Jan. 9, 1940. E. S. HARGREAVES ET AL 2,186,106

MEANS FOR WINDING WIRE AND OTHER LONG FLEXIBLE ARTICLES

Filed May 5, 1937 5 Sheets-Sheet 1

Fig. 1.

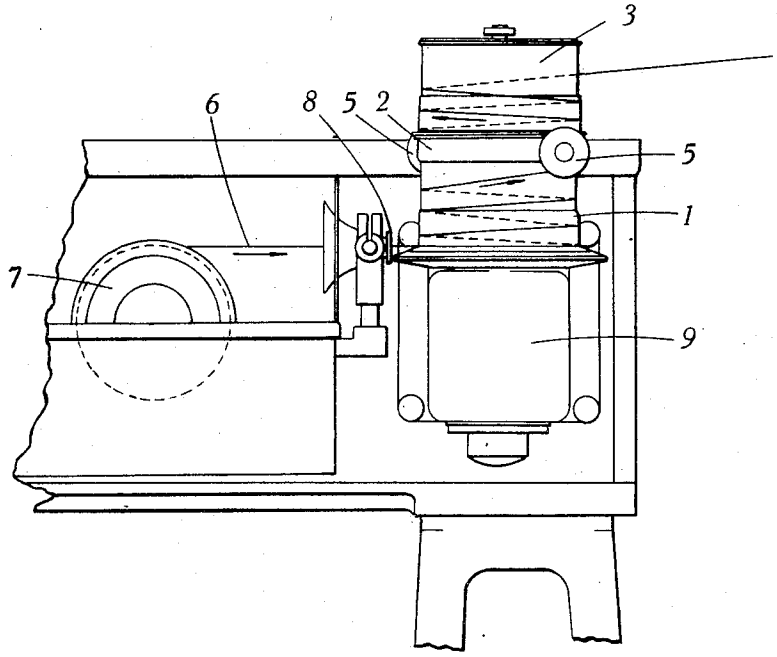
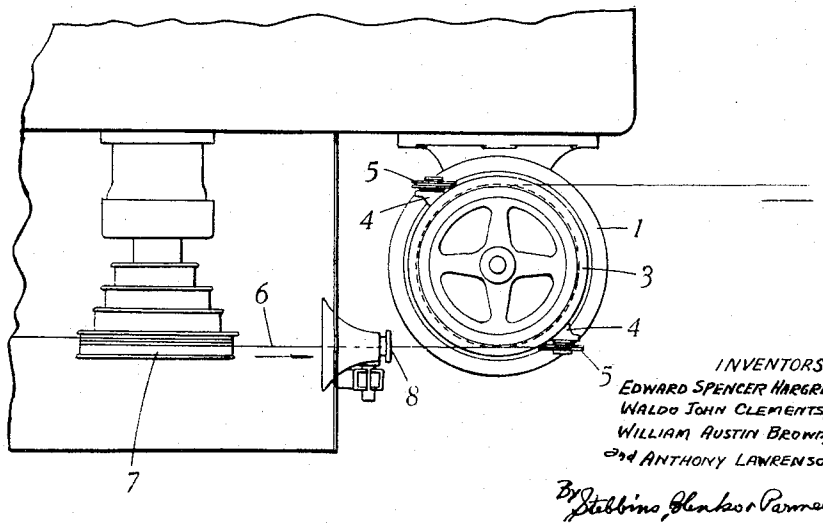


Fig. 2.



INVENTORS
EDWARD SPENCER HARGREAVES,
WALDO JOHN CLEMENTS,
WILLIAM AUSTIN BROWN,
and ANTHONY LAWRENSON
By Stebbins, Blanksor & Parmelee
ATTORNEYS

Jan. 9, 1940. E. S. HARGREAVES ET AL 2,186,106

MEANS FOR WINDING WIRE AND OTHER LONG FLEXIBLE ARTICLES

Filed May 5, 1937 5 Sheets-Sheet 2

Fig. 1a.

