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E. PFARRWALLER

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SHAFT COUPLING

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Fig. 1

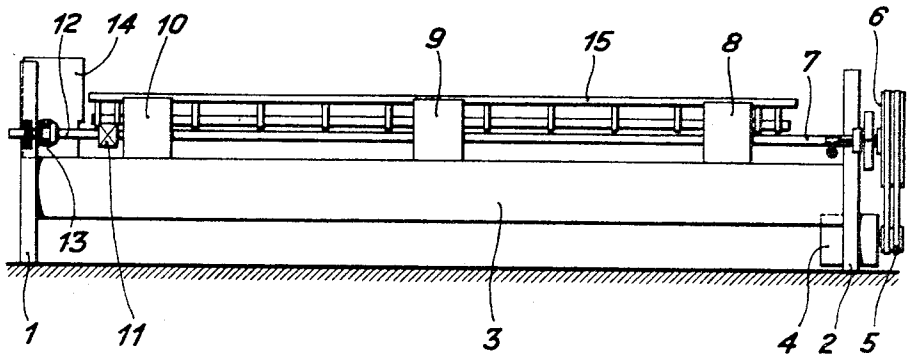


Fig. 2

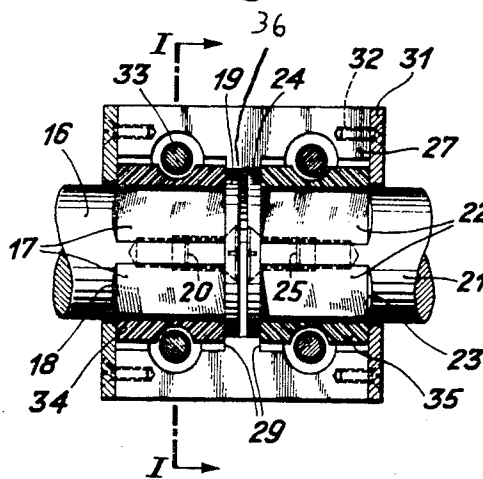
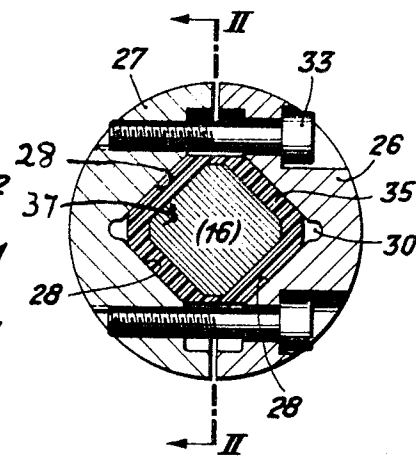


Fig. 3



Inventor:

Erwin Pfarrwaller

BY Gennie Edmonds,

Morton, Taylor and Adams

ATTORNEYS

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Erwin Pfarrwaller, Winterthur, Switzerland, assignor to
Sulzer Brothers Limited, Winterthur, Switzerland, a
Swiss company

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7 Claims

ABSTRACT OF THE DISCLOSURE

There is disclosed an elastic coupling for coupling together two aligned shafts, the coupling being capable of transmitting both torque and axial thrust without metal to metal contact between the shafts. The coupling comprises on each of the shafts to be coupled a male end of polygonal cross-section, an elastic sleeve forced over that end, and a disc or washer affixed to the end of that shaft to prevent the sleeve from being pulled off. It also comprises an outer sleeve split into two substantially semicylindrical rigid shells. These shells when fastened together constitute an outer sleeve or female member having at each end a cavity of similar polygonal cross-section. Each of these cavities fits about and squeezes one of the elastic sleeves and is bounded at each end by a radially inwardly extending shoulder surface. These two shoulder surfaces of each cavity embrace the ends of one of the elastic sleeves.

BACKGROUND OF THE INVENTION

The coupling of the present invention finds particular application in looms for the weaving of cloth.

