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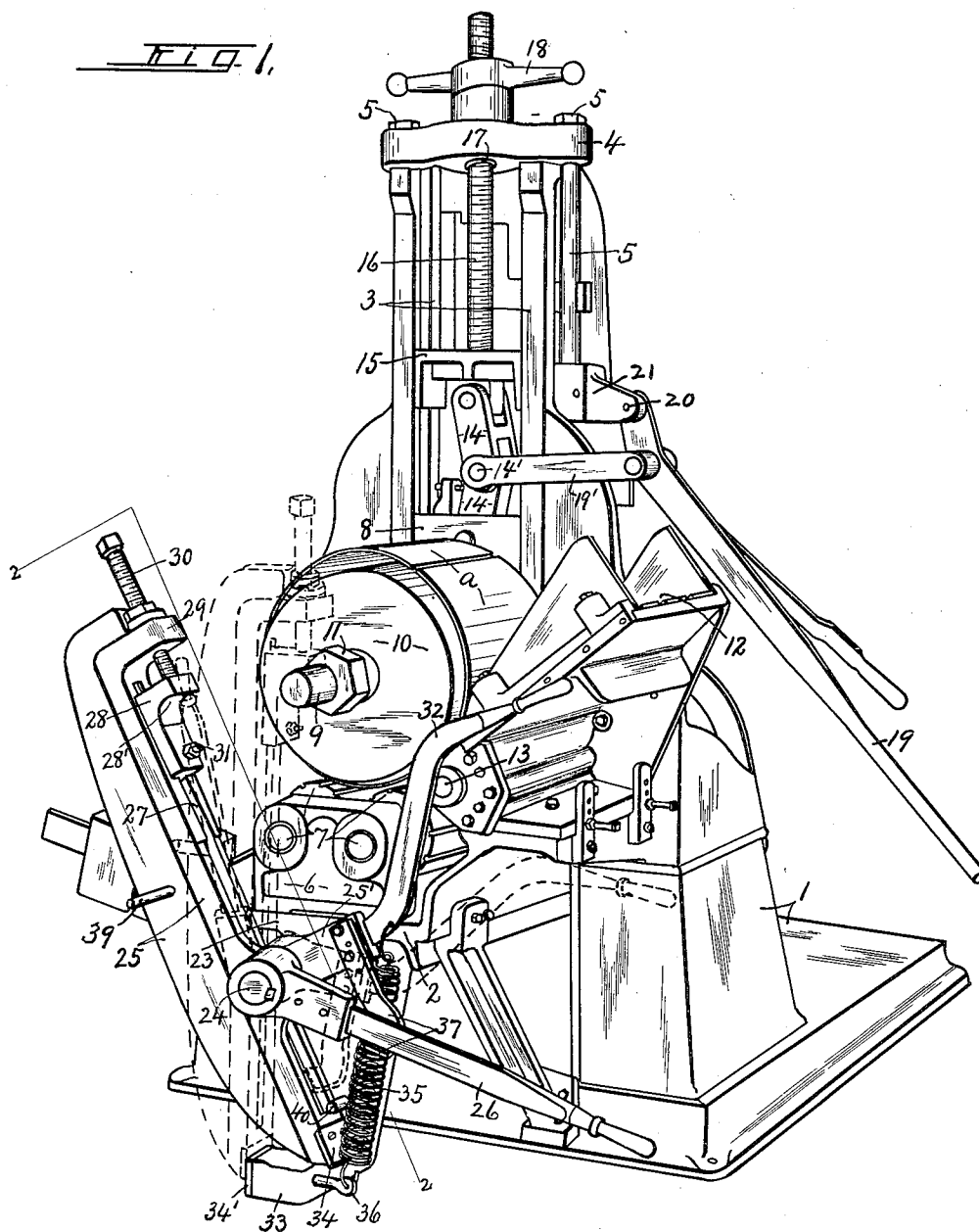
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1,945,693

