April 1, 1941. L. IVERSEN ET AL 2,236,971

APPARATUS FOR SUPPORTING METAL COILS

Filed Jan. 2, 1941 4 Sheets-Sheet 1

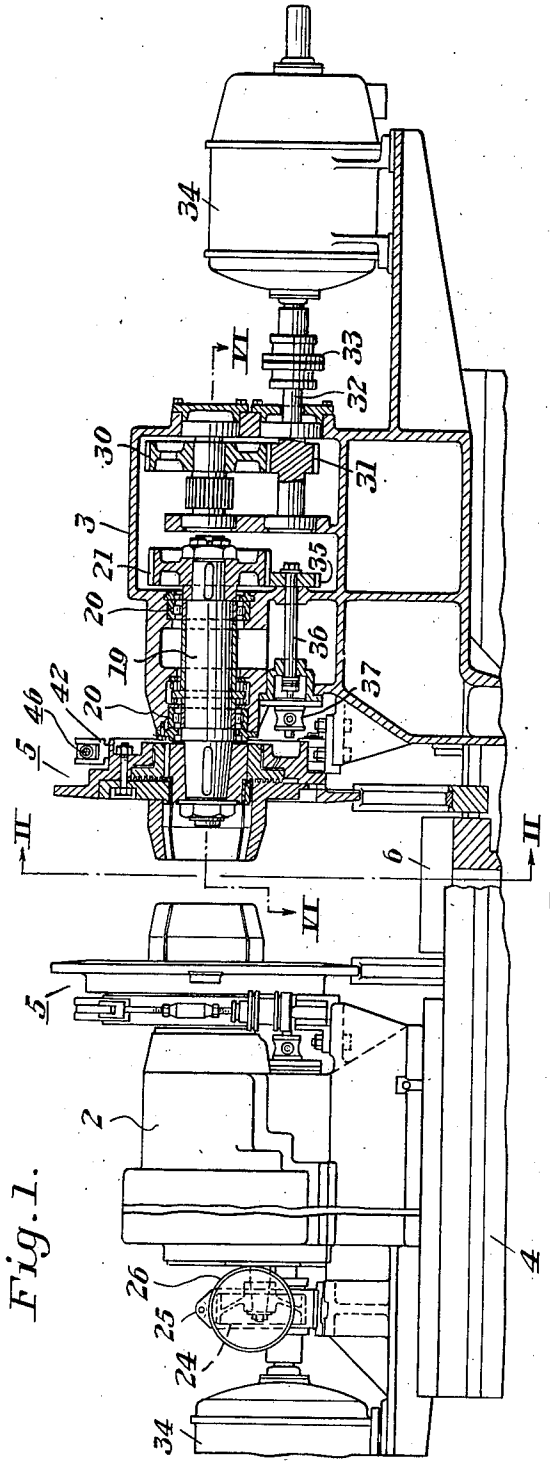


Fig. 1.

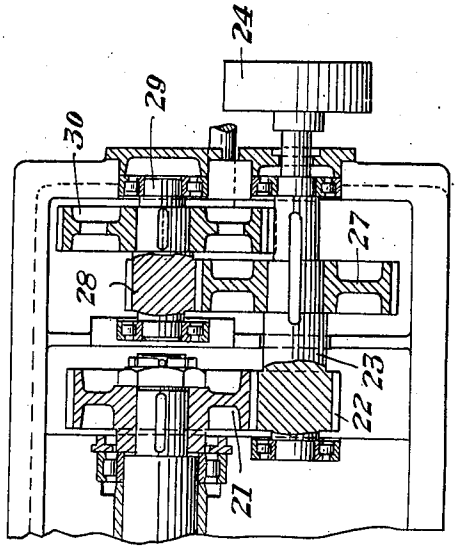


Fig. 6.

INVENTORS
Lorenz Iversen
and Franz J. Waldschutz
by Stellin and Blenker
Atty.

