C. L. PATTERSON.

CRANK SHAFT STRAIGHTENING MACHINE.

APPLICATION FILED DEC. 5, 1919.

1,369,904.

Patented Mar. 1, 1921.

3 SHEETS—SHEET 1.

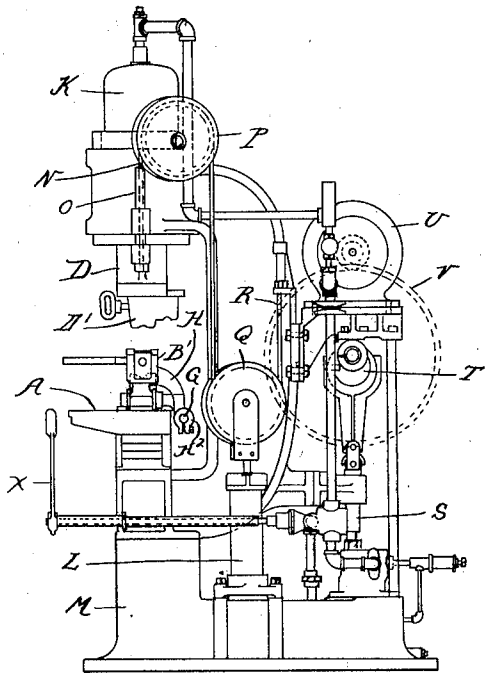


Fig. 1.

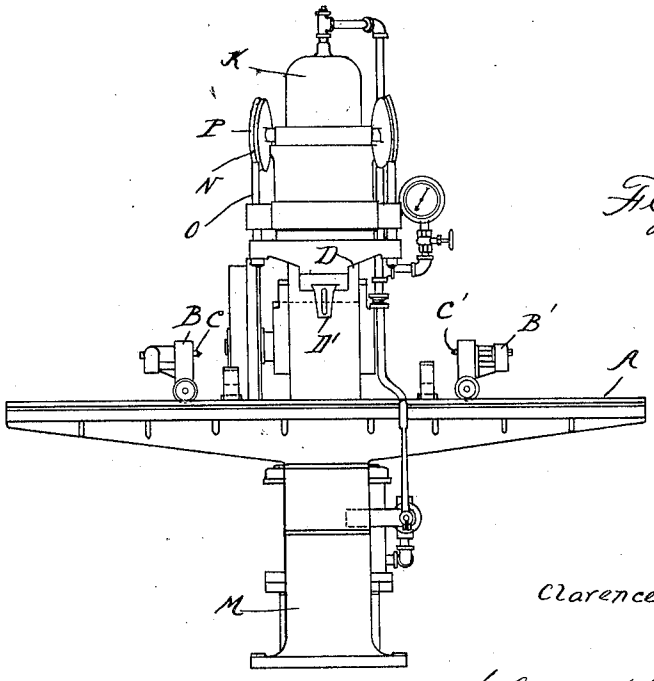


Fig. 2.

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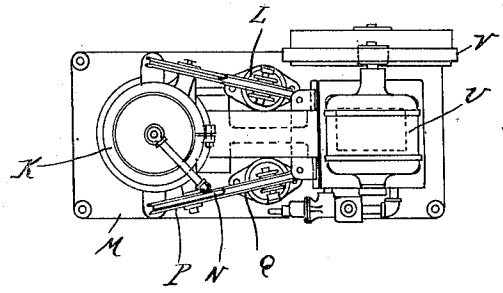


Fig. 3.

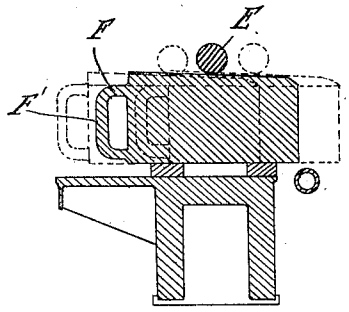


Fig. 7.

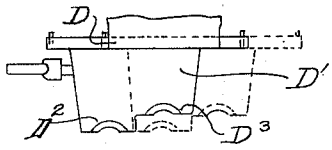


Fig. 8.

