

[54] **LOCK CYLINDER BODY AND METHOD OF PROVIDING THE SAME**

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[22] Filed: **March 10, 1969**
[21] Appl. No.: **805,510**

[52] U.S. Cl. **70/373, 29/513, 29/526, 70/449, 72/381**
[51] Int. Cl. **E05b 9/04**
[58] Field of Search **70/373, 448-449, 70/378; 72/379, 381, 398; 29/513, 526**

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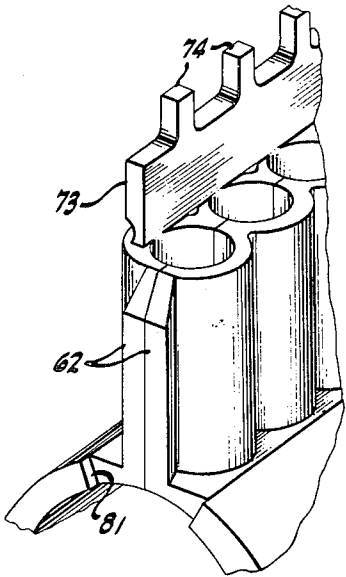
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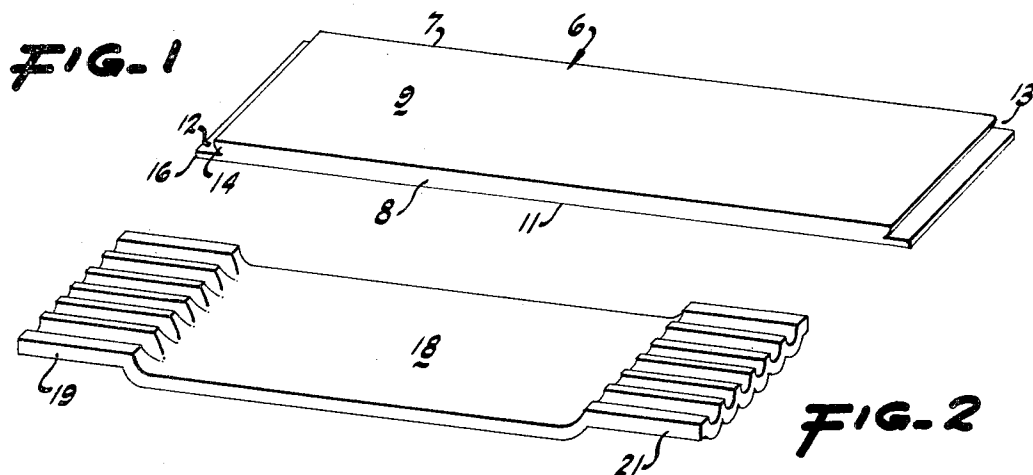
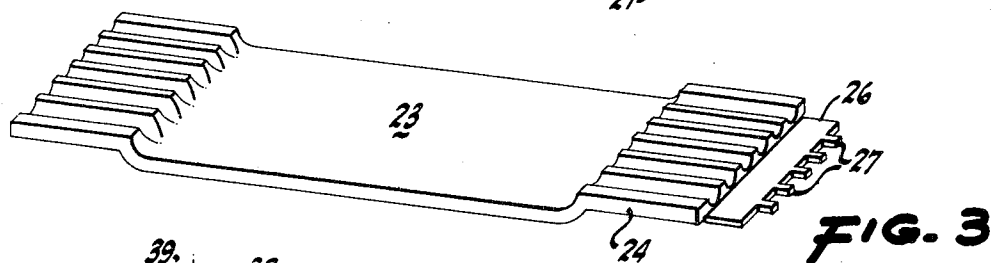
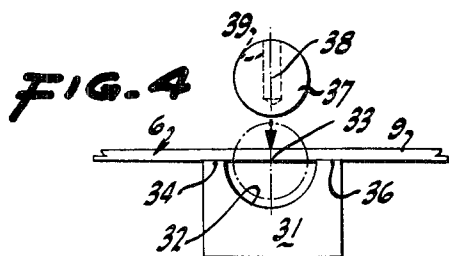
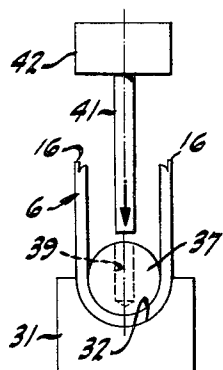
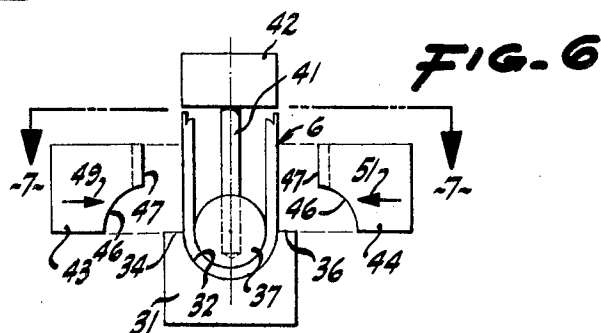
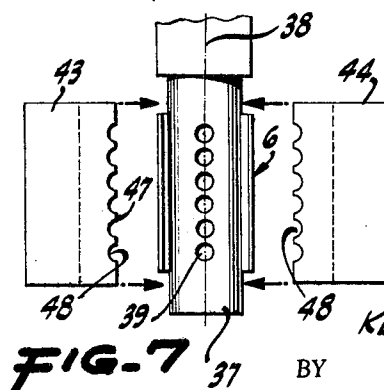
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[57] **ABSTRACT**

