

Nov. 23, 1965

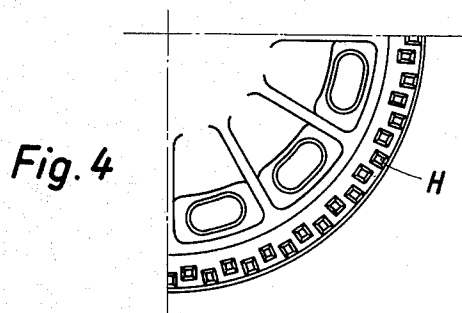
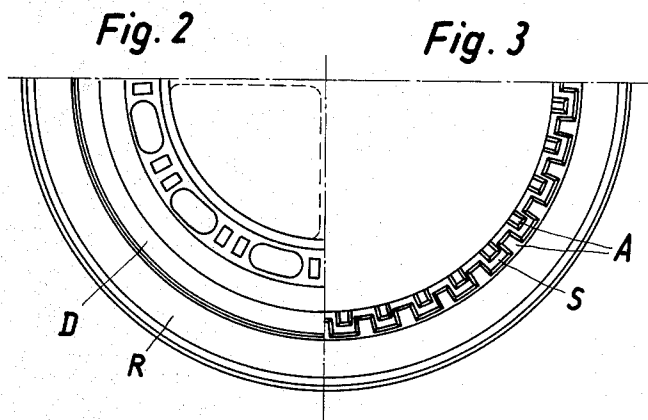
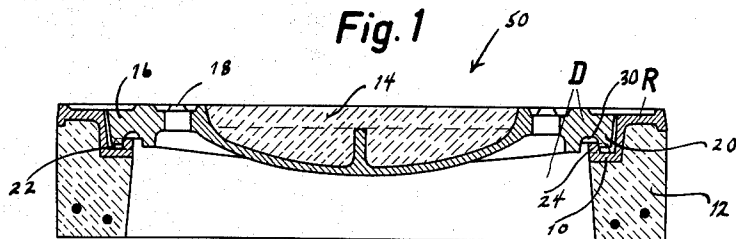
A. RAQUET

3,218,942

MANHOLE COVER CONSTRUCTION

Filed June 5, 1962

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Fig. 5

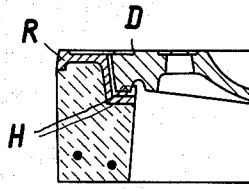
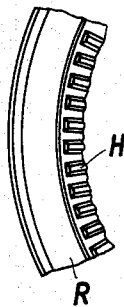


Fig. 6

Fig. 7



H

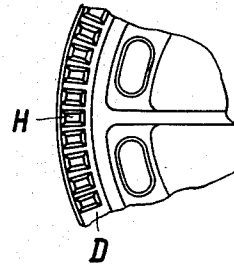


Fig. 8

Fig. 9

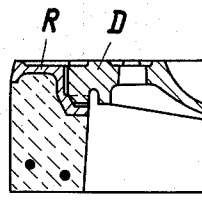
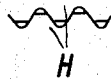
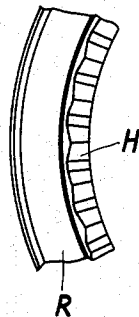


