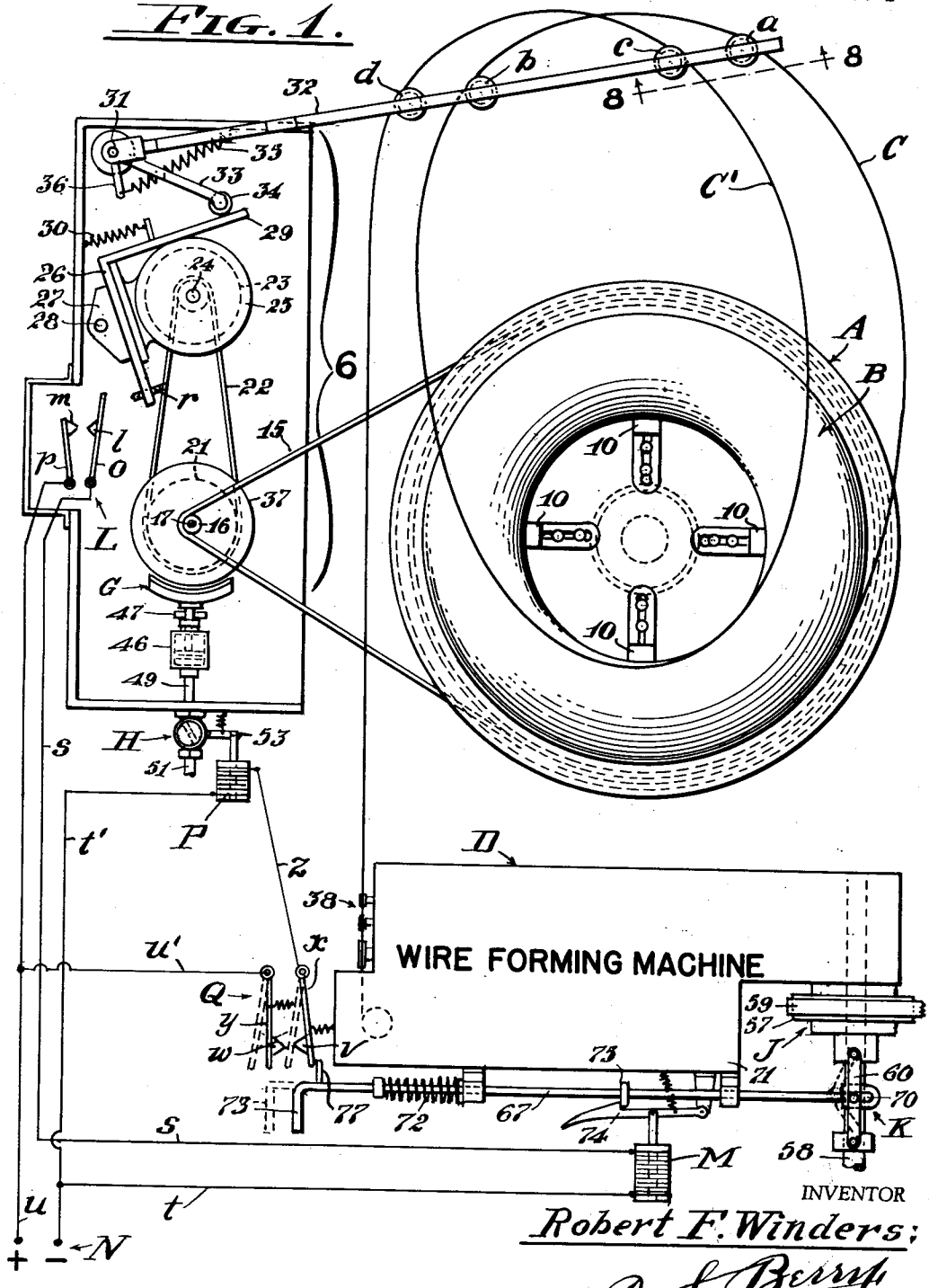
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MECHANISM FOR DELIVERING WIRE FROM A COIL THEREOF

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FIG. 1.



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FIG. 2.

