

Nov. 23, 1971

R. F. ASMAR ET AL

3,621,688

MECHANICAL CODE SETTING DEVICE

Filed July 13, 1970

3 Sheets-Sheet 3

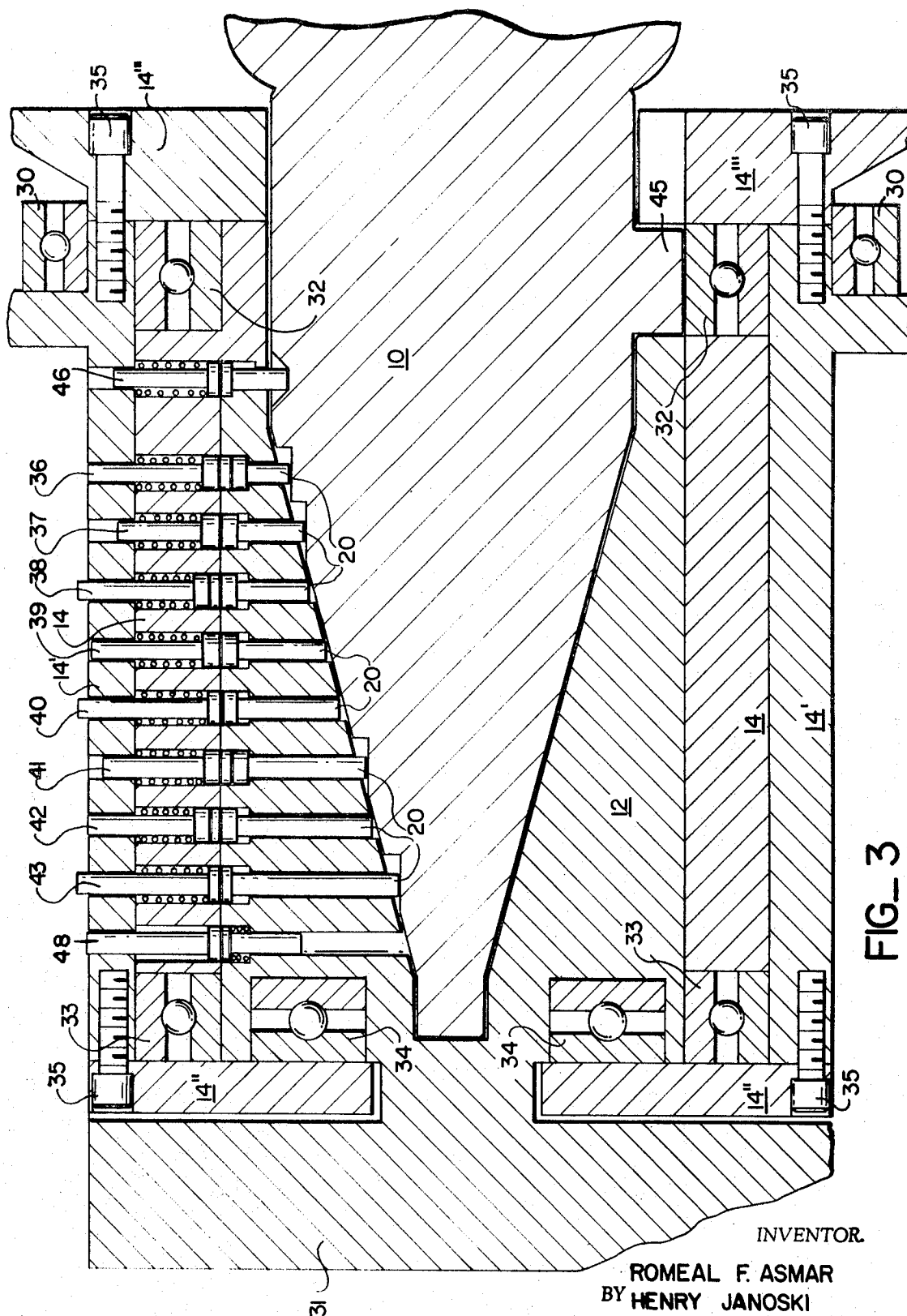


FIG. 3

INVENTOR.

ROMEAL F. ASMAR
BY HENRY JANOSKI

Mellin, Moore & Weissenberger
ATTORNEYS

1

3,621,688

MECHANICAL CODE SETTING DEVICE

Romeal F. Asmar, 1837 Andrea Lane, Concord, Calif. 94520, and Henry Janoski, Concord, Calif.; said Janoski assignor to said Asmar

Filed July 13, 1970, Ser. No. 54,517

Int. Cl. E05b 19/02, 27/06, 39/04

U.S. Cl. 70—352

10 Claims

ABSTRACT OF THE DISCLOSURE

A mechanical code setting device is disclosed comprising a core provided with a recess having a cross section which decreases from the surface of the core to the bottom of the recess, pin tumblers extending through passageways in the wall of the core and projecting into the recess, a key having a patterned outer surface of the same general configuration as the recess which contacts the inner ends of the pin tumblers when inserted in the recess to cause the outer ends of the pin tumblers to terminate at points with respect to the outer surface of the core in accordance with the pattern on the outer surface of the key and means for sensing such termination points. A preferred embodiment of the device is described and various applications and modifications are disclosed.

