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WAYS TO CREATE A SAFE ENVIRONMENT FOR TRAVELLING ON PUBLIC ROADS OF WITHIN SETTLEMENTS

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The ways of creating a safe environment for travelling on the roads of settlements are highlighted. The reasons that create a dangerous environment for travelling on the roads of settlements are considered. The expediency of improving the locking mechanism of manhole cover is highlighted. The literature sources devoted to the improvement of the lock mechanism of manhole cover have been analysed. The main disadvantages of manhole covers are revealed. It is established that the existing designs of manhole covers cannot provide a safe environment for travelling on the roads of settlements. The design of manhole cover is proposed, which differs from the existing ones in that it has one axial through hole in the centre of the plate, and the locking devices are connected with each other by means of a plate. The plate may be of any shape, such as rounded or polygonal. The plate has a central axial hole of oval shape and peripheral holes of rounded shape to which the counterweights of the locking devices' rocker arms are attached by means of hooks. It is shown that due to the presence of the plate with a central axial and peripheral holes, the locking devices are connected in a single locking mechanism. It is shown that by having a central axial hole in the plate, it is possible to operate the locking devices simultaneously. It is shown that, due to the presence of a single axial through hole made in the centre of the plate, it is possible to access the central axial hole in the plate. It is shown that due to the presence of a spring, the locking mechanism, when the cover is installed, closes spontaneously. It is established that the proposed design of the locking mechanism of the manhole cover reduces the cases of traumatism due to pedestrians and vehicles getting into the manhole shaft. This provides a safe environment for the movement of pedestrians and vehicles on the roads of settlements.

Keywords: safe environment, settlements, roads, manhole, manhole cover.

Introduction

The qualitative development of the city implies ensuring a safe environment for travelling on the roads of the settlements. To achieve this goal, works are also carried out, which include the construction of water supply and sewerage networks. One of the current problems in the field of sewerage facilities operation is injuries due to pedestrians and vehicles falling into the manhole shaft. The reason for this is the lack of manhole covers due to constant theft of manhole covers. Therefore, the problem of creating a safe environment for travelling on the roads of settlements is urgent.

The issue of creating a safe environment for travelling on the roads of settlements has been considered in the works of many scientists [1-9]. Many designs of manhole covers have been proposed [10-15]. At the same time, the issue of improving the locking mechanisms of manhole covers remains unsolved.

The manhole cover is the upper part of the manhole cover, which is located on the supporting part of the chamber or shaft. It consists of a body and a cover. Such manholes can be placed on the carriageway of streets, pavements, as well as in areas of green spaces and lawns. As a material for the manufacture of manhole covers of manholes it is customary to use cast iron [10-15], which by strength characteristics meets standard requirements. However, the manufacture of such a cover is metal-intensive and increases its cost. In addition, such a cover attracts the attention of metal thieves who cause significant material damage to the owners of manholes. In turn, open manholes pose a threat to pedestrians, vehicles, animals, etc., as they provide unprotected access to the manhole.

The paper [14] proposes a design of manhole cover of a manhole of an underground structure, which contains a supporting structure in the form of a disc with inner and outer surfaces. The supporting structure is made of reinforcing elements, which are monolithic with hardening mixtures. The supporting structure has through holes which are located diametrically relative to each other. The disadvantage of such a cover is that the through holes contribute to the penetration of dirt into the well shaft, as well as water during rains. This in turn leads to clogging of the shaft and premature corrosive wear of utilities. The handle for convenient removal and installation of this cover is a rod element. It is freely accessible, so it is easy to remove the cover.

The manhole cover of the inspection well is described in paper [15] is made in the form of a plate. Cover is equipped with pin with stopper, this connects it to the hatch by means of fixation ring with lock. At that, hatch is made with possibility of turning round the pin. The disadvantage of this manhole cover design is that it can be easily moved. The cover is insufficiently secured and has no protection against theft.

