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(54) Title: A TAP OFF BOX (TOB) ARRANGEMENT FOR USE IN A BUS BAR TRUNKING SYSTEM (BBT)

(57) Abstract: The present invention relates to a Tap off Box (TOB) arrangement for use in a Bus bar trunking system (BBT). The arrangement comprises housing (3), detachable cover means (2) fixed on the housing and an interlocking assembly. The interlocking assembly comprises a handle means (4) comprising a slot means (13), an interlock plate means (5) located in abutment with the said cover means (2). The plate means (5) has a bent profile (12) at one of its end such that in operation during ON condition while opening the said cover (2), the bent interferes with said slot means of the handle thereby restricting opening of the said cov-
er means.



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**A TAP OFF BOX (TOB) ARRANGEMENT FOR USE IN A BUS BAR
TRUNKING SYSTEM (BBT)**

FIELD OF THE INVENTION

The present invention relates to a Tap off Box (TOB) arrangement for use in Bus Bar Trunking System (BBTS). More particularly, the invention is concerned about an improved door interlocking arrangement for Tap off Box (TOB) of Bus bar trunking system (BBT) by using less number of components. Further, it provides external locking facility and status indication of the Tap off Box (TOB) whether it is in ON, OFF or TRIP position.

BACKGROUND OF THE INVENTION

10 The existing door interlocking arrangement for Tap off Box (TOB) of Bus bar trunking system (BBT) is very bulky , more number of parts and have many problems. In the existing door interlock arrangement, springs are used for interlocking mechanism. The springs wear and tear after certain period of operations. Therefore, the whole door padlocking/interlocking arrangement is unoperational. The existing design of the interlock is using too many
15 components for interlocking and uses metallic sheet handle.

The Indian patent application number 1814/MUM/2008 entitled "TAP OFF BOX FOR BUSBAR TRUNKING SYSTEM" discloses a tap off box provided with a support assembly arranged inside the housing to mount a circuit breaker on a bus bar in a bus bar trunking system. A link assembly is mounted on the circuit breaker to provide horizontal and vertical offset to accommodate the circuit breakers of different sizes. The support assembly provides a vertical offset to accommodate the circuit breakers of different sizes. When the circuit breaker is switched on, the operating lever in the link assembly presses a plunger down to get engaged with an interlocking assembly to prevent the removal of the tap of box from the bus
20 bar trunking system
25

The Indian patent application number 1840/MUM/2008 entitled "BUS BAR INTERLOCK MECHANISM FOR TAP OFF BOX" discloses an interlock mechanism for Tap off Box (TOB) with Bus Bar Trunking system. According to one embodiment of the present

invention, an interlock mechanism has a plunger assembly and an interlock assembly. The plunger assembly is mounted on a support plate holding a circuit breaker. An operating handle of the circuit breaker is connected to the plunger assembly through a link assembly. The interlock assembly is mounted on the tap off box. The link assembly pushes the plunger assembly to engage with the interlock assembly to lock the tap off box with the busbar to prevent the removal of the tap off box from the busbar, when the operating handle of the circuit breaker is moved to turn the circuit breaker to the ON state.

Thus, there is a need to overcome the problems of the existing interlock designs in the prior art. Therefore, the present inventors have developed an improved door interlocking arrangement for Tap off Box (TOB) of Bus Bar Trunking System (BBTS) by using less number of components to make the arrangement simple and effective. The present inventors have developed door interlocking arrangement by avoiding the usage of springs. Further, the present inventors have provided external locking facility by using the same two components. Further, the present inventors have provided status indication of the TOB whether it is in ON, OFF or TRIP position.

OBJECTS OF THE INVENTION

An object of the present invention is to overcome the problems/disadvantages of the prior art.

Another object of the present invention is to provide a Tap off Box (TOB) arrangement for use in Bus Bar Trunking System (BBTS)

Another object of the present invention is to provide an improved door interlocking arrangement for Tap off Box (TOB) of Bus bar trunking system (BBT).

Another object of the present invention is to provide an improved door interlocking arrangement by using less number of components.

Another object of the present invention is to provide external locking facility.

Another object of the present invention is to provide external locking facility by using less number of components.

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Yet, another object of the present invention is to provide status indication of the Tap off Box (TOB) whether it is in ON, OFF or TRIP position.

SUMMARY OF THE INVENTION

- 10 According to one aspect of the present invention there is provided a Tap off Box (TOB) arrangement for use in a Bus bar trunking system (BBT), said arrangement comprising:
housing;
cover means being detachably fixed on said housing;
an interlocking assembly comprising
- 15 a handle means comprising a predetermined slot means;
an interlock plate means
wherein said interlock plate means being operatively located in abutment with the said cover means
wherein said plate having a bent profile at one of its end so as to define a substantial L-shape
- 20 profile such that in operation during ON condition while opening the said cover, the bent interferes with said slot means of the handle thereby restricting opening of the said cover means.

- According to another aspect of the present invention there is provided an interlocking
- 25 assembly for use in housing for circuit breakers, contactors, interrupters, switches and in any other products where a cover is provided on the housing, assembly comprising :
a handle means comprising a predetermined slot means;
an interlock plate means

wherein said interlock plate means being operatively located in abutment with the said cover means

wherein said plate having a bent profile at one of its end so as to define a substantial L-shape profile such that while opening the said cover, the bent interferes with said slot means of the handle thereby restricting opening of the said cover means.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

Fig 1 illustrates isometric view of the Tap off Box (TOB) mounted on Bus Bar straight length.

10 Fig 2 illustrates side view of the Tap off Box (TOB) from handle side.

Fig 3 illustrates handle opposite side and TOB is in ON state.

Fig 4 illustrates zoom in view of handle opposite side.

Fig 5 illustrates zoom in view of handle side.

Fig 6 illustrates zoom in view of door interlocking assembly when TOB is in ON state.

15 Fig 7 illustrates front view of status indication of TOB.

Fig 8 illustrates side view of TOB in OFF state.

Fig 9 illustrates zoom in view of external locking

Fig 10 illustrates cover assembly on the top of TOB.

Fig 11 illustrates door interlock plate assembly.

20 Figs. 12 and 13 illustrates interlock plate

Fig 14 illustrates zoom in view of 'L' shape bend of interlock plate.

Fig 15 illustrates unbend view of interlock plate.

