No. 629,192. Patented July 18, 1899.

D. KAVANAGH.

BILLIARD CUSHION.

Application filed May 4, 1899.

(No Model.)

Fig. 1.

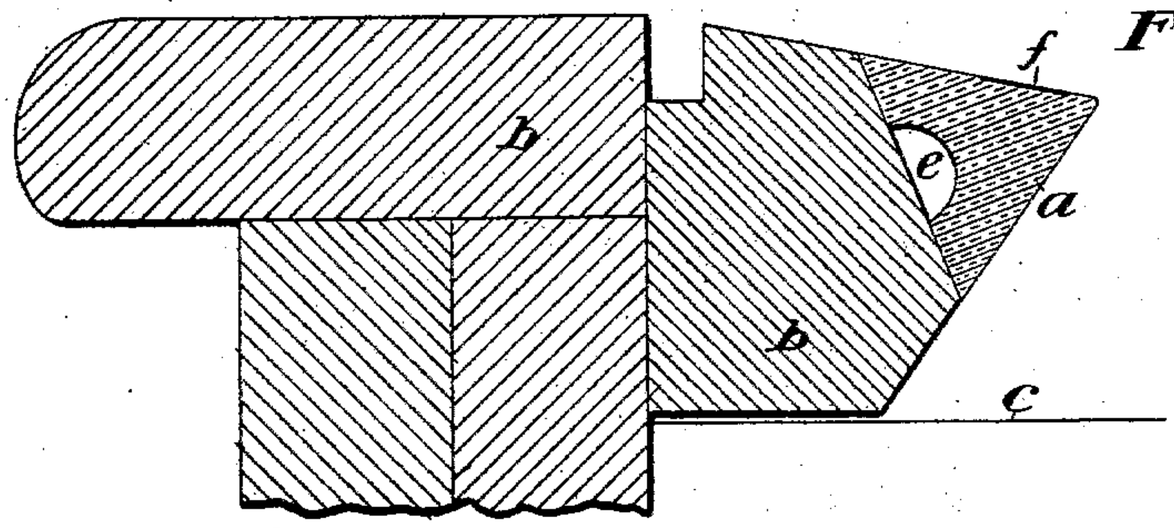


Fig. 2.

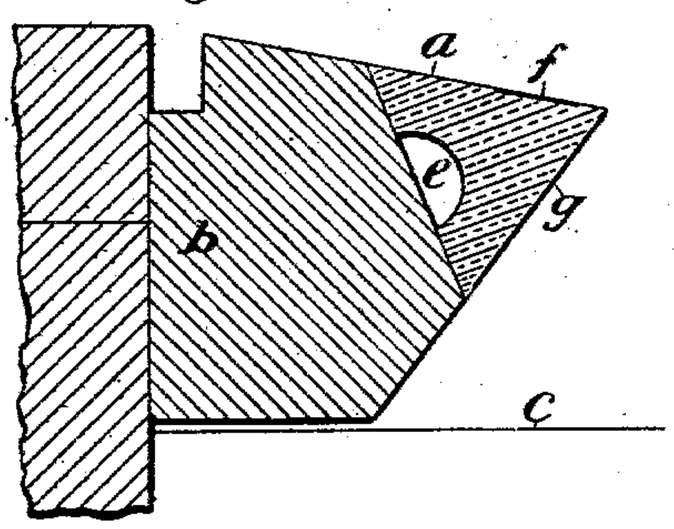


Fig. 3.