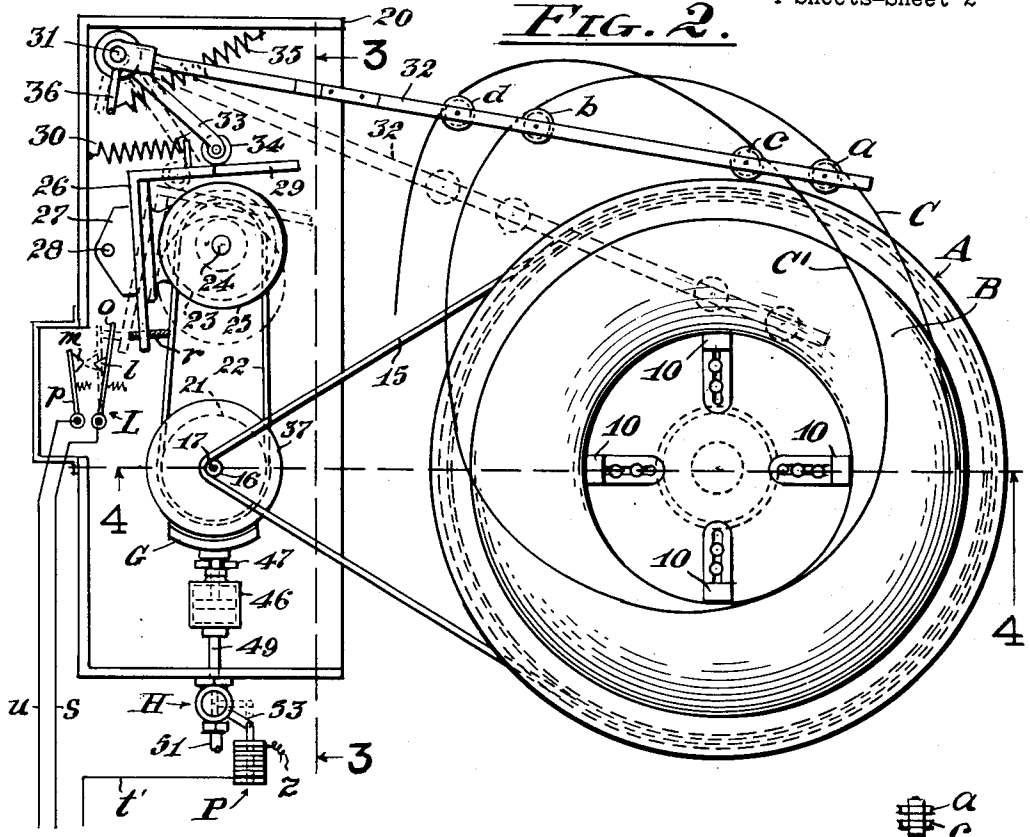
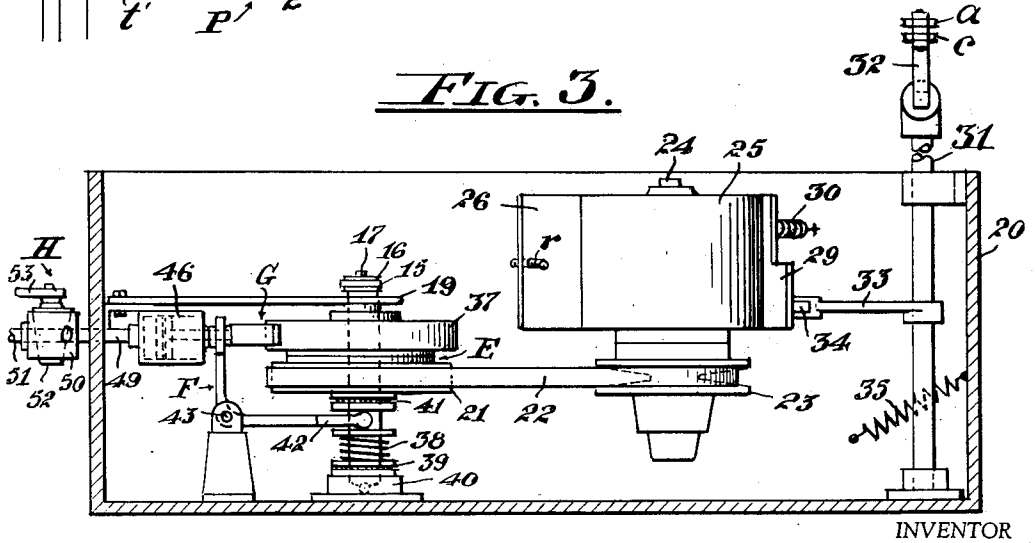


FIG. 3.



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FIG. 4.

