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CONSTRAINING DEVICE FOR ROLLER TAPPETS

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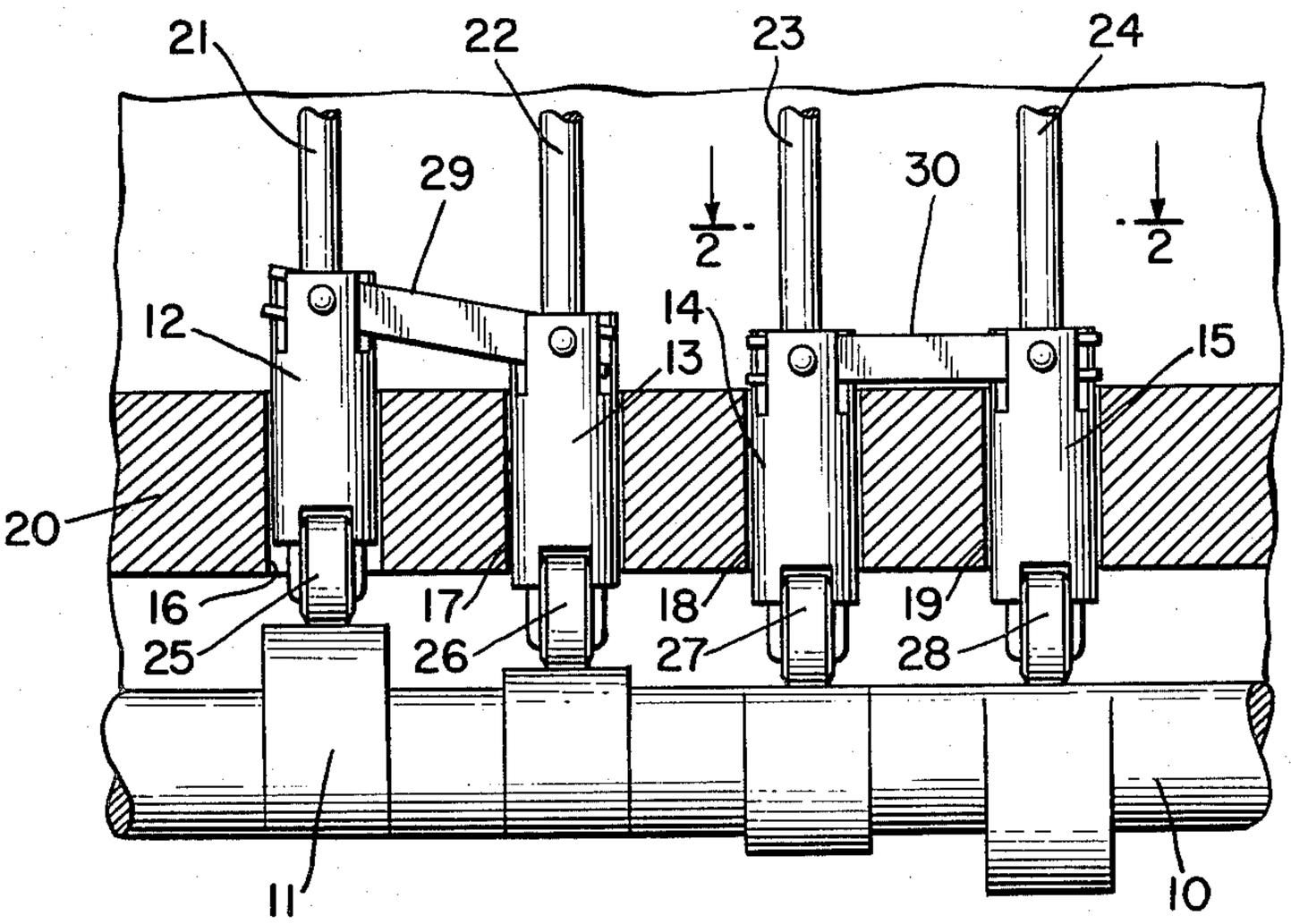

FIG. 1.

