Sept. 20, 1960 D. W. WARNER, JR., ET AL 2,953,655

CIRCUIT INTERRUPTERS

Filed Dec. 22, 1958

4 Sheets-Sheet 1

Fig. 1

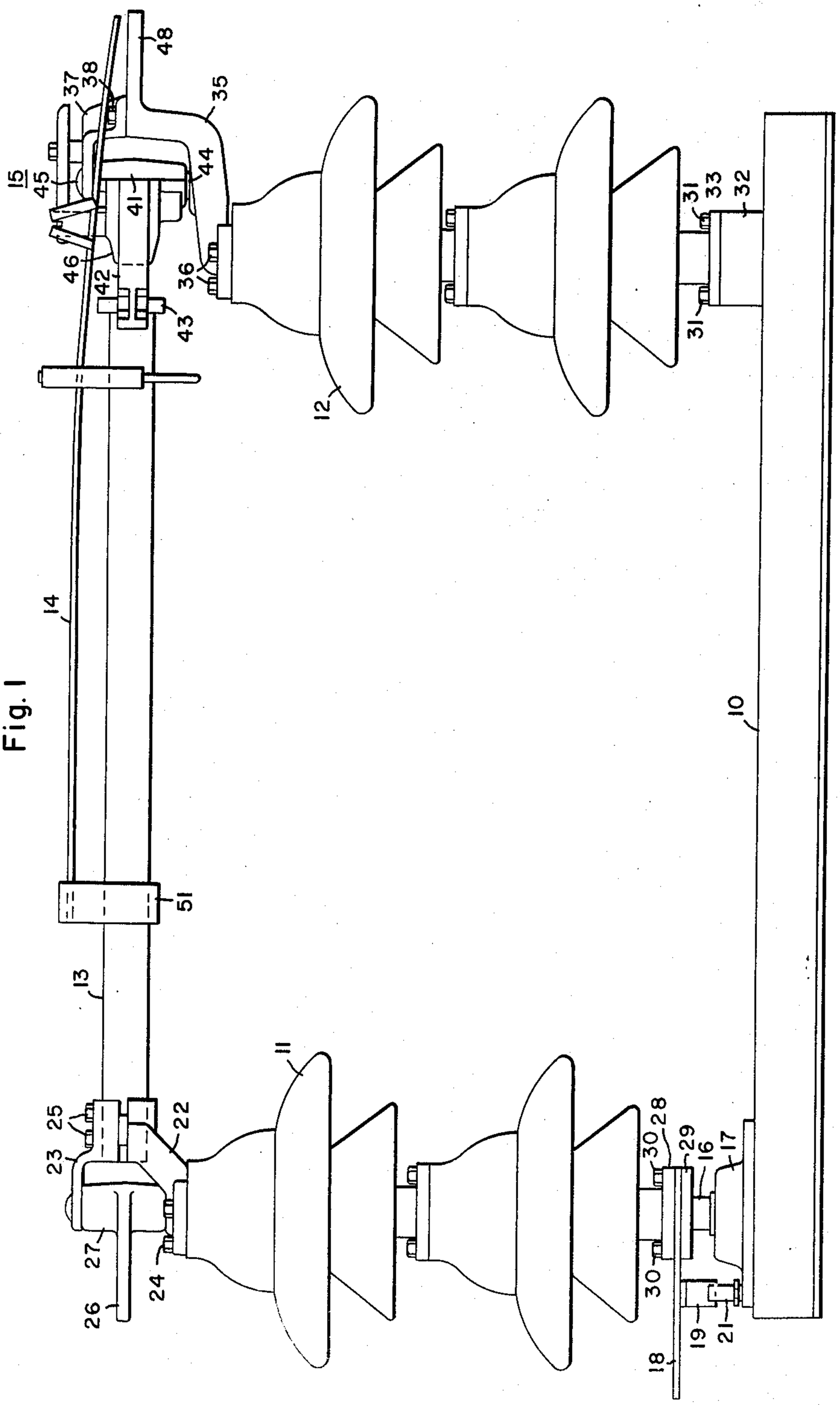

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Fig. 2