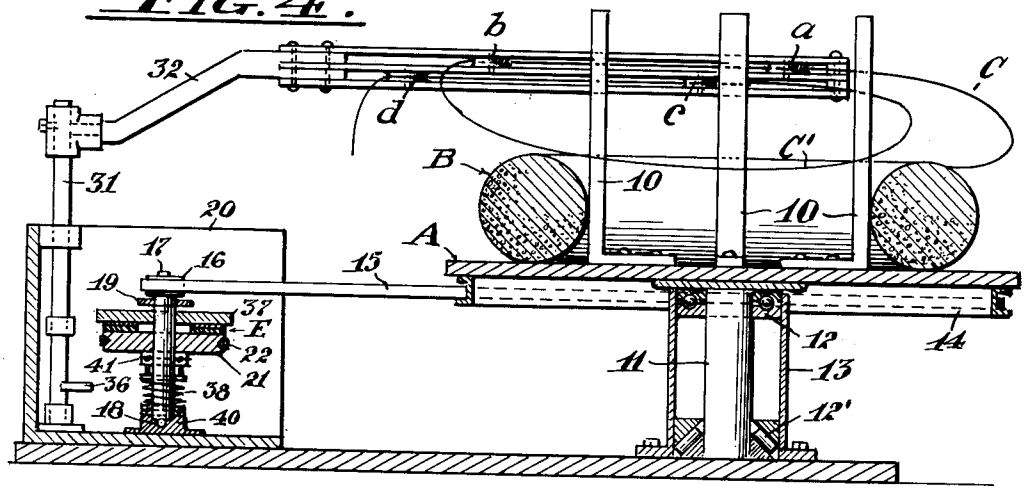
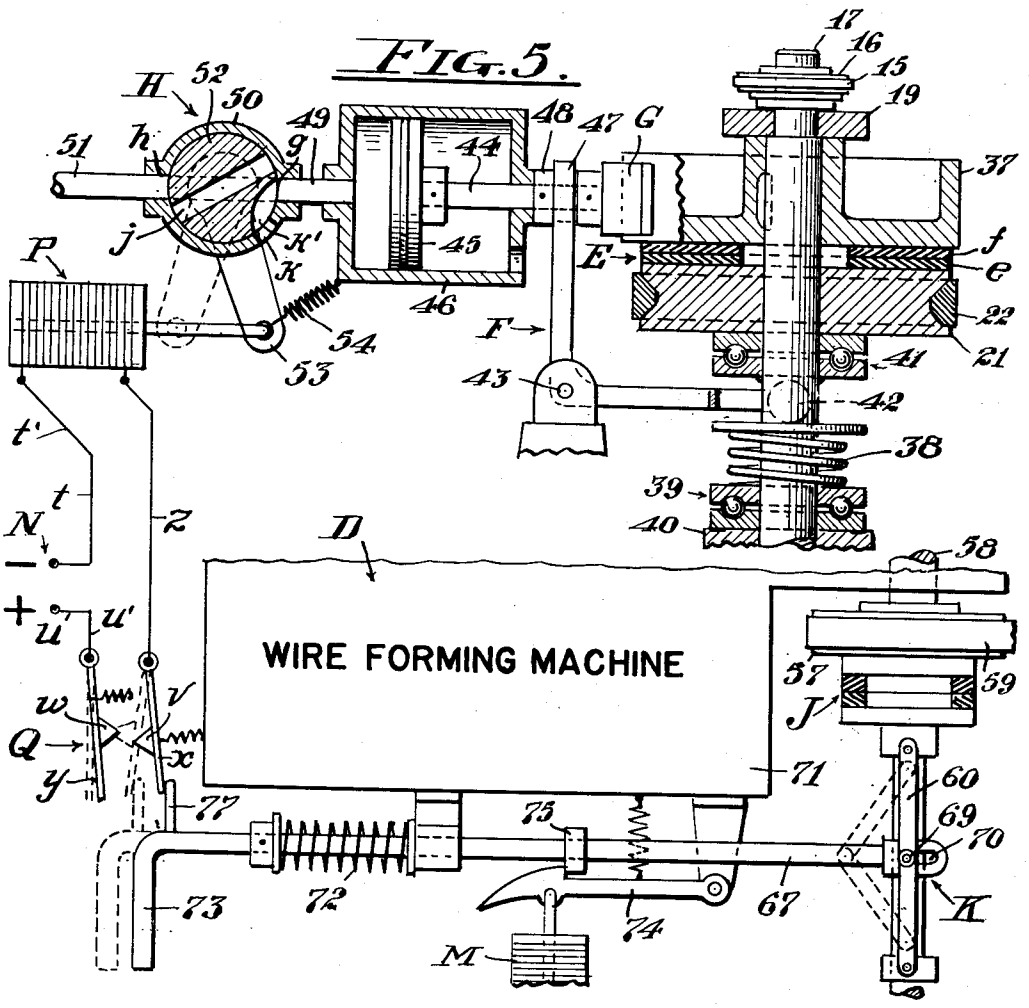


FIG. 5.



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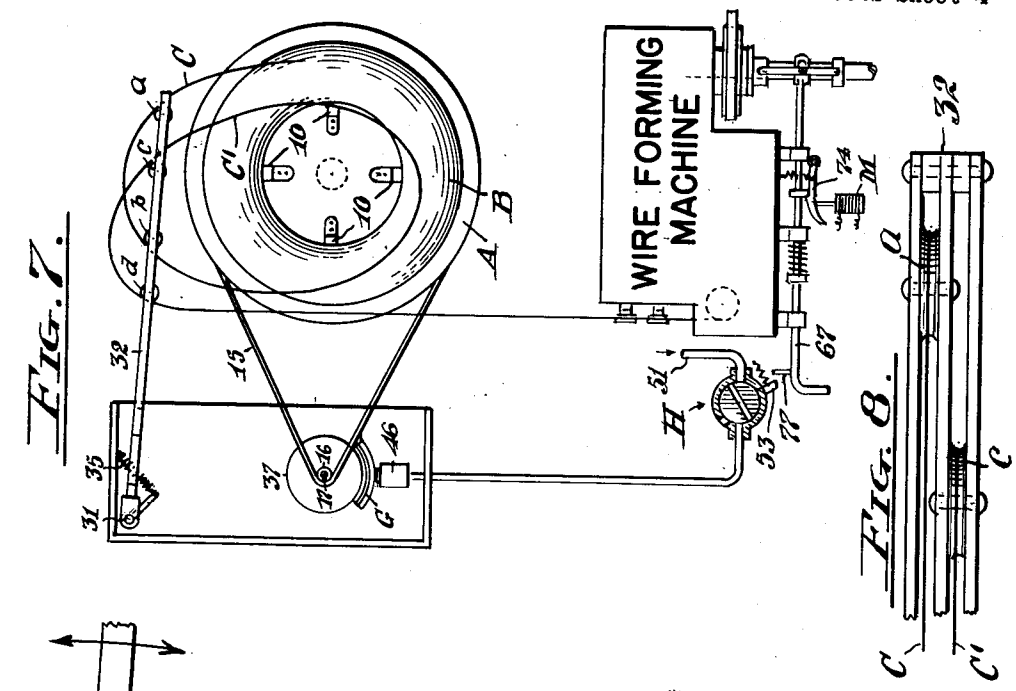


FIG. 7.

