June 22, 1943. E. W. REYNOLDS 2,322,391

BALANCING MEANS

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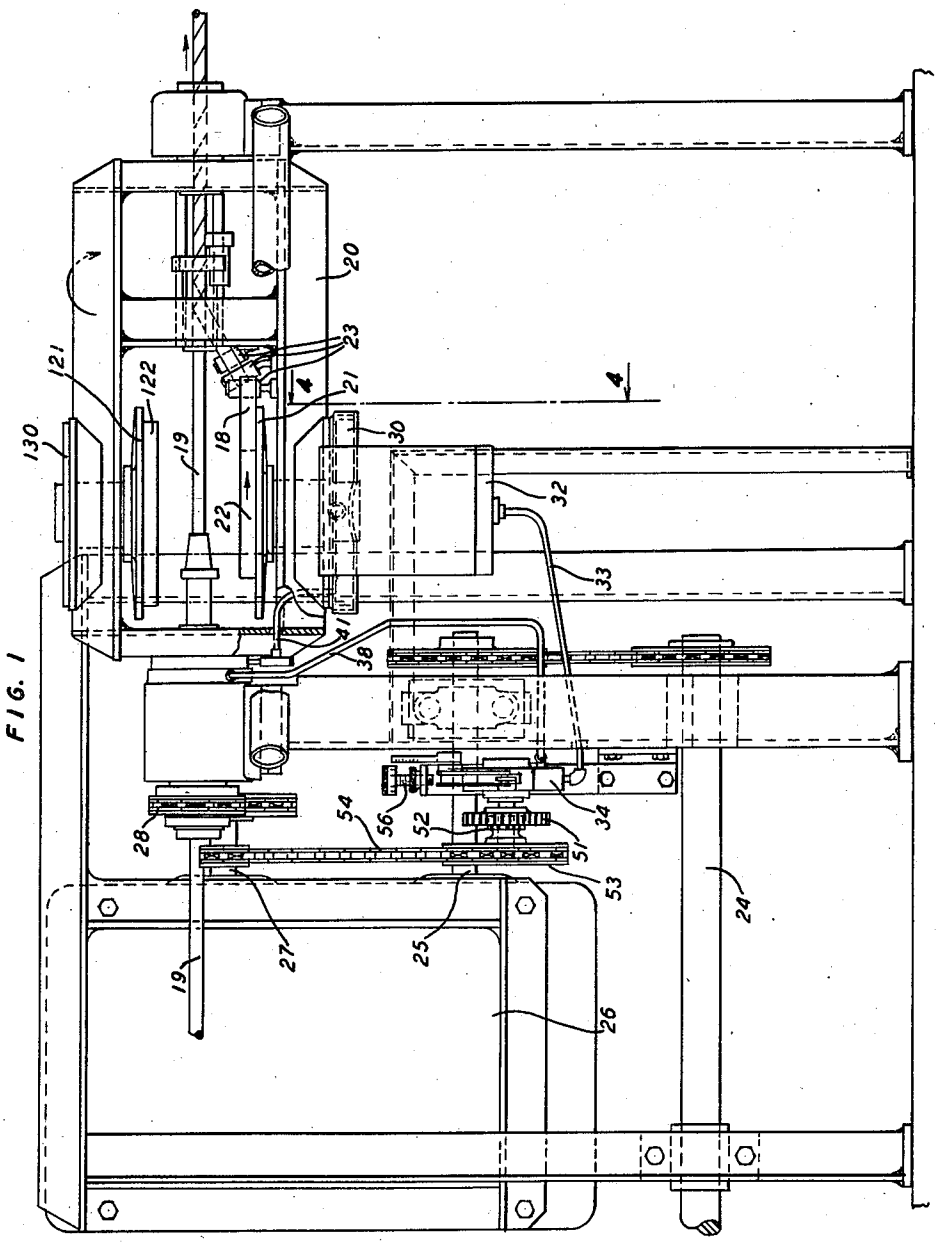


