UNITED STATES PATENT OFFICE

2,588,139

FLYER MECHANISM FOR TOROIDAL COIL WINDING MACHINES


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13 Claims. (Cl. 242—4)

This invention relates to toroidal coil winding machines, and particularly to machines of this type in which the flyer is driven by fluid under pressure.

In these machines, as shown for example in Patents 2,430,105 and 2,430,106 to R. M. Conklin, a flyer, slidably mounted on one lateral face of a positively driven annular shuttle, has driving fins projecting into the paths of air jets directed angularly to the side of the shuttle. Since the flyer necessarily extends over only a minor fraction of the shuttle circumference, only a few of the air jets can be effective in driving the flyer at any one time.

The object of this invention is an improved machine of this general type in which the flyer is driven at the required speed with maximum economy of the driving fluid.

In accordance with the object of the invention, the flyer slides on a track which may be on the shuttle or fixed to the machine in operative relation to the shuttle, but in either case, the fins or pockets are on the outer face of the flyer and the driving jet orifices are disposed around the outer periphery of the shuttle and in the plane of the track. In a machine of this design with suitably shaped pockets on the flyer, the lateral thrust of the flyer on the track is eliminated. Furthermore, the frictional drag on the flyer, due to centrifugal force, is reduced to very low value by shaping the leading edge of the flyer to direct air between the flyer and the track to produce a cushioning effect therebetween. Also, the jets are directed to the pockets through confining passages to minimize leakage and improve the effect of the operation of the flyer.

In one species of the invention, the flyer has a series of equally spaced pockets with central portions positioned in alignment with each other to divide the jets of air in a plane extending centrally through the shuttle and causing the divided jets to be directed through U-shaped paths upon each side of the flyer and shuttle to maintain maximum efficiency of the air forces and to balance the lateral forces on the flyer. A similar structure is provided in another species of the invention, this species having covers for the pockets, and individual guiding elements forming troughs for the jets of air leading directly to the central portions of the pockets. Furthermore, in one species of the invention the flyer is supported by a stationary supporting element, while the flyer in the other species is mounted to travel on the shuttle.

Other objects and advantages will be apparent from the following detailed description, when considered in conjunction with the accompanying drawings, wherein

Fig. 1 is a fragmentary side elevational view of one species of the invention;

Fig. 2 is an enlarged fragmentary sectional view taken along the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary top plan view of the shuttle showing the contours of the pockets of this species of the invention;

Fig. 4 is a fragmentary end elevational view of the flyer and its track;

Fig. 5 is a fragmentary side elevational view of another species of the invention;

Fig. 6 is an isometric view of a fragmentary portion of the shuttle and the flyer mounted thereon; and

Fig. 7 is a fragmentary top plan view of the flyer shown in this species of the invention.

Referring now to the drawings, attention is first directed to Figs. 1 to 3, inclusive. The species of the invention shown in these figures includes the conventional clamp 10 for a toroidal core 11, the clamp supporting the core for rocking movement about the centerline of the core to cause equal distribution of convolutions of wire 12 on the core. A shuttle 14 having a conventional type of removable insert portion 15 is supported on rollers 16 and driven by a gear 17 which engages teeth 18 on the inner periphery of the shuttle. The supply of wire 12 is wound on the shuttle in the conventional manner. A flyer indicated generally at 20 is arcuate in general contour and mounted for movement in a circuitous path about the shuttle on a support 21. The main body 22 of the flyer has inwardly bent side portions 23 to extend around the sides of a dovetail track 24 of the support 21 extending around the shuttle and disposed in close proximity as illustrated in Fig. 2. A removable insert 25 is provided for the track 24 and enables the operator to mount the core 11 in the clamp 10. The leading edges 26 (Figs. 1 and 4) of the flyer are bent outwardly to cause air to pass between the inner surfaces of the flyer and the outer surfaces of the track to cushion the flyer and minimize friction between these relatively moving parts.