TIGHT WRAP BENDING MACHINE

Filed Nov. 20, 1931

3 Sheets-Sheet 1



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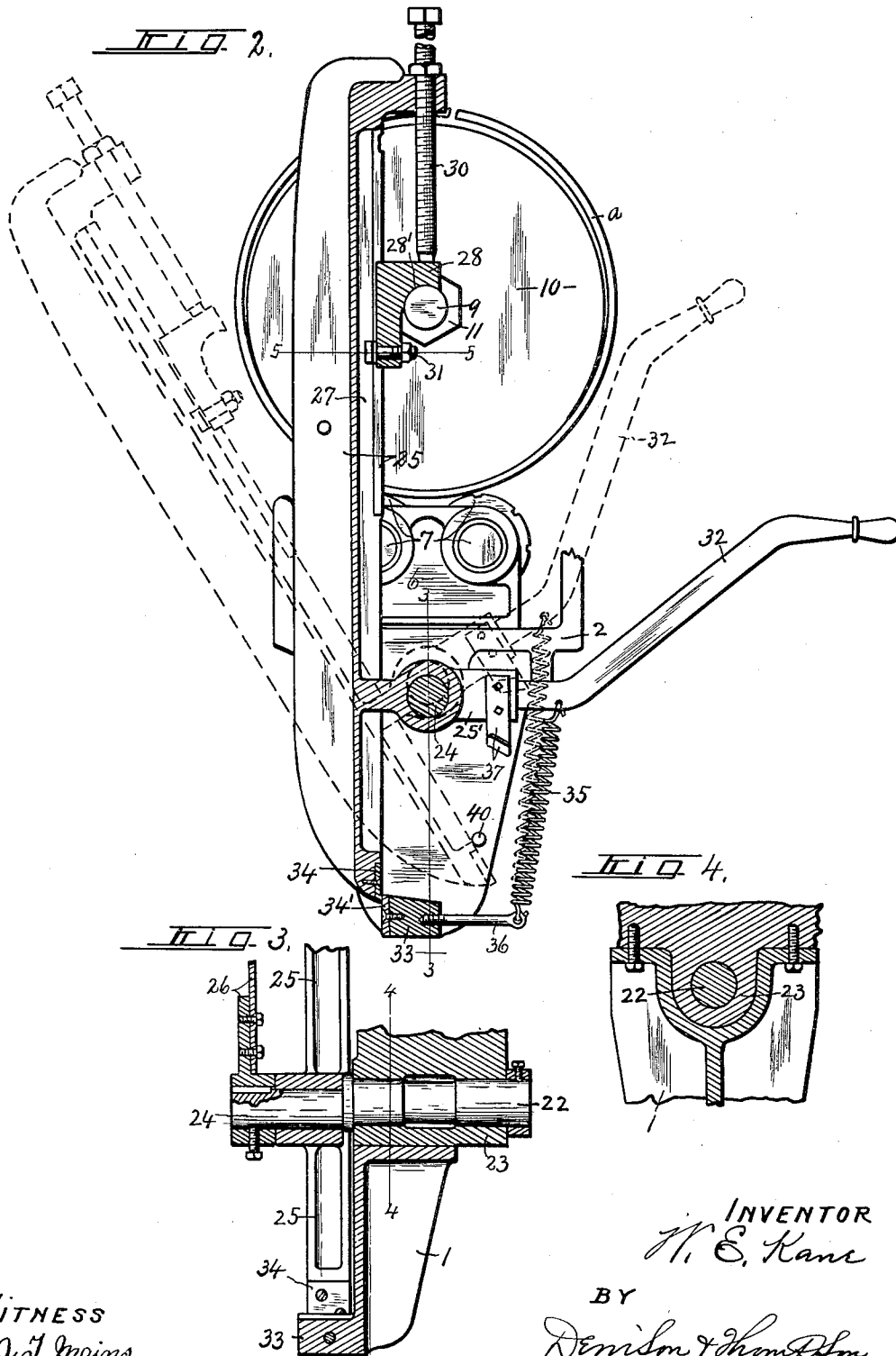
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FIG. 5.