FIG. 1

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FIG. 2

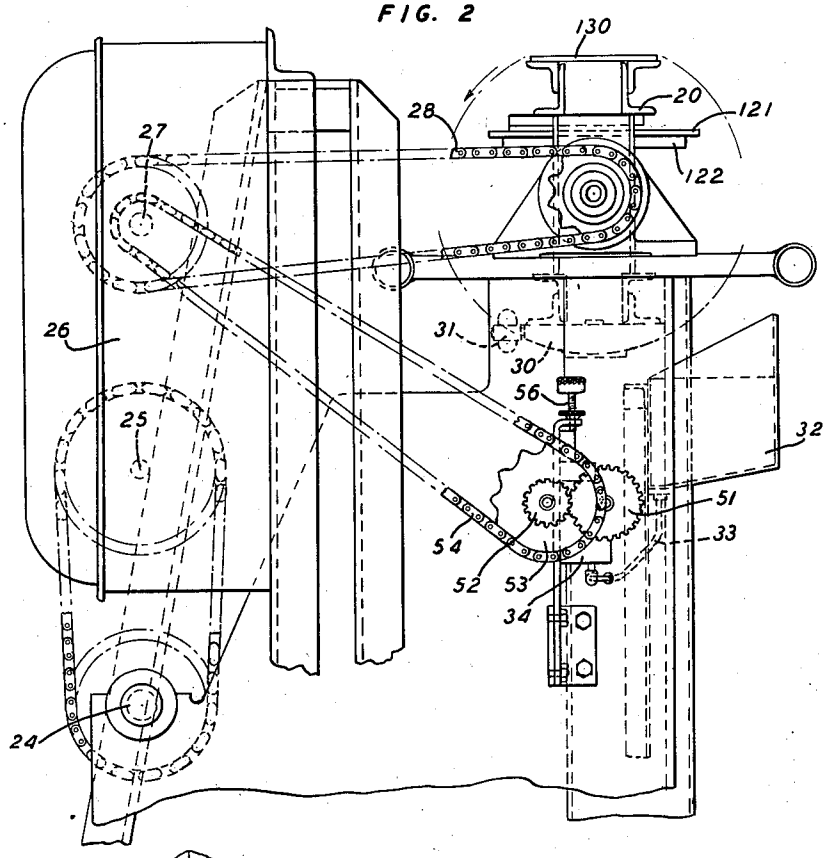
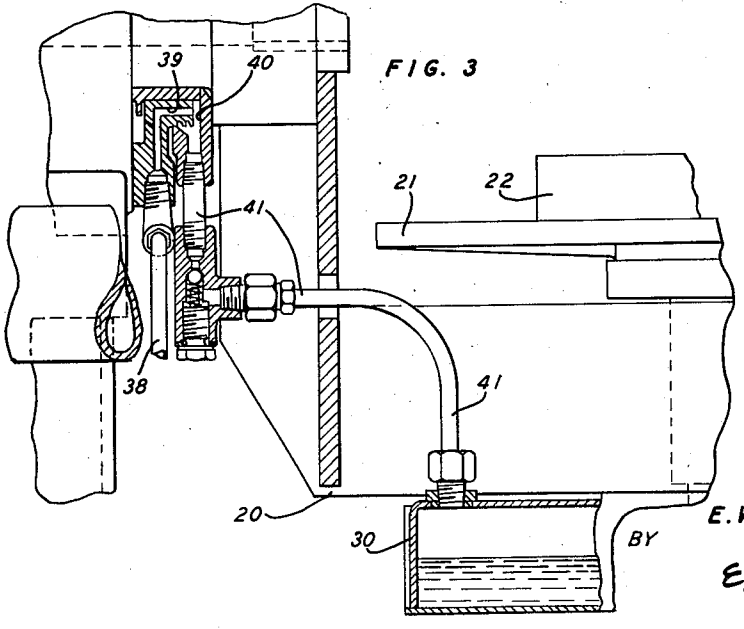


