Sept. 8, 1936. W. D. KELLER 2,053,291

FORGING MANIPULATOR

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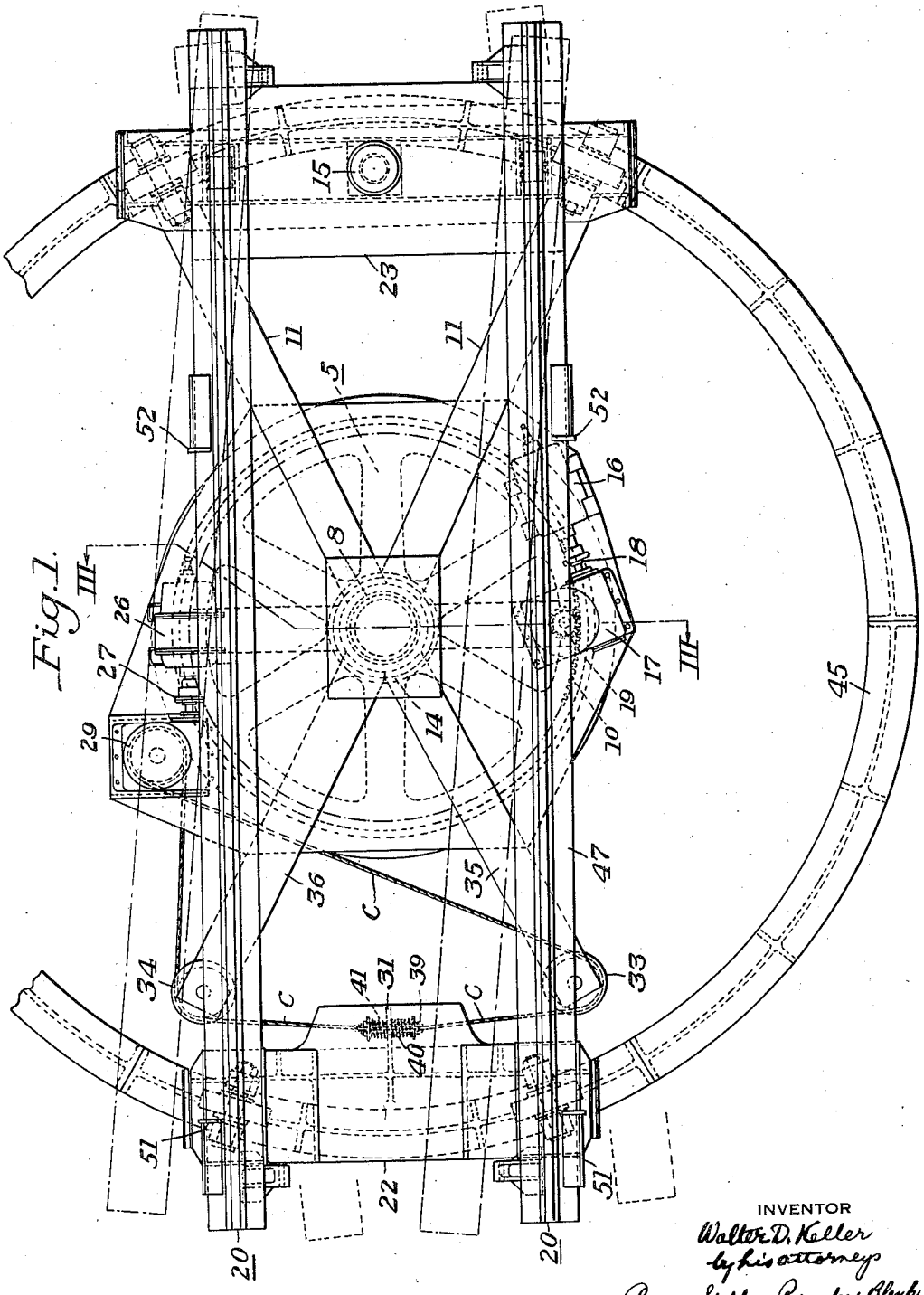


Fig. 1.