BACKGROUND OF THE INVENTION

This invention relates to mechanical devices for setting a code and more particularly to a mechanical device adapted to set a multiplicity of digital like identification codes.

It will be understood that any conventional lock and key mechanism is a mechanical code setting device in that the key acts on the elements of the lock mechanism to cause such element to assume certain predetermined positions. Such positions are, of course, "coded" in the sense that only a key having the proper configuration will place the elements of the lock in the proper position to allow the lock mechanism to be actuated. A common form of lock and key mechanism is the "pin tumbler" lock, as shown in U.S. Patent 2,905,926, in which a cylindrical core is received in a hollow cylinder and locked against rotation with respect thereto by pins. The pins are received in passageways in the wall of the hollow cylinder and are spring loaded to cause them to pass through corresponding passageways in the core and project into an appropriate keyway of constant cross-sectional dimensions in the core. Each pin is made up of two or more segments in abutting relation and proportioned so that when a key having a proper configuration is inserted into the keyway a juncture between segments of each pin will coincide with the periphery of the cylindrical core to permit rotation of the core within the hollow cylinder. Such rotation of the core, of course, serves to actuated the desired function, such as unlocking or recording functions, for example.

It will be understood that, although a single tumbler pin would be sufficient to lock the core against rotation in the cylinder, it would be comparatively simple to devise a tool other than a key of the proper configuration with which the pin tumbler could be properly positioned to allow such rotation. For this reason it is desirable to use a plurality of tumbler pins spaced along the keyway, all of which must be properly positioned by the key inserted therein to permit rotation of the core. However, in mechanisms of this type according to the teaching of the prior art the number of pin tumblers that can be used in any particular mechanism is limited by the resistance which such pin tumblers offer to the key upon its insertion into and removal from the keyway.

2

It is an object of this invention to provide a mechanical code setting device of the type described above in which the resistance offered by the pin tumblers to the insertion and removal of the key is reduced toward a minimum whereby the number of pin tumblers that may be used in a given mechanism is greatly increased.

It will be understood that any resistance offered by the pin tumblers to the insertion and removal of the key will result in wearing of both the pin tumblers and the key itself, eventually destroying the desired code setting relationships therebetween.

It is another object of this invention to provide a mechanical code setting device of the type described above in which the wearing of the key and pin tumblers in use is reduced toward a minimum.

According to the teaching of the prior art, each particular mechanical code setting device has been capable of setting at most a limited number of codes and generally only one code. In other words, in each particular device there is a small number of combinations of positions of the pin tumblers which will enable the device to be actuated to perform the desired function and thus the device is responsive to only a small number of key configurations.

It is an object of this invention to provide a mechanical code setting device capable of responding to a substantially increased number of key configurations in setting a substantially increased number of operative codes.

Where a mechanical code setting device according to the prior art is capable of setting a large number of different codes in response to a large number of key configurations, it is difficult to limit the use of the device to authorized persons since all of such key configurations must have certain common features which can be easily detected and imitated.

It is a further object of this invention to provide a mechanical code setting device capable of setting a large number of different codes in response to different key configurations in which the operable key configurations are more difficult to imitate and operable but false configurations may be detected.

It is an overall object of this invention to provide a mechanical code setting device, capable of providing both locking and recording functions, which is simple to operate, inexpensive to manufacture, and does not require electrical devices or other spark producing agencies.

SUMMARY OF THE INVENTION

Briefly, a mechanical code setting device according to this invention comprises a core member having a recess therein which recess has a surface defining a continuously decreasing cross-section along an axis of such core member, a key member for insertion in said recess along such axis and having an outer surface generally conforming to such surface of the recess, such outer surface bearing a pattern of irregularities thereon, and a plurality of pin tumblers slidably received in passageways spaced about such recess and passing through the wall of the core member transversely to such surface of such recess, such passageways being positioned to correspond to selected points in the pattern on such outer surface of the key member and such pin tumblers being adapted to project into the recess in the absence of the key whereby the outer ends of the pins terminate at points with respect to the outer surface of the core in accordance with the pattern on the surface of the key when the key is inserted in the recess. Means are provided for sensing the termination point of said pins with respect to the outer surface of the core. In accordance with a preferred embodiment of this invention the core is rigidly mounted. A cylinder having passageways through the wall thereof corresponding to the passageways through the wall of the core is rotatably mounted thereon and each pin tumbler comprises

3

two or more sections with an abutment therebetween occurring at the outer surface of the core and with certain of the pin tumblers projecting beyond the outer surface of the cylinder when a key having a proper pattern on the surface thereof is inserted in the recess.

