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(54) Benævnelse: **FREMGANGSMÅDE TIL REPARATION AF ET MANDEHUL**

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KR-A- 20030 003 468
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DESCRIPTION

Technical Field

[0001] Present disclosure relates to the field of manholes and their repairing methods. The invention discloses a new method for repairing manholes, including manhole covers and frames.

Background Art

[0002] The manhole top parts including manhole frame and manhole cover make up a set, which is made of cast iron and which during infrastructure construction is installed usually in the road surface, thus making them wearables like the tarmac surface or other parts which are exposed to mechanical wear and tear caused by traffic load. This wear and tear often result in that the manhole cover starts rocking in the frame, emitting a specific loud noise, which in urban areas is disturbing. As this noise is a result of mechanical movement of manhole cover in the manhole frame, then this phenomenon further accelerates wear of the cast iron parts of the manhole. Repairing of the cast iron parts of the manhole is very difficult as the manhole frame cannot be separated from the road surface without significantly damaging the pavement into which it is installed.

[0003] Generally, when there is an issue with a noisy manhole cover disturbing the daily lives of people nearby, the infrastructure network owner (INO) is notified. The INO contacts manhole repairing service provider, defines the location and all other known data about the manhole, for example size, time of installation if possible, etc. The service vehicle responds and arrives at the site. All necessary road and work safety procedures are carried out.

[0004] The most common practice for repairing manhole frames and covers has been the so-called invasive method, which means breaking the road surface in order to take out the old defective manhole frame from the road surface and installing new cast iron parts of the manhole into the road surface. The traditional invasive method ruins the road structure and has a very large combined carbon footprint. The carbon emission of the physical work carried out by the invasive method for exchanging manhole frames has not been measured, but even if it were zero, then replacing old cast iron parts of the manholes with new ones has a carbon footprint with a ratio of 4 kg CO_2 per 1 kg cast iron. The average cast iron parts set of the manhole weighs about 50 kg (200 kg CO_2). The physical work of the invasive method for exchanging manhole frames consists of breaking tarmac, digging out the original backfill soil, replacing the cast iron parts of the manhole, laying new backfill material, compacting the material, laying new tarmac, compacting the tarmac and waste management of dug out materials.

[0005] Korean patent application KR20110035106A "Manhole frame repair device and manhole repairing method using the same" describes a method for repairing a manhole, which comprises a manhole frame and a manhole cover. The method comprises following steps where the manhole cover is removed from the manhole frame and a levelling core is inserted into the manhole frame, said levelling core is levelled and centred. In said method the measuring device is not first installed to the levelling core and the manhole frame seating area surface smoothness is not measured. In said method the levelling core is supported onto the top surface of the manhole frame, which is at the same level as the road surface, and the levelling core is levelled in relation to the frame using said top surface as a base, also said surface is also used as base for cutting the seating area of the frame.

[0006] This is problematic, because said surface is open to wear and tear due to the road traffic crossing it and said surface itself may be worn and not level. Therefore, if said top surface is worn, the surface smoothness and flatness of said seating area of the frame could be restored by cutting in the plane, which is not parallel with the original seating area. If the seating area is cut not parallel to the original seating area, then there is a safety risk to compromise the structural integrity of the frame. This is due to removing largely unequal amounts of material from the frame seating area, which may leave the frame seating area too thin at certain points and thus not meet the load bearing requirements.

[0007] Therefore, a new method which does not involve breaking the road surface with a smaller carbon footprint is necessary. The purpose of the present invention is to provide a new advantageous method for repairing manhole cover frames, which does not damage road surface, has smaller carbon footprint and is fast and simple to carry out. The technical solution disclosed herein provides an opportunity to machine (refurbish) these cast-iron parts, on site, un-invasively to the road pavement, producing practically zero waste.

[0008] According to the present invention, the problematic situation of rocking manhole covers in a manhole frame emitting loud disturbing noise does not have to be solved by heavy machinery, digging and new parts, but rather that the existing situation can be improved with a non-invasive method.

[0009] Examples of a flange facers are known from patents US5630346A and US5050291.

Summary of invention

[0010] The purpose of the present solution is to provide a faster, simpler and more economical method for repairing manholes, including manhole frames and covers. This in turn provides more sustainability for infrastructure stakeholders, wherein the sustainability is provided on many levels. Whilst saving on carbon emissions on refurbishing the cast iron parts, also the road surface and structural integrity is not compromised. This means that the road retains its behaviour as a whole, not having "patches" which have been constructed at different times and possibly out of materials with slightly different characteristics.