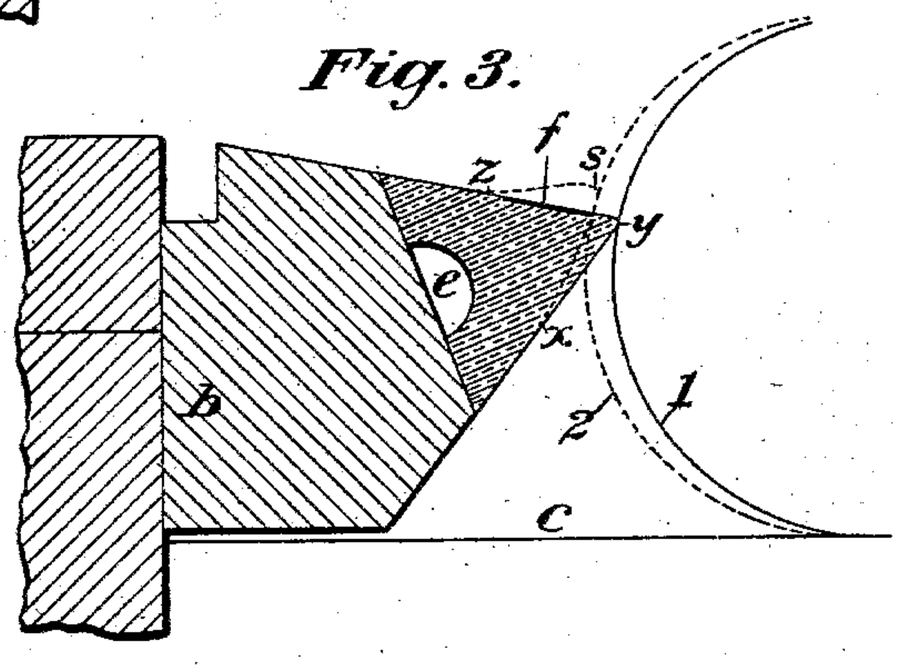


Fig. 5.

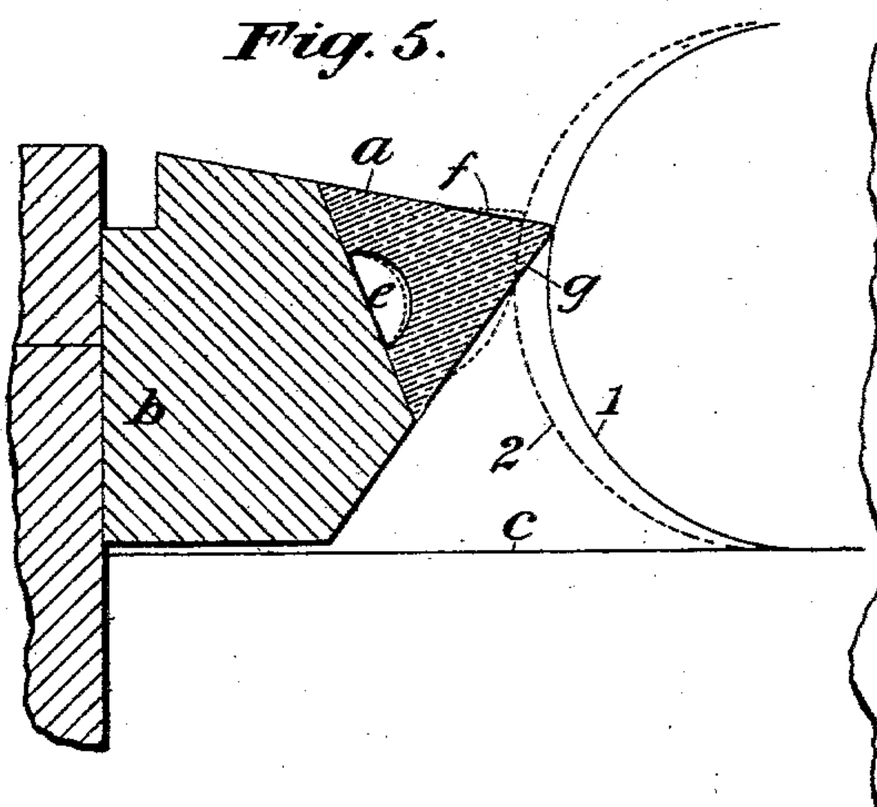
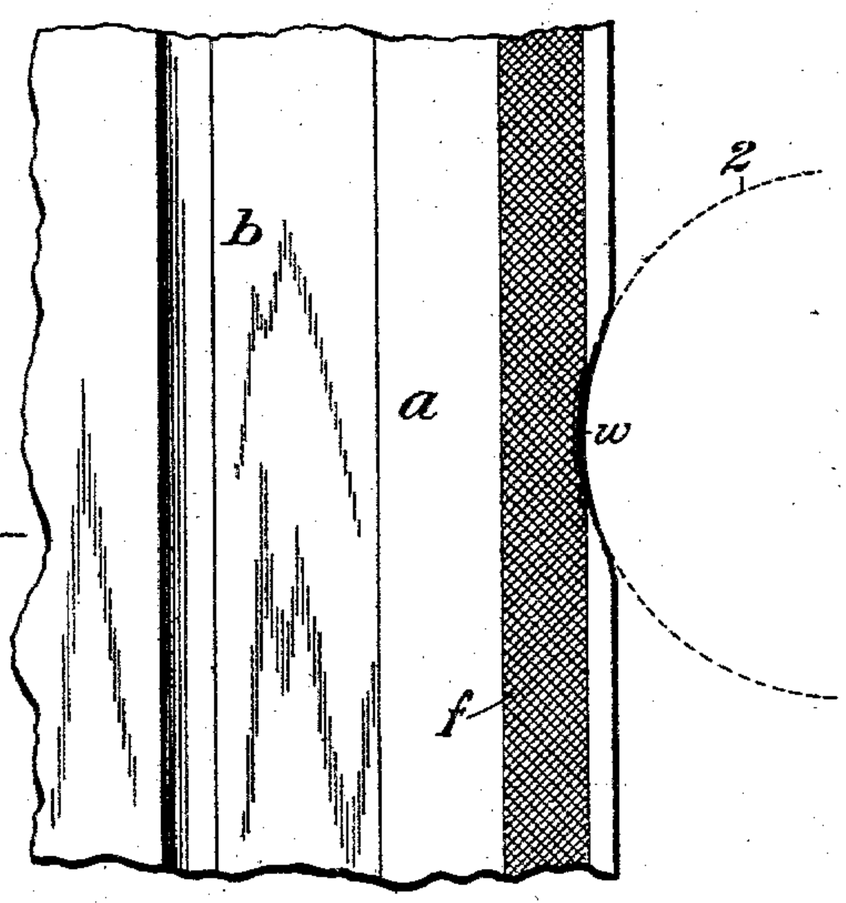