BRIEF DESCRIPTION OF THE DRAWING

The foregoing and other objects and features of the subject invention will become more clearly apparent from a reading of the following description of a preferred embodiment thereof in conjunction with the drawing wherein:

FIG. 1 is a fragmentary perspective view partially in section of an embodiment of this invention.

FIG. 2 is a fragmentary end view partially in section of the core member and housing of the embodiment of this invention shown in FIG. 1 with the key member removed and showing the arrangement of the pin tumblers in accordance with this embodiment of the invention.

FIG. 3 is a cross-sectional view taken along lines 3—3 of FIG. 2 with the key member inserted in the core member.

FIG. 4 is a fragmentary cross-sectional view showing the relationship of key member, core member, housing and pin tumblers according to another embodiment of this invention.

FIG. 5 is a side view in elevation, partially in section and partially schematic illustrating one application of the embodiment of this invention shown in FIGS. 1—3.

FIG. 6 is a representation of a pressure-sensitive strip having information printed on the surface thereof such as may result from the operation of the device illustrated in FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, the basic elements of the preferred embodiment of this invention are shown. Such elements comprise a key member 10, a core member 12 and a housing 14. As shown in FIG. 1, the housing 14 is a hollow cylinder. The core 12 has a cylindrical outer surface dimensioned to fit within the cylindrical housing 14. The core 12 has a recess formed therein along its cylindrical axis to receive the key member 10. According to this invention, a portion of such recess has a surface which is inclined with respect to the axis of the core to define a recess portion of continuously decreasing cross-section along such axis. As shown in FIG. 1, such surface is conical and the key member 10 is provided with a matching conical outer surface 16. As shown, the key member and recess may be provided with matching cylindrical portions 17 and 18 at opposite ends of the conical surface 16 in order to facilitate the insertion of the key member 10 into the recess. Similarly, the key member 10 may be provided with a thumb-grip 19 to facilitate handling and utilization of the key member 10.

A plurality of pin tumblers 20 comprising at least two sections 20a and 20b are slidably received in passageways in the core member 12 and housing 14 and are adapted to project into the recess in the core member 12 in the absence of a key member 10. As shown in FIG. 1, the conical surface 16 of the key member 10 is provided with a pattern of indentations 22. The openings of the passageways in the core member 12 are spaced along the inclined surface thereof to correspond to selected points in the pattern of indentations in the conical surface 16 of the key member 10. Since the passageways in the core member 12 extend transversely to the inclined surface of the recess in the core member 12 and the pin tumbler sections 20a project into such recess in the absence of key 10, the insertion of key member 10 into the recess in the core member 12 will actuate the pin tumbler sections 20a causing them to slide along the passageways and assume a predetermined position with respect to the outer surface of the core member 12. Such predetermined position will depend upon the length of the pin tumbler sections 20a and the presence or absence of an indentation 22 at the

4

point where the conical surface 16 of the key member 10 contacts the end of a pin tumbler section 20a. Thus it will be seen that the conical surface 16 of the key member 10 tends to contact all of the pin tumbler sections 20a essentially simultaneously and that such contact occurs essentially at one point for each of such pin tumbler sections 20a. For this reason, there is a minimum of sliding contact between the ends of the pin tumbler sections 20a and the conical surface 16 of the key member, thus reducing mechanical resistance and wear therebetween during insertion and removal of the key member 10.

It will be understood that in a simplified embodiment of this invention, the pin tumbler sections 20a received in the passageways in the core member 12 might be dimensioned so that they would project from the outer surface of the core member 12 if there is no indentation in the conical surface 16 of the key member at the point of contact therewith, or be flush with the outer surface of the core member 12 if there is an indentation in such surface 16 at the point of contact therewith. Such projection or lack of projection of the pin tumbler sections would provide a binary code corresponding to the pattern of indentations in the surface 16 of the key member 10 which binary code might be easily sensed. However, according to the embodiment of the invention shown in FIG. 1, it is necessary that an abutment occur between the sections of the pin tumblers at the outer periphery of the core member 12 in order to permit rotational movement between such core member 12 and the housing 14. Thus according to the embodiment of this invention shown in FIG. 1, the pin tumbler sections 20a are dimensioned so that they will not project beyond the outer surface of the core member 12 in the presence of a proper key and the pattern of indentations on the surface 16 of the key member 10 is sensed by means of cylinder 14, pin tumbler section 20b and pin tumbler insert sections 20c interposed between pin tumbler sections 20a and 20b as will be more fully described hereinafter.

