March 3, 1936. J. YOXALL 2,032,966

HYDRAULIC COUPLING OR BRAKING DEVICE

Filed Nov. 1, 1933

Fig. 1.

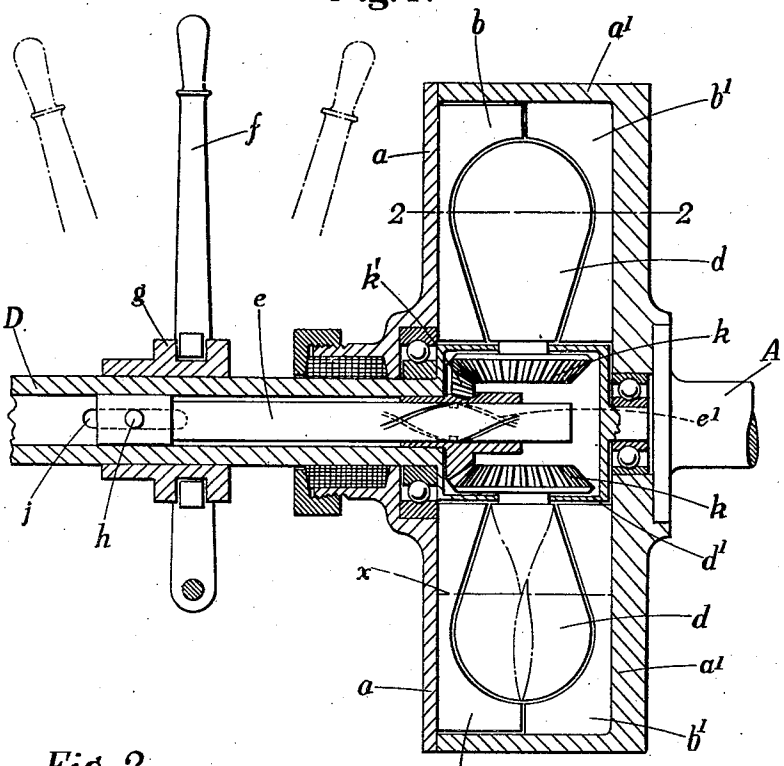


Fig. 2.

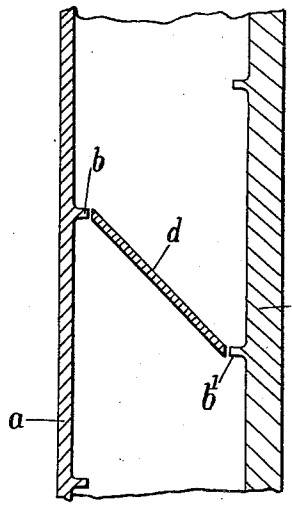


Fig. 3.

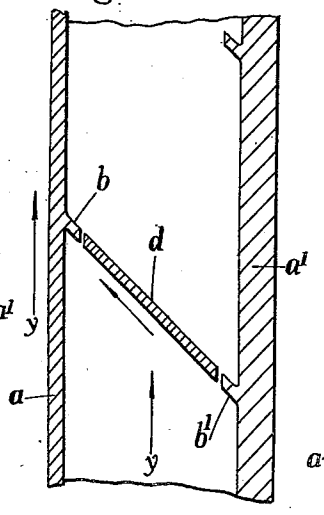
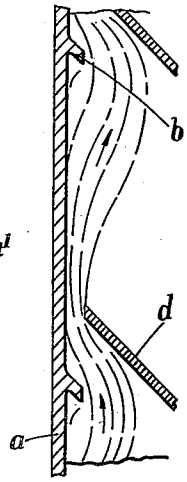


Fig. 4.



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HYDRAULIC COUPLING OR BRAKING DEVICE

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5 Claims. (Cl. 192—58)

The present invention relates to an improved hydraulic coupling device or brake of the kind in which a hollow cylindrical casing or drum rotates about the axis of a shaft carrying blades extending outwardly within the drum to a sufficient extent to become partly immersed in liquid contained within the drum and spread around the internal circumferential surface thereof by centrifugal force when the drum is rotated.