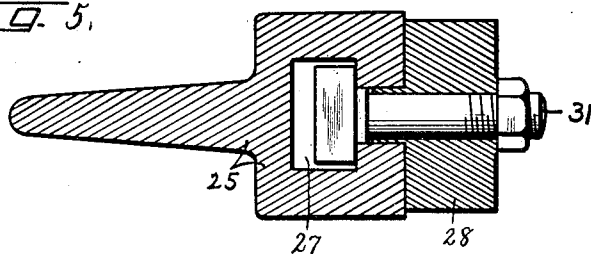


FIG. 6.

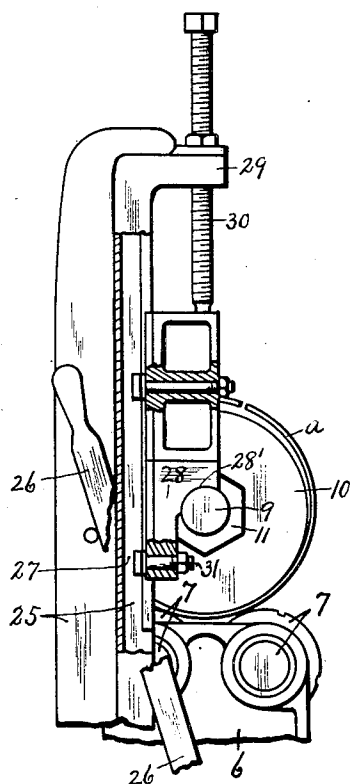
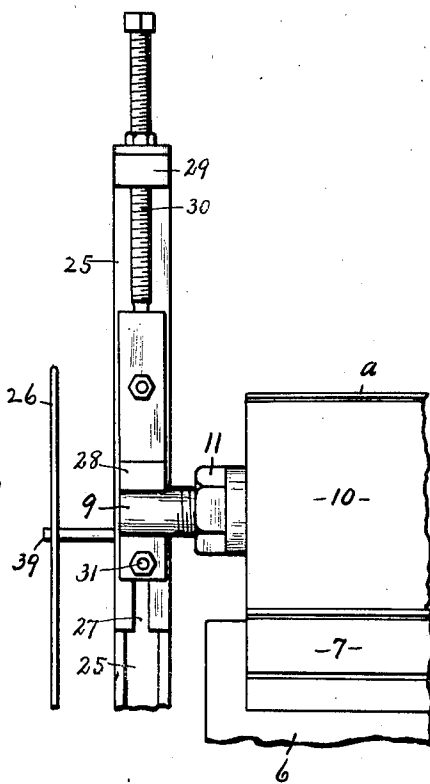


FIG. 7.



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TIGHT WRAP BENDING MACHINE

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Application November 20, 1931

Serial No. 576,317

9 Claims. (Cl. 153—61)

This invention relates to a metal bending machine involving the use of cooperative bending rollers for feeding and simultaneously bending and tightly wrapping the metal around one of the rollers of predetermined diameter so that the bent metal may assume a circular form of substantially the same diameter as the roller around which it is bent.

The roller around which the metal is bent or wrapped is preferably mounted upon a suitable supporting-mandrel in such manner that it may be easily and quickly removed and replaced by other rollers of different forms and sizes, according to the nature of the work to be performed, the forming roller being usually displaced axially from one end of the mandrel, and therefore, that end of the mandrel must be free from obstructions while the roller is being placed thereon or removed therefrom.

It is, of course, understood that the work operated upon must necessarily be subjected to considerable pressure, not only for feeding purposes but also for producing the desired form of the work, and under these conditions the free end of the mandrel and forming roller thereon tend to spring away from the other rollers which, if permitted, would cause more or less vibration of the mandrel and forming roller and resultant imperfections in the work operated upon.