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APPARATUS FOR SUPPORTING METAL COILS

Filed Jan. 2, 1941 4 Sheets-Sheet 2

Fig. 2.

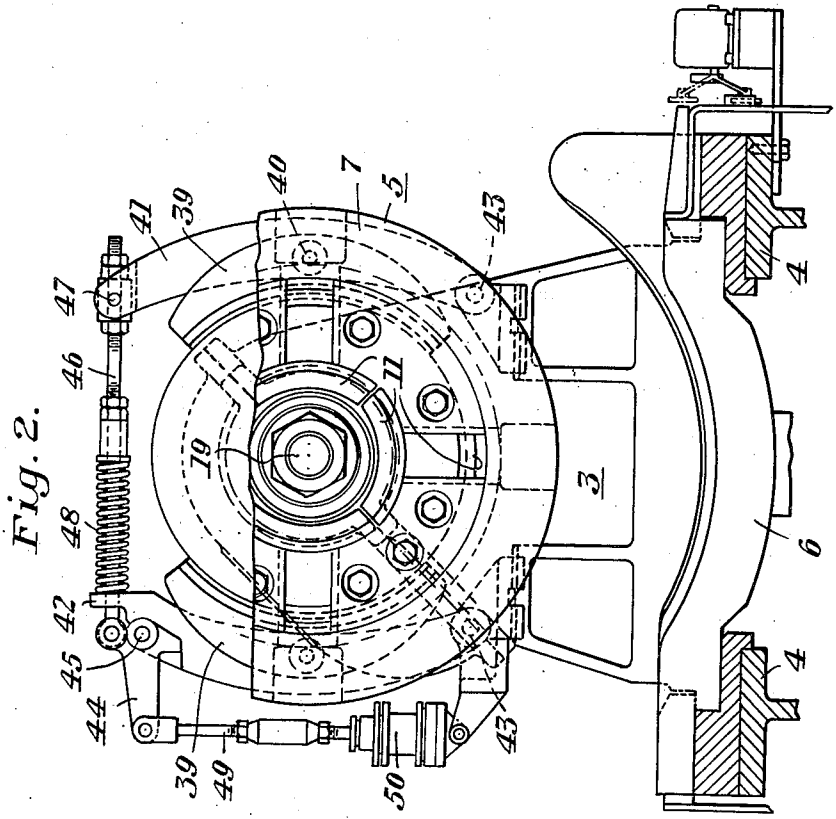
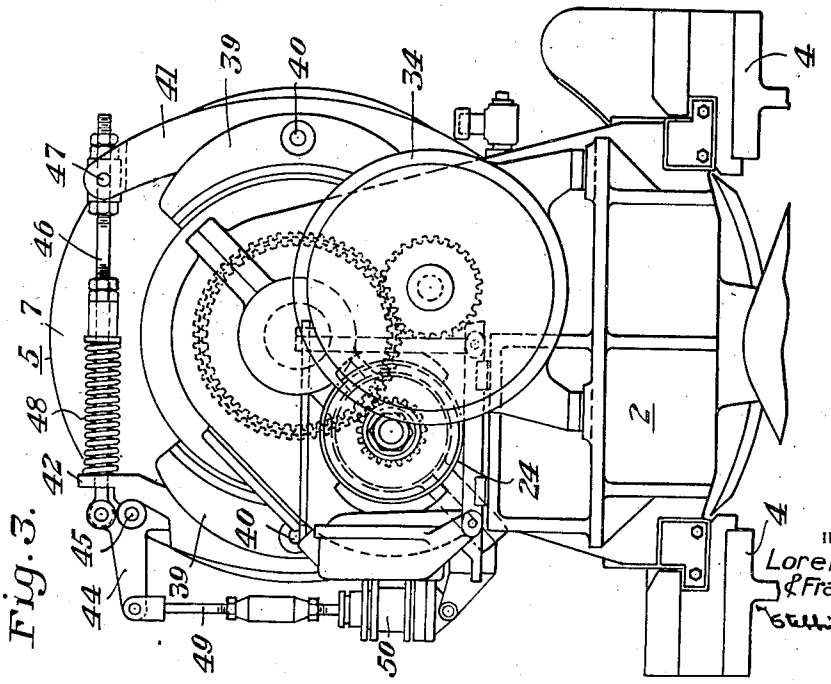


Fig. 3.