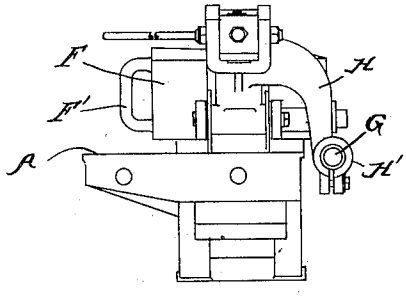


Fig. 9.

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3 SHEETS—SHEET 3.

Fig. 4.

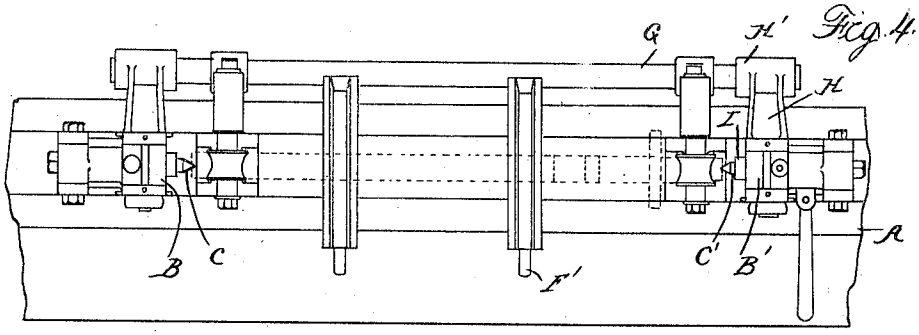


Fig. 5.

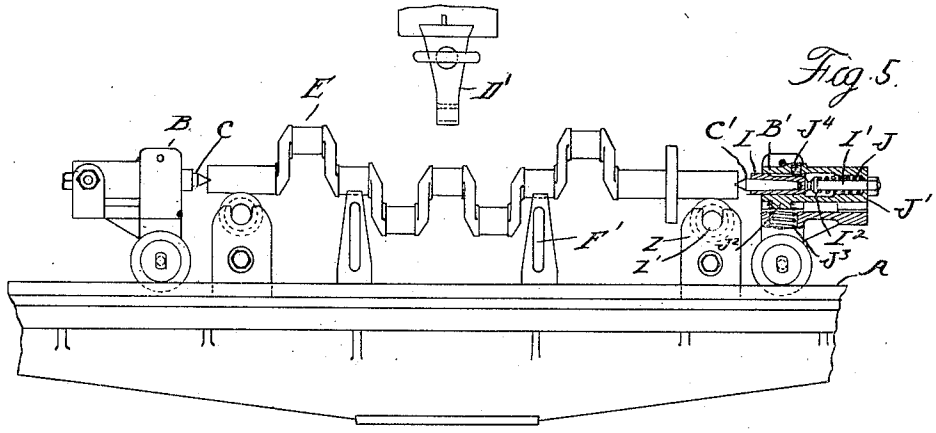
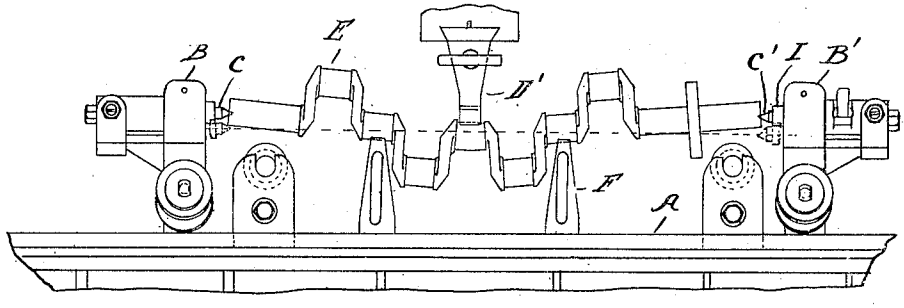


Fig. 6.



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UNITED STATES PATENT OFFICE.

CLARENCE L. PATTERSON, OF DETROIT, MICHIGAN, ASSIGNOR TO METALWOOD MANUFACTURING COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

CRANK-SHAFT-STRAIGHTENING MACHINE.