The main object, therefore, of the present invention is to provide simple and efficient means for resisting this spring action and resultant vibration of the mandrel and forming roller thereon during the bending operation upon the work, and also to permit said resisting means to be easily and quickly displaced when removing or replacing the forming roller or when removing the completed work from said roller.

One of the specific objects is to provide means operable at will for moving the pressure-resisting means to and from a position across the upper side of the free end of the mandrel and therefore into and out of the path of axial movement of the forming roller, and also to provide additional means operable at will for bringing the resistance means into close contact with the upper side of the mandrel to resist the upward spring or vibration thereof during the bending operation.

Another specific object is to provide means operable at will for exerting pressure of the forming roller toward the opposed bending rollers according to the nature of the work operated upon.

A further object is to provide the resisting

means with a mandrel-engaging element or bearing which is adjustable vertically to compensate for the different positions of adjustment of the mandrel and forming roller thereof, as for example, when using forming rollers of different diameters.

Other objects and uses relating to specific parts of the machine will be brought out in the following description.

In the drawings:

Figure 1 is a perspective view of a metal bending machine embodying the various features of my invention, the pressure-resisting means being shown by full lines in its inoperative position.

Figure 2 is an enlarged detail sectional view taken in the plane of line 2—2, Figure 1, showing more particularly the pressure-resisting means and operating means therefor in their operative positions, the dotted lines indicating the released position of the pressure-resisting means.

Figure 3 is a detail vertical sectional view taken in the plane of line 3—3, Figure 2.

Figure 4 is a detail sectional view taken in the plane of line 4—4, Figure 3.

Figure 5 is an enlarged horizontal sectional view taken in the plane of line 5—5, Figure 2.

Figure 6 is a detail sectional view of the upper portion of the parts shown in Figure 2, in which a filler block is interposed between the bearing block and adjusting screw.

Figure 7 is a face view of the parts shown in Figure 6 and adjacent ends of the bending rollers.

In order that the invention may be clearly understood, I have shown a specific form of metal bending machine comprising a main supporting frame or base 1 having a forwardly and rearwardly extending horizontal bedplate 2 and an upright guide 3 extending upwardly from the rear side of the bedplate 2 and provided at its upper end with a cap plate 4 which is removably secured in place by tie-bolts 5 to permit certain vertically movable parts to be removed and replaced through the open upper end of the guide 3 in a manner hereinafter described.

A bearing block 6 is suitably mounted upon the bedplate 2 for receiving and supporting a pair of similar forwardly and rearwardly extending feed rollers 7 having parallel horizontal axes disposed in transversely spaced relation with the upper portions of their feeding surfaces projecting an appreciable distance above the upper face of the block 6 to allow the work to be removed and replaced without interference therewith.

A mandrel-supporting block or cross head 8 is mounted in the upright guide 3 for vertical ad-

justment and serves to receive and support one end of a mandrel 9 which extends forwardly from the block 8 parallel with and directly over the space between the feeding rollers 7 in vertically spaced relation thereto. Upon this mandrel is journaled a forming roller 10 around and upon which the work as —a— is adapted to be bent or wrapped to conform more or less closely to the diameter of said forming rollers.

These rollers 7 and 10 constitute what may be termed the feeding and bending rollers for feeding the work through the machine and simultaneously bending it to the required curvature of the same diameter as, or greater diameter than, the forming roller, which latter is displaceable axially from the front end of the mandrel to permit the substitution of forming rollers of different sizes according to the requirements for the work operated upon.

When the forming roller 10 is operatively mounted upon the mandrel 9, the latter extends forwardly some distance beyond the front end of the roller and is preferably reduced and threaded and provided with a nut 11 by which the forming roller is held against axial displacement while permitting the free rotation thereof upon the mandrel, it being understood that the roller 10 will be held against axial movement by and between the mandrel-supporting block 8 and nut 11.