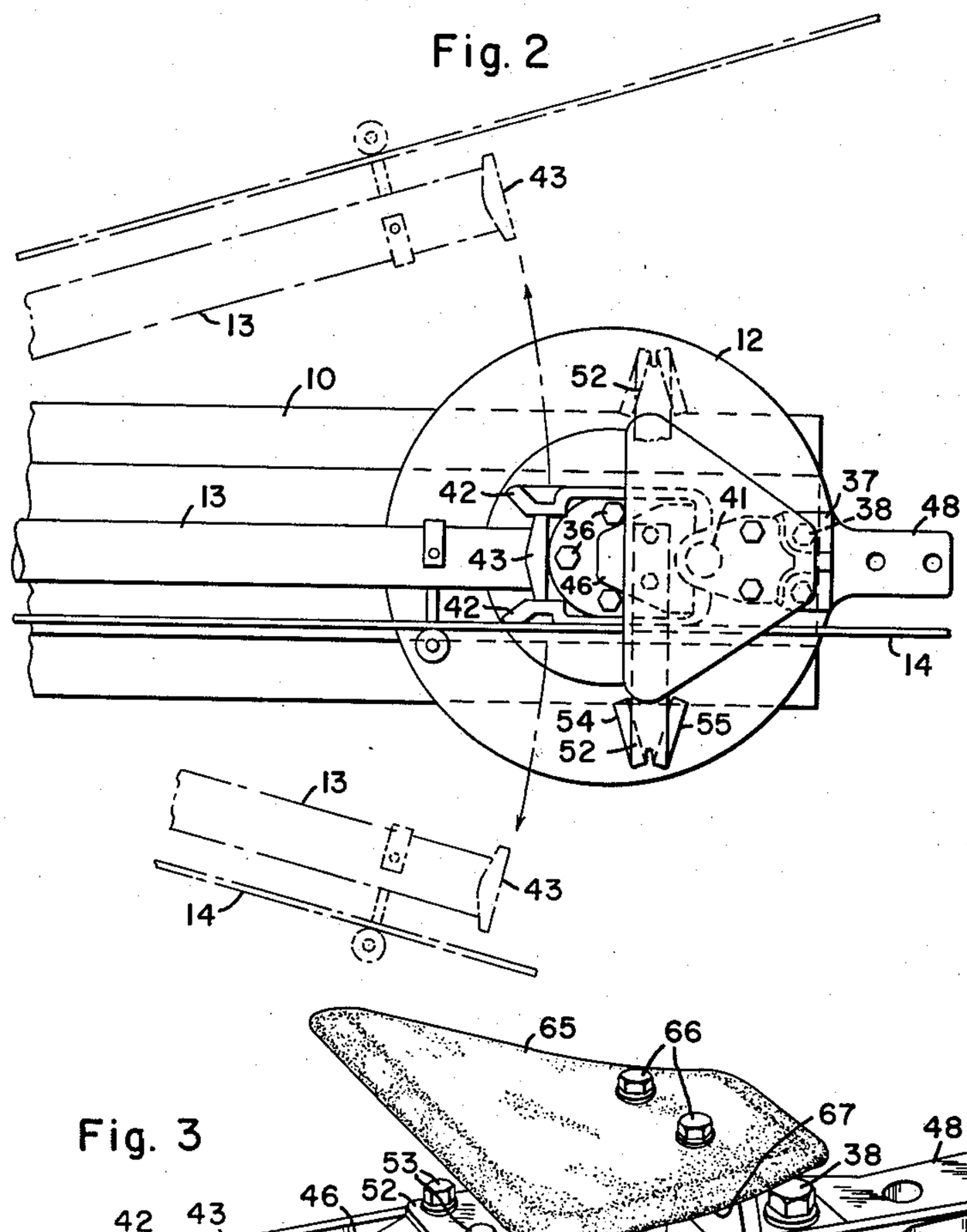


Fig. 3

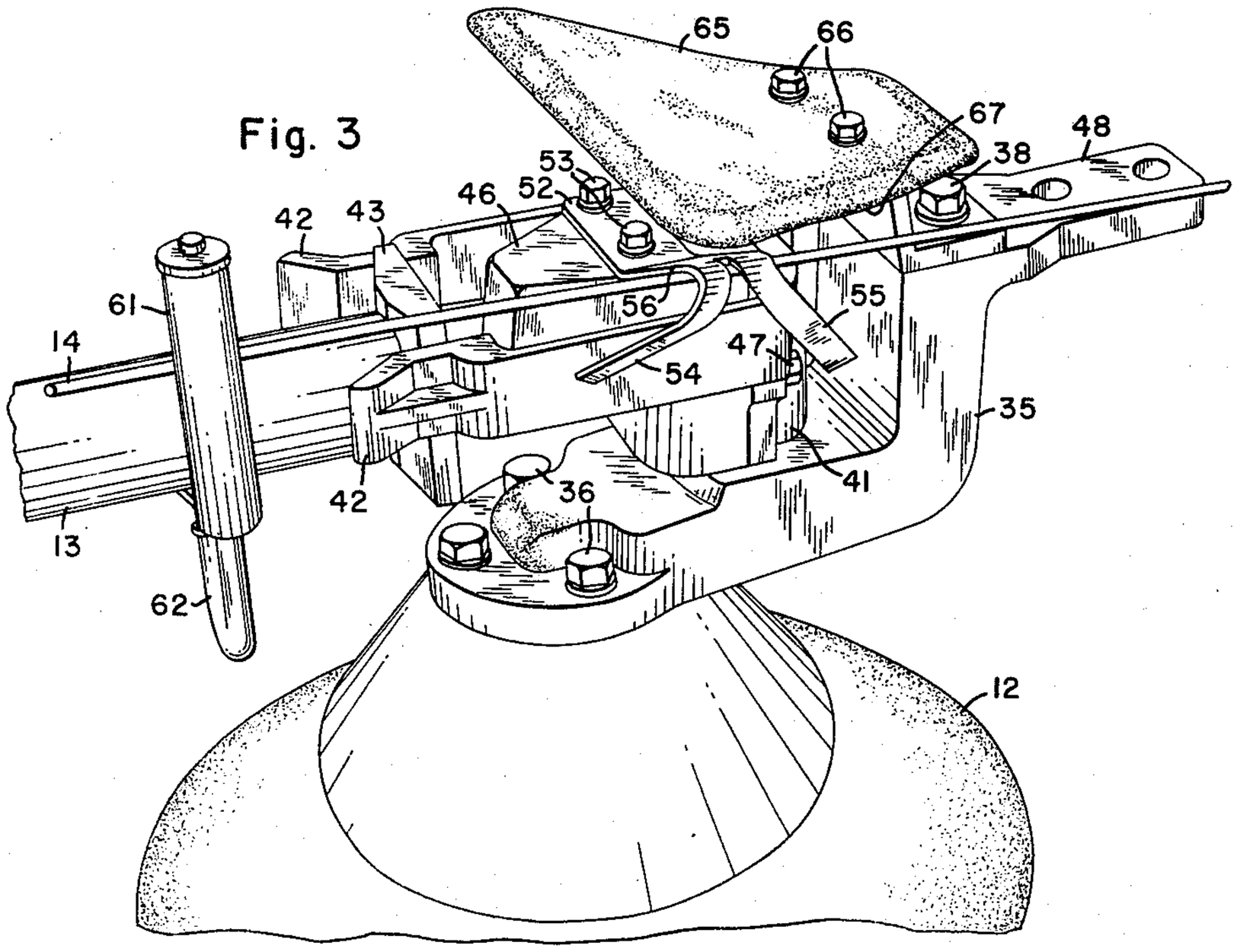

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