Jan. 26, 1937. H. ZARAFU 2,068,836

APPARATUS FOR DRAWING AND REELING WIRE

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Fig. 1.

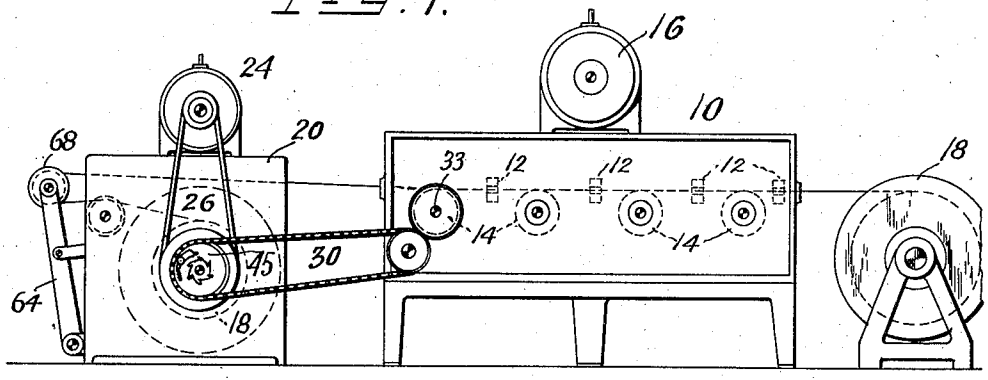


Fig. 2.

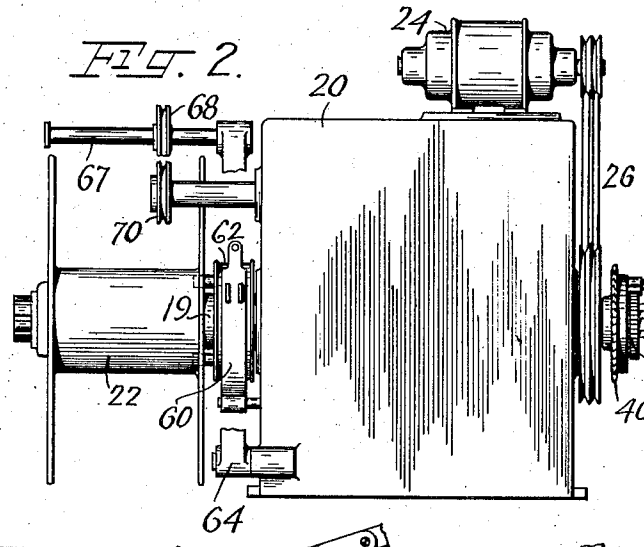


Fig. 3.

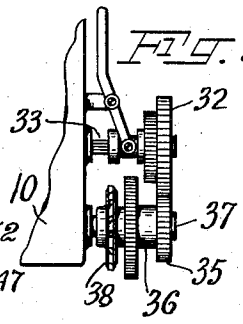


Fig. 4.

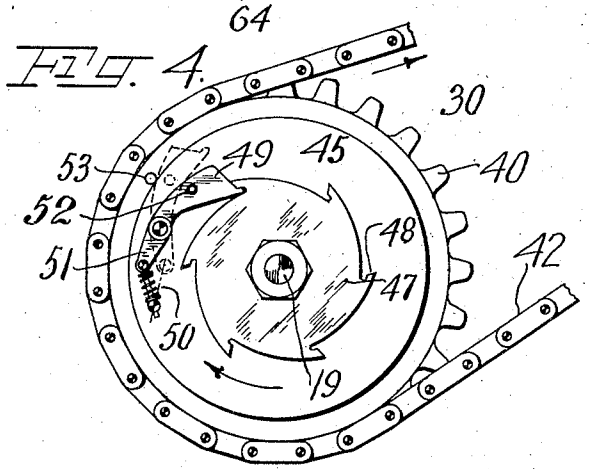
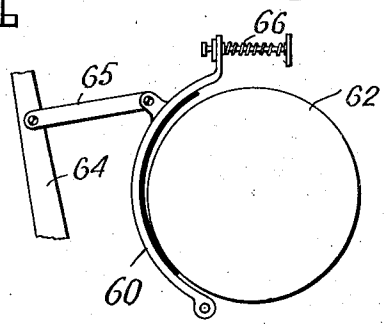


Fig. 5.



