Sept. 18, 1956 T. J. GARRISON 2,763,066

TESTING DEVICE FOR DETERMINING THE CONDITION OF CAM CONTOURS

Filed April 7, 1955 2 Sheets-Sheet 1

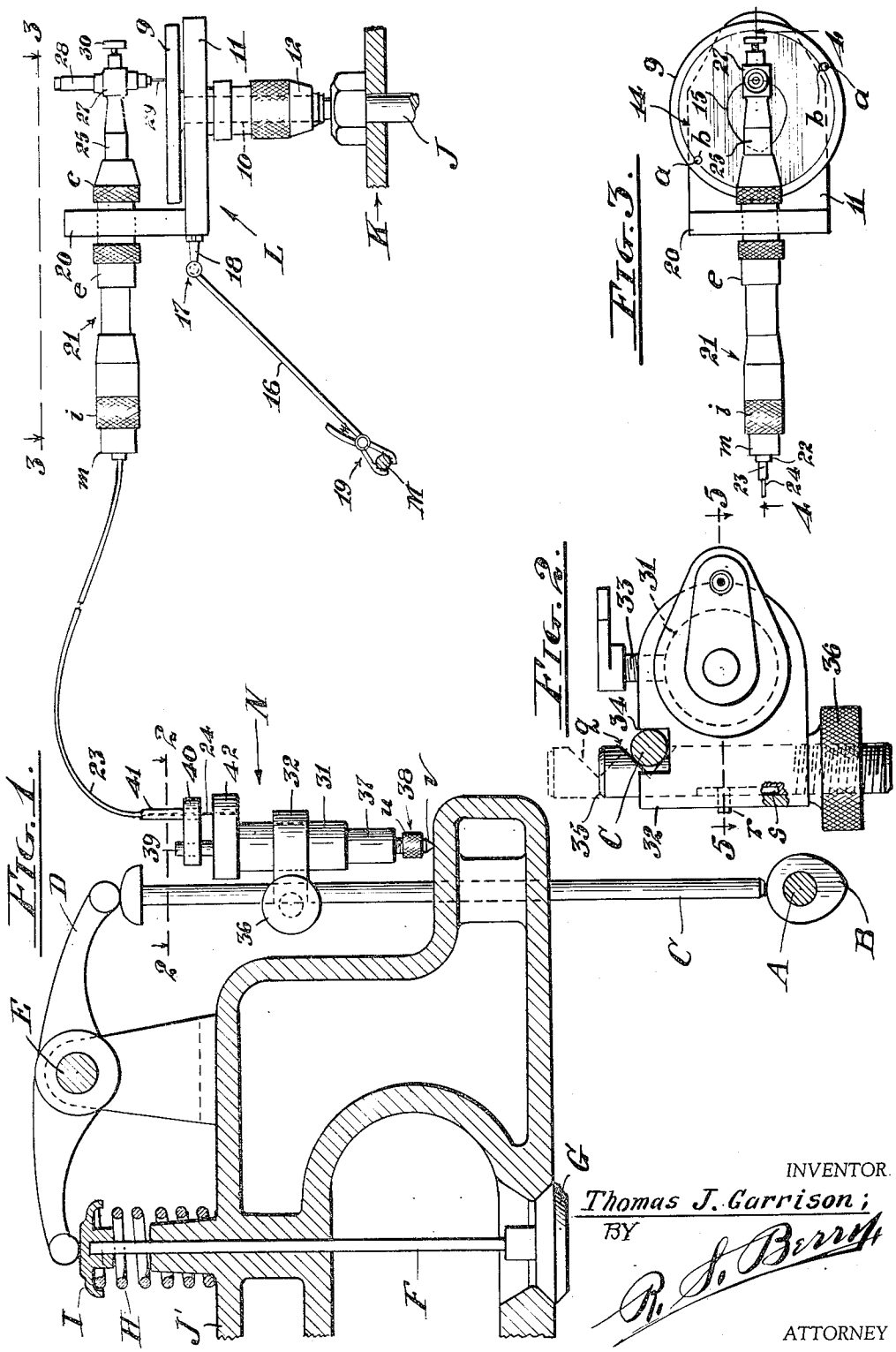


Fig. 1.

Fig. 3.

Fig. 2.