Fig. 4.



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UNITED STATES PATENT OFFICE.

DUDLEY KAVANAGH, OF NEW YORK, N. Y.

BILLIARD-CUSHION.

SPECIFICATION forming part of Letters Patent No. 629,192, dated July 18, 1899.

Application filed May 4, 1899. Serial No. 715,535. (No model.)

To all whom it may concern:

Be it known that I, DUDLEY KAVANAGH, of Manhattan borough, New York city, county and State of New York, have invented a new and useful Improvement in Billiard-Cushions; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to billiard-table cushions of that type which is now and has been for some years almost wholly the kind made and used—namely, cushions composed each of a strip of vulcanized-rubber compound having a cross-sectional shape approximately triangular and arranged, in conjunction with the cushion-rail and bed of the billiard-table, in such a manner that a ball such as used on the table will when caused to roll on the table-bed and to contact with the cushion have the initial point of contact between itself and the nose or upper edge of the cushion's work face at an elevation above the table-bed somewhat greater than that at which lies the center of the ball.

As is well known to those skilled in the art of making billiard-tables and understanding the game of billiards, the necessary elements of a satisfactorily-operating cushion are accuracy in the angles of incidence and reflection when a ball is played against the cushion, the greatest practicable degree of repellent power—that is, a capacity in the cushion to afford as much "legs" to the ball thrown off as possible—responsiveness when delicate strokes are played—that is, the capacity of the cushion in an eminent degree to properly repel or throw off either an object or the cue ball when the ball may strike the cushion with very little force—a capacity to throw off a ball at the correct angle when it shall have approached the cushion at an exceedingly acute angle, non-liability to cause or permit a ball to "jump" when played with great force against the cushion, and a capacity to retain for a comparatively long time all these essential qualities with which the cushion may be endowed when new, or, in other words, great durability. As it is a fact in practice that a cushion possessing in the greatest possible degree some one or more of these desirable qualities must therefore be lacking to an undesirable extent some other one or more of such qualities, it follows that to produce the best possible cushion practically the latter must embody the happiest possible combination of these individually somewhat antagonistic structural features. In other words, to produce the most satisfactory results these several and separately desirable but in some measure antagonistic qualities or characteristic features must be combined in such proportions as to produce a harmonious whole from which the best results desirable from a combination of such elements (the quality of each of which is in some measure necessary) may be obtained.