Thus, the existing designs of manhole covers cannot provide a safe environment for travelling on the roads of settlements.

The aim of the work is to provide a safe travelling environment on public roads within settlements by improving the design of manhole covers.

Results and discussion

It is possible to create a safe environment for movement on public roads within settlements by changing the design of the manhole cover.

The design of manhole cover is proposed (Fig. 1), which is made in the form of a plate and has at least two locking devices. Plate is equipped with an axial through hole. The slab may be circular, rectangular or other shapes. The axial through hole located in the centre of the slab. The slab has an inner, an outer and a side surface. Locking devices are arranged on the inner surface of the plate. Each locking device comprises a canopy and a rocker arm. The canopy is rigidly attached to the inner surface of the plate. The rocker arm is movably connected to the canopy by means of an axle. The rocker arm can rotate about the axis in one plane.

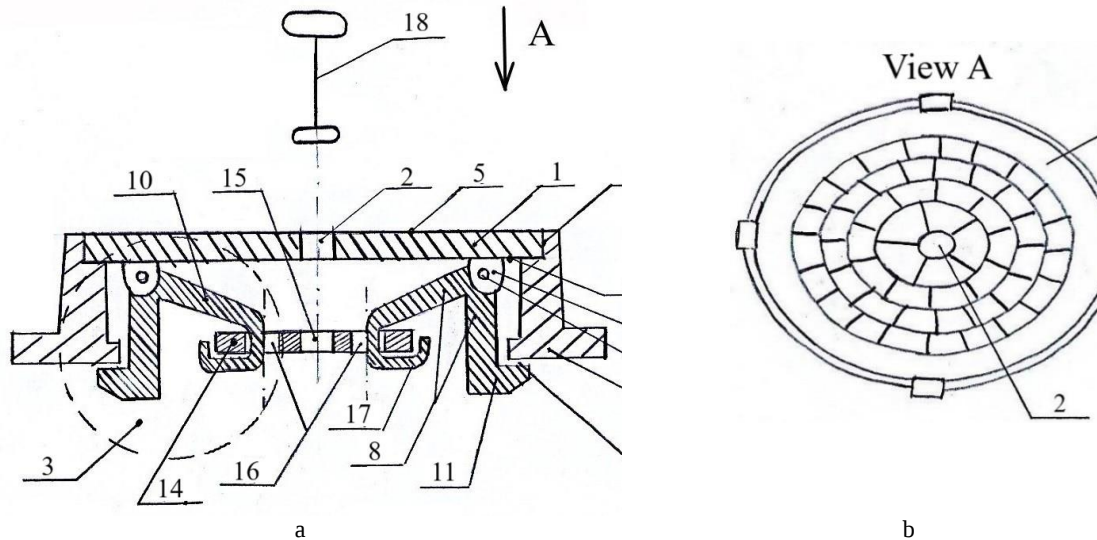


Figure 1 – View from the side of the lock on the manhole cover – a; b) section of the manhole cover A - A in the closed state – b: 1 - plate, 2 - through hole, 3 - locking devices, 4 - inner surface, 5 - outer surface, 6 - side surface, 7 - canopy, 8 - rocker arms, 9 - axle, 10 - counterweight, 11 - fixing tab, 12 - hatch body, 13 - gap, 14 - plate, 15 - central axial hole oval shape, 16 - peripheral holes, 17 - hooks, 18 – key.

The upper part of the rocker arm is made in the form of counterweight. The lower part of the rocker arm is made at an angle of 90° - in the form of a fixing protrusion. The angle formed by the counterweight and the line passing through the extreme point of the fixing protrusion and the upper part of the rocker arm is not more than 85° .