A lock cylinder body is fabricated of a strip of sheet metal with the central portion thereof folded upon itself to define an approximate cylinder and with the end portions extending approximately radially from said cylinder and disposed against each other to define a tumbler tongue in which there are opposed, concave surfaces defining pin tumbler chambers at least partially covered by an integral lip on at least one of the strips. The lock cylinder body is made by bending the central portion of a sheet of strip metal around a cylindrical form until the end portions of the strip are in substantial juxtaposition on opposite sides of a rod projecting radially from the form and then pressing the end portions toward each other until at least one of the end portions deforms around the rod.

3 Claims, 25 Drawing Figures





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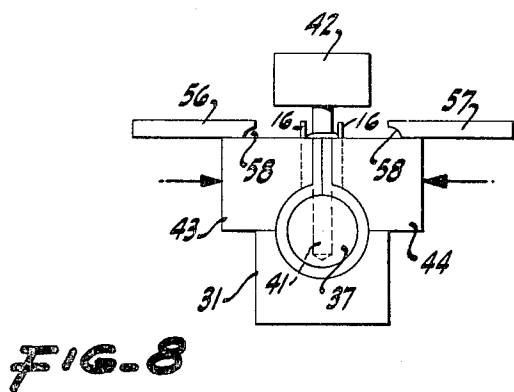
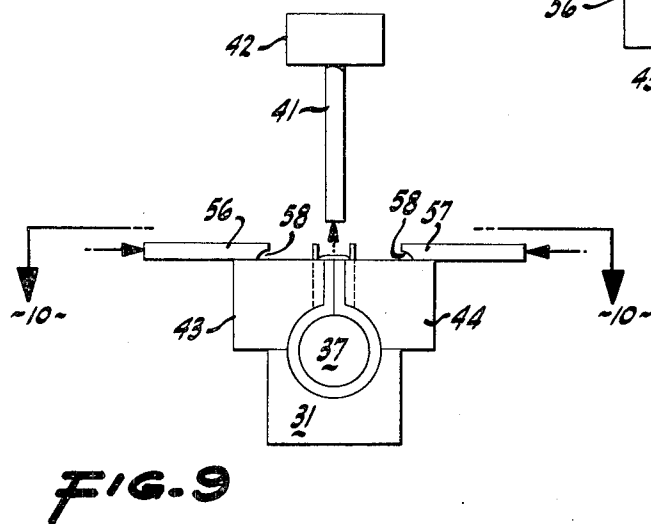
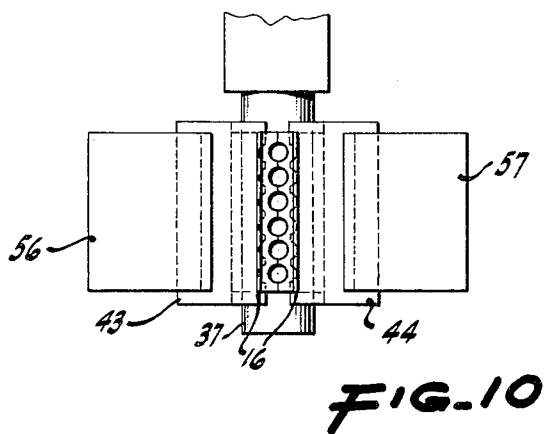
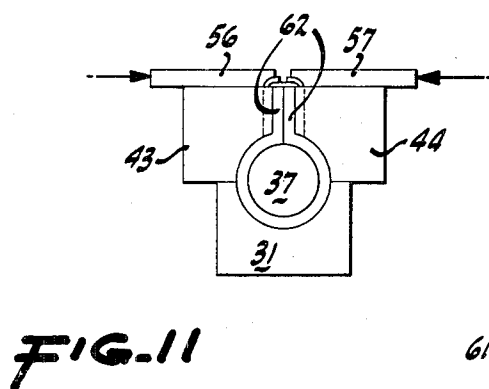
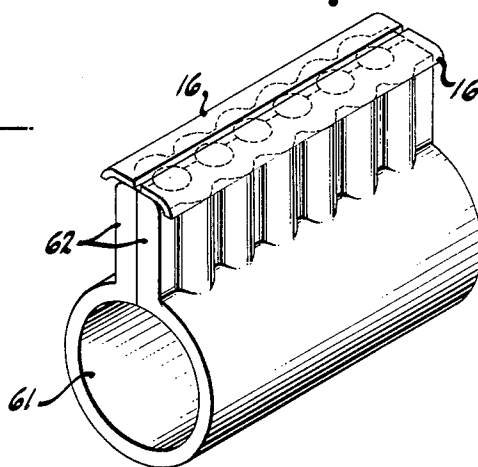


