This invention relates to improvements in tamper-proof padlocks, and more particularly to a padlock structure designed to prevent the operative insertion of shims or the like around a leg of the padlock shackle.

In the manufacture of padlocks of the pin, lever and disc tumbler type, whether the padlock bodies or cases be of solid stock or laminated, it is the practice to provide in the body or case a pair of spaced longitudinally extended openings of uniform size and shape to receive the extended leg and the short leg or toe of the padlock shackle. These shackle leg-receiving openings are ordinarily bored, drilled or cast in uniform diameter for smooth and easy longitudinal movement of the shackle as the padlock is opened and closed. In practice it is necessary to have these openings of slightly greater diameter than the diameter of the shackle to facilitate shackle alignment and to permit easy movement of the shackle and to compensate for slight variations in the size and shape of the shackle legs.

Padlocks of the pin, lever or disc tumbler type all include one or more internal spring urged levers adapted to enter shoulders or recesses in the shackle legs to hold the shackles in their inner retracted positions when the padlocks are closed and locked. Due to the fact that the shackle-receiving openings in a padlock body or casing are of slightly greater diameter than the padlock shackle and the fact that the holes may ultimately be slightly enlarged due to use and wear, burglars, thieves and tamperers have developed the art of surreptitiously opening such padlocks by the use of thin metal tools, bits or picks, hereinafter designated as "shims," which are inserted within a portion of a shackle opening of a padlock about the shackle leg and then manually moved accurately in either direction to contact and force back the spring urged locking lever, thereby producing an unauthorized release of the shackle and opening of the padlock without the use of a key or dialing operation (respecting a combination or keyless padlock).

With the foregoing in mind it is a primary object of the present invention to provide a tamper-proof padlock wherein the possibility of unauthorized operation of the locking lever through the operative turning of an inserted thin metal shim or like within a shackle hole is prevented by the provision within the shackle hole of a ring of alternating recesses and shoulders, the latter locally reducing the diameter of the shackle opening and providing shoulders which engage and block an inserted and turned shim before it can contact and operate the locking lever.

In padlock constructions of the type under consideration the shackle legs are intended to have slight lateral play or movement within the openings provided therefor in the padlock cases, and this is also true of that portion of the toe of the shackle which is provided with a shouldered recess for the purpose of receiving the locking lever. The present invention, by the provision of a reduced ring within the shackle opening provided with alternate shoulders and recesses more closely encircles the shackle leg in the areas of the shouldered portions of the ring and hence serves as a deterrent to the use and operation of an inserted tampering shim or tool.

A further object of the invention is to provide in a padlock casing a shouldered and notched ring-like extent within a shackle hole which provides shoulders to engage and obstruct any circular movement of an applied thin metal shim to the extent that the shim, when pressure is applied thereto, may be bent, twisted, broken or deformed without operatively engaging the locking lever of the padlock.

A further object of the invention is to provide a tamper-proof padlock of the character described having a shim blocking means within a shackle hole so arranged as to not interfere with the normal movement and operation of the shackle and which will be wearproof, notwithstanding frequent operations of the padlock, but will prevent unauthorized opening of the padlock through the insertion of a shim or the like around the padlock shackle.

A further object of the invention is to provide a padlock having means for preventing surreptitious operation of a shim inserted in a shackle opening, which construction does not complicate the ordinary manufacture and assembly of the padlock, nor add materially to the cost thereof, which is strong and durable, and which is extremely effective.

A further object of the invention is to provide a tamper-proof padlock which is of very simple construction, which increases the utility and performance, and safety of the padlock, and which is well adapted for the purposes described.

With the above and other objects in view, the invention consists of the improved tamper-proof padlock and its parts and combinations as set forth in the claims and all equivalents thereof.

In the accompanying drawings, in which the same reference characters indicate the same parts in all the views:

Fig. 1 is a vertical sectional view through a laminated padlock provided with the improved tamper-proof ring construction within one of the shackle legs omitted from said view;

Fig. 2 is an enlarged fragmentary detail sectional view of a portion of the laminated casing of the padlock with the short leg or toe of the shackle within a casing opening thereof, the latter being arranged with a recessed and shouldered plate to prevent manipulation of an inserted shim, the locking lever being omitted from said view;

Fig. 3 is an enlarged fragmentary view taken approximately along the line 3—3 of Fig. 1 with the shackle leg omitted;

Fig. 4 is a plan view of the lever guard plate used in a laminated padlock construction to provide the notched and shouldered circular extent of the shackle leg-receiving opening in the vicinity of the locking lever;

Fig. 5 is a longitudinal sectional view of the lever guard plate taken on line 5—5 of Fig. 4;

Fig. 6 is an enlarged fragmentary detail sectional view through a portion of the padlock casing provided with a shackle-receiving opening and showing the reduced circular area of shim obstructing alternate shoulders and recesses, the view also showing in broken lines the manner in which an applied shim is blocked against circular movement as it is moved toward the engaged end of the locking member which is also shown in broken lines; and

Fig. 7 is a fragmentary detail sectional view of the invention as applied to a padlock casing which is solid or non-laminated.

