Nov. 6, 1923. 1,473,094

W. J. HAWKER

LACE MACHINE

Filed Jan. 2, 1923 2 Sheets-Sheet 1

Fig. 1.

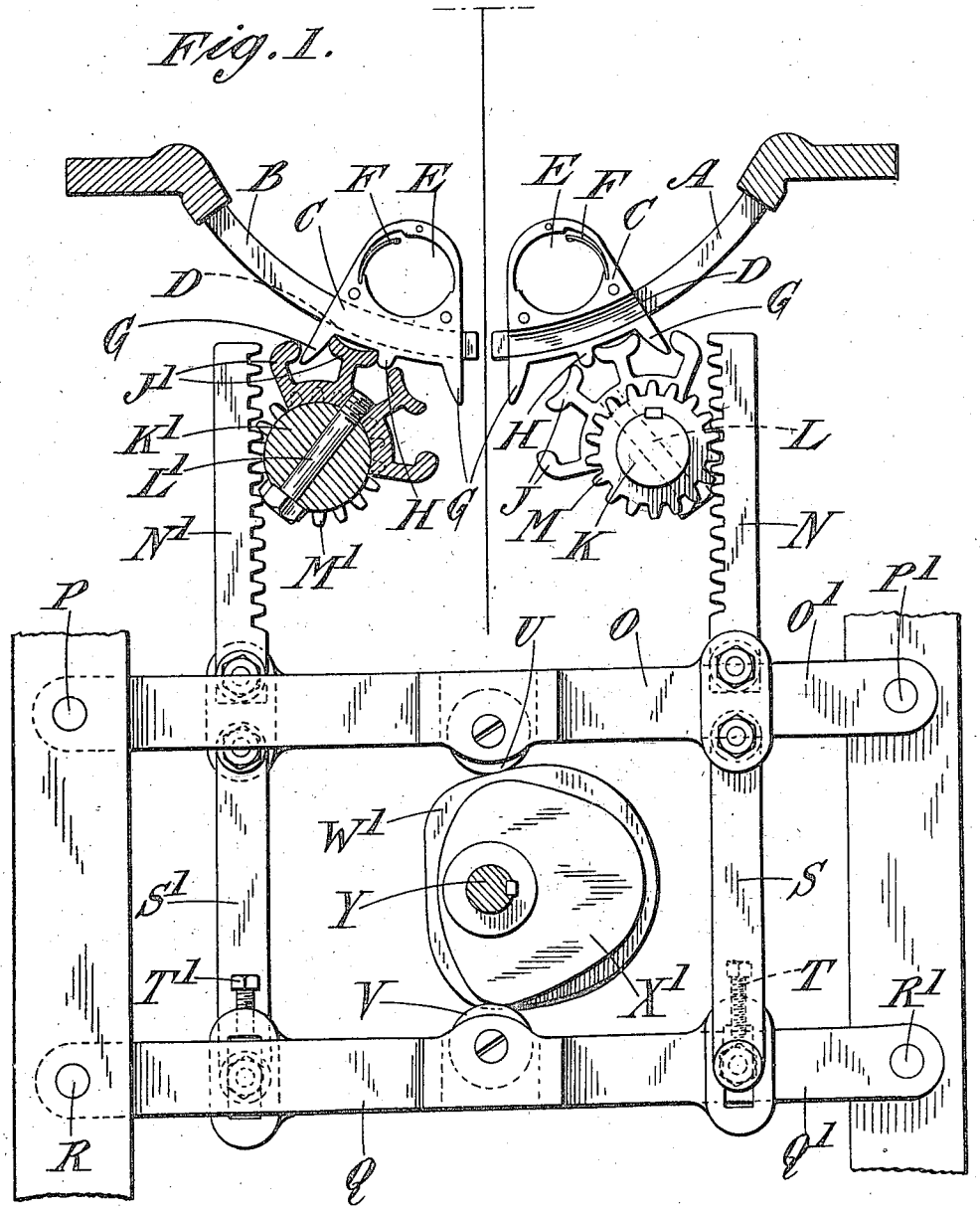

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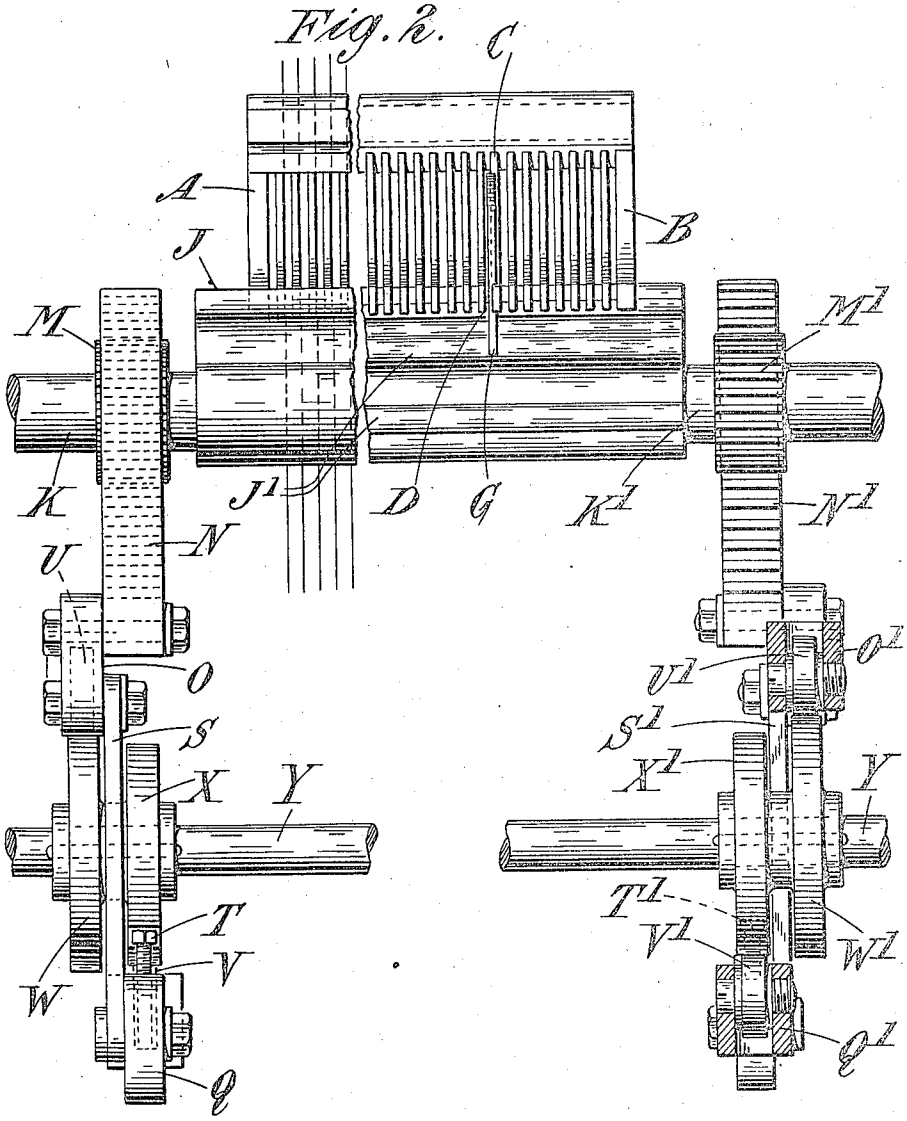
Fig. 2.



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Patented Nov. 6, 1923. 1,473,094

UNITED STATES PATENT OFFICE.

WILLIAM JOHN HAWKER, OF CHARD, ENGLAND, ASSIGNOR TO GIFFORD FOX & COMPANY LIMITED, OF CHARD, SOMERSET, ENGLAND, A COMPANY OF GREAT BRITAIN.

LACE MACHINE.

Application filed January 2, 1923. Serial No. 610,255.