It will be understood that the inclined surface 16 of the key member 10 need not be conical according to this invention. Instead such surface 16 and the corresponding inner surface of the recess may have any shape providing portions along the axis of the core member 12 of continuously decreasing cross-section. Thus such surface 16 might comprise a series of discreet conical steps, for example. Similarly, such surface 16 need not be rectilinear but might have either a convex or concave curvature along the axis of the core member 12. Obviously such surface 16 might be pyramidal or wedge-shaped along such axis. It will be understood that according to the teaching of this invention, the pin tumblers 20 must extend transversely through the inclined surface and ideally at right angles thereto.

Furthermore, it will be understood that the key member 10 may have slightly smaller cross-sectional dimensions than the cross-sectional dimensions of the recess in the core member 12 in order to permit the use of a pattern of protuberances from the surface thereof in place of a pattern of indentations 22. A mixed pattern of protuberances and indentations may also be used. In fact, embodiments of this invention might be designed to sense any pattern of irregularities in the surface of the key member 10.

However, as shown in FIGS. 1 and 2, the preferred embodiment of this invention is based on circular symmetry about the axis of the core member 12. Referring to FIG. 2, this configuration permits the use of pin tumblers arranged in radial array about a cross-section of the device. As shown in FIG. 2 the pin tumblers may be spring-loaded to cause them to project into the recess in the core member 12 in the absence of a key as indicated by springs 21.

As shown in FIG. 2, groups of pin tumblers may be arranged in common cross-sectional planes, perpendicular to the axis of the core member 12. However, it will be understood that the pin tumblers 20 need not be

5

arranged in groups in a plurality of planes perpendicular to the axis of the core member 12, but instead might be staggered along such axis in an irregular pattern to conform to a correspondingly irregular pattern of indentations on the inclined surface of the key member.

As shown in FIG. 2, the pin tumbler sections 20a, 20b, and 20c are dimensioned so that an abutment therebetween will occur at the outer periphery of the core member 12 upon insertion of the key member 10 therein. Thus, beginning at the top of the figure and going about the periphery thereof to the left, it will be seen that the first four pin tumblers are dimensioned to allow rotational movement between the core member 12 and the housing 14 whether there is an indentation in the key member 10 or not. If there is an indentation in the key member 10, these pin tumblers will remain in the position shown, and if there is no indentation in the key member 10, the pin tumblers will be forced outwardly so that the insert sections 20c will be forced into the passageways in the housing member 14 with the pin tumbler sections 20b, and the abutment between the insert sections 20c and 20a will coincide with the outer periphery of the core member 12. Rotational movement between the core member 12 and the housing 14 may, of course, occur in either instance. Where there is no indentation in the key member and the pin tumblers are forced outwardly, it will be seen that the pin tumbler sections 20b will project beyond the outer periphery of the housing member 14. Thus, these first four pin tumblers are adapted to provide an indication of the pattern on the key member which may be sensed externally of the device.

The next three pin tumblers serve solely to lock the device against rotation unless the proper key is inserted therein. These three pin tumblers are not adapted to provide any externally sensible indication of the pattern on the key member. Instead, the middle one of such three pin tumblers will only permit rotational movement between the core 12 and the housing 14 when there is an indentation in the key member corresponding thereto, whereas the other two pin tumblers will only permit rotational movement between the core member 12 and the housing 14 when there is no indentation in the surface of the key member corresponding thereto. It would, of course, be possible to dimension the pin tumbler section 20b of such other two pin tumblers so that they would project beyond the housing 14 when the proper key is inserted. This as well as other possible pin tumbler configurations and arrangements are indicated and more fully discussed in connection with FIG. 3 which is a cross-section taken along lines 3—3 of FIG. 2 showing a key member 10 inserted in the device.

Referring to FIG. 3, the core member 12 is shown rigidly mounted by means of the flange 31 formed on one end thereof, the housing 14 is slipped over the core member 12 and mounted thereon by means of bearings 32, 33 and 34. As shown in FIG. 3 the housing 14 may comprise a sleeve 14' and end caps 14'' and 14''' in addition to the main body 14 in order to provide ease of assembly of the housing and bearings onto the core member through the use of machine screws 34. Thus it will be seen that core member 12 is adapted to be rigidly mounted on an appropriate frame through the flange 31 and that the housing 14 is mounted on the core member 12 for rotation with respect thereto on bearings 32, 33 and 34. An additional bearing 30 may be interposed between the housing 14 and an appropriate frame member in order to more rigidly support the housing 14 during rotation thereof.