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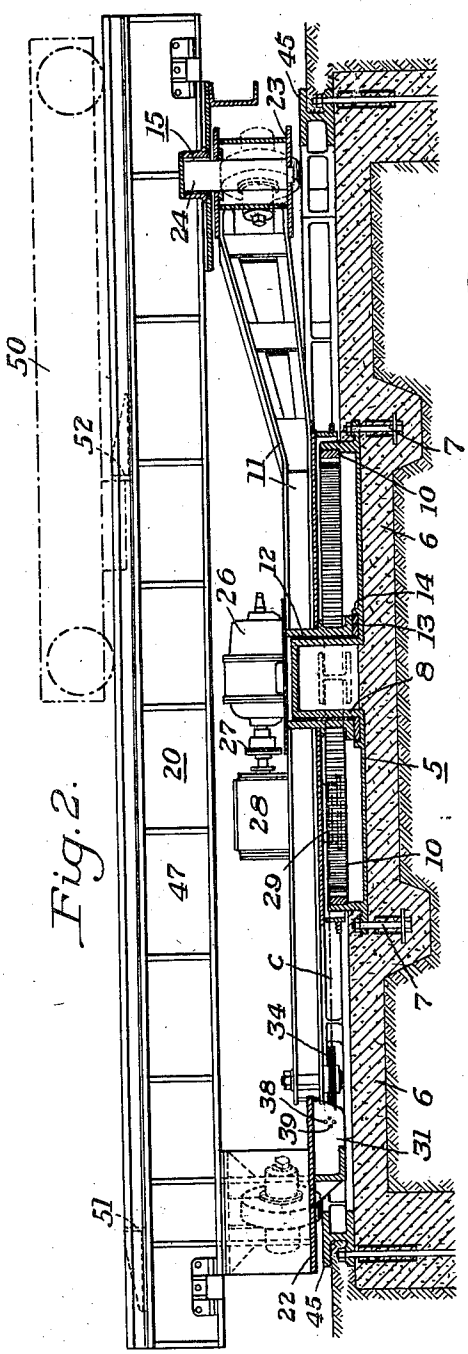


Fig. 2.

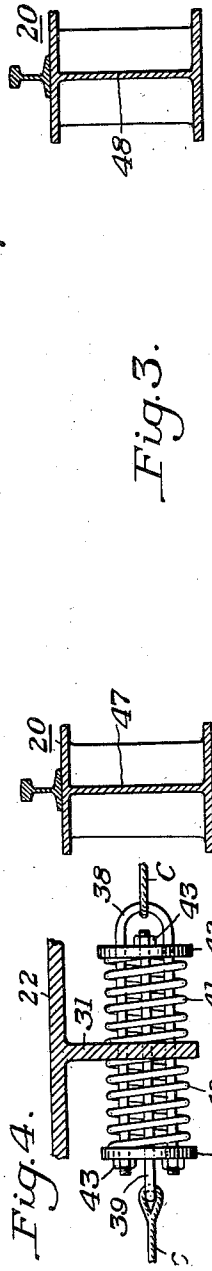
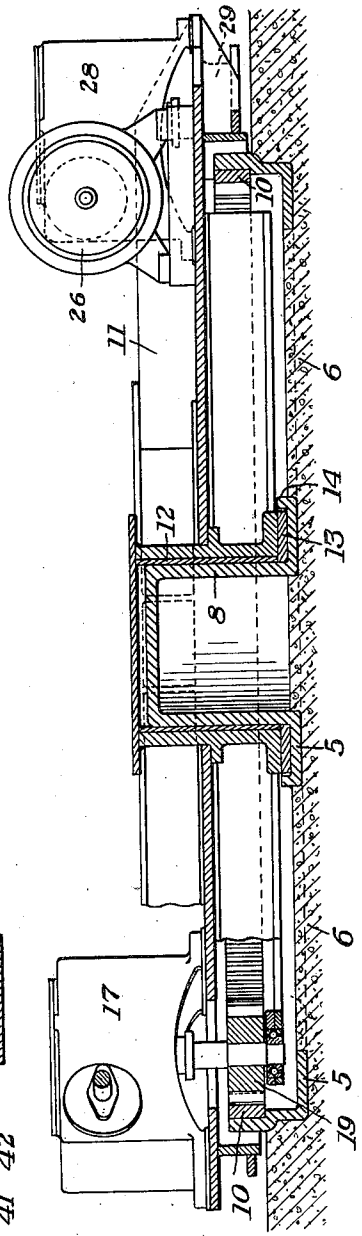


Fig. 4.