The flyer is provided with a series of pockets 28 of the contour shown in Figs. 2 and 3 mounted at equally spaced positions throughout the length of the flyer. These pockets are identical in structure, having central portions 29 beginning with sharp edges 30 to divide jets of air, directed toward the outer periphery of the shuttle and the flyer through apertures 31 in a control unit 32.
The portions of the pockets extending arcuately from the central portions 28 will be effective in directing their divided jets of air in equal quantities in U-shaped paths to utilize the maximum efficiency of the jets of air and balance lateral thrust on the flyer.

The control unit 32 extends substantially around the shuttle, with the exception of the opening 34 adjacent core 11, and has an inlet portion 35 connected to a supply of fluid or air under pressure (not shown). The passageways 31 shown in Figs. 1 and 2 extend in like directions relative to the flyer and the peripheral of the shuttle whereby the jets of air guided by the passageways will impinge upon the pockets of the flyer to apply forces to the flyer in the direction of its movement, the jets of air being directed in a plane extending centrally through the shuttle to balance the flyer. Furthermore, the areas of the shuttle not covered by the flyer will be assisted in their rotation by the jets of air which will tend to urge the shuttle in its direction of rotation and will therefore, not oppose the driving means. The flyer 20 in this species of the invention has a guide 36 for the wire 12 as it leaves the shuttle and is directed to the core.

By viewing Fig. 2 of the drawing, it will be noted that the arcuate inner surface or periphery 37 of the unit 32 conforms to the arcuate upper surfaces 38 of the pockets 28. Although the surfaces 37 and 38 are shown spaced apart, in actual structure there will be a minimum amount of space between these surfaces whereby the full effect of the jets of air against the pockets may be utilized.

The species of the invention shown in Figs. 4, 5 and 6 includes a structure very similar in detail to the species shown in Figs. 1, 2 and 3. In this species of the invention, the conventional clamp 40 for the toroidal core 41 is mounted for rocking movement about the center of the core to control the winding of convolutions of wire 42 through the shuttle 43 with its removable insert 44 is supported for rotation by rollers 46 and a gear 47, the gear interengaging gears 48 mounted on the inner periphery of the shuttle and the insert 44 to drive the shuttle at a constant speed. In this species of the invention, the shuttle 43 with its insert 44 has rounded outer surfaces 50 and annular inner surfaces 51 for engagement with the flyer 52. The flyer 52 is substantially rectangular in cross-section and as shown in Fig. 5 extends substantially around the shuttle, the inwardly extending flanges 53 terminating short of the teeth 54. The flyer 52 is arcuate in general contour so that it may travel in a circular path on the shuttle to lead the wire 42 off the shuttle and through an aperture 55 in a guide 56 as the wire travels from the shuttle to the core. The leading ends 56 of the flanges 53 are bent inwardly in like directions causing the air to pass between the inner surfaces of the flanges and the adjacent surfaces of the shuttle to cushion the flyer and minimize friction between these relatively moving parts due to centrifugal force on the flyer.

A common core is provided with a plurality of pockets indicated generally at 51 disposed at spaced positions on the outer periphery of the flyer. The pockets 51 are similar in contour to the pockets 28 in that they have central portions 60 to divide the jets of air into substantially equal parts controlled by the arcuate portions 61. Covers 62 are provided for the pockets 51 to limit escapement of the jets of air only in the paths controlled by the arcuate surfaces 61. Troughs 63 interposed in advance of the pockets 51, with vertical sides 64 and inwardly tapering bottom members 65, further control the jets of air, holding them against escapement laterally and directing them toward the leading central portions 66 where they may be divided.

A control unit 67 for a fluid, such as air, under pressure connected at 68 to a supply (not shown), has passageways 69 in its inner wall to direct jets of air toward the shuttle in the direction of rotation of the shuttle mainly in the path of the flyer, the passageways leading directly into the control troughs 63 and toward the pockets 51. In this species of the invention, the inner surface 70 of the unit 67 is not arcuate as shown in Fig. 2, but is positioned closely adjacent the path of the covers 62 of the pockets 51 and the upper edges of the vertical walls 64 to utilize the full effect of the jets of air directed toward the pockets.