The frame 1 is also provided with a work-guide 12 located at one side of the rollers 7 and 10 near the peripheries thereof and usually tangential to the periphery of the forming roller 10, said work-guide being adjustable to different angles about a pivotal axis 13 as may be required for bending the work to curvatures of different radii, it being understood that any suitable means may be provided for effecting these adjustments and holding the guide in its adjusted position.

As previously stated, the forming roller 10 is displaceable axially from the mandrel when the clamping nut 11 is removed to permit the use of various types of rollers of different diameter according to the nature of the work operated upon, and it therefore becomes necessary to provide means for adjusting the mandrel-supporting block 8 vertically, and also for tightening and releasing the forming roller upon and from the work.

For these latter purposes, the block is connected by toggle members 14 to a superposed cross-head 15 which is also adjustable vertically along and upon the upright guide 3 by means of an adjusting screw 16 having its lower end engaged with the cross-head 15 and its upper end engaged in a threaded socket 17 on the cap plate 4 and provided with a handle 18 by which it may be turned to resist upward thrust of the cross-head 15 when the toggle members 14 are moved toward their straightened position.

That is, the screw 16 serves as a means for adjusting the cross-head 15 and mandrel-supporting block 8 carried thereby through the medium of the toggle members 14 as may be required for the use of forming rollers 10 of different diameters, and when the mandrel-supporting block is adjusted to receive a forming roller of predetermined diameter, it may be additionally moved vertically for tightening and releasing the roller upon and from the work by flexing the toggle members 14 toward and from a straightened position.

To this end, the toggle joint or pivotal connection 14' between the toggle members 14, is

connected by a link 19' to a hand-lever 19 which is pivoted at 20 to a lug 21 on one of the tie-rods 5, as shown in Figure 1.

The construction thus far described is illustrative only of one type of machine with which my invention is adapted to be used except insofar as it relates to the metal bending rollers and to the supporting-mandrel for the forming roller having its supporting mandrel projecting beyond the front end thereof in such manner as to permit the forming roller to be removed and replaced from and upon the front end of the mandrel with suitable means such as the clamping nut 11 for holding the forming roller in operative position against endwise displacement when adjusted for use.

The front end of the mandrel 9 projects an appreciable distance beyond the corresponding face of the nut 11 and forming roller 10 when the latter is adjusted for use and is preferably cylindrical in cross section for engagement by a suitable bearing member forming a part of the subject-matter of the present invention to hold the mandrel and forming roller carried thereby, against radial vibration.

For this latter purpose, a rock shaft 22 is journaled in a suitable bearing 23 on the main-supporting frame 1 to extend forwardly and rearwardly parallel with and in a plane directly below the feeding rollers 7, as shown more clearly in Figures 1, 2 and 3.

This rock shaft has its front end provided with an eccentric extension or bearing 24 upon which is journaled an upright yoke 25 for lateral rocking movement independently of the rock shaft, the outer end of the eccentric bearing 24 being provided with a hand-lever 26 by which the rock shaft may be turned in the bearing 23.

The yoke 25 extends vertically some distance above and below the axis of the rock shaft 22 and its eccentric bearing 24, the upper arm being of greater length than the distance between the axis of the rock shaft 22 and the axis of the forming roller 10 and is provided with a lengthwise guideway 27 for receiving a radially adjustable bearing member 28.

This bearing member 28 projects laterally from the guide 27 toward the axis of the front end of the mandrel 9 and is provided with a concave lower bearing face 28' a distance from the axis of the eccentric bearing 24 approximately equal to the distance between said axis and upper face of the mandrel 9 with which it is adapted to engage when moved to a position shown by dotted lines in Figure 1, in a manner presently described.

The upper end of the yoke 25 above the bearing member 28 is provided with a lateral offset 29 overlying said bearing member 28 and provided with a threaded aperture engaged by an adjusting screw 30 which extends below the offset 29 and is engaged with the bearing member 28.

As previously stated, this bearing member 28 is adjustable along and upon the guideway 27 and is held in its adjusted position by a clamping bolt 31, as shown more clearly in Figures 2 and 6.