Fig. 3.



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UNITED STATES PATENT OFFICE

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FORGING MANIPULATOR

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Application December 22, 1933, Serial No. 703,581

10 Claims. (Cl. 78—96)

This invention relates to an improved bridge structure for use where the axis of a device, such as a forging manipulator, is to be swung about a central axis to be disposed in various positions with the axis of the device either radially disposed or offset somewhat to either side of a true radial position. More particularly, this invention relates to a turntable support for such mechanism as a forging manipulator, which provides for swinging the forging manipulator or the like to the desired angular position and at the same time displacing the forging manipulator or the like laterally from a true radial position.

In some plants, the equipment such as the presses, hammers, furnaces and other apparatus for working metal are grouped about a common axis. Obviously, with such plant layouts, a forging manipulator mounted or carried on a swinging support or turntable is best adapted to cooperate with the various apparatus.

I have provided an improved swinging or revolving bridge-type manipulator. The peel of the manipulator is carried by a trolley and is provided with gripping tongs which may be extended to grip a forging in a furnace, then withdrawn to retract the forging, the turntable swung through the required angle, and the peel again extended to bring the forging into cooperative relation with a press, a hammer or other forging device. To this end, the trolley on which the peel is mounted rolls back and forth on a bridge girder structure which is arranged to swing or revolve about the turntable axis.

In the manipulation of the forging while it is being worked in the press or hammer, it is sometimes the case that it is desirable to position the forging first in cooperation with one impression and then in cooperation with a second impression. Where the press or hammer dies are arranged with two or more parallel impressions, it may be desirable in operation that the axis of the work piece being forged coincides with the axis of one impression, and then with the axis of the other impression. It is obviously impossible with the ordinary type of swinging bridge manipulator to cause the axis of the piece to coincide with the axes of the two parallel impressions, as the axis of the forging manipulator and of the work piece being forged is always truly radial to the turntable axis.

This invention provides a simple manner of bringing the axis of the peel into offset relation to the axis of the turntable so that the axis of the peel may coincide with the axes of the several impressions of the press or hammer dies.

Fig. 1 is plan view of my improved bridge structure for forging manipulators and similar apparatus;

Fig. 2 is a view of the bridge structure partly in side elevation and partly in section through the axis of the turntable and through the pivotal mounting of the bridge member;

Fig. 3 is a transverse vertical section through the axis of the turntable taken on the line III—III of Fig. 1, the means for revolving the turntable being shown in elevation;

Fig. 4 is a detail partly in vertical section showing the arrangement for attaching the cables to the bridge member.

The turntable as shown herein in its preferred form can be most readily described by resolving the mechanism into three parts:—a fixed part or base plate, an intermediate part or pivot frame, and a main support or bridge member pivotally mounted on the frame and normally bridging the turntable axis. The base plate 5 is anchored in the cement foundation 6 by anchor bolts 7. It is formed with a centrally projecting hub 8; and is provided adjacent its periphery with an internal gear ring 10. The plate 5 is formed with openings as indicated in broken lines in Fig. 1 whereby the plate may be embedded in the concrete foundation 6 as indicated more clearly in Fig. 3.

A frame 11 is rotatably mounted on the hub 8 with a bearing sleeve 12 interposed. A bearing ring 13 or suitable form of roller bearing may be employed for bearing the load at the center of the mechanism of the frame 11, this bearing 13 being held in place by up-turned portions 14 of the plate 5.

