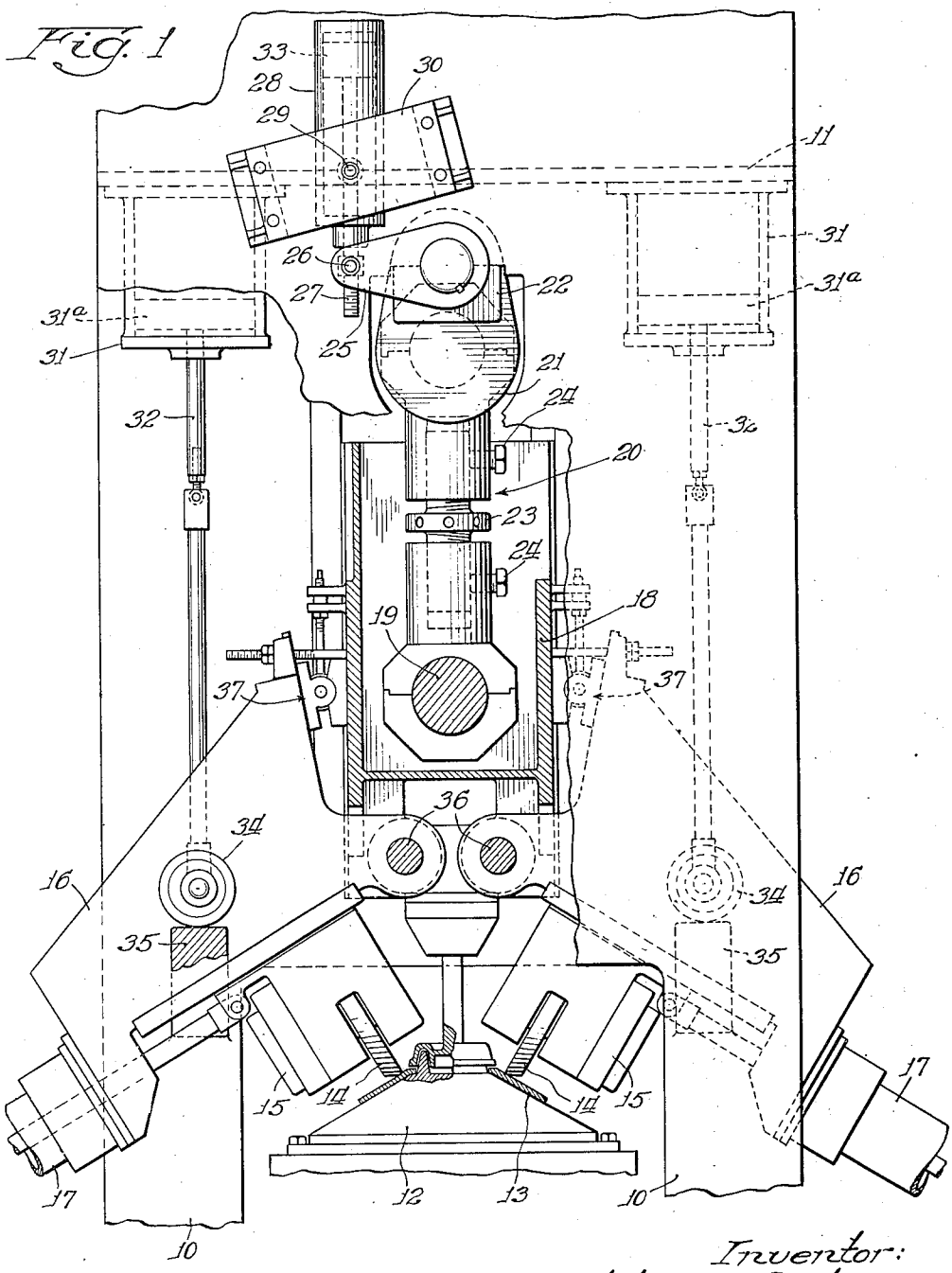
Jan. 23, 1945. A. W. DODERER 2,368,008

MACHINE FOR ROLLING CIRCULAR OBJECTS

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Fig. 1



Inventor:
Adolph W. Doderer
By: Edward C. Fritzbaugh
Atty.