Fig. 10

Fig. 11



H

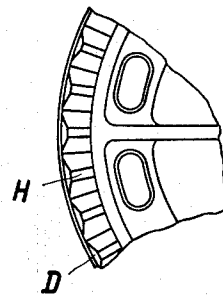


Fig. 12

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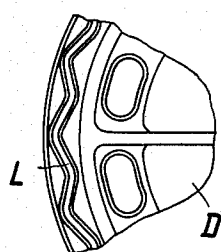
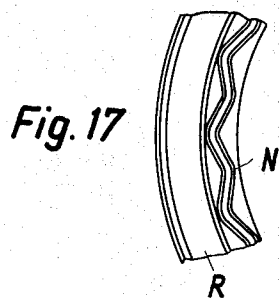
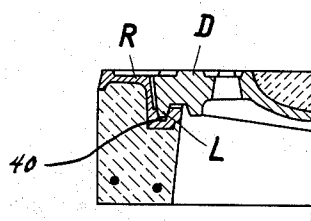
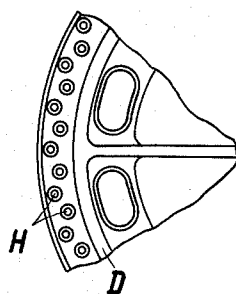
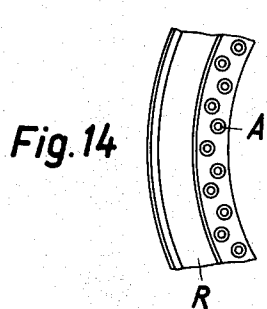
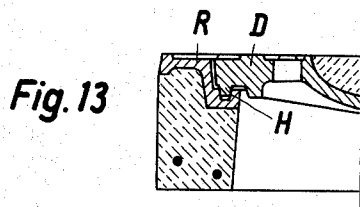
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MANHOLE COVER CONSTRUCTION

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Fig. 19

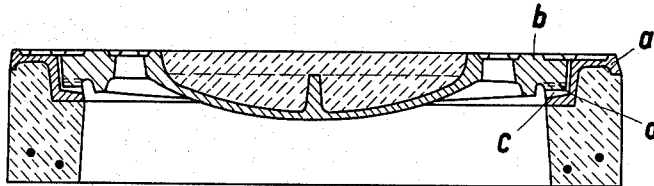


Fig. 20

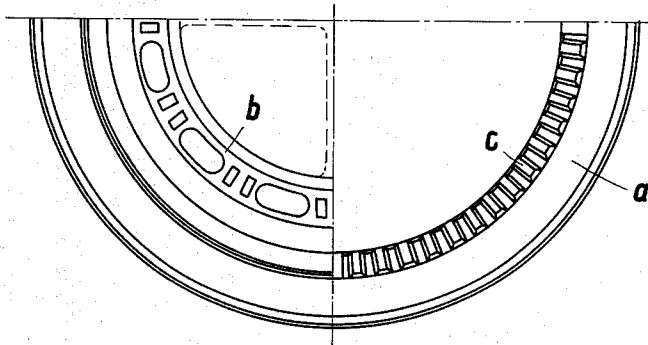
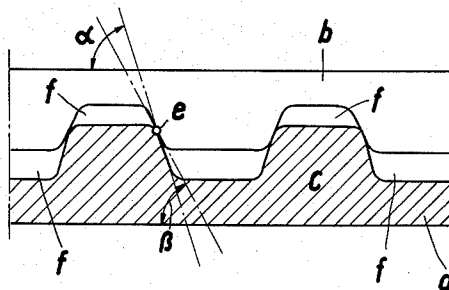


Fig. 21



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3,218,942

MANHOLE COVER CONSTRUCTION

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G 32,410

3 Claims. (Cl. 94—34)

This invention generally relates to closures and is particularly directly to a manhole cover construction of the type wherein the manhole cover proper is supported by and seated on a seating surface of a frame or support member.