[0011] The method provided with the present invention consists of adapting (partially) existing technology to a new application - repairing sewage and other infrastructure manhole top parts, like cover and frame, which are usually made of cast iron.

[0012] A method for repairing a manhole, which comprises a manhole frame and a manhole cover, comprises following steps:

1. 1) The manhole cover is removed from the manhole frame and a levelling core is inserted into the manhole frame and said levelling core is centred. The levelling core comprises hydraulic or mechanical fixation pistons, alignment and levelling accessories.
2. 2) A machining unit comprising a cutting unit is attached to said levelling core.

[0013] The machining unit is a flange facer, which comprises a cutting unit and a rotary unit.

[0014] 3) A measuring device (for example an indicator of surface smoothness) is installed to the machining unit and the manhole frame seating area surface smoothness is measured.

[0015] During the smoothness measurement, said machining unit is levelled in relation to the manhole frame seating area, using levelling accessories of said levelling core. The surface smoothness means foremost the surface flatness and evenness.

[0016] 4) The measuring device is detached from machining unit, and a cutting blade is installed to said cutting unit of machining unit.

[0017] 5) The machining unit cuts away a predetermined thickness of a manhole frame uneven seating area material, while moved along the circular path along the seating area. The said seating area is evened by removing material by cutting from said seating area by moving said cutting unit of said machining unit along said seating area on a circular path until the required surface smoothness of said seating area surface has been achieved by removal of minimum amount of material from said seating area, in other words from the seating area material is removed until intended surface smoothness is achieved. The cutting depth per rotation of machining unit along said path is 0.15-0.30 mm per rotation. In other words, the cutting depth corresponds to the material removed from the seating area of the frame by the cutting tool of the machining unit during the rotational movement of the machining unit along the seating area.

[0018] 6) The cutting is continued until the required surface smoothness of the manhole frame seating area surface has been achieved by cutting away the minimum amount of seating area material. The final manhole frame seating area surface smoothness after cutting step is about 0.01-0.10 mm, in a preferred embodiment of the invention, about 0.05 mm. After the cutting is completed, the manhole frame seating area surface is protected with suitable paint.

[0019] 7) Said levelling core and machining unit are removed from the manhole frame and a manhole cover is installed back to the machined manhole frame. Preferably, as a last step, said manhole cover seating area is machined before installing it back to the manhole frame. The manhole cover is machined with a machining unit, which is attached to the outer edges of the manhole cover and cuts seating area from the outside (perimeter) towards the centre of the manhole cover.

Brief description of drawings

[0020] The following is shown on the accompanying figures:

Figure 1: shows a cross-section view of a manhole, including manhole cover and manhole frame,

Figure 2: shows a cross-section view of the manhole top parts,

Figure 3: shows a perspective view of a manhole frame with levelling core and machining unit,

Figure 4: shows a perspective view of a manhole cover with levelling core and machining unit,

Figure 5: shows a top view of a manhole frame with levelling core and machining unit,

Figure 6: shows a top view of a manhole cover with levelling core and machining unit.

Description of embodiments

[0021] The typical manhole is shown on a Figure 1, which comprises of a manhole frame 1, a manhole cover 2, a telescope pipe 3, a manhole body 4, an inlet pipe 5 and an outlet pipe 6. The method provided by the present invention is used for repairing manhole top parts as shown on Figure 2, which are manhole frame 1 and manhole cover 2.

[0022] The manhole frame 1 comprise a frame seating area 7 as shown on Figure 3. The manhole cover 2 comprise a cover seating area 8, as shown on Figure 4. The frame seating area 7 and cover seating area 8 are the areas, where the manhole frame 1 and cover 2 touch together when installed. The manhole frame 1 and cover 2 are preferably made of cast iron.

[0023] The method for repairing a manhole comprising a frame 1 and a cover 2 is described hereinafter.

[0024] As a first step, the service crew opens the manhole by removing the manhole cover 2 and the manhole frame and cover seating areas 7, 8 are examined.