FIG. 3



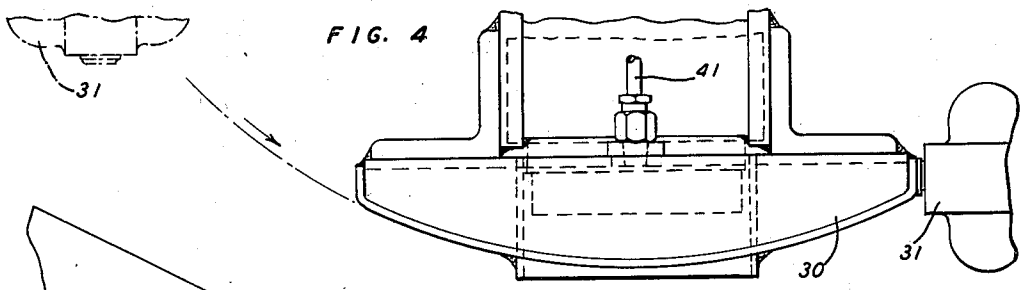
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FIG. 4



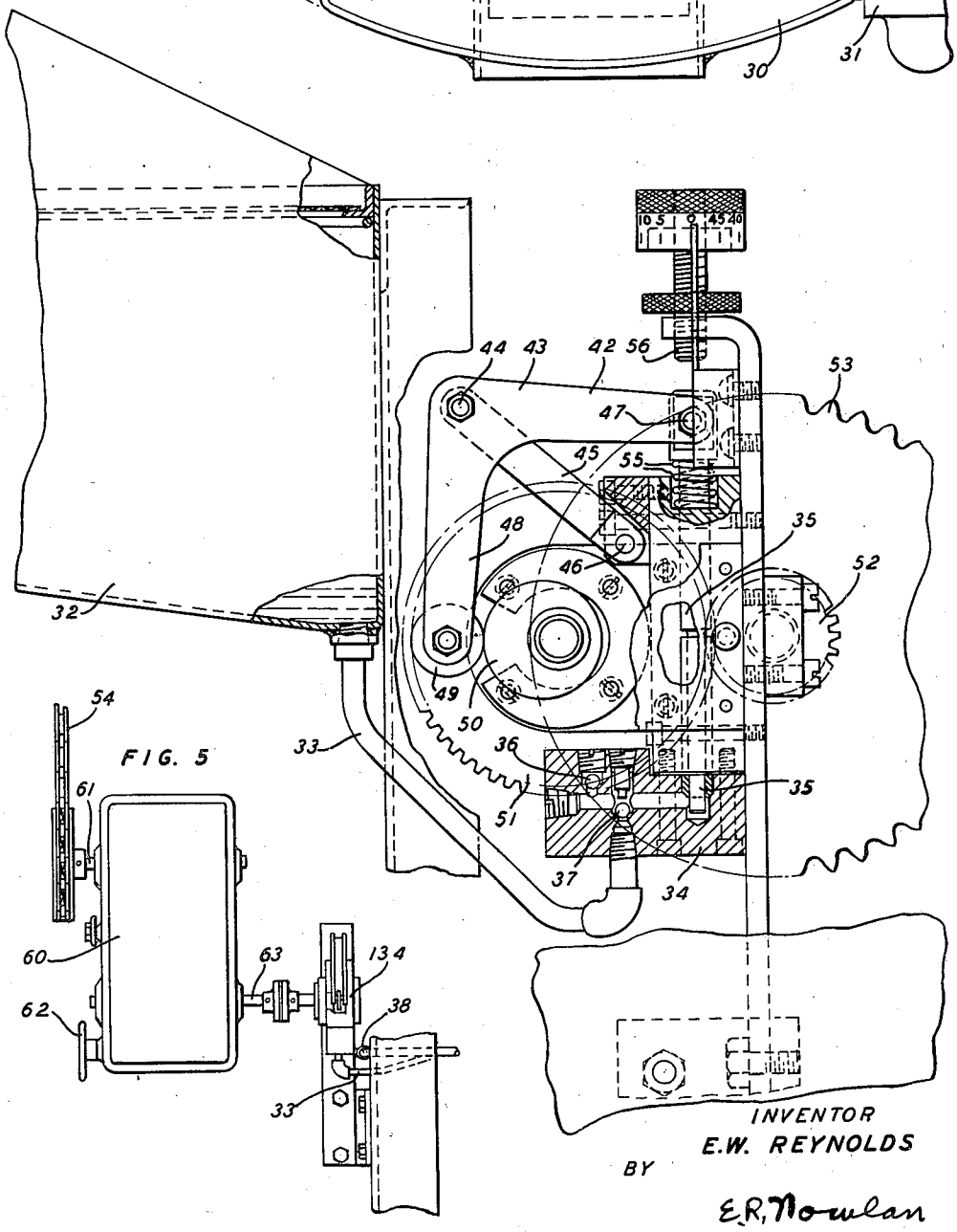


FIG. 5

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UNITED STATES PATENT OFFICE

2,322,391

BALANCING MEANS

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Application October 3, 1941, Serial No. 413,457

10 Claims. (Cl. 57—3)

This invention relates to balancing means, and more particularly to means for maintaining in centrifugal balance a rotating support from which material is being continuously drawn.

There are innumerable instances in various arts in which a supply of material in strand form, e. g. of ribbon, tape, wire, thread or the like, is being revolved in an orbit about an axis while, at the same time, strand is continuously being drawn from the supply. For example, in the manufacture of some kinds of multi-conductor electrical telephone cable, a core comprising a number of associated insulated wires is to be wrapped with paper tape served on the core in helical overlapping turns. To this end apparatus is provided for carrying a disc-like "pad" or spirally wound supply of paper tape in a circular orbit about a core advancing longitudinally along the axis of the orbit. An end of the tape being attached to the core, the tape is served on the core in helical turns by the combined effect of the longitudinal motion of the core and the orbital motion of the pad, the tape being drawn from the pad and wound on the core. Normally the longitudinal speed of the cable and the orbital speed of the pad remain constant and in a fixed relation to each other, thus keeping the pitch of the helical windings of the tape at a constant predetermined value. Since the tape is being continually removed from the pad the mass of the latter