Manhole covers are generally made from cast iron and engage the supporting frame in a planar, tight-fitting and preferably rattle-free manner. In order to obtain satisfactory fit between the cover proper and the supporting frame, the interengaging bearing or contact surfaces of the cover and the seat-providing support are customarily machined with removal of chips so as to attain contact surfaces of desirable smooth and form-fitting characteristics. Experience has shown, however, that in spite of careful original machining to provide plane and smooth bearing surfaces, the fit between the cover and the seating surface of the support becomes unsatisfactory and loose after some time. Thus, for example, it is well known in the art that prior art manhole covers arranged on streets and highways start rattling after a short period of use, particularly in locations of heavy traffic. Several reasons may be advanced for this phenomenon. Dirt and other contaminations, such as small stones, of course, tend to penetrate the transition area between the cover and the supporting frame and these contaminations by friction, other mechanical or chemical action, attack the interengaging contact surfaces of the manhole cover constructions, thereby causing unevennesses which, in turn, result in a looser fit and thus rattling. It should also be realized that manhole cover constructions, particularly in areas of heavy traffic, are subjected to a variety of loads, stresses and tensions which tend to cause deformation and bending primarily in the cover proper. Oftentimes, the stresses and loads on the manhole cover constructions are not uniformly distributed over the entire surface area of the cover, but the cover may be subjected to heavier loads at selected areas which again may cause deformation and uneven wear.

Generally, although the life of the manhole covers proper may be substantial, the covers have to be replaced as soon as the fit with the seating surface has become so loose that the passage of vehicles over the cover construction causes disturbing rattling and thus hazardous conditions. Experience has also established that it is not possible to rectify unsatisfactory fit between the cover and the seating surface.

Various attempts have been made for the purpose of preventing deterioration of the fit between the cover and the seating surface. Thus, for example, it has been suggested to equip the marginal circumferential rim portion of the manhole cover with a plurality of circumferential wedge-shaped protuberances or points which, in turn, engage the seating surface of the support member. Dirt and the like contaminations which penetrate through the sealing area between the frame and the cover fall then into the recesses between the wedges so that the wedge

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points proper will not be soiled. This prior art construction has, however, the serious disadvantage that the seating surface of the frame member is subjected to extremely high specific surface pressures by the point-shaped protuberances of the cover. This, in turn, causes premature wear at the contact surfaces between the wedge points and the seating surface, thereby defeating the very purpose of the constructions. Further, in this prior art construction, the cover is easily rotated about its axis so that when a vehicle passes over the cover and thus a certain rotation force is created, the cover tends to rotate, thereby again causing wear and untightness of the fit between the cover and the supporting frame. For this reason, this prior art construction has not met success in practice as the undesired rattling phenomenon is not prevented thereby.

In all prior art constructions, the bearing or contact surfaces of the manhole cover constructions are always worked by cutting or are machined in different manner which, of course, is expensive and generally connected with considerable expenditure.

Accordingly, it is a primary object of this invention to provide a manhole cover construction wherein the manhole cover proper engages the seating surface of the supporting frame in a snug and tight-fitting manner and wherein the tight-fitting engagement lasts for an indefinite period of time and is not disturbed by penetrating contaminations such as dirt, stones, pebbles and the like or by heavy loads and stresses such as the passing of heavy vehicles over the cover constructions.

Another object of this invention is to provide for a novel manhole cover construction which does not require machining of the interengaging contact surfaces of the cover and the seating surface.

It is also an object of this invention to provide a novel manhole cover construction which is superior to the prior art constructions, which is rugged in design and inexpensive to manufacture, and which has an indefinite life.

Another object of this invention is to provide a rattle-free manhole cover construction which is of simple design and can be manufactured in a minimum of time.

Generally, it is an object of this invention to improve on the art of manhole cover constructions as presently practiced.

Briefly, and in accordance with this invention, the manhole cover construction comprises the usual manhole cover and a supporting frame having a seating surface to be engaged by the marginal or rim portion of the cover. In accordance with the invention, the rim portion of the cover and the seating surface are provided with interlocking or interengaging formations which, once the cover has been placed on the seating surface, provide for a tight and snug fit between the frame and the cover and prevent undesired movement in horizontal planes. The interengaging formations referred to include male projecting members or protuberances on one of the cover and seating surface and complementarily shaped female members or depressions provided on the other one of said cover and seating surface. The male and female members are preferably uniformly arranged at equal distances in the circumferential direction of the cover construction. In a preferred embodiment, the male members are arranged on the cover while the female members are provided on the seating surface. The male and female members are preferably shaped in such a manner that the generally vertically extending side or lateral surfaces of the male and female members contact each other at least partly in