As shown in FIG. 3, a plurality of pin tumblers 20 as described hereinabove are arranged along the axis of the core member 12 and project into the recess therein into contact with the key member 10. It will be understood that such pin tumblers 20 need not be arranged in a straight line, but could be staggered with respect to each other in the circumference of the device to accommodate a corresponding pattern in the surface of the key

6

member 10. It will also be understood that such pin tumblers 20 need not extend perpendicularly to the axis of the core member 12 so long as they extend transversely to the surface of the recess in the core member 12.

It will be understood that each of the pin tumblers 20 comprise at least two sections 20A and 20B and that certain of them include a third section 20c as described hereinabove. For ease of explanation of the functions of the various pin tumblers 20 shown in FIG. 3, they have been designated from right to left 36, 37, 38, 39, 40, 41, 42 and 43. Referring first to pin tumblers 36 and 38, it will be seen that these pin tumblers are adapted to either project (38) beyond the outer surface of the housing member 14 in the absence of an indentation in the surface of the key member 10, or be fully housed (36) within the housing member 14 in the presence of an indentation in the surface of the key member 10. It will be seen that pin tumblers 36 and 38 are provided with an insert section 20a so that the housing 14 may be rotated with respect to the core 12 regardless of which of the two positions the pin tumblers 36 and 38 are caused to assume by the insertion of the key member 10. Thus these pin tumblers provide no locking action whatever and serve solely to sense the pattern on the surface of the key member 10 in order to enable a record thereof to be made as will be more fully described hereinafter.

Pin tumblers 37 and 39, on the contrary, serve solely to lock the housing 14 against rotation about the core 12 unless a proper key is inserted in the recess. To this end pin tumblers 37 and 39 comprise only two sections, pin tumbler 37 being dimensioned so that the abutment between the two sections thereof coincides with the outer periphery of the core member 12 only when the surface of the key 10 corresponding thereto is provided with an indentation. Pin tumbler 39, on the other hand, is dimensioned so that the abutment between the two sections thereof coincides with the outer periphery of the core member 12 only when the key inserted in the device does not have an indentation in the surface thereof corresponding to pin tumbler 39. It will be seen that both pin tumbler 37 and pin tumbler 39 remain entirely housed within the housing member 14 regardless of their position and thus are not adapted to sense the pattern on the surface of the key member 10 other than in connection with their locking function. It would, of course, be possible for a pin tumbler to perform both a locking function and a sensing function as indicated by pin tumblers 40 and 43. Thus, pin tumbler 40 comprises two sections which are adapted to abut at the outer periphery of the core member 12 when a key member 10 having no indentation corresponding thereto is inserted, the outer end of pin tumbler 40 projecting beyond the housing 14 under such conditions. Similarly, pin tumbler 43 comprises two sections adapted to abut at the outer periphery of the core member 12 and project beyond the surface of the housing 14 when a key member 10 having an indentation corresponding thereto is inserted. However, pin tumblers 40 and 43 are incapable of contributing substantially to the coded information which the device according to this invention is capable of producing, since their locking functions and indicating functions are necessarily combined.

Pin tumblers 41 and 42 do not perform either a locking function or an indicating function as described hereinabove. Instead, these pin tumblers serve solely to provide dummy codes on the key member 10, thereby making it more difficult to determine which of the pin tumblers are actually used in making up a particular operable code. It will be seen that pin tumblers 41 and 42 are each made up of three sections and that an abutment between such sections will occur at the outer periphery of the core member 12 regardless of whether there is an indentation in the surface of the key member 10 corresponding thereto or not. Furthermore, regardless of the position of the pin tumblers 41 and 42, they will not project beyond the housing 14 and thus will not contribute

to the coded information generated by the insertion of a key into the device.

It will be understood that more than three sections could be used in selected pin tumblers 20 so that the relative depth of the indentations in the surface of the key member 10 might be sensed. However, this would require the use of a code other than the simple binary code resulting from sensing the mere projection or lack of projection of the pin tumblers 20 from the housing 14. A more advantageous embodiment of this invention combining indicating and locking functions and capable of sensing relative irregularities in the key member while preserving the binary code is shown in FIG. 4.