In order that a ball played with considerable force against the cushion shall not jump, the latter must have its working face located in a plane oblique to that of the table-bed or must form an angle with the table-bed considerably less than a right angle, (in the well-known manner,) into which angle the ball is "wedged," so to speak, when it strikes and is more or less embedded in the cushion; but inasmuch as the ball will be repelled or thrown off by the cushion with less and less speed just in proportion as the degree of obliquity of the cushion's working face is increased therefore it is important that this degree of obliquity be reduced to the minimum. If that part of the cushion's face with which the ball contacts in the case of the hardest strokes played at such angle as tends to a very forcible impact of the ball and cushion were perpendicular to the plane of the table-bed, the reactive power of the cushion on the ball—*i. e.*, its capacity to quickly and forcibly throw off the ball—would be the greatest possible; but such form or arrangement of this part of the cushion's face is entirely impracticable, because with it the balls would jump to such an extent that the table would be useless for the game of billiards. Hence the departure from the perpendicular to the oblique form of the cushion's working face must be only to the extent necessary to avoid the jumping of the ball, thus rendering the cushion capable of repelling or throwing off the ball with the greatest practicable speed. In other words, the degree of obliquity of the face of the cushion must be such that the cushion will be as

"fast" a one as possible without liability of the balls jumping.

While it is necessary or unavoidable that the ball shall be embedded in the upper part of the working face of the cushion, this embedment should be as little as possible, especially in the case of a stroke with the angles of incidence and reflection comparatively non-acute, since this embedment impairs accuracy in the angles of the stroke, and many ways have been devised and used to render the cushion capable of powerful repellent action without getting perceptible and undesirable inaccuracy in the angles of the stroke. Most of the devices or means employed for this purpose are generally denominated "face-hardening" devices, and some such means for the specific purpose of preventing too much embedment of a ball striking the cushion with considerable force and at an angle not very acute may be employed in the construction of my improved cushion if found to be expedient, though in my improved cushion the necessity for the presence of some face-hardening means is not so necessary as in the cases of all previously-devised cushions that I know of, because in my cushion, as will be presently explained, less embedment of the ball can occur with a given degree of repellent capacity.

As is well known, the incorporation of face-hardening devices in the molded cushion-strip of rubber compound as a general rule leads to the objections that the cushion, though it may work well when new will soon lose its life—that is, will grow slow in action and will soon work imperfectly and unsatisfactorily, owing mainly, as I understand the matter, to the practical impossibility in most cases of making a cushion so that the rubber compound of the strip will remain in perfect union with the face-hardening device. In order that in playing a ball against the cushion at a very acute angle it shall promptly leave the point of contact therewith at a correct angle, (and not slide on the contacted surface to the least extent,) I deem it necessary to have the working surface of the cushion exceedingly impressible—that is, highly elastic and very responsive to the touch of the ball—and this quality is also very necessary where the ball has to be played very easily against the cushion even at a nearly or quite right angle and is required to rebound only a short distance. Therefore if any face-hardening device be employed it should be molded in or placed so far in rear of the actual working face of the rubber strip as not to interfere with the structural qualities just explained to be very important, while at the same time operating perhaps to render the cushion quicker when very hard strokes may be played.

