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ROLLER TAPPET CONSTRAINING DEVICE

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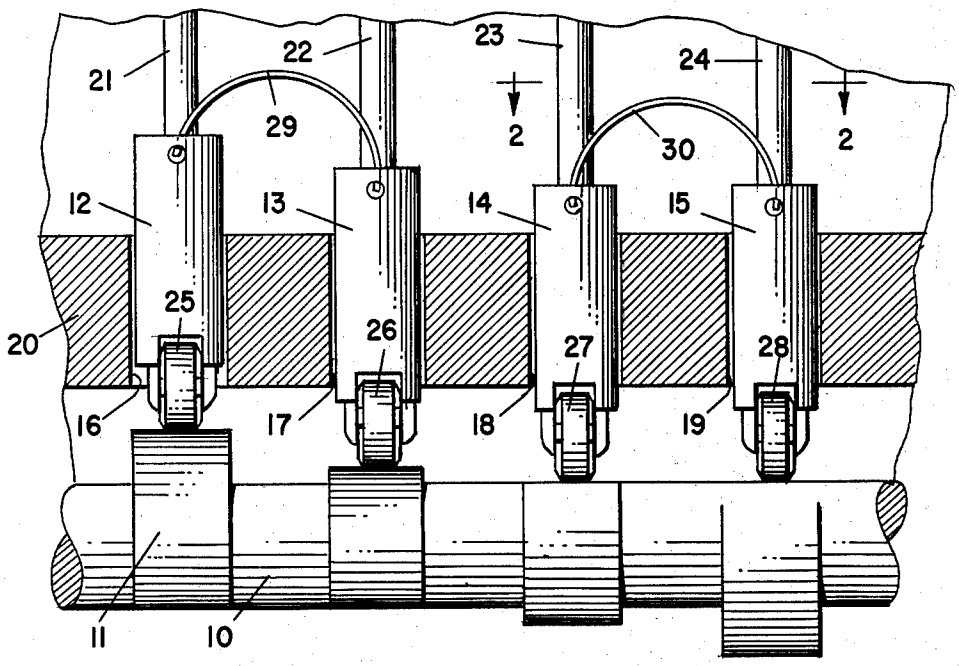


FIG. 1.

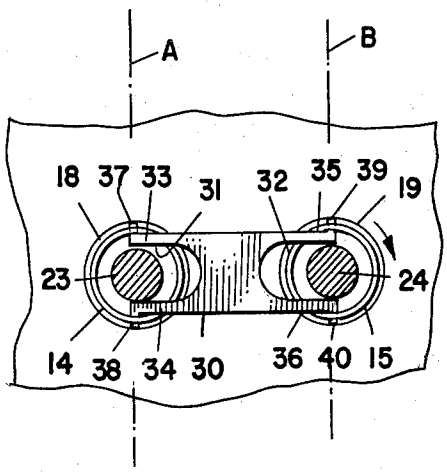


FIG. 2.

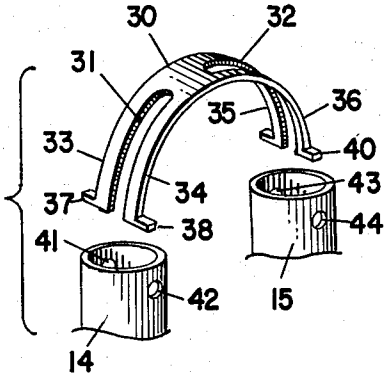


FIG. 3.

INVENTOR.
JOHN H. ENGLE
BY Elliott & Pastoriza
ATTORNEYS

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ROLLER TAPPET CONSTRAINING DEVICE

John H. Engle, 1044 Maple St., Santa Monica, Calif.

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This invention relates generally to components employed in internal combustion engines and more particularly to a novel roller tappet constraining device or guide 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 individuals 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.

With all of the foregoing in mind, it is a primary object of this invention to provide an improved device

for constraining rotational movement between roller tappets in internal combustion engines.

More particularly, it is an object to provide a constraining device which does not require any modifications of the engine block bores or any expensive modification of the roller tappets themselves.

Another important object is to provide such a device in which normal type push rods may be employed and which is adaptable to engine blocks with roller tappets of varying spacing from each other so that great versatility is provided.

Still another important object is to provide a constraining device in which a small amount of play for rotational movement of the tappets may still exist so that they can properly accommodate any chance misalignments between the rollers themselves and the cam surfaces engaging the rollers.

Another object is to provide a constraining device which is extremely simple to insert and remove and in which once inserted, and the push rods assembled, an automatic locking of the constraining device in place is effected.

Still another important object is to provide a constraining device which may be formed from a single stamping operation to the end that great economy is realized in the provision of the device.

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 resilient strip of material having opposite ends arranged to engage the upper ends of two adjacent tappets in a pivotal type coupling such that the strip is arched between the tappets. Towards this end, the opposite ends of the strip terminate in legs, the extreme ends of which are coupled to the tappets so that the push rods may pass between the legs free of engagement therewith. By effecting a loose coupling between the ends of the legs and the respective roller tappets, some slight play is provided to accommodate any misalignments of the rollers on the tappets with the cam shaft surfaces. Moreover, because of the arched construction, small variations in spacing between adjacent tappets can be accommodated so that a single strip may be adapted to many different types of engines.

The width of the curved strip is slightly less than the outside diameter of the roller tappets but greater than the outside diameter of the push rods so that the legs at the opposite ends of the strip may straddle the push rods free of engagement therewith. This width provides sufficient strength so that it is not possible for the tappets engaged by the strip to rotate relative to each other nor relative to the engine block itself.

