United States Patent

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[33] France
[31] No. 146,338

[54] APPARATUS FOR LONGITUDINALLY ENTRAINING ELONGATED MATERIAL
6 Claims, 11 Drawing Figs.

[52] U.S. Cl. 226/180, 226/187
[51] Int. Cl. B65h 17/20
[50] Field of Search 226/180, 187, 186, 177, 176

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Primary Examiner—Allen N. Knowles
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ABSTRACT: Elongated material is pressed between a driving roller and a counter roller. The counter roller is pushed towards the material by a mobile support device adapted to pivot about an axis parallel to the direction of the axis of the rollers. A stop limits the pivoting movement of the mobile support device, the pivoting axis of which is near the plane containing both the axes of rotation of the rollers.

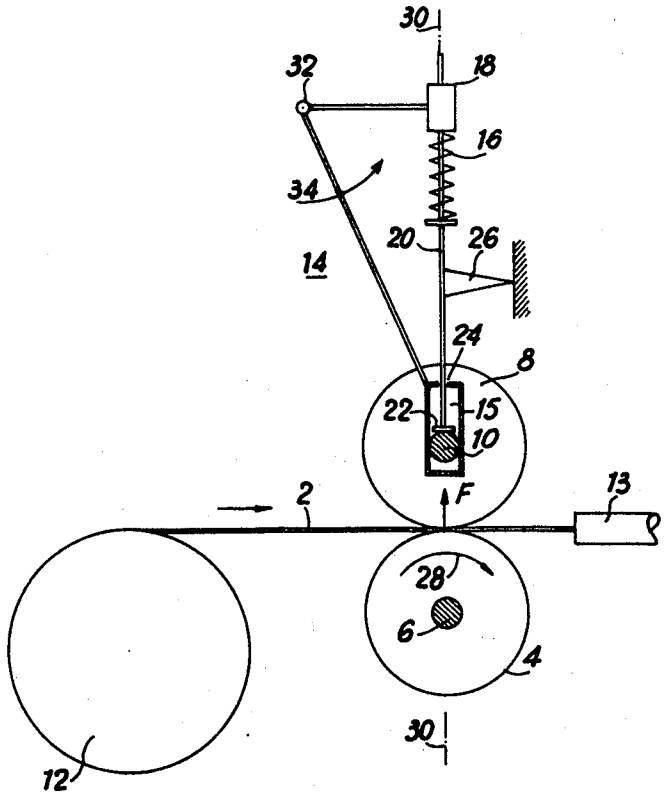

Fig. 1

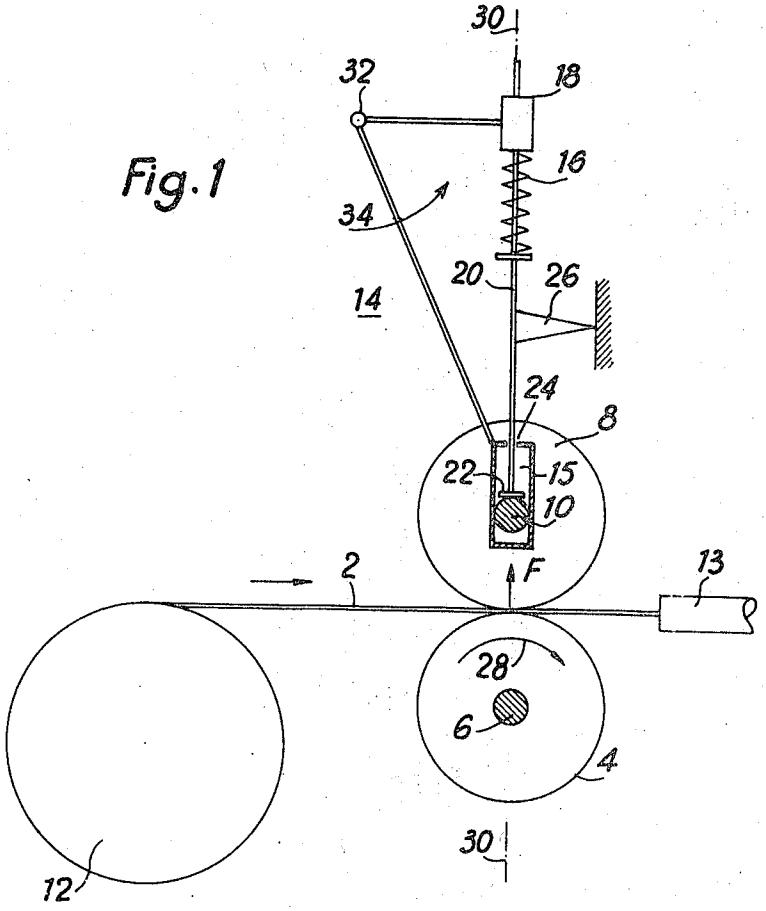

Fig. 4

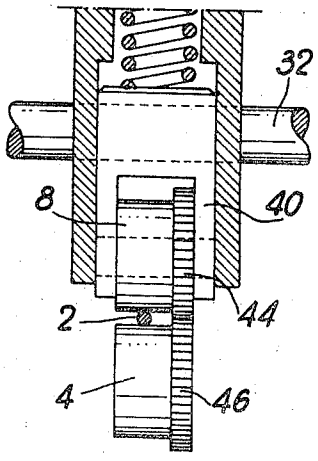

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Fig. 2

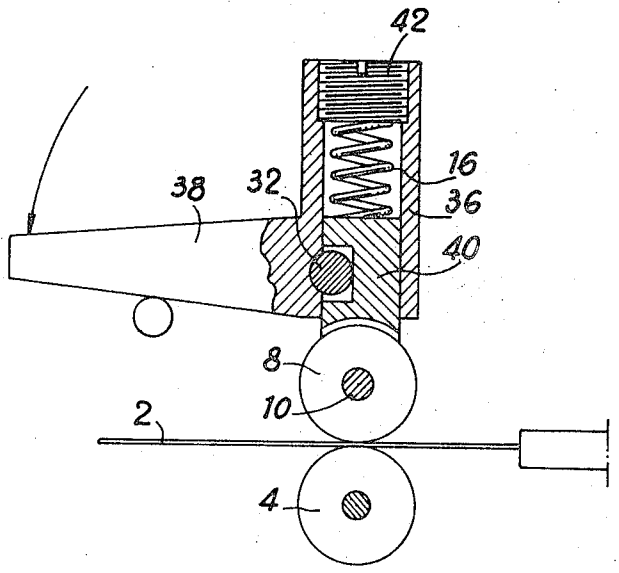

Fig. 3

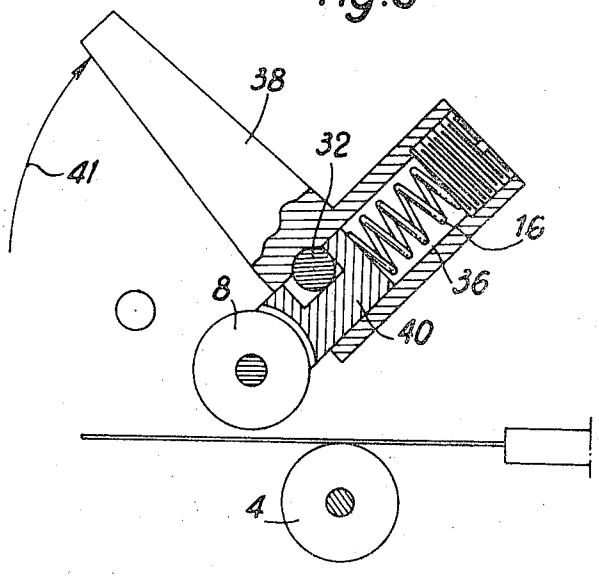

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Fig. 5

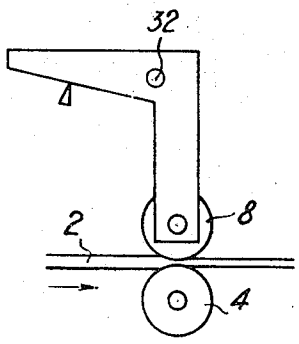


Fig. 6

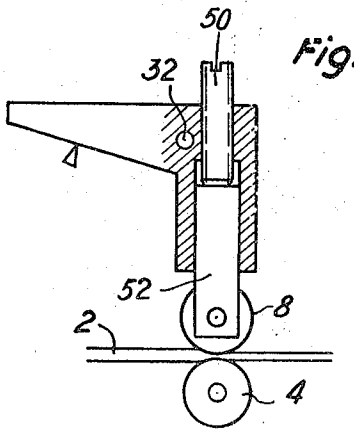


Fig. 7

