This invention relates to braiding machines and the like, and more especially to machines of this kind which operate at high speed and in which the braider bobbins or lacers are kept fixed at the driver plates during a part of the whole of the range of wave-shaped motion of the rollers provided upon upper transverse arms of the carrier for the bobbins or lacers, said rollers engaging from the rear with fixed cam-discs mounted on the pillars for said driver plates.

In case machines of this aforementioned kind are provided only with a single curved guide-track to bring about the aforementioned motion, smooth transit of the braider bobbins or lacers, that is transit without shocks, from one to another driver plate can only be brought about either by means of switches or similar guide-tracks arranged in tangential directions to said former or main track in conjunction with heart-shaped switch members, shuttles or the like, or also by means of a series of guide plates for the one group of braider bobbins or lacers, for instance, the group of bobbins or lacers which rotate in counter-clockwise sense, said series of guide-plates surrounding the driver plates completely and overlapping each other at their pointed ends, while only the other group, for instance the group of bobbins or lacers which rotates in clockwise sense, is being kept in position within semi-circular recesses on the driver plates by means of the above mentioned guide tracks which are of bell-shaped configuration and by rollers mounted on said transverse arms for the carrier for said bobbins or lacers.

These switches, and guide tracks, guide plates or the like may be dispensed with, if two cam-discs are mounted on each pillar for the driver plates, and more particularly, if said cam-discs comprise separate series of cams or guide tracks, one series serving to control the group of bobbins or lacers which rotate in counter-clockwise sense and another series of cams or guide-tracks serving to control the group of braider bobbins or lacers which rotate in clockwise sense. In this case, however the transit of said bobbins or lacers from one driver plate to the other will not yet be immediately free of shocks which is due to the fact that the pointed ends of the cam-discs cannot be made to sufficiently overlap each other to fully smoothen the entrance of a bobbin or lacer carrier into the respective guide-track and the change of its direction of motion.

In order to avoid the difficulties encountered in practice in connection with high-speed braiding machines and the like, especially during transit of the bobbins or lacers from the one to the other driver plate, my present invention provides a number of novel arrangements and contrivances to reliably bring about a smooth transit, that is a transit without shocks and oscillations, of the braider bobbins or lacers from the one to the other driver plate.

The technical progress attained by my present invention consists essentially therein that, owing to said novel contrivances and their mode of operation, each of the two groups of bobbins or lacers which rotate in opposite sense along a wave-shaped path about the center of the machine will be transferred without shocks in a kinematically exact manner by rolling motion along specifically formed guide surfaces or cams mounted on the driver plates. By my invention, therefore, special guide plates, switches, heart-shaped guide members or the like which had ordinarily been used in machines of the present kind may be dispensed with, and in addition to this, during transit of the braider bobbins or lacers from one to another driver plate a proper mechanical impulse will be given to said bobbins or lacers by resilient auxiliaries in conjunction with notches and oblique guide surfaces on parts of the bobbins or lacers, said mechanical impulse serving to essentially expedite entrance of said bobbins or lacers into the respective guide-track. By my invention straight guide-tracks in tangential direction to the main guide-track are dispensed with during transfer of the bobbins or lacers and their carriers from one to the other driver plate and the mode of positive-
ly guiding and suspending the bobbins or lacers on said driver plates by the intermediary of a resilient member will have the effect that the several bearing surfaces at which the carrier for the bobbins or lacers is permanently and tightly surrounded semi-circularly by properly shaped beds or recesses in the driver plates will essentially serve to secure the bobbins or lacers against tilting around their horizontal axis. An overlapping arrangement of the circularly concentrical parts of the cam or guide surfaces which would be contrary to free release of the bobbin or lacer carrier from its suspension on the driver plate will not be necessary in the present case, as the pointed ends of these cams or guide surfaces need only be bent towards the outside for the purpose of facilitating smooth and shockless entrance of the bobbin or lacer carriers into the guide-track. Also, the cams or guide-tracks for either group of bobbins or lacers carried along a serpentine path in opposite directions of motion may be mounted at the required distance from each other between the driver plates, thus permitting in the first place free passage of said carriers without endangering the smoothness of operation of the machine, and in the second place, any desired extension of said carrier towards below for the purpose of providing facilities for mounting the aforementioned several bearing surfaces.