is being continually diminished during the process. Hence the rotary or centrifugal balance of the pad and its rotary support is being continually converted into a greater and greater unbalance, assuming that they are in balance when operation commences with a full pad.

An object of the present invention is to provide an apparatus having means to compensate in a simple, accurate and reliable manner for unbalance of a continuously progressive character occurring in a rotary member.

In one embodiment, in an apparatus for serving paper tape on a longitudinally advancing cable core, the invention may be illustrated as including a supporting member rotating about an axis along which a cable core advances, means on the frame to support a disc-like pad of paper tape to be served on the core, the pad being rotatable about an axis perpendicular to its own principal plane and hence to the axis of the frame also, and means to compensate for the diminishing mass of the pad and including a tank mounted on the frame and means to supply water to the tank at a rate having a constant relation to the rate of withdrawal of tape from the pad.

Other objects and features of the invention will appear from the following detailed description of one embodiment thereof taken in connection with the accompanying drawings in which the same reference numerals are applied to identical parts in the several figures, and in which

Fig. 1 is a partly diagrammatic view in side elevation of an apparatus constructed in accordance with the invention;

Fig. 2 is an end view of the showing of Fig. 1 from the left;

Fig. 3 is an enlarged, broken sectional detail of a portion of the water circulation;

Fig. 4 is an enlarged view on the line 4—4 of Fig. 1; and

Fig. 5 is a diagrammatic view of the essentials of a modified form.