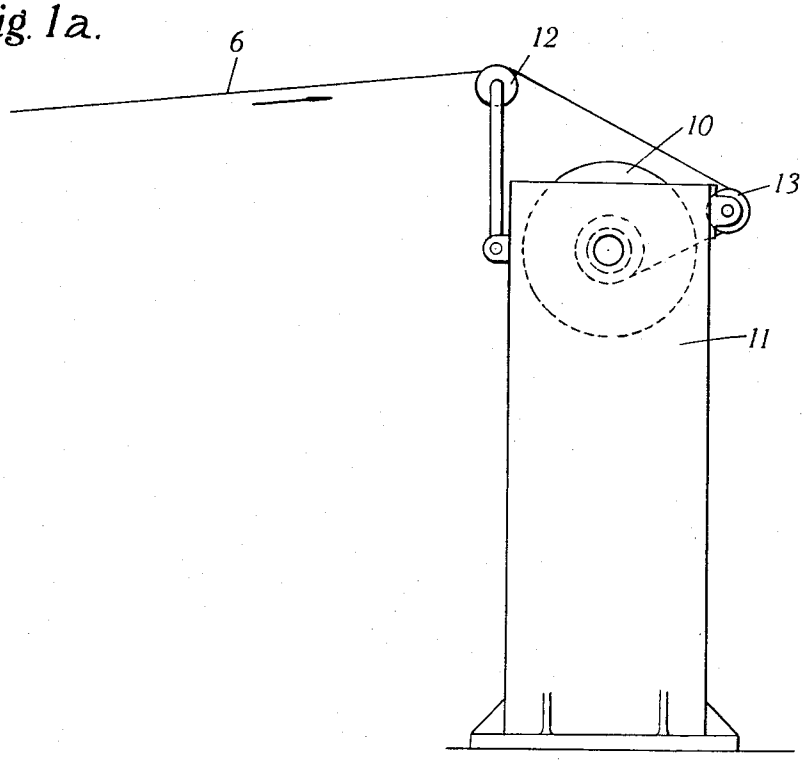
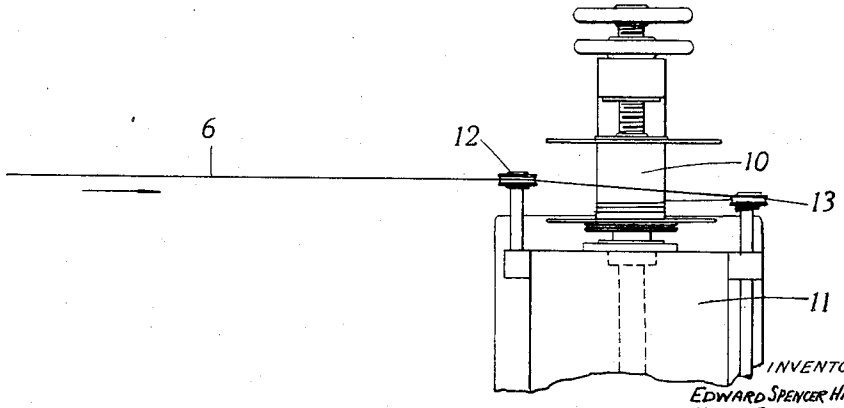


Fig. 2a.



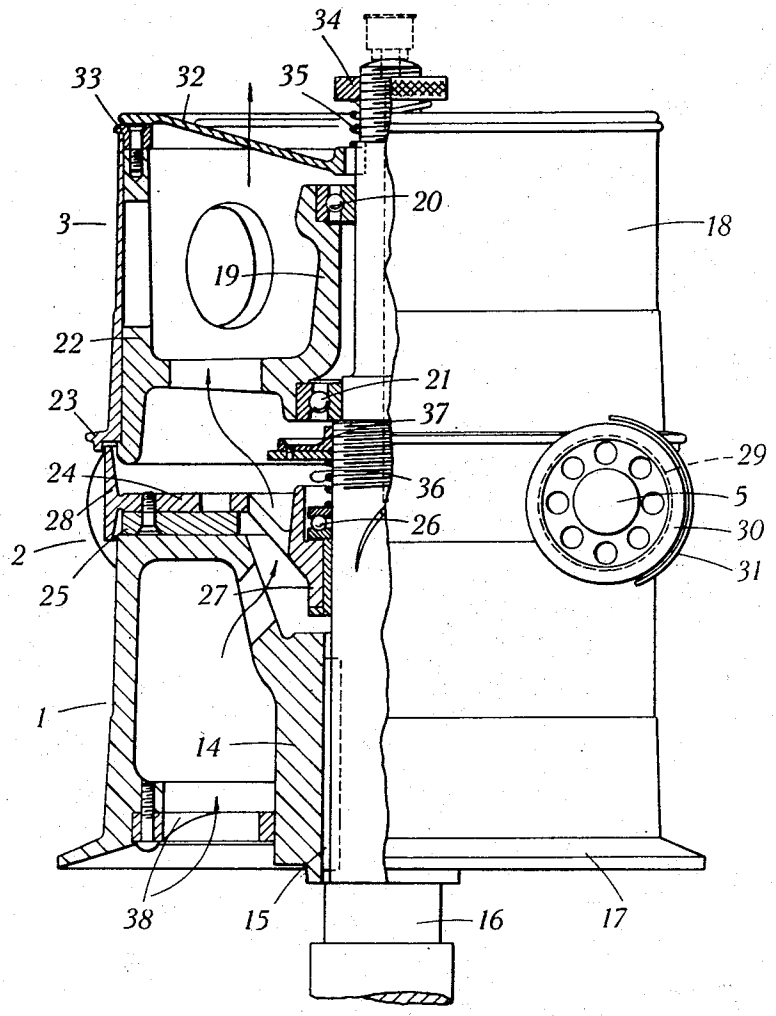
INVENTORS
EDWARD SPENCER HARGREAVES,
WALDO JOHN CLEMENTS,
WILLIAM AUSTIN BROWN,
and ANTHONY LAWRENSON
By Stebbins, Blanchard & Parmelee
ATTORNEYS