The frame 11 is thus rotatably mounted for swinging about the hub 8 whose axis is the turntable axis. The frame 11 provides a pivotal mounting 15 for the main support of the turntable mechanism; and is, therefore, termed the pivot frame. Mechanism is mounted on the pivot frame 11 for swinging the same about the hub 8. In the embodiment illustrated, this mechanism takes the form of a motor 16 and reduction gearing 17 connected thereto by a flexible coupling 18 so as to drive a spur gear 19 meshing with the ring gear 10. The control for the motor 16 is preferably of the reversing plugging type, whereby the frame 11 may be swung in either direction and stopped practically instantaneously.

The main support takes the form herein of a bridge member 20. This main support is given a sufficiently sturdy construction to carry heavy

loads, and loads, moreover, which shift lengthwise of the bridge member. The weight of the main support 20 and its load is borne by rollers or wheels; and in the embodiment illustrated a front truck 22 and a rear truck 23 are provided. The rear truck 23 is secured to the frame 11 and carries the vertical pin 24 which constitutes a part of the pivotal mounting 15, the weight being transmitted to the truck 23 through the pivotal mounting 15. The truck 22 is secured to the main support 20 and, therefore, receives load directly therefrom. It is obvious that both of the trucks may be secured to the frame 11, and that in such case a bearing may be provided between the movable end of the bridge member 20 and the frame 11 to permit turning movement of the bridge member 20 about the pivotal mounting 15 relative to the frame 11.

Means are provided for turning the member 20 about the pivotal mounting 15. I prefer to drive such means from a motor 26 mounted on the frame 11; because this simplifies the control of the alining operations. Through a flexible coupling 27 and reduction gearing 28, the motor 26 drives a winding means such as a drum 29. One or more turns of cable *c* are wound on the drum 29; and the ends of the cable anchored to a web 31 of the front truck 22. Sheaves 33 and 34 rotatably mounted on the frame 11 guide the cables so that one end of the cable extends from the web 31 in one direction of turning movement of the main support 20, and the other end of the cable extends from the web 31 in the other direction of turning movement. In the embodiment shown, the frame 11 has radially projecting arms 35 and 36 for carrying the sheaves 33 and 34 respectively. The motor 26 is a reversible motor and may likewise have a control of the reversible plugging type to facilitate positioning of the member 20 relative to the frame 11.

As shown particularly in Fig. 4, the web 31 is symmetrically pierced with four holes; and U-bolts 38 and 39 are passed through these holes in the web 31 from opposite sides. Two coil springs 40 and 41, one on each side of the web 31, surround the bolts 38 and 39 and bear at their outer ends against washers 42. Nuts 43 on the ends of the U-bolts 38 and 39 place the springs 40 and 41 under compression. The ends of the cable *c* are secured to the bends of the U-bolts; and in this manner the cable ends are resiliently anchored to the truck 22.

It will be noted that the truck 22 is of peculiar form so as to provide maximum operating space for the peel which is to be carried by the bridge member 20. The portion of the truck 22 intermediate the wheels is depressed; and the web 31 is formed on a portion of the truck 22 which extends below the bottoms of the wheels. The cable *c* is, therefore, disposed below the level of the track 45 on which the truck wheels travel. Correspondingly, the sheaves 33 and 34 are mounted beneath the arms 35 and 36; and the winding means 29 is at the lower end of the reduction gearing 28. Such a low elevation for the means employed for turning the member 20 is of considerable advantage in connection with the depressed portion of the truck 22 for giving the peel maximum freedom in operation.

The bridge member 20 comprises a pair of girders 47 and 48 on which are carried the tracks for the wheels of the trolley 50. Stops 51 and 52 are carried by the member 20 for limiting the extent of back and forth travel of the trolley 50 on the girders 47 and 48.