In the accompanying drawings which form part of this specification I have represented an example of the new machine constructed according to my present invention. In the drawings, Fig. 1 is a perspective view of one of the eight driver plates for the lacers as seen from the top of Fig. 4, Fig. 2 a perspective view of a carrier which in operating condition of the machine carries a bobbin or lacer, Fig. 3 an elevation, partly in section, of said carrier, Fig. 4 a longitudinal section through two adjacent driver plates with the intermediate bobbin or lacer carriers therebetween in view, Fig. 5 is a transverse section through Fig. 4 as seen from the top along line VIII—VIII, Fig. 6 a transverse section through Fig. 4 along line IX—IX, Fig. 7 a longitudinal section through the hook 56 forming part of Figs. 2, 3, 4 and 5, and Fig. 8 a top-view of the cam-discs which are fixed to the upper ends of the pillars for the bobbins or lacers, four under cam-discs (11) and four upper cam-discs (10) being shown.

Referring now more particularly to the drawings, the sleeves 15 and 15' are rotably mounted upon the respective pillars 6 and 6' which are fixed on the base plate 1 as shown in Figs. 4, 5 and 6, said sleeves resting by means of their under collars 16 and 16' on ball bearings 9 and 9', respectively. Mounted on the sleeves 15 and 15' are the usual driving gears 18, 18', 20, 20' and 27, 27', the driver plates 18', 20, 20' and 27, 27' which overlap each other in steps, and the four-armed star-shaped intermediary cams 26 and 26'. The pillars 6 and 6' carry at the upper end thereof cam-discs 11, 11' and 10, 10' which are kept in proper relative position with respect to each other by means of the square heads 8 and 8' and nuts 22 and 22' as shown in Fig. 5. Intermediate the two driver plates and the cams 23 and 23' the carrier for the bobbins or lacers is mounted rotatably on a number of bearing surfaces 50, 52, 54 and 63 in semi-circular beds or recesses on said driver plates. The carrier for the bobbins or lacers is contacting by means of the foot-plate 51 in axial direction with the driver plates 20 and 20'. The transverse arm 55 as shown in Fig. 2 is equipped with two hook-shaped extensions 56 and 56' which in the position shown in Fig. 5 engage with the fixed cams 23 and 23' fast on the driver plates 20 and 20'. At the upper end the carrier is provided with the transverse arm 64 with rollers 14 thereon, which for one of the groups of bobbins or lacers which rotate in the same sense engage with the inner edge 70 of the guide-track of the upper cam 19 and 19' from the rear thereof. A like transverse arm which, however, is equipped with downwardly directed rollers forms part of the oppositely rotating group of bobbins or lacers, the rollers being guided in this case by the under cams 11 and 11'.

The mode of operation of my new machine, and in particular, the kinematic performance during transit of the bobbins or lacers from one driver plate to another will be as follows:

The under part of Fig. 8 is a top-view of the driving mechanism, the upper cams which are covered up by the cams 10' being shown in dotted lines, while the upper part of Fig. 8 shows the under cams for the group of bobbins or lacers which rotate in opposite direction.