To all whom it may concern:

Be it known that I, WILLIAM JOHN HAWKER, subject of the King of England, and residing at Chard, Somerset, in England, have invented certain new and useful Improvements in Lace Machines, of which the following is a specification.

This invention relates to lace machines and has for its object to provide an improved form of bobbin carriage and operating mechanism therefor.

Hitherto bobbin carriages for plain net lace machines have been formed with a downwardly directed toe at either end, and these carriages have been moved through the combs by means of driver bars and fetcher bars, each operated by a separate cam shaft and respectively engaging the outer and inner faces of the toes.

Alternatively, the carriages have been provided with a series of teeth operated by roller lockers or grooved rollers rotatably mounted in geared cradles rocked by means of cranks. With such an arrangement the carriages were moved at a constant speed, as the teeth are always in mesh with the grooved rollers whereas the driver and fetcher bars only engage the two-toed carriage intermittently, the required retardation or acceleration being thus imparted to the carriages.

According to this invention the carriage is not only given the required acceleration and retardation but further it is positively actuated throughout its travel and at the same time the actuating mechanism is simplified. To this end, a third toe is provided centrally between the toes at either end of the carriage, and two oscillating locker members, actuated from a single cam shaft and provided with approximately T shaped or undercut teeth or ribs engage the toes on the carriages in such a manner that one or more toes on each carriage are always in engagement with one or other of the locker members. By the employment of a three-toed carriage difficulties which otherwise arise with the "turn again" are avoided.

Preferably the central toe of each carriage is shorter than the toes at either end and the necessary oscillating movement is imparted to the locker members by means of racks actuated through suitable links and lever mechanism from the common cam shaft.

One construction of carriage and actuating mechanism therefor is shown somewhat diagrammatically in the accompanying drawings, in which

Figure 1 is an end view from the left of the machine one pair of cams being removed for the sake of clearness, and

Figure 2 is a front elevation, the right hand side being shown in section.

In the drawings the front and rear sets of comb bars, A and B respectively, are arranged in the usual manner, a small space being left between their ends, within which the warp threads may be reciprocated. The bobbin carriages C, of which only one is shown in Figure 2 of the drawings, each have a recess D in one face which slides over the comb bars, and they carry the bobbins in holes E provided with a spring clip F. Each bobbin carriage C has two lateral toes G G and one shorter central toe H, which are adapted to be engaged by approximately T shaped teeth or ribs J J′ on the locker members K K′. The exact shape of these teeth or ribs J J′ may be varied as may be required, the form shown in the drawings being designed to reduce weight as far as possible. The rear locker member K′ is shown in section in Figure 1 to illustrate a convenient method of securing the ribs J or J′ to the member K or K′ by means of bolts L or L′ respectively.

The shaft of the front locker member K carries a pinion M at the left hand end of the machine, and that of the rear member K′ a pinion M′ at the right-hand end of the machine. This pinion M′ is driven by a rack N′ which is mounted at or near one end of a lever O′ pivoted at a suitable point P′ to the frame of the machine. Another lever Q′ is pivoted at R′ to the frame and the two levers O′ Q′ are connected together at their free ends by a link S′ in such a manner as to remain substantially parallel to one another. An adjusting screw T′ or the like is provided by means of which the effective length of the link S′ may be varied. The levers O′ and Q′ carry rollers U′ and V′ respectively which engage with the surfaces of cams W′ and X′ keyed to a driving shaft Y.

The driving mechanism for the pinion M and the front locker member K is precisely similar to that just described. This mechanism comprises a pair of parallel levers O and Q pivoted at P and R to the frame of the machine and connected by an adjustable link S, a rack N mounted on the lever O and engaging with the pinion M, and rollers U and V engaging the surfaces of cams W, X keyed to the same driving shaft Y the cams X and W being removed in Figure 1 for the sake of clearness. These cams W, X are similar to the cams W′ and X′. The distance between the pivot P and the point of connection between the rack N and the lever O is exactly the same as the corresponding distance in the driving mechanism for the pinion M′ at the other end of the machine. The cams W and W′ which engage with the upper rollers U and U′ are similar to one another but are oppositely disposed with reference to the shaft Y. These cams are so shaped that the required acceleration and retardation is produced in the motion of the carriages. The cams X and X′ are provided to ensure that the rollers are always in engagement with the cams, a permanent positive drive on the racks thus being effected.