The upper end of the yoke 25 is movable about the axis of the eccentric bearing 24 to and from a position across a part of the front end face of the roller 10 to cause a similar movement of the bearing member 28 across the upper face of the front of the mandrel 9 or from a position shown in full lines in Figure 2 to a position shown by dotted lines.

This rocking movement of the yoke 25 about its eccentric bearing 27 is independent of the rocking movement of the rock shaft 22 and is accomplished by means of a hand lever 32 which is

secured to a radial offset portion 25' of the yoke 25, as shown more clearly in Figures 1 and 2. That is, the yoke 25 and its extension 25', including the hand-lever 32, constitutes what may be termed a bell-crank lever for moving the bearing member 28 carried thereby, into and out of registration with the upper face of the front end of the mandrel 9, when the rock shaft 22 is adjusted angularly by its operating lever 26 to bring the axis of the eccentric extension 24 in a plane

above that of its rock shaft or to the position shown by dotted lines in Figure 2.

Under these conditions, the yoke will be firmly locked in the mandrel-holding position to prevent vibration of the forming roll 10 during the bending operation, thus permitting the forming roller to be brought into pressing coaction with the feeding rolls 7 with sufficient pressure to cause the work to be tightly bent and wrapped around the forming roll until it assumes a neutral radius approximately equal to that of the periphery of the roll, it being understood that the bending rollers with the work between them may be rotated any number of revolutions necessary to fix the radius of curvature of the work.

That is, when the lever 26 which is secured to the eccentric bearing 24 is rocked downwardly to the position shown by full lines in Figure 1, it will effect the corresponding rocking movement of the rock shaft 22 for moving the eccentric bearing 24 upwardly with its axis slightly above that of the rock shaft, under which conditions the distance between the axis of the eccentric bearing 24 upon which the yoke 25 is journaled and the concave face 28' of the bearing member 28 will be slightly greater than the distance between the said axis and the upper face of the front end of the mandrel 9 to allow the bearing member 28 to pass over the top of said mandrel when rocked from its position shown by full lines to the position shown by dotted lines in Figure 1.

In order that the engaging faces between the lower end of the yoke 25 and base extension 33 may better resist the wear to which they are subjected, they are provided respectively with plates 34 and 34' of hardened steel or equivalent material.

After the bending operation has been completed, the lever 26 will be rocked downwardly, thereby rocking the eccentric 24 and yoke 24' carried thereby upwardly until the lower end of the yoke is disengaged from the base extension 33, at which time the bearing member 28 will be raised out of engagement with the mandrel 9 which permits the yoke to be rocked laterally from its mandrel-engaging position, shown by dotted lines in Figure 1, some distance to one side of the periphery of the roller 10, or to the position shown by full lines in the same figure, by means of the lever 32 and against the action of a counter-balancing spring 35 having one end attached to the lever 32 and its other end attached to an anchor bolt 36 on the base extension 33, as shown in Figures 1 and 2.

The arm 25' of the yoke 25 to which the lever 32 is secured, is provided with a downwardly extending stop shoulder 37 extending across the lower edge of the lever 26 to assist in limiting the upward swinging movement of the lever 32 and yoke 25 operated thereby when said yoke is shifted to its inoperative position.

As soon as the bending operation of a piece of work is completed, the hand lever 19 may be rocked upwardly for effecting a corresponding upward movement of the forming roll 10 with the work thereon away from the feeding rolls 7 through the medium of the link 19', toggle members 14 and mandrel-supporting block 8, at which time the completed work may be withdrawn forwardly from the periphery of the forming roll 10 and the bending operations repeated upon another piece of work, in the manner previously described.