[0025] A specially developed levelling core 9, as shown in Figures 3 to 6, is used in the next steps. As a next step, the levelling core 9 is inserted to the manhole frame 1 and the levelling core 9 is firstly centred, as shown on Figures 3 to 6. The specially developed levelling core 9 differs from normal levelling core in that it comprises hydraulic fixation pistons, alignment and levelling accessories (not shown on Figures). In alternative embodiment of the invention, the fixation pistons of the levelling core may be mechanical fixation pistons. This step provides a base for the tooling in the next steps.

[0026] Next, the machining unit 10 comprising a cutting unit 11 is attached to the levelling core. The machining unit 10 is in a preferred embodiment of the invention a flange facer, which is shown on Figures 3 to 6, and which comprises a cutting unit 11 and rotary unit 12. The machining unit 10 is fixed to the machinable material from the inside. The machining unit cuts the material of the seating area 7 from inside towards the perimeter of manhole frame 1. However, other machining units, having the same working principle may be suitable. The machinable material is the uneven and rough area on the manhole frame seating area 7. The types of flange facers used with the present method are usually used in wind turbine construction, mating different surfaces in hydro powerplants, joining metal to metal or metal to rubber surfaces in the chemical and other industrial applications, where high accuracy and smoothness is necessary to provide high pressure tightness in joints.

[0027] After that, the measuring device is installed (not shown on Figures) to the machining unit 10 and the manhole frame seating area 7 surface smoothness (evenness) is measured. This provides insight to the manhole frame 1 condition and the rough amount of material in the manhole frame 1 that has to be removed.

[0028] During the measurement process, the machining unit 10 is levelled in relation to the manhole frame seating area, using levelling accessories of the levelling core 9. Levelling the cutting unit in relation to the manhole frame seating area, enables to make a maximum parallel cut to the manhole frame seating area initial surface. This ensures that during the cutting process, as equal amounts of material as possible, are removed from the manhole frame seating area, thus retaining the manhole frame seating areas uniform properties, as not to compromise structural integrity of the manhole frame seating area.

[0029] Next, the measuring device is detached from the machining unit and a cutting blade is attached to the cutting unit 11.

[0030] As a next step, the machining unit 10 cuts away a predetermined thickness of a manhole frame 1 uneven seating area 7 material, when moved along the circular path along the seating area 7. The cutting depth is usually 0.15-0.30 mm per rotation of the machining unit 10, as the machining unit 10 moves along the seating area 7. This 0.15-0.30 mm at a time is determined beforehand by the operator. The initial cutting depth depends on the initial unevenness of the manhole frame 1 seating area 7 surface. In case of a high surface unevenness, the cutting depth is set as small as possible in order to prevent damaging of the cutting blade. The first cutting rotations eliminate the surface unevenness slowly, in order to

prevent possible jam of the cutting blade. Normally, it takes multiple rotations to complete the cutting of the manhole frame seating area 7 to eliminate unevenness.

[0031] This cutting is continued until the required surface smoothness of the manhole frame seating area 7 surface has been achieved with cutting away the minimum amount of manhole frame 1 seating area 7 material. The final manhole frame 1 seating area 7 surface smoothness is about 0.01-0.10 mm, preferably about 0.05 mm. The said seating area 7 is evened by removing material by cutting from said seating area 7 by moving said machining unit 10 along said seating area 7 on a circular path until the required surface smoothness of said seating area 7 surface has been achieved by the amount of material removed from said seating area 7.

[0032] After cutting is completed, exposed metal surface, the manhole frame 1 seating area 7 surface, is protected with suitable paint.

[0033] As a last step, the machined manhole frame 1 has a manhole cover 2 installed. This can be the old manhole cover, the old manhole cover with a machined seating area, or a new manhole cover - depending on the situation.

[0034] The machining unit 10 attached to the manhole cover 2 seating area 8 is shown on Figures 4 and 6. In the preferred embodiment of the invention (example implementation not covered by the invention), the manhole cover is machined with a machining unit, which is attached to the outer edges of the manhole cover 2 and cuts seating area 8 from the outside (perimeter) towards the centre of the manhole cover 2. In the preferred embodiment, the machining unit for cutting manhole cover 2 is a flange facer, that cuts from the outside edges.

[0035] In one embodiment of the present invention, the old manhole cover 2 is machined with a flange facer cutting the material from outside towards the centre of the manhole cover 2.

