July 28, 1959 E. J. BURKE 2,896,572

NON-SLIP FRICTION DRIVE

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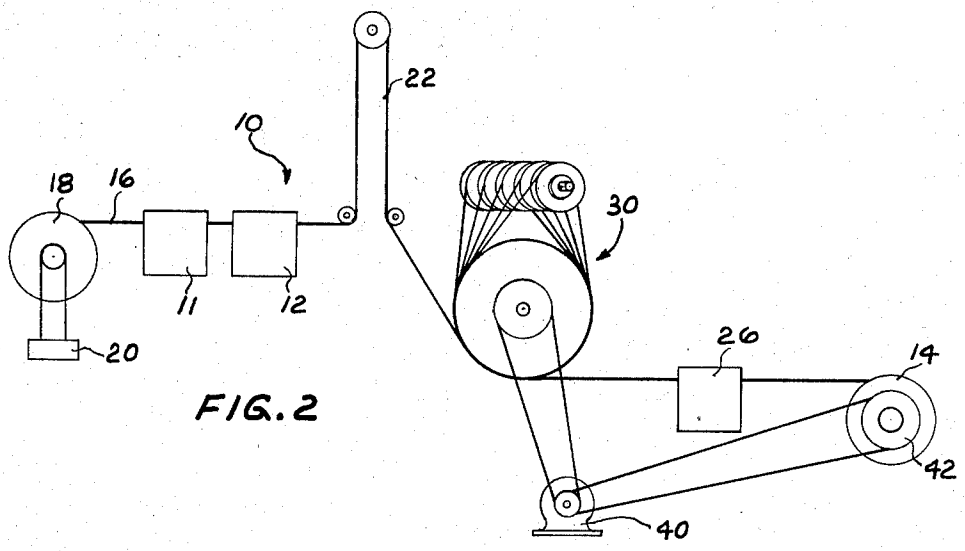



FIG. 2

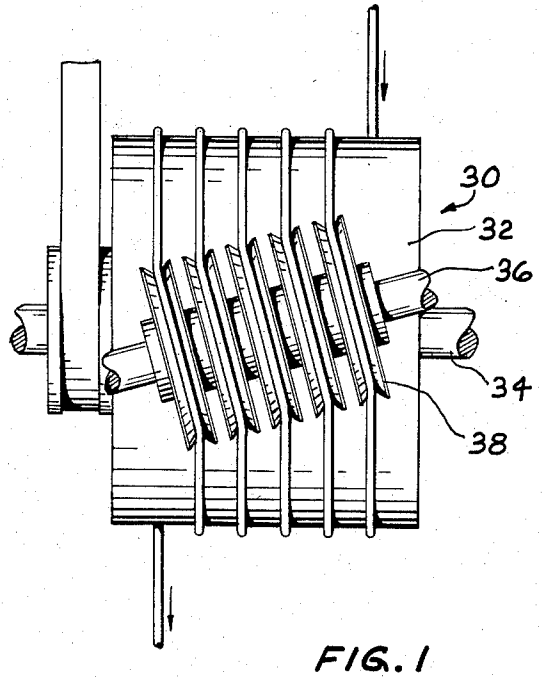



FIG. 1

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# NON-SLIP FRICTION DRIVE

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This invention relates to power driven constant speed non-slip friction drive mechanisms, and more particularly to mechanisms for drawing wire through tinning baths at constant speed.

For the purpose of setting an environment for this invention, a wire tinning machine may be thought of as comprising a supply reel with drag means resisting removal of the wire from the supply reel, a tinning bath with an adjacent cooling tower to permit hardening of the tin before rewinding, a drive means to pull the wire through the bath against the resistance of the drag means, and a rewind reel with its spooling mechanism to lay the wire evenly on the reel. It is necessary in the operation of tinning wire that the wire be pulled through the tinning bath at a substantially uniform rate. If wire is pulled through tin baths at too fast a rate, not enough tin will be deposited on the wire, and in time as the copper in the wire goes into cold solution in the coating, it will work through the thin tin coating. If wire is pulled through the hot tin baths at too slow a rate, the copper in the wire will be heated and will go into solution in the tin bath. Copper in solution in the tin bath will change the characteristics of the bath and will introduce difficulty in maintaining control over the bath, with the result that the wire produced will have coating characteristics different from those desired. If the speed of the wire through the tinning bath is not uniform, there will be variations in the time that successive portions of the wire are in the tinning bath, which will of course produce undesirable uneven tinning.

Previous attempts at establishing uniform speed of travel of wire through tinning baths have pointed out the necessity of providing an intermediate drive means between the tinning bath and the take-up or rewind reel. A power driven rewind reel cannot be depended upon to pull the wire through the tinning bath at constant speed, because of the continually changing diameter of the reel as wire is added, as well as because of slippage and sidewise sliding of wire on wire at crossover points on the reel. Such variants produce changing rates, which result in non-uniform passage through the tinning bath, which in turn produces non-uniform tinning and an inferior product.