According to the present invention an hydraulic coupling comprises a rotatable shaft, a plurality of blades on said shaft, said blades being inclined with respect to the axial plane of the coupling device, a cylindrical casing having a peripheral wall and at least one end wall, means for rotating said casing, internal webs formed on at least one of said end walls substantially radially thereof and extending substantially diagonally across the said peripheral wall, said webs also framing at least part of at least one of said blades at predetermined relative angular positions of said casing and said shaft with sufficient clearance to permit said blades to rotate within said casing, and fluid within said casing to transmit energy from said casing to said blades.

The essential features of the invention are illustrated in the accompanying drawing in which:

Figure 1 is an axial sectional elevation of one form of my improved device.

Figure 2 is a fragmentary sectional plan view taken on the line 2—2 of Figure 1.

Figure 3 is a view similar to Figure 2 but showing a slight modification, and

Figure 4 is a portion of Figure 3 showing the motion of the fluid over an end wall of the drum.

In the construction illustrated the cylindrical casing or drum consists of the end wall *a* with webs *b* thereon, and the counterpart *a'* with webs *b'* thereon. The parts *a a'* constituting the drum are secured together and are rotated by a driving shaft A. The drum contains fluid which reaches to about the level *x* when the drum is stationary.

The webs *b b'* constitute partitions extending across the internal cylindrical surface of the drum and down its end walls, dividing the corresponding portion of the interior of the drum into pockets in which the fluid becomes distributed equally by centrifugal force when the drum rotates.

Blades *d* are secured to bevel pinions *k* mounted rotatably in a drum-like enlargement or box *d'* of a hollow shaft D. The blades are radial but each is set with its plane at an angle (say 60°) to the axial plane containing its centre line. The pinions *k* mesh with a pinion *k'* mounted on a solid shaft *e* within the shaft D. A quick-pitch threaded engagement between the interior of the pinion *k'* and the surface of the shaft *e* enables the pinion *k'* to be turned,—and hence the angular setting of the blades *d* to be adjusted,—by shifting the shaft *e* longitudinally. The shaft *e* may be shifted longitudinally by any convenient means such for example as by pinning it at *h* to a sleeve *g* keyed to the shaft D but axially shiftable along it by means of a lever *f*, the shaft D being slotted at *j* to permit the axial movement of the pin. In this manner the "pitch" of the blades *d* can be varied to any extent within the limits of the slot *j*.

The shape and angular setting of the webs *b b'* are such that they closely frame the blades *d* as the latter come into register with them. Any suitable number of the blades may be employed. The number of the webs may be the same as the number of the blades and they may be set at the same angular distance apart as the blades in which case all of the blades will register simultaneously with the webs, or the number or setting may differ in which case the registering of all of the blades will not be simultaneous. The number of the webs may or may not, as desired, be a multiple or sub-multiple of the number of the blades.

Although the blades *d* are normally set at a definite angle determined by the adjustment of the lever *f*, and the side portions of each web *b b'* are "staggered" (Figure 2) to correspond and thereby "frame" the blades as they come into register therewith, these webs may either stand out in planes perpendicular to the end walls of the drum as shown in Figure 2 or at an oblique angle to said end walls so as to be aligned with the blades as shown in Figure 3.

The way in which the device operates is briefly as follows:—Assume that the shaft A and hence also the drum *a a'* is set in rotation and that there is substantially no load on the shaft D. The liquid in the drum will be lifted by friction and by the webs *b b'* and become spread by centrifugal force around the interior of the drum. Meanwhile the blades will be dragged round by the liquid and, neglecting friction, the unloaded shaft D will eventually rotate at substantially the same speed as the driving shaft A. When load is applied to the shaft D its speed will be reduced and the blades *d* in the drum will lag relatively to the webs *b b'*. Assuming the rotation of the

drum (and hence also of the liquid) is in the direction of the arrow *y* in Figure 3 the pressure on the blade *d* is also in the direction *y* and when the blade lags behind the drum the liquid is deflected laterally as shown in Figure 3 and thereby acquires a wavy motion over the edges of the webs *b* on the end wall *a* and into the pockets between those webs as shown in Figure 4. As each blade approaches a position of register with a web it drives into or tends to shear an oncoming crest of liquid and derives a maximum thrust from said crest. By changing the pitch or angular setting of the blades the driving effect of the liquid can be correspondingly varied. In the limit position the blades may merely slice the liquid and receive minimum drive therefrom (see dotted position in Figure 1).