FIG. 8.

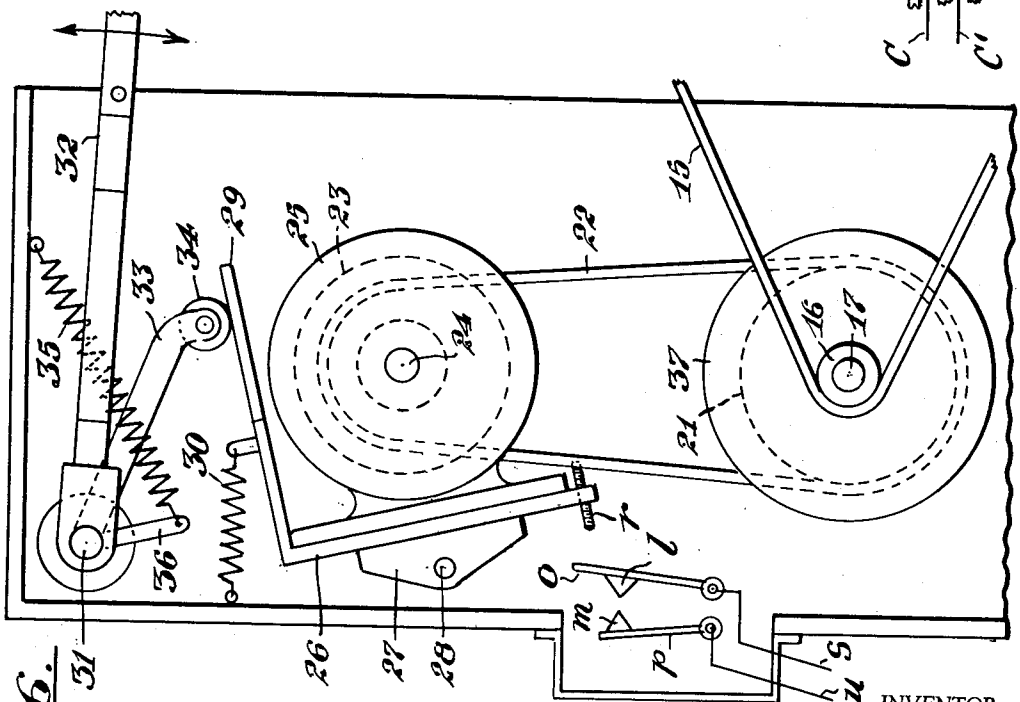


FIG. 6.

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3,137,452

MECHANISM FOR DELIVERING WIRE FROM A COIL THEREOF

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Filed Sept. 14, 1961, Ser. No. 138,094
5 Claims. (Cl. 242—54)

This invention relates to a mechanism for feeding wire from a coil thereof to a wire forming machine.

An object of the invention is to provide a powered mechanism whereby wire may be fed from a rotating coil thereof and delivered to a wire forming machine wherein the speed of rotation of the coil and the feed of the wire therefrom will be automatically varied according to the demands of the wire forming machine and wherein rotation of the coil and feed of the wire therefrom will be automatically terminated in event of stopping of the wire forming machine, or in event of tangling of the wire being fed from the coil.

Another object is to provide a wire feeding mechanism of the above character which is especially advantageous for use in the delivery of wire from coils thereof wherein the initial weight of the coil is, for example, in the neighborhood of two thousand pounds, thus necessitating the effective application of forces in overcoming inertia in initiating movement of the coil and in overcoming momentum in arresting movement thereof.

With the foregoing object and advantage in view, together with such other objects and advantages as may subsequently appear, the invention resides in the parts and in the combination, construction and arrangement of parts hereinafter described and claimed and illustrated by way of example in the accompanying drawings in which:

FIG. 1 is a diagram in plan depicting the mechanism as applied and in operation in effecting the feed of wire from a coil thereof to a wire forming machine;

FIG. 2 is a diagram in plan depicting in dotted lines the wire feeding mechanism with parts as disposed to automatically stop operation of the wire feeding mechanism;

FIG. 3 is an enlarged detail in section and elevation as seen on the line 3—3 of FIG. 2 in the direction indicated by the arrows;

FIG. 4 is a detail in section and elevation taken on the line 4—4 of FIG. 2 as seen in the direction indicated by the arrows;

FIG. 5 is a schematic diagram of the brake and clutch elements of the wire feeding mechanism with their associated controls embodied in a wire forming machine;

FIG. 6 is an enlarged view of the portion of FIG. 1 indicated by the bracket 6;

FIG. 7 is a diagram in plan depicting a modification of the invention with portions removed; and

FIG. 8 is a detail in elevation of the wire supporting arm as seen on the line 8—8 of FIG. 1 in the direction indicated by the arrows.

Referring to the drawings more specifically A indicates a rotary table for supporting a coil B of wire C which coil is seated on the table and centered axially thereof by a multiple of equispaced circularly arranged posts 10 mounted on the table A and abutting the inner periphery of the coil.

The upper end portions of the posts 10 project a substantial distance above the upper face of the coil B to serve as guides to aid in directing the wire C into an enlarged convolution or loop C′ as it separates from the coil B and preliminary to its delivery to a wire forming machine D, the purpose of which will later appear. The table A is mounted on the upper end of an upstanding shaft 11 revolubly supported by bearings 12—12′ on a fixed standard 13.