1,369,904. Specification of Letters Patent. Patented Mar. 1, 1921.

Application filed December 5, 1919. Serial No. 342,671.

To all whom it may concern:

Be it known that I, CLARENCE L. PATTERSON, a citizen of the United States of America, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Crank-Shaft-Straightening Machines, of which the following is a specification, reference being had therein to the accompanying drawings.

The invention relates to machines designed for use in the straightening of crank shafts, and it is the object of the invention to facilitate and expedite the operation and to combine great power with accuracy of operation.

Crank shafts which have been subjected to heat treatment are frequently warped, so as to be inaccurate. This inaccuracy may be eliminated by the bending of the shaft, but this is an operation requiring both power and delicacy. To determine the portions of the shaft that are out of true, it is revolved upon centers and when the most eccentric points are ascertained, pressure is applied thereto to bend the shaft. If, however, this pressure is applied to the shaft while still upon the centers, there is great danger of breaking or destroying the accuracy of these centers. On the other hand, the removal of the shaft from the centers and the replacement of the same after each bending operation is a slow process.

With the present invention the shaft to be trued is placed on centers and remains in engagement therewith during all of the straightening operations. At the same time, the construction is such that powerful pressure can be applied to the eccentric points of the shaft without any objectionable stressing of the centers. Other features of advantage will be referred to more specifically hereinafter.

In the drawings:

Figure 1 is a side elevation of the machine;

Fig. 2 is a front elevation thereof;

Fig. 3 is a plan view of the pressure applying portion of the machine;

Fig. 4 is a plan view of the work table and shaft-supporting centers;

Figs. 5 and 6 are front elevations illustrating the operation of straightening the crank shaft;

Fig. 7 is a cross-section showing the arrangement of the fulcrum blocks;

Fig. 8 is an elevation of the stepped plunger head and showing its relation to the shaft-supporting centers;

Fig. 9 is an end elevation of the clamping member.

A is a work-supporting table; B and B′ are carriages longitudinally movable upon said table and supporting the centers C and C′ for engagement with the work. D is a plunger, preferably hydraulically operated, which is arranged to move vertically in relation to the table and work supported thereon, the arrangement being such that by moving the carriages C and C′ any desired point in the shaft can be registered with the plunger. Thus when an inaccurate crank shaft, such as E, is engaged with the centers, it may be revolved thereon to determine the points of eccentricity and these points are then placed in registration with the plunger for the application of pressure to bend the shaft.

As has been stated, the application of pressure to the work while in engagement with and supported solely by the centers would produce such a stress upon these delicate parts as to endanger breaking. This result I have avoided by the placing of pressure-resisting bearings beneath the shaft on opposite sides of the point to which pressure is applied and as shown, F are these pressure-resisting bearings which are of a tapering form and provided with handles F′ for adjusting the same transversely of the table A. These pressure-resisting bearings alone are insufficient to relieve the centers from stress, inasmuch as any bending pressure applied to the shaft between said bearings will cause a movement of the portions of the shaft beyond the bearings in the opposite direction. In other words, these bearings form fulcrum points upon which the shaft rocks, so that downward movement of the plunger will inevitably cause an upward movement of the ends of the shaft. I have therefore so constructed the centers and the carriages for the same as to permit freedom for upward movement, while at the same time maintaining their relative positions longitudinally of the shaft and the engagement of the centers with the shaft.

In detail G is a rod or shaft arranged

parallel to the shaft operated upon and adjustably engaging bearings on the carriages B and B'. As shown, each of these carriages has a rearwardly and downwardly extending arm H carrying at its free end a clamping bearing H' for engaging the shaft G so that this shaft will be normally held below and in rear of the table. When the work is engaged or disengaged, the clamps H' are released, so as to permit the free sliding of the bearings upon the shaft G, but normally these clamps are tightened, thereby holding the carriages B and B' a fixed distance apart. The enters C and C' are preferably resiliently yieldable and to this end the tapering shanks of the centers are engaged with correspondingly tapering recesses in a longitudinally adjustable cylindrical member I having a shank I' surrounded by a spring J, one end of which bears against the collar I^2 and the other end against the fixed shoulder in a surrounding housing J'. The latter is attached to the carriage by a transversely extending pivot J^2, while a spring J^3 yieldably holds the casing J' against a stop J^4. The tension of the spring J is such as to apply a yielding pressure to the centers for holding the same in engagement with the work, while the yielding of the spring J^3 will permit a rocking of the center to compensate for angular movement.