Jan. 9, 1940. E. S. HARGREAVES ET AL 2,186,106

MEANS FOR WINDING WIRE AND OTHER LONG FLEXIBLE ARTICLES

Filed May 5, 1937 5 Sheets-Sheet 3

Fig. 3.



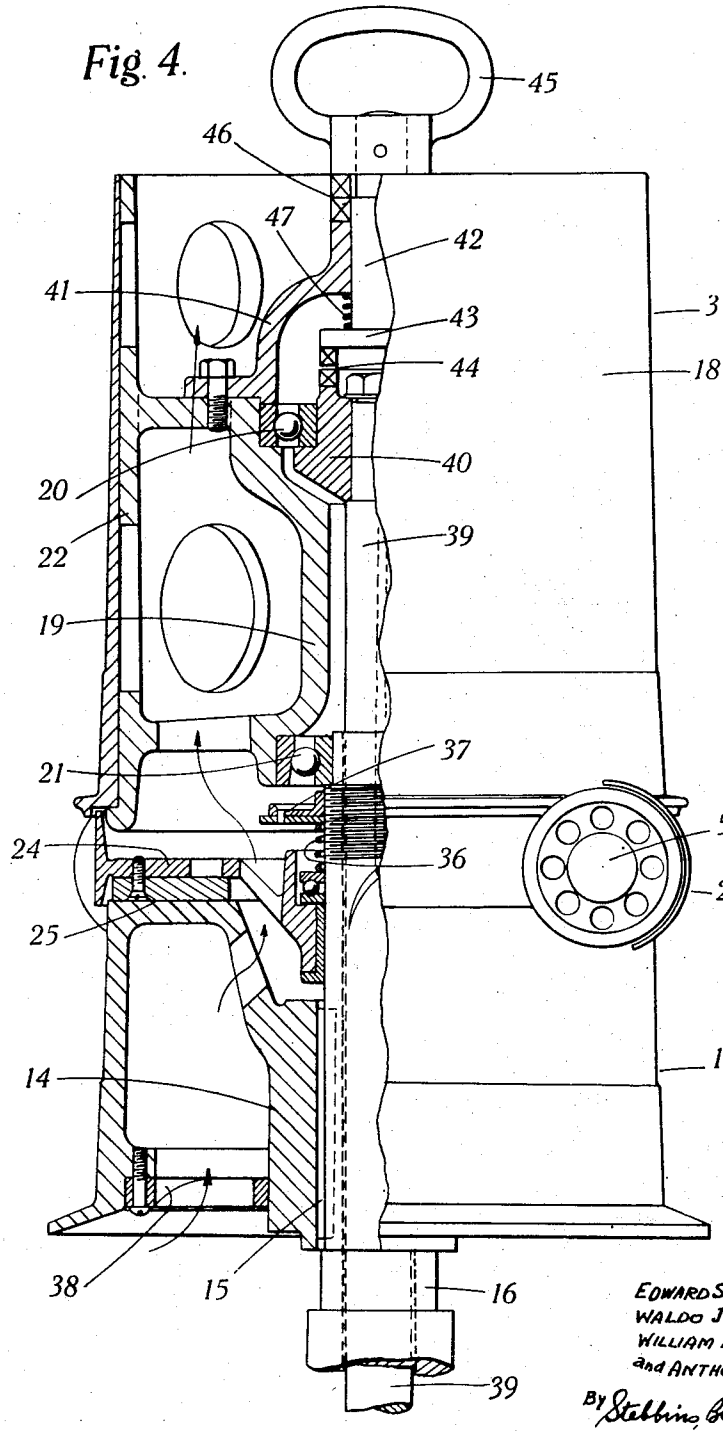
INVENTORS
EDWARD SPENCER HARGREAVES,
WALDO JOHN CLEMENTS,
WILLIAM AUSTIN BROWN,
and ANTHONY LAWRENSON
By Stebbins, Blenkarn & Parmelee
ATTORNEYS

Jan. 9, 1940. E. S. HARGREAVES ET AL 2,186,106

MEANS FOR WINDING WIRE AND OTHER LONG FLEXIBLE ARTICLES

Filed May 5, 1937 5 Sheets-Sheet 4

Fig. 4.



