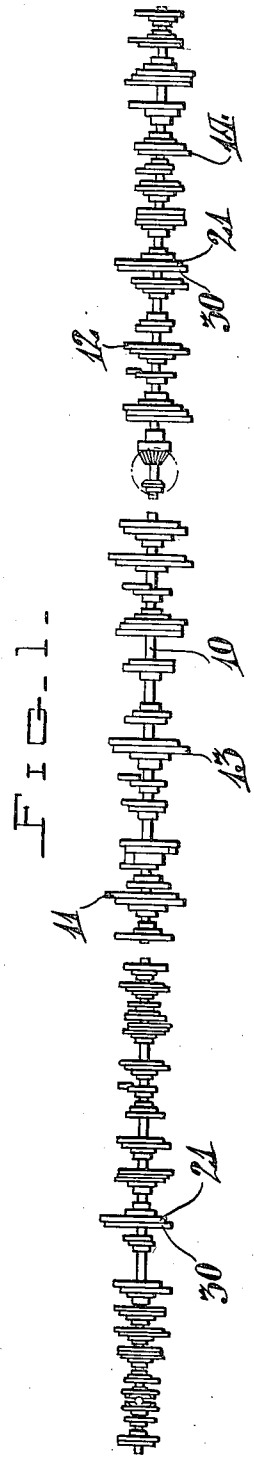


FIG. 1.

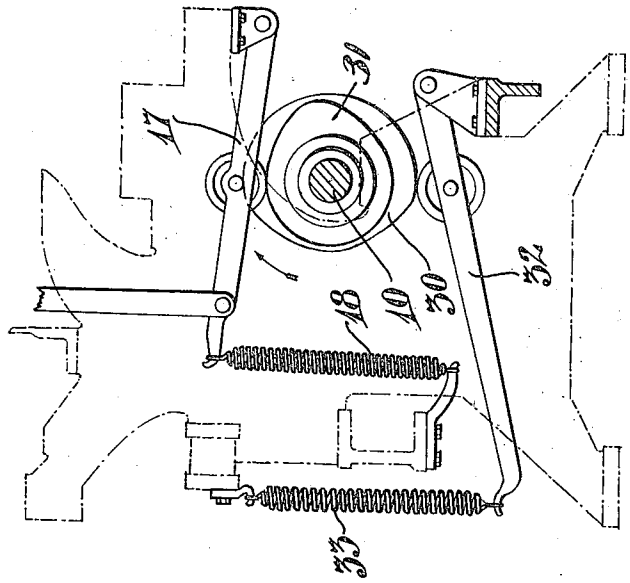


FIG. 3.

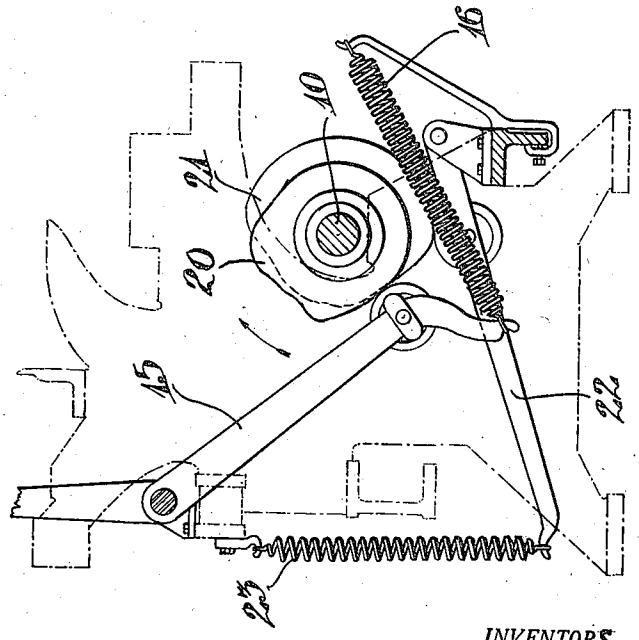


FIG. 2.

INVENTORS.
Christian F. Meyer
and Melchior Zwicky.
BY
ATTORNEYS.

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CAMSHAFT-OPERATED KNITTING MACHINE

Christian F. Meyer, Wyomissing, and Melchior Zwicky, Berkshire Heights, Pa., assignors to Textile Machine Works, Wyomissing, Pa., a corporation of Pennsylvania

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7 Claims. (Cl. 66—82)

This invention relates particularly to camshaft operated knitting machines of the full-fashioned type, though applicable to like machines in which a plurality of mechanisms of varying loads are moved at different times in the cycle of operations with resulting variation of the torque upon the shaft.