FIG. 9

FIG. 12



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FIG. 13

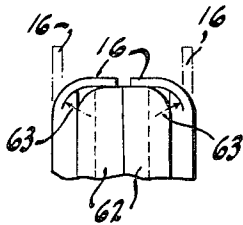


FIG. 14

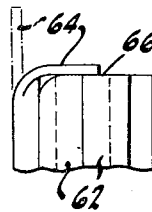


FIG. 16

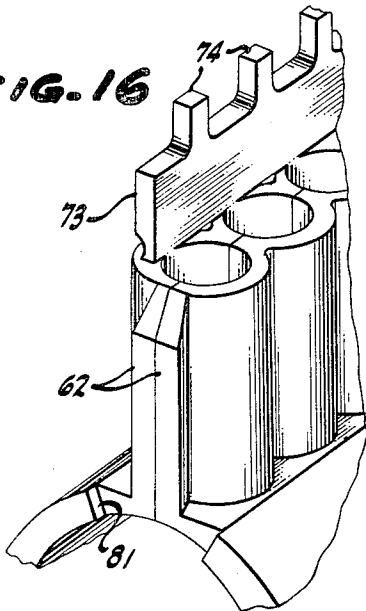
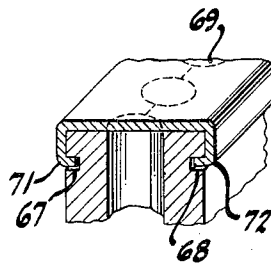