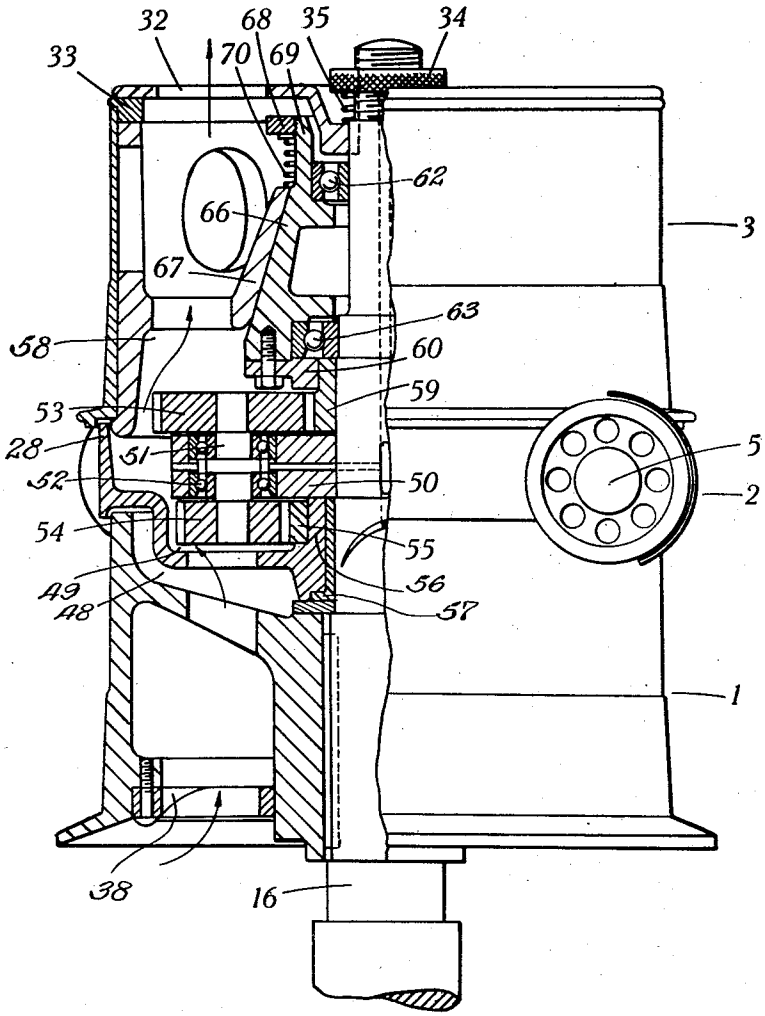
INVENTORS
EDWARD SPENCER HARGREAVES,
WALDO JOHN CLEMENTS,
WILLIAM AUSTIN BROWN,
and ANTHONY LAWRENSON
By Stebbins, Blanchard & Parmelee
ATTORNEYS

Jan. 9, 1940. E. S. HARGREAVES ET AL 2,186,106

MEANS FOR WINDING WIRE AND OTHER LONG FLEXIBLE ARTICLES

Filed May 5, 1937 5 Sheets-Sheet 5

Fig. 5.



INVENTORS
EDWARD SPENCER HARGREAVES,
WALDO JOHN CLEMENTS,
WILLIAM AUSTIN BROWN,
and ANTHONY LAWRENSON

BY Stebbins, Blanke & Parmelee

ATTORNEYS

Patented Jan. 9, 1940 2,186,106

UNITED STATES PATENT OFFICE

2,186,106

MEANS FOR WINDING WIRE AND OTHER LONG FLEXIBLE ARTICLES

Edward Spencer Hargreaves, Rainhill, and Waldo John Clements and William Austin Brown, Eccleston Park, Prescot, and Anthony Lawrenson, Eccleston, England, assignors to British Insulated Cables Limited, Prescot, Lancashire, England, a British company

Application May 5, 1937, Serial No. 140,830
In Great Britain May 14, 1936

5 Claims. (Cl. 242—25)

There are a number of machine operations in which a member such as wire or cord or other similar long flexible article is required to be wound up on a support in the course of delivery from the machine. These conditions exist, for instance, in a machine for drawing wire. The wire coming from the last die is usually received on a block or spool which is driven at the appropriate speed. When the block or spool contains the requisite quantity of wire the machine is stopped while the block is emptied, or while the full spool is removed and an empty spool substituted. This stoppage entails a waste of time, both of the machine and of its operative, and there is a risk of breaking the wire, particularly during restarting, as well as additional wear on the clutch or other starting device and on the dies and other parts due to the uneven running. This example is given as a typical case.