Jan. 23, 1945. A. W. DODERER 2,368,008

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Fig. 2

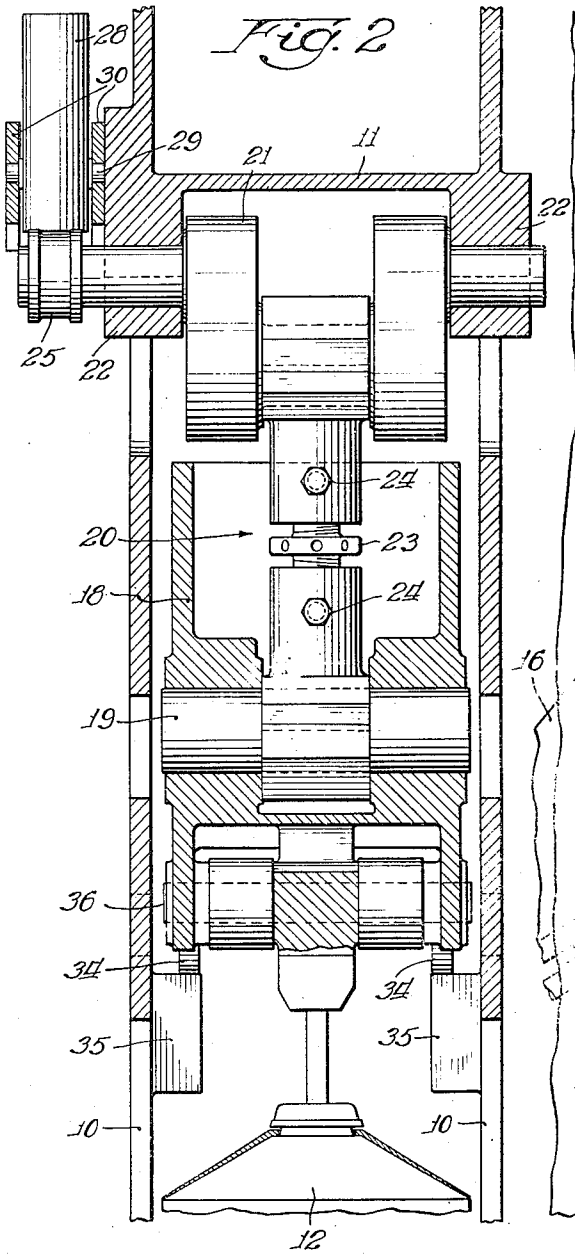
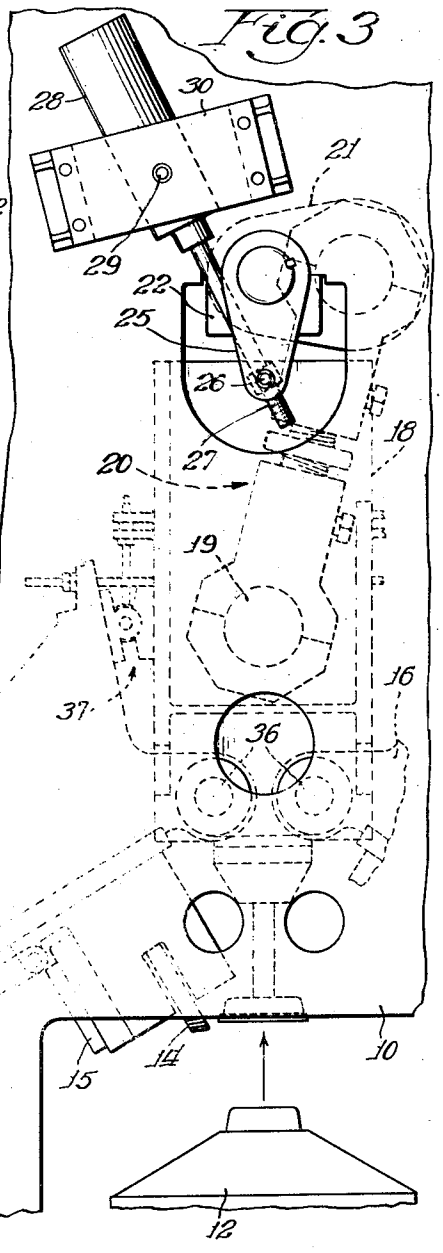