Although the invention is not to be restricted thereto, for purposes of illustration, in the principal form of the invention, the padlock body or case 10 is of laminated construction and is built up of a plurality of superimposed secured-together plates 11 provided internally with parti-
3. tions and walls to define cavities for certain of the lock mechanism. Housed within cavities within the case 10 are a spring urged locking lever 12 and a key-operated cylinder 13 housing pins and having a mutilated inner end portion 17 which is adapted to engage the recog-
cnize the locking lever 12 under the action of a proper key inserted into the cylinder 13. While the padlock illus-
trated is of the pin type it could, within the scope of the present invention, be of any conventional type and the locking lever 12 could also be used in disc tumbler or lever while a laminated pack-

case 10 is illustrated in Figs. 1 and 2, the case could be of solid construction as indicated at 10' in the modifica-
tion of Fig. 7.

Regardless of the form the padlock case takes, it is

provided with a pair of spaced-apart longitudinally ex-
ten shackle leg-receiving openings 14 and 15 which open through the top plate of the padlock casing and which longitudinally movably receive respectively the long leg 16 and the short leg or tool 17 of the padlock shackle. The short leg or tool 17 of the padlock shackle at its inner end is provided with a shouldered notch 19 which is engaged by the projected end portion of the locking lever 12 for shackle locking purposes.

In the manufacture of a padlock body or case the

shackle receiving openings 14 and 15 are of uniform size and shape and are of slightly greater diameter than the diameter of the shackle legs to permit easy movement of the shackle therein to compensate for slight varia-
tions or inaccuracies in the size and shape of the shackle legs. The clearance between the shackle openings 14 and 15 and the shackle legs is also desirable to permit clearance and free operation of the shackle legs should foreign matter or dirt enter the shackle openings, and in the case of a laminated padlock body, the larger size of the openings compensates for any variations or in-
accuracies in the holes in the superimposed plates when they are lined up and assembled.

The necessity for slight clearance as between the walls of the shackle holes and the inserted legs of the shackle has, however, invited the practice by thieves and tam-
erers of inserting into the shackle holes around the shackle thin metal shims or the like which, when turned ac-

rately, can engage the end of the locking lever 12 and force it free of the shackle toe notch 17 and thus release the shackle and unauthorized open the padlock. To guard against this unauthorized tampering practice, the present invention aims at providing within a shackle hole of a padlock casing, such as the opening 15 in the embodiment illustrated, a circular or ring-like area in the vicinity of the locking lever and formed of alternate recesses and shoulders which locally reduce the circum-
ference of the shackle leg opening 15. As will best appear from Figs. 2 and 3, one of the uppermost plates of the padlock case 10, as for instance the plate 20, is

formed with an opening 21 provided with alternate curved recesses 22 and shoulders 23. The in-set edges of the recesses 22 lie in a circle described on a radius slightly less than the radius of the case opening 15 in the body therebelow as shown in magnified or exaggerated form in Fig. 2. Also the protruding curved edge portions of the shoulders 23 lie along a circle described on a radius slightly less than the radius of the circle which includes the in-set walls of the recesses 22. Hence the opening in the plate 20 is reduced slightly relative to the major extent of the case opening 15 and is further slightly re-
duced by the shoulders 23. This reduction, occasioned by the recesses 22 and shoulders 23, takes place in the casing cavity immediately adjacent the opera-
tive edge of the locking lever 12.