In accordance with the invention it is proposed to eliminate the disadvantages indicated by arranging that the machine continues to run at a uniform rate while permitting the finished coil or spool to be cleared. There is, therefore, no need to stop the machine from the commencement of operating until the supply of raw material is exhausted or the desired total quantity of wire has been produced. Subsidiary manipulations which do not affect the running of the main part of the machine provide for the removal of the finished product from time to time. Hereinafter this product will be spoken of as "wire" for convenience and the member on which the product is wound in the final operation of the machine will be spoken of as a "block."

In accordance with the invention we combine with the ordinary block, on which the wire is wound, a second block, or the equivalent, coaxial with the first and capable of being rotated at a speed which may be different from that of the first and started and stopped as required, and a guide member, mounted on a carrier located between the two blocks and also rotatable about the axis of the blocks at a speed which may be different from that of the first block and may be variable.

For reasons previously indicated, the first block will generally rotate continuously at constant speed throughout the operation of the machine and the second block will rotate intermittently in the opposite direction to that of the first and will be stopped at intervals to allow of the removal of a quantity of wire. The wire in passing from the first block to the second goes over the guide member and this is rotated with its carrier at an appropriate speed to carry out the transfer of the wire from the first block to the second. The guide member may comprise a small grooved pulley which is free to rotate on its axis in a plane which is substantially tangential to the cylindrical surfaces of the blocks. The guide is mounted on a projecting arm so as to lie outside the radius of the blocks and the arm is mounted on a suitable bearing or support so as to rotate about the axis of the blocks.

The invention is further described with reference, by way of example, to the accompanying illustrations wherein:

Figures 1 and 1*a* represent side views of an arrangement, in accordance with the invention, applied to a wire-drawing machine;

Figures 2 and 2*a* are plan views;

Figures 3, 4 and 5 are part-sectional views of three forms of construction of the blocks.

In the arrangement shown in Figures 1 and 2 a winding device in accordance with the invention is mounted at the delivery end of a wire-drawing machine. The device comprises the first, or lower, block 1, an intermediate guide carrier 2 and the second, or upper, block 3, mounted one above the other so as to be rotatable, in a manner hereinafter described, about a common vertical axis. An arm 4 projecting from the carrier 2 carries an intermediate guide member 5 in the form of a small grooved pulley which is located outside the radius of the blocks. The pulley 5 is free to revolve on its axis in a plane which is substantially tangential to the cylindrical surface of the blocks, and is adapted to be rotated by the carrier 2 about the vertical axis of the blocks. Two such guide members 5 are shown mounted diametrically opposite to one another upon the guide carrier 2; one only of these, however, is brought into operation at any time. A wire 6, having passed over the final capstan wheel 7 of the wire-drawing machine and through a finishing die 8, is directed to and passed several times around the first block 1. The latter, being positively and continuously driven by means located with its support 9, serves to draw the wire 6 through the final reducing die 8. From the first block 1 the wire 6 is led over the guide pulley 5 to the second block 3 about which it is wrapped in the direction opposite to that in which it is wrapped upon the first block 1. From the second block 3 the wire 6 passes to a reeling or similar device which in the example shown comprises a rotatable bobbin 10 mounted in a stand 11 with its axis horizontal, the wire 6

being directed to the bobbin 10 by suitable guides 12 and 13. The direction of movement of the wire 6 is indicated by the arrows.

Instead of passing from the second block 3 to a reeling or other coiling device, the wire 6 may be allowed to accumulate upon this second block which may be stopped periodically in the manner hereinafter described to permit the removal of the accumulated wire.

The speed of the rotation of the carrier 2 must be so chosen that the guide member 5 uncoils the wire 6 from the first block 1 at the same rate as that at which it coils the wire on the second block 3. Generally the two blocks 1 and 3 will be of approximately the same diameter, although this is mainly a matter of convenience. Assuming that this condition exists and that the circumferential slip of the wire on either of the blocks is neglible, the following are examples of appropriate speeds. In each case the speed of the first block 1 is represented as 100. In the first example the speed of the second block 3 is equal and opposite to that of the first block 1, —100. In this case the appropriate speed for the carrier 2 is zero, that is to say, the guide 5 stands still and the transfer of the wire 6 is effected by the movements of the two blocks 1 and 3 past it in opposite directions. In the second example the second block 3 is running at a speed opposite to and greater than that of the first block 1 and is represented by —140. The appropriate speed of the guide carrier 2 is in this case —20 that is to say, it is moving in the same direction as the second block 3 at a relatively slow speed. In the third example the second block 3 is stationary. The appropriate speed for the carrier 2 is then 50, being in the same direction as that of the first block 1. It will be seen that, on the assumptions made, the speed of the carrier 2 is always halfway between the speeds of the two blocks 1 and 3, taking into account the directions of rotation as affecting the sign of the number indicating the speed.