Affixed to the under side of the table A is an annular rail 14 arranged contiguous the perimeter of the table A concentric with the axis of the shaft 11. The rail 14 has its outer periphery engaged by a continuous flexible driving element 15, such as a sprocket chain, belt or cable, which passes around and is engaged by a driving wheel or pulley 16 on the upper end of an upstanding revoluble shaft 17. The shaft 17 is seated at its lower end on an end thrust bearing 18 and has its upper end portion revolubly guided in a bracket 19 projecting horizontally from an upstanding wall 20.

Loose on the shaft 17 is a pulley 21 engaged by a belt 22 which passes around and is engaged by a variable speed pulley 23 on the drive shaft 24 of an electric motor 25 mounted for horizontal swinging movement toward and away from the shaft 17. The motor 25 is here shown as rigidly mounted on an upright panel 26 erected at its lower end on a bracket 27 mounted to swing horizontally on a pivot 28. Projecting from the panel 26 and extending alongside the motor 25 is a plate 29 to which is connected the outer end of a pull spring 30 acting on the plate 29 and panel 26 to normally swing the motor 25 away from the shaft 17 to a retracted position wherein the variable speed pulley 23 is in its low speed driving condition.

Erected adjacent the plate 29 on the side thereof opposite the motor 25, is a vertically extending rock-shaft 31 on the upper end portion of which is fixed a long horizontal arm 32 the outer end portion of which extends contiguous the coil B on a plane slightly thereabove. The arm 32 functions as a directional support for wire C delivered from the coil B, as will be later described, and also serves as an actuator for turning the rock-shaft 31 in one direction under a pull imposed on the outer end of the arm 32 by the wire C supported thereon.

Means are provided whereby turning of the rock-shaft 31, under a pull imposed on the arm 32, will effect swinging movement of the motor carrying panel 26 in opposition to the pull spring 30, which means comprises an arm 33 fixed on the shaft 31 having a roller 34 on its outer end seated against the outer face of the plate 29 so that inward movement of the arm 32 will be transmitted through the rock-shaft 31, arm 33, roller 34 and plate 29 to the panel 26. A pull spring 35 has one end thereof attached to the wall 20 and has its other end connected to a bracket 36 fixed on the rock-shaft 31, which spring acts through the rock-shaft 31 to normally maintain the arms 32 and 33 in their retracted position and to yieldably oppose advance movement of the arm 32 under the pull of the wire C, as will be later described.

Mounted on the outer end portion of the arm 32 are two pair of direction rollers *a–b* and *c–d* around which the wire C is rove; the wire C leading from the coil B being passed successively around the direction rollers *a–b* on the arm 32 and then looped around the upstanding end portions of the posts 10 and then passed around the direction rollers *c* and *d*. The wire C leads from the roller *d* to the intake feed rollers 38 of the wire forming machine D as indicated in FIG. 1.

Fixed on the shaft 17 adjacent the pulley 21 is a brake drum 37 and interposed between the pulley and brake drum are the members *e–f* of a friction clutch E of which the member *e* is affixed to the upper side of the pulley 21 while the clutch member *f* is affixed to the under side of the brake drum 37. The members *e–f* of the clutch E are normally disposed in interengagement by a spring 38 encircling the shaft 17 and exterting an upward thrust against the underside of the pulley 21. As here shown, the spring 38 seats at its lower end on a ball bearing 39 abutting a bearing 40 supporting the shaft 17, and which spring bears indirectly at its upper end on a ball bearing 41 on which seats the underside of the pulley 21.

Interposed between the spring 38 and the bearing 41 is a yoke 42 constituting the lower end of an upstanding bell-crank lever F pivoted at 43 and adapted to be rocked to depress the spring 38 to thereby disengage the clutch E or to release the depressed spring to effect engagement of the clutch.

A brake shoe G is provided for engagement with the drum 37 to stop rotation of the shaft 17 and the table A driven therefrom. As here shown, the brake shoe G is fixed on a piston rod 44 fitted with a piston 45 arranged in a cylinder 46. The upper end 47 of the bell-crank F extends astride the piston rod 44 between the shoe G and a collar 48 on the piston rod 44 and normally acts under the thrust of the clutch spring 38 to retract the piston 45 and thereby dispose the brake shoe G out of engagement with the drum 37.

The brake shoe G is applied by directing fluid under pressure into the cylinder 46 behind the piston 45 under control of a valve H, the brake being designed to be applied simultaneously with release of the clutch E. The cylinder 46 is fitted with a fluid supply conduit 49 leading from the discharge side of the valve H which is here shown as embodying a housing 50 having an outlet port *g* with which the conduit 49 connects and having an intake port *h* with which connects a supply pipe 51 leading from any suitable source of fluid under pressure. The valve housing 50 is fitted with a valve cylinder 52 having a passage *j* adapted to be disposed in and out of communication with the ports *g* and *h* on turning the valve to its on and off positions. The valve H has an exhaust port *k* and the valve cylinder 52 is provided with a passage *k'* adapted to be positioned to open the port *k* to the discharge port *g* whereby the cylinder 46 is opened to atmosphere and thus normally exhausted of fluid presusre and whereby the clutch E is normally engaged and the brake G normally released. The valve H is provided with an operating lever 53 acted on by a spring 54 normally positioning the valve cylinder 52 with the passage *j* closed to the ports *g* and *h* and with the exhaust port *k* opening the discharge port *g* to atmosphere as particularly shown in FIG. 5.