A loom is made up of a number of devices or components, some of which execute reciprocating or otherwise discontinuous motion. When the loom is started and stopped, these components impose momentary peak loads on the loom drive. Thus for example this is the case with the picking mechanism, the reed and the heddle frames. The motions of these components must take place in the proper sequence and at the proper phases of the loom cycle. By employing a single main drive shaft from which the drives to the individual components are derived through power take-offs such as shafts, belts, cams and similar linkages, correct relative timing of these motions can be obtained in a relatively simple manner.

If however there is employed a rigid interconnection of the components, the peak loads occurring in the individual components of the loom and the vibrations which may arise due to engagement or impact of moving parts with one another produce heavy stresses on the portions of the drive adjacent those power take-offs and these stresses are communicated back up the power train as far as the flywheel of the loom, and may thus have deleterious effects on the separate drives of the individual loom components. This is especially the case of loom components which include large moving masses as for example the drive to the reed, which at beating up is subjected to additional vibrations. It is also true of the lighter components of the loom which must undergo precisely defined motions, such as the drive of the weft thread tuck-in needles in a loom of the gripper shuttle type.

In order to exclude undesired mutual interaction of the component operations of the loom, the subsidiary drive shafts to those components may be insulated from and coupled to the shaft or shafts which drive them by means of elastic couplings, for the purposes of shock absorption. These couplings operate to take up and damp out the above described reactions. As between loom components more and less sensitive to shock, the more sensitive ones are

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desirably arranged to derive their power from the main loom shaft upstream, in the sense of power flow, of elastic couplings through which the less sensitive components receive their power. The take-offs to these sensitive elements may advantageously also include elastic couplings. By a suitable ordering of the power take-offs and by suitable disposition of oscillating masses and elastic parts, there can be obtained a quiet and uniform operation of the sensitive components of the loom.

The elastic coupling elements employed must in general be capable of transferring not only torque but also axial thrust, because the bevel gear drives employed in the power take-offs or in reversing mechanisms and also the clutches, belt couplings and the like involve axial stresses which are superposed on the torsional stresses of rotary motion. Even in the case of the axial stresses there are time variant loads having peaks and vibrations to be taken into account. These must so far as possible be taken up and damped out by elastic means in order to obtain a stable, quiet and dependable operation of the loom.

In general the angular and axial motions occurring in the couplings between the driving and driven elements must be held to low levels in order to prevent departure of the various loom operations from proper relative time phase.

In the maintenance of looms it also is of advantage if the drive of the individual loom components can be separately withdrawn for repair or maintenance. The coupling elements employed must therefore be easily disassembled.

Elastic, shock absorbing couplings have been proposed in many forms. In one type similar to a dog clutch, coupling discs fastened perpendicularly to the axis of rotation on the adjacent ends of the two shafts are provided, one with eccentric studs which engage corresponding bores in the other in order to communicate rotary motion from the driving to the driven shaft. Elastic elements combined with the studs, for example, in the form of rubber sleeves, prevent engagement between rigid elements in the operation of the coupling and have a shock absorbing effect. Such a coupling however occupies a certain amount of space transversely of the axis of rotation beyond the radius of the shafts. It is, moreover, incapable of transmitting axial stress. Its elasticity is limited by the dimensions of the elastic components thereof and cannot be adjusted to varying individual circumstances.

A further simple solution of the coupling problem is achieved by giving to the adjacent ends of the shafts a polygonal cross-section, for example square, and by slipping over those adjacent ends a sleeve having the corresponding polygonal interior cross-section, an elastic mass such as for example a rubber sleeve being vulcanized between one or both shafts and the sleeve, in order to confer on the coupling the desired elasticity. Such a coupling has the advantage of requiring only a small amount of space but it cannot be opened up for repair or maintenance and its elasticity is not adjustable.