Continuing with the same assumptions, an indication will be given of the cycle of speed changes during the working of the machine. The first block 1 will be considered to be running steadily at 100. In the initial condition the second block 3 is stationary and the guide carrier 2 is running at about half speed in the same direction as the first block 1. The wire 6 coming from the machine is then being coiled on the first block 1 at a rate represented by 100 and being removed therefrom by the guide member 5 at a rate represented by 50 and being supplied to the second block 3 at this same rate. Accordingly the wire is being accumulated on the two blocks 1 and 3 at equal rates. The second block 3 is then run up to speed in the opposite direction and is given a speed somewhat higher than that of the first block 1. While this is taking place the guide carrier 2 is slowed down to zero and is then reversed and continues to run at a slow rate in the opposite direction. Under these conditions the transfer of wire 6 from the first block 1 to the second block 3 takes place slightly more rapidly than the winding on of the wire 6 to the first block 1. This procedure is carried on sufficiently long to transfer to the second block 3 the surplus wire accumulated on the first block 1 during the stoppage, in addition to the quantity given from the wire-drawing machine while the second block 3 is running. When the appropriate quantity has passed on to the second block 3 this can be stopped temporarily to permit of the removal of the appropriate quantity of wire from the machine. This quantity may either have been allowed to accumulate on the second block 3, or may have been drawn therefrom continuously to a third block or reeling device on a separate axis such as the bobbin 10. In either case, in order to cut the wire and remove it, it is necessary to stop the second block for a short time. It will be seen that this can be done without interfering with the running of the first block.

From the preceding description of the speed changes to be given to the various members will be recognized the general requirements of the drives thereof. Hereinafter some indication of practical methods of obtaining the desired results will be given together with descriptions, by way of example, of several forms of apparatus illustrated in Figures 3, 4, and 5 whereby these methods may be carried out.

The driving of the first block 1 continuously presents no difficulty and in the constructions shown the drive is effected by keying this block to an axially arranged driving shaft. The first, or lower, block 1, as shown in Figure 3, consists of a substantially hollow cylindrical member formed upon a central boss 14 keyed by means of a key 15 upon a central vertical driving shaft 16. In the usual manner this block 1 is formed with a lower peripheral flange 17 and the outer cylindrical wall tapers slightly from the flange 17 upwards. The continuous drive to the first block 1 is effected by the driving shaft 16. The second block 3 is mounted above the first block 1 on an extension of the shaft 16 about which it is freely rotatable. It is preferable that the second block 3 be made as light as possible, for which purpose it may consist of a substantially hollow body of aluminium with an outer steel fleeting ring 18 shrunk thereon. The body portion comprises a central hollow boss 19 carrying upper and lower ball-bearings 20 and 21 whereby the block is mounted free to rotate on the upper portion of the shaft 16, and an outer cylindrical support 22 for the fleeting ring 18, perforated for the purpose of lightness. The fleeting ring 18 is formed with a lower peripheral flange 23 and the cylindrical outer surface tapers gently upwards therefrom.

Between the first and second blocks is located the guide carrier 2 comprising an annular plate 24 provided on the underside with an annular friction disc 25 which rests upon the upper end face of the first block 1 whereby the guide carrier is supported forming a slipping frictional connection between the two blocks. The guide carrier 2 is mounted so as to be freely rotatable on the shaft 16 which it engages by means of a ball-bearing 26 located in a central boss 27. The periphery of the carrier 2 is in the form of a shallow cylindrical flange 28 which bridges the gap between the first and second blocks with sufficient clearance to permit relative rotation of those members.

Mounted on the carrier 2 is the freely rotatable guide pulley 5 having a peripheral groove 29 formed by two radial flanges 30. As previously described, the guide pulley 5 is located outside the radius of the blocks upon a radial extension 4 (Fig. 2) of the carrier 2 in such a manner that it is freely rotatable in a plane substantially tangential to the cylindrical external surface of the blocks. A curved guide plate 31 is located just clear of the periphery of the guide pulley 5 to prevent the wire from climbing over the pulley

flanges 30 and thus becoming detached from the guide.