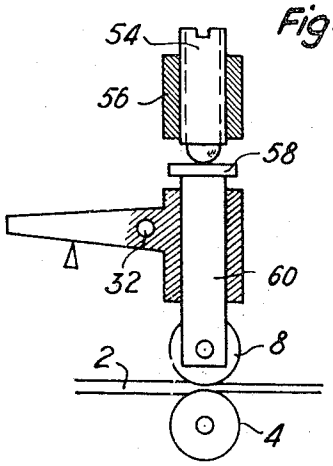


Fig. 8

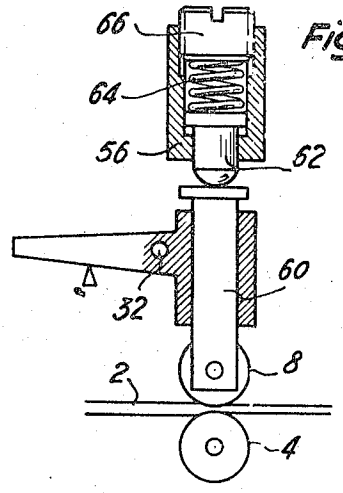


Fig. 9

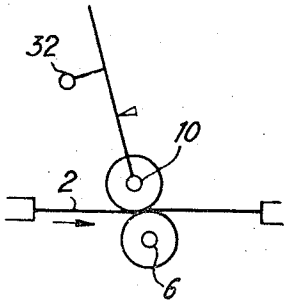


Fig. 10

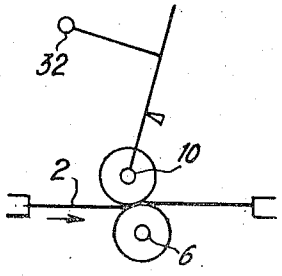
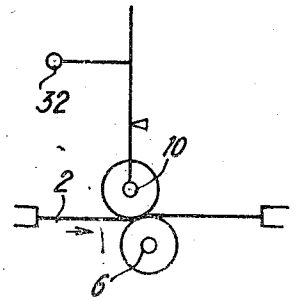


Fig. 11



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APPARATUS FOR LONGITUDINALLY ENTRAINING ELONGATED MATERIAL

This invention relates to apparatus for feeding elongated material in the direction of its length.

In certain known apparatus for the unwinding of a continuous electrode for use in welding, for example from a reel, there is generally used a geared motor unit which rotates one or more rollers against which the electrode is applied by an equal number of counter rollers which are under a fixed or adjustable pressure. The support for each counter roller is generally constituted by a pivoting or sliding frame so as to facilitate the placing in position of the electrode and the interruption of the feed of the electrode in the event of unwinding mishaps. The pressure which the counter roller applies to the electrode is generally achieved by means of a spring acting on the pivoting or sliding frame. The placing in position and locking of the counter roller necessitates the employment of auxiliary means, for example screws, a lever or an eccentric.

According to the present invention there is provided an apparatus for feeding elongated material in the longitudinal direction which apparatus comprises a driving roller, a counter roller, and a mobile support device which, when the apparatus is in the operative position, i.e. is in a position to entrain a length of material, presses the material by means of the counter roller on the driving roller, the driving roller and the counter roller having axes of rotation which are parallel to each other and perpendicular to the longitudinal axis of the material, the mobile support device being adapted to rotate about an axis parallel to the direction of the axes of the driving roller and of the counter roller and the mobile support device including a stop limiting the rotation of the mobile support device under the action of the forces whereby the counter roller acts upon it in the operative position, characterized in that, in the operative position, the distance between the axis of rotation of the mobile support device and the plane containing the axes of rotation of the driving roller and of the counter roller is substantially less than the distance between the projection on said plane of the axis of rotation of the mobile support device and the point of contact of the counter roller with the material being preferably less than a third of said distance.