INVENTORS
Lorenz Iversen
& Franz J. Waldschutz
Stellin and Blenko
Attys.

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APPARATUS FOR SUPPORTING METAL COILS

Filed Jan. 2, 1941 4 Sheets-Sheet 3

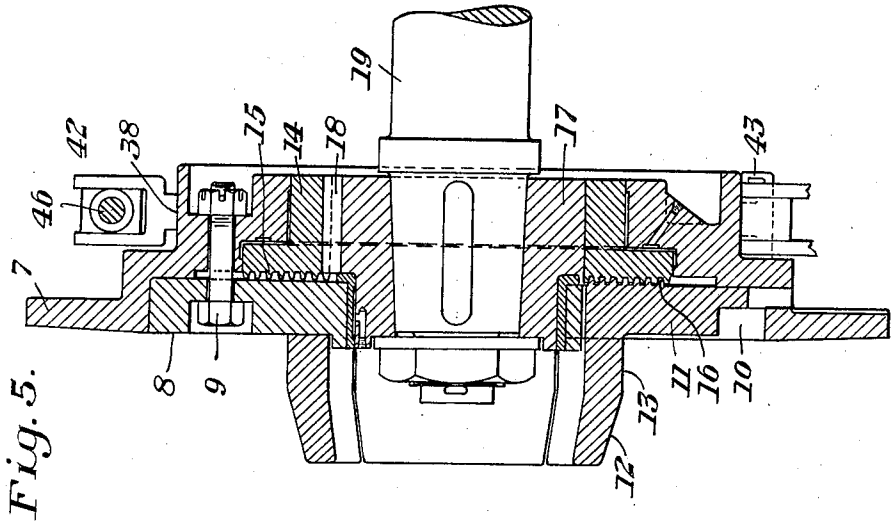


Fig. 5.