REFERENCES CITED IN THE DESCRIPTION

Cited references

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Patent documents cited in the description

- KR20110035106A **[0005]**
- US5630346A **[0009]**
- US5050291A **[0009]**

Patentkrav

1. Fremgangsmåde til reparation af et mandehul omfattende en mandehulsramme (1) og et mandehulsdæksel (2), omfattende følgende trin, hvor:

i mandehulsrammen (1) med fjernet mandehulsdæksel (2), indsættes og centreres en nivelleringskerne (9), derefter fastgøres en bearbejdningsenhed (10) omfattende en skæreenhed (11) til nævnte nivelleringskerne (9), **kendetegnet ved, at** en måleindretning monteres i bearbejdningsenheden (10), og overfladejævnheden af bærefladen (7) af mandehulsrammen (1) måles, hvor under målingen nævnte bearbejdningsenhed (10) nivelleres i forhold til bærefladen (7) af mandehullet, derefter frigøres måleindretningen fra nivelleringskernen, og en skæreklinge fastgøres til skæreenheden (11), derefter udjævnes nævnte bæreflade (7) ved at fjerne materiale ved at skære fra nævnte bæreflade (7) ved at bevæge nævnte bearbejdningsenhed (10) langs nævnte bæreflade (7) på en cirkelformet bane, indtil den påkrævede overfladejævnhed af nævnte bæreflade- (7) overflade er opnået med mængden af materiale fjernet fra nævnte bæreflade (7), derefter fjernes nævnte nivelleringskerne (9) og bearbejdningsenhed (10) omfattende skæreenheden (11) fra mandehulsrammen (1).

2. Fremgangsmåden ifølge det foregående krav, hvor nivelleringskernen (9) omfatter hydrauliske fastgørelsesstempler, tilpasnings- og nivelleringsudstyr.

3. Fremgangsmåden ifølge krav 2, hvor fastgørelsesstemplerne er valgt fra følgende fastgørelsesstempler: hydrauliske, mekaniske.

4. Fremgangsmåden ifølge et hvilket som helst af de foregående krav, hvor bearbejdningsenheden (10) er en flangebearbejdningsmaskine.

5. Fremgangsmåden ifølge krav 4, hvor flangebearbejdningsmaskinen omfatter en skæreenhed (11) og en drejeenhed (12).

6. Fremgangsmåden ifølge et hvilket som helst af de foregående krav, hvor skæredybden er 0,15-0,30 mm per omdrejning af bearbejdningsenheden (10),

efterhånden som bearbejdningsenheden (10) bevæger sig langs bærefladen (7).

7. Fremgangsmåden ifølge et hvilket som helst af de foregående krav, hvor bærefladen (7) af mandehulsrammen (1) skæres til en overfladejævnhed på 0,01 til 0,10 mm.

8. Fremgangsmåden ifølge krav 7, hvor bærefladen (7) af mandehulsrammen (1) skæres til en overfladejævnhed på 0,05 mm.

9. Fremgangsmåden ifølge et hvilket som helst af de foregående krav, hvor efter skæring af bærefladen til den ønskede overfladejævnhed, dækkes bærefladen (7) af mandehulsrammen (1) med maling.