Or, if a different forming roll is required to bend metal articles to a different form or diameter, the clamping nut 11 may be removed to permit forward axial displacement of the roller 10 from the front end of the mandrel, after which another roller may be placed upon the mandrel and clamped in place by retightening the nut 11, it being understood that the mandrel-supporting block 8, and its supporting head 15, may be adjusted vertically by means of the screw 16 to bring

When the yoke 25 and its bearing member 28 have been adjusted to the position just described with the bearing member 28 directly over the front end of the mandrel 9, the hand-lever 26 will be rocked upwardly for effecting a corresponding rocking movement of the rock shaft 22 to move the eccentric extension 24 downwardly with its axis slightly below that of the rock shaft, thereby causing a corresponding downward movement of the yoke 25 and at the same time, bringing the bearing member 28 into engagement with the upper face of the front end of the mandrel 9 to hold said mandrel and roller 10 thereon against vertical vibration during the bending operation or, as the work is fed between the rollers 7 and 10.

During this bending operation between the bending rollers, the pressure of the upper roller 10 upon the work may be varied by the downward rocking movement of the hand lever 19 which causes the toggle members 14 to move toward a straightened position due to the resistance of the screw 16 to prevent upward thrust of the cross-head 15.

When the yoke 25 has been lowered to bring its bearing member 28 into firm engagement with the upper face of the front end of the mandrel 9, the lower end of the lower arm of the yoke 25 will be brought into engagement with the upright side of a forward extension 33 of the base of the main frame 1 for locking the yoke against swinging movement about the axis of the eccentric extension 24, as shown more clearly in Figures 2 and 3.

That is, when adjusting the yoke 25 to bring its bearing member 28 into engagement with the front end of the mandrel 9, it is first elevated by the upward rocking movement of the eccentric extension 24 a sufficient distance to allow the bearing member 28 to swing over the top of the mandrel 9, during which operation, the lower end of the yoke will be free to swing across

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the lower face of the forming roll into proper bending co-action with the feeding rolls 7, and that the bearing member 28 may also be adjusted vertically along the yoke 25 to conform to the different positions of the mandrel relatively to the axes of the feeding rolls.

It will be observed that when the lever 32 and yoke 25 have been operated to bring the bearing member 28 directly over the mandrel 9, the lever 26 will be rocked upwardly to lower the eccentric 24 and yoke 25 and thereby cause the bearing member 28 to engage the upper and outer faces of the mandrel 9, this upward and lateral rocking movement of said lever 26 being limited by engagement with a stop 39 on the yoke 25, as shown in Figures 1 and 7.

It will also be noted that when the lever 26 is rocked downwardly to raise the eccentric 24 and yoke 25 to release the bearing member 28 from the mandrel 9 and also to disengage the shoulder 34 from the shoulder 34', the yoke 25 will then be rocked laterally and outwardly to carry the bearing member 28 beyond the periphery of the roller 10, at which time the lower end of the yoke will be brought into engagement with a limiting stop 40 on the frame 1, as shown more clearly in Figures 1 and 2, it being understood that the weight of the upper arm of the yoke is sufficient to overcome the tension of the counterbalancing spring 35.

It will be observed from the foregoing description that the invention is directed more particularly to the means, such as the yoke 25 and its bearing member 28, together with the yoke-operating means for moving the bearing member into and out of engagement with the front end of the mandrel 9, for the purpose of preventing vibration of the bending roll 10 during the bending operation, and that the bending and feeding rolls, together with the supporting frame therefor, may be varied materially for different classes of work, without departing from the spirit of the invention.

The operation will be fully understood from the foregoing description and it is obvious that various changes may be made in the subject-matter of the invention without departing from the spirit thereof.

What I claim is:—

1. In a metal bending machine, co-operative feeding and bending rollers, one of which is a forming roller around which the metal is bent, a supporting mandrel for the forming roller extending beyond one end thereof, said forming roller being displaceable axially from the extended end of the mandrel, a bearing member, means operable at will for moving the bearing member about an axis parallel with that of the mandrel for engaging said bearing member with the mandrel, and additional means for shifting said axis toward and from the mandrel to bring the bearing member into holding engagement therewith.