FIG. 15

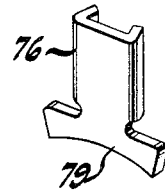


FIG. 18

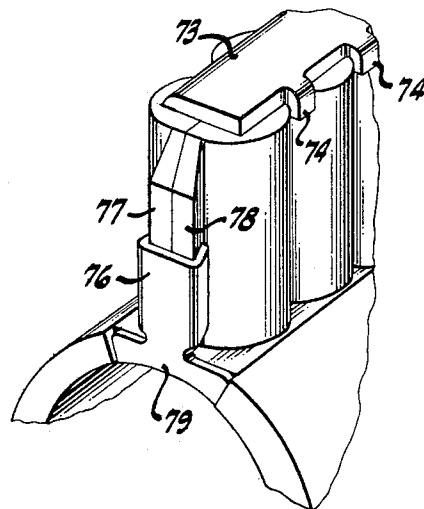


FIG. 17

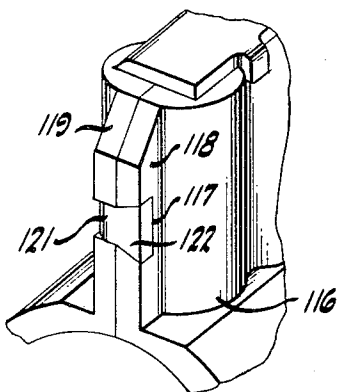


FIG. 24

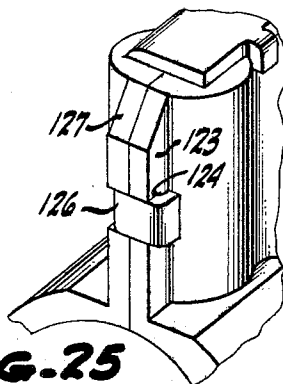


FIG. 25

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FIG-19

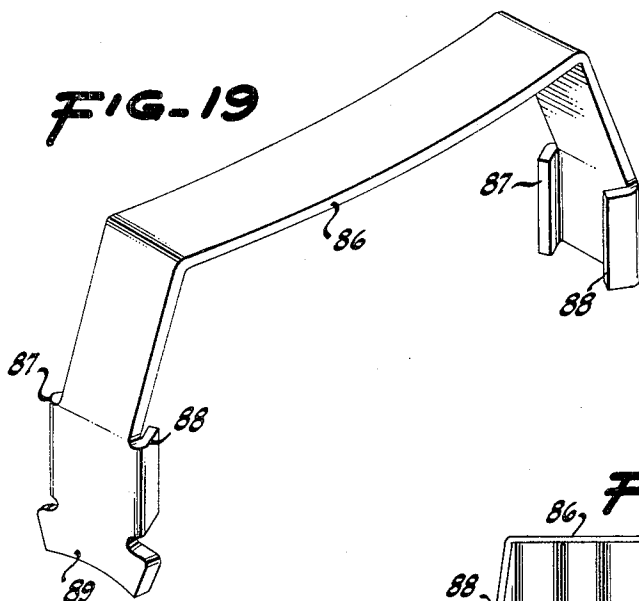


FIG-20

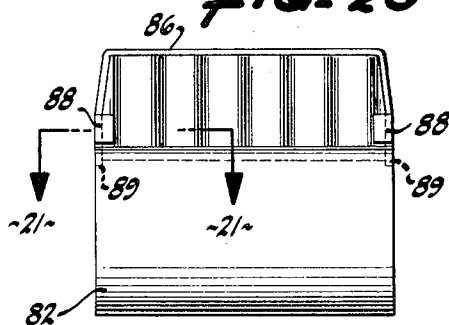
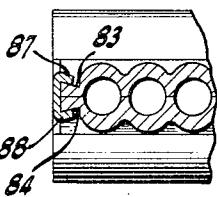


FIG-21

FIG-22

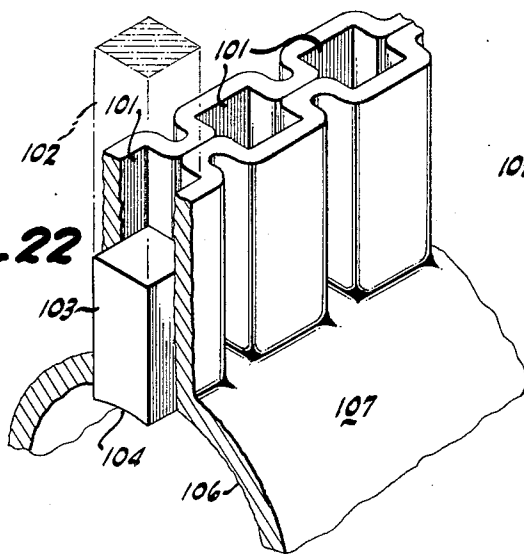
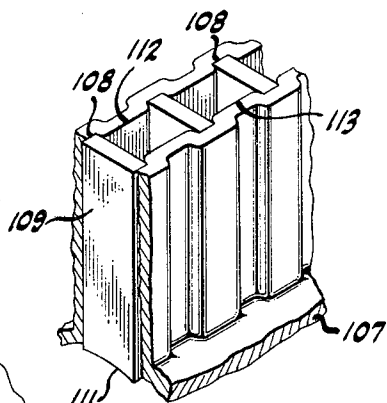


FIG-23



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LOCK CYLINDER BODY AND METHOD OF PROVIDING THE SAME

Virtually all commercially produced pin tumbler lock sets have a cylinder body and plug in combination carrying the pin tumblers. Usually, the cylinder body is externally machined from solid stock or from partially extruded stock and is internally subjected to drilling to provide not only an axially extending, interiorly smooth, circular cylindrical bore to receive the rotatable plug, but likewise is drilled at right angles to the axial bore with one or more holes to receive the tumbler pins and springs. The tumbler pin holes must be provided on exact centers or with precise spacing in order that the lock mechanism will work well. Often the cylinder body is drilled for pins from the exterior of the central portion of the body rather than from the exterior of the tongue in order that a drill jig may be introduced into the central part of the body so as to guide the drills and prevent run-out or other inaccuracies. These operations are necessarily expensive in that there is a substantial cutting of metal with a corresponding waste of stock, there is the necessity of mechanically carving the finished irregular shape and any drill holes for pins made on the exterior must later be filled in.