INVENTOR.
Thomas J. Garrison;
BY
R. S. Berry
ATTORNEY

Sept. 18, 1956 T. J. GARRISON 2,763,066

TESTING DEVICE FOR DETERMINING THE CONDITION OF CAM CONTOURS

Filed April 7, 1955 2 Sheets-Sheet 2

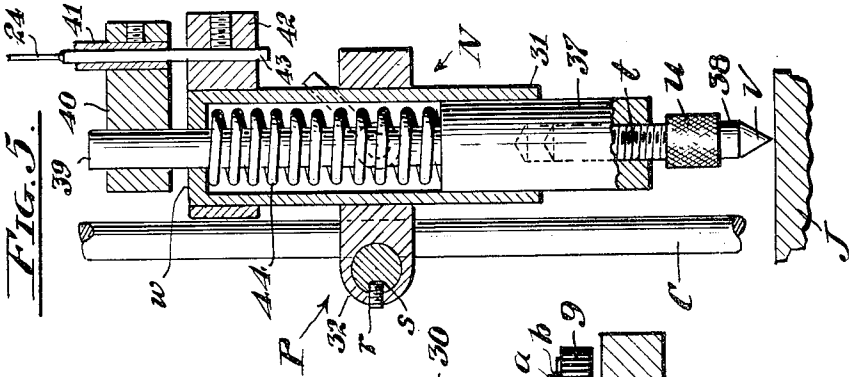


FIG. 5.