One object of the invention is to provide for substantially equalizing the torque throughout the cyclic operation of the mechanisms, and for substantially preventing variation in the speed of the cam shaft during its rotation and the essential characteristic thereof being the provision of compensating means cooperatively arranged in relation to the unequal-load mechanisms so as to effect such equalizing, such compensating means desirably including the provision of special balancing cams by which a variable load is placed upon the cam shaft to equalize the torque thereon under different load conditions, all as hereinafter fully described in connection with the accompanying drawing illustrating practical application thereof, and clearly defined in the claims.

In the drawing:

Figure 1 illustrates the cam shaft of a full fashioned knitting machine which has a plurality of knitting and narrowing cams for the various sections of the machine and is provided with compensating devices according to the invention.

Figures 2 and 3 are vertical sectional views of a full fashioned knitting machine respectively illustrating compensating devices for the knitting and narrowing cams in accordance with the invention.

In a full-fashioned knitting machine, it is necessary to operate the various parts in a determined sequence. Therefore, the cams for operating these parts are arranged on the cam shaft so that each operates at the proper time in a cycle of operations and, inasmuch as it is impractical to operate the parts at equal intervals in a cycle, the operating periods of the cams are unevenly distributed about the cam shaft. As a result of the essential arrangement of the numerous cams, the cam shaft is statically unbalanced and tends, when the driving power is cut off, to turn to a position of rest. Further, many of the mechanisms are usually operated from the cam shaft through levers maintained in cooperative relation to the cams by springs which, on cutting off the driving power, tend to cause improper movement of the cam shaft, with consequent liability of damaging the machine parts and ruining the fabric.

The loads acted upon by the various cams are unequal, since the load acted upon by a particular cam may be greater or less than that acted upon by other cams, because of the varying masses of different parts of the machine. Hence, the work required of the usual motor for driving the cam shaft varies in a cycle of operations and, as a result, there is also a condition of dynamic unbalance because of the unequal torque which the motor must apply to the cam shaft at various times in a cycle of operations.

Referring to Figures 1 to 3, a usual cam shaft 10 of a full fashioned knitting machine is provided with a plurality of cams for each section of the machine, certain of the cams, such as 11, 12 being "knitting" cams and others, such as 13, 14, being "narrowing" cams, the latter becoming operative on axial shifting of shaft 10 in conventional manner.

As mentioned above, most of the cams act through lever mechanisms to operate the corresponding parts of the machine. For example, in Figure 2 there is shown a lever 15 adapted to be held in contact with the related cam by a spring 16 and operable by the cam to actuate the catch bar mechanism of the knitting machine. In Figure 3 the lever 17, biased by spring 18 is operable by its cam to lower and raise the usual narrowing points.

As may be seen from Fig. 1, the cams are cyclically arranged on shaft 10 to operate at various times in a cycle of operations. In order to effect a substantial static and dynamic balance of the knitting cams we determine the composite contour of all the knitting cams, here indicated at 20, for a certain portion of the machine and then provide for said portion a counteracting cam 21 having a contour substantially inverse to that of such determined composite knitting cam. As indicated, cam 21 is arranged on shaft 10 to act upon a lever 22 to which a counteracting force is applied by a spring 23. The arrangement is such that, as cam shaft 10 is rotated and each cam operates upon the related mechanism, the spring 23 acts through lever 22 on cam 21 to apply more or less force for maintaining a substantially equalized torque on shaft 10. At times, a portion of the available counteracting force of spring 23 may be applied through lever 22 to assist the driving motor for shaft 10 to carry the load of operating mechanisms of relatively large mass, thus making it possible to utilize a motor of smaller size than would otherwise be necessary to insure application of sufficient torque for operation of the heaviest load in a cycle of opera-

tions. In like manner, a counteracting cam 30 is provided having a contour which is a substantial inverse composite of the contours of the narrowing cams, the latter being indicated at 31. The counteracting cam 30 for the narrowing cams is arranged for cooperation with a lever 32, to which counteracting force is applied by a spring 33, when cam shaft 10 is shifted axially as usual for narrowing operations.