Fig. 4

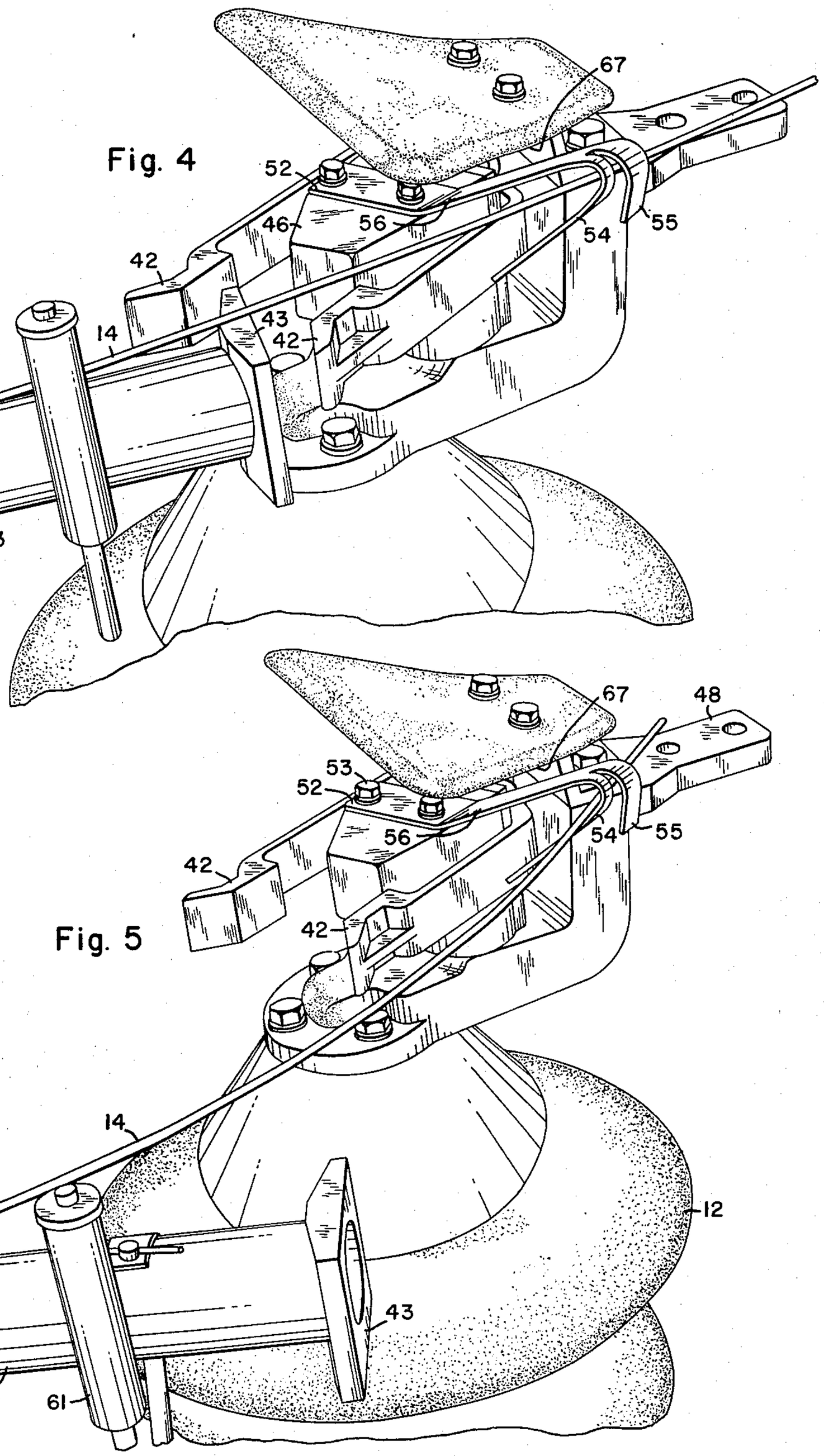


Fig. 5

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