Fig. 3



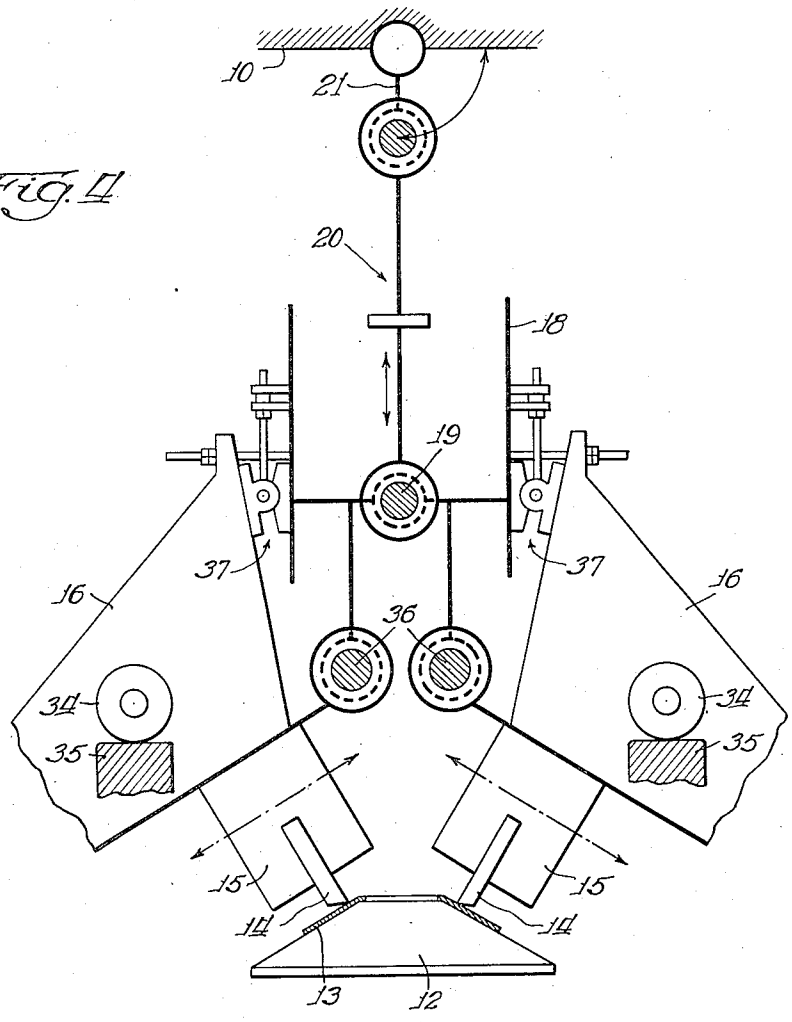
Inventor:
Adolph W. Doderer
By: Edward C. Griffbrough
Atty.

Jan. 23, 1945. A. W. DODERER 2,368,008

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Fig. 4



Inventor:
Adolph W. Doderer
By: Edward C. Gritzbaugh
Atty.

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UNITED STATES PATENT OFFICE

2,368,008

MACHINE FOR ROLLING CIRCULAR OBJECTS

Adolph W. Doderer, Chicago, Ill., assignor to Borg-Warner Corporation, Chicago, Ill., a corporation of Illinois

Application November 15, 1941, Serial No. 419,280

14 Claims. (Cl. 80—16)

This invention relates to machines for rolling circular objects such as discs, cones and the like.

It has been proposed to roll circular objects such as wheel bodies by placing them upon a rotatable platen, then forcibly projecting one or more rolls thereagainst, and traversing the surface of the object with said rolls to progressively expand its diameter. In order to secure a uniform product it is necessary that the rolls be brought into contact with the object to be rolled in a uniform manner so that the thickness of the object will not vary appreciably. The forces required to effect the rolling and expanding of the object are very high and it has been found difficult to provide the necessary movement of the rolls to and from the object to permit the object to be inserted into the machine and subsequently withdrawn therefrom and yet have the rolls sufficiently rigid during the rolling operation to secure absolute uniformity.

The principal object of this invention is to provide an improved rolling machine wherein the rolls may be moved toward and from the object to be rolled and yet will be sufficiently rigid during the rolling operation to provide a uniform product.

Another object of this invention is to provide a rolling mechanism for circular objects wherein the rolls while being raised or lowered are flexibly supported and while performing the rolling operation are rigidly held against the object to be rolled.

Another object of this invention is to provide a raising and lowering mechanism for a rolling machine wherein the raising and lowering is done by means of flexible power means such as hydraulic pressure in conjunction with compressible fluid means for counter-balancing the mechanism to be raised and lowered, and the mechanism is held in operative position by rigid mechanical means.