It is therefore an object of my invention to provide a lock cylinder body fabricated of a strip of sheet metal yet possessing all of the attributes and accuracy of the solid form of body.

Another object of the invention is to provide a lock cylinder body which is economical to construct and utilize.

A further object of the invention is to provide a lock cylinder body involving much less skilled labor and specialized machinery for its production than is now the case.

A further object of the invention is to provide a lock cylinder body in which it is not necessary to cross drill the cylinder body and subsequently to fill a portion of the cross-drilled openings.

A further object of the invention is to provide a lock cylinder body in which no de-burring is required.

An additional object of the invention is to provide a lock cylinder body having surfaces with a highly accurate finish and with considerable hardness and adaptability to long wear.

A further object of the invention is to provide a lock cylinder body which has a long life and smooth operation throughout its effective life.

An additional object of the invention is to provide a lock cylinder body which can be reproduced in series with consistently high accuracy.

A further object of the invention is to provide a lock cylinder body in which cross drilling may be omitted and top loading of the pins and springs can easily be accomplished, if desired.

An additional object of the invention is to provide a lock cylinder body having dimensional stability over a long period of time.

Another object of the invention is to provide a lock cylinder body generally improved over lock cylinder bodies presently available.

A further object of the invention is to provide a method making a lock cylinder body having the attributes above stated and which itself is an economical and effective advance in the manufacturing field.

Other objects together with the foregoing are attained in the embodiments of the invention described in the accompanying description and illustrated in the accompanying drawings, in which:

FIG. 1 is an isometric view of a strip of sheet metal having a particular configuration for use in providing a lock cylinder body;

FIG. 2 is an isometric view similar to FIG. 1 but showing a modification of an initial strip of sheet metal of the sort shown in FIG. 1;

FIG. 3 is a view similar to FIGS. 1 and 2 but showing a further modified form of initial strip of sheet metal;

FIG. 4 is an end elevation showing diagrammatically an initial step in the method of forming the lock cylinder body;

FIG. 5 is an end elevation similar to FIG. 4 and showing a subsequent step in the method;

FIG. 6 is an end elevation showing a still-subsequent step of the method;

FIG. 7 is a cross-section, the plane of which is indicated by the line 7—7 of FIG. 6;

FIG. 8 is an end elevation of a step subsequent to the step of FIG. 6 in the method of formation;

FIG. 9 is an end elevation of an additional step in the method of formation of the lock cylinder body;

FIG. 10 is a cross-section, the plane of which is indicated by the line 10—10 of FIG. 9;

FIG. 11 is an end elevation of a subsequent step in the formation method for the lock cylinder body;

FIG. 12 is an isometric view of a lock cylinder body formed in accordance with the method and having the attributes required;

FIG. 13 is an end elevation with a portion being broken away of the structure of FIG. 12;

FIG. 14 is a view similar to FIG. 13 but showing a modified arrangement;

FIG. 15 is an isometric view with portions broken away showing a further modified form of arrangement;

FIG. 16 is an isometric view with portions broken away of a further modified form of arrangement in partially finished condition;

FIG. 17 is a view comparable to FIG. 16 showing the parts in final position and with an end clip;

FIG. 18 is an isometric view of an end clip as utilized in connection with the FIG. 17 modification;

FIG. 19 is an isometric view of a duplex clip for use with a construction substantially as shown in FIGS. 16 or 17 in the absence of integral tabs;

FIG. 20 is a side elevation of such a construction employing the clip of FIG. 19;

FIG. 21 is a cross-section, the plane of which is indicated by the line 21—21 of FIG. 20;

FIG. 22 is an isometric view, portions being broken away, of a modified construction employing square pin tumbler chambers;

FIG. 23 is an extension of FIG. 22 and is of a further modified form of chamber for the employment of rectangular, flat tumbler pins; and

FIGS. 24 and 25 show alternate end fasteners.

The lock cylinder body and the method of making it are subject to numerous variations on the principal theme, and the description and drawings herein are intended simply to illustrate the principles involved, allowing for adequate variation in details.

As an example, the lock cylinder body starts out as a strip 6 of sheet metal (FIG. 1) generally of rectangular plan and having a pair of parallel side walls 7 and 8 extending at right angles to an upper surface 9 and a corresponding, parallel lower surface 11. The starting strip can be as described or in addition can have grooves 12 and 13 along its opposite margins, each groove being defined by an under-cut and rounded molded portion 14 and a tab portion 16. The strip 6 is conveniently of any suitable sort of sheet metal or comparable material and in many instances is cartridge brass. This material has sufficient ductility to respond to the process involved without substantial deterioration and sometimes with substantial, metallic improvement due to work hardening and the like. An alternate material is aluminum, which is not usually suitable for this work but because of the effects of the present process turns out to be surprisingly satisfactory.