form-fitting manner while the generally horizontal base and head surfaces, by contrast, define a small distance therebetween. In this manner, a construction is obtained having a relatively large total contact surface which is capable of absorbing heavy loads without causing displacement or deformation. The interengaging male and female members furthermore provide a tight fit in each direction and acting on all sides, so that rattling is effectively prevented. The symmetrical uniform spacing of the meshing or interengaging cover and frame support elements, considered from a dimensional point of view, can be readily accomplished by present-day pattern techniques that interchangeability of the components can be effected without difficulty. The interengaging contact surfaces between the cover and the supporting frame may be of various shapes as will appear from the several embodiments to be described hereinafter.

According to a further modification of this invention, the generally vertically extending surfaces of the interengaging male and female members are inclined or slanted and the inclination of the male member is different from that of the corresponding female member so that the angle embraced by two opposing surfaces is unequal. In this manner, point or linear contact between the opposing surfaces of the male and female members may be accomplished. Such point or linear contact is of great advantage in many instances as it results in relatively large surface loads. In this manner, unevennesses emanating from the original manufacture are readily eliminated after the cover has been subjected to a load of a passing vehicle or the like. If the cover, for some reason, should become deformed or distorted in any manner, rattling will still be prevented because, due to contact at at least three different points and due to the high surface pressure, additional contact areas will be created when a heavy load bears against the cover so that any initial rattling will disappear and the tightness of the fit is increased.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there are illustrated and described preferred embodiments of the invention.

In the drawings:

FIG. 1 is a vertical section through a first embodiment of a manhole cover construction in accordance with this invention;

FIG. 2 is a fragmentary plan view of the construction of FIG. 1;

FIG. 3 is a corresponding plan view on the supporting frame with the cover removed;

FIG. 4 is a plan view of the bottom side of the cover of a different embodiment;

FIG. 5 is a sectional view of trapezoidally shaped male and female members;

FIG. 6 is a vertical section through a construction embodying the interengaging formations of FIG. 5;

FIGS. 7 and 8 fragmentarily illustrate an embodiment with radially extending interengaging formations, FIG. 7 illustrating the supporting frame and FIG. 8 the cover;

FIG. 9 shows a different embodiment of interengaging formations;

FIG. 10 is a vertical section through a construction embodying the formations of FIG. 9;

FIGS. 11 and 12 are views corresponding to FIGS. 7 and 8, employing a different embodiment of interlocking formations;

FIG. 13 is a vertical section through an embodiment employing interlocking formations of the kind illustrated in FIGS. 14 and 15;

FIGS. 14 and 15 are views corresponding to FIGS. 7 and 8 employing different interlocking formations;

FIGS. 16, 17 and 18 correspond to the views of FIGS.

13, 14 and 15, illustrating still a further embodiment of interlocking formations;

FIG. 19 is a vertical section through still another embodiment;

FIG. 20 shows on the left-hand side a plan view of the construction of FIG. 19, while the right-hand side illustrates the supporting frame with the cover removed; and

FIG. 21 is an enlarged elevation in diagrammatic form of the contact between cover and the seating surface of the supporting frame.

Referring now to the drawings in particular, it will be noted that FIG. 1 shows a manhole cover construction 50 comprising a manhole cover D proper and a supporting frame R having a seat-providing portion 10. The frame R is secured in the usual manner to concrete, stone or the like material 12. The cover D comprises a central portion 14 and a marginal rim portion 16. The cover D is also provided with the usual holes and patterns as indicated by reference numeral 18. In accordance with this invention, the cover D is equipped with a plurality of downwardly projecting protuberances or male members 20, while the seating surface 10 is shaped so as to form substantially complementarily shaped depressions or female members 22. It will be noted that the male members 20 which are spaced at equal distances circumferentially around the rim portion 16 are shaped so that the free end surface of the male members 20 does not engage the bottom or base of the female members 22, but is spaced therefrom. By contrast, a substantial portion of the side surfaces of the male and female members are in contact with each other to provide for a secured fit. It will also be noted that the inner defining wall 24 for the female members 22 projects upwardly into a depressed portion 30 of the rim portion 16 adjacent the male member 20 whereby additional bearing contact between the cover D and the seating surface 10 is provided.