As herein illustrated, the invention is embodied in an apparatus for serving a paper tape 18 in helical turns on a cable core 19 which is being advanced longitudinally of itself from left to right in Fig. 1 by any suitable means (not shown) through the axially hollow journallings of a rotatable frame 20. A plate-like circular support 21 is mounted in the frame to be rotatable about an axis perpendicular to the axis of rotation of the frame 20. A pad, or disc-like spirally wound mass 22 of the tape 18 rests on and is coaxially rotatable with the support 21. From the pad, the tape runs over guide rolls 23 to the core 19 to be wound thereon. A second pad support 121 identically like the support 21 carries a dummy pad 122 to counterbalance the support 21 at all times and the pad 22 when first put in place.

A main drive shaft 24, running at constant speed, drives the input shaft 25 of an adjustably variable speed transmission device 26. The particular nature and construction of this device 26 and its mode of operation are no part of the present invention and so are not particularized here. It serves to adjust the ratio of the rotary speed of the frame 20 to the longitudinal speed of the cable core 19 to give the desired pitch to the turns of tape served on the core. An output shaft 27 of the device 26, which runs at a constant speed in operation, drives the frame 20 in rotation through any suitable means such as a belt or chain 28, at a rotary speed which is normally constant. Thus the pad 22 resting on the support 21 is carried in a circular orbit about the core 19 to serve the tape on the core. The tape is thus continuously withdrawn from the pad 22 and laid on the core. This withdrawal of tape from the pad 22 can be effected because the support 21 is rotatable and permits the pad to rotate on its own axis

while it also revolves about the axis of the frame 20. The mass of the pad 22 is thus continually diminished by withdrawal of tape. The mass of the pad 22 when fresh and newly put in place, is counterbalanced by the pad 122. But, as the mass of the pad 22 diminishes the counter-mass of the pad 122 is made to be increasingly excessive and centrifugal stresses between the increasingly unequal masses 22 and 122 come into play as the operation proceeds.

To compensate for this increasing centrifugal unbalance, a tank 30, itself counterpoised by an equivalent mass 130, is mounted on the frame 20 with its center of form preferably in the axis of the support 21. This tank 30 is preferably shallow in the direction of the axis of the support and circular about that axis. Thus it is shallow radially of the frame and changes in the radius of gyration of an increasing mass of water contained in it become negligible. A removable drain plug 31 in one edge of the tank, when in the position shown in dotted lines in Fig. 4, allows the tank 30 to be drained into a supply tank 32, stationarily mounted in a suitable position.

A supply pipe 33 runs to the intake of a variable delivery pump generally indicated at 34. A reciprocable plunger 35 has its lower end in the chamber of the pump. On entering the chamber and displacing water therefrom, the water is forced out of the plunger through a check valve 36; and when the plunger is withdrawn from the chamber, water from the supply tank 32 and pipe 33 enters the pump chamber through a check valve 37. Water forced out through the outlet check valve 36 passes via pipe 38 and a passage 39 in a stationary collar in a bearing housing of the frame 20, into an annular chamber 40 in a collar on the frame 20. Thence the water passes through delivery pipe 41 to the tank 30.

The plunger 35 of the pump 34 is driven down for operation by the arm 42 of a bellcrank lever 43 pivoted at 44 on a link 44 which is pivoted at 46 on a stationary pin. The arm 42 is pivotally secured to the upper end of the plunger 35 at 47. A cam roller 49 is mounted in the other arm 48 of the lever 43 to be driven by an eccentric cam 50. The cam 50 is driven in continuous rotation through gears 51 and 52 and sprocket 53 by a chain 54 from the shaft 27. The plunger 35 is raised in its reciproction by a compression spring 55. Thus the plunger is driven positively down by the lever 43 for its delivery stroke, but is resiliently raised for its suction stroke. The suction stroke can be adjustably limited by an adjustable stop 56 positioned to abut the upper end of the plunger 35; and by this means the volume and hence the mass of water being delivered by the pump 34 to the tank 30 can be adjusted to compensate substantially exactly for the mass of tape being removed from the pad 22. Once this adjustment is made to accord with the particular dimensions and specific gravity of the tape being used, the ratio of water being supplied to tape being removed remains constant whatever variations in speed of the machine generally may occur, even during periods of acceleration to start and deceleration to stop, since the rotations of the frame 20 and of the cam 50 are effected from the common driving member 27.