The mechanism described provides both for revolving the entire movable structure about the hub 8 and for small angular movements of the member 20 about the pivotal mounting 15 relative to the frame 11. During the usual arcuate movements of the entire movable structure about the hub 8, the wheels of the trucks 22 and 23 travel on the track 45. It is frequently desirable to provide an installation with which one or more complete revolutions may be effected; and for this reason the wheels of the two trucks are preferably disposed at the same radial distance from the hub 8 so as to travel on a common circular track. It is obvious, however, that two tracks at different radial distances from the hub 8 may be employed. The position of the girders 47 and 48 when the bridge member 20 is swung to the right is indicated in dot and dash lines in Fig. 1 of the drawings. The corresponding positions of the ends of the girders when the bridge member 20 is swung to the left are indicated in broken lines in the same figure. When thus displaced laterally, the wheels of the front truck 22 operate at a slight angle from their true radial position. The track 45 is made broad enough so that in actual operation this discrepancy is not important.

With the forging manipulator installed with the turntable axis located on the center line of the press or hammer, the peel may be manipulated to take up a work piece, swing the same into alinement with the press or hammer; and then the trolley 50 may be operated to carry the work piece into operative position.

If it be desired to displace the main support 20 laterally with respect to the hub 8, the pivotal mounting 15 and the axis of the bridge member 20 are brought into alinement with the axis of the impression sought to be used. This may, for instance, be accomplished by rotating the spur gear 19 until the pivotal mounting 15 is on the axis of the impression. The winding means 29 is then rotated in the proper direction for swinging the member 20 to the right or to the left as required to bring the same into alinement with the impression. These operations may be performed simultaneously if desired.

While two independent motors are provided in the preferred embodiment for effecting the two motions, that is the revolving of the frame 11 and the turning of the member 20 on the pivotal mounting 15, it would be possible to actuate both the spur gear 19 and the winding means 29 by a common motor to bring about the lateral displacement of the main support 20. The reduction gearing would be so chosen as to cause the spur gear 19 to rotate the frame 11 through the proper arc while the winding means 29 turned the main support 20 into alinement with the center line of the hammer or press. Such an arrangement might in sume instances simplify the control for the forging manipulator, as driving the single motor would effect the desired lateral displacement. It would be preferable, however, to retain a second motor which would be called upon for the normal swinging or revolving operations of the turntable mechanism as a whole.

While I have illustrated and described the embodiment of my invention which I at present prefer, it will be understood that the invention is not thus restricted but may be variously modified

within the contemplation of the invention and under the scope of the following claims.

I claim:

1. A turntable mechanism comprising a base providing a circular track, a bridge member located on a diameter of said track for swinging movement around the center thereof, having guide members longitudinally thereof adapted to carry a reciprocating carrying device, a truck secured to one end of said bridge member and movable around said track, a frame pivoted at the center of said track, a pivotal mounting for said bridge member located on said frame, offset from the pivotal axis of said frame for supporting the other end of said bridge member and means for relating said bridge member and frame for swinging movement as a unit or for swinging movement of the bridge member relative to said frame to selectively position said bridge member diametrically or offset somewhat to either side of a true diametrical position.

2. In a forging manipulator, a bridge member having guideways along which a device carrying a forging may move back and forth along the bridge member, a pair of trucks for carrying said bridge member, said trucks being adapted for arcuate movement about a common axis substantially midway between the two, one of the trucks directly carrying the bridge member adjacent one end thereof, means for swinging the other truck about said axis, the second-mentioned truck supporting the bridge member through a pivotal mounting adjacent the other end of the latter thereby carrying a portion of the weight of the bridge member and its load, and means for relating the bridge member and said trucks for swinging movement as a unit or for pivoting of the bridge member about said pivotal mounting to selectively position said bridge member diametrically or offset relative to a true diametrical position.

3. In turntable machanism for supporting a peel trolley, the combination with a bridge member along which the trolley is reciprocable of a rotatably mounted frame having its axis of rotation disposed centrally of the turntable mechanism, said bridge member being pivotally mounted adjacent one of its ends on said frame with the axis of pivoting offset from said frame axis, said bridge member including a truck on the other side of the central axis from said pivotal axis for supporting the other end of the bridge member, said truck being arcuately movable about said central axis and permitting limited swinging of the bridge member about its pivotal mounting, and means for relating said bridge member and frame for swinging movement as a unit or for swinging movement of the bridge member relative to said frame to selectively position said bridge member diametrically or offset relative to a true diametrial position.