INVENTOR
Herman Zarafu
BY
Gustaver R. Thompson
ATTORNEY

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APPARATUS FOR DRAWING AND REELING WIRE

Herman Zarafu, West New York, N. J., assignor to Elevator Supplies Company, Incorporated, Hoboken, N. J., a corporation of New Jersey

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6 Claims. (Cl. 205—16)

This invention relates to apparatus for drawing and reeling wire and provides improvements therein.

The wire drawing part of the apparatus has different motivation characteristic from the reeling part of the apparatus, particularly with respect to the power (electric motors) for driving each of them and with respect to the inertia on starting and stopping. The wire drawing part requires essentially a powerful motor of the constant speed type, while the reeling-part requires a motor which is relatively weak and which can gradually slow down as the wire builds up on the reel. Because the reel motor must gradually slow down after running speed has been attained, and for other reasons, the use of one motor for driving the two units is not practically feasible. For successful results, the reeling unit should operate to maintain an approximately constant tension on the wire not only during acceleration but throughout the running of the combined units.

Various solutions of the problem of obtaining uniformity of acceleration of the motors of the two units have been proposed. The one most generally adopted is to provide a multiple-step accelerating electrical controller for the motor of the wire-drawing unit and to operate it to accelerate the motor of the drawing unit step-wise (retarded acceleration) so as to bring about as nearly as possible a conformation between the accelerations of the two units. This requires the use of expensive motors and expensive and complex speed control apparatus and requires a relatively long time for the two motors to reach full operating speed. Moreover during the accelerating period there is always the danger of the wire drawing unit being driven too fast with relation to the reeling unit, causing excessive slippage of the wire in the wire-drawing unit, with consequent "burning"; or of the wire-drawing unit being driven too slow with relation to the reeling-unit, causing excessive tension on and breaking of the wire. The inertia of the reeling-unit when the parts have reached running speed, is very considerable. As the reeling-unit turns against much less resistance than the wire-drawing unit, when the driving-force of the motors diminishes the inertia of the reeling-unit will act to more nearly maintain the speed of the reeling-unit than the inertia of the drawing-unit will act to maintain the speed of the latter. Consequently there are the same disadvantages arising from disconformity of the speeds of the reeling unit and drawing unit on deceleration as there are on acceleration. The difficulties hereinbefore mentioned are greatly accentuated in high speed apparatus.

The present invention provides a combination of reeling and drawing units in which the accelerating time is materially decreased as compared with previous combinations; in which the dangers of breaking and burning of the wire is greatly reduced; and in which expensive and complicated control apparatus for the drawing-unit motor is not required, and a simple and the least expensive type of motors may be used.

An embodiment of the invention is illustrated in the accompanying drawing, wherein:

Fig. 1 is a view in side elevation of a combination wire drawing and reeling apparatus incorporating the present improvements.

Fig. 2 is a rear-elevation of the reeling unit.

Figs. 3, 4 and 5 are detail views.

Referring to said drawing, numeral **10** designates the wire drawing unit and **20** the reeling unit. The wire drawing unit may be of the usual or any suitable and well known construction. A typical wire drawing unit comprises a plurality of dies **12** and a plurality of drums **14**, one after each die, around which one or more turns of the wire are wound. The dies act to successively reduce the diameter of the wire. The drums **14** are driven through suitable gearing at different speeds by a motor **16**. The increase in speed of one drum over another through the series is slightly less than that required to take up on the drum the elongation of the wire due to its passage through a die. This arrangement results in an intermittent lessening of the tension of the wire between a die and a drum, and consequently of the tension of the wire around the drum. This results in alternate seizing and slipping between the wire and drum throughout the operation of the apparatus, and its purpose is to prevent excessive tensioning and breaking of the wire within the drawing-unit, as is usual and well understood. Wire to be drawn may come from a reel **18**.