Alternate to the strip 6 is the sheet metal strip 18 of FIG. 2. This has the same central portion as shown in connection with FIG. 1 but has been subjected to a preliminary forming operation to afford a pair of fluted ends 19 and 21 displaced from the general plane of the central portion. The forming of the end portions 19 and 21 is only roughly to dimension and is not necessarily done accurately but is done sufficiently well so as generally to characterize the configuration of the end portions

of the initial strip. In a somewhat similar fashion there can alternatively be provided a strip 23, as shown in FIG. 3, corresponding generally to the FIG. 2 strip except that at least one end portion 24 has a projecting, continuous and attached tab 26 with a number of projecting fingers 27.

Although any of the starting strips 6, 18 or 23 can be employed, it is convenient to describe the formation of the lock cylinder body in connection with the strip 6.

As particularly illustrated diagrammatically in the figures showing the method, a strip 6 (FIG. 4) is centrally poised on a concave die 31 having a semi-cylindrical cavity 32 therein symmetrical about a central axis 33. The die provides a pair of shoulders 34 and 36 so that the strip is well supported. Disposed above the die 31 is a cylindrical form 37 adapted eventually to fit half-way into the cavity 32 except for the thickness of the metal interposed. The form 37 is of considerable axial extent along an axis 38 initially parallel to the axis 33. The form 37 is transversely drilled part way through to provide one or more blind passages 39 leaving a smooth die surface elsewhere on the form. The individual axes of the passages 39 intersect the axis 38 and are parallel to each other or coplanar, the passages 39 being substantially the same shape and diameter as the pins eventually to be utilized as tumblers in connection with the lock cylinder body being formed.

After the strip 6 has been placed as described, the form 37 descends toward the cavity. There is a resulting bending of the strip 6 in the region of its central portion so as to conform generally to the resulting semi-annular space between the form and the cavity wall. Metal flow occurs during this operation, which results in the end portions of the strip extending generally upwardly and approximately parallel to each other.

Following this there is lowered toward the form 37 a plurality of forming pins 41 anchored in a carrier 42 and arranged to have the final shape and configuration of the desired pin cavities in the lock cylinder body. The pins 41 are displaced by descent of the carrier 42 so that they fit tightly but readily into the various openings 39, the pins being lowered until they are well and quite accurately supported by the form 37 and the carrier. That is, the pins 41 of the series are firmly supported at both ends in almost precisely correct position and alignment.

Subsequently, as shown in FIG. 6, a pair of side dies 43 and 44 are simultaneously and equally approached toward the pins 41. Each of the dies 43 and 44 has a quadrant cavity 46 corresponding generally to the configuration of the cavity 32 and also has a discontinuous meeting surface 47 designed ultimately to lie on the vertical axis of the assembly except for the thickness of the metal interposed. The dies 43 and 44 additionally are provided with serrations 48 corresponding to the desired exterior configuration of the lock cylinder body in the vicinity of the pin chambers.

The side dies 43 and 44 approach each other in the direction of the arrows 49 and 51 (FIG. 6) and eventually occupy the final position shown in FIG. 8; that is, with the end portions 19 and 21 of the strip disposed adjacent to each other with a gap between them defined by the nearly meeting adjacent surfaces and by the pin chambers temporarily occupied by the pins 41. As a result of this die action, the initial strip 6 is given nearly the final configuration of the lock cylinder body. The body formation is the result of substantial metal flow and deformation since the dies 43 and 44 are in effect coining dies or forging dies. They establish not only a closely accurate external configuration of the part but by causing metal flow around the accurately finished and positioned pins 41 likewise provide an accurately determined interior contour for the pin chambers. Depending somewhat upon the material of the initial strip 6, there is more or less work hardening of the material so that the ultimately resulting interior surface is quite wear resistant. Furthermore, the metal flow removes any appreciable tendency of the folded strip to spring apart later on and ensures that the finally desired configuration is permanently formed.

At the conclusion of the formation of the cylinder body, as shown in FIG. 9, the carrier 42 and the pins 41 are completely withdrawn and positioned in an entirely different location. This leaves a lock cylinder body completely formed and ready for the top reception of the tumbler pins and springs. At this stage the tumbler pins and springs can be loaded into the just-formed, upwardly open chambers in the body, the lower ends of the pins being supported on the form 37, which can be rotated slightly to present a solid surface for this purpose.