The plunger D is operated preferably by a single acting hydraulic motor K for supplying the downward pressure and a spring for effecting the return movement. As shown, a pair of springs are arranged in housings L mounted on the base M of the frame and the connection between these springs and the plunger is through the medium of the flexible cables N, attached within guide tubes O on opposite sides of the plunger and passing over shives P and beneath shives Q to an anchorage R on the frame. The hydraulic pressure is furnished by a pump S operated by an eccentric crank T, which latter is driven from the motor U through the medium of a step-down gearing V. The application of the pressure is controlled by a valve W, which is preferably operated by a lever X at the base of the machine to apply pressure to the plunger when said lever is depressed and to relieve pressure when the pedal is lifted.

In operation, the shaft to be straightened is engaged with the centers C and C', the latter being properly spaced by adjustment of the clamps H' upon the rod G. When thus engaged, the shaft may be revolved and the points of greatest eccentricity marked thereon, after which the carriages are moved to adjust the shaft longitudinally and to register the high point with the plunger. Before, however, applying any pressure the pressure bearings F are adjusted transversely of the bed to engage portions of the shaft on opposite sides of the high point to be engaged by the plunger. The operator then presses the pedal Y, which by admitting high pressure fluid to the cylinder K will move the plunger downward, thereby bending the shaft. At the same time, there will be an upward movement of the opposite ends of the shaft, which is permitted by the lifting of the carriages off from the table, while the centers will rock in these carriages to compensate for the angular movement. This movement does not materially effect the distance between centers which are maintained relatively fixed by the rod G and clamps H'. When the pedal is released, the hydraulic pressure is relieved, which will permit the springs acting through the cables N to raise the plunger out of engagement with the shaft. The bearing blocks F may then be disengaged and the shaft revolved again to determine the point or points for further application of pressure and the straightening operation can be repeated until the shaft is true.

To further facilitate the operation of the machine the plunger D is preferably provided with a transversely adjustable member D' having the stepped bearings D^2 and D^3 for alternative engagement with the work. This limits the amount of movement which it is necessary to impart to the plunger in the application of pressure to different parts of the shaft. I also preferably provide roller supports Z for the ends of the shaft, while the latter is being engaged or disengaged from the center, and which avoid all danger of dropping the shaft during this operation. These supports are connected to arms Z', which are adjustably mounted on the rod G so as to move with the carriages and centers when the latter are shifted longitudinally of the table.

What I claim as my invention is:

1. In a machine for straightening shafts, the combination with pressure applying means, of centers on which said shaft is revolubly supported, adjustable to bring different portions of the shaft into register with said pressure applying means, means intermediate the centers for supporting work while being engaged by the centers, and means for maintaining said centers and supporting means in fixed relation to each other when the centers are being adjusted in relation to the pressure applying means.

2. The combination with pressure applying means, of centers for revolubly supporting a shaft, means for adjusting said centers to bring different portions of the shaft into register with said pressure applying means, bearings intermediate the centers for relieving said centers from the pressure of said applying means, the bearings being shiftable transversely to the shaft for ad-

justment thereunder, means for maintaining the centers and pressure relieving bearings in fixed relation to each other during the adjustment of the centers for register with the pressure applying means and means yieldingly permitting deflection of said centers relative to said bearings to compensate for the bending of the shaft.

3. The combination with pressure applying means, of centers for revolubly supporting a shaft, adjustable to bring different portions of said shaft into register with the pressure applying means, bearings for engaging said shaft and receiving the pressure of said applying means, and means for holding said centers and bearings in fixed relation to each other adapted to permit deflection of the centers relative to said pressure receiving bearings to compensate for the bending of the shaft and to relieve said centers from stress.