The wire forming machine D with which the wire feeding mechanism above described is associated, embodies a normally engaged clutch J connecting a power driven pulley 57 with a driven shaft 58 actuating the wire forming mechanism in the machine D in a usual manner; the pulley 57 being driven by a belt 59 from a source of power (not shown). The clutch J is locked in its engaged position by a toggle lever 60 and is adapted to be released in the usual manner by the operation of a slide bar 67 attached to the toggle lever 60 by a lost motion connection K here shown as comprising a pin 69 on the toggle lever 60 engaged in an elongated slot 70 in the inner end portion of the slide bar 67 as particularly shown in FIG. 5.

The slide bar 67 is mounted for longitudinal movement on the housing 71 of the wire forming machine D and is advanced to its forwardmost position against the thrust of a spring 72 so as to advance the toggle lever 60 and thereby engage the clutch J and thus place the wire forming machine D in operation; the slide bar 67 being manually advanced through the medium of a hand hold 73 on the outer end thereof.

A spring urged pawl 74 is arranged to then engage a collar 75 fixed on the slide bar 67 to retain the latter in its forward position so that the clutch J will then be disposed in its engaged position. When the slide bar 67 is in its forward position the outer end of the slot 70 will be spaced from the pin 69 on the lever 63 to afford a lost motion clearance whereby initial outward movement of the slide bar 67 occasioned on release of the pawl 74 from the collar 75, will occur for a short distance before operatively disengaging the clutch lever 63, the purpose of which will appear hereinafter.

Means are provided for automatically disengaging the pawl 74 from the slide bar 67 which means embodies a normally open microswitch L controlling a solenoid magnet M connected to the pawl 74 and operable on energizing the magnet to swing the pawl 74 to its disengaged position. The switch L embodies a pair of normally disengaged contacts *l* and *m* on spring arms *o* and *p*, respectively, and is arranged with the arm *o* disposed for engagement and movement to its switch closing position by an adjustable stem *r* on the panel 26. The stem *r* is located on the margin of the panel 26 opposite that carrying the plate 29 and is adjusted thereon so that when the panel 26 is swung under the urge of the arm 32 when advanced to its forwardmost position, the stem will engage the switch arm *o* and close the switch L. The switch L normally remains open at all times except when closed as above stated and which occurs only when the arm 32 is moved to its extreme forward position.

The contact *l* on the switch arm o connects with an electrical conductor *s* leading to one terminal of the solenoid M the other terminal of which connects with a conductor *t* which with a conductor *u* connecting with the contact *m* on the switch arm *p* leads to an outlet N of a source of electrical current supply in a usual manner.

Means are provided for automatically actuating the fluid pressure control valve H which means is controlled by actuation of the slide bar 67 in placing the wire forming machine D out of operation. This means is shown in FIGS. 1, 2 and 5 as being electrically operated and as embodying a solenoid P connected to the operating lever 53 of the valve H which solenoid is controlled by a normally open microswitch Q adapted to be closed by movement of the slide bar 67 under the urge of the spring 72. The switch Q embodies a pair of contacts *v–w* on a pair of normally retracted switch arms *x–y* of which the switch arm *x* extends in front of a projection 77 on the slide bar 67 so that as the slide bar is retracted from its advanced clutch releasing position, the switch Q will be closed thereby. A conductor *u'* leads from the conductor *u* to the switch contact *w* and a conductor *z* leads from the contact *x* to one terminal of the solenoid P the other terminal of which connects with the conductor *t* through a conductor *t'*.

In the arrangement shown in FIG. 7, the valve H is controlled directly by movement of the slide bar 67, the projection 77 on the latter being disposed to engage the valve operating lever 53 to open the valve for the passage of fluid under pressure therethrough on retraction of the slide bar.

When the wire forming machine D is out of operation with the slide bar 67 retracted and switch Q closed, as shown in dotted lines in FIG. 1, the solenoid P will be energized and the valve H thereby held open so as to deliver fluid pressure into the cylinder 46 whereby the bell-crank lever F will be actuated so as to engage the brake G and release the clutch E. The parts of the wire feeding mechanism will then be brought to rest except as to the motor 25 and the variable speed pulley 23, belt 22, and pulley 21 driven thereby.

In the operation of the invention, on the wire C being rove from the coil B around the direction rollers *a–b*, posts 10 and direction roller *c–d*, in the order named, and the leading end of the wire engaged by the intake feed rollers 38 of the wire forming machine D, the machine D is set in operation by engaging the clutch J, which is effected by advancing the slide bar 67 from its initial retracted position indicated in dotted lines in FIGS. 1 and 5 to the advanced position shown in full lines in which position the slide bar spreads the toggle lever 60 so as to lock the clutch J in its engaged and driving position. The slide bar is then engaged by the pawl 74 and retained thereby in its advanced position in opposition to the spring 72. Forward movement of the slide bar 67 opens the switch Q thereby de-energizing the solenoid P so that the valve H will be restored to normal by the spring 54 and thus exhaust the fluid under pressure from the cylinder 46 thereby simultaneously releasing the brake G and engaging the clutch E.

Coincident with initiating operation of the wire forming machine D, or shortly previous thereto, electrical cur-

rent is directed from a suitable source of supply to the motor **25** as by closing a control switch in a usual manner, whereupon the motor **25** will act to drive the pulley **23**, belt **22** and pulley **21** so as to rotate the shaft **17** through the then engaged clutch E. Rotation of the shaft **17** acts through the sprocket or pulley **16** and element **15** to drive the rotary table A and thereby rotate the coil B and effect unwinding of the wire C therefrom.