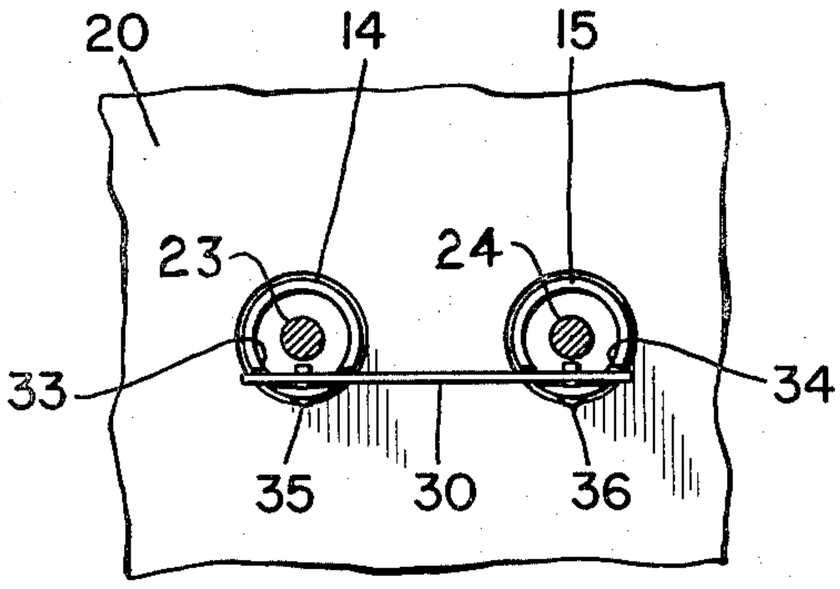

FIG. 2.

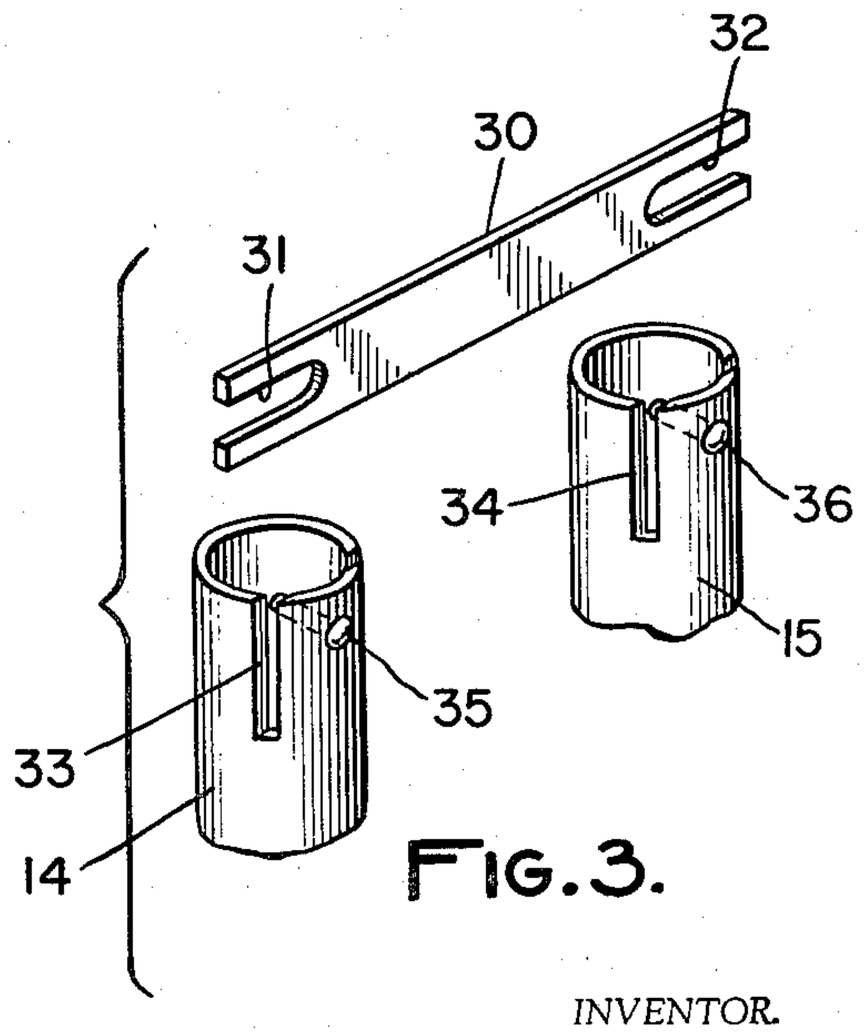

FIG. 3.

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CONSTRAINING DEVICE FOR ROLLER TAPPETS

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This invention relates generally to components employed in internal combustion engines and more particularly, to a novel constraining device for roller tappets useful in high quality internal combustion engines such as used in racing cars.

Conventional tappets are employed to actuate push rods in an internal combustion engine. Towards this end, the tappets are arranged to reciprocate within suitable bores in the engine block. This motion is provided by a cam shaft having cam surfaces circumferentially and axially spaced in such a manner as to actuate the roller tappets and thereby move the push rods in the proper sequence for operating the cylinder valves in the internal combustion engine.

In most commercial automobile engines, the lower ends of the tappets constitute smoothly rounded surfaces that simply ride on the cam surfaces, there being provided suitable oil lubrication. In higher quality internal combustion engines, such as used in racing or sports cars, it is common practice to employ roller tappets wherein the lower ends of the tappets themselves are provided with rollers for riding on the cam shaft surfaces to provide a smoother action, less friction, and greater accuracy in the actual movements taking place by minimizing wearing of the engaging surfaces. It is with this latter type of tappet that the present invention is concerned.