In this particular construction the second block 3 serves primarily as a transmission member for the wire coming from the first block 1 and passing to a reeling device, such as described above with reference to Figures 1 and 2, or to a third block arranged on axis parallel with that of the shaft 16. The second block 3 in this case is rotated on the shaft 16 by the pull of the wire being drawn therefrom. The necessary tension is applied to the block 3 by means of a tension ring 32 keyed on to the end of the driving shaft 16 above the block and engaging at its outer edge a friction ring 33 fixed to the top of the block and forming a slipping frictional connection between the two blocks. The tension is controlled by means of a nut 34 engaging the screw-threaded end of the shaft 16 and serving to compress a spring 35 down on to the centre of the tension ring 32. The guide carrier 2 tends to rotate with the first block 1 by virtue of the engagement of the friction ring 25 on the underside of the guide carrier with the top of this block. A compression spring 36 located about the shaft 16 is adapted to be pressed down on to carrier bearing 26 by means of an adjustable nut 37 threaded upon the shaft 16, thereby to control the frictional engagement between the guide carrier and the first block. Thus the guide carrier 2, which has to rotate at a speed intermediately between that of the two blocks, as already mentioned, receives its driving motion from the movement of the first block 1. The actual speed of rotation of the guide carrier during transference of the wire, is always less than that of the first block, pull in the wire as it passes over the guide pulley 5 from the first to the second block serving to overcome the slipping frictional coupling which, however, determines the tension in the wire.

Cooling of the apparatus is effected by the provision in the lower part of the first block 1 of an impeller 38 which creates an axial flow of air through the apparatus whilst the first block is rotating.

By an alternative method the wire may be allowed to accumulate upon the second block in appropriate quantities for removal from time to time, thus eliminating any subsequent reeling or winding device. In this case a drive may be applied directly to the second block 3. This may be effected by a shaft passing through the hollow driving shaft of the first block or it may be done through a driving coupling, which is disconnected when the second block is stopped so as to permit the removal of the accumulated wire over the end of the block. In the example of such an arrangement illustrated in Figure 4 the construction of the first block 1, the carrier 2 and the drive thereto is similar to that already described with reference to Figure 3. The driving shaft 16, however, is hollow and terminates at the bottom bearing 21 for the second block 3. A second driving shaft 39 for the second block 3 passes freely through and extends upwards beyond the end of the first driving shaft 16. These two shafts provide independent driving means for the two blocks, which may thus be positively driven at different speeds of rotation and independently controlled. Fixed to the upper end of the second shaft 39 is a collar 40 which provides a seating for the upper bearing 20 of the second block 3. To the inside of the second block 3 is fastened a frame 41 which encloses and extends above the end of the second shaft 39 and which is apertured to accommodate a cylindrical stem 42. The stem 42 is located above and axially in line with the second shaft 39 and is capable of turning and sliding movement with respect to the frame 41. The lower end of the stem 42 is formed with a flange 43 provided with downwardly extending projections adapted to interengage with upstanding projections on the collar 40 to form a dog-clutch 44. On the upper end of the stem 42 is fixed a handle 45 which also is provided with downwardly extending projections adapted to interengage with upwardly extending projections on the frame 41 to form another dog-clutch 46. Both clutches 44 and 46 are maintained in engagement by means of a compression spring 47 which surrounds the lower end of the stem 42 and bears against the frame 41 and the flange 43 on the end of the stem. In order to disengage the clutches 44 and 46 it is necessary to raise the handle 45 against the pressure of the spring 47 and to turn it until the co-engaging projections forming the upper clutch 46 abut against one another. In this position the projections forming the lower clutch 44, which are shorter than those of the upper clutch 46, are maintained clear of one another. Thus, when the clutches are engaged, there is a drive to the second block 3 from the second driving shaft 39 through the collar 40, the stem 42 and the frame 41. The drive to the second block may be interrupted periodically by stopping the second driving shaft for the purpose of removing accumulated wire from this block. Meanwhile wire will accumulate on the first block 1, but this is readily transferred to the second block by temporarily increasing the speed of this block on restarting. It will be seen that by disengaging the clutch connection between the second shaft 39 and the second block 3, the latter becomes a freely rotatable member and the apparatus may function in a manner similar to that illustrated in Figure 3.

Another convenient method of driving comprises making the two blocks and the guide carrier, directly or indirectly, parts of an epicyclic gear of the so-called differential type. An arrangement embodying a toothed wheel epicyclic gear is illustrated by way of example in Figure 5. This arrangement is similar in external appearance to that described with reference to Figure 3, the drive being effected by means of a solid shaft 16 passing vertically upwards through the axis of the device and to which the first block 1 is keyed. The upper part of the first block 1 is recessed (48) to accommodate a similarly recessed annular portion 49 of the guide carrier 2. Within the guide carrier is located an arm 50 keyed to and consequently adapted to rotate with the driving shaft 16. A vertical shaft 51 mounted in ball-bearings 52 in the arm 50 carries two toothed planet wheels, an upper one 53 and a lower one 54, both fixed to the common shaft 51 and consequently adapted to rotate together. The lower planet wheel 54 engages with a toothed gear wheel 55 formed on the boss 56 of the guide carrier 2, the latter being supported by a bearing 57 so as to rotate on the driving shaft 16 clear of the first block 1. The upper planet wheel 53 is accommodated in a recessed part 58 in the lower portion of the second block 3 and engages a toothed gear wheel 59 formed on a downwardly extending portion 60 of the inner part 66 of a two part central boss of the second block 3. The inner part 66 of the central boss