As the material of the cushion-strip is perfectly incompressible, though highly elastic, by reason of the great mobility of the particles of the mass and the power and rapidity with which they resume their normal relationship after distortion of the shape of the mass—as, for instance, by the impact of a ball against the nose and upper working face of the cushion—the practical problem presented for solution in the devisement of a billiard-cushion that shall be as near perfection in all particulars as possible has ever been to construct the cushion so that while possessing in an eminent degree the peculiarities I have explained as being necessary the manner of displacement of the particles of the mass shall be such that in resuming their normal relationship the cushion will act with the greatest possible ball-repellent force. In other words, in order to make the cushion act on the ball with the greatest possible degree of repellent force it must be made so that when the ball strikes it the displacement of the particles in or the disbursing of the mass of rubber compound shall be such that in resuming the normal condition the cushion will exert the greatest possible action on the ball in the right direction and in the best possible manner for the purpose desired. Now, as is well understood, the cushion being made necessarily with an oblique working face and a comparatively sharp working upper edge or "nose" the effects of a ball striking the nose or working face of the cushion are to bend upwardly and backwardly the extreme forward edge or nose and at the same time to displace the particles of the mass so as to produce a hump in the top surface of the mass in rear of the nose or working edge. Now when under these conditions the mass of rubber compound resumes its normal shape, thereby repelling or throwing off the ball, its action on the ball operates in a large measure to press the ball downwardly toward or against the bed of the table, because the upturned nose and the upwardly-displaced particles (or the hump above alluded to) in the resumption by the mass of its normal shape necessarily produces this effect; but, as I have above explained, the best possible repellent action of the cushion is attained when in the resumption of its normal shape or condition the movement of the displaced particles shall be such as will cause them to press against the ball in a direction approximately horizontal. In other words, to get the most desirable action practically possible the construction and operation of the cushion should be such that when struck by the ball the particles of the mass shall be forced as nearly rearwardly or backwardly in a horizontal direction as practicable, so that in the reaction of the cushion on the ball they will move forwardly as nearly as practicable in a horizontal direction. By such mode of action not only is the ball not wedged in beneath the nose of the cushion, so that less of the reactive power of the cushion will be expended in "unwedging the ball," so to speak, but, furthermore, a maximum proportion of the reactive force of the cushion operates to throw off the ball in a plane approximately

parallel with that of the table-bed, and hence the ball will leave the cushion with more legs or at a greater speed than under other conditions, and upon this theory of the principle of construction and mode of operation rests my invention, which may be said to consist, essentially, in the combination, with the rubber cushion-strip, of means for preventing the particles of the mass from being displaced upwardly in rear of the nose when the ball strikes against the latter and for causing a displacement of the particles of the mass in an approximately rearward direction, so that in resuming its normal shape the particles of the rubber strip will move and act so as to repel the ball as nearly as possible in a horizontal direction, all as will be hereinafter more fully explained and as will be most particularly pointed out in the claims of this specification.

To enable those skilled in the art to make and use my improved cushion, I will now proceed to more fully describe my invention, referring by letters and figures to the accompanying drawings, which form part of this specification and in which I have shown my improvement carried into effect in that precise form of cushion in which I have so far practiced it, though it may be carried out either wholly or in part under some modifications thereof.

In the drawings, Figure 1 is a vertical cross-sectional view of so much of a billiard-table as it is necessary to show in order to illustrate my invention in one form of it or carried out as to the main part of it. Fig. 2 is similar view, but showing the invention embodied as to both of its features or parts. Fig. 3 is a cross-sectional view illustrating the natural tendency and action relatively to the displacament of the particles of the rubber mass composing a cushion-strip of the modern approved form when struck by a ball. Fig. 4 is a top view of what is illustrated in vertical section of Fig. 3. Fig. 5 is a similar cross-section to Fig. 3, but showing how the displacement of the particles of rubber occurs in my improved cushion-strip.

In the several figures the same part will be found always designated by the same letters and figures of reference, and in some of the figures I have illustrated by circular, full, and dotted lines a billiard-ball coacting with the cushion.

a is the rubber cushion-strip, made of vulcanized-rubber compound and of about the usual approved size and cross-sectional shape and secured in the usual manner to the wooden lining of the cushion-rail *b*, that is bolted (in the ordinary way) to the bed of the table, the playing-surface of which is illustrated by the line *c*. It may, however, be remarked right here that in making my improved cushion I prefer that it be of the maximum size of cushion-strips and contain a comparatively large percentage of pure rubber; also, that the recess or concavity at *e* in the rear surface of the molded strip, which is usually (though not invariably) formed in the strip *a*, is of very great advantage in my improved construction of cushion and is preferably made comparatively large, since in the use of my cushion the displacement of the particles of the rubber mass is so different from that in other cushions as to render it quite desirable that this cavity *e* (between the rear surface of the cushion and the plane surface of the wooden cushion-rail lining) be comparatively large.