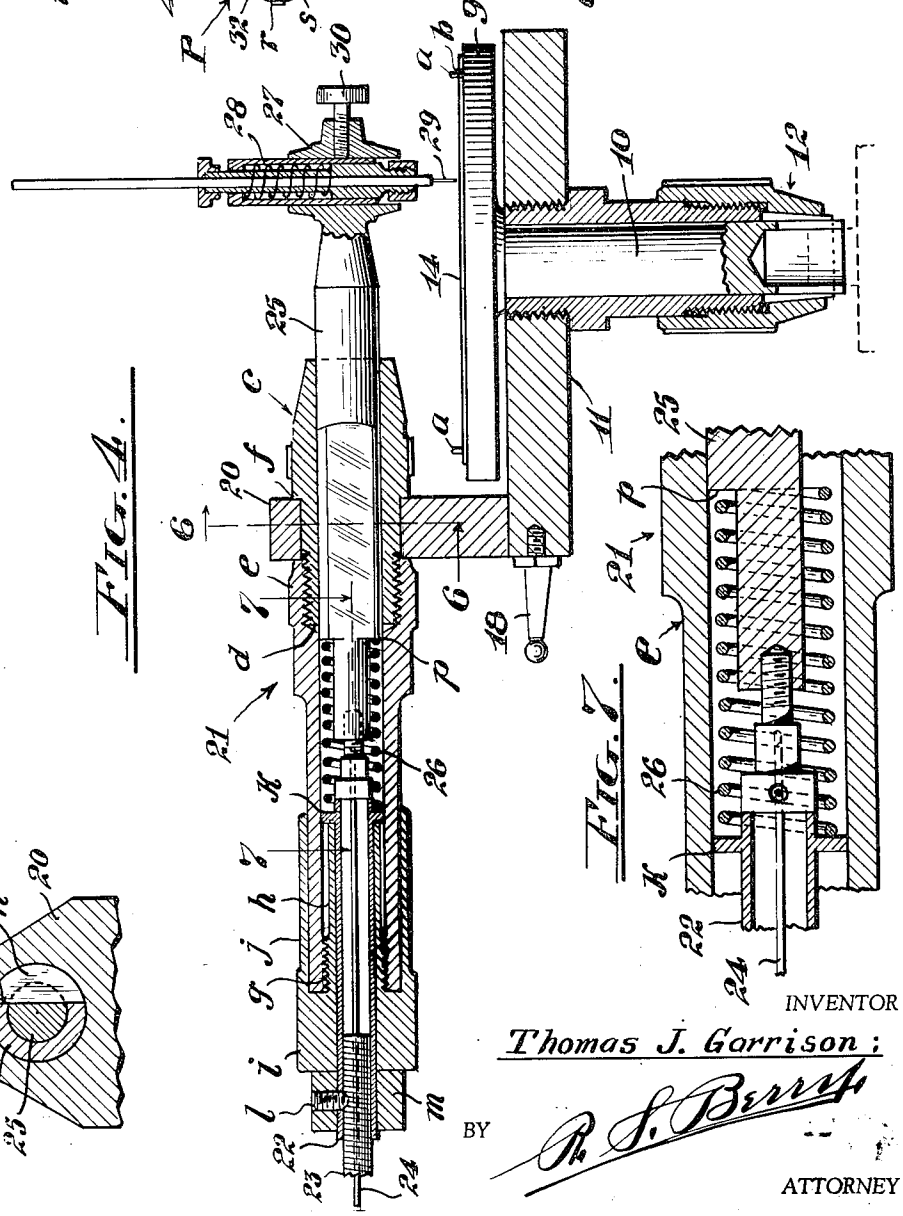


FIG. 4.

FIG. 7.

FIG. 6.

INVENTOR

Thomas J. Garrison;

BY R. S. Berry

ATTORNEY

United States Patent Office 2,763,066 Patented Sept. 18, 1956

2,763,066

TESTING DEVICE FOR DETERMINING THE CONDITION OF CAM CONTOURS

Thomas J. Garrison, Los Angeles, Calif.

Application April 7, 1955, Serial No. 499,888

6 Claims. (Cl. 33—174)

This invention relates to a testing device for ascertaining the condition of the contours of the cams on engine cam-shafts, and has as its primary object the provision of a means whereby defects in the contoured surfaces of the cams of the cam-shaft of an engine may be indicated while the shaft is installed in operative condition and whereby removal of the shaft from its mounting for such purpose is rendered unnecessary.

As is well known, the operation of the internal combustion engine employed in motor vehicles involves the employment of a cam-shaft fitted with a series of cams which impel push-rods which in turn operate rocker-arms that actuate spring seated valves controlling the engine intake and exhaust, the cams serving to time the operation of the valves. Manifestly any deformation of the cams, such as worn or pitted cam contours, is reflected in erratic operation of the valves with consequent irregularity of engine operation. There being other factors which interfere with smooth engine performance, such as improper timing of ignition and incorrect carburetion of the fuel delivered to the engine, it is common practice, in "tuning the motor" to endeavor to correct faulty operation by first making ignition timer and carburetor adjustments and replacements without regard to the cam-shaft since the latter is not readily accessible and ordinarily involves considerable time and costs in effecting its removal and replacement.

The present invention is designed to enable quick determination of the condition of the several cams on the cam-shaft without interfering with its mounting and whereby in event faulty operation of the engine is due to a defective cam or cams such may be readily ascertained and demonstrated; the invention contemplating the employment of an attachment to the push-rod together with an indicator actuated by combined movement of the push-rod and rotation of the cam shaft of an ignition timer or distributor whereby movement of the push-rod will be translated to the delineator so that on observing the latter during the operation, irregularity of movement of the push-rod and consequent erratic operation of the valve controlled thereby can be readily detected.

A further object is to provide a testing device for the purpose above set forth as well as for similar uses, which is simple in construction, which may be readily applied, and which is effective in its operation.

With the foregoing objects in view together with such other objects and advantages as may subsequently appear, the invention resides in the parts and in the combination, construction and arrangement of parts hereinafter described and claimed, and as illustrated by way of example in the accompanying drawing in which:

Fig. 1 is a diagram in section and elevation illustrating the testing device as applied:

Fig. 2 is a detail in plan and horizontal section taken on the line 2—2 of Fig. 1:

Fig. 3 is a plan view as seen on the line 3—3 of Fig. 1:

Fig. 4 is an enlarged vertical section taken on the line 4—4 of Fig. 3:

Fig. 5 is a view in vertical section taken on the line 5—5 of Fig. 2:

Fig. 6 is a detail in cross section taken on the line 6—6 of Fig. 4: and

Fig. 7 is an enlarged detail in longitudinal section taken on the line 7—7 of Fig. 4.

Referring to the drawings more specifically A indicates the cam-shaft of an internal combustion engine, B designates a cam thereon and C denotes an upstanding push-rod seated on the cam B the upper end of which engages one end of a rocker arm D pivoted at E, the other end of which abuts the upper end of the stem F of a valve G. A spring H bears between a cap I and a cylinder head J' and normally closes the valve G.