The provision of a single intermediate driven drum about which several loops or coils of wire are wrapped before being fed to the rewind reel does not provide the solution to the problem. If the single revolving drum is smooth surfaced, or if it is spirally grooved, the wire will walk off the drum or stack up against any flange that might be present. If the drum is provided with parallel grooves, slippage and crimping will occur as the wire passes over the ridges between the grooves.

One constant speed drive system utilizes a pair of spaced parallel grooved capstans. However, to avoid the disadvantages of slipping and twisting which occur when wire rides over the ridges between parallel grooves, the capstans have to be spaced to a considerable extent.



The usual spacing is from 6 to 15 or more diameters; that is to say, that two inch diameter capstans have to be spaced from 12 to 30 or more inches between centers. This wide spacing is extremely wasteful of valuable space on the frame of a tinning machine.

An object of this invention is to overcome the disadvantages and deficiencies of prior drive mechanisms.

Another object of this invention is to provide a constant speed friction drive unit capable of being attached to existing wire coating machines.

A further object of this invention is to provide a constant speed friction drive which will be compact and will require no widely spaced parts.

A still further object of this invention is to provide a constant speed friction drive which has only one driven part.

A still further object of this invention is to provide a constant speed friction drive unit capable of use in diverse fields of working with wire-like material.

These and other objects of this invention which will become apparent in the course of the disclosure are accomplished by bringing wire or other filamentary material, that is to be pulled through a machine, around a large smooth drum set perpendicular to the travel of the wire, and then around a pulley set at an angle to the drum.

The invention will be more readily understood upon consideration of the following specification and by reference to the accompanying drawings of a preferred embodiment in which:

Fig. 1 is a plan view of the drive unit; and

Fig. 2 is a diagrammatic view of the drive unit and its relationship to a wire tinning machine.

As shown in the drawing, the drive mechanism **30** of this invention is mounted on the frame of the wire coating machine **10**, intermediate tinning bath **12** and spooling device **26**. The wire **16** is brought from the pay-off or source reel **18**, which has a brake or drag **20**, through the preparation bath **11**, through the tinning bath **12**, up through a cooling tower **22**, around the drive mechanism **30** a plurality of turns, through wire laying spooling mechanism **26** and onto the take-up or collecting reel **14**. Brake **20** by preventing reel **18** from spinning freely and by taking up the sudden jerk that occurs when wire is pulled out from under what should have been an underlying layer serves to provide the necessary resistance to drive **30** so as to maintain tension on the wire.

The drive mechanism **30** comprises a relatively large smooth faced cylinder or drum **32** of friction material, e.g., wood. Cylinder **32**, which is of the order of 5¾" in diameter, is rotatably mounted on the frame of the tinning machine so that the axis **34** of cylinder **32** is in a plane normal to the travel of wire **16** through tinning machine **10**, and is in a horizontal plane. In close proximity to cylinder **32** is a shaft **36** set at an angle to axis **34**, but also located in a horizontal plane. It should be understood that while in the preferred embodiment cylinder **32** is in the horizontal plane, the cylinder could as well be in the vertical plane. Also, it is necessary only that the shaft for the sheaves be circumferentially disposed with respect to the cylinder, and that they be mounted in close proximity to the cylinder. The shaft angle is of the order of 5° to 10° from the normal to the travel of the wire through the tinning machine. Shaft **36** carries a plurality of sheaves **38**, of the order of 2", made of steel and ball bearing mounted on shaft **36** so as to be individually and freely rotatable thereon. Although sheaves **38** are shown in the drawings as having equal diameters, it should be understood that sheaves of different diameters could be used, in that sheaves of

different diameters would merely change the spacing of the coils on cylinder **32**.

The angle of shaft **36** to axis **34** is determined by the proximity to cylinder **32**, the relative diameters of sheaves **38** and cylinder **32**, and the spacing desired for successive turns of wire **16** on cylinder **32** for a particular wire size. The angle of shaft **36** must be set so that each coil around cylinder **32** is at a right angle to axis **34**, or in other words, each wrap of wire on drum **32** must be parallel to the travel of wire through the tinning machine. The fact that all crossover of the wire takes place on sheaves **38**, prevents axial movement of wire across cylinder **32**. That is to say, there is no walking of wire on the cylinder, the same length of cylinder is used at all times, and the onrunning and offrunning lines, as well as each coil, travel through a fixed position on the cylinder.