Fig. 6

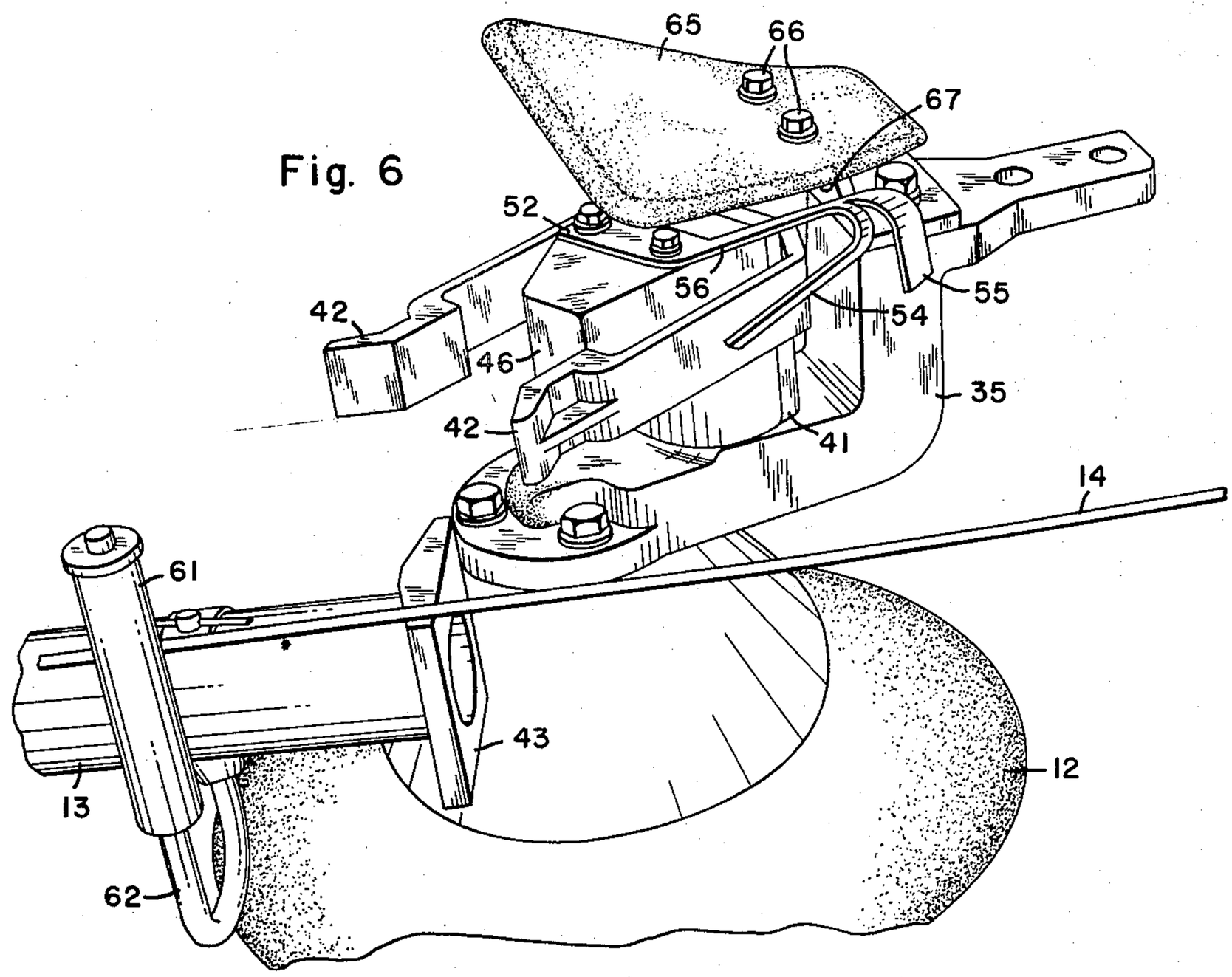
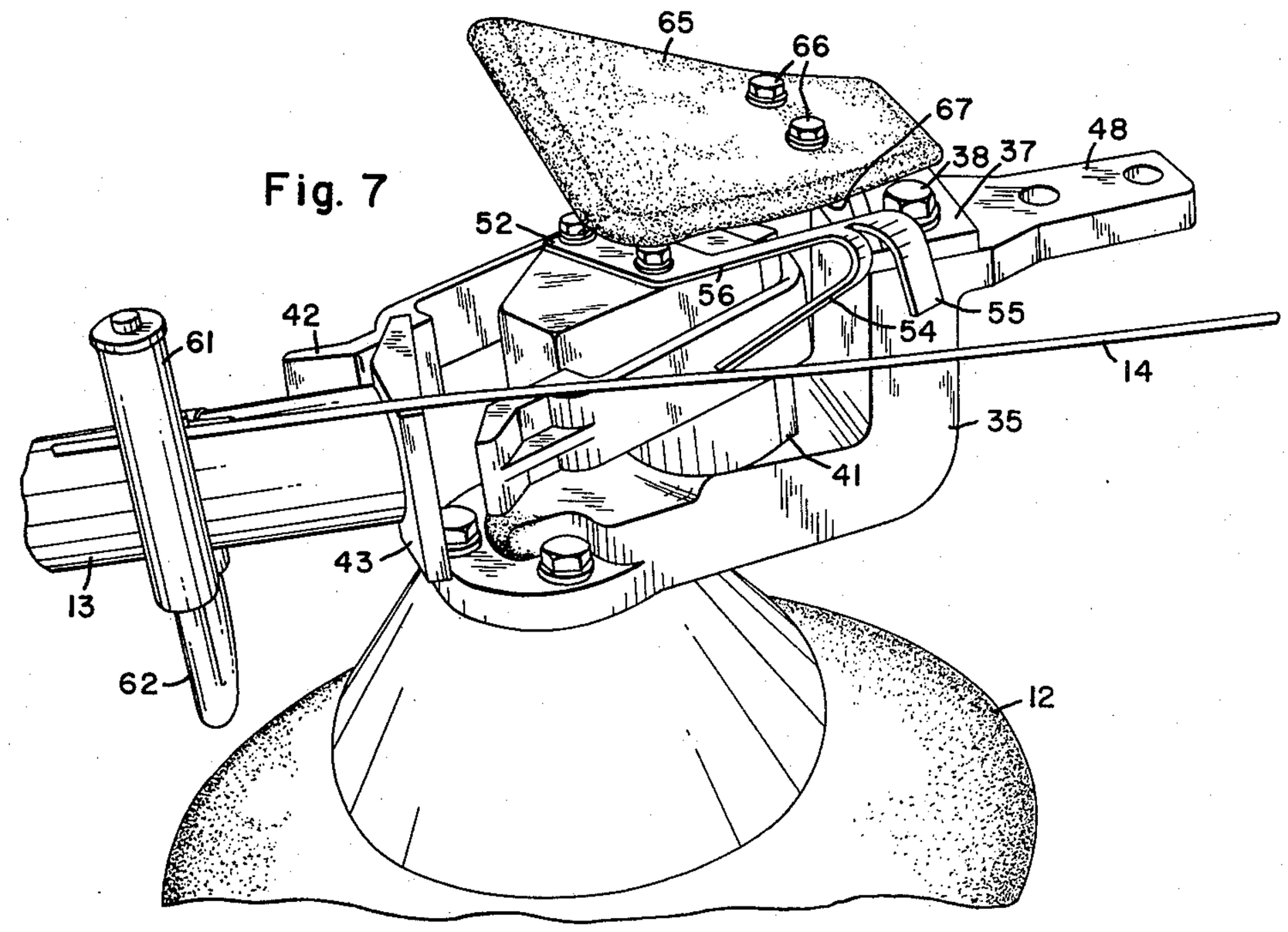