In carrying out the invention, use is made of the rotary shaft J of the ignition timer or distributor K, which shaft rotates in unison with the cam shaft A through the usual driving connections not shown.

The shaft J is utilized as a means for actuating in part a cam contour indicator L which embodies a revoluble horizontally extending disk 9 fixed on the upper end of a shaft 10 journalled on and extending through a base-plate 11 and fitted at its lower end with a chuck 12 whereby the shaft 10 can be detachably engaged with the upper end of a distributor shaft J to rotate with the latter. The disk 9 carries on its upper face a graph-sheet 14 bearining a central delineation 15 complementary with the contour of the cam B, it being contemplated to provide a series of the sheets 14 bearing various delineations 15 according to various sizes and shapes of cams B employed in the various makes of motors in order to adapt the attachment for use in connection with the various motors. As a means for fastening the sheet 14 on the disk 9 upstanding pins *a* are mounted on the upper face of the disk 14 for detachable engagement with notches *b* in the perimeter of the disk 14, as particularly shown in Fig. 3.

Means are provided for holding the base plate 11 against turning on rotation of the shaft 10, which is here shown as comprising a tie-rod 16 one end of which is connected by a ball and socket joint 17 to a stem 18 fixed on the plate 11 and the other end of which tie-rod is fitted with a clasp 19 for clamping engagement with a suitable projection M on the block of the engine to which the attachment is to be applied.

The base plate 11 is fitted with an upstanding flange 20 which affords a rigid support for a horizontally extending tubular housing 21 embodying an inner end portion *c* which projects through the flange 20 and has an externally threaded outer end *d* engaged by an internally threaded intermediate housing section *e*. A shoulder *f* on the end portion *c* abuts the inner face of the flange 20 while the inner end of the section *e* abuts the outer face of the flange 20 so as to tightly fasten the housing 21 in place on the flange 20. The outer end of the housing section *e* is formed with internal threads *g* which engage a threaded nipple *h* on a cap *i* formed with a sleeve *j* which telescopes the outer end portion of the section *e*.

Extending into and through the nipple *h* is a tube 22 having a flange *k* on its inner end abutting the inner end of the nipple *h* and projecting into the outer end of the tube 22 is a flexible tube 23 which is affixed to the tube 22 by set screw *l* mounted in a collar *m* encompassing the outer end portion of the tube 22 and abutting the cap *i*. Extending longitudinally through the tube 23 is a wire 24 the inner end of which is affixed to a reciprocal shaft 25 slidably supported by and extending lengthwise through the end portion *c* of the housing 21, the shaft 25 being held against turning relative to the housing 21 by a key *n*

carried by the end portion *c* and extending transversely of a flat face *o* formed on the shaft **25**, as particularly shown in Fig. 6.

Interposed between the flange *k* on the tube **22** and a shoulder *p* the inner portion of the shaft **25** is a coiled expansion spring **26** which exerts a longitudinal thrust on the shaft **25** tending to normally advance the latter outwardly relative to the housing **21** and to exert a pull on the wire **24**.

The outer end of the shaft **25** is formed with a head **27** on which is mounted for vertical adjustment a tubular element **28** carrying a stylus **29** which projects downwardly from the head **27** and terminates adjacent to or in sliding contact with the sheet **14** and is normally presented to the delineation **15** on the latter. A set screw **30** is mounted on the head **27** for engagement with the element **28** to securely hold the latter in its adjusted position.

The flexible tube **23** and the wire **24** therein lead to an actuator N which is designed for attachment to the push-rod C in such manner that longitudinal reciprocal movement of the rod will effect corresponding movement to the wire **24** and shaft **25** and thereby be translated into movement of the stylus **29** transversely of the disk **9** and sheet **14** thereon. The actuator N embodies a cylinder **31** fitted with a clamp P by means of which it may be rigidly attached to the push rod C and positioned in longitudinal parallel relation thereto. The clamp P embodies a block **32** which slidably encompasses the cylinder **31** and is thereby adjustable to various positions along the length of the cylinder. A set screw **33** carried by the block **32** is engageable with the cylinder **31** to securely hold the block **32** in its adjusted positions.