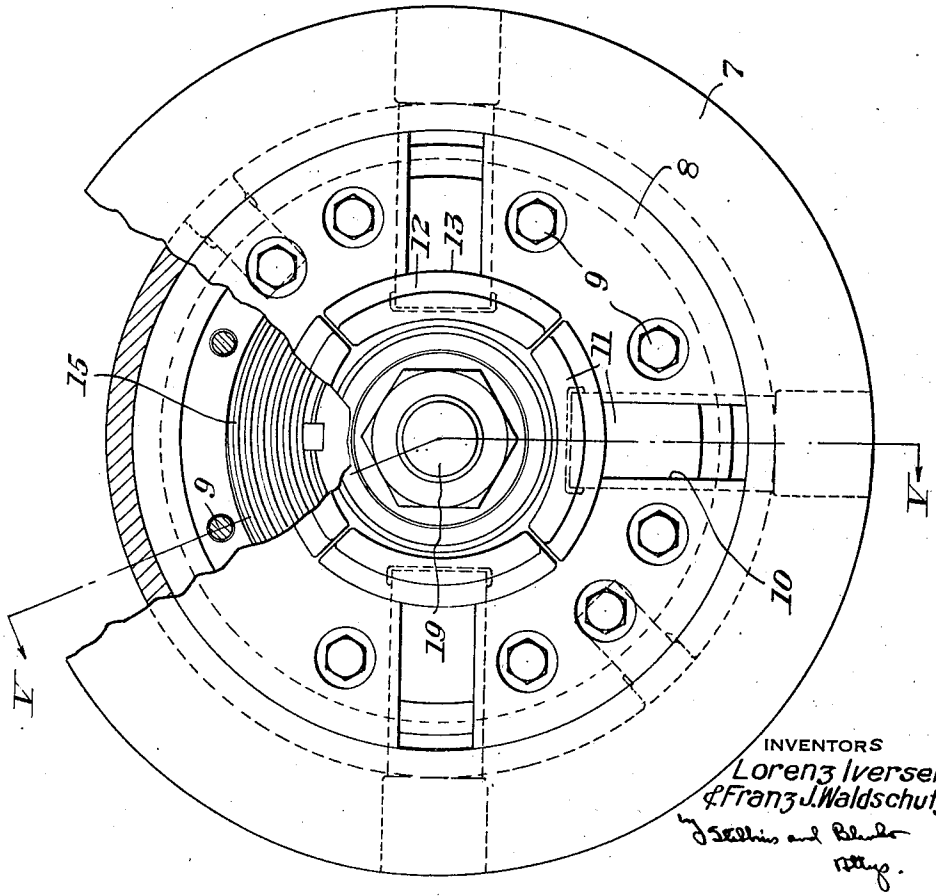


Fig. 4.

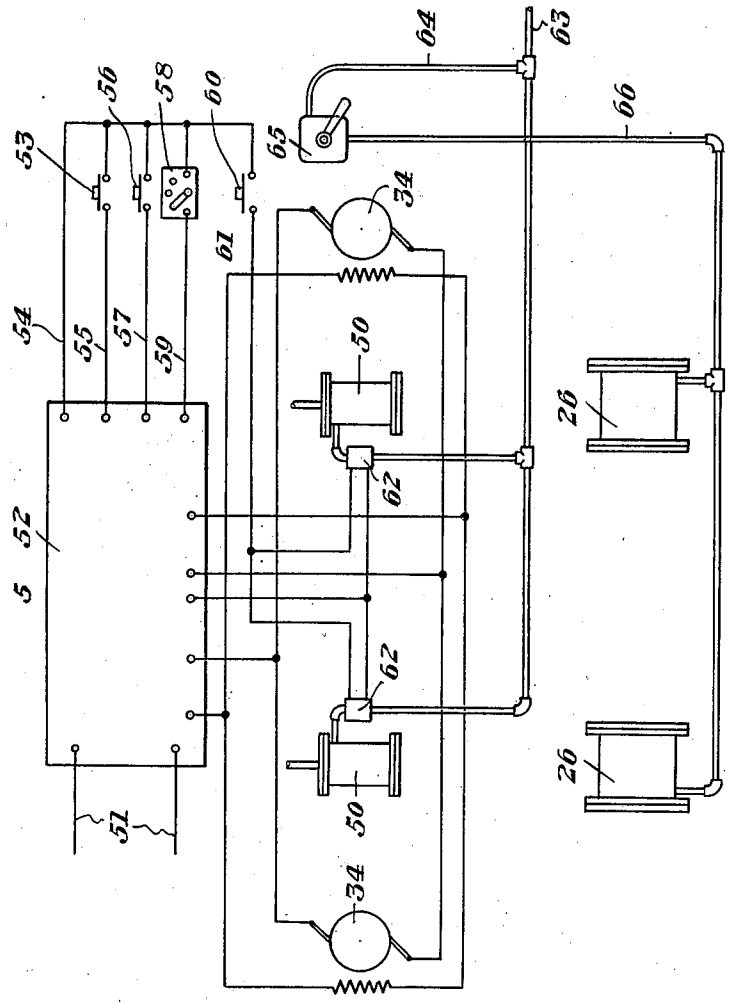
INVENTORS
Lorenz Iversen
& Franz J. Waldschutz
by Stellhorn and Blenko
Attys.

April 1, 1941. L. IVERSEN ET AL 2,236,971

APPARATUS FOR SUPPORTING METAL COILS

Filed Jan. 2, 1941 4 Sheets-Sheet 4

Fig. 7.



INVENTORS
Lorenz Iversen
and Franz J. Waldschutz
by Stellin and Bleuler
Attys.