A considerable length of the wire extends between the coil B and the wire intake rollers **38** of the wire forming machine D, which length in passing around the direction rollers *a–b* on the arm **32** followed by a loop thereof passing around the posts **10** and then leading to the machine D around the rollers *c–d* assumes a large spiral configuration by reason of the inherent stiffness or resistance to bending pressure of the wire. Because of flexibility of the considerable length of the wire as a whole, such spiral arrangement is subject to fluctuation; the spiral formation permitting variation in the recited length of the wire as will be occasioned during operation by reason of the delivery of the wire from the coil C being continuous while the intake into the wire forming machine is intermittent due to the frequent stopping of the wire delivered to the machine when severing the wire into formed lengths.

The wire C delivered from the coil B passes to the wire forming machine at a speed dependent upon the rate of consumption of the wire by the machine D which may vary between a minimum and a maximum. Such variation is reflected by variation in the pull of the wire imposed on the arm **32** by the wire intake mechanism **38** and resisted by the spring **35** and whereby the arm **32** will be caused to rapidly assume various positions within the range of its path of travel, which in normal operation will be confined to the outermost portion of such movement. When the pull on the arm **32** is at its minimum the arm **32** will be retracted by the spring **35** to near its outermost position so that the variable speed pulley **23** will then be positioned to drive the belt **22** and the rotary table A at slow speed, but on increase of such pull, the arm **32** will be advanced inwardly so as to dispose the variable speed pulley **23** in a position such as to drive the belt **22** and rotary table at a higher speed. It follows that while the motor **25** operates at a uniform speed of rotation, the rotary table and the wire coil thereon will vary in their speed of rotation according to the position of the arm **32** in its arc of travel.

In event, for any cause, the recited pull on the arm **32** be excessive, as by entanglement of the wire C in the coil B the arm **32** will be automatically pulled fully inward by tension imposed on the wire by the feed **38** thereby causing the motor carrying panel **26** to swing under the pressure of the arm **33** thereby closing the switch L and energizing the solenoid M to thereby release the pawl **74** from engagement with the slide bar **67** so that the spring **72** will act to advance the slide bar to its off position thus disengaging the clutch J and stopping the machine D. Initial movement of the slide bar **67** will close the switch Q to thereby energize the solenoid P and actuate the valve H to thereby disengage the clutch E and simultaneously apply the brake G thus terminating movement of the rotary table A and stopping feed of the wire C from the coil B.

When it is desired to terminate the operation of the wire forming machine D and the wire feeding mechanism, the pawl **74** is released by the operator and the slide bar allowed to move to its fully retracted position under the urge of the spring **72** so as to disengage the clutch J of the wire forming machine to stop the latter and also effect stopping of the rotary table A by disengaging the clutch E and setting the brake G.

The speed of rotation of the table A and the speed of rotation of the intake feed rollers **38** are so related to each other that the rollers **38** will intermittently feed into the wire forming machine in a given period a length of

the wire C delivered by the rotating reel B on the table over such period. Such relative speeds are primarily determined by regulation of the respective motors by which the wire working machine and the wire feed mechanism are operated.

During the operation of the wire delivering mechanism the speed of travel of the wire C leading from the coil B will vary relative to the speed of rotation of the table A by reason of variation in the radius of the coil at the point of departure of the wire from the coil, occasioned by the wire feeding from the coil at various points between the inner and outer perimeters thereof. This speed variation together with that occasioned by continuous delivery of the wire from the coil and intermittent feed of the wire to the wire forming machine is compensated for by the variable speed transmission afforded by the variable speed pulley **23** controlled by the pivoted wire supporting arm **32** as it is actuated to move forward on a pull being imparted thereto by the wire intake mechanism or feed rollers **38** of the wire forming machine in feeding the wire to the latter, which action accelerates rotation of the table and coil, and as the arm is actuated by the spring **35** to move rearward during the interval when the pull of the feed rollers **38** is relaxed to thereby dispose the pulley **23** so as to then decelerate rotation of the table and coil. This alternate acceleration and deceleration of speed of rotation of the table and reel occurs with a frequency dependent upon the length of time required to form a length of wire delivered to the wire forming machine on each operation, which in some instances is quite rapid. During such acceleration and deceleration the loop C′ will be alternately enlarged and diminished by the alternate elongation and shortening of the length of wire C extending between the coil B and the intake feed rollers **38** of the wire forming machine, the loop C′ thus serving to compensate for such variations in wire lengths and obviating binding of the wire in its progress from the coil B to the wire forming machine.

While a specific embodiment of the invention has been shown and described, the invention is not limited to the exact details of construction set forth, and the invention embraces such changes, modifications and equivalents of the parts and their formation and arrangement as come within the purview of the appended claims.