Alternatively, no pin and spring loading need take place at this stage. If there is loading, however, of the pins and springs, it is preferred immediately thereafter to move auxiliary closing dies 56 and 57 into position. As these dies mutually approach the center plane, they encounter and fold over the tabs 16 which previously have been left upstanding. The tabs are folded over by the shaped ends 58 of the auxiliary dies and in effect bend around the molded or curved portions 14 of the initial strip.

Preferably the tabs 16 are in the aggregate something shorter than the width of the lock cylinder body to leave a slight space between them. The folded tabs keep any loaded tumblers and springs in position, and the space between them serves as a breathing opening or drain opening should the lock cylinder ultimately be installed in inverted position.

In the event the lock cylinder body is not loaded adjacent the stage shown in FIG. 9 of the drawings, the tabs 16 are left open. In any event, when the lock cylinder body is finished at the stage shown in FIG. 9, the form 37 is axially withdrawn and the auxiliary dies 56 and 57, if used, are withdrawn, as are the side dies 43 and 44. The lock cylinder body at that stage is then removed from the die 31.

If the removed lock cylinder body is then subsequently charged with tumbler pins and springs, it can later on be returned to a fixture of a comparable nature, as shown in FIG. 11, and the previously upstanding tabs 16 can be then folded over. The finally resulting cylinder body is in appearance substantially as shown in FIG. 12 and can be readily interchanged with a standard cylinder body formed in the classical way described initially. It has been found in extensive tests and in operation that this lock cylinder body is at least the equal of those previously supplied as to operation and life but is considerably cheaper and has some attributes uniquely its own. One is that the interior cylindrical surface 61 of the formed body is quite accurate in its dimensions and has a highly finished resulting surface determined by the finish of the form 37. Similarly, the interior cylindrical surfaces of the pin chambers in the two-part tongue 62 are likewise similarly highly finished and are somewhat work hardened. The parts are quite accurately positioned and are completely without burrs at the intersection of the pin chambers with the plug chamber.

In the event aluminum is utilized as the sheet metal starting strip, the interior surfaces, if not sufficiently hard, can readily be subjected to an anodizing operation, which imparts an extremely hard wear surface thereto. In that instance the exterior may or may not also be anodized to provide different colors in order to distinguish certain runs of cylinder bodies from other runs thereof.

As shown particularly in FIG. 13, while the initial strip 6 need not have the molded configuration 14, it is preferred that it do so in order that the tabs 16 when folded inwardly have a large radius of curvature 63 in order not to have any areas of high stress concentration and in order that the curved or molded portion serve somewhat as a guide. It is, of course, possible to omit one of the tabs 16, for example, and to extend the other tab 16 at least partly over the pin chamber to retain the pins and springs therein. If a tab is provided simply on one side, it is preferred to make it a tab 64 somewhat longer than the tab 16 so that it extends far enough over the pin chamber to afford substantial support around at least most of the periphery of the underlying tumbler spring. A space 66 for drainage may, if desired, be provided.

In some instances, also, it is desired not to have the initial grooves 12 and 13 on the starting strip 6, but to leave those

edges simply linear and planar as first described. In that instance, since there are no tabs on the initial strip, it is formed, usually by the operation of the side dies 43 and 44, with grooves 67 and 68. These are to receive an entirely separate second strip 69 of sheet metal preformed to provide intumed flanges 71 and 72 designed to be engaged endwise with the grooves 67 and 68. The strip 69 covers over the pin tumbler chambers.

In the event it is desired to have some extra retention of the outer portions of the two-part tongue 62, an elongated tab 73 can be provided with its own fingers 74 corresponding to the fingers 27 in FIG. 3. In fact, the structure of FIG. 16 can be derived from the initial strip 23 of FIG. 3. This is done by further coining which does not disturb the tab 73 or the fingers 74 materially, but the tab 73 is bent downwardly to cover the pin chambers and the fingers 74 finally are bent downwardly with respect to the tab 73 preferably to lie in the serrations or channels between the successive pin tumbler chamber walls. This is illustrated in final form in FIG. 17.

There is an easily realized possibility of providing an end clip 76 (FIG. 17) further to retain together the end portions 77 and 78 of the two-part tongue. The clip 76 can simply be positioned frictionally around the end portions. A further advantage is attained if the clip 76 is made of extremely hard material with an extension 79 adapted to dovetail into a recess 81 (FIG. 16) in the barrel portion of the cylinder body. The portions 76 and 79, being quite hard, tend to resist any attempt to drill into the cylinder body in order to displace or disrupt the pin tumblers to open the lockset. A hardened clip 76 can be positioned at one or both ends of the cylinder body.