Fig. 6 is an enlarged or magnified view of that upper corner portion of the padlock case 10 which includes the shackle leg opening 15 and the shackle leg 17 there-

within, the further showing the blocking action imposed on a tampering shim 24 or the like inserted by a thief or tamperer into the upper end of the opening 15 around the shackle leg 17. In practice the shim or tool 24 may be a very thin piece of spring steel or metal curved to partially surround the shackle leg and it is inserted into the upper end of the opening 15 around that side of the shackle leg which is opposite the locking lever 12. After being wedgingly inserted, the shim 24 is manually worked circularly in either direction with the expectation of bringing an edge thereof into contact with the engaged end of the locking lever 12 to force the lock or close the plate of the shackle notch 19 to thereby release the shackle and unlock the padlock. With the present improvements, although the shim might be wedged into the upper end of the shackle opening between its wall portions and the shackle leg 17, when an effort is made to turn the shim, one end thereof will spring or bow outwardly slightly into a recess 22 and will ultimately contact a shoulder at the end of said recess 22 as at (a) or (b) in Fig. 6. This will prevent further rotation of the shim and pre-
vent it from reaching the locking lever 12, which is shown in broken lines in Fig. 6. Be the shim inserted opening of the padlock through the use of the shim 24 is effec-
tively prevented. The alternating recesses 22 and should-

ers 23 in the plate 20 cause the thin metal shim to be-
come positioned eccentrically with respect to the plate opening 21 and furthermore wedges the shackle leg 17 against side diameter dimensions of the plate opening 21 as at (c), eliminating clearance for any addi-
tional metal or progress of the shim. The thin shim, in being moved, may wrinkle or bend slightly into one or more of the recesses 22. The shim must be inserted into the case opening 15 along the outside edge of the shackle leg because any other position thereof would place it over the locking lever 12 in a position where it would be in-
effective in respect to releasing the locking lever.

It will be observed, particularly from Fig. 2, that the

case opening 15 below the plate 20 is of slightly greater diameter than the largest diameter of the recessed por-
tions of the plate opening 21. This obviously serves to re-
strict or block movement of an inserted shim, and if a portion of an inserted shim projects into the enlarged portion of the shackle opening 15 below the plate 20, then, when force is applied to the shim, that portion which is within the notched and shouldered opening 21 of the plate 20 has to bend or buckle, and smooth sur-
faces around which it might be freely moved are absent.

As was mentioned heretofore, the concept of providing within a shackle opening in a padlock body a notched and shouldered extent can be applied to padlock bodies other than those of the laminated type shown in Fig. 1. For instance, in Fig. 7 the padlock body 10' is of solid metal and is provided with a shackle opening 15' which at its upper end may be enlarged to have effec-
tively inserted therein a semi-metallic ring 20' whose bore is slightly less that of the opening 15' there-
below and which ring, on its inner surface, at a suitable depth is provided with alternate recesses 22' and shoul-
ders 23', the latter further reducing the effective internal diameter of the opening 15'.

From the foregoing description it will be apparent that the improved padlock construction is such that a shackle leg-receiving opening having a locking ring-like extent of alternating recesses and shoulders, effectively prevents the operation of a locking lever releasing shimm without complicating the manufacture and operation of the pad-
lock. The tamperproof padlock is of simple and novel construction and is well adapted for the purposes de-
scribed.

What is claimed is the invention:

1. In a lock having a body with a circular opening extending inwardly therein from one end, a shackle hav-
ing a leg thereof movably receivable by said circular opening, and a locking lever operatively mounted within the body and having a cam-like shoulder end portion releasably
engageable with a portion of the shackle leg within said opening, which lever end portion is susceptible of being contacted and releasably moved by a shim inserted into said body opening when moved circularly, spaced shoulders formed within a narrow axial extent of the body opening inwardly of its end and adjacent a portion of the locking lever to locally reduce the diameter of a portion of the opening and obstruct contact between a shim inserted into the body opening and said locking lever end portion.

2. A lock, comprising a laminated body formed of a plurality of superimposed, secured-together plates, plates adjacent one end of the body being formed with aligned openings to provide a shackle leg socket, which extends inwardly from one end of the body, a shackle having a leg thereof movably received by said body socket, a locking lever operatively mounted within the body and having a cam-like end portion extending laterally into an inner portion of said socket and releasably engageable with a portion of the shackle leg within said socket susceptible of being contacted and moved by the circular movement of a shim inserted into said body opening, the opening in one of the body plates adjacent the locking lever being of reduced size and its walls being formed with spaced-apart shoulders.

3. A lock, comprising a laminated body formed of a plurality of superimposed, secured-together plates, a plurality of adjacent plates adjacent the top of the body being formed with aligned circular openings to provide a shackle leg socket extending inwardly from the top of the body, a shackle having a leg thereof movably received by said body socket, a locking lever operatively mounted within the body and having a cam-like end portion extending laterally into an inner portion of said socket and releasably engageable with a portion of the shackle leg, said lever end portion being susceptible of being engaged and unauthorizedly operated by a shim inserted into said socket and moved circularly, the opening in a body plate above the locking lever being of reduced size and its wall being formed with spaced-apart shoulders whose projecting edges lie in a circle of less diameter than the diameter of said plate opening.

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