With these structures, it is apparent that a minimum amount of air under pressure may be utilized in causing the flyers to travel in circular paths about their crotches mainly under the control of the wires, maintaining the wire under a desired tension and uniformly forming convolutions of the wires on the cores. The application of the jets of air toward the shuttles in the directions of their rotation, to impinge upon the shuttles at their outer periphery and to be effective in impinging upon the pockets, through controlled paths in one instance furnished by the troughs 63, causes efficient driving of the flyers under forces which will assist, rather than oppose the rotation of the shuttles. In addition to the saving of power or air under pressure toward a fine reduction in turbulence, by confining the air streams, and a comparable reduction in noise which are important factors in machines of this type.

It is to be understood that the above described arrangements are simply illustrative of the application of the principles of the invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. A flyer mechanism in a toroidal coil winding machine wherein an annular shuttle for a supply of wire is driven about its axis through an annular core on which the wire is to be wound, the flyer mechanism comprising an arcuate element supported for movement in a circular path about the periphery of the shuttle and having a portion to guide the wire from the shuttle around portions of the core, a pocket mounted on the outermost surface of the element beyond the periphery of the shuttle, and an impelling means to direct a fluid under pressure toward the periphery of the shuttle to contact the pocket and cause the element to move about the shuttle.

2. A flyer mechanism in a toroidal coil winding machine wherein an annular shuttle for a supply of wire is driven about its axis through an annular core on which the wire is to be wound, the flyer mechanism comprising an arcuate element supported for movement in a circular path about the periphery of the shuttle and having a portion to guide the wire from the shuttle around portions of the core, means to direct jets of air under pressure toward the periphery of the shuttle and the outermost surface of the element, and a pocket mounted on the outermost surface of the element and having
a central edge dividing the jets of air into substantially equal parts to balance the lateral thrusts of the element on the shuttle and to cause travel of the element about the shuttle:

3. A flyer mechanism in a toroidal coll winding machine wherein an annular shuttle for a supply of wire is driven about its axis through an annular core on which the wire is to be wound, the flyer mechanism comprising an arcuate element supported for movement in a circular path about the periphery of the shuttle and having a portion to guide the wire from the shuttle around portions of the core, means to direct jets of air under pressure toward the periphery of the shuttle and the outermost surface of the element, and a pocket mounted on the outermost surface of the element with arcuate side portions joined by a central edge to divide the jets of air into substantially equal parts and direct them in substantially U-shaped paths to balance the lateral thrust on the element and utilize the maximum forces of the jets to drive the element about the shuttle.

4. A flyer mechanism in a toroidal coll winding machine wherein an annular shuttle for a supply of wire is driven about its axis through an annular core on which the wire is to be wound, the flyer mechanism comprising an arcuate element supported for movement in a circular path about the periphery of the shuttle and having a portion to guide the wire from the shuttle around portions of the core, means to direct jets of air under pressure toward the periphery of the shuttle and the outermost surface of the element, and a plurality of pockets mounted on the outermost surface of the element at equally spaced positions, each pocket having arcuate cavities disposed in lateral alignment with each other and joined by a central portion to divide the jets of air into substantially equal parts and direct them in U-shaped paths through their respective cavities to balance the lateral thrust on the element and cause travel of the element about the shuttle.

5. A flyer mechanism in a toroidal coll winding machine wherein an annular shuttle for a supply of wire is driven about its axis through an annular core on which the wire is to be wound, the flyer mechanism comprising an arcuate element supported for movement in a circular path about the periphery of the shuttle and having a portion to guide the wire from the shuttle around portions of the core, a hollow unit substantially surrounding the shuttle, supplied with air under pressure and having spaced outlets in an inner wall thereof to direct jets of air under pressure toward the periphery of the shuttle and the outermost surface of the element, and a pocket mounted on the outermost surface of the element and having a central edge dividing the jets of air into substantially equal parts to balance the lateral thrust of the element on the shuttle and to cause travel of the element about the shuttle.