FIG. 2 illustrates a plan view of the embodiment of FIG. 1 showing the lid positioned on the seating surface 10.

FIG. 3 is a plan view on the supporting frame R showing the female members which in this figure are indicated by reference numeral A, while the meander-like web extending between the depressions or female members is indicated by S.

FIG. 4 is a view on the bottom side of a manhole cover, wherein the marginal or rim portion is provided with a plurality of evenly spaced male protuberances arranged in a waffle-like pattern. It will be noted that the individual male members H have a substantially rectangular cross section. In this embodiment, the protuberances H have the form of truncated pyramids, while the corresponding depressions or female members are shaped so that the opposing lateral surfaces of female and male members will at least partially contact each other while the top of the pyramids and the bottom of the depressions are spaced from each other.

FIG. 5 diagrammatically indicates trapezoidally shaped protuberances H engaging in corresponding depressions, while FIG. 6 is a corresponding vertical section employing this variation of the interlocking formations.

In FIGS. 7 and 8, the male and female members H extend in radial manner, FIG. 8 showing the bottom side of the cover. In this embodiment, the protuberances H on the cover engage between the protuberances on the seating surface of the frame.

According to the embodiment of FIG. 9, the protuberances H have a substantially triangular form. FIG. 10 illustrates a construction wherein the embodiment of FIG. 9 has been employed.

FIGS. 11 and 12 illustrate a variation wherein substantially triangularly shaped protuberances extend radially as seen in the drawings.

According to the embodiment of FIGS. 13, 14 and 15, truncated cones H are used as male members which en-

gage in correspondingly shaped depressions on the seating surface of the frame, the depressions being indicated by A.

In order to be able to provide a large number of male and female members, the individual members are arranged in staggered or offset relationship as seen in FIGS. 14 and 15.

Viewing now the embodiment of FIGS. 16, 17 and 18, it will be noted that an endless strip L projects in sine-shape formation from the underside of the cover D. The cross section of this strip is substantially trapezoidal. This strip or band L is received in a complementarily shaped groove or female member N as seen in FIG. 17. The vertical section through this embodiment can be viewed in FIG. 16. Again, it will be noted that a distance 40 is defined between the bottom of the groove N and the free top surface of the strip L.

In the event that the original contact between the opposing bearing surfaces is point-shaped or linear, this contact will be enlarged upon application of heavy loads as the pressure bearing on the contact surfaces, of course, will create larger contact surfaces. In this manner, the fit between the cover and the seating surface of the frame member will, in fact, improve upon prolonged use. It will be noted that the inventive construction can be manufactured in exceedingly simple manner without requiring machining or other expensive production methods.

It will also be realized that if replacement should be necessary, this can be effected without difficulty.

Turning now to the embodiment of FIGS. 19, 20 and 21, it will be noted that the frame member *a* again supports the cover *b*. Both the cover *b* and also the frame *a* are provided in the region of the bearing surfaces with projecting protuberances or male members *c* and *d* which may be shaped in any suitable manner. However, according to the embodiment of these figures, the protuberances have to be formed so that contaminations, such as dirt or small pebbles, cannot lodge themselves in between the contact surfaces. According to the invention, this feature is obtained by providing sufficient space adjacent the bearing surfaces so that these adjacent spaces are capable of receiving the contaminations.