The length of the rocker arm is calculated so that a gap is provided between the locking protrusion and the base of the manhole housing of the manhole. The gap serves for free operation of the locking device. The dimensions of the gap are approximately 5 - 10 mm. The locking devices are connected to each other by means of a plate. The plate may have any shape. The plate has a central axial hole of oval shape and peripheral holes of rounded shape. Counterweights of the rocker arms of the locking devices are fixed to the peripheral holes by means of hooks. The hole in the plate serves for inserting a key. This key is used to install and remove the plate, as well as to open and close the locking devices. The key is in the form of a rod with an oval-shaped loop formed at its end.

The device works as follows. The key is passed first into the through hole and then into the central axial hole of the oval-shaped plate, turned to 90° and the cover is lifted to install it on the hatch body. Once the cover is in place, the key is turned 90° and removed from the axial hole of the oval shaped plate. The key is then turned 90° again and a force is applied to the plate to push it downwards. The key is pulled out through hole located in the centre of plate.

To remove the hatch cover, the key is first passed through the through hole in the centre of the plate and then through the oval-shaped centre hole in the plate and turned to 90° . The manhole cover is removed from the manhole body of the manhole.

The proposed design of the manhole cover can be supplemented with plate springs, placing them opposite the counterweights (Fig. 2). The springs are fixed on the inner surface of the plate by any known method, e.g. soldering, riveting or screws.

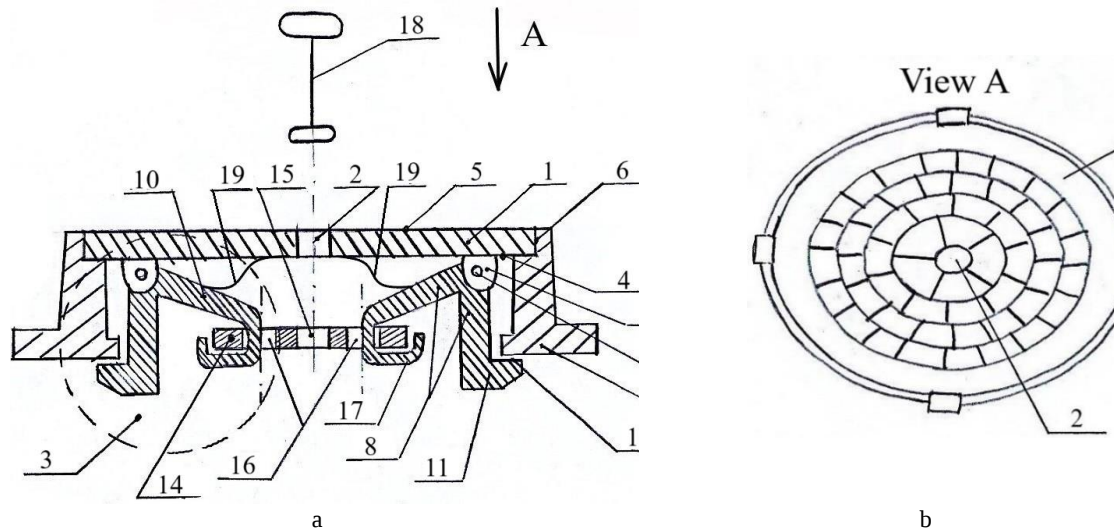


Figure 2 – View from the side of the lock on the manhole cover – a; b) section of the manhole cover A - A in the closed state – b: 1 - plate, 2 - through hole, 3 - locking devices, 4 - inner surface, 5 - outer surface, 6 - side surface, 7 - canopy, 8 - rocker arms, 9 - axle, 10 - counterweight, 11 - fixing tab, 12 - hatch body, 13 - gap, 14 - plate, 15 - central axial hole oval shape, 16 - peripheral holes, 17 - hooks, 18 - key, 19 – spring.

