R. T. HAZELTON.

SAFETY COUPLING.

APPLICATION FILED JAN. 5, 1915.

1,141,461. Patented June 1, 1915

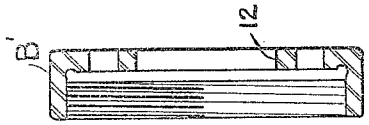

FIG. 3

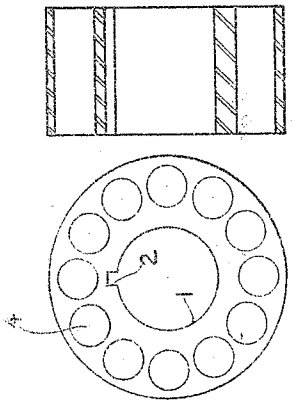

FIG. 2

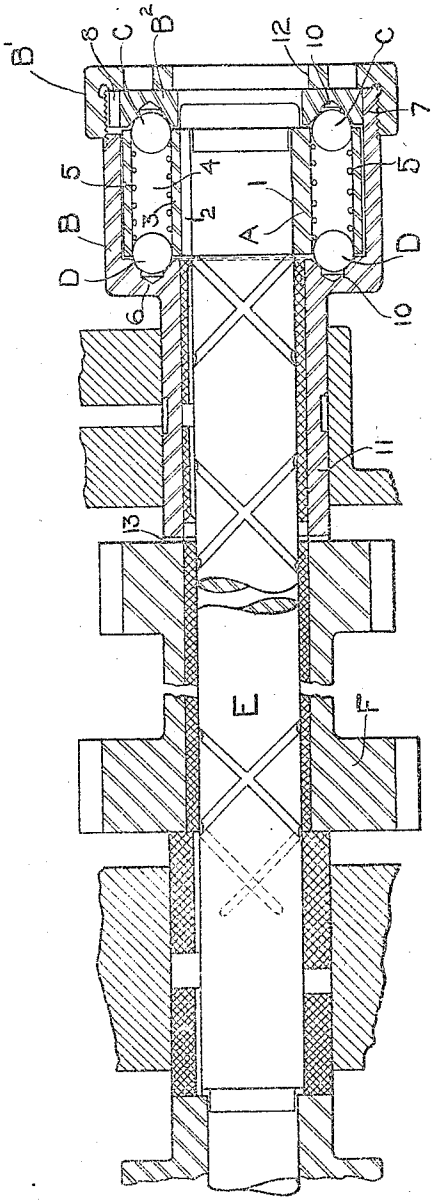

FIG. 1

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SAFETY-COUPLING.

1,141,461. Specification of Letters Patent. Patented June 1, 1915.

Application filed January 5, 1915. Serial No. 548.

To all whom it may concern:

Be it known that I, ROBERT T. HAZELTON, a citizen of the United States, and residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented a new and Improved Safety-Coupling, of which the following specification is a full disclosure.

This invention relates to a mechanism whereby only such stresses and strains as fall below a pre-determined maximum may be transmitted, whereby the transmission elements may not suffer injury in case an ultimately moved part should encounter and be impeded by an abnormal resistance.

One object within the contemplation of this invention is to create a transmission arrangement which embodies the advantages of a positive drive, as of the so-called shear-pin type, as well as the advantages of an impositive drive, as of the friction-drive type; while at the same time eliminating certain disadvantages of each of said distinct systems.

Another object is to provide a safety device capable of transmitting positively and without slipping any load less than a predetermined maximum and which will be certain to yield or fail to transmit stresses exceeding said maximum within accurately defined limits.

A more concrete object is to render available a power-transmitting mechanism which will afford a positive drive and which will not creep like an imperfect friction-drive and yet which will safely yield in case of undue stress and at once restore itself to its normal transmitting conditions to insure a positive drive and avoid the loss of time of a shear-pin arrangement, which requires the replacement of the sheared element after it has functioned.

Another object is to create an organization as above stated in which the pressures will be well balanced and confined only to the operating surfaces thereby avoiding the necessity of building, maintaining and lubricating special thrust-bearings.

Another object is to formulate an arrangement in which the stresses are balanced throughout and in which the construction is so simple and elementary that it may be manufactured at a minimum cost and installed with facility in various types of machines.

Another object is to materially improve the combination more fully described and claimed in the patent of Hazelton & Einstein, No. 1,125,686 issued January 19th, 1915, by avoiding the use of shear-pins, while yet insuring a positive transmission free from creeping as to the feeding of the table and also rendering certain a yield at the desired strain, while yet permitting a momentary discontinuance of the transmission in case of undue table resistance.

Other objects will be in part obvious from the annexed drawings and in part indicated in connection therewith by the following analysis of this invention.

This invention accordingly consists in the features of construction, combination of parts and in the unique relations of the members and in the relative proportioning and disposition thereof; all as more completely outlined herein.