The motor **16** in the present combination may be a constant speed electric motor of simple construction, and current may be supplied thereto in such a way as to accelerate the wire drawing unit to full speed in the shortest time that it is possible to bring the motor to full speed with its load.

The reeling unit comprises a reel or spool **22** mounted on a spindle **19** which is driven by a relatively weak motor **24** through suitable means, as the pulleys and belts shown at **26**.

Numeral **30** designates suitable gearing for

connecting reeling unit 20 to the drawing unit 10, so that the reel 22 may be driven by the motor 16 of the wire drawing unit on starting and while the units are accelerating to running speed. The gearing 30 may comprise a gear 32 mounted on a shaft 33 forming an extension of the shaft of one of the drums 33, and a gear 35 on a sleeve 36 turning on the shaft 37, which sleeve 36 also has fixed thereon a sprocket wheel 38. The reel shaft 19 has mounted loosely thereon another sprocket wheel 40, and these two sprockets are connected by a sprocket chain 42. The gears 32 and 35 may be parts of a change speed gearing as illustrated. A change in the ratio of the gears 32 and 35 may be effected by the change speed gearing to accommodate the speed imparted to the reeling unit by the gearing 30 to spools of different diameter on the reeling unit.

A clutch 45 is provided for connecting the sprocket wheel 40 to the reel shaft 19. To this end the reel shaft 19 may have fixed thereon a ratchet wheel 47 having undercut teeth 48. Pivotally mounted on the sprocket wheel 40 is a pawl 49 adapted to engage the teeth 48 on the ratchet wheel. The pawl 49 is pressed toward the ratchet wheel 47 by spring 50, which spring acts upon an arm 51 on the pawl, and the angular relation between the spring 50 and arm 51 are such that the spring presses the pawl toward the ratchet wheel 47, through a certain range of movement of said pawl. When however the pawl 49 reaches a predetermined position in its movement, the spring 50 will act on the arm 51 in such manner as to press the pawl 49 around its pivot in the opposite direction, and hold the pawl out of contact with the ratchet wheel. The toothed end of pawl 49 is weighted to such an extent that the centrifugal force developed in the aforesaid weighted end when the reeling unit has attained running speed, is superior to the force of spring 50 acting around the pivot of pawl 49, so that pawl 49 may turn around its pivot away from ratchet wheel 47. A stop 53 may be provided for limiting the movement of the pawl due to the reflex action of the spring 50. The position where the spring acts to hold the pawl out of engagement with the ratchet wheel 47 is indicated by the dotted line position Fig. 4. Suitable means are provided for resetting pawl 49 to engage the ratchet-wheel 47, before each starting of the combined units 10 and 20. A pin 52 projecting outwardly from pawl 49 can be grasped by the fingers, and thus permits of manual operation of the pawl to a position where it engages the ratchet wheel 47.

Means are also preferably provided for retarding the speed of the reel when it starts to run ahead of the drawing-unit, as for example when power is thrown off of the motors 16 and 24. In the act of stopping, the greater effective momentum of the reel causes it to run ahead of the movement of the parts of the drawing unit running under their momentum. Numeral 60 designates a brake shoe pivoted in proximity to a brake drum 62 on the reel shaft 19. The brake shoe 60 is connected to a lever 64 through a link 65. Acting against the brake shoe is a spring 66, the tension of which is slightly greater than a predetermined tension which the reeling unit maintains on the wire coming from the drawing unit, hereinafter described. The lever 64 has thereon an arm 67 extending across the width of the spool on which the wire is wound, and the arm 67 has mounted loosely thereon a roller or wheel 68 around which the wire passes after leaving the drawing unit and before it winds on the reel. The wire is distributed on the spool by means of a reeling guide 70 which is reciprocated across the width of the spool in the usual well known manner. The roller 68 carried by the lever 64, moves across the spool along with the reeling guide 70.