A further object of this invention is to provide a three-point lock for the reciprocating portion of a rolling machine while a blank is being rolled.

These and other objects and features of this invention will become apparent from the following description when taken together with the accompanying drawings in which:

Fig. 1 is a fragmentary front elevation partly in section of a rolling machine to which this invention may be adapted;

Fig. 2 is a fragmentary side elevation in section of the rolling machine of Fig. 1;

Fig. 3 is a fragmentary front elevation of the rolling machine showing the machine in inoperative position; and

Fig. 4 is a diagram of the linkages used together with the support therefor.

Referring now to the drawings for a detailed description of the invention the novel mechanism will be described with reference to a machine for rolling conical discs. It is understood however that the invention is not limited to use in a machine of this specific character but is applicable to any machine wherein large thrusts are created during the operation of the machine, which thrusts must be taken unyieldingly in order to insure a uniform product. Certain parts of the machine which are not pertinent to this invention will not be described herein in order not to complicate the disclosure unduly.

The machine is shown in elevation in Fig. 1 and is comprised of a pair of vertical columns 10 which support a cross member 11, and a rotatable platen 12, said platen 12 being supported from a fixed base (not shown) and driven in any suitable manner. On platen 12 is shown a conical blank 13 which is to be rolled and spun to a larger diameter. Insofar as this invention is concerned, blank 13 may be a flat disc, or it may be a tapered cone or disc, or may have any special shape desired. The rolling is accomplished by means of a pair of rolls 14 which are mounted in roll carriages 15 slidably supported in roll frames 16, each of said carriages being traversible over the surface of blank 13 by means of a cylinder 17 containing suitable hydraulic apparatus or other power means.

Platen 12 is axially fixed on the machine, and in order that a new blank may be inserted into the machine after a preceding blank has been rolled, it is necessary to raise and lower rolls 14 with respect to the blank. Accordingly, roll frames 16 are mounted in a cross-head 18 which is slidable vertically with respect to columns 10 of the machine. Cross-head 18 is connected by means of a pin 19 to a connecting rod 20, the upper end of which is connected to a crankshaft 21 mounted in bearings 22 (Fig. 2) located in a depending portion of cross member 11. Connecting rod 20 is provided with a turn buckle 23 by which the effective length of the connecting rod may be altered. Said turn buckle 23, once adjusted, may be set by means of set screws 24.

Crankshaft 21 extends upwardly to the left in Fig. 2 and is provided with a smaller throw 25, the crank pin 26 of which is in the form of a trunnion pivotally mounted therein and connected to a piston rod 27. Said piston rod 27 is

in turn connected to a piston 33 located in a cylinder 28 mounted on trunnion bearings 29 in a pair of spaced plates 30 secured to the front of the machine.

Supported from cross piece 11 are two cylinders 31 in which are contained pistons 31a which operate piston rods 32 connected to roll frames 16. Cylinders 31 are adapted to be filled with compressed air and are intended to counter-balance the greater portion of the weight of the rolls 14 and their associated mechanism.

The operation of the rolling machine just described is as follows:

For purposes of illustration it will be assumed that the machine is initially in the condition shown in Fig. 3 wherein the rolls 14 are raised from platen 12 so that a fresh blank 13 may be inserted between platen 12 and rolls 14 and then placed upon the platen. The rolls are maintained in the raised position partly by reason of the lifting force of the compressed fluid in cylinders 31 and partly by virtue of fluid under pressure being admitted behind piston 33 in cylinder 28, both of which had contributed to rotate crankshaft 21 counterclockwise (Fig. 3) to the position shown in Fig. 3. With a blank in place on platen 12, the rolls 14 are lowered by releasing the fluid in the upper part of cylinder 28 and admitting fluid under pressure to the opposite side of piston 33. This causes piston rod 27 to be pulled back into cylinder 28 and rotates crankshaft 21 clockwise (Fig. 3), thereby exerting a downward force upon cross-head 18 and the associated roll frames 16 and rolls 14. As the crankshaft rotates, the angularity between piston rod 27 and the supporting plates 30 changes. The trunnions 29 permit such change in angularity without creating undue strains in the rod. The movement of piston 33 and rod 27 into cylinder 28 continues until connecting rod 20 and crankshaft 21 assume a dead center position. This represents the bottom of the stroke of cross-head 18 and rolls 14. At this stage rolls 14 are contacting blank 13 and the latter is rotating, thereby causing rolls 14 likewise to rotate over the surface of the blank. During the downward movement of cross-head 18 and its associated frames and rolls, the compressed air in cylinders 31 exerts a lifting force which is used to assist in raising the slide and associated mechanism after the rolling operation is completed.