The bobbin or lacer k is about to leave the curved track 150 thus passing over into the track 151. The concentrical, partly circular portion of the two tracks 150 and 151 terminates at the line which interconnects the two center-points of the pillars so that the lacer k may be released from the respective driver plate without being impeded by the track 150. The outwardly bent pointed ends 122' and 124 serve to expedite exit and entrance of the lacer from and into the respective portion of the track. In order to attain smooth operation in case of a high-speed machine, this mode of guiding the rollers along the interior guide surface of the cams which in itself is known will not yet be sufficient, especially for the reason that the cams must be arranged to leave
a certain free space underneath and intermediate the driver plates to permit passage of the bobbins or lacers. Switches or guide members on the base plate, or a plurality of rollers, heart-shaped guides or the like on the bobbin or lacer carriers would not constitute an improvement, because such guide means should be properly constructed to permit free release of the carrier from one to another driver plate. For this reason guide means of this kind would be inoperative at the very points of transit of the lacers from one to another driver plate. In this respect an effective remedy is provided by my invention which is based on practical experience with machines of the present kind. I have found it to be absolutely necessary at certain bobbin or lacer speeds to impart to the carrier a definite impulse of motion during transit from one to another driver plate, in addition to guiding said carrier by positive rolling motion along the rear surface of a curved guide-track. This impulse of motion will greatly expedite guiding of the bobbins or lacers into another direction of motion. More particularly, said impulse of motion is imparted to the carrier for the bobbins or lacers according to my invention by means of a cam of sickle-shape or similar conformation as shown in Figs. 1, 4 and 5, said cam being positioned oppositely to semi-circular beds or recesses on the driver plates in conjunction with the hook-shaped members 56 and 56' as well as with the notches 56' shown in Figs. 2, 3 and 7 and the oblique guide surfaces 64 shown in Fig. 7. The bobbin or lacer, when arriving in its position 29 shown in Fig. 8, is about to change its direction of rotation, and the resilient pin 24 shown in Figs. 1, 4, 5 and 7 will be positioned within the notch 56 on the hook-shaped extension 56 as shown in Figs. 2, 3 and 7. The pin 24 as well as the extension 56 are moving at different velocities on the side where the bobbin or lacer is still in condition of engagement with the respective driver plate and about to leave the latter. In consequence of this, the pin 24 is depressed to slide out of the notch and to come in contact with the oblique guide surface 64 on the extension 56, said oblique guide surface at this time overtaking said pin. The relatively strong spring now presses said pin against said surface and thus imparts a mechanical impulse to said extension 56, said impulse counter-acting the inertia and tendency of said extension to retain its former direction of motion, thus effecting a change of direction of motion which is fully resilient and free of shocks. In order to reduce friction, according to my invention the pin may further be provided with a roller at the top. The cam 23 performs its kinematic function partly prior and partly subsequent to the aforementioned motions in conjunction with the operation of the resilient pin in the following manner: As shown in Fig. 5, the two adjacent driver plates are about to transfer one of the bobbin or lacer carriers which had been rotated in clockwise sense around its axis from the right-hand to the left-hand driver plate. Shortly before said carrier has arrived in the position shown the sickle-shaped cams or the like 23 and 23' on the rotating driver plates are positioned, as Fig. 5 shows, somewhat further below, while the inner edge 56 of the hook, commencing at the under edge 50, will slide in upward direction along the inner guide surface of the cam 23. Simultaneously therewith the upwardly directed roller 14 of the lacer carrier, Figs. 2, 3 and 4, will slide onto the inner surface 129, Fig. 8, of the curved track 11 on the left-hand driver plate. Upward sliding of the hook 56 onto the surface 80 and entrance of the roller 14 into the curved track 11 causes the bobbin or lacer carrier to come in engagement with the left-hand driver plate.