Considering now the device as a brake and assuming that the blades *d* and the shaft D and any load (such as a flywheel) have acquired a certain definite speed having a definite relation to the speed of the drum, it will be understood that if the drum speed be reduced, the blades *d* and shaft D will tend to continue at the same speed and therefore the drum will then have a braking effect on the shaft D.

It will also be understood that if the drum *a a'* be held stationary, any rotation imparted to the shaft D will be retarded by the action of the blades *d* on the liquid in the drum, and that if the drum be rotated in the opposite direction this braking effect on the shaft D will be increased.

End thrust may be taken up by the provision of suitable end thrust bearings.

Finally it will be understood that whether the device be acting as a driving coupling or as a brake the amount of reaction between the blades and the liquid can be regulated at the will of the operator by altering the pitch of the blades.

What I claim is:—

1. An hydraulic coupling comprising a rotatable shaft, a plurality of blades on said shaft, said blades being inclined with respect to the axial plane of the coupling device containing the center line of said blades, a cylindrical casing having a peripheral wall and a pair of end walls, means for rotating said casing, internal webs formed on one of said end walls substantially radially thereof and extending substantially diagonally across the said peripheral wall, said webs also framing at least one of said blades at predetermined relative angular positions of said casing and said shaft with sufficient clearance to permit said blades to rotate within said casing, and fluid within said casing to transmit energy from said casing to said blades.

2. An hydraulic coupling comprising a rotatable shaft, a plurality of blades on said shaft, said blades being inclined with respect to the axial plane of the coupling device containing the center line of said blades, a cylindrical casing having a peripheral wall and at least one end wall, means for rotating said casing, internal webs formed on at least one of said end walls, substantially radially thereof and extending substantially diagonally across the said peripheral wall, said webs also framing at least part of at least one of said blades at predetermined relative angular positions of said casing and said shaft with sufficient clearance to permit said blades to rotate within said casing, and fluid within said casing to transmit energy from said casing to said blades.

3. An hydraulic coupling comprising a rotatable shaft, a plurality of blades on said shaft, said blades being inclined with respect to the axial plane of the coupling device containing the center line of said blades, a cylindrical casing having a peripheral wall and at least one end wall, means for rotating said casing, fluid within said casing, internal webs formed on at least one of said end walls substantially radially thereof and extending substantially diagonally across the said peripheral wall, said webs also framing at least part of one of said blades at predetermined relative angular positions of said casing and said shaft with sufficient clearance to permit said blades to rotate within said casing and, below a predetermined speed, to constrain the fluid to move in smooth wave form over said webs and blades circumferentially of the casing.

4. An hydraulic coupling comprising a rotatable shaft, a plurality of blades on said shaft, said blades being inclined with respect to the axial plane of the coupling device containing the center line of said blades, a cylindrical casing having a peripheral wall and at least one end wall, means for rotating said casing, fluid within said casing, internal webs formed on at least one of said end walls substantially radially thereof and extending substantially diagonally across the said peripheral wall, said webs also framing at least part of at least one of said blades at predetermined relative angular positions of said casing and said shaft and, above a predetermined speed, to constrain the fluid to assume a quasi-rigid condition and so cause said shaft and said casing to travel in substantial synchronism.

5. An hydraulic coupling comprising a rotatable shaft, a plurality of blades on said shaft, means for altering the inclination within predetermined limits of said blades with respect to the axial plane of the coupling device containing the center line of said blades, a cylindrical casing having a peripheral wall and at least one end wall, means for rotating said casing, internal webs formed on at least one of said end walls substantially radially thereof and extending substantially diagonally across the said peripheral wall, said webs also framing at least part of at least one of said blades at predetermined relative angular positions of said casing and said shaft with sufficient clearance to permit said blades to rotate within said casing, and fluid within said casing to transmit energy from said casing to said blades.

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