Referring to FIG. 4, an arrangement of the key member 10, core member 12, housing 14 and pin tumblers 20 is shown in which relative depth of indentations in the pattern on the surface of the key 10 may be used to provide both a locking function and a binary indication of such surface pattern. As shown in FIG. 4 the pin tumbler 20 indicated by the reference numeral 36 is identical in form and operation to that indicated by reference numeral 36 in FIG. 3. The pin tumbler indicated by reference numeral 36' includes an insert section 20c' that is thicker than normal and a section 20b' that is shorter than normal. Thus, if there is no indentation in the key member corresponding to pin tumbler 36', the abutment between the insert 20c' and section 20a will lie at the periphery of the core member 12 and section 20b' will project beyond the housing 14 the selected distance for the binary code used; if there is an indentation of normal depth the insert 20c' will perform a locking function; and if the indentation is of selected increased depth such locking function will be avoided as indicated. Similarly, the pin tumbler 36'' includes an insert section of normal thickness but a section 20a' of increased length. Thus, if there is no indentation in the key member 10 corresponding to pin tumbler 36'' the section 20a' will perform a locking function and section 20b will project beyond the selected distance from the housing 14; if there is an indentation of normal depth the abutment between insert section 20c and section 20d' will be at the periphery of core member 12 releasing the locking function and section 20b will project beyond the housing 14 the selected distance for the binary code used; and if the indentation is of selected increased depth the locking function will again be released, as shown, but without projection of section 20b beyond the housing 14.

It will be understood that if no locking function is desired in the device, it would be possible for all of the pin tumblers 20 to comprise three sections so that the pattern on any key of the proper general configuration may be sensed. In such case, there would be no preferred orientation of the key with respect to the core, since any key in any orientation would be operable to enable the housing 14 to be rotated with respect to the core 12. However, in view of the locking function performed by pin tumblers such as 37, 39, 40 and 43, there will be only one correct orientation for the insertion of the key member 10 into the core 12 as shown in FIGS. 1 and 3. According to this embodiment of the invention, such correct orientation is secured through the use of a tongue and groove guiding means as indicated at 45 in FIGS. 1 and 3. Thus, a tongue 45 is provided on the outer periphery of the shank of the key member and an appropriate groove is provided in the housing member 14 and core member 12 to receive such tongue 45. It will be understood that any other appropriate indexing means may be used, including a selected matching asymmetry in the configuration of the key member 10 and recess in the core member 12.

It will be understood that according to the teaching of this invention, the insert sections 20c of the pin tumblers are carried either by the housing member 14 or by the core member 12 during rotation of the housing member 14 about the core member 12. Thus one full revolution of the housing 14 is required in order to return all of the parts of the device to their original location prior to removal of the key member from the device. For this reason

the tongue and groove arrangement provides means for locking the key member 10 in the device until the housing member 14 has been rotated back to its original position. This function may also be provided by an additional pin tumbler 46 located in the core member 12 and housing 14 at the shank of the key member 10. An appropriate locking indentation is provided in the shank of the key member 10 to receive the pin tumbler 46, which pin tumbler 46 comprises two sections adapted to abut at the outer periphery of the core member 12 when the pin tumbler 46 is seated in the locking indentation. It will be seen that upon rotation of the housing, the key 10 will be locked in the core 12 by lower section of the pin tumbler 46 until one full rotation is completed. It would, of course, be possible to rely on the operation of the pin tumbler 46 to insure proper orientation between the key member 10 and the core member 12 in which case the tongue and groove guide means 45 would not be required, although either or both may be used as desired.

A still further pin tumbler 48 is shown in FIG. 3 which performs a function that will be more fully understood in connection with a specific application of the preferred embodiment of this invention to be described in connection with FIG. 5. Such pin tumbler 48 comprises two sections which are spring-loaded to tend to cause the pin tumbler to project beyond the periphery of the housing member 14. The sections of the pin tumbler 48 are dimensioned so that the abutment therebetween will occur at the outer periphery of the core member 12 when the outer end of the pin tumbler 48 is forced into alignment with the outer periphery of the housing member 14 against the spring loading thereof. Thus, the pin tumbler 48 functions to lock the housing 14 against rotation about the core member 12 in the absence of a compressive force on the pin tumbler 48 forcing it into the housing 14.

Referring to FIG. 5, a particular application for this embodiment of the invention is shown. According to this embodiment of the invention, the projection or lack of projection of the pin tumblers 20 from the housing 14 is sensed by a sheet of pressure-sensitive material 50, received between the outer periphery of the housing member 14 and an appropriate roller 51. As shown in FIG. 5, the housing member 14 is provided with a flange 52 which serves as a hand-grip to facilitate rotation of the housing 14 after insertion of the key member 10 into the core member 12 to secure proper positioning of the pin tumblers 20. As the housing 14 is rotated, the sheet or strip of pressure-sensitive material 50 compressively received between the outer surface of the housing 14 and the roller 51 will be advanced, and as projecting pin tumblers 20 are successively brought into contact with the pressure-sensitive sheet under the roller 51, they will leave spaced impressions in the pressure-sensitive material providing a record of the code set by the insertion of the particular key into the core. Thus a complete rotation of the housing 14 will result in a strip of pressure-sensitive material upon which marks have been impressed representative of the pattern on the surface of a particular operable key. Such strip may then be visually or otherwise read to identify the particular operable key which was used in operation. The pin tumbler 48 prevents the operation of the device in the absence of a strip of pressure-sensitive material in compressive contact with the outer surface of housing 14 under roller 51. The marks impressed on the pressure-sensitive material may comprise holes, indentations, discolorations, coatings, etc. in, on or through the surface of such material or the material itself.