DETAILED DESCRIPTION OF THE ACCOMPANYING DRAWINGS

25 According to the invention there is provided an improved door interlocking arrangement for Tap off Box (TOB) of Bus bar trunking system (BBT) by using less number of components. The present invention is also provided an external locking facility by using the same two components. Further, the present invention is provided with status indication of the TOB whether it is in ON, OFF or TRIP position. The present invention provides the unit foolproof

door interlock which has got good life as well. This door interlock provides the interlocking of the TOB in the ON state so that the electrical circuit which is inside the TOB is not getting exposure to the customer. Even if the customer tries to open the door of the TOB in ON state, the interlock will prevent the opening of the door. In this manner it provides foolproof door interlocking by using minimum number of components. Other problem which was there in the existing TOB is that external locking feature was absent in the existing design, which is provided in the new design of interlock. So if some maintenance work has to be done on the unit customer can lock the handle in OFF state and do the maintenance operation. Status indication was there in the existing design of TOB but the size was small, for the customer it was impossible to see the status clearly from fair distance. In the new design of the TOB status indicating sticker are big enough so that customer can have clear visibility of the status indication from all three sides.

Fig. 1 shows the Tap Off Box (TOB) which is mounted on to the busbar straight length (1). From the outer view there is a box (3) which houses the inner assembly of the TOB. There is cover(2) of the TOB which is used to close the TOB and to isolate it from outer side, as it is having live electrical current path which can be dangerous to operator. TOB has a mechanism to operate MCCB which is inside the box (30). It is a rotating mechanism which is operated by a Plastic Handle (4). In the design of the TOB Door interlocking is one of the mandatory interlock which provides the interlocking between cover (2) and the handle (4) so that when the TOB is switched ON to electric current supply its door should be prevented from opening. TOB shown above is in the OFF state, handle (4) is in perfect vertical condition. There is an interlock plate (5) which is used to provide door padlocking. Interlock plate (5) has a 'L' bend (12) which interlocks the handle (4) with the cover (2) when TOB is in ON state. There is a grip (15) attached to the interlock plate(5) so that when the TOB is in OFF state & when customer wants to open the cover(2) of the TOB it can provide a better grip to the operator so that it can easily open the cover (2). There is status indication sticker on the TOB. There is front sticker (6) and handle opposite side sticker (10) & (8) is the indicator which points towards the status of the TOB when it is being operated by the

customer. In the Fig. 1 TOB is in OFF state so the door interlocking is not required & operator can open the cover (2) of the TOB with using grip (15) to hold the cover (2).

Fig. 2 provides side view of the TOB from handle (4) side. Handle side indicator (7) which points onto handle (4) side sticker (9) when the TOB is operated by the customer. Again TOB is in OFF state. In the handle (4) there is a hole (16) which is provided for external locking purpose. Hole (11) is there in the interlock plate (5) and is aligned with hole (16) of the handle so that when the TOB is in the OFF state customer can externally lock the handle (4) of the TOB with the interlock plate(5) which is connected to the cover(2) from outside so that the TOB cannot be operated. This external locking feature provides customer safer and isolated operation from electric current supply when the some maintenance activity has to be done on TOB. It ensures complete isolation of the TOB interior from the electric current supply. Also the TOB is in OFF state so it can be seen from the figure that there is no interference between operating handle (4) and the cover's (2) 'L' bend (12) so when the customer tries to open the cover (2) of the TOB when external locking is absent, he can open the cover of the TOB as it is in OFF state and door interlocking is required only in the ON state.

Fig. 3 shows the handle (4) opposite side view and TOB is in ON state. From the view it is clear that handle (4) is inclined because to make the TOB in ON state operator has to operate the handle by providing rotary motion which is approximately 30 degree for making the MCCB in ON state. From the above figure it can be seen that handle (4) position is such that when the operator wants to open the cover (2) of the TOB, 'L' bend (12) of interlock plate (5) interfere with the section of the operating handle (4) making it interlocked in ON state so that even if operator tries to pull the cover (2) he will fail to make it operate. By this operation door interlocking is provided in the TOB. It can be seen that door interlocking is provided by using only two components which are handle (4) & interlock plate(5) so as to reduce the number of components to be used for interlocking. From fig. 3 it can be seen that it has handle (4) opposite side view of the TOB. Because the TOB is in ON state it can be

observed that handle (4) opposite side indicator (8) is pointing towards the ON state on to the handle (4) opposite side sticker (10). Reason for change in handle (4) opposite side indicator (8) is that it is coupled to the mechanism of the TOB so when the TOB is operated correspondingly there is also a rotary motion in the indicator and it provides convenience to the operator that he can be sure about that status of the TOB from outside. This feature provides the customer to know about the status of the TOB whether it is in ON/OFF/TRIP State. Status indication is provided from all three sides of visibility.

Fig. 4 shows the zoom in view of the handle (4) opposite side. The state of the TOB is in ON state so correspondingly handle (4) opposite side indicator (8) is also pointing towards the ON state on to the handle (4) opposite side sticker (10). When the handle (4) is again operated in to the OFF state handle (4) opposite side indicator (8) will point towards the OFF state on to the handle (4) opposite side sticker (10). TRIP condition arrives when the TOB is in ON state and connected to electric current supply and suddenly if short circuit fault or an overload fault occurs thus making the MCCB state into the TRIP condition. In this case MCCB will provide the necessary rotary motion to the mechanism of the TOB and handle (4) opposite side indicator (8) is also coupled with the same mechanism so it will also show the TRIP indication on to the handle (4) opposite side sticker (10). By this concept all the three status condition of the MCCB will be known to the customer from outside.

Fig. 5 also show the same concept but only difference is that this is zoom in view from that handle side view. So it can be seen that because the TOB is in the ON state handle (4) side indicator (7) is pointing towards the OFF state on to the handle (4) side sticker (9).

Fig. 6 shows the zoom in view of the door interlocking assembly when the TOB is in ON state. Handle (4) is inclined because of the rotary motion provided to it. Thus TOB is in ON or energized state, it can be seen that 'L' bend (12) in the interlocking plate (5) is very close to handle section (13) which is provided to interlock the cover opening in ON state, when the customer wants to open the cover (2) of the TOB, 'L' bend (12) will interfere with the handle

section (13) of the operating handle (4) thus providing foolproof door interlocking. Fig. 6 shows the zoom in view of the door interlocking assembly when the TOB is in ON state. Handle (4) is inclined because of the rotary motion provided to it. Thus TOB is in ON or energized state, it can be seen that 'L' bend (12) in the interlocking plate (5) is very close to handle section (13) which is provided to interlock the cover opening in ON state, when the customer wants to open the cover (2) of the TOB 'L' bend (12) will interfere with the handle section (13) of the operating handle (4) thus providing foolproof door interlocking.