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UNITED STATES PATENT OFFICE

2,236,971

APPARATUS FOR SUPPORTING METAL COILS

Lorenz Iversen and Franz J. Waldschutz, Pittsburgh, Pa., assignors to Mesta Machine Company, Pittsburgh, Pa., a corporation of Pennsylvania

Application January 2, 1941, Serial No. 372,814

10 Claims. (Cl. 242—78)

This invention relates to apparatus for supporting metal coils and is herein particularly described as embodied in a feed reel for handling coils of strip metal, although it may be applied to the handling of coiled rods or bars, to strip coilers and the like.

Feed reels are used for supporting and paying out strip steel for processing, as, for example, cold reducing, skin passing, shearing, or leveling. The general principle and construction of such feed reels is well illustrated in Moxley Patent No. 1,990,084.

The present invention provides a new and better means for engaging and controlling coils. As shown in the Moxley patent, cone mandrels have customarily been used for engaging the eye of the coil, these mandrels being of such size as to round the coil in case it is out of round and to center it on the axis of rotation of the feed reel so that it may be paid out smoothly. There are, however, definite limitations on the use of such mandrels. If the innermost wrap of the coil does not lie snugly against the adjacent wrapping, difficulty in entering the cones may be experienced. This is particularly true if the eye of the coil is small, a condition which becomes increasingly more common in present-day operations. Difficulty is likewise encountered if an accentuated out-or-round condition is encountered in the coils. In addition, there is an undue limitation on the amount of back tension that can be exerted by the present-day feed reels. Control of the back tension and an exertion thereof to an enhanced degree are both important in present-day practice.

We employ a series of lugs for interiorly engaging the coil, these lugs being mounted on and rotatable with a supporting head. The head may be driven to pay out the strip or it may be braked to exert back tension thereon. For these purposes, it is connected to a dynamo electric machine which may act either as a motor or as a dynamic brake. If desired, a friction brake may be employed, in which case the dynamo electric machine may or may not be utilized as a dynamic brake, depending on the requirements of the case. The dynamo electric machine is not connected directly to the head, but is connected through a lug actuating mechanism which is arranged to move the lugs radially inwardly or outwardly on the head when the lug adjusting means is rotated relative to the head. Provision is made for effecting such relative rotation so that the lugs are expanded within the eye of the coil, thus gripping the coil firmly, whereafter the head and the lug adjusting means rotate together under the influence and control of the dynamo electric machine, or the friction brake, or both.

In the accompanying drawings illustrating a present preferred embodiment of the invention as applied to a feed reel for coils of metal strip,

Figure 1 is a front elevation partly broken away;

Figure 2 is a vertical section on the line II—II of Figure 1;

Figure 3 is an end view;

Figure 4 is a face view partly broken away of one of the rotatable heads;

Figure 5 is a vertical section on the line V—V of Figure 4;

Figure 6 is a horizontal section on the line VI—VI of Figure 1; and

Figure 7 is a control diagram.

The feed reel shown in the drawings comprises a pair of opposed housings 2 and 3 slidably mounted on a base 4. Each housing carries a rotatable head designated generally by the reference character 5, these heads cooperating to support a coil. A saddle 6 is provided for lifting coils so that they may be engaged by the heads 5. The housings 2 and 3 are arranged to be moved toward and away from one another, and the saddle is arranged to be lifted, by mechanism of the character illustrated and described in the Moxley patent above referred to. Such mechanisms constitute no part of the present invention and need not be here described.

The housings 2 and 3 and their associated mechanisms are the same.

Each of the heads 5 comprises a ring 7 (see Figure 5) having a recess in its face which accommodates a chuck plate 8 held in place by bolts 9. The chuck plate 8 has guideways 10 for a set of four lugs 11. These lugs jointly form an expansible and contractible mandrel adapted to enter the eye of a coil of strip. The mandrel has a conical portion 12 which facilitates its entry into the eye of the coil and a cylindrical portion 13 which bears against the innermost wrap when the mandrel is expanded.