As shown in FIG. 5, the housing 14 is provided with a further flange 53 having gear teeth 54 formed about its outer periphery. As indicated by dotted lines 55, 56, the gear teeth 54 and the flange 53 on the housing 14 may be mechanically coupled through an appropriate mechanism to actuate any desired device. For example, as indicated by dotted lines 55 in FIG. 5, a partial rotation of the housing 14 may be coupled through the flange 53 and gear teeth 54 to an appropriate mechanism for actuating

a metering device such as a gasoline pump, for example. Upon actuation of such metering device, the rotation of the housing 14 is stopped and the operation of the metering device is carried out. The information generated during operation of such metering device may be transferred to a remote unit associated with the device of this invention, as indicated by the shaft 57 and the alpha-numeric recording wheels 58. When the operation of the metering device has been completed, the further rotation of the housing 14 may be coupled through the flange 53 and gear teeth 54 to an appropriate stamping device 59 as indicated by dotted lines 56 to cause the information recorded on the alpha-numeric wheels 58 of the remote indicating device to be impressed upon the pressure-sensitive sheet or strip 50 adjacent the coded information produced by the device of this invention as shown in FIG. 6.

Referring to FIG. 6, it will be seen that the alpha-numeric information generated by the metering device during two separate operations thereof have been printed on the left-hand side of the strip 50, whereas a series of dots representative of the pattern on the particular key 10 used during such operation has been imprinted on the right-hand side of the strip. As shown in FIG. 6, two different keys, each having a different pattern, have been used in performing the two separate operations of the metering device. However, it will be understood that the same key could be used for successive operations of the device, in which case the same pattern of dots would be repeated for each operation on the right-hand side of strip. Any appropriate reading means may be used to sense the pattern of dots on the right-hand side of the strip and thereby identify the key used in the particular operation of the metering device. For example, apertured cards corresponding to particular key patterns could be placed over the right-hand side of the strip in order to match the imprinted pattern to the known patterns of authorized keys.

It will be understood that the device of this invention may be used in a wide variety of applications and in a wide variety of forms. The device of this invention is particularly suited to applications such as gasoline metering, since it does not include any agencies which might produce an explosion hazard, such as would be produced by electrical devices, for example. Furthermore, the device of this invention is inexpensive to manufacture, simple to operate and positive in its action. The configuration of the key member 10 of this device makes it almost impossible to make a counterfeit imitation of an authorized key pattern. The large number of patterns which may be accommodated make the device of this invention particularly suitable in applications requiring the use of a large number of different authorized keys. It is believed that those skilled in the art will make many modifications in the device disclosed herein to suit it for particular applications. It will be understood, for example, that any force-responsive means appropriate in a particular application might be used in place of the pressure-sensitive sheet 50 to detect the projection or lack of projection of the pin tumblers 20 from the housing 14. In fact, the housing 14 may be replaced by other appropriate means for sensing the position of the pin tumblers 20 with respect to the outer surface of the core member 12 as mentioned hereinabove.

The pin tumblers sections need not be cylindrical as shown in the drawing but may take any desired shape. Similarly, the pin tumbler inserts need not be cylindrical and in fact they may advantageously be spherical balls interposed between the other pin tumbler sections.

What is claimed is:

1. A mechanical code setting device comprising:

- (a) a core member having a given axis, a recess formed in said core member along said axis, the surface of said recess having a portion inclined with respect to said axis to define a recess portion of continuously decreasing cross-section along said axis;

(b) a key member for insertion in said recess along said axis and having an inclined outer surface portion generally conforming to said inclined surface portion of said recess, said outer surface portion of said key member having a pattern of surface irregularities formed therein;

(c) means for sensing said pattern of surface irregularities on said inclined outer surface portion of said key member upon insertion of said key member in said recess, said means comprising a plurality of pin tumblers each slidably received in a different one of a plurality of passageways having openings spaced from each other in said inclined surface portion of said recess and extending through said core member transversely of said inclined surface portion of said recess, said openings of said passageways being positioned to correspond to selected points in said pattern of irregularities on said inclined outer surface portion of said key member and said pin tumblers being adapted to project through said openings into said recess in the absence of said key member, whereby, upon insertion of said key member in said recess along said axis, said pin tumblers extend along said passageways to points of termination with respect to the outer surface of said core member in accordance with said selected points of said pattern on said inclined outer surface portion of said key member, the inclined outer surface portion of said key member extending along substantially the entire extent of said openings of said passageways when said key member is inserted into said recess, whereby the points of contact of said pin tumblers with said recess in the absence of said key member lie generally on the inclined surface portion of said recess; and

(d) means for sensing said points of termination of said pin tumblers with respect to the outer surface of said core member.