Fig. 7



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# CIRCUIT INTERRUPTERS

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7 Claims. (Cl. 200—48)

This invention relates, generally, to circuit interrupters and, more particularly, to disconnecting switches of the side-break type.

Disconnecting switches for relatively high voltage service may be provided with quick-break arc horns to interrupt arcs drawn during opening of the switches. Heretofore, such switches in outdoor service have been susceptible to ice formations during adverse weather conditions which prevent the proper functioning of the switches during opening and closing operations.

An object of the invention is to provide a shield for a disconnecting switch which prevents the formation of ice between a fixed portion and a movable portion of the switch.

Another object of the invention is to provide an arc horn for a disconnecting switch which is so shaped that it may be utilized on either a left or a right hand break switch.

A further object of the invention is to provide an arc horn which cooperates with the ice shield on a disconnecting switch to shear off ice formed on the horn and the shield, thereby permitting the switch to be opened or closed.

Still another object of the invention is to provide an arc horn which is shaped to prevent a large quantity of ice from forming in the portion of the horn which is engaged by a resilient whip or auxiliary blade during opening of the switch.

A still further object of the invention is to reduce the rebounding action of the resilient whip or auxiliary blade during opening of the switch.

Other objects of the invention will be explained fully hereinafter or will be apparent to those skilled in the art.