Operation

In starting the combined apparatus (drawing unit 10 and reeling unit 20) the pawl 49 is engaged with the ratchet wheel 47. The motor 16 is energized. The motor 16 being a relatively powerful motor accelerates the drawing unit to its operating speed within a short time. The surface speed of the empty spool on the reeling unit is approximately the same, but slightly less, as hereinbefore explained, than the wire speed on leaving the drawing unit 10. The reel is driven through the gearing 30 and accelerates at the same speed as the drawing unit 10. The centrifugal force operating on the pawl 49 is prevented from throwing the pawl 49 out of engagement with the teeth 48 of the ratchet wheel 47 while there is torque between the clutch parts 40 and 47 by reason of the overhang of the teeth on the pawl 49. As soon as reel 22 reaches operating speed this torque ceases. The reeling motor 24 (already energized) now is capable of operating the reel (and ratchet wheel 47) at a slightly higher speed than that at which the reel is driven by motor 16 through gearing 30, sprocket 40 and pawl 49 thus causing tooth 48 to move away from pawl 49 whereupon centrifugal force acting on pawl is sufficient to move it completely out of engagement with ratchet wheel 47, where it is held by the spring 50, as heretofore explained. The slightly higher speed of ratchet wheel 47 creating overrunning and release, as mentioned above, is caused by the fact that the motor 24 is capable of driving the reeling unit 20 to develope full wire speed at the reel surface, whereas the drive through gearing 30 and sprocket 40 runs the reel 22 at a slightly lower speed with a consequent slight wire slip as heretofore explained.

The motor 24 of the reeling unit should be energized at the same time as motor 16 if motor 16 is energized in one accelerating step. When motor 16 is energized through a multiple step controller, the motor 24 should be energized at the same time as the last step of acceleration is applied to motor 16.

After operating speed is attained the reeling unit winds the wire going thereto from the drawing unit under a desired predetermined tension. As the wire builds up on the spool of the reeling unit, the speed of the motor 24 is retarded or held back by the tension of the wire, the retardation being progressive throughout the winding of the wire.

On deenergizing the motors 16 and 24, as in stopping, the momentum of the reeling unit 20 would cause it to run ahead of the drawing unit 10 running under the momentum of its parts. This will increase the tension on the wire. The increased tension will pull the lever 64 against the resistance of the spring 66, and cause the brake shoe to act on the brake drum 62 and retard the speed of the reeling unit.

The invention may receive other embodiments than that herein specifically illustrated and described.

What is claimed is:

1. In combination, a wire drawing unit having a relatively powerful motor capable of driving

the drums which pull the wire through the dies, a reeling unit comprising a reel and having a relatively weak motor capable of driving the reel to maintain a desired tension on the wire coming from the drawing unit, gearing for connecting the said reel with the wire-drawing unit so as to be driven by the motor thereof, and a clutch for disconnecting said gearing from said reel when the drawing unit and the reeling unit have attained a desired operating speed.

2. A combination according to claim 1 further comprising a brake for said reel, a lever for applying said brake having a roller thereon over which the wire passes before winding on said reel, and means for restraining movement of said lever at pulling-forces below the tension which it is desired to maintain on the wire.

3. A combination according to claim 1, wherein said gearing is arranged to impart a surface speed to said reel slightly less than the drawing speed of the wire.

4. A combination according to claim 1, said clutch comprising a pawl and a ratchet-wheel, and means for throwing said pawl to disengaging position when the reel reaches full operating speed.

5. A combination according to claim 1, said clutch comprising a pawl and a ratchet-wheel having teeth partially overhanging the engaging-part of said pawl, and means for throwing said pawl to disengaging position when the reel reaches full operating speed.

6. A combination according to claim 1, said clutch comprising a pawl and a ratchet-wheel, means for throwing said pawl to disengaging position when the reel reaches full operating speed, and means for resetting said pawl in engagement with said ratchet wheel prior to the restarting of the driving and reeling units.

HERMAN ZARAFU.