2. A mechanical code setting device as claimed in claim 1 wherein said pin tumblers each comprise two or more sections and said means for sensing said points of termination of said pin tumblers comprises a housing in which said core member is received, said housing having passageways therein forming extensions of said passageways in said core member, said pin tumblers projecting into said passageways in said housing with an abutment between sections of each of said pin tumblers occurring at the outer periphery of said core member and certain of said pin tumblers projecting outside said housing when said key member is inserted in said recess.

3. A mechanical code setting device as claimed in claim 2 wherein said means for sensing said points of termination of said pin tumblers further comprises force-responsive means adjacent at least a portion of the outer surface of said housing.

4. A mechanical code setting device comprising:

(a) a core member having a given axis, a recess formed in said core member along said axis, the surface of said recess having a portion inclined with respect to said axis to define a recess portion of continuously decreasing cross-section along said axis;

(b) a key member for insertion in said recess along said axis and having an outer surface portion generally conforming to said inclined surface portion of said recess, said outer surface portion of said key member having a pattern of surface irregularities formed therein;

(c) means for sensing said pattern of surface irregularities on said outer surface portion of said key member upon insertion of said key member in said recess, said means comprising a plurality of pin tumblers, each pin tumbler comprising a plurality of sections and each being slidably received in a different one of a plurality of passageways having openings spaced from each other in said inclined surface portion of said recess and extending through said core

11

member transversely of said inclined surface portion of said recess, said openings of said passageways being positioned to correspond to selected points in said pattern of irregularities on said outer surface portion of said key member and said pin tumblers being adapted to project through said openings into said recess in the absence of said key member, whereby, upon insertion of said key member in said recess along said axis, said pin tumblers extend along said passageways to points of termination with respect to the outer surface of said core member in accordance with said selected points of said pattern on said outer surface portion of said key member, and

(d) means for sensing said points of termination of said pin tumblers with respect to the outer surface of said core member, said sensing means comprising a housing in which said core member is received, said housing having passageways therein forming extensions of said passageways in said core member, said pin tumblers projecting into said passageways in said housing with an abutment between sections of each of said pin tumblers occurring at the outer periphery of said core member and certain of said pin tumblers projecting outside said housing when said key member is inserted in said recess and force-responsive means associated with said sensing means adjacent at least a portion of the outer surface of said housing, said housing being mounted for rotation about said core member and said force-responsive means contacting said housing at a fixed location with respect to said core member whereby successive areas of said housing are brought into contact with said force-responsive means upon rotation of said housing.

5. A mechanical code setting device as claimed in claim 4 wherein said force-responsive means comprises a pressure-sensitive sheet pressed into contact with the outer surface of said housing and adapted to receive an impression upon being brought into contact with pin tumblers which project beyond said housing by rotation of said housing about said core member.

6. A mechanical code setting device as claimed in claim 5 wherein certain of said pin tumblers comprise at least three sections, the intermediate sections thereof being

12

dimensioned to correspond to selected amounts of irregularity of said pattern of irregularities in said surface of said key member.

7. A mechanical code setting device as claimed in claim 6 wherein said core member is cylindrical, said surface of said recess and said outer surface of said key member are conical, said pattern of irregularities comprises a pattern of indentations, and said housing is a hollow cylinder dimensioned to receive said core member with the outer surface of said core member in sliding contact with the inner surface of said housing.

8. A mechanical code setting device as claimed in claim 7 wherein a pressure-sensitive sheet is received between a roller and the outer surface of said housing and adapted to be advanced by rotation of said housing and receive an impression upon contact with pin tumblers projecting beyond said housing.

9. A mechanical code setting device as claimed in claim 8 wherein rotation of said housing actuates a recording device mechanically coupled thereto and adapted to imprint information on said sheet.

10. A mechanical code setting device as claimed in claim 9 wherein partial rotation of said housing enables the operation of a metering device mechanically coupled thereto and a further partial rotation of said housing actuates a recording device adapted to imprint information generated by the operation of said metering device onto said pressure-sensitive sheet.

References Cited

UNITED STATES PATENTS

1,020,208	3/1912	Loughlin	70—364 A
1,417,715	5/1922	Bryce	70—434
3,302,211	1/1967	Essex	346—53
1,376,405	5/1921	Conte	70—433
3,529,455	9/1970	Hartzell	70—355

ROBERT L. WOLFE, Primary Examiner

U.S. Cl. X.R.

70—358, 373, 387, 403, 433; 235—60; 346—52