In fig. 7, it can be observed that TOB is again in ON state. Handle (4) is pointing towards the ON state on to the front sticker (6). Reason for this is that handle (4) is coupled with the operating mechanism. In the different condition of the MCCB which can be either of OFF/ON/TRIP condition handle (4) will point towards the different state on to the front sticker (6). This concept provides status indication from the front side. So when a customer is looking at the TOB from the front side he will have the idea of the status of the TOB from outside. From Fig. 4, Fig. 5 & Fig. 7, it is clear that customer will have clear idea of the status of the TOB from outside from all three possible sides of visibility (Front, Handle & Handle Opposite side).

Fig. 8 provides side view of the TOB in OFF state. It can be observed that in the OFF state of the TOB external locking is provided with the help of the external lock (14) which is coupling Interlock plate (5) and the operating handle. In this condition if operator wants to operate the TOB in ON state he will fail to do so because of the external locking. Apart from external locking customer will fail to open the cover of the TOB as well. This is also a good feature because if customer wants to do some maintenance work on to TOB he has to isolate the TOB from electric current supply before that, this can be done by using the external locking. In the application where TOB is used with the bus bar straight length someone unknowingly or even accidentally operate the TOB in ON state which can dangerous to avoid this type of operation external locking is very important.

Fig. 9 is the zoom in view of the external locking. TOB is in OFF state, so its handle is in vertical position. An external lock is provided between handle hole (16) & interlock plate (5) hole.

- 5 Fig. 10 shows the cover (2) assembly which is on the top of the TOB. It can be seen that door interlock plate (5) is assembled on to it.

Fig. 11 shows the door interlock plate assembly. There is plastic grip (15) which is fitted on to the interlock plate (5). The Plastic grip (15) has the serrations on its surface, so that
10 customer can have better grip while he tries to open the cover (2) of the TOB. In case of leakage current customer will be isolated from the metallic part. It can be seen that there is 'L' bend (12) at the end part of the interlock plate. The 'L' bend (12) & the other bend which holds the grip is an integral part of the interlock plate only.

- 15 Figures 12 and 13 show only interlock plate (5). The two opposite direction bends are in one single part along with the holes which are there for fixing of the interlock plate with the cover (2) of the TOB and for external locking. The interlock plate comprises a substantially planar region of appropriate length, which allows the handle to rotate ON position at a desired angle. The planar region further comprises chamfered portion having a predetermined
20 curvature to place the bent profile comprising serrated grip at a predetermined greater height than the bent profile adapted for interlocking.

- Fig. 14 shows the zoom in view of the L bend (12). To provide this kind of feature it requires one bending operation. Bending radius & its design profile is such that it does not interfere in
25 the normal ON, OFF operation of the TOB. But when the TOB is turned ON the design provide foolproof door interlocking.

Fig. 15 shows the unbend view of the interlock plate. The two close lines which are there around bend area shows the area where bending operation has to be performed. Both the

bending operation is done in opposite directions with accuracy, so that desired design profile is matched by the sample.

Following marking is used to describe the figures:

- 5 1. Bus bar Straight length
- 2. Cover
- 3. Box
- 4. Handle
- 5. Door Interlock Plate
- 10 6. Front Sticker
- 7. Handle side indicator
- 8. Handle Opposite side indicator
- 9. Handle Side Sticker
- 10. Handle Opposite Side Sticker
- 15 11. Hole For External Locking
- 12. L Bend
- 13. Slot in Handle
- 14. External Lock
- 15. Grip for Door Padlock
- 20 16. Handle Hole for External Locking

ADVANTAGES OF THE INVENTION

- 1. Simple arrangement provided for foolproof and safer door padlocking/ door interlocking.
- 2. Three way clear status indication of the true status of Tap off Box, which can be known to
- 25 user from all three possible site of visibility.
- 3. The door interlocking arrangement is cost effective and easy to implement as it requires minimum changes in the existing design.
- 4. The door interlock has got good operating life

5. External locking from outside for the customer, which will ensure safety to the customer during maintenance.

The invention has been described in a preferred form only and many variations may be made in the invention which will still be comprised within its spirit. The invention is not limited to the details cited above. Bus bar Straight length, Cover, Box, Handle, Door Interlock Plate, Front Sticker, Handle side indicator, Handle Opposite side indicator, Handle Side Sticker, Handle Opposite Side Sticker, Hole For External Locking, Slot in Handle, External Lock, Grip for Door Padlock, and Handle Hole for External Locking as stated do not limit the scope of the present invention. The structure thus conceived is susceptible of numerous modifications and variations, all the details may furthermore be replaced with elements having technical equivalence. In practice the materials and dimensions may be any according to the requirements, which will still be comprised within its true spirit.

CLAIMS

1. A Tap off Box (TOB) arrangement for use in a Bus bar trunking system (BBT), said arrangement comprising:
5 housing;
cover means being detachably fixed on said housing;
an interlocking assembly comprising
a handle means comprising a predetermined slot means;
an interlock plate means
10 wherein said interlock plate means being operatively located in abutment with the said cover means
wherein said plate having a bent profile at one of its end so as to define a substantial L-shape profile such that in operation during ON condition while opening the said cover, the bent interferes with said slot means of the handle thereby restricting
15 opening of the said cover means.
2. Arrangement as claimed in claim 1, wherein said interlock plate means additionally comprises another bent profile adapted to open the cover.
- 20 3. Arrangement as claimed in claim 2, wherein said bent profile comprises serrated grip.
4. Arrangement as claimed in claim 1, wherein said interlock plate comprises hole means.
- 25 5. Arrangement as claimed in claim 1, wherein said handle means comprises hole means such that during OFF conditions the said hole means comes in alignment with the hole means on the interlock plate adapted to externally lock the cover.

6. Arrangement as claimed in claim 1, wherein said interlock plate comprises at least one hole for fixation with the cover means.
7. Arrangement as claimed in claim 1, wherein said interlock plate comprises substantially planar region of appropriate length adapted to allow said handle to rotate so as to operatively locate itself to ON position at a desired angular position.
8. Arrangement as claimed in claim 7, wherein the said handle is inclined to about 30° approximately.
9. Arrangement as claimed in claim 7, wherein said planar region further comprises chamfered portion having a predetermined curvature so as to place the bent profile comprising serrated grip at a predetermined greater height than said bent profile adapted for interlocking.
10. An interlocking assembly for use in housing for circuit breakers, contactors, interrupters, switches and in any other products where a cover is provided on the housing, assembly comprising :
a handle means comprising a predetermined slot means;
an interlock plate means
wherein said interlock plate means being operatively located in abutment with the said cover means
wherein said plate having a bent profile at one of its end so as to define a substantial L-shape profile such that while opening the said cover, the bent interferes with said slot means of the handle thereby restricting opening of the said cover means.
11. Arrangement as claimed in claim 10, wherein said interlock plate means additionally comprises another bent profile adapted to open the cover.