In accordance with one embodiment of the invention, a disconnecting switch of the side-break type is provided with an arc horn which cooperates with an ice shield to shear off icicles formed on the shield and the horn, thereby permitting sliding contact of a whip or auxiliary blade with the horn during operation of the switch. The shield prevents ice from forming between the movable member carrying the contact jaws and the support for the movable member. The arc horn is shaped to minimize ice formation in the arc horn loop without contributing to ice formation in the break jaws

For a better understanding of the nature and objects of the invention, reference may be had to the following detailed description, taken in conjunction with the accompanying drawings in which:

Figure 1 is a view, in elevation, of a disconnecting switch embodying the principal features of the invention;

Fig. 2 is a view, in plan, of a portion of the switch illustrated in Fig. 1;

Fig. 3 is an enlarged view in perspective, of a portion of the switch shown in the closed position;

Figs. 4, 5 and 6 are views, similar to Fig. 3, showing successive positions of the switch members during opening of the switch, and



Fig. 7 is a view, similar to Fig. 4, showing the switch members in a partly closed position.

Referring to the drawings, and particularly to Fig. 1, the disconnecting switch structure shown therein comprises a generally channel-shaped base **10**, a rotatable insulator assembly **11**, a stationary insulator assembly **12**, a main switch blade **13**, an auxiliary blade or whip **14**, and a contact assembly **15**. The rotatable insulator assembly **11** is mounted on a shaft **16**, which is rotatably disposed in a bearing housing **17** attached to the base **10**. The insulator **11** may be rotated by means of an actuating lever **18**. A stop member **19** on the lever **18** is disposed to engage a stop member **21** on the bearing housing **17** to limit the rotation of the insulator **11** in a direction to close the switch.

The main switch blade **13**, which may be a tubular member composed of a conducting material, has one end clamped between a support **22** and a clamping plate **23**. The support **22** may be attached to the cap of the insulator **11** by means of bolts **24**. The plate **23** may be attached to the support **22** by means of bolts **25**. A terminal pad **26** is rotatably mounted between the plate **23** and the support **22**. A bearing pin (not shown) may extend through a bearing housing **27** formed integrally with the pad **26** to support the pad. A line conductor may be attached to the terminal pad **26**.

The insulator assembly **11** has a base **28** which is attached to a flange **29** on the shaft **16** by means of bolts **30**. The actuating lever **18** is disposed between the base **28** and the flange **29** and is secured by the bolts **30**.

The stationary insulator assembly **12** may be attached to the base **10** by means of bolts **31**. A spacing member **32** may be provided between a base **33** of the insulator assembly and the channel shaped base **10**.

The contact assembly **15** comprises a supporting member **35** which is attached to the cap of the insulator assembly **12** by means of bolts **36**. A plate **37** is attached to the support **35** by means of bolts **38**. A break-jaw **41** is pivotally mounted between the support **35** and the plate **37**. As shown more clearly in Fig. 2, the break-jaw has two spaced arms **42** which engage a contact member **43** in the end of the blade **13** when the switch is in the closed position. The break-jaw **41** is supported by a bearing pin (not shown) which is disposed in a bearing member **44** on the support **35** and a bearing **45** on the plate **37**. A housing **46** is attached to the break-jaw **41** by bolts **47** as shown in Fig. 3. Electric current may be conducted through the break-jaw **41** and the bearing members which support the jaw in the manner fully described in a copending application of W. H. Stuellein and J. H. Sprow, Serial No. 556,139, filed December 29, 1955. A line conductor may be connected to a terminal pad **48** formed integrally with the support **35**.

As previously explained, the auxiliary blade **14** is preferably composed of a resilient conducting material, such as beryllium copper. As shown, it is similar to a whip in shape and has one end attached to the main blade **13** by means of a clamp **51**. When the switch is in the closed position, the whip **14** engages an arc horn **52**, one end of which is attached to the housing **46** by means of bolts **53**. As shown in Figs. 3 to 7 inclusive, the other end of the arc horn **52** is split into two wings **54** and **55**. The wings **54** and **55** are bent downwardly and they diverge laterally.

Thus, a loop is formed at the junction of the wings **54** and **55** with an intermediate portion **56** of the horn **52**. As shown in Fig. 2, the wings **54** and **55** of the arc horn **52** are so shaped that the arc horn may be utilized for either a right-hand break or a left-hand break switch. The position of the arc horn **52** for a left-hand break switch is shown by the broken lines in Fig. 2. The arc horn **52** is preferably composed of beryllium copper.