A better understanding of the invention will be had by now referring to a preferred embodiment thereof 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 to those skilled 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 engine 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 integral curved strips of resilient material associated with pairs of tappets such as the strip **29** for the tappets **12** and **13** and the strip **30** for the tappets **14** and **15**.

Since each of the constraining devices for respective pairs of tappets are identical, detail description of one will suffice for all. Thus, with reference to FIGURE 2, which illustrates a plan view of the tappets **14** and **15**, it will be noted that the curved strip includes longitudinal slots **31** and **32** extending inwardly from opposite ends and terminating short of the mid-point of the strip **30**. These slots, respectively, define legs **33**, **34** and **35**, **36**. The extreme tips of the legs themselves terminate in laterally extending pins such as indicated at **37**, **38**, and **39**, **40**. These pins in turn are arranged to be pivotally coupled to the upper cylindrical portions of the roller tappets **14** and **15** such as to enable rotation about transverse axes such as indicated at A and B in FIGURE 2.

With particular reference to FIGURE 3, this coupling is achieved by providing small transverse openings **41** and **42** in diametrically opposite portions of the upper cylindrical end of the tappet **14** and similar diametrically opposite transverse openings **43** and **44** in the upper end of the tappet **15**. The provision of these openings in the roller tappets is the only modification required to adapt the constraining device to any engine.

To insert the constraining device, the legs such as **33** and **34** are urged together until the pins **37** and **38** are adjacent the inside portions of the diametrically opposite openings **41** and **42**. The legs **33** and **34** are then released so that the pins **37** and **38** project through the openings **41** and **42**. Similarly, the legs **35** and **36** are urged together to insert the pins **39** and **40** in the openings **43** and **44** in the upper end of the roller tappet **15**. After the curved strip **30** has been inserted as described so as to form an arched configuration between the adjacent tappets, the push rods such as the push rods **23** and **24** may then be inserted into the upper ends of the tappets so that they are straddled by the legs. The slots **31** and **32** are of sufficient width and arcuate extent to be free of any engagement with the push rods during relative up and down motion of the tappets. On the other hand, the insertion of the push rods will prevent urging of the legs towards each other sufficiently to release the pins so that the push rods effectively lock the pins within the openings.

The width of the curved strip is slightly less than the diameter of the roller tappets as is evident from FIGURE 2 but is greater than the outside diameter of the push rods. This width provides sufficient structural strength for the resilient curved strip to prevent any twisting thereof so that the tappets are substantially held against rotation. However, by providing a loose fit of the various pins in the roller tappet upper openings, slight play is provided to accommodate any misalignments between the roller and the cam surfaces on the cam shaft. Further, as a consequence of the arched configuration and the resilient nature of the curved strip, some accommodation of varying spacing between adjacent tappets in different types of engines is possible so that the curved strip is adaptable to a variety of different engine constructions.

Preferably, the curved strips are formed by a single stamping operation from spring steel.

In operation, it will be evident that with the curved strips assembled, the push rods in place on adjacent pairs of tappets such as illustrated in FIGURE 1, and the cam shaft **10** rotated, 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.

From the foregoing description, it will be evident that the present invention has provided a novel means for preventing relative rotation between tappets to the end that friction and wear of the rollers on the cam surfaces is minimized. Further, the prevention of relative rotation is achieved without requiring any modification or expensive machining operations on the engine block, push rods, or other components with the exception of the provision of the diametrically opposite openings in the upper end of the roller tappets.

While only one specific configuration for the curved strip has been shown and described, it will be evident that minor variations may be effected in its construction without departing from the scope and spirit of this invention.

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 curved strip of resilient material adapted to be arched between the upper portions of said roller tappets with opposite ends of said strip coupled to said upper portions for pivoting movement about transverse parallel axes, whereby vertical movement of said tappets can take place and rotation of said tappets is constrained by said strip.

2. A constraining device according to claim 1, in which said opposite ends of said strip terminate in pairs of legs having tip portions coupled to diametrically opposite points on said roller tappets such that push rods extending from said roller tappets pass respectively between said legs free of engagement with said strip.

3. A constraining device according to claim 2, in which said strip is of uniform width less than the diameter of said roller tappets and greater than the diameter of said push rods.

4. 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 curved strip of resilient material having elongated slots extending inwardly from opposite ends and terminating short of the mid-point of said strip to define pairs of legs at each end of said strip, each leg terminating in a laterally outwardly directed pin, said roller tappets having open upper cylindrical ends from which said push rods extend, each cylindrical end including diametrically opposite transverse openings adapted to receive oppositely directed pins in a loose fit from one of said pairs of legs, the next adjacent roller tappet receiving the pins of the other pair of said pairs of legs in a loose fit so that said curved strip is arched between two adjacent roller tappets, the push rods associated therewith passing upwardly through said slots in said curved strip, successive adjacent pairs of roller tappets being similarly provided with integral curved strips so that each curved strip constrains two roller tappets from rotational movement within their bores.

5. A constraining device according to claim 4, in which the diameter of said push rods is such as to prevent narrowing of said slots by urging said legs together sufficiently to free said pins from said transverse openings, whereby the curved strip is locked to the pair of roller tappets with which it is associated after said push rods are received in said tappets.

6. A constraining device according to claim 5, in which said single integral curved strip of resilent materal comprises spring steel formed by a stamping operation.

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