I claim:

1. The combination with a wire forming machine having wire intake mechanism adapted to engage and exert a pull on a wire delivered thereto, and embodying clutch-operating means controlling operation thereof, of a rotary table adjacent to but spaced from said wire forming machine for supporting a coil of wire thereon, a pivoted wire supporting arm arranged to swing adjacent said table opposite and in spaced relation to said intake mechanism, a plurality of direction rollers on said arm around which a length of wire leading from a coil thereof on said table is adapted to be rove with the leading end thereof directed from one of said rollers to said intake mechanism, an upstanding member on said table projecting above a coil of wire thereon adapted to have passed therearound the portion of wire leading over certain of said direction rollers for disposing said wire portion in a loop; a tensioned spring urging said arm outward in opposition to a pull exerted on the wire from said intake mechanism; means for rotating said table to unwind wire from the coil thereon embodying an upstanding rotary shaft, a driving connection between said rotary shaft and said rotary table, a pulley loose on said rotary shaft adapted to be engaged therewith, a belt passing around and engaging said pulley, a variable speed pulley engaged by said belt, a motor having a drive shaft on which said variable speed pulley is mounted, a pivoted panel on which said motor is carried for horizontal swinging movement, spring means connected to said panel normally retaining the panel, motor and variable speed pulley in a retracted position wherein said pulley drives the belt thereon at

slow speed, means for swinging said panel in opposition to said spring under the thrust of forward movement of said arm to thereby vary the action of said variable speed pulley; means for stopping rotation of said table embodying a brake drum fixed on said rotary shaft and a normally engaged clutch connecting said brake drum and the pulley on said rotary shaft, means for simultaneously actuating said clutch and brake to disengage the clutch and apply the brake; and means operated by actuation of the clutch-operating means of the wire forming machine operatively connected to said clutch and brake operating means to actuate the latter.

2. In a machine for delivering wire from a coil thereof to a wire forming machine, a rotary table for supporting and turning a coil of wire to unwind wire therefrom, a motor, means for driving said table from said motor embodying a variable speed pulley mounted on said motor, a belt engaging said pulley, a clutch driven by said belt, a shaft on which said clutch is mounted, and a driving connection between said shaft and said table, a brake drum on said shaft embodied in said clutch, a brake engageable with said drum, and means for simultaneously disengaging said clutch and applying said brake to stop rotation of said shaft and table and also to alternately simultaneously engage said clutch and release said brake, a pivotal mounting for said motor, and means for swinging said mounting to actuate said variable speed pulley to vary the speed of rotation of said table.

3. In a machine for delivering wire from a coil thereof,

(*a*) a rotary reel supporting table,

(*b*) a revoluble shaft,

(*c*) a driving connection between said shaft and said table,

(*d*) a brake drum fixed on said shaft,

(*e*) a brake shoe engageable with said drum normally out of engagement therewith,

(*f*) a pulley loose on said shaft, normally inter-engaged clutch members interposed between and interconnecting said brake drum and pulley,

(*g*) powered variable speed transmission mechanism drivingly connected to said pulley;

(*h*) a speed control arm,

(*i*) yieldable means normally maintaining said arm in a retracted position,

(*j*) wire guides on said arm engaged by wire unwinding from a reel on said table whereby increasing tension on the wire will swing said arm to an advanced position in opposition to said yieldable means,

(*k*) means actuated by said arm adapted to condition said variable speed transmission mechanism to drive said pulley and table at slow speed when said arm is in its retracted position and to drive said pulley and table at increasing speeds as the arm moves toward its advanced position wherein said pulley and table are rotated at a maximum high speed; and

(*l*) means actuated by movement of said arm into its fully advanced position to simultaneously disengage said clutch members and advance said brake shoe into engagement with said brake drum.

4. The structure called for in claim 3, in which said last named means comprises

(*a*) a normally retracted fluid pressure actuated plunger connected to said brake shoe,

(*b*) means actuated by said arm on moving to its advanced position for delivering fluid pressure to advance said plunger and thereby engage said shoe with said brake drum, and

(*c*) means connected to said plunger adapted to disengage said clutch members on advance of the plunger.

5. The combination with a wire forming machine having wire intake mechanism adapted to engage and exert a pull on a wire delivered thereto, of a horizontal rotary table adjacent to but spaced from said wire forming machine for supporting a coil of wire thereon, powered mechanism connected to said table for rotating same to unwind wire from a coil thereon, a pivoted wire supporting arm arranged to swing adjacent said table near one side thereof and on a plane thereabove, said arm being spaced from said winding machine opposite said wire intake mechanism, a plurality of direction rollers on said arm around which a length of wire leading from a coil thereof on said table is adapted to be rove with the leading end thereof directed from one of said rollers to said intake mechanism, a tensioned spring urging said arm outward in opposition to a pull exerted on the wire from said intake mechanism, a variable speed transmission in said powered mechanism, connections between said transmission and said arm controlling said powered mechanism by swinging movement of said arm to vary the speed of rotation of said table from minimum to maximum according to various positions of said arm as it is moved under the opposing pulls exerted thereon by the wire and said spring; said arm and connections acting on said variable speed transmission to accelerate rotation of said table on movement of said arm under increasing pull imposed thereon by the wire, means for stopping rotation of said table controlled by movement of said arm under the pull of the wire to an advanced position contiguous that where said arm and connections condition said variable speed transmission to drive said table at a maximum high speed; said powered mechanism embodying a shaft, means for rotating said shaft, and means for driving said rotary table from said shaft; and in which said table stopping means embodies a normally engaged clutch in said shaft rotating means, a brake controlling rotation of said shaft through said clutch, and valve controlled fluid pressure means controlled by said arm for simultaneously disengaging said clutch and applying said brake and also alternately engaging said clutch and releasing said brake.

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