The block **32** is formed on one side margin thereof with a vertical slot **34** having a width slightly exceeding the diameter of the push-rod C and thus adapted to be positioned astride the latter. As a means for clamping the rod C in the slot **34** a slidebar **35** is mounted for longitudinal movement on the block **32**, which bar slidably extends transversely through the block with its ends protruding from opposite sides thereof. One side of one portion end of the slide bar **35** intersects the slot **34** and is formed with a V-notch *q* presented toward the slot **34** and adapted to be positioned astride the push-rod C while the other end portion of the slide-bar is formed with threads on which is screwed a knurled nut **36** which bears against the adjacent side of the block **31** and is operable on rotation thereof to advance or retract the push-rod **35** which is held against rotation by means of a screw *r* threaded in the block **31** and extended into a longitudinal slot *s* in the slide bar. To effect clamping engagement of push-rod C with the block **32**, the slide bar **35** is initially disposed in an advanced position, on retracting the nut **36** thereon, such that the notch *q* can be positioned astride the push-rod as indicated in dotted lines in Fig. 2. On this being accomplished, the slide bar **35** is retracted by advancing the nut **36** thereon so as to draw the push-rod C and block **32** toward each other until the push-rod is firmly seated in the slot **34**. When the block **32** is thus attached to the push rod C, the cylinder **31** will be carried on the push-rod to move longitudinally in unison therewith.

Mounted in the cylinder **31** is a reciprocal piston **37** which projects below the lower end of the cylinder and is fitted on its lower end with an axial stem **38** having a threaded end portion *t* screwed into the piston for longitudinal adjustment relative to the latter, the stem being equipped with a knurled finger hold *u* whereby it may be readily grasped and rotated.

The stem is formed with a pointed lower end *v* for seated engagement on a horizontal wall portion of the cylinder head or engine block adjacent the push-rod C.

The piston **37** is fitted with a stem **39** which extends through the upper end wall *w* of the cylinder **31** and has a laterally extending projection **40** fixed on its upper end portion to which is rigidly attached a tube **41** which ex-

tends through the projection **40** parallel with the stem **39**. The upper end of the tube **41** is affixed to and extends in continuation of the flexible tube **23**. A lateral projection **42** is fixed on the upper end of the cylinder **31** and extends in parallel relation to the projection **40**. A stem **43** fastened to the projection **42** slidably extends into the lower end of the tube **41** and has its outer end affixed to the wire **24**. A coiled expansion spring **44** encompasses the piston stem **39** within the cylinder **31** and bears between the piston **37** and the cylinder end wall *w* so as to exert opposing thrusts on the piston **37** and cylinder **31** whereby the piston **37** is maintained in an advanced position relative to the cylinder so that when the latter is applied to the push-rod C with the stem **38** abutting the wall J the stem **38** will be held in such seated position during reciprocal movement of the cylinder **31** with the push-rod. The thrust thus exerted on the piston **37** by the spring **44** is translated through the piston stem **39** and projection **40** to the tube **41** and flexible tube **23** so as to hold the latter against longitudinal movement relative to the wire **24** and whereby the wire **24** can reciprocate within the tube **23** when moved with the cylinder **31**.

In the application and operation of the invention, the indicator L is attached to the distributor shaft J by means of the chuck **12**, and the base **11** with its superstructure including the housing **21** is fastened against rotation by means of the tie rod **16** and clasp **19**. The actuator N is clamped on a push-rod as before described with the projections **40** and **42** spaced apart and with the stem **38** seated on the engine wall J and with the spring **44** under tension. A sheet **14** bearing a delineator **15** corresponding to the contour of the cam B to be tested is affixed to the disk **9**, and positioned so that the stylus **29** will be seated or directed toward the portion of the delineation **15** corresponding to the portion of the cam B engaging the push-rod, such as intermediate the low or dwell portion of the cam wherein the valve G is closed. On rotating the cam shaft A, the cam B will actuate the push-rod C movement of which will be translated to the stylus **29** to advance and retract the latter over the then revolving sheet **14** which moves in unison with the cam B.

Normally the stylus will traverse the cam delineation **15** in register therewith but in event of any irregularity in the cam contour such will be reflected by erratic movement of the stylus relative to the delineation **15** thus indicating such irregularity to an observer. In this fashion the several cams B on a cam shaft A may be tested and their condition readily determined.