To enable others skilled in the art so fully to comprehend the underlying features thereof that they may embody the same by the numerous modifications in structure and relation contemplated by this invention, drawings depicting a preferred form have been annexed as a part of this disclosure, and in such drawings, like characters of reference denote corresponding parts throughout all the views, of which:—

Figure 1 is a longitudinal section showing the general arrangement of this invention, and Figs. 2 and 3 show further details thereof.

Continuing now by way of a more detailed description, it may be stated that the illustrated embodiment of this invention contemplates two series of hardened steel balls mutually combined with a first-member intervening between each of the two series of balls and with a coöperating member in part disposed on the outer side of the one series of balls and in part disposed on the outer or more remote side of the other series of balls; all in coöperative relation with resilient means whereby each series of balls will impede a relative rotary movement of said members and will so carry the pressures as substantially to balance the two members against relative movement in a lateral or axial direction.

Referring to the drawings, A indicates what may be termed the intervening trans-

mission-member and B, B^1 and B^2 indicate the parts constituting the circumscribing or non-intervening transmission-member. Motion is caused to flow from the one member to the other through the instrumentality of a peculiar transmitting means embodying two series of hardened balls.

The intervening transmission member A here assumes the form of an annular sleeve having a hub 3 an aperture 1 whereby it may be fitted to a power transmitting shaft or the like and may be connected thereto against relative movement as by means of the key-way 2 and a suitable coöperating key. This intervening member is provided with a series of apertures 4 which are in this embodiment extended in a direction parallel with that of the surface whereby the member is secured to the power-shaft or the like. That is to say, these apertures are preferably arranged in form of an equi-spaced circumferential series, each aperture extending parallel with the axis of the member and at such a distance therefrom as to provide a sufficient moment arm. These apertures 4 are adapted snugly to retain the balls of at least one of the corresponding series of hardened steel balls and the ball-receiving apertures are sufficiently deep so that under certain conditions said balls may retreat or be forced more or less completely into said apertures, although normally about a hemisphere only of each ball will be contained within the aperture or socket. Preferably, however, the apertures 4 are open at each end and extend from one side to the other of the member and the diameter of these apertures is preferably slightly greater than that of the balls, so as to permit one series of balls, as represented by C, to be stationed at one end of the apertures 4; and in like manner to enable the other series of balls D to be stationed at the other side of the member A. This arrangement is convenient inasmuch as it enables a single expansile spring 5 to serve for each pair of balls by thrusting them in opposite directions away from the intermediate plane of the member A. By this construction, no strains tending to shift it are imposed on the member A by the springs 5, and regardless of the strength of the springs, there is no tendency to shift the position of the member A laterally, *i. e.*, in an axial direction, and consequently the member A does not have to be held in position by means of special thrust-bearings which are always liable to give trouble.

The companion member B is constructed and arranged to receive the pressures of the series of balls C and D in such a way that the said pressures are always balanced. This is accomplished by forming the member B with a shoulder or annular side-wall 6 which may conveniently be formed integrally with the member B. The complementary element or part B^2, as a matter of convenience in assembling and in enabling the pressures to be adjusted, is separably secured to the member B. Thus, the part B^2 here assumes the form of a collar adapted to be telescoped by the overhanging annular portion 7 of the member B, and it is prevented from rotating therein by means of a key 8. This collar is adjustable in an axial direction by means of a cap or adjuster B^1. Now, inasmuch as the shoulder or side-wall 6 and the collar B^2 are each provided with a series of ball-seats 10 spaced in registry with the apertures 4, it will be evident that the springs 5 will yieldably retain the balls C and D in said ball-seats and relative rotary movement between the members A and B can be permitted only in case the turning moment is sufficient to force the balls C and D toward one another against the resistance of the springs 5.

It has been found by practical tests that this arrangement is not only well balanced, in that it avoids the necessity for thrust-bearings, but to all intents and purposes is a positively acting mechanism in that motion is transmitted without permitting of any slipping or creeping. It has also been demonstrated by practical tests that this mechanism may be depended upon to yield at about the same stress or load. A great difficulty with ordinary friction devices and with shear-pin couplings is that it is always doubtful as to just what load will be effective to produce a yield; and it has been found in practice that such devices are very unreliable and in some instances will unexpectedly transmit dangerous loads. The disclosed construction, however, will be found always to yield within narrow limits at the load determined by each specific adjustment, and it can be relied upon to perform in the way expected.

A material advantage of this construction over the ordinary ball-ratchets, which embody a single series of balls, lies in the fact that it is quite devoid of unbalanced forces and therefore its utility and adaptability in connection with machine tools is greatly enhanced.