DRAWINGS

FIG. 1

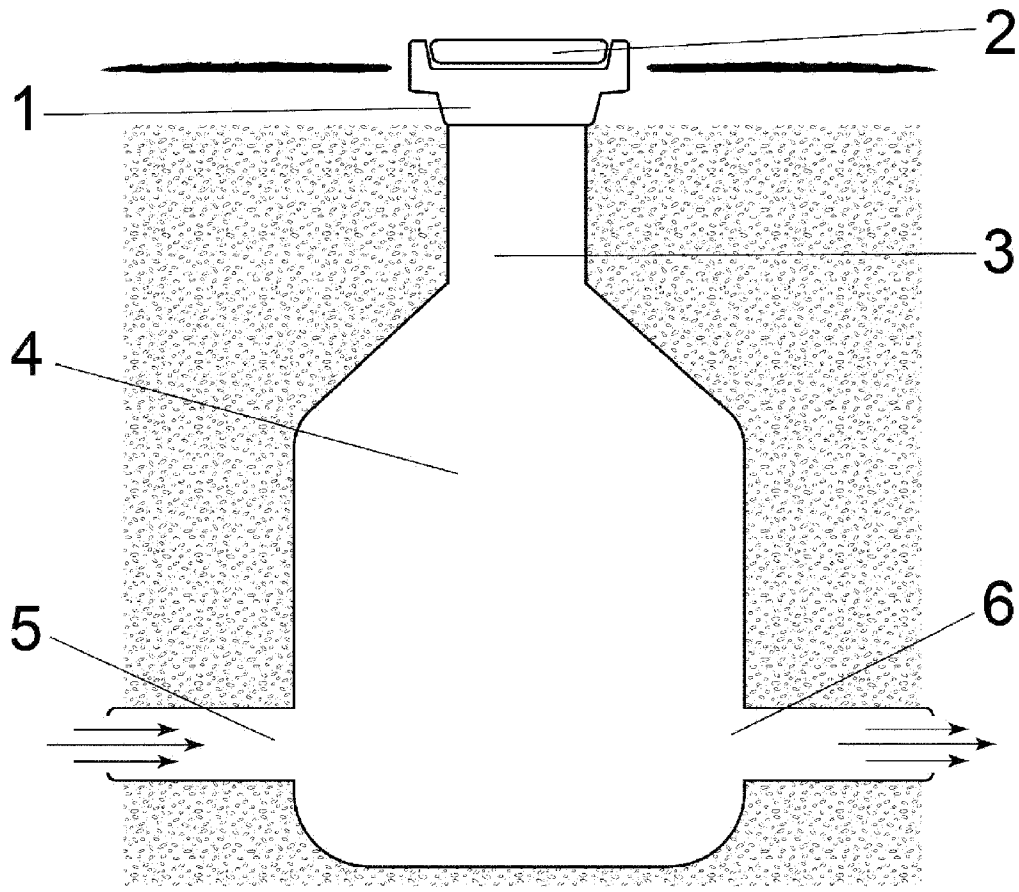

FIG. 2

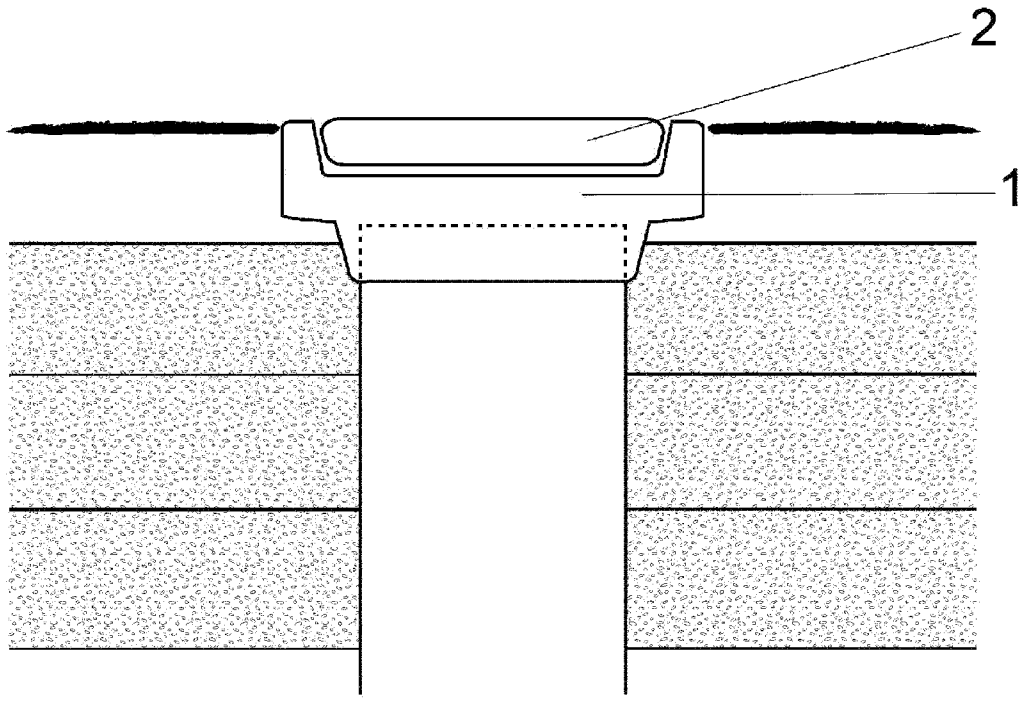