The apparatus of the invention makes it possible to entrain material of widely varying nature, e.g. wires, rods, bars, strips or sections; for example, it may be used for entraining a bar of metal in a screw-cutting lathe or in a cutter, or an electrode wire in an electric arc welding machine.

The present invention simplifies the construction and the putting into operation of an apparatus for achieving the entrainment of an elongate object, and embodiments of the apparatus of the invention exhibit the following advantages:

- in a single and simple operation it is possible to position with precision and simultaneously to lock the counter roller or, conversely, to disengage it;
- regulation of the pressure applied by the counter roller is possible, both during running and when it is at a standstill; and
- the pressure can be maintained despite the successive manipulations of the counter roller.

It becomes possible to achieve automatically the result that, in the operative position, the plane containing the axes of the driving roller and of the counter roller is perpendicular to the length of the material, which can be, for example, and electrode wire.

The counter roller can be totally drawn aside, so that it becomes possible readily to position or withdraw the electrode wire or other material.

For a better understanding of the invention, and to show how the same may be carried into effect, reference will now be made, by way of example to the accompanying drawings which show diagrammatically several embodiments of the apparatus of the invention and in which:

FIG. 1 illustrates the principle of the invention:

FIG. 2 shows, partly in section, an embodiment of the invention in the operative position;

FIG. 3 is a second view of the embodiment of FIG. 2 wherein the apparatus is shown in the inoperative position;

FIG. 4 shows, partly in section, a portion of another embodiment; and

FIGS. 5 to 11 show further embodiments.

The operation of the several embodiments of the apparatus of the invention shown in the drawings is described below with reference to the entrainment of an electrode wire for use in an automatic or semiautomatic electric arc welding machine, but it will be understood that the apparatus of the invention can be used for other purposes.

Referring first to FIG. 1, an electrode wire **2** is drawn by a roller **4** which is rotated by a geared motor unit (not shown) in the direction of the arrow **28** about its axle **6**. The electrode wire **2** is urged against the roller **4** by a counter roller **8**, which is mounted idly on an axle **10**. The electrode wire is withdrawn from a spool **12** and fed into a wire guide **13**.

The counter roller is guided into contact with the electrode wire and applies pressure to the latter by means of a mobile support device which is identified in FIG. **1** by the general reference numeral **14** and which comprises:

a guiding system which permits the counter roller **8** to be displaced perpendicularly on its axis, the guiding system comprising a window frame **15** cut in the mobile support device and in which the axle **10** of the counter roller **8** is movable;

a spring **16**, bearing at its upper end on a member **18** and exerting a thrust on the axle **10** at its lower end, the thrust being transmitted by a rod **20** and by a transverse member **22**, the upper end of the rod being guided in the member **18** and through an opening **24** in the window frame **15**;

a mobile stop **26** which contacts a stationary portion (the position of which may be adjusted) on the machine and which limits the rotation of the mobile support device in the direction of the thrust on the counter roller, the direction of said rotation being indicated by the arrow **34**. The stop **26** prevents movement of the mobile support device beyond the operative position, i.e. beyond the normal electrode wire entrainment position, shown in FIG. **1**. In this position the stop is disposed in a manner such that a plane **30–30** containing the axes of the axles **6** and **10** is perpendicular to the length of the electrode wire **2** and is identical with the plane in which, at this instant, the window frame **15** for the counter roller **8** permits the displacement of the axle thereof. If the axle of the counter roller **8** were guided by a tie rod oscillating about an axle fixed to the mobile support device, the plane to be considered for displacement would be the plane tangent to the cylindrical surface described by the axle of the counter roller.