It has been found that the roller type tappets may tend to rotate within the bores in the engine block after being subjected to their normal reciprocal motion by the cam shaft. When rollers are used, slight rotations of the tappets will misalign the rollers themselves with the direction of motion of the cam surface with the result that some sliding action will take place rather than rolling action. This sliding action is undesirable not only because of friction, but because of resulting wear which may render the motion erratic and inaccurate.

It is possible, of course, to avoid the above problem by providing a small key in the tappet adapted to fit within a vertical groove in the engine block bore to constrain the tappet against rotation. This solution, however, requires an expensive machining operation on the engine block.

Since it is common practice for individual themselves to start with a conventional internal combustion engine, as from a stock automobile, and rework the same to provide an improved racing car type engine, it is preferable to avoid expensive machining operations. It has, therefore, been the practice to provide some other type of means coupling adjacent roller tappets together to prevent their rotation and yet permit the desired vertical motion. Such means, however, has generally required a modification in the push rods in order to avoid interference between the push rods and the constraining means. Moreover, any such means is usually only useful on the particular engine for which it is designed.

In my United States Patent No. 3,101,077 issued August 20, 1963, there is disclosed a roller tappet constraining device which solves the foregoing problems without requiring any modifications of the engine block bores or any expensive modification of the roller tappets themselves, and in which normal type push rods may be employed. Essentially, this device comprised a curved spring strip terminating at opposite ends in laterally extending feet adapted to fit loosely within small lateral bores in the cylindrical upper ends of the roller tappets. It has been found that wear occurs at the lateral openings

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in the cylindrical ends of the roller tappets as a consequence of the feet protruding therein after prolonged operation of the engine. As a consequence, the resilient strip eventually becomes disengaged or "pops" free from its coupled position.

With the foregoing in mind, it is a primary object of this invention to provide an improved constraining device for roller tappets in internal combustion engines which meets all of the objects set forth in my above-mentioned United States patent and in which additionally, will not cause undue wear at the upper cylindrical ends of the roller tappets themselves to the end that greater life is provided.

More particularly, it is an object to provide a roller tappet constraining device in which a resilient type element is avoided and rather only a rigid structure is used so that no biasing forces exist between the constraining device and the portions of the roller tappets to which it is coupled so that longer wearing is assured.

More generally, it is an object to provide a constraining device for roller tappets which is considerably more rugged than any device provided heretofore and yet which may be manufactured for an equivalent or lesser expense than prior art devices for achieving the same ends.

Briefly, these and many other objects and advantages of this invention are attained by providing a constraining device in the form of a single integral elongated flat plate having opposite ends arranged to be coupled to the upper end portions of two adjacent tappets such that the plate is positioned in spaced parallel relationship with the axes of the roller tappets. In the preferred embodiment of the invention, the coupling is accomplished by providing elongated U-shaped notches in the opposite ends of the plate extending towards each other and terminating short of the midpoint of the plate. The upper cylindrical ends of the roller tappets themselves are provided with vertical slots to one side of their axes for receiving the ends of the plate. Suitable pivot pins extend radially inwardly from the inner cylindrical wall of the upper ends of the tappets to be received in the respective U-shaped notches.

With the foregoing arrangement there is permitted angular variation of the plate within its own plane relative to the roller tappets and also slight movement of the plates transverse to the tappets so that the tappets are free to move up and down in vertical directions and yet are constrained against rotation. By positioning the plate in parallel spaced relationship to the axes of the tappets, the push rods which extend upwardly along these axes will pass to the side of the rigid plate and thus avoid interference therewith.

A better understanding of the invention will be had by now referring to a preferred embodiment of the invention as illustrated in the accompanying drawings, in which:

FIGURE 1 is a side elevational view partly in cross-section illustrating a cam shaft and series of roller tappets with which the constraining device of this invention is employed;

FIGURE 2 is a fragmentary plan view of a portion of the structure taken in the direction of the arrows 2—2 of FIGURE 1; and,

FIGURE 3 is a perspective exploded view of the constraining device and roller tappets with which it is used.

Referring first to FIGURE 1, there is illustrated a portion of an internal combustion engine cam shaft 10 provided with cam surfaces such as indicated at 11. These surfaces are axially and circumferentially spaced in such a manner that proper sequential lifting of roller tappets may be effected. The roller tappets themselves are indicated at 12, 13, 14, and 15 and are guided for up and down movement through circular bores 16, 17, 18, and 19 in the engine block 20. Suitable push rods 21, 22,

23 and 24 extend from the upper ends of the roller tappets as shown. The upper ends of these push rods in turn operate conventional type rocker arms (not shown) for opening and closing valves in the cylinders of the engine, all as is well known in the art.

