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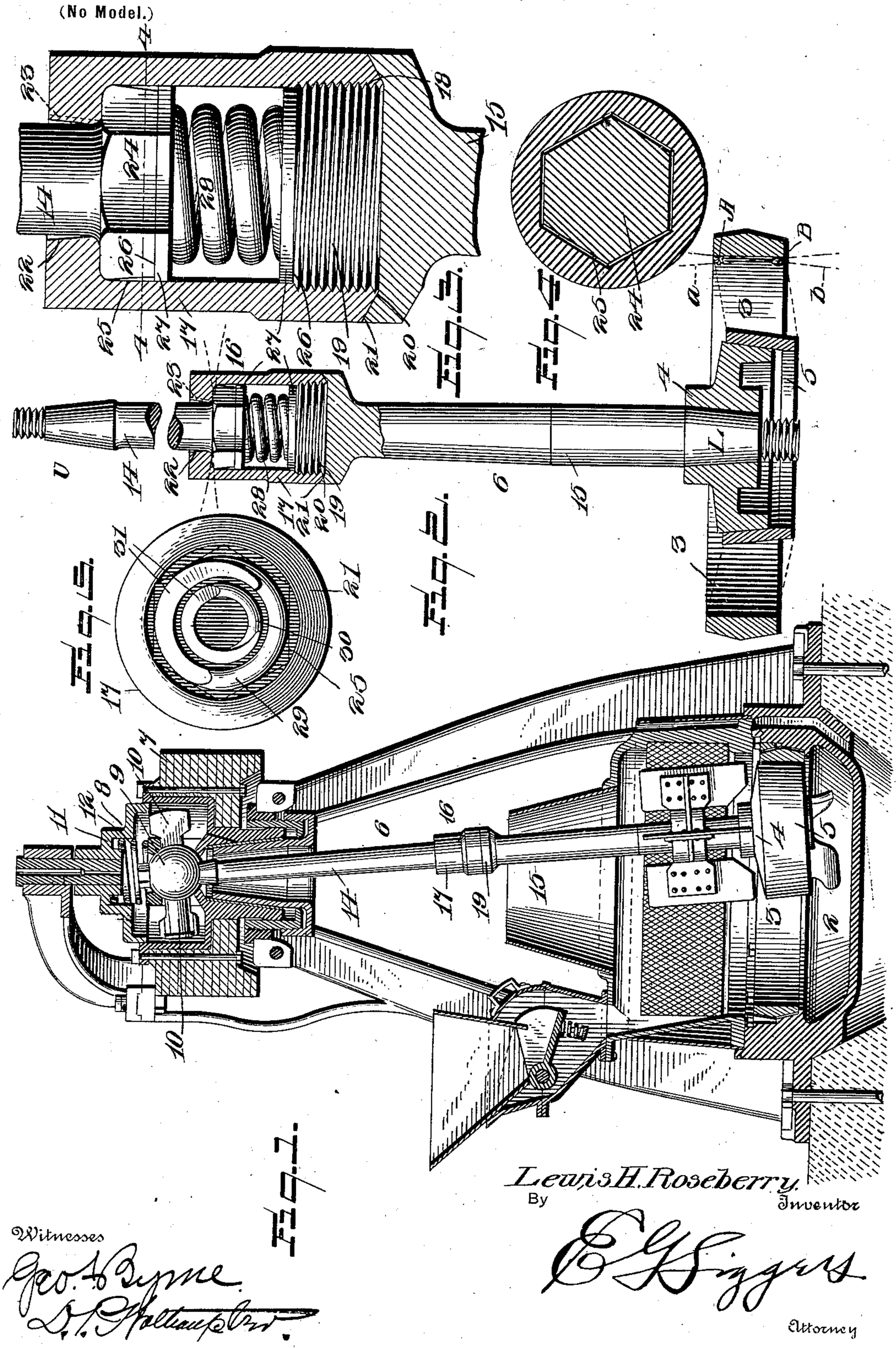
L. H. ROSEBERRY.

ROLL SHAFT FOR ROLLER MILLS

(Application filed Mar. 15, 1900.

(No Model.)



Witnesses
Geo. H. Byrne.
L. L. Hollingsworth

Lewis H. Roseberry.
Inventor
By
E. G. Siggers
Attorney

UNITED STATES PATENT OFFICE.

LEWIS H. ROSEBERRY, OF EASTON, PENNSYLVANIA.

ROLL-SHAFT FOR ROLLER-MILLS.

SPECIFICATION forming part of Letters Patent No. 661,744, dated November 13, 1900.