While the invention has been shown and described as embodied in a cam especially provided for the purposes indicated, this is not intended to be construed as a limitation of the invention.

It is to be noted that in either arrangement described above the unequal operating loads at various points in a cycle of operation of the cam shaft are compensated for by the application of a counteracting force which thus effects an equalization of the torque on the shaft and also that, when the cam shaft is at rest, the counteracting forces act to hold the shaft against improper movement due to the uneven distribution of the operating cams thereby effecting a static balance.

It is also to be noted that in all said arrangements the cam action controlled torque equalizing means employed to counteract the loads of the several mechanisms act to equalize the torque on the main cam shaft, and substantially without vibration, shock, jar, binding or other detrimental hindrance, thereby maintaining the rotational speed of the cam shaft practically constant and uniform under varying loads and enabling the machine to function with smoothness and exactitude.

What we claim is:

1. In a full fashioned knitting machine, a cam shaft, a plurality of cams thereon, cam-actuated levers having unequal operating loads unevenly distributed cyclically of said shaft, a compensating cam having an effective contour substantially inverse to the composite contour of the other cams on said shaft, and a lever for said compensating cam having a load acting thereon to balance said cam shaft throughout substantially its entire operating cycle, said compensating cam and lever being arranged for operation independently of the loads tending to unbalance the cam shaft.

2. In a full fashioned knitting machine; a cam shaft; two selectively operative sets of cams thereon, said cams being unevenly distributed cyclically of said shaft; cam-actuated levers having unequal operating loads; a plurality of compensating cams, one for each set of operating cams and having an effective contour substantially inverse to the composite contour of the respective set of operating cams; and cooperating compensating levers operable independently of said first named cam-actuated levers and having operating loads disposed cyclically of said shaft to uninterruptedly dynamically balance the related operative cams and levers together with the mass of the inoperative cams and to statically balance all of the cams and levers operable by said shaft.

3. In a full fashioned knitting machine having a shiftable cam shaft, knitting cams, narrowing cams operative on shifting of said shaft, and cam actuated levers; a compensating cam having an effective contour substantially inverse to the composite contour of said knitting cams; and a compensating lever operable independently of said knitting cams having an operating load acting on said compensating cam to uninterruptedly dynamically balance said knitting cams and levers together with the mass of said narrowing cams and to statically balance both said knitting and narrowing cams and levers.

4. A full fashioned knitting machine comprising a cam shaft, a plurality of knitting cams thereon having operating periods unequally distributed cyclically of said shaft, a plurality of sets of operating devices having load mechanisms respectively applicable to the knitting cams, and mechanical torque equalizing means acting on said cam shaft during successive operations of said load mechanisms, said means comprising a compensating cam and a load device therefor, said cam having a contour such that it coacts with said load device and compensates for the combined loads normally imposed on the cam shaft by the knitting mechanisms in a manner to dynamically balance the cam shaft throughout substantially the entire knitting cycle.

5. A full fashioned knitting machine comprising a cam shaft, a plurality of knitting cams thereon having operating periods unequally distributed cyclically of said shaft, a plurality of sets of operating devices having load mechanisms respectively applicable to the knitting cams, and mechanical torque equalizing means acting on said cam shaft during successive operations of said load mechanisms, said means comprising a compensating cam and a lever operatively associated therewith for applying a load thereto, said cam having a contour such that it coacts with said lever and compensates for the combined loads normally imposed on the cam shaft by the knitting mechanisms in a manner to dynamically balance the cam shaft throughout substantially the entire knitting cycle.

6. A straight knitting machine comprising a shaft, a multiplicity of cams on the shaft, and followers for the cams, one of the cams being disposed on the shaft in predetermined cyclic relation to the positions of a plurality of the other cams on the shaft, and a follower of said one cam reacting thereagainst with a force corresponding to the composite magnitudes of the forces of followers against the other cams of said plurality, and in a direction opposite to said forces of followers, to compensate for a cyclic unbalancing effect on the shaft by the other cams and followers.

7. In a straight knitting machine, the combination with a shaft, and mechanism for actuation by the shaft including a plurality of work cams on the shaft, and followers for the cams, of means for compensating for a cyclic unbalancing effect of said mechanism on the shaft comprising a plurality of cams each having a contour constituting substantially the inverse composite of the contours of a plurality of the work cams, and followers for the compensating cams.

CHRISTIAN F. MEYER.
MELCHIOR ZWICKY.