The ring 7 is bored to accommodate a rotatable cam 14 whose working face lies immediately behind the lugs 11. The working face is provided with a face thread or cam 15 engaging corresponding threads or followers 16 formed on the backs of the lugs 11. Rotation of the cam 14 relative to the head will cause expansion or contraction of the mandrel as the lugs 11 are forced radially inwardly or outwardly, depending on the direction of rotation.

The cam 14 is mounted on a collar 17 and keyed thereto by a key 18. The collar 17 is in turn keyed to a head supporting shaft 19. The shaft 19 is carried by bearings 20 in the head 3 (or 2) and at its outer end carries a gear 21. The gear 21 meshes with a pinion 22 on an intermediate shaft 23. The shaft 23 carries a brake drum 24 having a brake 25 which is actuated by an air cylinder 26. The brakes 25 are biased to open position. If the air pressure in the cylin-

ders 26 is released, the shafts 23 are free running, and by controlling the amount of pressure in the air cylinders 26 a controlled resistance to the rotation of the shafts 23 may be imposed.

The shaft 23 also carries a gear 27 meshing with a pinion 28 on an intermediate shaft 29. The shaft 29 carries a gear 30 meshing with a pinion 31 whose shaft 32 is connected through a coupling 33 to a dynamo electric machine 34 which may function either as a motor or a dynamic brake.

The gearing above described is all enclosed in the housing 3 (or 2), which housing is arranged to contain a quantity of lubricating oil (not shown). The gear 21 drives a gear 35 on a shaft 36 connected to an oil pump 37 for supplying oil under pressure to the bearings 20.

From the foregoing description of the rotatable head 5 it will be seen that if the ring 7 is held stationary, the mandrel may be expanded or collapsed by driving the motor 34 in one direction or the other. A holding brake is provided for preventing rotation of the head 5 so that this may be accomplished. As shown in Figure 5, the ring 7 is provided with a drum portion 38 which may be engaged by brake shoes 39 (see Figures 2 and 3). Each brake shoe 39 is pivotally connected at 40 on levers 41 and 42. The levers 41 and 42 are pivotally mounted at their lower ends at 43 on the housing 3 (or 2). The lever 42 carries at its upper end a bell crank 44 pivoted on the lever 42 at 45. One arm of the bell crank lever is connected to a link 46 which is pivotally connected to the lever 41 at 47. A spring 48 on the link 46 biases the brake to open position. The other arm of the bell crank lever 44 is connected through a link 49 to the piston of an air cylinder 50 secured to the housing 3 (or 2). The introduction of air under pressure to the upper end of the cylinder 50 serves to set the brake and hold the head 5 against rotation.

The sole power transmitting connection between the head 5 and the dynamo electric machine 34 is through the cam 14. The working face 15 of this cam transmits a thrust in one direction or the other (depending on which of the elements 5 and 34 drives and which is driven), the thrust being exerted in a line having both radial and tangential components. If we assume the dynamo electric machine 34 to be functioning as a motor, it will be seen that it causes rotation of the cam 14 tending to expand the mandrel until sufficient resistance to expansion is encountered to prevent further radial movement, whereupon the head will be rotated. The thread-like nature of the cam face 15 permits of exerting a very powerful radial thrust so that the mandrel, in expanding, will grip the coil firmly, thus insuring that there will be no slippage and that a heavy back tension can be imposed, and will also tend to round out any coil which is delivered to the feed reel out-of-round. The low pitch of the cam face 15 makes the connection an "irreversible" one; that is to say, the angularity of the cam is less than the angle of friction for the engaging surfaces so that no amount of radial pressure on the jaws will serve to collapse the mandrel. The low pitch of the cam likewise provides sufficient friction to insure against accidental change of the mandrel setting by reason of inertia effects or accidental tugs on the strip.