The drawings illustrate one of the many possible combinations that may be made of this mechanism with the driving and driven elements of a machine tool. Thus, in this instance, the part E receives the power or motion in the first instance from a suitable prime mover of the machine tool, and it is connected with one or the other of the members A and B to propel the same. This part E is here shown as a power shaft which may extend into the socket of the member A through the bore of a sleeve 11 on the member B, or through an aperture 12 of the member B^1, as may be preferred. This power shaft will preferably be independ-

ently mounted in bearings and may be driven by a gear secured to another portion thereof.

F indicates a power-driven member, here in the nature of a gear, forming a part of the transmission system for controlling the table movements of a milling machine or the like. This gear F is provided at 13 with a suitable clutch whereby it may be connected with the end of the sleeve 11 extending from the member B.

It is to be noted that various features and elements of this organization may be replaced in position and the parts may be variously arranged without, however, departing from the principle of this invention.

Having thus revealed this invention, I claim as new and desire to secure by Letters Patent of the United States:—

1. A transmission device of the nature disclosed combining a first series of balls; a second series of balls spaced away from said first series; a first member intervening between said two series of balls and provided with sockets for individually receiving each ball of said series; a second member having a part provided with seats for individually receiving the balls of the one series, an oppositely located part having a series of seats adapted to receive the balls of the second series; springs for resiliently positioning said balls to exert a thrust in opposite directions on the parts of such second member to balance said two members against relative lateral movement, means for positively rotating one of said members, and means for deriving motion from the other member.

2. A transmission device of the nature disclosed combining an annular member providing a series of apertures; balls located at the open ends of each aperture; springs for urging said balls in opposite directions out of said apertures; a second member having a serrated face co-acting with the balls at one end of said apertures and an element rigid with said second member and provided with a serrated face co-acting with the balls at the other end of said apertures.

3. A transmission device of the nature disclosed combining a circumscribing member having an annular side-wall provided with a series of ball-seats; an annular member concentrically within said first member; a first series of balls yieldingly carried by said second member and co-acting with the ball-seats of said first member; a second series of balls arranged in opposition to said first series and carried by said second member; a member non-rotatably secured to said first member and having a series of ball-seats co-acting with said second series of balls; and means for adjusting said member laterally with relation to said first member.

4. A mechanism of the nature disclosed combining a motion-transmitting shaft; a first and a second series of balls arranged concentrically with said shaft; means for urging said balls apart; means for restraining a revolution of said balls about said shaft; a sleeve surrounding said shaft and co-acting with the one series of said balls; and a part non-rotatably secured to said sleeve and co-acting with the other series of said balls to balance the stresses thereof and to permit of a momentary rotary movement between said sleeve and said shaft when a pre-determined stress maximum has been exceeded.

5. A yieldable safety-coupling of the nature disclosed combining an annular circumscribing member having a side-wall provided with a circumferential series of ball-seats; a collar connected to said member at a distance from said wall and also having a series of ball-seats; an annular member intervening between said collar and said wall and carrying two series of balls, springs for forcing the balls of the one series away from the balls of the other series and into said ball-seats; and means for adjusting the distance between said collar and said wall.

6. A yieldable safety-coupling of the nature disclosed combining a first member providing a plurality of seats; a corresponding number of friction-elements mounted in said seats; a second member providing serrated portions arranged in opposition to said seats; and means for urging said friction-elements in opposite directions to engage said portions with balanced stresses.

7. A transmission device of the nature disclosed combining a first series of balls; a second series of balls in coaxial relation with said first series; a first member positioning said two series of balls and provided with seats for individually receiving the balls of said series; a second member having a portion arranged at one side of said first member and provided with seats for individually receiving the balls of the one series; a part connected to said second member and located at the opposite side of said first member and also having a series of seats adapted to receive the balls of the second series; springs for resiliently positioning the balls of the respective series in opposite directions; means for positively rotating one of said members, and means for deriving motion from the other member.

8. A transmission device of the nature disclosed combining an annular member providing a plurality of recesses arranged in two series; balls located at the open ends of each recess; springs bearing on said balls and exerting pressures in opposite directions with respect to said member; and a second member having seats co-acting with said balls.

9. A transmission device of the nature

disclosed combining a member having an annular side-wall provided with a series of ball-seats; an annular member coaxial with said first member; a first series of balls yieldingly intervening between said members and co-acting with the ball-seats of said first member; and a part non-rotatably secured to said first member and having a series of ball-seats; a second series of balls arranged between said part and said second member and co-acting with the ball-seats thereof.

10. A mechanism of the nature disclosed combining a motion-transmitting shaft; a plurality of balls arranged concentrically about said shaft; means for urging some of said balls in opposite directions to others thereof, means for restraining a revolution of said balls about said shaft; and means co-acting with said balls to balance the stresses thereof and to permit of a momentary rotary movement between said means and said shaft when a pre-determined stress maximum has been exceeded.

In witness whereof, I hereunto subscribe my name, as attested by the two subscribing witnesses.

ROBERT T. HAZELTON.

Witnesses:
SOL EINSTEIN,
H. T. WILLIAMS.