The manhole cover of a manhole with plate springs will operate as follows. The key is first passed through the through hole, located in the centre of the plate, and then into the central axial hole of oval shape, located in the plate, rotate by 90^0 providing its grip with the plate and lift the cover for its installation on the manhole body. In this case, the counterweight movably mounted on the axis of the rocker of the locking device rises up, pressing the spring, and the fixing tab is pushed inwards. The cover is installed on the manhole body of the manhole. The key is turned to 90^0 and removed from the axial hole of the oval-shaped plate and from the hole located in the centre of the plate. In this case, the spring is released from the forceful pressure by the counterweight and the counterweight of the locking device under the pressure of the lamellar spring goes down, the fixing tab goes under the base of the manhole body, securely locking the manhole opening with the cover.

To remove the lid, the key is first passed through the through hole located in the centre of the plate, then into the oval-shaped central hole located in the plate, rotated by 90^0 ensuring its grip on the plate and lift the lid. In this case, the counterweight movably mounted on the axis of the rocker arm of the locking device rises up, pressing the spring, and the locking tab is pushed inwards, unlocking the locking device. The manhole cover is removed from the manhole body of the manhole.

Thus, by having a plate with a central axial hole and peripheral holes, the locking devices are connected to form a single locking mechanism. By having a centre axial hole in the plate, it is possible to operate the locking devices simultaneously. Due to the presence of a single axial through hole made in the centre of the plate, it is possible to access the central axial hole in the plate. Due to the presence of a spring, the locking mechanism locks spontaneously when the lid is inserted.

Conclusions

Extended technological capabilities of the manhole cover prevent its easy removal by unauthorised persons. The cases of injuries due to pedestrians and vehicles falling into the manhole shaft are reduced. A safe environment for pedestrians and vehicles on the roads of settlements is ensured.

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ШЛЯХИ СТВОРЕННЯ БЕЗПЕЧНОГО СЕРЕДОВИЩА ДЛЯ ПЕРЕМІЩЕННЯ НА ДОРОГАХ ЗАГАЛЬНОГО КОРИСТУВАННЯ В МЕЖАХ НАСЕЛЕНИХ ПУНКТІВ

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Висвітлено шляхи створення безпечного середовища для переміщення на дорогах населених пунктів. Розглянуто причини, які створюють небезпечне середовище для переміщення на дорогах населених пунктів. Висвітлено доцільність вдосконалення замкового механізму кришки люка оглядового колодязя. Проведено аналіз літературних джерел, присвячених вдосконаленню замкового механізму кришки люка оглядового колодязя. Виявлені основні недоліки кришок люку оглядового колодязя. Встановлено, що існуючі конструкції кришок люка оглядових колодязів не можуть забезпечити створення безпечного середовища для переміщення на дорогах населених пунктів. Запропоновано конструкцію кришки люка оглядового колодязя, яка відрізняється від існуючих тим, що має один осьовий наскрізний отвір в центрі плити, а замкові пристрої з'єднані між собою за допомогою пластини. Пластина може бути будь-якої форми, наприклад округлої або багатокутної. Пластина має центральний осьовий отвір овальної форми та периферійні отвори округлої форми до яких за допомогою гачків закріплені противаги коромисел замкових пристроїв. Показано, що завдяки наявності пластини з центральним осьовим та периферійними отворами, замкові пристрої з'єднані в єдиний замковий механізм. Показано, що завдяки наявності в пластині центрального осьового отвору є можливість одночасно керувати замковими пристроями. Показано, що завдяки наявності одного осьового наскрізного отвору, виконаного в центрі плити є можливість доступу до центрального осьового отвору в пластині. Показано, що завдяки наявності пружини замковий механізм, при встановленні кришки замикається самовільно. Встановлено, що запропонована конструкція замкового механізму кришки люка оглядового колодязя зменшує випадки травматизму через потрапляння пішоходів і транспортних засобів у колодязну шахту. Це забезпечує безпечне середовище для переміщення пішоходів і транспортних засобів на дорогах населених пунктів.

Ключові слова: безпечне середовище, населені пункти, дороги, оглядовий колодязь, кришка люка.

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