Figure 7 shows the controlling mechanism. Power lines 51 lead to a contactor panel 52 having relays of known construction for actuating electric contacts. A switch button 53 is provided for closing a circuit 54—55 which controls the starting and stopping of the dynamo electric machines 34 when they are used as motors. A control button 56 controls a circuit 54—57 for reversing the dynamo electric machines 34 when used as motors. A rheostat 58 controls a circuit 54—59 for operating contactors on the panel 52 so that the dynamo electric machines 34 will serve as regenerators. A push button 60 controls a circuit 54—61 energizing electromagnetic air valves 62 which control the supply and release of air pressure to the air cylinders 50. Air under pressure is supplied to the valves 50 from a compressed air line 63. A branch 64 from this line leads to a pressure control and release valve 65 and thence through a pipe 66 to the air cylinders 26.

If desired, electromagnets may be employed in place of the air cylinders 26. In such case, the amount of braking effort exerted is fixed except insofar as it may be preadjusted by the brake setting.

It will be observed that the friction brakes 24 and the regenerative brakes provided by the dynamo electric machines 34 supplement one another. In most instances, the requirements of the problem will be met by supplying regenerative brakes alone, in which case the friction brakes will be omitted; or by supplying friction brakes alone and using A. C. or D. C. dynamo electric machines which function solely as motors. However, if extreme tensions are required, it may be desirable to provide both sets of brakes, as illustrated in the drawings, thus giving a maximum of braking at a minimum of expense.

The operation of the apparatus may now be described: The housings 2 and 3 are separated until there is a clear space between the mandrels greater than the width of the coil to be handled. The coil is rolled onto the saddle 6 and by reason of the configuration of the saddle (see Figure 2) assumes a position such that the axis of the coil is approximately in the same vertical plane as the axis of the shafts 19. The saddle is raised until the axis of the coil is approximately coaxial with the axis of the shafts 19. At this time the chucks should be collapsed. If this has not been previously done, air pressure is admitted to the cylinders 50, thus setting the head brakes, and the motors 34 are operated in the proper direction to collapse the chucks. The chucks being collapsed, the heads 2 and 3 are brought together until the mandrels have entered the eye of the coil for substantially their full depth. Then with the head brakes set, the motors 34 are operated in the proper direction to expand the mandrels. Operation of the motors is continued until the mandrels firmly engage the coil. The limiting engagement pressure may be determined by adjusting the pressure in the cylinders 50 so that the drums slip when the mandrels have been sufficiently expanded. The coil is now ready for paying out. The head brakes are released and the motors 34 are operated so as to pay out the coil, as, for example, to a rolling mill which serves to advance the strip in the processing thereof. Back tension may now be applied to the strip either by actuating the friction brakes or the regenerative brakes (the dynamo electric machines 34) or both, depending on the installation and the amount of back tension desired.

The thread-like cam surfaces 15 are of opposite hand on the two heads and of such hand

in each case that the pull of the strip as it is paid out tends to expand the mandrels. The friction between the cam surfaces and the followers on the lugs 11 is sufficient to insure that there will be no loosening of the mandrels due to fortuitous inertia effects occasioned by jerks on the strip or jerky control of the apparatus. On the other hand, when it is desired to collapse the mandrels, no difficulty due to sticking or jamming is encountered.

The apparatus above described has many advantages. It is simple and rugged in construction. The forces transmitted from the motor to the head, or from the head to the brake (or brakes), are transmitted solely through the chuck adjusting mechanism so that duplication of drives and controls is eliminated. High but controlled pressures may be exerted by the mandrels on the coil and (partly because of this fact) very high back tensions may be exerted. The amount of back tension may be nicely controlled so that a smooth paying out of the coil can be effected with consequent improvement in the operation of the processing apparatus, such as a rolling mill.

We have illustrated and described a present preferred embodiment of the invention. It will be understood, however, that this is by way of illustration only and that the invention may be otherwise embodied within the scope of the following claims.