4. In a machine for straightening shafts, the combination with pressure applying means, of shaft supporting centers adjustable to bring different portions of a shaft into register with the pressure applying means, means intermediate the centers for supporting the shaft during engagement with the centers and means securing the centers and supporting means in fixed relation during adjustment for register with the pressure applying means.

5. In a machine for straightening shafts, the combination with pressure applying means, of shaft supporting centers adjustable to and from each other to accommodate different lengths of shafts, and shiftable bodily together to bring different portions of a supported shaft into register with the pressure applying means, and means for supporting the shaft during engagement with the centers, adjustable in relation to the centers, adapted to be shifted bodily with the centers when the latter are moved into desired relation to the pressure applying means.

6. In a machine for straightening shafts, the combination with fluid operated pressure applying means, of shaft supporting centers adjustable to bring different portions of a supported shaft into register with the pressure applying means, means intermediate the centers for supporting the shaft during engagement with the centers and means for securing the centers and supporting means in fixed relation during adjustment for register with the pressure applying means.

7. In a machine for straightening shafts, a work table, fluid operating straightening means moving transversely to the plane of the table, shaft supporting centers adjustable transversely to the movement of the pressure applying means on the table whereby any portion of a shaft may be brought into register with the pressure applying means, means intermediate the centers supporting the shaft during engagement with the centers and means securing the centers and supporting means in fixed relation during adjustment for register with the pressure applying means.

8. In a machine for straightening shafts, the combination with fluid operating pressure applying means, of shaft supporting centers adjustable to and from each other to accommodate different lengths of shafts and shiftable bodily together to bring different portions of a supported shaft into register with the pressure applying means and means for supporting a shaft during engagement with the centers, adjustable in relation to the centers and adapted to be shifted bodily with the centers when the latter are moved into a desired relation to the pressure applying means.

9. In a machine for straightening shafts, the combination with pressure applying means, of shaft supporting centers yieldingly mounted to provide for lateral and longitudinal, displacement and adjustably secured together whereby any portion of a supported shaft may be brought into register with the pressure applying means, means intermediate the centers for supporting the shaft during engagement with the centers adapted to be shifted bodily with the centers for engagement of any portion of the shaft with the pressure applying means and means intermediate the centers adapted to support the shaft during deflection of the latter under the operation of the pressure applying means.

10. In a machine for straightening shafts, a work table, liquid operated pressure applying means moving transversely to the plane of the table, shaft supporting centers adjustable on the table transversely to the line of movement of the pressure applying means, means adjustable on the table intermediate the centers for supporting a shaft during engagement with the supporting centers, means yieldingly maintaining the centers in engagement with a supported shaft during deflection of the latter under operation of the pressure applying means and means adjustably securing the supporting centers and the supporting means together to permit the centers and supporting means to be shifted bodily along the table in relation to the pressure applying means.

11. In a machine for straightening shafts, the combination with a work table, a hydraulic press the direction of stroke of which is transverse to the table, shaft supporting centers shiftable on the table transversely to the line of movement of the press for bringing different portions of a supported shaft into the working range of the press, yielding means supporting the cen-

ters and permitting lateral and longitudinal displacement of the latter during deflection of an engaged shaft, means adjustable on the table transversely to the line of movement of the centers for supporting a shaft between the centers when engaged by the press and means for adjustably securing the centers in fixed relation during adjustment for register with the pressure applying means.

12. In a machine for straightening shafts, a work table, center carriages shiftable longitudinally on the table, shaft supporting centers yieldingly mounted on the carriages adapted to be deflected longitudinally and laterally, means connecting the carriages adjustably for maintaining the centers in desired relation while permitting bodily movement thereof along the table, means on the table adjustably secured to the carriage connecting means to move with the latter and adapted to support work while being engaged by the centers, liquid operated pressure applying means movable transversely to the plane of the table for engaging work carried by the centers and means intermediate the centers shiftable on the table transversely to the line of motion of the center carriages for contacting with and supporting work on the centers when undergoing deflection by the pressure applying means.

In testimony whereof I affix my signature.

CLARENCE L. PATTERSON.