engages the upper extension of the driving shaft 16 by means of upper and lower ball-bearings 62 and 63 in the manner similar to that described with reference to Figure 3. The external surface of the inner part 66 is in the form of an upwardly tapering cone. The outer part 67 of the central boss is in the form of a conical member, which surrounds and frictionally engages the outer conical surface of the inner member 66, and upon which the second block 3 is formed. In this construction the first block 1 and the arm 50 which carries the planet wheels 53 and 54, being keyed to the driving shaft 16, always rotate together. The second block 3 is rotated by the pull of the wire being drawn therefrom as described above. The rotation of the guide carrier 2 is effected by virtue of the engagement between the planet wheels 53 and 54 and the gears formed on the bosses of the carrier and second block 3, the relative sizes of these gears being so chosen that the speed of rotation of the carrier 2 is always halfway between the speeds of the two blocks for the purpose described above.

In practice there may always be some slipping of the wire on the blocks, and it may be necessary to incorporate a slipping clutch or similarly acting device to accommodate this. Thus in the arrangement shown in Fig. 5 the driving connection between the second block 3 and the differential gear already described is effected through a friction clutch formed by the interengaging conical members 66 and 67. The frictional engagement may be adjusted by means of a nut 68 which engages a screw-threaded extension 69 formed on the inner member 66 of the clutch and which serves to press a compression spring 70 down on to the outer member 67. In this case a braking tension may also be applied to the second block 3 by means of a tension ring 32 pressed by a nut 34 and spring 35 down on to a brake ring 33 located on the top of the block, in the manner already described with reference to Figure 3, and forming the slipping frictional connection between the two blocks.

What we claim as our invention is:

1. A wire winding device comprising a first block, a second block co-axial with the first block, the said second block being rotatable independently of the said first block, a carrier located between the first block and the second block and rotatable about the axis of the blocks at a speed which may be different from the speed of rotation of either block, a guide carried by the said carrier serving to transfer the wire from one block to the other, and slipping frictional connecting means between the first block and one of the other two rotatable members controlling their speed in relation to that of the first block, thereby determining the tension in the wire.

2. A wire winding device comprising a first block, a second block co-axial with the first block, the said second block being rotatable independently of the said first block, a carrier located between the first block and the second block and rotatable about the axis of the blocks at a speed which may be different from the speed of rotation of either block, a guide carried by the said carrier serving to transfer the wire from one block to the other, an annular friction member interposed between adjacent relatively movable surfaces of the said first block and the carrier, and an adjustable spring engaging the carrier serving to control the frictional engagement between the friction member and the said adjacent surfaces.

3. A wire winding device comprising a first block, a second block co-axial with the first block, the said second block being rotatable independently of the said first block, a carrier located between the first block and the second block and rotatable about the axis of the blocks at a speed which may be different from the speed of rotation of either block, a guide carried by the said carrier serving to transfer the wire from one block to the other, a brake-disc located above and in engagement with the upper surface of the second block, the brake-disc being secured to the upper end of the driving spindle for the first block, and an adjustable spring maintaining the brake disc in engagement with the second block.

4. A wire winding device comprising a first block, a second block co-axial with the first block, the said second block being rotatable independently of the said first block, a carrier located between the first block and the second block and rotatable about the axis of the blocks at a speed which may be different from the speed of rotation of either block, a guide carried by the said carrier serving to transfer the wire from one block to the other, slipping frictional connection means between the first block and one of the other two rotatable members controlling their speed in relation to that of the first block, and an impeller formed in the structure of one of the blocks creating an axial flow of air through the device.

5. A wire winding device comprising a first block, a second block co-axial with the first block, the said second block being rotatable independently of the said first block, a carrier located between the first block and the second block and rotatable about the axis of the blocks at a speed which may be different from the speed of rotation of either block, a guide carried by the said carrier serving to transfer the wire from one block to the other, slipping frictional connecting means between the first block and one of the other two rotatable members controlling their speed in relation to that of the first block, and an epicyclic, differential gear interconnecting and controlling the relative direction of movement of the blocks and carrier.

EDWARD SPENCER HARGREAVES.
WALDO JOHN CLEMENTS.
WILLIAM AUSTIN BROWN.
ANTHONY LAWRENSON.