2. In a metal bending machine, a frame having an upright guide, a block movable along said guide, a mandrel mounted on the block, a forming roller journaled on the mandrel, feeding rollers co-operating with the forming roller to bend the work around the same, a rock-shaft journaled on the frame and provided with an eccentric, a yoke journaled on the eccentric to swing across one end of the forming roller and provided with a bearing member movable therewith for engaging the mandrel, means for rocking the yoke upon said eccentric, and means for rocking the

rock shaft and its eccentric for raising and lowering the yoke.

3. In a metal bending machine, a frame having an upright guide, a block movable vertically in the guide, means operable at will for moving the block, a mandrel secured to the block to move therewith, a forming roller journaled on the mandrel and displaceable axially from one end thereof, feeding rollers co-operating with the forming roller for bending the metal around and upon the latter, a rock shaft journaled on the frame and provided with an eccentric, a yoke journaled on the eccentric to swing transversely of the axis of the forming roller and provided with a bearing member movable therewith to and from a position across the upper face of the mandrel, means for rocking the shaft and its eccentric for raising and lowering the yoke and thereby to move said bearing member into and out of engagement with the upper face of the mandrel, and means for rocking the yoke upon the eccentric.

4. In a metal bending machine, a frame having an upright guide, a block movable vertically in the guide, means operable at will for moving the block, a mandrel secured to the block to move therewith, a forming roller journaled on the mandrel and displaceable axially from one end thereof, feeding rollers co-operating with the forming roller for bending the metal around and upon the latter, a rock shaft journaled on the frame and provided with an eccentric, a yoke journaled on the eccentric to swing transversely of the axis of the forming roller and provided with a bearing member movable therewith to and from a position across the upper face of the mandrel, means for rocking the shaft and its eccentric for raising and lowering the yoke and thereby to move said bearing member into and out of engagement with the upper face of the mandrel, and means for rocking the yoke upon the eccentric, and co-operative means between the yoke and frame for holding said yoke against rocking movement upon its eccentric when in holding engagement with the mandrel.

5. In a tight-wrap metal bending machine, a frame, co-operative bending rollers arranged to feed the metal and to simultaneously bend the same around one of the rollers, a mandrel supporting the last-named roller, means for moving the mandrel with its roller thereon toward and from the other rollers, a rock-shaft journaled on the frame and provided with an eccentric bearing, a yoke pivotally mounted on said bearing to swing toward and from the mandrel, a bearing block mounted on the yoke to move therewith about the axis of the eccentric to and from a position across the side of the mandrel farthest from the meeting faces of the rollers, and means for rocking said shaft with the eccentric thereon for moving the yoke endwise to engage the bearing block with the mandrel.

6. A metal bending machine as in claim 5, in which the means for moving the yoke endwise to engage the bearing block with the mandrel also causes said yoke to interlock with the frame to hold the yoke against pivotal movement away from the mandrel.

7. In a metal bending machine of the character described, a frame having an upright guideway, a cross-head movable along the guideway, co-operative bending rollers journaled in the frame and head respectively to rotate about horizontal parallel axes, the roller on the head having a co-axial mandrel projecting from one end there-

of, means for moving the cross head and its roller vertically along said guideway toward and from the other rollers, and means movable transversely of the axes of said rollers into and out of engagement with the upper face of the projecting end of the mandrel for holding the mandrel and its roller against vibration when engaged therewith during the bending operation.

8. In a metal bending machine, a frame, a roller supporting mandrel, a rock-shaft having an offset bearing, a yoke journaled on said bearing to move toward and from the mandrel independently of the rocking of said shaft and provided with a bearing member adapted to register with the mandrel when the yoke is rocked to one position, and means operable at will for rocking said shaft to cause the offset bearing to move the yoke endwise for engaging its bearing member with the mandrel when registered therewith.

9. In a metal bending machine as in claim 8, means for adjusting said bearing member toward and from the axis of rocking movement of the yoke.

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