Application filed March 15, 1900. Serial No. 8,814. (No model.)

To all whom it may concern:

Be it known that I, LEWIS H. ROSEBERRY, a citizen of the United States, residing at Easton, in the county of Northampton and State of Pennsylvania, have invented a new and useful Roll-Shaft for Roller-Mills, of which the following is a specification.

This invention relates to roller crushing-mills of the type known as the "roller-and-die" mill, in which the material is reduced or crushed by a roll working within and against the inner surface of a ring or die and carried by a gyratory shaft, and the invention has special reference to an improved construction of roll-shaft designed for use in a roller-mill of this nature.

In roller-mills of the class referred to, involving a gyratory shaft carrying a roll traveling within and working against a ring or die located in the mortar or pan of the mill, one of the greatest objections thereto is the destructive result attendant upon the use of the one-piece rigid roll-shaft, which presents an unyielding shaft throughout its entire length irrespective of the unevenness of the material being crushed or pulverized within the mortar. By reason of the unyielding nature of the one-piece solid shafts now in common use the enormous deflective vibration or strain on the shaft incident to the uneven positions which hard material may assume within the ring or die of the mortar frequently causes a breakage or snapping of the shaft at some intermediate point, usually at a central point between its ends, and also constantly impairs the upper mechanism of the mill associated with the upper end of the shaft and oftentimes entirely destroys the said upper mechanism. Furthermore, in the use of the ordinary roll-shaft the absence of means for absorbing or compensating for the deflective or lateral vibration upon the shaft, as well as abnormal strain or thust in a longitudinal direction, not only causes an early destruction of the upper mechanism and principal parts of the mill by reason of the continual swaging and hammering action, but the same action also produces the excessive crashing sound which is such an objectionable feature of roller crushing-mills. It is also by reason of the use of one-piece solid roll-shafts that the present forms of roller crushing-mills are so expensive to operate and involve frequent repair.

It is the purpose of the present invention to overcome the objections noted to the use of one-piece solid roll-shafts by providing an improved construction of shaft having means for absorbing the energy of vibration and compensating for strain in all directions upon the shaft, while at the same time providing means for yieldingly maintaining the axial alinement of the shaft, thereby correcting such alinement when disturbed by the deflective or lateral strain upon the shaft.

To this end the invention primarily contemplates a sectional form of roll-shaft provided with a simple and effective construction of vibration-joint securing the desirable result referred to.

With these and many other objects in view, which will readily appear to those familiar with the art as the nature of the invention is better understood, the same consists in the novel construction, combination, and arrangement of parts hereinafter more fully described, illustrated, and claimed.

The fundamental feature of the invention involving the sectional formation of the shaft and the vibration-joint therefor, having means absorbing or compensating for longitudinal and lateral vibration of the shaft, is necessarily susceptible to modification without departing from the spirit or scope of the invention; but the preferred construction for carrying the invention into effect is shown in the accompanying drawings, in which—

Figure 1 is a longitudinal sectional view of a roller crushing-mill equipped with a roll-shaft embodying the improvement. Fig. 2 is a longitudinal sectional view of the shaft removed from the mill, illustrating the relation of the roll to the ring or die within the mortar and also indicating by dotted lines the lines of deflection which the parts follow on account of the vibration of the shaft. Fig. 3 is an enlarged sectional view of the vibration-joint. Fig. 4 is a cross-sectional view on the line 4 4 of Fig. 3. Fig. 5 is a bottom plan view of the coupling-sleeve which connects the contiguous ends of the shaft-sections, showing the springs therein.

Like characters of reference designate corresponding parts in the several figures of the drawings.

In carrying out the invention it is unimportant what specific type of roller-mill the improved shaft may be associated with; but the shaft possesses special utility in connection with roller-mills of the roller-and-die type and involving the use of a gyratory shaft carrying at its lower end a crushing-roll working within and against the inner surfaces of the ring or die, and so for illustrative purposes the invention is shown in the drawings as applied to this class of roller-mills.