Cylinder **32**, which is the only part of this tension drive which must be power driven, is driven by a suitable power means **40**, while sheaves **38** are freely rotatable. Power means **40** is also used to power the rewind reel **14** through a slip clutch **42** which is overdriven to deliberately pull on drive **30** so that there will always be tension on wire **16** regardless of the amount of wire on spool **14**. By means of slip clutch **42**, rewind spool **14** is overdriven sufficiently to take up or rewind the wire at whatever speed it is fed off drive mechanism **30**. The amount of the overdrive is roughly 5%, that is to say that the input is driven so that when spool **14** is smallest, the spool is driven at a minimum of 5% greater linear speed than the linear speed of the wire. In the preferred embodiment, the use of five sheaves was found to give excellent non-slip qualities. While one sheave on the angled shaft of this invention produced greater non-slip feeding than heretofore known, the greatly improved results obtained by using a plurality of sheaves dictated the use of at least two sheaves. The number of sheaves depends upon the requirements of the forces involved. The mechanical gain or tensional build-up of friction drive **30** is of course dependent upon the number of coils of wire around the unit, and must be such that a small force on the output side exerts a large force on the input side. Drive mechanism **30** gives a drive of frictional force great enough to overcome all the forces that may be working opposite to the friction. In other words, device **30** serves to build up the frictional forces to a point where they will overcome all the opposing forces. In practice this is accomplished by building up the forces on drum **32** by increasing the number of coils of wire **16** around the drum, with a sheave for each coil, until no change in speed of wire travel can be detected by ordinary shop equipment.

In use, wire **16** after emerging from bath **12** is looped around driven cylinder **32** and free sheaves **38** in the usual pulley winding (as shown in Fig. 1). By virtue of the angle of shaft **36** the successive windings on cylinder **32** are spaced, and there is no slippage of wire on either the cylinder or the sheaves. This invention is very compact in that the spacing between cylinder **32** and sheaves **38** is less than has been heretofore possible in machines not utilizing the angled shaft of this invention, e.g., a clearance of only a half-inch is adequate. This small clearance means that for the embodiment of this disclosure, a spacing of only 4⅜" between centers need be provided, as against the 12" to 30" previously required. Furthermore, because of the angled shaft, sheaves **38** may be of a smaller size relative to cylinder **32** and still not produce torsional deformation of the wire as the successive turns are spaced on the smooth face of the cylinder.

While the invention has been described and depicted in its preferred application, it is by no means limited thereto. The invention is of general utility in the field of providing constant speed for a moving wire-like member, whether the wire is to be worked on (e.g., coated with insulation or tinned) or is to be the working member (e.g., a haul line used in pulling another object).



While the illustrated embodiment shows only one wire being drawn through the machine, it should be understood that the practical application of friction drive **30** is not limited to a single wire. More than one wire may be coiled around drum **32**, provided that each additional wire is parallel to wire **16**. It is however necessary that each wire have its own set of sheaves. In practice, drum **32** may be of considerable length, while frame **10** may be provided with mounting means for a plurality of angled shafts, similar to shaft **36**. As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope hereof, it is to be understood that the invention is not limited to the specific embodiments hereof except as defined in the appended claims.

What is claimed is:

1. A constant speed friction drive device for elongated material of circular cross-section comprising a frame, a cylinder rotatably mounted on the frame normal to the travel of the material, drive means for the cylinder, a shaft mounted on the frame at an angle to the cylinder, and a plurality of freely rotatable sheaves on the shaft, whereby a wire-like member looped about the cylinder and the sheaves will be uniformly advanced.

2. A constant speed friction drive device for a wire working machine comprising a smooth surfaced cylinder of frictional material mounted normal to the travel of wire through a wire working machine, power means to drive the cylinder, and a plurality of freely rotatable sheaves of substantially smaller size than the cylinder rotatably mounted at a small angle to the normal to the travel of wire, the axis of the sheaves lying in a plane parallel to the axis of the cylinder, the cylinder and the sheaves so constructed and arranged that wire looped therearound in pulley fashion will be uniformly advanced.

3. A uniform speed friction drive device for drawing wire through a wire tinning machine comprising a smooth surfaced wooden cylinder having its axis in a plane normal to the travel of wire through the machine, power means to revolve the cylinder, a plurality of freely rotatable steel sheaves circumferentially disposed with respect to the cylinder and slightly offset from normal to the travel of wire, said sheaves mounted in close proximity to the cylinder, whereby wire looped around the cylinder and one of the sheaves in each of a plurality of loops will be uniformly advanced.

4. In a wire tinning machine of the type having a source of wire to be tinned, means resisting the drawing of wire from the source, a tinning bath, and a rewind collector for tinned wire, the combination with a means to draw the wire through the tinning bath at constant speed, said drawing means comprising a first roll, a second roll consisting of a plurality of freely rotatable sheaves in proximity to the first roll and at an angle to the first roll, and drive means for said first roll of sufficient force to overcome the resisting means.

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