Essential features of this mode of cooperation of the several control members consist therein that the cams 23 and 23' are rotating, while the cams 10 and 11 are fixed to the pillars 6 and 6' and that the points of transit between the fixed tracks, for instance between the tracks 150 and 151 in Fig. 8, are bridged by reason of the kinematically correct rolling motion of the hook 56, 56' along the guide-surfaces of the cams 23 and 23' which are of specific conformation. As soon as the bobbin or lacer has just moved beyond its central position and as soon as the bobbin or lacer carrier has been taken over by the left-hand driver plate, the right-hand cam 23' which must move at a speed smaller than that of the extension 56 engages at its upper guide surface 82 with the guide surface 56 of the hook-shaped extension 56', thus moving the latter surface in front of the former, the action of the aforementioned oblique guide surfaces on said extension 56' being thus further supplemented and the bobbin or lacer positively assisted during change of the direction of its motion. During the course of motion subsequent to transit from one to another carrier the bobbin or lacer comes in engagement with the left-hand driver plate by means of the rollers 14 and the hook-shaped extension 56, while the pin 24 remains in the notch on said extension 56 and the carrier is being tilted by action of the resiliency of said pin around a transverse axis with the result of securely forcing the roller 14 into engagement with the curved track 151, Fig. 8, and having the carrier safely retained and gripped by the semi-circular bearing surfaces 50, 52, 54 and 63 on the driver plates. In this manner...
undesirable swinging motions of the bobbin or lacer around a vertical axis will be prevented by the projections 53, Fig. 2, which are embedded in the recesses 217 and 217'. Figs. 1 and 5. At the same time there will be exerted a resilient counter-action against the weight of the entire bobbin or lacer.

Above the transverse arm 53 the carrier is equipped with two rollers 57 and 57', Figs. 2, 3, 4, and 6, either of these rollers being mounted in a member 55 which is resiliently sidable in lateral direction. The slide members 55 are guided within a radial slot of a cylindrical guide member 59, Fig. 2, and further narrow radial slots 62 are provided on the upper part of said guide members, said latter slots serving for reception of stops 60 carried by the slide members 55 to limit motion of the latter.

Intermediate the slide members 55 there is interposed a spring 61 tending to force said members together with the rollers 57 of the guide member 59 in lateral direction. During transfer of a bobbin or lacer carrier from one to another driving plate the rollers 57 will roll along the recessed guide surfaces of the star-shaped members 26 forming part of the adjacent driver plates, thus giving the bobbin or lacer an additional resilient support during transit from one to another driving plate.

I claim:

1. A braiding machine and the like comprising in combination, a plurality of driving members, a bobbin or lacer carrier, a transfer mechanism for driving said bobbin or carrier in succession by one or another of said driving members, a cam on said driving members, an extension on said carrier, and resilient means intermediate said extension and said cam to accelerate said carrier during transit from one to another of said driving members.

2. A braiding machine and the like comprising in combination, a plurality of driving members, a bobbin or lacer carrier adapted to be driven in succession by one or another of said driving members, and mechanism for effecting transit of said carrier from one to another of said driving members, said mechanism including means for accelerating said carrier during transit from one to another of said driving members.

3. A braiding machine and the like comprising in combination, a plurality of driving members, a bobbin or lacer carrier, and mechanism to effect transit of said carrier from one to another of said driving members, said mechanism including a sickle-shaped cam associated with said driving members, an extension on said carrier, said extension being of a shape to cooperate with said cam at a time when said carrier is about to leave said one of said driving members.
said extension which at this time co-operates as an oblique surface with said pins, said impulse of motion being of a direction to counter-act the tendency of said carrier to retain its motion prior to said transit.

8. A machine as specified by claim 6, said machine including notches on the extensions of the carrier, and pins mounted resiliently in vertical direction on the driving members and adapted to co-operate with said extensions, transverse arms provided at the upper part of said carriers, rollers on said transverse arms, said rollers adapted to co-operate with the pair of fixed cams permitting the former to be tightly pressed against the latter.

9. A machine as specified by claim 6, said machine comprising two or more rollers resiliently displaceable in transverse direction to the axis of the carrier, and star-shaped plates associated with the driving members, said star-shaped plates having circular recesses co-operative with said rollers.

In testimony whereof I affix my signature.

JOHANN HEINRICH BORNEMANN.