FIG. 3

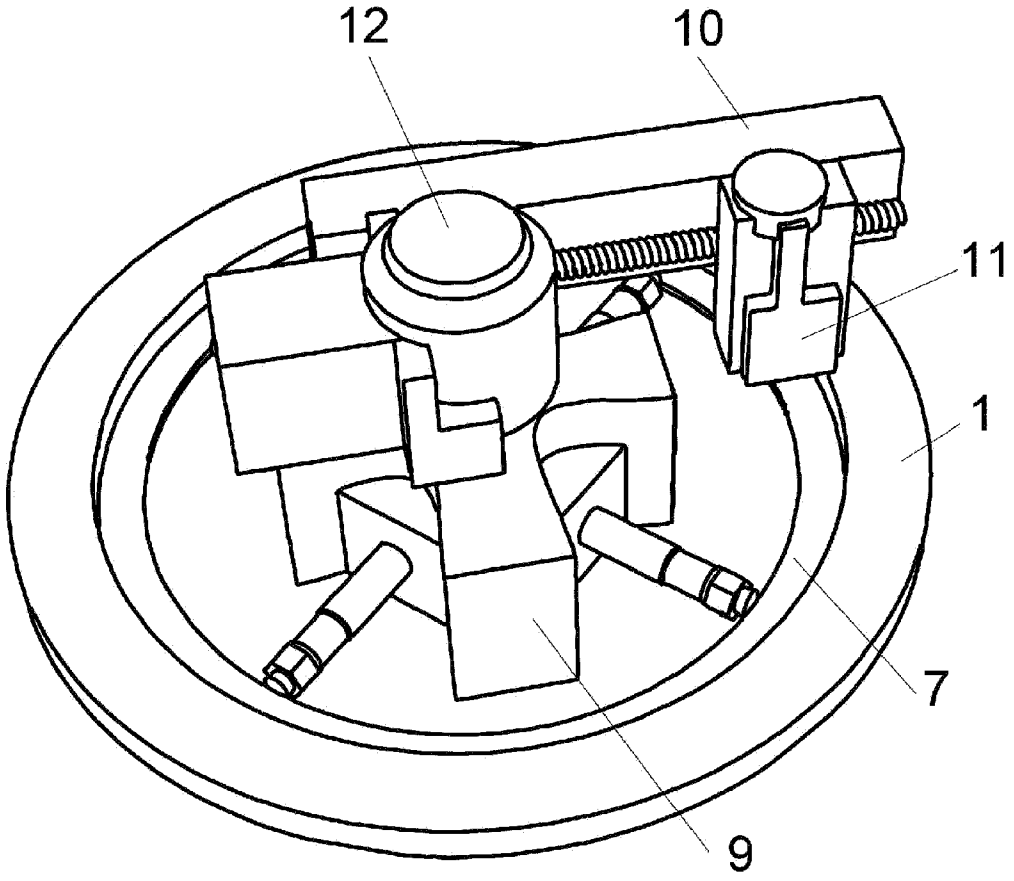

FIG. 4