Referring particularly to the drawings, the numeral 1 designates the upright stand or framework of the roller crushing-mill, within the bottom portion of which stand or framework is arranged the mortar or pan 2, having mounted therein the usual ring or die 3, with which coöperates the crushing-roll 4, provided with a tire 5 and mounted on the lower end of the gyratory roll-shaft 6. The gyratory roll-shaft 6 is suspended from the upper end within the body of a pulley 7, and in connection with this pulley and the upper end of the roll-shaft is arranged what is commonly termed the "upper" mechanism 8 of the mill, which is subjected to such a destructive strain by the excessive vibrations of the ordinary one-piece solid roll-shaft. This upper mechanism 8 includes a bearing-ball 9, trunnions 10 at opposite sides of the ball, a cover-casting 11, a top spring 12, interposed between the cover-casting and the ball at the upper end of the roll-shaft, and the divers fittings associated therewith. In the ordinary construction of roller-mills there is no interruption in the rigidity and solidity of the roll-shaft between its upper mechanism 8 and the crushing-roll 4 at the lower end thereof. The present invention, however, contemplates the formation of the roll-shaft in sections, the same consisting of upper and lower longitudinally-alined shaft-sections 14 and 15, respectively, the upper shaft-section 14 being associated with the upper mechanism 8 of the mill in the manner described and the lower shaft-section 15 carrying the roll 4, which coöperates with the ring or die 3 of the mortar 2. The said upper and lower alined shaft-sections 14 and 15 are substantially coextensive in length to dispose the joint or coupling connection therebetween at a point centrally between the ends of the shaft, although conditions may require the location of the joint at some other intermediate position; but irrespective of the lengths of the shaft-sections the same are designed to be yieldingly coupled together by a vibration-joint 16, which not only compensates for deflective and longitudinal vibrations of the shaft, but also corrects and yieldingly maintains the axial alinement of the shaft-sections.

In the preferred form of vibration-joint 16 the same includes a coupling-sleeve 17, preferably of a cylindrical form and provided in the lower end thereof with a threaded socket 18, which receives the screw-tenon 19, formed at the upper end of the lower shaft-section 15, and at the base of the screw-tenon 19 the said lower shaft-section is provided with an annular chamfered seat-flange 20, which tightly registers with the correspondingly beveled or chamfered lower edge 21 of the coupling-sleeve 17 to obviate the possibility of said end of the sleeve spreading under the enormous deflective or longitudinal strain to which the parts are subjected. The said coupling-sleeve 17 of the vibration-joint is provided with a closed upper end having formed therein a tapered shaft-opening 22, with an oil hole or groove 23 located at one side thereof, and adapted to receive therein the lower end portion of the upper shaft-section 14. The said lower end of the upper shaft-section 14 is provided with an annular head 24, which is of a peripheral polygonal contour, such as hexagonal or other equivalent shape, and this polygonal head 24 fits in the correspondingly-shaped interior polygonal seat 25, formed within the coupling-sleeve 17, contiguous to the closed end thereof, and which coöperates with the said head 24 to prevent a relative turning of the parts. At this point it may be observed that the said head 24 is slightly tapered to permit, in connection with the slightly-tapered form of the opening 24, of the relative rocking movement of the coupling-sleeve and the upper coupling-section 14 upon a deflective or lateral strain upon the lower shaft-section.

The polygonal shaft-head 24 of the upper shaft-section and the screw-tenon 19 of the lower shaft-section are both provided with flat bearing-surfaces 26, upon which fit the flat pressure plates or disks 27, the upper of which plates or disks is of a polygonal form to correspond to the shape of the head 24 and the seat 25, and between the two plates or disks 27 is interposed a yielding compensating device 28, preferably in the form of external and internal helical springs 29 and 30, respectively arranged one within the other and having flattened ends 31, bearing flatly upon the pressure-plates 27. The compensating or spring device 28 is mounted in place under sufficient pressure to firmly separate the contiguous ends of the shaft-sections and maintain the correct axial alinement thereof, while at the same time permitting of a yield to deflective or lateral as well as to a longitudinal thrust upon the shaft during the operation of the mill. In this connection it may also be observed that the weight of the material used in the construction of the vibration-joint acts in the capacity of a counterbalance to the lateral throw of the shaft caused by the uneven positions which the objects or material assumes within the ring or die of the mortar.

With reference to the material used in the construction of the joint it may be explained

that the coupling-sleeve 17 is made much stronger than any other part of the roll-shaft in order that the tendency to breakage at the joint may be reduced to a minimum, and the pressure-plates 27, which are employed as bearings for the ends of the spring device 28, are preferably made of steel tempered to the same hardness as the springs, so as to prevent the springs impairing the parts associated therewith. The compensating or spring device 28, which is preferably made of the external and internal springs 29 and 30, really constitutes the most essential part of the invention, and in being applied in position the said compensating or spring device is placed under a pressure of about six thousand pounds, thus being capable of powerfully maintaining the axial alinement of the shaft-sections under normal operating conditions, inasmuch as the crushing-roll of an ordinary roller-mill swings up against the ring or die by centrifugal force under pressure ranging from four thousand to six thousand pounds. Any excess of pressure or undue strain will cause the compensating or spring device 28 to yield, and thereby prevent breakage of the shaft or impairment of the upper mechanism 8, associated therewith.