The left-hand side of FIG. 20 shows the construction of FIG. 19 in plan view, while the right-hand side illustrates the same construction with the cover removed. The upstanding protuberances provided on the seating surface of the supporting frame can be clearly seen.

FIG. 21 is an enlarged diagrammatic elevation of the contact picture between the cover and the frame. *a* indicates the frame, while *b* refers to the cover. *c* indicates the protuberances of the frame *a*. It will be noted that these protuberances are distributed over the circumference of the seating surface of the frame at equal distances. *d* indicates the protuberances of the cover *b* which are distributed with the same uniformity. It will be noted that the protuberances *c* and *d* are shaped so that the adjacent surfaces interengage or contact each other along a point or line only. This point or line contact has been indicated by reference letter *e*. In order to obtain such small contact area, the lateral surfaces, that is, the bearing surfaces of the protuberances of both the frame and of the cover, are slanted in different manner. In other words, they define different angles as is clearly visible in FIG. 21.

The contact surfaces of the protuberances *d* of the cover *b* enclose with the vertical axis an angle β , while the contact surface of the protuberances *c* of the frame encloses the angle α . It can also be recognized from FIG. 21 that at the location *f*, sufficient space is available to accommodate dirt and the like contaminations so that the presence of such contaminations will not affect the contact between the cover and the frame as indicated at reference letter *e*. This, of course, is of great advantage as the presence of contaminations cannot be avoided,

and in the present embodiment, such contaminations do not impair the intended contact. Further, the point or linear contact has the further advantage that a particularly high bearing pressure takes place at the contact area *e*. This, in turn, means that if, in spite of the many bearing contact possibilities, contact should be established at two points only, then, due to the high bearing pressure, substantially immediate wear will take place at two points *e* upon application of heavy loads. Even if this wear amounts to a fraction of a millimeter only, a third bearing or contact point *e* will result. As soon as this third point *e* has been reached, any rattling will, of course, again be prevented.

It will be realized that the invention is not limited to any particular shape of a manhole cover construction. Thus, the construction may be circular, rectangular or the like.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. A manhole cover construction comprising a supporting frame presenting a seating surface, a manhole cover having a circumferential rim portion in register with said seating surface, a plurality of protuberances substantially equidistantially spaced on said rim portion and depending therefrom, each protuberance having a free end surface and inclined sides, said seating surface having a plurality of substantially equidistantially spaced depressions, each depression being defined by a bottom surface and inclined sides, the inclined sides of said protuberances and said depressions including different angles, whereby said protuberances upon engagement in said depressions contact the sides of said depressions along points and lines only and a clearance is formed between said end surfaces and said bottom surfaces.

2. A manhole cover construction comprising a supporting means presenting a seating surface, a manhole cover having a circumferential rim portion in register with said seating surface to be supported thereby, a plurality of protuberances on one of said seating surface and said rim portion, said protuberances being spaced at substantially equal distances and having inclined external side surfaces and a substantially horizontally extending free end surface, the other one of said seating surface and said rim portion being formed with a plurality of depressions defined by inclined walls and a substantially horizontally extending bottom surface, the inclination of said walls being different from the inclination of said side surfaces, said protuberances being capable of engaging into said depressions so as to form a clearance between the bottom surfaces of the depressions and the free end surfaces of the protuberances, the inclined side surfaces of said protuberances contacting the inclined walls of said depressions at selected points.

3. A manhole cover construction comprising a supporting frame presenting a seating surface, a manhole cover having a circumferential rim portion in register with said seating surface, a plurality of protuberances with inclined external side surfaces and a free end surface arranged on one of said seating surface and said rim portion, and a plurality of shaped depression means having a bottom surface and inclined side surfaces on the other one of said rim portion and said seating surface, said protuberances being capable of engagement in said depression means so as to define a clearance between the free end surface and the bottom surface, the inclination of the side surfaces of the depression means being different from that of the side surfaces of the protuberances, whereby point and linear contact between said protuberances and said depression means occurs.

7

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