By reference now to Fig. 3 it will be understood that when a ball, such as illustrated by the full circular line 1, forcibly contacts with the nose or working surface of the rubber strip the latter will be distorted from its normal cross-sectional shape shown in full lines to the shape or condition illustrated by the dotted lines, and it will be seen that when the rubber particles resumé their normal positions the tendency and action of the cushion during this restoration to its natural shape is to press downwardly and forwardly on the surface of the ball (illustrated by the dotted line 2) in repelling or throwing off the ball, and that therefore a large percentage of the repellent power and action of the cushion is consumed in unwedging the ball (as I have hereinbefore expressed the idea) from between the bed-surface *c* of the table and that part of the oblique face of the cushion which was in forcible contact with the ball's surface at a locality wholly (and some distance) above the center of the sphere, and it will also be readily understood that while perhaps a very small amount of displacement of the rubber particles may occur in a rearward direction and be dissipated at the rear surface, imperceptibly changing the shape of the mass at the vicinity of the rear recess or cavity *e*, practically about all the displacement of particles amounts merely to a translation of the particles normally occupying the approximately triangular area *x y z*, Fig. 3, to the somewhat similarly-shaped area marked *z s x* in the same figure. Of course I can only describe and illustrate this approximately correct manner of displacement with substantial, not mathematical, accuracy, and it will be observed that for the sake of distinctness in my illustrations I have not shown in the drawings the green cloth covering which always envelops the oblique working face and the top surface of every billiard-cushion in a finished and operative condition, and while it is true that the operation or action of a naked cushion when struck by a billiard-ball is modified by the presence of the usual cloth covering what I am describing and illustrating is substantially correct with reference to the covered or finished cushion-strip.

As I have made the accompanying drawings on a scale of full size as to the cushion and the ball it presents to the eye just about the actual conditions herein described.

By reference especially to Fig. 4 it will be

seen that the displacement of the rubber particles diminishes laterally from the point *w* in either direction to where the dotted circle 2 of the ball runs out of contact with the cushion, and it will be understood, of course, that the vertical cross-sectional views are made on planes which coincide with the point *w* of the top view, Fig. 4. *f* is a narrow strip or ribbon-like piece of some textile fabric, preferably a tolerably thin but strong quality of canvas, that is molded onto the top surface of the rubber strip *a* at about the locality shown. In practice this strip of canvas is properly placed in the mold in which the plastic or dough-like rubber compound is put in the usual process of manufacture of cushion-strips and in which the strip, with its adjuncts, is subjected to the vulcanizing process. The canvas *g*, which by preference covers the entire oblique surface of the rubber strip *a*, is also applied in like manner during the process of manufacture, all in such manner that in the finished cushion the interstices of the woven fabrics *f* and *g* will be filled in with the rubber compound. In other words, so that in the finished article as to both the top and the oblique faces of the cushion-strip these surfaces will be composed of rubber and canvas, the outermost particles of both of which materials will be flush with each other or lie in the same plane.

By reference now to Fig. 5, where I have shown the normal configuration of the cushion in full lines and its distorted shape (caused by the impact of the ball) in dotted lines, it will be seen that the particles are displaced almost imperceptibly in an upward direction at the top surface of the cushion, to a greater extent downwardly at the locality of the oblique working face of the strip, and perceptibly in a rearward direction, so as to lessen the area of the cavity or recess *e* in the back side of the cushion-strip, and it will be understood that under such conditions as to the manner in which the shape of the cushion is distorted by the impact of the ball in resuming its normal shape, and thereby throwing off the ball 2, my improved cushion operates in a much more efficacious and desirable manner than cushions of the previously-known constructions. In the first place, in resuming its normal condition the cushion pushes on the ball in an almost wholly horizontal direction, while it operates to rather counteract the enforcement downwardly of the ball onto the bed *c* (which of course by the friction created consumes a portion of the ball-repellent power of the cushion) in lieu of augmenting this undesirable condition, as does a cushion such as those heretofore made and used, and, in the second place, the contacting and impacted portion of the cushion not being elevated as heretofore this nearly horizontal repellent force of the cushion is initially applied to the ball at a point lower down on its spherical surface more nearly in line horizontally with the ball's center of gravity, and hence with more effect on the ball bodily to throw it off.