The pump 34 disclosed above is herein termed a variable delivery pump because of the adjustability of the volume delivered at each stroke by adjustment of the stop 56, although so long as the whole apparatus runs at constant speed, the delivery of the pump is invariable. The adjustability of the pump is in order that the volume of its delivery may be varied to meet various rates of change of mass in the pad 22 according as the dimensions (width and thickness) or specifice gravity (density of material) of the tape 18 composing the pad 22 are changed from case to case of use. In this arrangement the rate of operation of the pump remains unalterable in relation to the speed of rotation of the frame 20.

In Fig. 5 is shown a modification in which the delivery of the pump is assumed to be invariable and the rate of operation of the pump is arranged to be adjustably variable to set the volume delivered by the pump in unit time at an amount proportional to the loss of mass of the pad in the same time. In this case the chain 54 drives the input shaft 61 of any suitable adjustably variable speed transmission generally indicated at 60 and having a member 62 operable to adjust the speed of the output shaft 63. A simple, non-adjustable, constant delivery pump generally indicated at 134, is driven from the shaft 63. The pump intake is connected through the pipe 33 to the supply tank 32, and its outlet to the pipe 38 and so eventually to the tank 30, as before.

The embodiments disclosed are illustrative and may be modified and departed from variously without departing from the spirit and scope of the invention as pointed out in and limited only by the appended claims.

What is claimed is:

1. In an apparatus having a rotatable frame and a member thereon of diminishing mass and carried by the frame in a circular orbit about the axis of rotation of the frame, the combination with the said rotatable frame of a container rigidly mounted on the frame to rotate therewith, a second stationary container not on the frame, a pump to transfer liquid from one container to the other to compensate for centrifugal unbalance caused by the diminishing mass of the member, and common driving means for the frame and the pump to drive the same in constant speed ratio.

2. In an apparatus having a rotatable frame and a member thereon of diminishing mass and carried by the frame in a circular orbit about the axis of rotation of the frame, the combination with the said rotatable frame of a container rigidly mounted on the frame to rotate therewith, a second stationary container not on the frame, a pump to transfer liquid from the first named container to the other to compensate for centrifugal unbalance caused by the diminishing mass of the member, and common driving means for the frame and the pump to drive the same in constant speed ratio.

3. In an apparatus having a rotatable frame and a member thereon of diminishing mass and carried by the frame in a circular orbit about the axis of rotation of the frame, the combination with the said rotatable frame of a container rigidly mounted on the frame to rotate therewith, a second stationary container not on the frame, a pump to transfer liquid from the first named container to the other to compensate for centrifugal unbalance caused by the diminishing mass of the member, and common driving means for the frame and the pump to drive the same in constant speed ratio, together with means to adjust the rate of output of the pump to correspond to an altered rate of loss of mass of the member.

4. In an apparatus having a rotatable frame and a member thereon of diminishing mass and carried by the frame in a circular orbit about the axis of rotation of the frame, the combination with the said rotatable frame of a container rigidly mounted on the frame to rotate therewith, a second stationary container not on the frame, a constant delivery pump to transfer liquid from the first named container to the other to compensate for centrifugal unbalance caused by the diminishing mass of the member, and common driving means for the frame and the pump to drive the same in constant speed ratio, together with normally constant adjustably variable speed transmission means interposed between the said common driving means and the constant delivery pump to adjust the rate of output of the pump to correspond to an altered rate of loss of mass of the member.