It will be apparent that as the driving shaft Y rotates, say in a clockwise direction in Figure 1, the levers O′ Q′ will be raised and the levers O Q lowered. This movement will be imparted to the racks N N′ and the pinions M M′ and their locker members K K′ will both rotate at the same speed in a clockwise direction, the teeth J J′ driving the bobbin carriages C through the comb bars A and B towards the right in Figure 1. After a short time the rollers U U′ will reach their highest positions on the cams W W′, after which the motion will be reversed and the bobbin carriages moved back towards the left. Further rotation of the shaft Y brings the rollers U U′ into their lowest positions and the motion is again reversed. Thus continuous rotation of the shaft Y causes the racks N N′ to reciprocate and thus the teeth J J′ on the locker members K K′ drive the carriages C backwards and forwards through the comb bars A and B.

The invention is not restricted to any definite type of operating mechanism and the mechanism shown and described may be varied within wide limits. Other variations in the construction and arrangement of parts of the machine may also be made without departing from the spirit of the invention.

What I claim as my invention and desire to secure by Letters Patent is:—

1. A lace machine including in combination two sets of comb bars projecting inwardly towards one another, means for reciprocating the warp threads in the space between the adjacent inner ends of the comb bars, a bobbin carriage adapted to slide on the comb bars through the warp threads, three downwardly projecting toes on the bobbin carriage, two oscillating locker members having undercut teeth which engage the toes of the bobbin carriage throughout its travel across the comb bars, and means for oscillating the locker members as set forth.

2. A lace machine including in combination two sets of comb bars projecting inwardly towards one another, means for reciprocating the warp threads in the space between the adjacent inner ends of the comb bars, bobbin carriages adapted to slide on the comb bars through the warp threads, three downwardly projecting toes on each bobbin carriage the central toe being shorter than the other toes, two oscillating locker members having approximately T shaped teeth which engage the toes of the bobbin carriages throughout their travel across the comb bars, and means for oscillating the locker members as set forth.

3. A lace machine including in combination two sets of comb bars projecting inwardly towards one another, means for reciprocating the warp threads in the space between the adjacent inner ends of the comb bars, a bobbin carriage adapted to slide on the comb bars through the warp threads, three downwardly projecting toes on the bobbin carriage, two oscillating locker members having under-cut teeth which engage the toes of the bobbin carriage throughout its travel across the comb bars, a single driven cam shaft, and means for transmitting the drive from the cam shaft to the locker members as set forth.

4. A lace machine including in combination two sets of comb bars projecting inwardly towards one another, means for reciprocating the warp threads in the space between the adjacent inner ends of the comb bars, bobbin carriages adapted to slide on the comb bars through the warp threads, three downwardly projecting toes on each bobbin carriage the central toe being shorter than the other toes, two oscillating locker members having approximately T shaped teeth which engage the toes of the bobbin carriages throughout their travel across the comb bars, a pinion mounted on each locker member, a rack engaging with each pinion, a single cam shaft, and means for transmitting the drive from the cam shaft to the racks whereby the locker members are oscillated as set forth.

5. A lace machine including in combination two sets of comb bars projecting inwardly towards one another, means for reciprocating the warp threads in the space between the adjacent inner ends of the comb bars, bobbin carriages adapted to slide on

the comb bars through the warp threads, three downwardly projecting toes on each bobbin carriage, two oscillating locker members having undercut teeth which engage the toes of the bobbin carriages throughout their travel across the comb bars, a pinion mounted on each locker member, a rack engaging each pinion, a parallel lever system connected to each rack, a single driven shaft, cams mounted on this shaft, and rollers mounted on the lever systems and engaging the surfaces of the cams as set forth.

In testimony whereof I have signed my name to this specification.

WILLIAM JOHN HAWKER.