We claim:

1. Apparatus for supporting metal coils having a hollow center comprising a rotatable head, a set of lugs mounted on the head and adapted to enter the hollow center of a coil, the lugs being rotatable with the head but movable radially inward and outward with respect thereto, a dynamo electric machine, a rotatable power transmitting member connected therewith, and a power transmitting connection between the lugs and the rotatable member effective for transmitting a thrust therebetween in directions having both radial and tangential components.

2. Apparatus for supporting metal coils having a hollow center comprising a rotatable head, a set of lugs mounted on the head, the lugs being rotatable with the head but movable radially inward and outward with respect thereto, a source of power, and a rotatable driving connection between the power source and the lugs effective for urging the lugs outwardly and rotatably in one direction and inwardly and rotatably in the other direction, the lugs being effective when so urged by the power source for correspondingly rotating the head.

3. Apparatus for supporting metal coils having a hollow center comprising a rotatable head, a set of lugs mounted on the head, the lugs being rotatable with the head but movable radially inward and outward with respect thereto, a lug actuating means rotatable relative to the head effective for urging the lugs inwardly or outwardly, and a dynamo electric machine connected to the head through the lug actuating means and effective for rotating the same.

4. Apparatus for supporting metal coils having a hollow center comprising a rotatable head, a set of lugs mounted on the head, the lugs being rotatable with the head but movable radially inward and outward with respect thereto, a lug actuating means rotatable relative to the head effective for urging the lugs inwardly or outwardly, a dynamo electric machine connected to the head through the lug actuating means and effective for rotating the same, and a brake for the head.

5. Apparatus for supporting metal coils having a hollow center comprising a rotatable head, a set of lugs mounted on the head, the lugs being rotatable with the head but movable radially inward and outward with respect thereto, a lug actuating means rotatable relative to the head effective for urging the lugs inwardly or outwardly, a dynamo electric machine connected to the head through the lug actuating means and effective for rotating the same, and means for effecting braking of the lug actuating means.

6. Apparatus for supporting metal coils having a hollow center comprising a rotatable head, a set of lugs mounted on the head, the lugs being rotatable with the head but movable radially inward and outward with respect thereto, a lug actuating means rotatable relative to the head effective for urging the lugs inwardly or outwardly, and a dynamo electric machine connected to the head through the lug actuating means and effective for rotating the same, the dynamo electric machine having electrical connections so that it may function either as a motor or as a regenerative brake.

7. Apparatus for supporting metal coils having a hollow center comprising a rotatable head, a set of lugs mounted on the head, the lugs being rotatable with the head but movable radially inward and outward with respect thereto, lug actuating means rotatable relative to the head, a power source connected to the head solely through the lug actuating means and effective therethrough for rotating the head, and means for applying a drag to the lug actuating means.

8. Apparatus for supporting metal coils having a hollow center comprising a rotatable head, a set of lugs mounted on the head, the lugs being rotatable with the head but movable radially inward and outward with respect thereto, lug actuating means rotatable relative to the head, a power source connected to the head solely through the lug actuating means and effective therethrough for rotating the head, means for applying a drag to the lug actuating means, and brake means for the head.

9. Apparatus for supporting metal coils having a hollow center comprising a rotatable head, an expansible and collapsible mandrel on the head, a cam member rotatable relative to the head, a follower on the mandrel engaging the cam member whereby relative rotation of the cam member and the head causes expansion or contraction of the mandrel, and a dynamo electric machine for rotating the head, the sole connection between the dynamo electric machine and the head being through the cam member.

10. Apparatus for supporting metal coils having a hollow center comprising a rotatable head, an expansible and collapsible mandrel on the head, a cam member rotatable relative to the head, a follower on the mandrel engaging the cam member whereby relative rotation of the cam member and the head causes expansion or contraction of the mandrel, the connection between the cam and the follower being irreversible so that pressure on the mandrel cannot effect a movement of the cam member, and a dynamo electric machine for rotating the head, the sole connection between the dynamo electric machine and the head being through the cam member.

LORENZ IVERSEN.
FRANZ J. WALDSCHUTZ.