6. A flyer mechanism in a toroidal coll winding machine wherein an annular shuttle for a supply of wire is driven about its axis through an annular core on which the wire is to be wound, the flyer mechanism comprising an arcuate element supported for movement in a circular path about the periphery of the shuttle and having a portion to guide the wire from the shuttle around portions of the core, a hollow unit substantially surrounding the shuttle, supplied with air under pressure, having an inner surface which is arcuate in cross-section and outlets through the inner surface to direct jets of air under pressure toward the periphery of the shuttle and the outermost surface of the element, and a plurality of pockets mounted on the outermost surface of the element at substantially identical positions substantially intersecting the space between the element and the arcuate surface of the unit, each pocket having arcuate cavities disposed in lateral alignment with each other and joined by a central portion to divide the jets of air into substantially equal parts and direct them into their respective cavities to balance the driving on the element and cause uniform travel of the element about the shuttle.

7. A flyer mechanism in a toroidal coll winding machine wherein an annular shuttle for a supply of wire is driven about its axis through an annular core on which the wire is to be wound, the flyer mechanism comprising an arcuate element supported for movement in a circular path about the periphery of the shuttle and having a portion to guide the wire from the shuttle around portions of the core, a pocket mounted on the outermost surface of the element beyond the periphery of the shuttle, an impelling means to direct a fluid under pressure toward the periphery of the shuttle to contact the pocket and cause the element to move about the shuttle, and a trough mounted on the outermost surface of the element to direct the fluid under pressure in a restricted path toward the pocket.

8. A flyer mechanism in a toroidal coll winding machine wherein an annular shuttle for a supply of wire is driven about its axis through an annular core on which the wire is to be wound, the flyer mechanism comprising an arcuate element supported for movement in a circular path about the periphery of the shuttle and having a portion to guide the wire from the shuttle around portions of the core, a hollow unit substantially surrounding the shuttle and a cover for the pocket disposed substantially parallel with the axis of the shuttle.
10. A flyer mechanism in a toroidal coil winding machine wherein an annular shuttle for a supply of wire is driven about its axis through an annular core on which the wire is to be wound, the flyer mechanism comprising an arcuate element supported for movement in a circular path about the periphery of the shuttle and having a portion to guide the wire from the shuttle around portions of the core, a pocket mounted on the outermost surface of the element beyond the periphery of the shuttle, a stationary track to movably support the element, and an impelling means to direct a fluid under pressure toward the periphery of the shuttle to contact the pocket and cause the element to move about the shuttle.

11. A flyer mechanism in a toroidal coil winding machine wherein an annular shuttle for a supply of wire is driven about its axis through an annular core on which the wire is to be wound, the flyer mechanism comprising an arcuate element supported for movement in a circular path about the periphery of the shuttle and having a portion to guide the wire from the shuttle around portions of the core, a pocket mounted on the outermost surface of the element beyond the periphery of the shuttle, a stationary track to movably support the element, an impelling means to direct a fluid under pressure toward the periphery of the shuttle to contact the pocket and cause the element to move about the shuttle, and a leading member of the element to cause air to pass between the element and the track to cushion the element and thus minimize friction resulting from centrifugal force on the element.

12. A flyer mechanism in a toroidal coil winding machine wherein an annular shuttle for a supply of wire is driven about its axis through an annular core on which the wire is to be wound, the flyer mechanism comprising an arcuate element substantially surrounding the shuttle and mounted for movement thereon with a portion carried by the element to guide the wire from the shuttle around portions of the core, a pocket mounted on the outermost surface of the element beyond the periphery of the shuttle, and an impelling means to direct a fluid under pressure toward the periphery of the shuttle to contact the pocket and cause the element to move about the shuttle.

13. A flyer mechanism in a toroidal coil winding machine wherein an annular shuttle for a supply of wire is driven about its axis through an annular core on which the wire is to be wound, the flyer mechanism comprising an arcuate element supported for movement in a circular path about the periphery of the shuttle and having a portion to guide the wire from the shuttle around portions of the core, a pocket mounted on the outermost surface of the element beyond the periphery of the shuttle, an impelling means to direct a fluid under pressure toward the periphery of the shuttle to contact the pocket and cause the element to move about the shuttle, and a leading member of the element to cause air to pass between the element and its support to cushion the element and thus minimize friction between the element and its support.

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REFERENCES CITED
The following references are of record in the file of this patent:

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<thead>
<tr>
<th>Number</th>
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<tbody>
<tr>
<td>2,430,105</td>
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