5. In an apparatus having a rotatable frame and a member thereon of diminishing mass and carried by the frame in a circular orbit about the axis of rotation of the frame, the combination with the said rotatable frame of a container rigidly mounted on the frame to rotate therewith, a second stationary container not on the frame, a pump to transfer liquid from the first named container to the other to compensate for centrifugal unbalance caused by the diminishing mass of the member, and common driving means for the frame and the pump to drive the same in constant speed ratio, the said pump being of normally constant adjustably variable output per cycle of operation and thereby adjustable to set the rate of output thereof to correspond to an altered rate of loss of mass of the member.

6. In an apparatus for serving strand material on a longitudinally moving core and having a rotatable frame through the axis of which the core passes and a strand supply support on the frame to be carried thereby in a circular orbit about the core and to carry a supply of strand diminishing in mass as the strand thereof is wound upon the core, the combination with the said rotatable frame of a container rigidly mounted on the frame to rotate therewith, a second stationary container not on the frame, a pump to transfer liquid from one container to the other to compensate for the centrifugal unbalance caused by the diminishing mass of the strand supply carried by the support, and common driving means for the frame and the pump to drive the same in constant speed ratio.

7. In an apparatus for serving strand material on a longitudinally moving core and having a rotatable frame through the axis of which the core passes and a strand supply support on the frame to be carried thereby in a circular orbit about the core and to carry a supply of strand diminishing in mass as the strand thereof is wound upon the core, the combination with the said rotatable frame of a container rigidly mounted on the frame to rotate therewith, a second stationary container not on the frame, a pump to transfer liquid from the first named container to the other to compensate for centrifugal unbalance caused by the diminishing mass of the strand supply carried by the support, and common driving means for the frame and the pump to drive the same in constant speed ratio.

8. In an apparatus for serving strand material on a longitudinally moving core and having a rotatable frame through the axis of which the core passes and a strand supply support on the frame to be carried thereby in a circular orbit about the core and to carry a supply of strand diminishing in mass as the strand thereof is wound upon the core, the combination with the said rotatable frame of a container rigidly mounted on the frame to rotate therewith, a second stationary container not on the frame, a pump to transfer liquid from the first named container to the other to compensate for centrifugal unbalance caused by the diminishing mass of the strand supply carried by the support, and common driving means for the frame and the pump to drive the same in constant speed ratio, together with means to adjust the rate of output of the pump to correspond to an altered rate of loss of mass of the supply.

9. In an apparatus for serving strand material on a longitudinally moving core and having a rotatable frame through the axis of which the core passes and a strand supply support on the frame to be carried thereby in a circular orbit about the core and to carry a supply of strand diminishing in mass as the strand thereof is wound upon the core, the combination with the said rotatable frame of a container rigidly mounted on the frame to rotate therewith, a second stationary container not on the frame, a constant delivery pump to transfer liquid from the first named container to the other to compensate for centrifugal unbalance caused by the diminishing mass of the strand supply carried by the support, and common driving means for the frame and the pump to drive the same in constant speed ratio, together with normally constant adjustably variable speed transmission means interposed between the said common driving means and the pump to adjust the rate of output of the pump to correspond to an altered rate of loss of mass of the member.

10. In an apparatus for serving strand material on a longitudinally moving core and having a rotatable frame through the axis of which the core passes and a strand supply support on the frame to be carried thereby in a circular orbit about the core and to carry a supply of strand diminishing in mass as the strand thereof is wound upon the core, the combination with the said rotatable frame of a container rigidly mounted on the frame to rotate therewith, a second stationary container not on the frame, a pump to transfer liquid from the first named container to the other to compensate for centrifugal unbalance caused by the diminishing mass of the strand supply carried by the support, and common driving means for the frame and the pump to drive the same in constant speed ratio, the said pump being of normally constant adjustably variable volume of output per cycle of operation and thereby adjustable to set the rate of output thereof to correspond to an altered rate of loss of mass of the supply.

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