It will be observed that during the lowering or raising movement, cross-head 18 is controlled by fluid under pressure which in turn acts against the usual resiliently biased safety valve. During such movement, therefore, any excessive resistance encountered by the rolls would cause the rolls to stop, and the exact point at which the rolls would stop would be indeterminate. At the bottom of the stroke, however, connecting rod 20 is in dead center position with respect to crankshaft 21 and accordingly considerable variations in pressure can be created without affecting the position of cross-head 18 with respect to platen 12. Such variations in pressure would merely create greater bearing loads on the crankshaft without necessarily straining any part of the mechanism between the cross-head and shaft. Bringing the connecting rod to read center position, therefore, insures a return of cross-head 18 to the same position relative to platen 12 each time.

After the blank has been rolled, fluid pressure is relieved from the bottom of piston 33 and is admitted to the top of the piston, thereby rotating crankshaft 21 counterclockwise (Fig. 3) until piston 33 reaches the bottom of its stroke. During this counter-clockwise rotation, piston 33 is assisted by air cylinders 31 which likewise exert an upward force upon roll frames 16 and the associated apparatus to raise said apparatus. It will be observed that because of the counterbalancing effect exerted upon the movable parts by air cylinders 31, cylinder 28, piston 33, piston rod 27 and trunnions 29 may be made relatively light since these elements are not required to withstand the total forces exerted by the entire weight of the movable mechanism.

Due to the fact that the movement of the rolls across the blank creates a shifting load which causes eccentric forces to be produced in the cross-head 18, the rigidity provided by the crank and connecting rod is not sufficient to insure absolute uniformity in the rolled blank. Thus it might be possible to tilt the roll frames 16 relative to cross-head 18 and introduce a variation in the thickness of the product. To avoid such a possibility, a three-point lock is provided as follows:

Referring to Figs. 1 and 4, each roll frame 16 is provided with an abutment 34 located beyond the farthermost point at which a roll will contact a blank. In the path of each abutment 34 is a stop block 35 which may be integral with columns 10. Roll frames 16 are pivotally supported from cross-head 18 at 36 and are locked in any given angle with respect to cross-head 18 by means of adjustable wedge blocks 37.

Stop blocks 35 are so positioned that when crank 21 and connecting rod 20 are in dead center position, abutments 34 bear firmly against stop blocks 35, thereby stressing the entire structure between blocks 35 and bearings 22 for crankshaft 21. Because of the stressed condition in this structure all slack or lost motion is taken up before the rolls commence to move over the blank and hence there will be no further appreciable movement of the structure as a result of the rolling operation. The entire structure will be locked between the stop blocks and the crankshaft bearings and for this reason perfectly uniform results will be obtained from the machine. The three point nature of the locking means results in a more rigid structure and tends toward a more uniform distribution of the load between the two stop blocks.

Adjustments for wear or for different thicknesses of blanks can be made by means of turnbuckle 23. The magnitude of the reaction forces can likewise be varied by means of turnbuckle 23 since, with any given spacing between the upper and lower reaction points a longer connecting rod will require greater stresses to be imposed thereon to compress it between the fixed reaction points and these increased stresses will of course be transmitted to the reaction points. Additional adjustments can be made if desired by making either stop blocks 35 or abutments 34 adjustable, it being contemplated that any suitable means can be employed for this purpose. An example of such means is disclosed in a copending application of F. A. Stuhlman et al., Serial No. 421,161, filed December 1, 1941.

It is understood that the foregoing description is merely illustrative of a preferred embodiment of the invention and that the scope of the invention therefore is not to be limited thereto but is to be determined by the appended claims.

I claim:

1. A rolling machine comprising a support for a blank to be rolled, roll means for operating on

the blank, means for relatively reciprocating the roll means and support, said reciprocating means comprising a crankshaft spaced from the support, a connecting rod connecting the crankshaft to the roll means, said crankshaft assuming a dead center position with respect to the connecting rod when the roll means operates on a blank, and hydraulic means for rotating the crank shaft from and to the dead center position, whereby thrust imposed upon the connecting rod by the roll means is taken in compression by the crankshaft.