The mobile support device **14**, which includes the perimeter of the window frame **15** and the member **18**, which are rigidly interconnected but may be adjustably connected, if such should be desirable, rotates about a pivot **32**. The pivot **32** is disposed externally of the plane **30–30** at the side at which the electrode wire **2** arrives, i.e. to the left in FIG. **1**; it could also be in the plane **30–30** but the structure thus produced would be in a relatively unstable state of equilibrium.

In the operative position, the mobile support device does not tend to rotate if the electrode wire is immobile. The force F exerted by the electrode wire on the counter roller **8** is transmitted by the transverse member **22** and the spring **16** to the member **18**. It tends to rotate the mobile support device about the pivot **32** in the direction of the arrow **34**, this being restricted by the stop **26**. When the electrode wire **2** is entrained by the driving roller, the force by means of which it rotates the counter roller also tends to urge the mobile support device against its stop.

In order to interrupt rapidly (if this should be necessary) the feed of the electrode wire, it suffices to rotate the mobile support device **14** in the direction opposite to that shown by the arrow **34**. The counter roller **8** is displaced towards the left, its axle ascending and then descending in the window frame **15**; when the said axle abuts on the lower portion of the window frame, the counter roller **8** no longer bears on the electrode wire and the latter is no longer entrained by the driving roller.

In the operative position shown in FIG. 1 the distance between the axis of rotation of the mobile support device and the plane 30–30 containing the axles 6 and 10 is approximately equal to a third the distance between the projection of the pivot 32 on said plane and the point of contact of the counter roller 8 with the material. In practice, the distance between the pivot 32 and the member 18 guiding the rod 20 is very much shorter than that shown in FIG. 1, so that a small movement of rotation of the mobile support device 14 will suffice to engage or disengage the device 14 into or from the working position. This rotation may be imparted manually or by means of an electromagnet, a pneumatic jack, etc.

Referring now to FIGS. 2 and 3 of the drawings, there is shown an apparatus in which the mobile support device comprises a sleeve 36 which is provided with a finger 38 which constitutes the mobile stop. The mobile support device can be secured to an axle 32 or can be adapted to rotate about the axle 32. In the sleeve 36 there slides a piston 40 which terminates in a flange (not shown) and in which axle 10 is journaled The roller 8 is urged against the electrode wire 2 by a spring 16 the compression of which is regulated by a screw 42 screwing into the sleeve 36. The apparatus is shown in its operative position in FIG. 2 whereas in FIG. 3 the apparatus is shown in its declutched position which is attained by exerting pressure on the finger 38 in the direction of the arrow 41.

In FIG. 4 of the drawings there is shown part of a modification of the apparatus shown in FIGS. 2 and 3, the view shown in FIG. 4 being taken from the right-hand side of the embodiment shown in FIGS. 2 and 3. In this modification, the counter roller 8 is provided with a toothed wheel 44 meshing with a toothed wheel 46 secured to the driving roller 4 when the apparatus is in the operative position. It then suffices, in order to entrain the electrode wire 2, that substantially half the counter roller pressure of the one if wheels 44 and 46 did not exist should be applied, thus diminishing the risk of hammering or bruising of the wire.

The apparatus of the invention may not comprise a spring, such as the spring 16, for urging the counter roller 8 against the roller 4, but the pressure exerted by the counter roller 8 on the wire then considerably deforms the latter. The extent of the deformation depends, particularly, on the hardness of the wire and on the adhesion which it is desired to obtain; the deformation may be diminished by increasing the flexibility of the means in the apparatus which connects the counter roller 8 to the roller 4 and which then to a certain extent replaces the spring. FIG. 5 of the drawing shows a simple arrangement of this kind.

Referring next to FIG. 6 of the drawing, there is shown an embodiment of the apparatus of the invention in which a screw 50 is screwed into the mobile support device and bears on a pusher member 52 carrying the axle of the counter roller 8; by action on the screw 50, the pressure acting on the counter roller 8 can be adjusted.

In the embodiment of the apparatus of the invention shown in FIG. 7 an adjusting screw 54, which is screwed into a portion 56 in the apparatus which is not secured to the mobile support device, bears in the operative position on the upper end 58 of a pusher member 60 which carries the axle of the counter roller 8.