Another known elastic coupling is one in which the end of one of the shafts has fastened thereto a projecting hollow sleeve of square interior cross-section and into which the other shaft end extends. The end of the second shaft similarly possesses a square cross-section whose diagonal approximates the dimension of one side of the cross-section of the inside of the sleeve. The sleeve and the end of the second shaft are angularly displaced by about 45°. Cylindrical elastic rubber rolls are then inserted, optionally with prestressing, into the four empty corner spaces so provided between the sleeve and the end of the second shaft. Upon the application of a torque between the two shafts, the rubber rolls are elastically deformed, but a positive coupling is retained which will transmit, within the strength limit of the structure, all peaks in torsional stress. Axial stresses can however not

be transmitted. In addition the variation with stress in the relative angular position of the two shafts is relatively large and is of course dependent on the torque being transmitted so that an accurate time phase relation cannot be maintained between elements coupled to the shafts on the two sides of such a coupling. Moreover, this coupling is similarly difficult to disassemble.

Summary of the invention

In contrast thereto, the invention provides an elastic coupling which connects together driving and driven shafts in an elastic and shock absorbing manner such that the stiffness of the coupling can be readily adjusted to match the requirements of any individual application. The coupling can transmit both torsional and axial stresses, with relative motions between the driving and driven shafts of controllable small value, and the coupling is readily disassembled when stationary.

In accordance with the invention, the ends of the shafts to be coupled together have a substantially polygonal cross-section. A coupling member is provided which comprises at least two shells spaced from each other along a plane parallel to the axis of the shafts, these shells being held in relative position by adjustable stressing elements such as machine screws. Moreover, the coupling shells have, at least as to one of the shaft ends, cavities therein which are so matched to the corresponding shaft end that a vacant space is formed between them and the end of that shaft, this space being filled with an inert elastic material capable of absorbing mechanical stresses and which has the effect of preventing direct contact between the rigid parts of the coupling and the ends of the shaft and also between the ends of the shafts themselves.

The coupling of the invention is capable of providing dependable operation to the various elements of a loom so as to insure a proper time sequence in the motions of its components. The coupling of the invention can readily be opened up or disassembled, when its shafts are stationary, by loosening the tightening means, e.g. the machine screws above referred to. The polygonal cross-section of the shaft ends and corresponding formation of the coupling shells which surround the shaft ends make possible transmission of torsional moments. Preferably rectangular or triangular sections are employed since for given shaft diameters and torsional moments those cross-sections provide more favorable loading conditions for the elastic inserts than do polygonal cross-sections having a larger number of sides. This is because with a small number of sides to the polygon the compression forces operate over larger surfaces and entail smaller shearing forces.

Brief description of the drawings

The invention will now be further described in terms of a preferred non-limitative exemplary embodiment thereof and with reference to the accompanying drawings in which:

FIG. 1 is a schematic diagram of a loom fitted with a drive coupling according to the invention and seen from the cloth beam end thereof;

FIG. 2 is a longitudinal section through a coupling in accordance with the invention, FIG. 2 being a sectional along the line II—II in FIG. 3; and

FIG. 3 is a sectional view taken on the line I—I in FIG. 2.

Description of preferred embodiment

Referring to FIG. 1, reference characters 1 and 2 identify the frame members of a gripper shuttle loom on the picking and catching sides thereof. Reference character 3 denotes a cloth beam while the main drive motor is indicated at 4, connected via a V-belt drive 5 with a pulley 6. The pulley 6 is formed as a flywheel and connects to one side of a disengageable clutch. The main drive shaft 7 of the loom, connected to the other side of that clutch, extends substantially across the whole width of the loom.

Reference characters 8, 9 and 10 identify selvedge-forming tuck-in devices, the drives for which are derived from the main drive shaft 7 with the help of bevel gears, cams, drive belts or similar devices. An elastic coupling 11 according to the invention, to be further described hereinafter, connects the shaft 7 with a shaft 12, from which the picker 14 and reed are driven.

