PUBLISHED MAY 4, 1943. BY A. P. C.

O. SPECHT

CRANKSHAFT FOR INTERNAL COMBUSTION ENGINES

Serial No. 366,846

Filed Nov. 23, 1940

2 Sheets-Sheet 1

Fig. 1

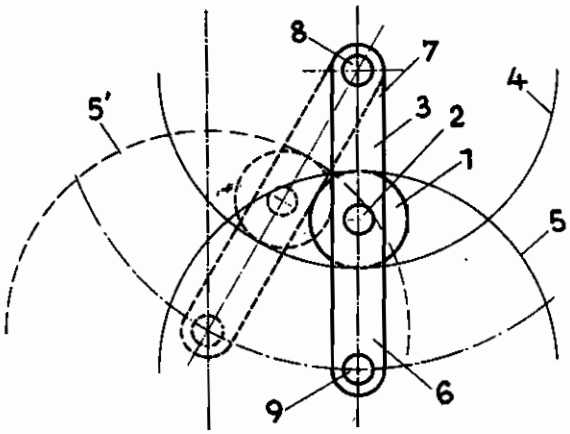

Fig. 2

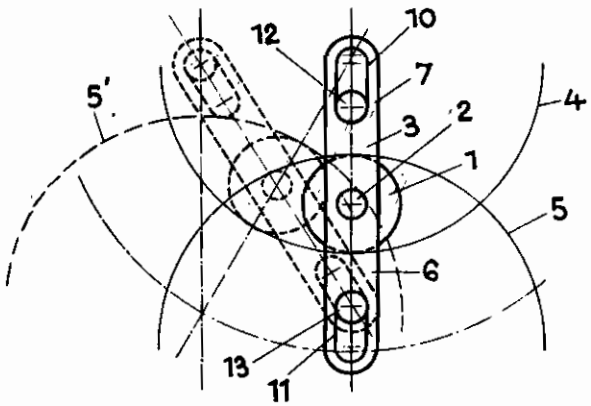

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Fig. 3

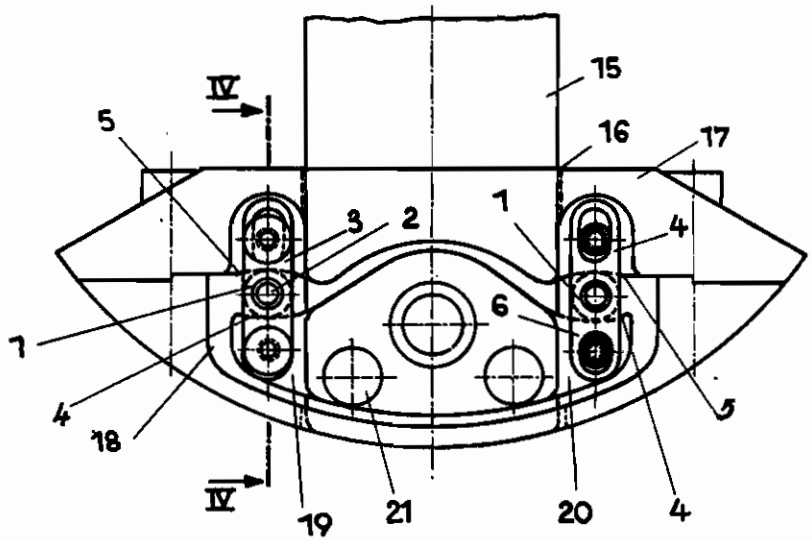
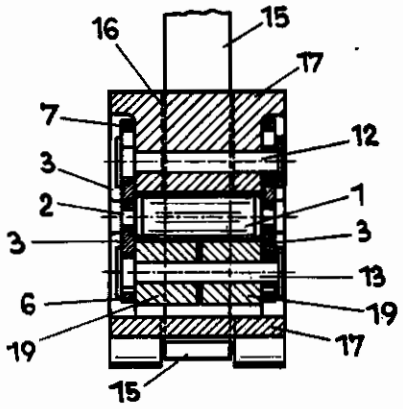


Fig. 4



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ALIEN PROPERTY CUSTODIAN

CRANKSHAFT FOR INTERNAL COMBUSTION ENGINES

Otto Specht, Berlin-Spandau, Germany; vested in the Alien Property Custodian

Application filed November 23, 1940

The invention relates to a crankshaft for internal combusion engines, the balance masses of which for eliminating vibrations are pendulously suspended on rollers between raceways, particularly after the manner of a centrifugal pendulum of the "bifilar" suspension type.