The embodiment of the apparatus of the invention shown in FIG. 8 differs from the embodiment shown in FIG. 7 in that the screw 54 is replaced by a finger 62 which is urged by a spring 64 against the pusher member 60. The spring 64 is compressed by a screw 66.

FIGS. 9, 10 and 11 of the drawing shown embodiment wherein, in the operative position, the plane containing the axles 6 and 10 of the roller 4 and of the counter roller is not perpendicular to the plane containing the wire 2. Consequently, there is a realignment of the wire during its passage between the rollers, the realignment of the wire causing the wire to be straightened which is frequently useful when the latter is supplied in coils or on reels.

The embodiments of the apparatus of the invention described above can be modified in many ways. For example, the surface of the roller in contact with the electrode wire can be striated, or it can form a groove, etc., and this applies also to the surface of the counter roller. One and the same pair of rollers and counter rollers can entrain a plurality of wires simultaneously. The shapes and position of the stops may differ from those shown in the accompanying drawings. Means may be provided for adjusting the positions of the stops, of the pivoting axis of the mobile device, or of the frame carrying the counter roller.

It is also possible to provide for reversal of the direction of rotation of the driving roller in order, for example, to produce the striking of a welding arc by electrode-work contact, followed by interruption of said contact, or alternatively to remove the electrode wire from its wire guide. Equilibrium of the mobile support device depends above all on the position of the stop and of the line of action (F in FIG. 1) of the force with which the counter roller acts on the mobile support device. Thus, in general, it will be possible to rotate the roller in one direction or the other, for example to replace the reel by the wire guide, and vice versa, in the cases illustrated in FIGS. 1 and 2. If the roller is driven in the latter sense, it tends to suppress the action of the stop, but the thrust on the counter roller normally provides this action. The apparatus may be designed so that, when the roller is required to supply an excessive force which, for example, would cause the wire to buckle, the stop 26 moves away from the fixed portion on which it is required to bear; the mobile support device then rocks, and the wire is no longer applied on the roller.

A plurality of devices according to the invention can be controlled simultaneously by one and the same system rotating the mobile pressure devices thereof. This arrangement is advantageous, for example, when a multiplicity of identical articles is being manufactured by welding. It would also be possible to entrain the same wire by a plurality of devices according to the invention, arranged in series. If the mobile support devices of the apparatus are mechanically interconnected, a single stop and a single control arrangement will suffice for the assembly.

I claim:

1. In apparatus for entraining elongated material in the longitudinal direction, comprising a driving roller, a counter roller, and a mobile support device which, when the apparatus is in a position to entrain elongated material, presses the elongated material by means of the counter roller on the driving roller, the driving roller and the counter roller having axes of rotation which are parallel to each other and perpendicular to the longitudinal axis of the elongated material, the mobile support device being adapted to rotate about an axis parallel to the axes of the driving roller and of the counter roller, the mobile support device including a stop limiting the rotation of the mobile support device under the action of the forces imposed by the material whereby the counter roller acts upon said mobile support device in the operative position; the improvement in which, in said operative position, the distance between said axis of rotation of the mobile support device and the plane containing the axes of rotation of the driving roller and of the counter roller is substantially less than the distance between the projection on said plane of said axis of rotation of the mobile support device and the point of contact of the counter roller with the elongated material.

2. Apparatus as claimed in claim 1, the distance between said axis of rotation of the mobile support device and the plane containing the axes of rotation of the driving roller and of the counter roller being less than one-third the distance between the projection on said plane of said axis of rotation of the mobile support device and the point of contact of the counter roller with the elongated material.

3. Apparatus as claimed in claim 1, and means mounting the axle of the counter roller on the mobile support device for movement relative to the mobile support device in a direction perpendicular to the axis of rotation of the counter roller.

4. Apparatus as claimed in claim 3, and spring means acting between the mobile support device and the axle of the counter

roller continuously to urge the counter roller toward the driving roller.

5. Apparatus as claimed in claim 1, said stop being so disposed that when the counter roller bears against the stop

said plane is perpendicular to the axis of the material.

6. Apparatus as claimed in claim 5, and means mounting the counter roller for movement relative to the mobile support device in said plane.