2. In a rolling machine, a support for a blank to be rolled, roll means for operating on the blank, and means for relatively reciprocating the roll means and the support, said reciprocating means comprising a crankshaft, a connecting rod and a cross-head, means for supporting the rolls from the cross-head, and means for rotating the crankshaft, said crank-shaft rotating means being yieldable and adapted to rotate the crankshaft to dead center position with respect to the connecting rod whereby said connecting rod and crankshaft takes the thrust created by the rolls as they operate upon the blank.

3. In a rolling machine, a support for a blank to be rolled, roll means for operating on the blank, and means for relatively reciprocating the roll and the support, said reciprocating means comprising a crankshaft, a connecting rod and a cross-head, means for supporting the rolls from the cross-head, means for rotating the crankshaft, said crankshaft rotating means comprising hydraulic means for producing a torque in the crankshaft to rotate said crankshaft from and to a dead center relation with respect to the connecting rod, and resilient means for counterbalancing the weight of the connecting rod, cross-head and roll means.

4. A rolling machine as described in claim 3, said hydraulic means comprising a pivoted cylinder, a piston in said cylinder, a rod operated by said piston, and a pivoted connection between the piston rod and crankshaft.

5. A rolling machine as described in claim 3, said counterbalancing means comprising a plurality of cylinders each having a piston and a piston rod, means for connecting the piston rod to the roll means, said pistons being moved by air under pressure in a direction to counteract the weight of the roll means, cross-head and connecting rod.

6. A rolling machine comprising a support for a blank to be rolled, roll means for operation on the blank, said means comprising a roll and a support therefor, said roll being shiftable over the surface of the blank and productive of shifting loads in the machine, an upper reaction point for the roll means located centrally of the blank, other reaction means located on either side of the roll, and means for stressing the roll means to produce a reaction in the upper reaction point which is substantially opposite in direction to the reaction produced in the other reaction means, thereby locking the roll means against undesired shifts in position relative to the blank which might result from the shifting loads.

7. A rolling machine as described in claim 6, said roll support including a collapsible linkage which is adapted to assume a rigid position when the roll is operating on a blank.

8. A rolling machine as described in claim 6, said roll support including a crank and connecting rod, and means for oscillating said crank from a dead center position with respect to the connecting rod to an angular position with respect thereto, corresponding to operative and inoperative positions respectively of the roll means.

9. A rolling machine as described in claim 6, said roll support including a crank and connecting rod, means for oscillating said crank from a dead center position with respect to the connecting rod to an angular position with respect thereto corresponding to operative and inoperative positions respectively of the roll means, and means for varying the magnitude of the reaction forces on the reaction points.

10. In a rolling machine, a support for a blank to be rolled, roll means for operating on the blank, means for relatively reciprocating the roll means and the support to move them toward and away from each other, said reciprocating means including means adapted to yield when there is an excessive resistance to the roll means and support moving together, said reciprocating means including means providing a non-yieldable reaction for preventing relative movement of the roll means and the support apart when the roll means operates on a blank, and means for passing the roll means over the blank.

11. In a rolling machine, a support for a blank to be rolled, roll means for operating on the blank, means for relatively reciprocating the roll means and the support to move them toward and away from each other, yieldable reaction means for the reciprocating means operative during relative reciprocation between the roll means and the support, said reciprocating means including means providing a non-yieldable reaction for preventing relative movement of the roll means and the support apart when the roll means operates on a blank, and means for passing the roll means over the blank.

12. In a rolling machine, a support for a blank to be rolled, roll means for operating on the blank, means for relatively reciprocating the roll means and the support to move the roll means and the support toward and away from each other, said reciprocating means comprising a collapsible linkage capable of assuming a dead center position to provide a non-yieldable reaction for preventing relative movement of the roll means and the support apart when the roll means operates on a blank, yieldable means for collapsing the linkage to reciprocate the roll means relative to the support, said yieldable means being likewise capable of arranging the linkage in dead center position when the roll means is to operate on a blank, and means for passing the roll means over the blank.

13. A rolling machine as described in claim 12, said collapsible linkage comprising a crank shaft and a connecting rod connected to the roll means.

14. A rolling machine as described in claim 12, and means for adjusting the effective length of the linkage whereby to vary the distance between the roll means and the support when the linkage is in its dead center position.

ADOLPH W. DODERER.