The coupling of the invention is illustrated in FIGS. 2 and 3. Referring to FIGS. 2 and 3, the two shafts to be coupled together are denoted 16 and 21. They have each on their adjacent ends a portion of substantially polygonal cross-section defined by four flat faces successively 90° apart and parallel to their respective axes, these faces being denoted 17 on shaft 16 and 22 on shaft 21. Sleeve-like inserts 34 and 35 of rubber or the like fit over the ends of the shafts so shaped, and a circular disc as indicated at 19 and 24, is affixed at the end of each shaft by a screw as indicated at 20 and 25. The disc 19 has a diameter larger than the separation of two opposite ones of the faces 17, and the disc 24 similarly has a diameter larger than the separation of two opposite ones of the faces 22. Preferably each disc has a diameter somewhat larger than that of the circular portion of the shaft to which its affixed, as shown. On each shaft therefore its insert is held, against motion axially of that shaft, between the shoulders (indicated at 18 on shaft 16 and at 23 on shaft 21) which are located at the ends of the flat faces away from the ends of the shafts and the discs 19 and 24.

The two shafts are joined by an outer sleeve made up of two substantially semicylindrical shells 26 and 27. These two shells are assembled together by means of machine screws 33, to form an outer sleeve embracing the adjacent ends of the shafts 16 and 21 via the elastic inserts 34 and 35. These inserts are received in cavities in the outer sleeve which the two shells thus form, these cavities having a cross-section similar to that of the shaft ends.

The shells 26 and 27 have at the middle of their axial length each an inwardly projecting rib of substantially semicircular extent so that when the coupling is assembled as shown in FIG. 2, these ribs fit with a suitable small clearance about the discs 19 and 24. The rib of shell 27 is seen in FIG. 2, where it bears reference character 36. Each of the shells has between the semicircular rib thereof of just described on each of its ends a partial cavity defined by a pair of plane surfaces as indicated at 28 in FIG. 3.

In the embodiment being described, these two plane surfaces are at right angles to each other. When the two shells are assembled together by means of the screws 33 as indicated in the drawings, the four surfaces 28 at each end of the outer sleeve which the two shells then constitute define a cavity, generally indicated at 37 in FIG. 3, having a cross-section of substantially the same shape as the shaft ends and sufficiently larger to accommodate, with squeezing thereof, one of the elastic insert sleeves 34 and 35. Each of these cavities in the outer sleeve formed by the assembled shells is partly bounded, adjacent the axial midpoint of that outer sleeve, by a shoulder surface as indicated at 29 in FIG. 2, formed on the semicircular ribs 36 of the shells.

Lastly, each shell has affixed at each end thereof a plate 31 of substantially semicircular outline, except for a semicircular cut-out at the center provided therein for accommodation of one of the shafts 16 and 21.

Consequently when the shells are assembled around the ends of the two shafts as indicated in FIG. 2, each of the elastic inserts is squeezed between the two shells and is moreover held at the axial ends thereof not only by the surfaces 18 or 23 and the disc 19 or 24, but also between one of the shoulder surfaces 29 and one pair of coplanar semicircular discs 31. The shells are moreover so dimensioned that with the coupling so assembled, the shafts have a clearance between them, as indicated in FIG. 2.

The coupling of the invention is capable of transmitting not only torque but also axial thrust—the latter by virtue of engagement of the inserts 34 and 35 at the shoulders 18, 23, 29 and at the discs 31 and ribs 36, and also by frictional engagement of those inserts at the exterior faces 17 and 22 on the shafts and at the interior faces 28 on the shells. The degree of isolation between the shafts can be controlled by the extent to which the screws 33 are tightened.

The interior dihedral angles where the two plane faces 28 of each of the shells meet have a tendency to promote tearing of the elastic inserts when the screws 33 are drawn up tight. In order to diminish this tendency it is advantageous to provide at these dihedrals a fillet or groove, as indicated at 30 in FIG. 3.

In operation, the elastic inserts tend to flow into these grooves, and by suitable dimensioning of these grooves the elastic behavior characteristics of the inserts, and hence of the coupling, can within limits be controlled.