12. Arrangement as claimed in claim 11, wherein said bent profile comprises serrated grip.
13. Arrangement as claimed in claim 10, wherein said interlock plate comprises hole means.
14. Arrangement as claimed in claim 1, wherein said handle means comprises hole means such that during OFF conditions the said hole means comes in alignment with the hole means on the interlock plate adapted to externally lock the cover.
15. Arrangement as claimed in claim 10, wherein said interlock plate comprises at least one hole for fixation with the cover means.
16. Arrangement as claimed in claim 10, wherein said interlock plate comprises substantially planar region of appropriate length adapted to allow said handle to rotate so as to operatively locate itself to ON position at a desired angular position.
17. Arrangement as claimed in claim 10, wherein said planar region further comprises chamfered portion having a predetermined curvature so as to place the bent profile comprising serrated grip at a predetermined greater height than said bent profile adapted for interlocking.
18. A Tap off Box (TOB) arrangement for use in a Bus bar trunking system (BBT) as herein substantially described and illustrated with the accompanying drawings.

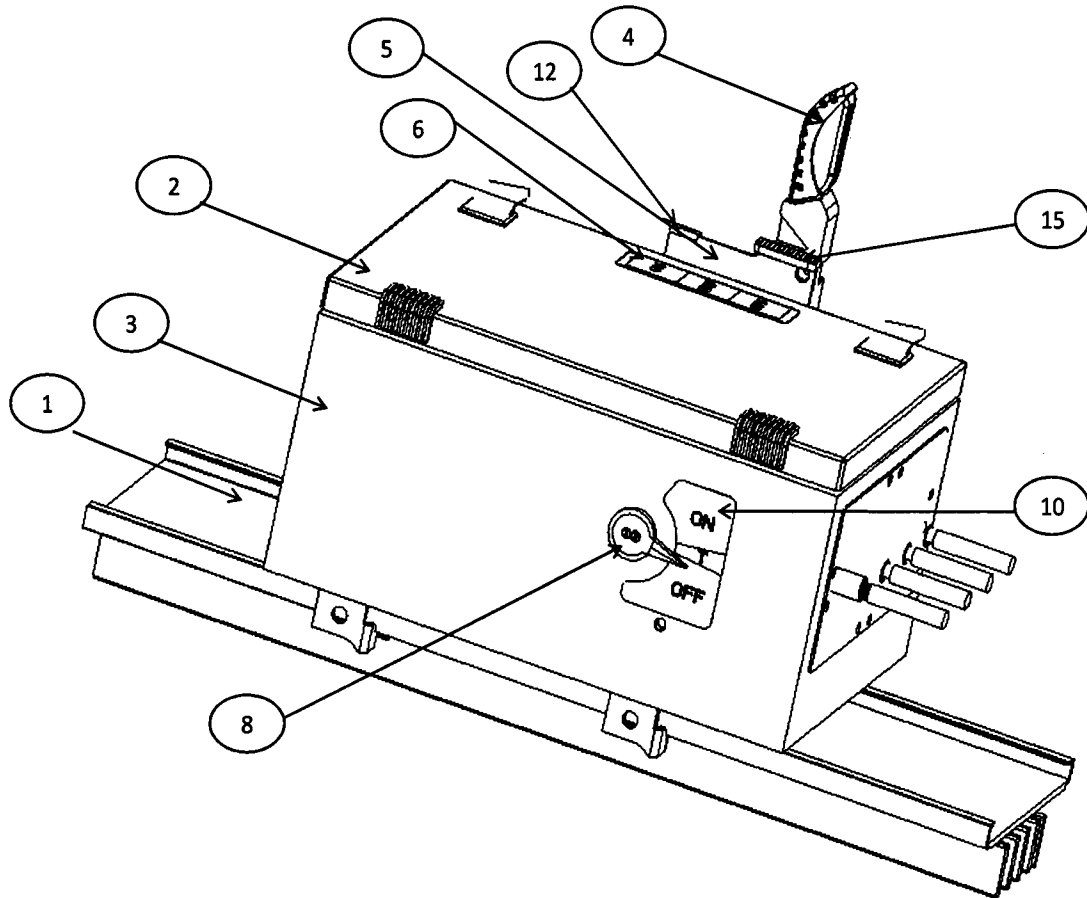


Fig. - 1

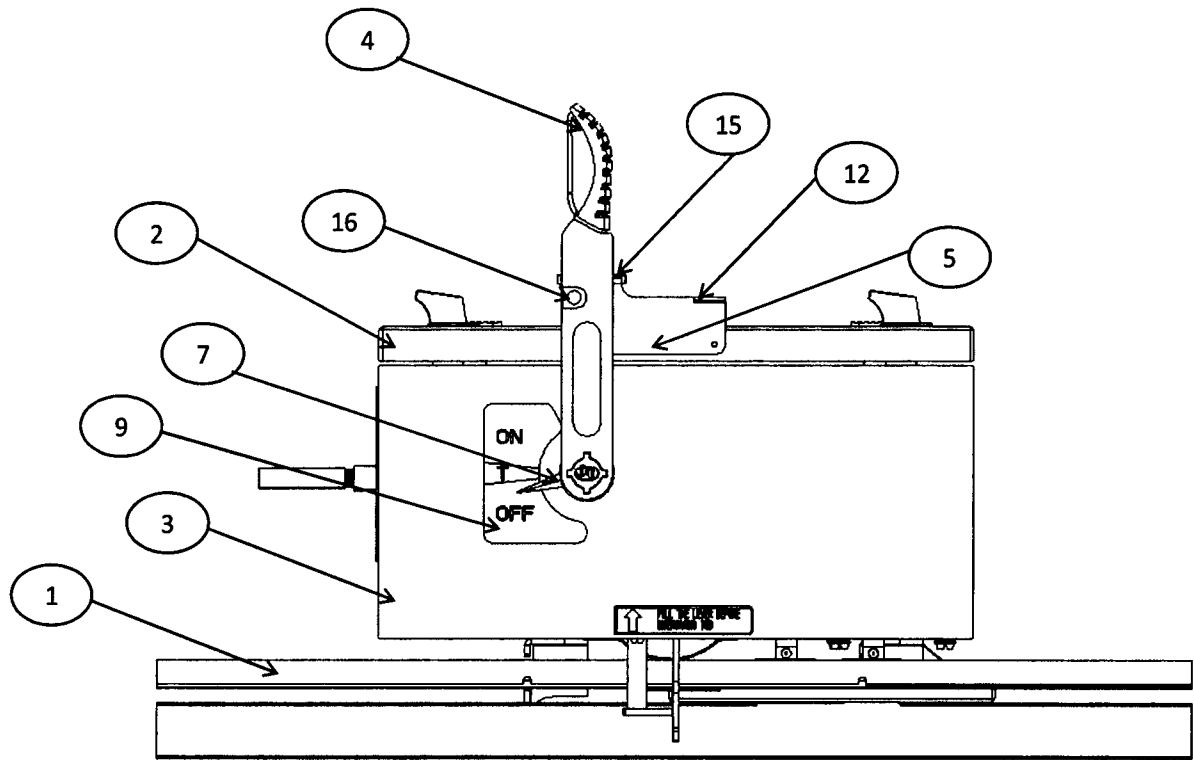


Fig. - 2

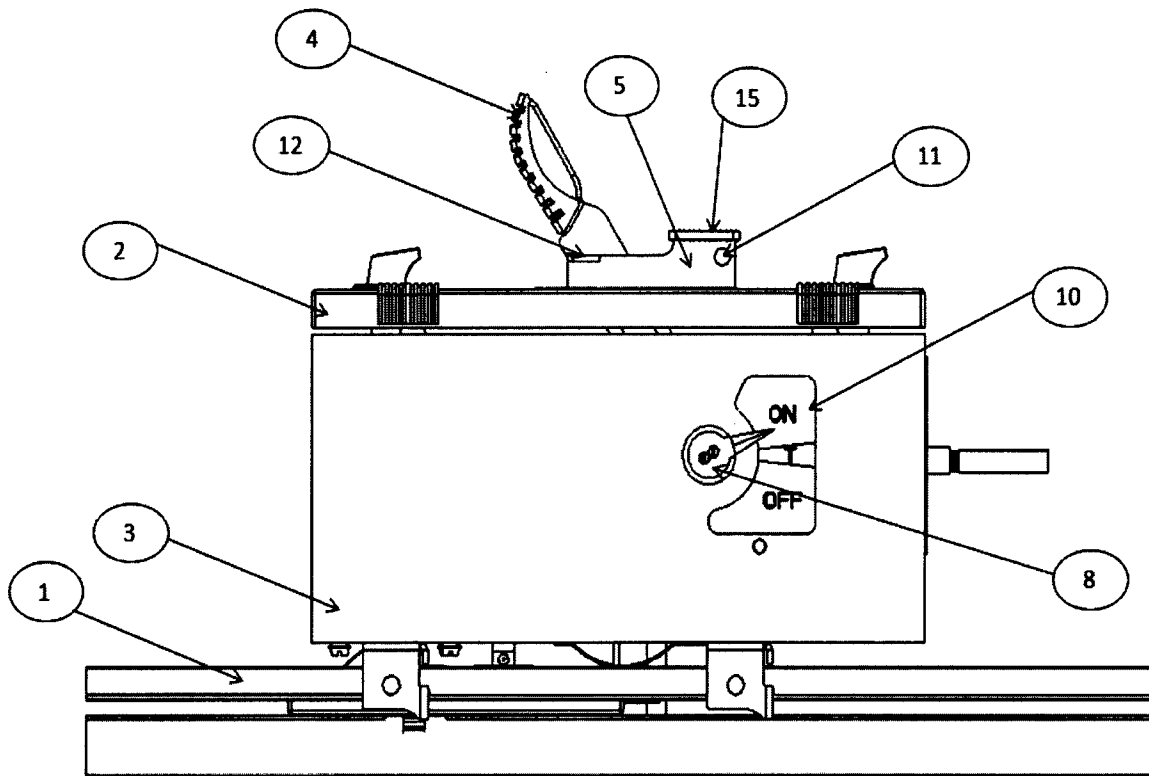


Fig. - 3

4/13

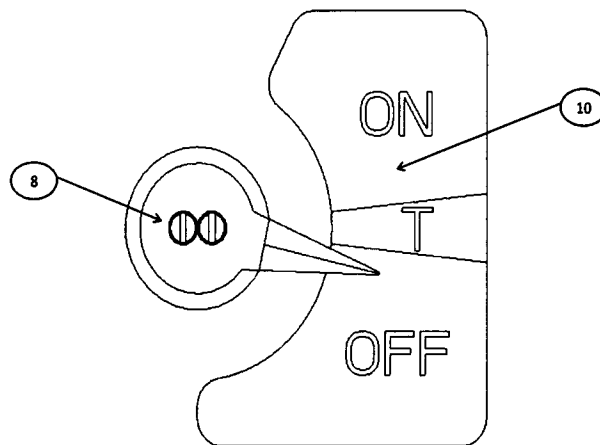


Fig. - 4

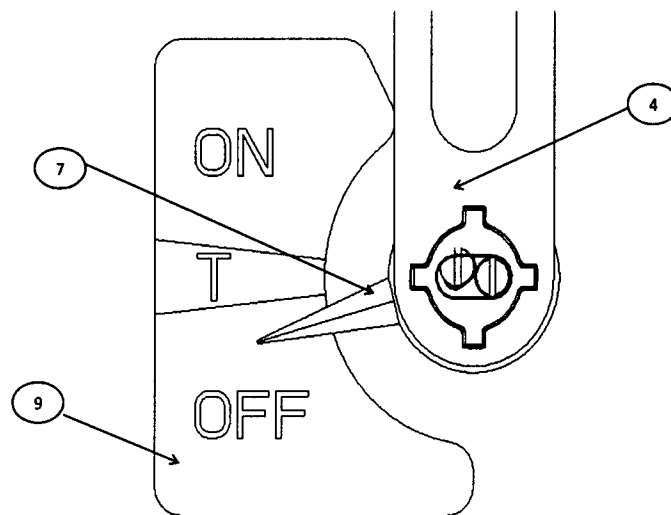


Fig. - 5

5/13

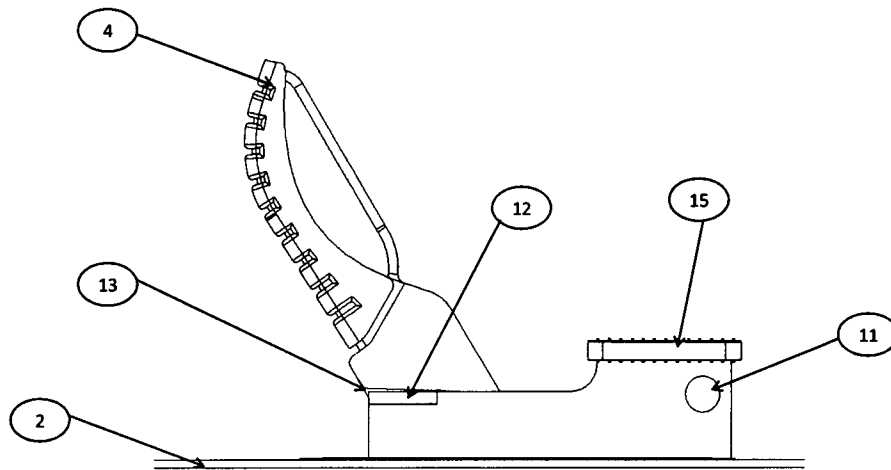


Fig. - 6

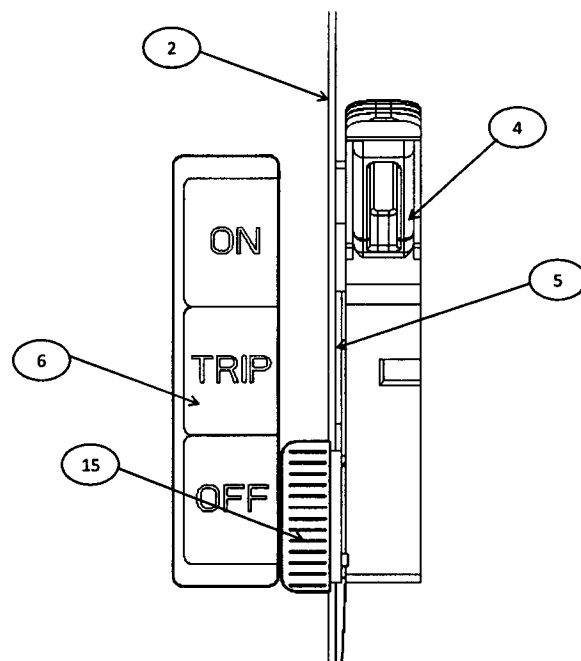