4. The combination defined in claim 3 in which the frame is furnished with a truck for supporting load imposed on the frame through said pivotal mounting.

5. A turntable mechanism comprising a frame, means for mounting said frame for rotation around a fixed axis of rotation to different radial positions, an elongate bridge member aligned with said frame, means longitudinally thereof for a reciprocating carrying device, means movable around said axis of rotation supporting one end of said bridge member and means on said frame and offset from said axis of rotation supporting the other end of said bridge member enabling a limited movement of said bridge member out of alignment with said frame, and means for relating said bridge member and frame for swinging movement as a unit or for swinging movement of the bridge member relative to said frame to selectively position said bridge member radially or offset somewhat to either side of a true radial position.

6. A turntable mechanism comprising a frame, means for mounting said frame for rotation around a fixed axis of rotation to different radial positions, an elongate bridge member aligned with said frame, means longitudinally thereof for a reciprocating carrying device, means movable around said axis of rotation supporting one end of said bridge member and means on said frame and offset from said axis of rotation supporting the other end of said bridge member enabling a limited movement of said bridge member out of alignment with said frame, and means for relating said bridge member and frame for swinging movement as a unit or for swinging movement of the bridge member relative to said frame to selectively position said bridge member radially or offset somewhat to either side of a true radial position, said last-mentioned means comprising flexible elements extending in each of opposite directions from the portion of the bridge member not supported by the frame, and winding means cooperating with said flexible elements for positioning said bridge member relative to said frame.

7. A turntable mechanism comprising a frame, means for mounting said frame for rotation around a fixed axis of rotation to different radial positions, an elongate bridge member aligned with said frame, means longitudinally thereof for a reciprocating carrying device, means movable around said axis of rotation supporting one end of said bridge member and means on said frame and offset from said axis of rotation supporting the other end of said bridge member enabling a limited movement of said bridge member out of alignment with said frame, and means for relating said bridge member and frame for swinging movement as a unit or for swinging movement of the bridge member relative to said frame to selectively position said bridge member radially or offset somewhat to either side of a true radial position, said last-mentioned means comprising a pair of cables each extending from said bridge member in one of the directions of turning movement thereof, winding means for winding in and paying out said cables, and a pair of sheaves carried by said frame on the opposite side of said axis from the means on said frame for supporting the bridge member.

8. A turntable mechanism comprising a frame, means for mounting said frame for rotation around a fixed axis of rotation to different radial positions, an elongate bridge member normally extending radially in opposite directions from said axis of rotation, means on said frame and offset from said axis of rotation for pivotally supporting one end of said bridge member so as to enable a limited movement of said bridge member out of radial alignment, a truck movable around said axis of rotation supporting the other end of said bridge member, and means for relating said bridge member and frame for swinging movement as a unit or for swinging movement of the bridge member relative to said frame to selectively position said bridge member radially or offset somewhat to either side of a true radial position.

9. Turntable mechanism as defined in claim 8 in which power driven means are provided for

swinging the bridge member and frame in unison about said axis.

10. A turntable mechanism comprising a frame, means for mounting said frame for rotation around a fixed axis of rotation to different radial positions, an elongate bridge member normally extending radially in opposite directions from said axis of rotation, means on said frame and offset from said axis of rotation for pivotally supporting one end of said bridge member so as to enable a limited movement of said bridge member out of radial alignment, a truck movable around said axis of rotation supporting the other end of said bridge member, and means for relating said bridge member and frame for swinging movement as a unit or for swinging movement of the bridge member relative to said frame to selectively position said bridge member radially or offset somewhat to either side of a true radial position, said last-mentioned means comprising a pair of cables each extending from said bridge member in one of the directions of turning movement thereof, and winding means for winding in and paying out said cables, said cables being anchored to said bridge member below the bottom of the adjacent truck wheels.

WALTER D. KELLER.