I claim:

1. In a cam testing mechanism for indicating the condition of the contour of a cam on an engine cam shaft while in operative position, a disk bearing the delineation of a cam to be tested, a rotary shaft carrying said disk, means on said shaft for detachably engaging a distributor shaft, a longitudinally reciprocal shaft having an outer end portion projecting over said disk, a housing mounted on said shaft, a stylus carried on the outer end portion of said reciprocal shaft designating said cam delineation, a flexible tubular shaft connected to said housing, a wire extending through said tubular shaft connected to said reciprocal shaft, and means controlled by the cam being tested connected to said wire for moving said reciprocal shaft to cause said stylus to traverse said delineation during rotation of said disk and indicate to an observer by irregular movement of said stylus relative to the delineation any irregularity of the contour of the cam being tested.

2. The structure called for in claim 1 in which said cam controlled means comprises a reciprocal member to which said wire is attached and a clamp on said member engageable with the push rod actuated by the cam being tested.

3. In a cam testing mechanism for indicating the condition of the contours of the cams on cam shafts of engines which latter embody push-rods actuated by the

cams and include a distributor shaft rotated in unison with the cam shaft, a rotary disk bearing a cam delineation corresponding to the contour of the cam being tested, a shaft on which said disk is axially mounted, means for detachably connecting said shaft to said distributor shaft to rotate in unison therewith, a stylus arranged to indicate said delineation, a reciprocal shaft on which said stylus is carried, a mounting for said reciprocal shaft, a wire having one end thereof attached to said reciprocal shaft, a reciprocal member to which the other end of said wire is attached, a clamp on said member engageable with the push rod actuated by the cam being tested, and a tubular shaft encompassing said wire having one end fixed to the mounting of said reciprocal shaft, and a stationary member relative to which said reciprocal member is movable to which the other end of said tubular shaft is affixed.

4. The structure called for in claim 3 together with an expansion spring in said reciprocal shaft mounting exerting a longitudinal forward thrust on said reciprocal shaft.

5. In a cam testing mechanism for indicating the condition of the contours of the cams on cam shafts of engines which latter embody push-rods actuated by the cams and include a distributor shaft rotated in unison with the cam shaft, a rotary disk bearing a cam delineation corresponding to the contour of the cam being tested, a shaft on which said disk is axially mounted, means for detachably connecting said shaft to said distributor shaft to rotate in unison therewith, a stylus arranged to indicate said delineation, a reciprocal shaft on which said stylus is carried, a mounting for said reciprocal shaft, a wire having one end thereof attached to said reciprocal shaft, an expansion spring in said mounting exerting a forward thrust on said shaft and a consequent pull on said wire,

a reciprocal cylinder to which the other end of said wire is attached, means for clamping said cylinder on the push-rod actuated by the cam being tested, a piston in said cylinder, a stem on said piston adapted to seat on a fixed abutment, an expansion spring in said cylinder bearing on said piston to maintain said stem in its seated position, a flexible tubular shaft encompassing said wire having one end thereof fixed relative to said piston and having its other end fixed to the mounting of said reciprocal shaft.

6. In a cam testing mechanism for indicating the condition of the contours of the cams on cam shafts of engines which latter embody push-rods actuated by the cams and include a distributor shaft rotated in unison with the cam shaft, a rotary disk bearing a cam delineation corresponding to the contour of the cam being tested, a shaft on which said disk is axially mounted, means for detachably connecting said shaft to said distributor shaft to rotate in unison therewith, a stylus arranged to indicate said delineation, a reciprocal shaft on which said stylus is carried, means engageable with the engine push rod actuated by the cam being tested for moving said reciprocal shaft in unison with the engaged push rod; said reciprocal shaft moving means embodying a flexible shaft having a wire one end of which is connected to said reciprocal shaft and means for connecting the other end of said wire to the push rod.

References Cited in the file of this patent

UNITED STATES PATENTS

1,488,968	Wirt	Apr. 1, 1924
2,648,912	Osgood	Aug. 18, 1953
2,714,328	Hamburger	Aug. 2, 1955
2,721,989	Gates	Oct. 25, 1955