A further variation of the separate clip concept like that shown in FIGS. 15, 17 and 18 can be afforded with the arrangement shown in FIGS. 19, 20 and 21. In this latter arrangement the cylinder body 82 although fabricated as before has no integral closing tabs of its own but is preferably formed with some under-cut grooves 83 and 84 at one or preferably both ends. Spanning all of the otherwise exposed pin tumbler chambers is a closure strap 86 of slightly springy and initially bowed material having at opposite ends some intumed flanges 87 and 88. These flanges can initially be substantially parallel and be sufficiently flexible as to be bent inwardly toward each other. The strap 86 can likewise include a guard extension 89 like the extension 79 of FIG. 18. With this arrangement, the separate strap 86 is positioned over the previously formed two-part tongue of the cylinder body, and when finally positioned the flanges 87 and 88 are crimped inwardly to afford a firm interlocked holding. Here again, if the strap 86 is made of hard material, it becomes very difficult to drill into the pin tumbler section of the cylinder body.

Since the manufacture of the cylinder body does not depend upon a drilling or rotary operation to form the pin tumbler chambers, it is feasible to provide an arrangement as shown in FIGS. 22 and 23. In this instance the pin chambers 101 are formed on pins 102 which are not circular cylindrical in configuration but rather are square cylinders. The square pins are received in appropriate recesses in the form 37 and otherwise act just as do the pins 41 shown in connection with the circular cylindrical configurations. The lock cylinder is otherwise the same as previously described, but in this instance since the pin chambers are non-circular they may be utilized in connection with square tumbler pins 103. These, being non-rotatable, can

have a polarized special configuration including a circular cylindrical lower surface 104 to conform exactly to the external, circular cylindrical configuration of the usual rotary plug. Standard, circular cylindrical tumbler pins can be utilized in the plug, as they have at least point contact with and describe an arcuate path against the concave surface 104 of the square pins. The surface 104 continues exactly the interior circular cylindrical surface 106 of the cylinder body. The plug pins thus do not suffer any axial disruption in movement in sweeping over the substantially continuous interior cylinder and square pin surfaces. This affords slightly easier than usual rotation of the plug and slightly greater than usual accuracy in axial positioning of the tumbler pins.

While the non-circular pins of FIG. 22 are preferably square, they are not necessarily so. As shown in FIG. 23, the cylinder body 107, although quite similar to the previously formed cylinder bodies, is designed to have non-circular, rectangular pin chambers 108 distinguished in their proportions from the square pin chambers and adapted to receive relatively flat, rectangular pins 109 having circular cylindrical or concave arcuate lower surfaces 111. It is not essential that the tumbler chambers 108 be entirely and completely surrounded by walls. In fact, the two-part tongue of the FIG. 23 construction exemplifies the possibility that some of its interior wall surfaces 112 and 113 may be spaced apart. The non-circular tumblers as shown in FIGS. 22 and 23 are somewhat akin to the wafer tumblers sometimes utilized but are herein characterized as pin tumblers despite their non-circular shape in order to illustrate the general adaptability of the present cylinder body construction and the method of constructing the cylinder body.

Instead of a separate closure clip at the end or ends of the cylinder body, an integral holding device or devices can be employed. In FIG. 24, there is shown a body 116 having a dove-tail socket 117 formed in one of the end flanges 118 thereof. The other end flange 119 has a tongue 121 formed integrally therewith. The tongue has a dove-tail end 122 which occupies the socket 117 when the tongue is deformed to lie transversely of the cylinder body. The parts are thus firmly held together even despite any residual "spring" in the body portions after deformation.

The arrangement of FIG. 25 is similar in that one flange 123 of the body has a notch 124 therein while a prong 126 projects from the other body flange 127 and after passing through the notch 124 is bent to overlie the side of the flange 123. In this way, also, the body is held in the desired position.

What is claimed is:

1. A lock cylinder body comprising a strip of sheet metal having a central portion folded upon itself to define an approximate cylinder and having end portions extending approximately radially from said cylinder and disposed adjacent to each other with a gap between them defining a tumbler tongue, and means on and integral with at least one of said end portions forming a tab disposed to extend from said one end portion at least part way across said gap.

2. A lock cylinder body as in claim 1 in which said tab extends across the radially outer end of both of said end portions.

3. A lock cylinder body as in claim 2 in which said tab on said one end portion has fingers extending radially against the other of said end portions.

* * * * *