In order to illustrate the action of the vibration-joint 16, it will be observed by reference to Fig. 2 of the drawings that in the event of a piece of material or object becoming positioned contiguous to the upper edge of the ring or die 3 the same will spring or deflect the roll-shaft, so that the face of the roll-tire 5 will be in a line parallel to the dotted line A, whereas when the object or piece of material assumes the position B contiguous to the lower edge of the ring or die the shaft will spring in the opposite direction and cause the face of the tire of the roll to assume a plane parallel to the dotted line *b*. In either of these positions the vibration-joint absorbs the vibration and causes the lower shaft-section to assume its correct axial alinement without transmitting vibratory strain to the upper mechanism 8. The longitudinal strains or thrusts are absorbed or compensated for in the same manner, and the rocking movement or vibration of the coupling-sleeve with reference to the ends U and L, respectively, of the two shaft-sections is indicated by dotted lines in Fig. 2 of the drawings.

From the foregoing it is thought that the construction, operation, and many advantages of the herein-described roll-shaft will be readily apparent to those familiar with the art without further description, and it will be understood that various changes in the form, proportion, and minor details of construction may be resorted to without departing from the principle or sacrificing any of the advantages of this invention.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is—

1. A roll-shaft for roller-mills, consisting of a pair of separate longitudinally-alined upper and lower shaft-sections, the upper section being provided with supporting means at one end, and the lower section carrying the crushing-roll at one end, and a vibration-joint coupling the contiguous ends of the separate shaft-sections, said joint being provided with yielding means for absorbing longitudinal vibration, and also permitting of a relative rocking movement of the shaft-sections to relieve the supporting means for the shaft from undue strain, substantially as set forth.

2. A roll-shaft, for roller-mills, having supporting means at one end, and carrying the crushing-roll at its opposite end, said shaft being formed in sections between its opposite ends, and a vibration-joint coupling the contiguous ends of the separate shaft-sections, and having a compensating spring arranged to maintain a separation of said sections to permit of a relative rocking movement thereof, substantially as set forth.

3. A roll-shaft for roller-mills, consisting of separate shaft-sections, and a vibration-joint coupling the sections and having a yielding compensating device consisting of external and internal springs arranged one within the other, and interposed between the contiguous ends of the shaft-sections, substantially as set forth.

4. A roll-shaft for roller-mills, consisting of separate shaft-sections, one of which is provided with a supporting member at one end, and the other of which carries the crushing-roll, and a vibration-joint comprising a coupling-sleeve connected with the contiguous ends of the shaft-sections, intermediate the supported end of the shaft and the crushing-roll, to permit of a relative rocking movement between the sections, and a yielding compensating device housed within the sleeve and interposed between the contiguous ends of the shaft-sections, said compensating device exerting a pressure to yieldingly maintain the axial longitudinal alinement of the shaft-sections, substantially as set forth.

5. A roll-shaft for roller-mills, consisting of upper and lower shaft-sections, the upper shaft-section being provided at its lower end with a polygonal head, and the lower shaft-section being provided at its upper end with a tenon, a coupling-sleeve fitted at its lower end upon the tenon of the lower shaft-section and provided at its upper end with a tapered shaft-opening, said sleeve being also provided contiguous to its upper end with an interior polygonal seat receiving the polygonal shaft-head, pressure-plates fitting upon the inner surfaces of the tenon and head of the opposite shaft-sections, and a spring compensating device interposed between the coupled ends of the shaft-sections and bearing upon said pressure-plates, substantially as set forth.

6. A roll-shaft for roller-mills, consisting of upper and lower shaft-sections, the upper section being provided at its lower end with a

shaft-head, and the lower section being provided at its upper end with a screw-tenon and at the base of said tenon with a chamfered seat-flange, a coupling-sleeve arranged upon said screw-tenon and provided with a lower beveled end registering with said chamfered seat-flange, said sleeve being provided at its upper end with a shaft-opening receiving the lower end of the upper shaft-section, and a compensating spring device interposed between the coupling ends of the shaft-sections, substantially as set forth.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

LEWIS H. ROSEBERRY.

Witnesses:
WILLIAM HENRY WALTERS,
E. CRAWFORD PARKER.