With these known suspensions, particularly of centrifugal bifilar pendulums, the position of the rollers during starting, specially in the case of tunings to low orders, is no longer corresponding to the geometrical conditions of the pendulum length—no matter whether bolts or rollers are used—as the angle inclination of the raceways is not sufficient to reconduct the roller under the action of the centrifugal force into the geometrically correct position. This has as a consequence that the centres of the raceways and of the rollers do not coincide in one line, so that an uncontrollable variation of the pendulum length and thus of the tuning relation will result. A pendulum of this kind only deficiently meets the demands made on it, as the different elementary masses of the weight would swing with different pendulum lengths. These drawbacks become particularly evident if it is the question of a pendulum which is tuned to low vibration orders, as with such a tuning the angle of inclination within the swinging freedom of the raceways is resulting particularly small owing to the great length of the pendulum, so that there is no possibility of reconducting the roller against the influence of the unavoidable friction.

These disadvantages are eliminated, according to the invention, by connecting the rollers with guides, preferably guides after the manner of links capable of maintaining the prescribed pendulum length. This guiding is effected in such a way that in any position of the pendulum the roller maintain the geometrical pendulum length. In the case of using links, these are preferably double-armed levers bearing in their centers the rollers, the free lever ends being articulated on the one hand to the pendulum weight and on the other to the rotating machine element. The most appropriate articulation points of the links at the rotating part and at the swinging part of the pendulum arrangement are the raceway centers, which are at a distance of one pendulum length from each other. If constructional considerations do not permit such an articulation of the links, it is recommended to provide for a pivotal and movable mounting of both ends of each link at the rotating part and at the movable part of the arrangement, preferably by using a slotted guide, thus taking into consideration the varying length. These articulation points only can be placed in the center lines of the raceways at any distance but in equally spaced relation from the raceway centers.

Some details of the mounting according to the invention are shown in the drawings which are representing some forms of embodiment of the invention by way of example and its essential parts. In these drawings:

Fig. 1 shows diagrammatically the articulation of the links in the raceway centers,

Fig. 2 the articulation of the links in the center lines of the raceways,

Fig. 3 a side elevation of the pendulum,

Fig. 4 a section taken on the line IV of Fig. 3.

Fig. 1 shows the articulation of the roller 1 in the center 2 of the double-armed lever 3. The roller is arranged between the raceways, i. e. between the raceway 4 rotating with the machine element and the raceway 5 provided in the balance weight. The ends 6 and 7 of the lever 3 are articularly connected at 8 with the rotating machine part and at 9 with the counterweight (both not represented in the drawing). If, when starting, the counterweight with its raceway 5 would move relatively to the raceway 4 of the rotating machine element into the position 5' shown in dotted lines, the lever 3 is carried away simultaneously with the roller 1, as equally shown in dotted lines. In this manner provision is made for maintaining constant the geometrical pendulum length. In the case that such an articulation of the lever 3 in the raceway centers as shown in Fig. 1 is not practicable for constructional reasons, the articulation of the lever 3 in the center lines of the raceways can be realized at any distance but in equally spaced relation from the raceway centers, as shown in Fig. 2. The lever 3, too, bears in its center the roller 1, the ends 6 and 7 of said lever being in the form of slotted guides 10 and 11 into which fixing members e. g. in the form of articulating pins 12, 13 are engaging, which are arranged on the one hand on the rotating machine element (not represented) and on the other on the counterweight. If now during starting the counterweight and with it the raceway 5 is moved into the position 5', shown in dotted lines, also the lever 3 with its roller 1 is brought into the position shown in dotted lines. This is made possible by the fact that a displacement of the lever 3 with the articulating pins 12, 13 in the slotted guides 10 and 11 takes place.

Fig. 3 shows a centrifugal bifilar pendulum

e. g. for an internal combustion engine for damping torsional vibrations in the crankshaft. The crank cheek 15 projecting through a recess 16 into a cavity 18 of the centrifugal weight 17 is provided with plates 19 and 20. These plates 19 and 20 may be made in one piece with the crank cheek 15 or subsequently attached to it on both sides and secured thereto by means of bolted joints 21. The plates 19 and 20 bear the rotating raceways 4, whilst further raceways 5 are provided in the upper part of the centrifugal weight 17. Between these two raceways 4 and 5 are rollers 1 which, according to the invention, in the example of construction of Fig. 2, are pivotally mounted at 2 on the double-armed levers 3. One end 6 of the double-armed lever 3 is in this case articularly mounted on the plates 19 and 20, whilst the end 7 is connected with the upper part of the centrifugal weight 17.

Instead of using link guides, as shown by way of example in the drawings, it is of course also possible to guide the rollers 1 in the raceways 4 and 5 with the help of a toothing provided on the raceways and at the rollers in such a way that the rollers will follow the swinging motion of the pendulously mounted weight. When using toothings, preferably provision is made in an appropriate manner for maintaining a constant meshing of teeth, e. g. by a particular safety device as a stop or the like. In the limit case the toothing may be made in such a way that each roller is provided with one or two teeth directed towards the corresponding raceway, these teeth being in engagement with the corresponding mating teeth on the raceway.

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