By the tightening together the coupling shells 26 and 27 with the screws 23 and the resultant squeezing of the elastic inserts 34 and 35 between the coupling shells and the shaft ends, the coupling of the invention is made capable of transmitting not only torsional moments but also axial stresses. The shoulder surfaces 18 and 23 on the shafts and 29 on the shells and the similar shoulder surfaces provided by the discs 19 and 24 and by the plates 31 confine the elastic inserts 34 and 35 at the axial ends thereof. With the aid of the shells therefore, these inserts are substantially completely enclosed and can be compressed to any desired degree by adjustment of the screws 33, giving to the coupling any desired degree of stiffness for the transmission of both torque and axial thrust.

As illustrated in FIG. 3, the shells are preferably so made that the plane (parallel to the common axis of the shafts) along which the shells are joined by the screws 33 contains at least one of the dihedral edges of the squared shaft ends. More particularly, the construction is preferably such that this plane contains the diagonal of the shaft cross-sections. With these constructions, the insert sleeves 34 and 35 will be dependably compressed when the screws 33 are tightened.

The elastic inserts are subjected to a suitably chosen prestressing by the tightening together of the coupling shells. The inserts 34 and 35 may be made of a tough rubber-like shock absorbing material such as natural rubber, buna or Teflon of various hardnesses and thicknesses, optionally with reinforcement in the form of cords or textile fibers or other loading.

According to requirements, the coupling may include one or more than one of the yielding inserts 34 and 35. Thus it may include such an insert between the driving shaft and the coupling, or it may include that between the coupling and the driven shaft, the other of the yielding inserts 34 and 35 being replaced by a non-elastic dummy of metal in order to stiffen the coupling as a whole.

The individual elements of the coupling, such as the shaft ends, the shells and the yielding inserts, may be manufactured in series with preset dimensions and predetermined stress transmission characteristics to be stocked so as to be available according to need for selection and assembly in the combinations required to provide couplings of various characteristics.

By means of the elastic coupling 11 according to the

invention interposed into the drive shaft of the loom of FIG. 1, the reaction of stress peaks and sudden increases in load in the picking mechanism 14 and reed 15 onto the drive to the tuck-in needle devices 8, 9 and 10 upstream of that coupling are reduced and peaks or variations are eliminated. In the operation of the coupling the adjacent ends 16 and 21 of the shafts rotate with respect to each other and to the shells 26 and 27, with corresponding deformation of the elastic inserts 34 and 35. This affects the relative timing of the operation of the loom components in that the drives which in the sense of energy transmission are downstream of the coupling 11 begin their motions with a phase shift, e.g. a delay, with respect to the loom elements deriving their drive upstream of the coupling, this phase shift being proportional to this relative rotation. These phase shifts may however be held within tolerable limits by suitable dimensioning of the coupling, suitable selection of material for the inserts 34 and 35, and suitable adjustment of the screws 33.

While the invention has been described hereinabove in terms of a presently preferred embodiment thereof, the invention itself is not limited thereto, but rather comprehends all modifications thereof and departures therefrom properly falling within the spirit and scope of the appended claims.

I claim:

1. A shaft coupling comprising two shafts each having at one end thereof a portion of substantially polygonal cross-section, two substantially semi-cylindrical shells having at their axially opposite ends when assembled into a cylinder, cavities of substantially polygonal cross-section corresponding to and fitting with clearance about the polygonal portions of said shafts, a removable insert of yielding material disposed between said shells and at least one of said shaft ends, and means to draw said shells together about said shaft ends.

2. A coupling according to claim 1 wherein said shafts have shoulders at one end of said portions of polygonal cross-section and wherein said shells have radially entrant portions at the ends and at the center thereof.

3. A coupling according to claim 1 wherein said yielding material is loaded with reinforcing material.

4. A coupling according to claim 1 wherein the parting plane of said shells is parallel to the axes of said shaft ends.

5. A coupling according to claim 1 wherein the parting plane of said shells contains the axes of said shaft ends.

6. A coupling according to claim 1 wherein each of said shells has formed therein a groove of substantially semicircular cross-section along the intersection of two faces defining said cavities of polygonal cross-section.

7. A coupling according to claim 2 including a retaining disc at said one end of each of said shafts.

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HALL C. COE, Primary Examiner