The type of tappets illustrated in FIGURE 1 are provided with rollers 25, 26, 27, and 28 at their lower ends for rolling engagement with the cam surfaces. When such roller type tappets are employed, it is important, as discussed heretofore, to prevent rotation of the tappets within the bores in the engne block in order that the rollers will not become misaligned with the cam surfaces. In accordance with the present invention, this rotation is prevented by constraining devices in the form of elongated rigid flat plates associated with pairs of tappets such as the plate 29 for the tappets 12 and 13, and the plate 30 for the tappets 14 and 15.

Since each of the constraining devices for respective pairs of tappets are identical, detailed description of one will suffice for all. Thus, with reference to both FIGURES 2 and 3, which illustrates the tappets 14 and 15, it will be noted that the elongated plate 30 is provided with U-shaped notches 31 and 32 extending into its opposite ends and terminating short of its mid-point. The end portions of the plate 30 in turn are arranged to be received within slots 33 and 34 formed in the upper cylindrical sidewall portions of the tappets 14 and 15. When the plate 30 is so positioned within the slots, it will lie in a position parallel to and spaced from the axes of the roller tappets so that the push rods 23 and 24 will pass to one side of the plate 30 as indicated in FIGURE 2.

Cooperating with the U-shaped notches 31 and 32 are steel pivot pins 35 and 36 which extend radially inwardly from the inner portion of the upper cylindrical end walls of the tappets 14 and 15 so as not to interfere with the push rods 23 and 24.

In operation, it will be evident that with the elongated plates assembled and the pivot pins passing through the elongated U-shaped notches, when the cam shaft 10 of FIGURE 1 is rotating, the usual vertical relative motion between the roller tappets can take place to operate the push rods and any relative rotation between the tappets themselves and the engine block is prevented. This constraining of the roller tappets against rotation is a consequence of the large area of the flat plate ends bearing against the sides of the slots formed in the upper cylindrical walls of the roller tappets. The position of the pivot pins within the U-shaped notches serves as a guide to maintain the plate in position with respect to the pair of adjacent roller tappets with which it is associated.

From the foregoing description, it will be evident that the present invention has provided an improved means for preventing relative rotation between the roller tappets. This improved means comprises the single plate cooperating with the pivot pins and there is no biasing or resilient forces necessary so that wear between the pins and elongated U-shaped slots is minimized. Also, any friction that does exist is largely between the plate and pivot pins rather than with the tappets themselves. This latter feature is important since the plate would be formed of hard steel whereas oftentimes the cylindrical ends of the roller tappets are formed from aluminum and thus subject to considerable wear when any constraining device is biased into engagement with these portions of the roller tappets.

What is claimed is:

1. A constraining device for preventing rotation of roller tappets with respect to cam surfaces engaging said roller tappets, comprising: a rigid flat plate adapted to extend in a direction parallel to and spaced to one side of the axes of said tappets; and means coupling the ends of said plate to said roller tappets, respectively, said means permitting angular movement of said plate in its own plane with respect to said roller tappets while constraining said roller tappets from rotation about their individual axes with respect to said plate.

2. A constraining device for preventing rotation of roller tappets with respect to cam surfaces engaging said roller tappets, comprising: a rigid flat, elongated plate having U-shaped notches in its opposite ends, the upper portions of said roller tappets having slots for receiving the opposite end edges of said plate so that the plane of said plate when positioned in said slots is substantially parallel to and spaced from a plane including the axes of said roller tappets; and pivot pins extending from the inner walls of said roller tappets in a radial direction to pass through said U-shaped notches whereby vertical movement of said tappets can take place and rotation of said tappets is constrained by said plate and slots.

3. In an internal combustion engine including a cam shaft having cam surfaces, a plurality of roller tappets riding on said cam surfaces operating push rods, and an engine block having bores receiving and guiding vertical movement of said roller tappets, constraining devices for preventing rotation of said roller tappets in said bores during vertical movements of said roller tappets, each of said constraining devices comprising: a single integral rigid flat plate having elongated U-shaped notches extending inwardly from opposite ends of said plate and terminating short of the mid-point of said plate, said roller tappets having upper cylindrical ends from which said push rods extend, each cylindrical end including a lateral slot cut vertically into its sidewall for receiving one end edge of said plate, the next adjacent roller tappet receiving the opposite end edge of said plate so that when said plate has its ends received in the slots of two adjacent roller tappets, said plate is parallel to and spaced from the axes of said roller tappets; and pivot pins extending radially inwardly from the inner walls of said cylindrical ends of said roller tappets to pass through said U-shaped notches, said pins terminating short of said axes of said roller tappets, the push rods associated therewith passing upwardly past said pins to one side of said ends of said plate, successive adjacent pairs of roller tappets being similarly provided with integral plates and pins so that each plate constrains two roller tappets from rotational movement within their bores.

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