Fig. - 7

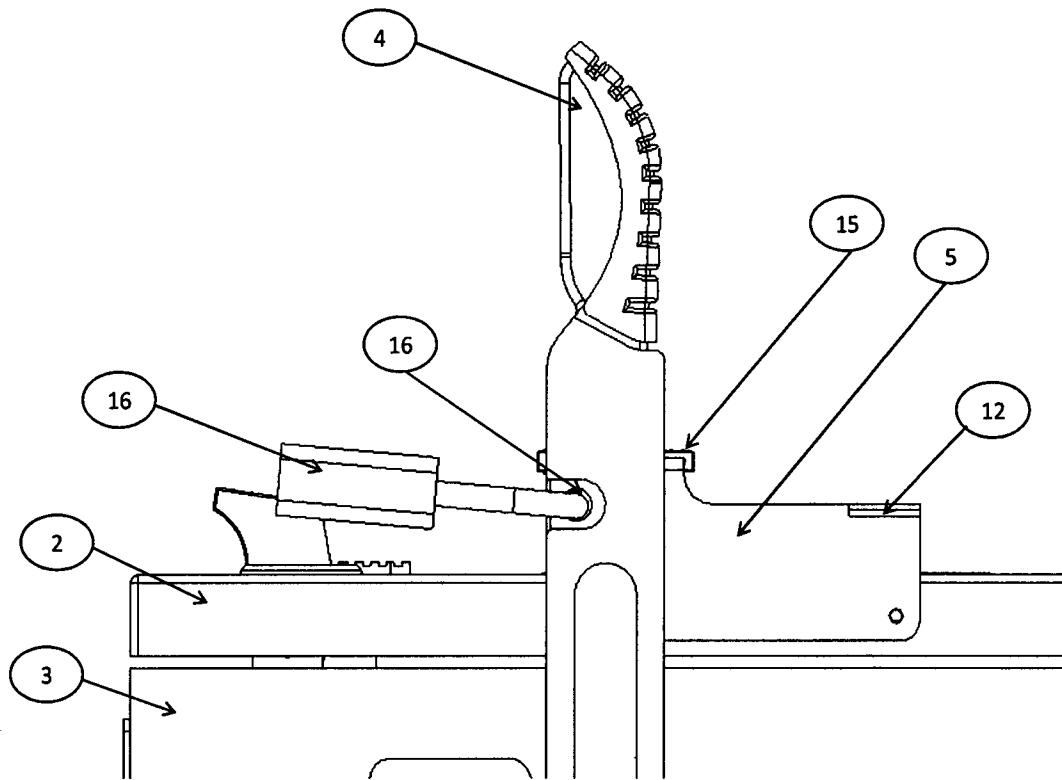


Fig. - 9

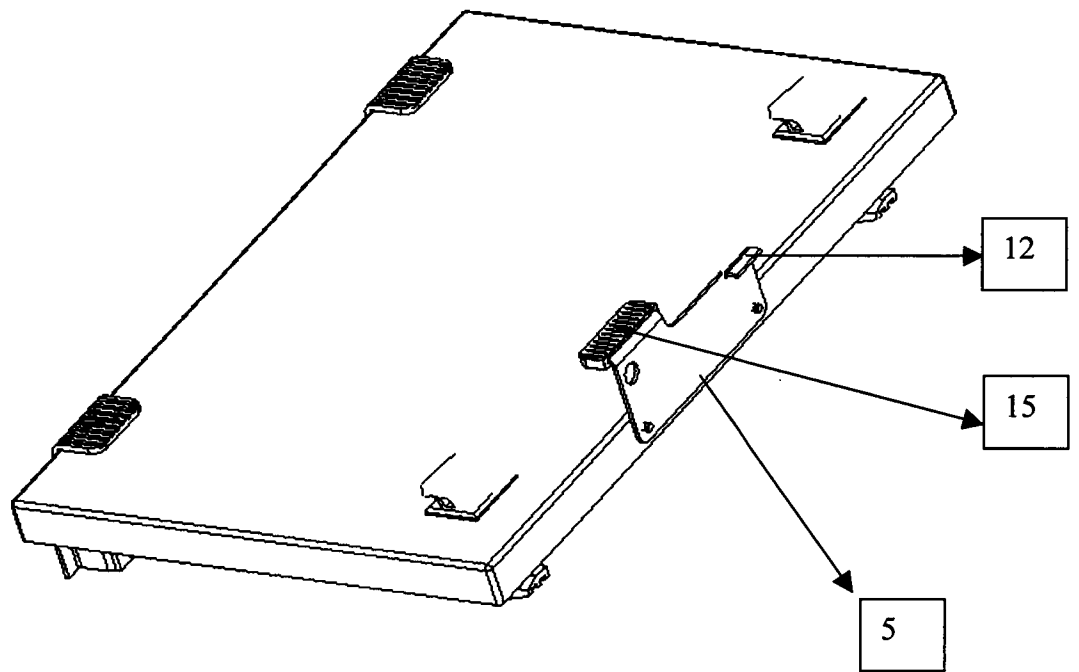


Fig. - 10

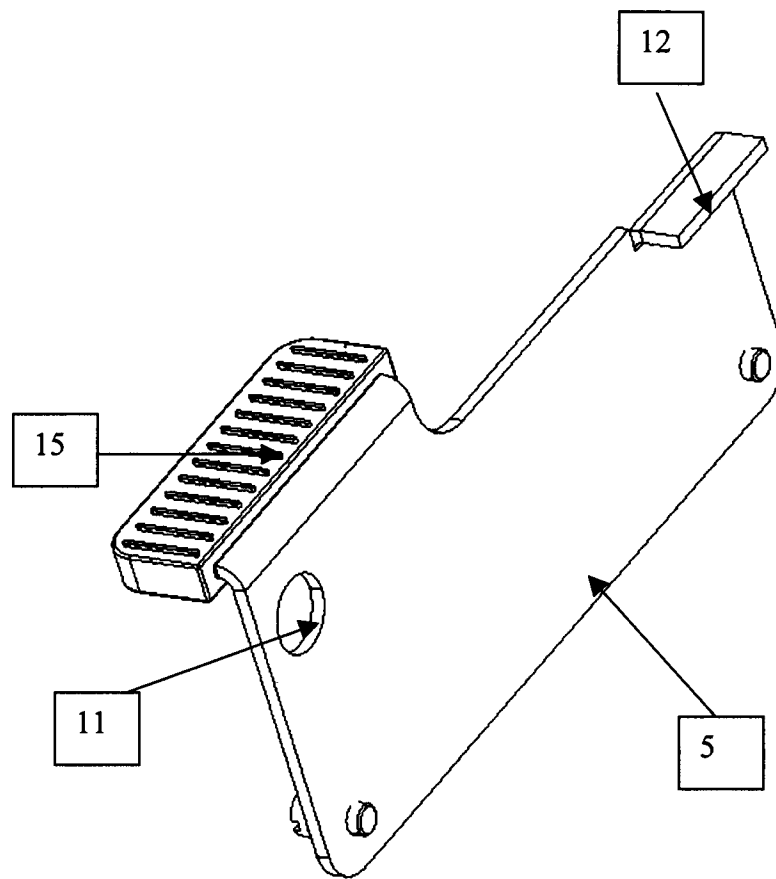


Fig. - 11

10/13

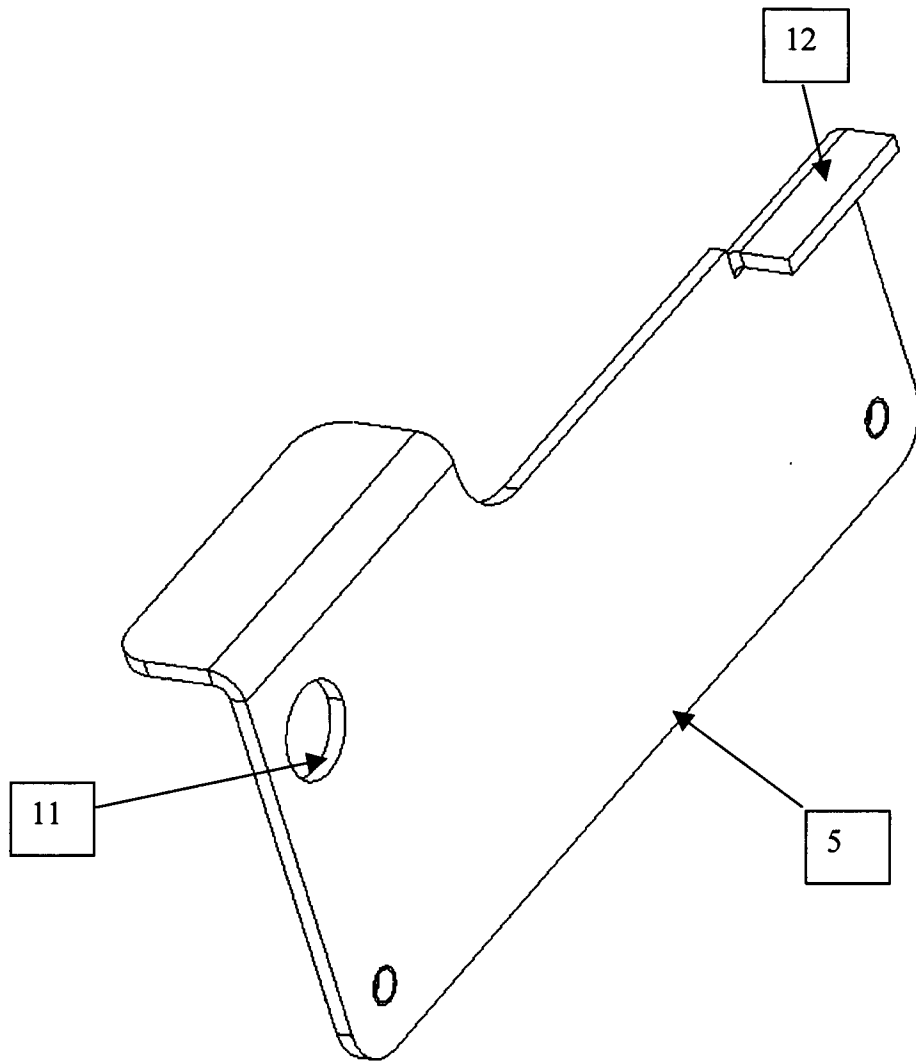


Fig. - 12

11/13

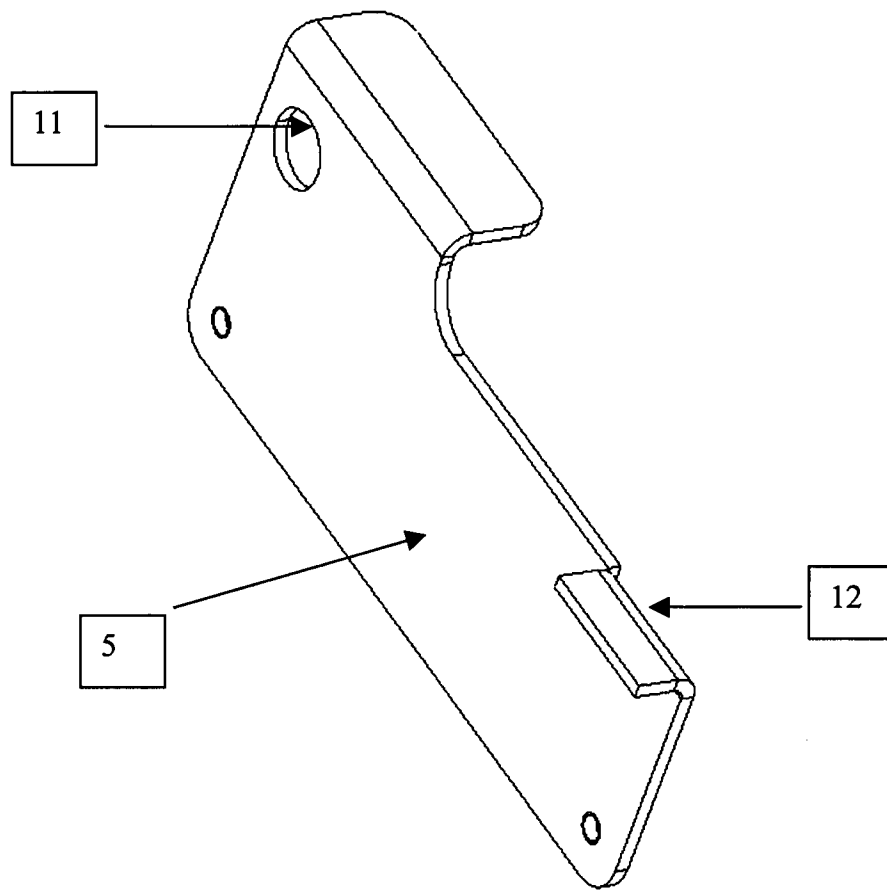


Fig. - 13

12/13

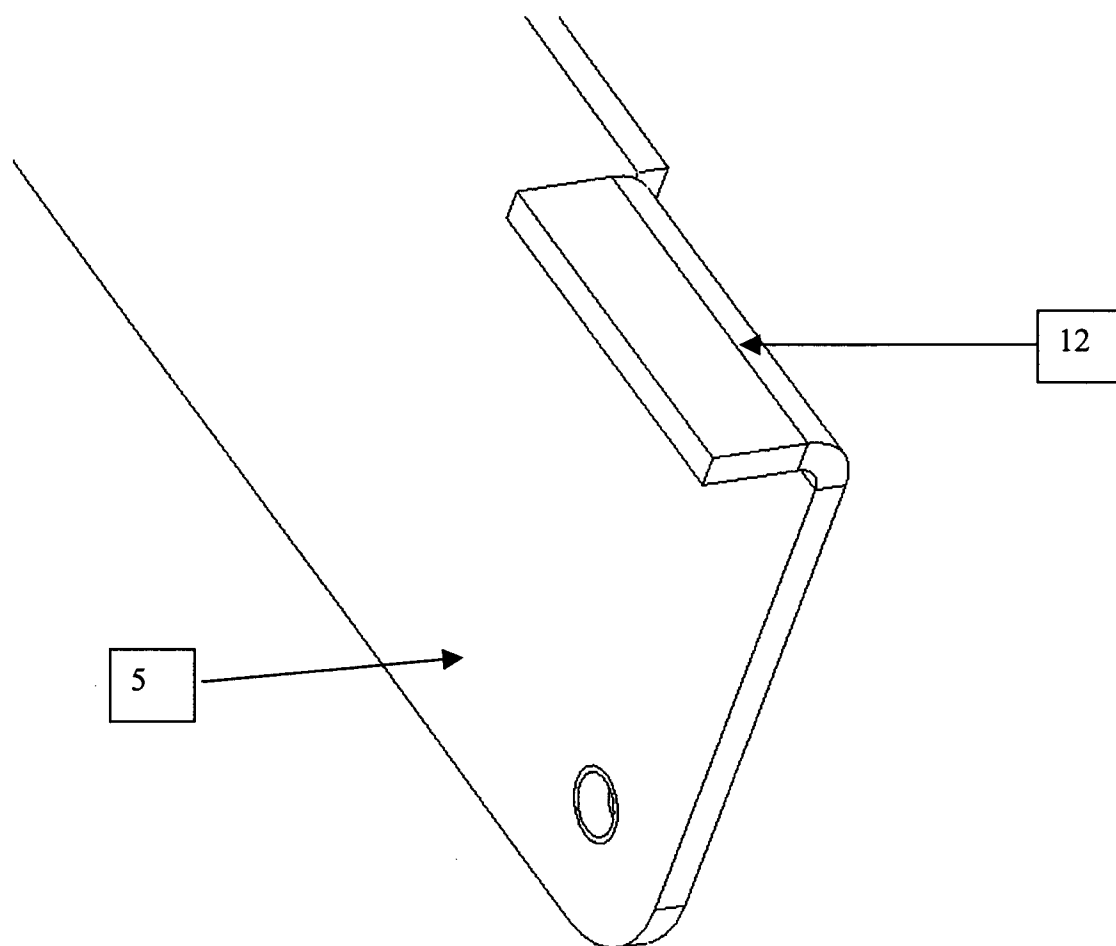


Fig. - 14

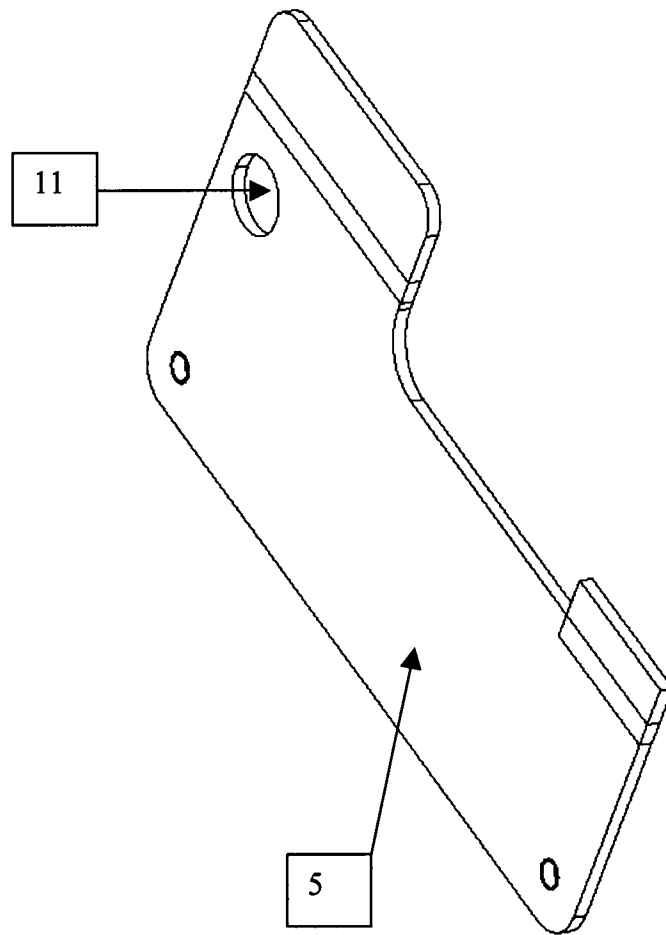


Fig. - 15