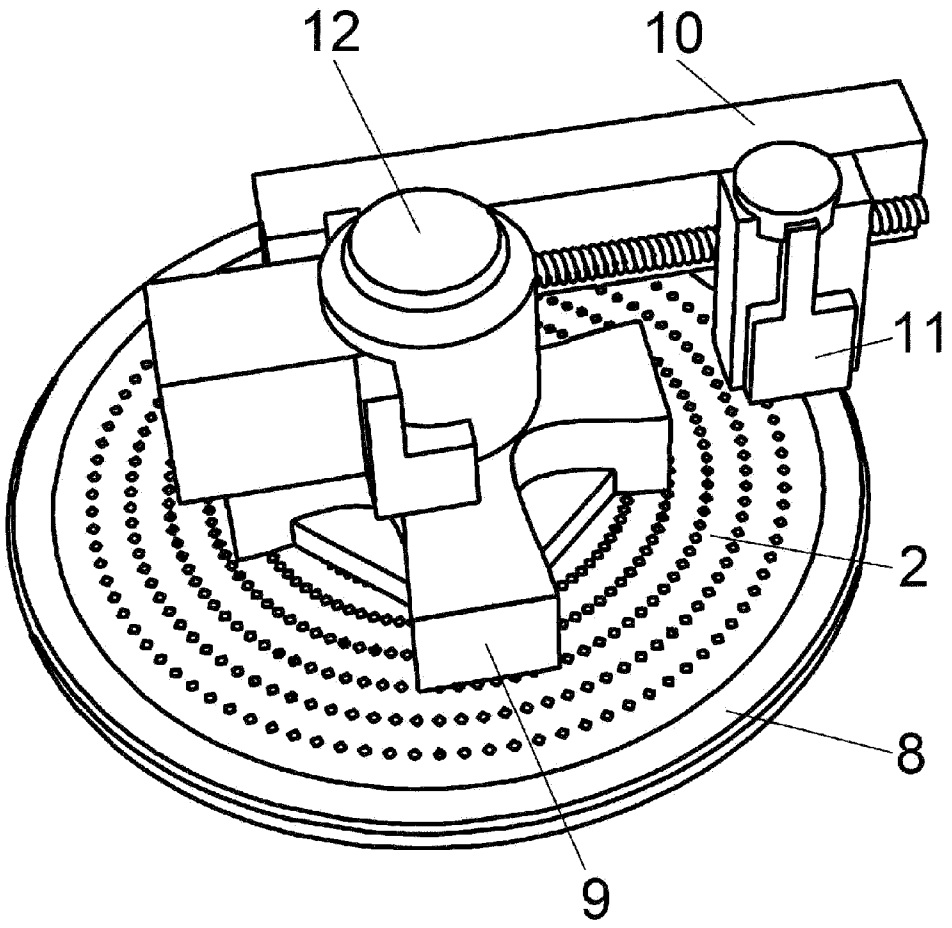

FIG. 5

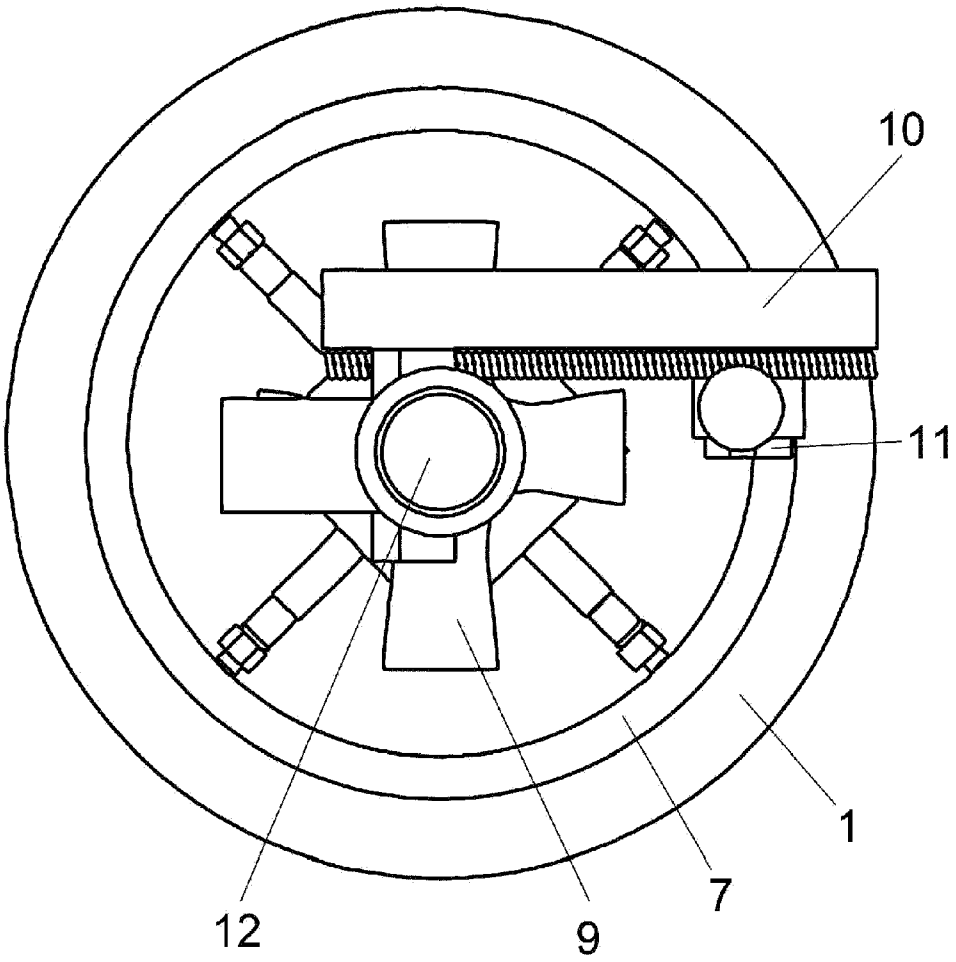

FIG. 6