Although the presence in my cushion of the canvas or other facing *g*, of non-stretchable material, is very desirable, since it performs the function of preventing even the slight lifting or turning upwardly and backwardly of the extreme edge or nose of the cushion, yet with this device omitted my improved cushion, by reason of the combination with the rubber mass, in the manner shown and described, of the top strip *f* of canvas or other suitable non-stretchable fabric, will produce greatly-improved results, since by reason of this combination alone preventing the displacement of the particles of rubber upwardly at the top surface of the cushion the latter is made to operate, as I have just above explained, to repel the ball more nearly horizontally than cushions heretofore made.

The canvas facing *g*, molded on, as described, is, I know, not new, *per se*, in a billiard-cushion, and it has heretofore been suggested that such a facing operates to tie down or prevent the uprising of the nose of the cushion when the latter may be struck by a ball; but, in the first place, such a cushion as heretofore made is not efficient for any such purpose, because when such a cushion has its nose forced upwardly and backwardly, as illustrated at Fig. 3, the canvas facing will move approximately into the plane of a radius of a circle whose center is nearly coincident with the lower point or root of the strip *a*, and when moved in this manner its upper edge will be higher relatively to the bed *c* of the table than before, and hence will not prevent the upper forward part of the cushion from assuming the higher position into which the impacting ball tends to lift it. In my improved cushion, however, any initial bulging up of the top surface of the cushion immediately in rear of the nose or extreme working edge being prevented by the function of the strip *f*, as the ball proceeds to embed its impacting surface in the rubber mass the particles of the latter are naturally displaced downwardly, and this sort of displacement operating, necessarily, to throw the non-stretchable facing *g* into a curved condition, as illustrated by the dotted line at Fig. 5, an inevitable consequence of this changed condition shortening the distance (measured in a straight line) between the upper and lower (immovable) edges of the strip *g* is to pull downward the nose of the cushion in opposition to the effort of the impacting ball to lift it.

Of course in the manufacture of my improved cushion the proportions of the parts and the precise relative positions or arrangement thereof may be varied some without materially changing the mode of operation peculiar to my invention, and hence without departing from the spirit of the latter, and although, as I have said, the best results fol-

low from the combination, with the rubber strip *a*, of both the non-stretchable front facing *g* and the top strip *f* for preventing an undue displacement of the particles of the mass at the top of the cushion, a cushion comprising only the strip *a* and the said top-bulging preventive *f* or its equivalent will give vastly better results than any billiard-cushion heretofore made that I know of.

It will be observed from an inspection of Fig. 5, which illustrates with substantial correctness the action of the cushion when distorted by a comparatively hard blow of a ball and automatically returned by its elasticity to its normal shape, that mainly by the prevention of the usual upward bulging of the top surface of the rubber mass the latter has its particles displaced mostly in a rearward direction, and hence so that in resuming their former positions the cushion is made to reflect or throw off the ball more nearly in a horizontal manner, and hence so as to give the reflected ball more legs than possibly obtainable with other prior kinds of cushions.

If it should be found expedient and desirable to incorporate within the molded mass *a* some sort of face-hardening device, the addition of such device would not of course make the concrete structure any the less within the scope of my invention. I, however, do not deem the addition of any such device necessary, and should its presence be deemed possibly of benefit I should advise its incorporation in such manner as not to materially interfere with the described operations and effects of the structure I have herein shown and described.

Having now so fully explained the character of my invention and the manner of carrying it into effect that those skilled in the art can readily understand and practice it, either in whole or in part, what I claim as new, and desire to secure by Letters Patent, is—

1. In a billiard-cushion, the combination, with a strip of suitable rubber compound, or other allied gum, of a strip of suitable, non-elastic, material, arranged at the top surface of the cushion, and in rear of the nose thereof, in substantially the manner specified; for the purpose set forth.

2. The combination, with a strip of rubber compound, or other allied gum, of a device operating to prevent any material displacement upwardly, at the top surface of, but in rear of the nose of said strip, of the particles composing the latter; and a non-stretchable facing, to the oblique forward surface of said strip; all in substantially the manner and for the purposes set forth.

In witness whereof I have hereunto set my hand this 2d day of May, 1899.

DUDLEY KAVANAGH.

In presence of—
DAVID E. MCFARLAND,
EDW. J. CAHILL.