As shown in Figs. 2 and 3, the contact member **43** on the blade **13** is disposed between the arms **42** of the break-jaw **41** when the switch is in the closed position. The whip **14** engages the arc horn **52**. As shown in Fig. 4, when the blade **13** is swung to the right, as is the case for a right-hand break switch, the break-jaw **41** and the housing **46** are swung to the right with the blade **13** until the contact member **43** is disengaged from the arms **42** of the break-jaw. However, the whip **14** is still engaged in the loop of the arc horn **52**.

As shown in Fig. 5, the whip **14** remains engaged in the loop of the arc horn **52** until the main blade **13** is swung far enough to the right to cause the end of the whip **14** to slide through the loop of the arc horn **52**. When the whip **14** is disengaged from the arc horn, it strikes a bumper **61** carried by the main blade **13**. The bumper **61** is composed of a resilient material, such as rubber, which can absorb the energy of the whip **14**, thereby preventing rebounding of the whip which might cause restriking of the arc if the whip rebounded into contact with the break-jaw or other conducting member of the switch. The bumper is mounted on one leg of a U-shaped member **62**, the other leg of which may extend through the blade **13** and be attached to the blade.

The switch is shown in its fully opened position in Fig. 6. It will be noted that the whip **14** is disengaged from the arc horn **52** and is resting against the bumper **61**. The break-jaw **41** is retained in the opened position by means of an overcenter spring (not shown) which is disposed inside the housing **46**.

During closing of the switch, the contact member **43** of the main blade **13** first engages one arm **42** of the break-jaw **41** and then engages the other arm **42** as the break-jaw is moved towards its closed position by the main blade **13**. As shown in Fig. 7, the whip **14** engages the wing **54** of the arc horn **52** and slides downwardly along this wing until it passes the end of the wing from which position it moves to its fully closed position, as shown in Fig. 3. When the switch is utilized as a left-hand break switch, and the arc horn **52** is changed to the other side of the break-jaw, the whip will engage the wing **55** during the closing operation. Thus, the arc horn is suitable for either a right-hand break switch or for a left-hand break switch. In either case the whip **14** is pressed against the arc horn by the bumper **61** during the closing operation.

In order to preclude the possibility of ice formations preventing the proper operation of the switch, an ice shield **65** is attached to the plate **37** by means of bolts **66**. The ice shield **65** is disposed a short distance above the arc horn **52** and extends over a portion of the horn. The shield **65** covers the space between the movable break-jaw **41** and the supports **35**, thereby preventing ice from forming in this space to prevent the break-jaw from swinging about its pivot point during operation of the switch.

By referring to Figs. 3, 4, 5 and 6, it will be seen that one edge of the upwardly bent portion **56** of the arc horn **52** moves along an edge **67** of the shield **65** as the switch is being opened. In this manner, any icicles formed on the shield **65** and the arc horn **52** are sheared off, thereby permitting the switch to open and the whip **14** to maintain electrical contact with the arc horn **52**. Actual tests have shown that the shearing action removes the ice from the arc horn even though the horn extends beyond the shield **65**. Furthermore, the horn is so shaped that ice is prevented from forming in the loop portion of the horn, thereby enabling the whip **14** to engage the loop portion during opening of the switch.

During closing of the switch, the other edge of the intermediate portion **56** of the arc horn **52** moves along the edge **67** of the shield, thereby shearing off any ice formed while the switch was in the opened position. Thus, the shearing action takes place during both opening and closing of the switch, thereby preventing ice formations from interfering with the proper operation of the switch.



As previously stated, the present switch has functioned properly under severe icing conditions where other switches have failed to operate. Thus, the present invention provides an arc horn which cooperates with an ice shield to remove ice which may be formed on the switch while in service. The present structure functions equally well during both opening and closing of the switch. The switch may be utilized as either a righ-hand break or a left-hand break switch.

Since numerous changes may be made in the above-described construction, and different embodiments of the invention may be made without departing from the spirit and scope thereof, it is intended that all matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative, and not in a limiting sense.

We claim as our invention:

1. In a disconnecting switch, in combination, a fixed support, a contact assembly pivotally mounted on said support, a main switch blade for engaging said contact assembly, said contact assembly being actuated about its pivotal support by said blade, an arc horn, an auxiliary blade for engaging the arc horn, said auxiliary blade being disengaged from the arc horn after the main blade is disengaged from the contact assembly, a shield adjacent said arc horn, and said horn and said shield being moved relative to each other by movement of the contact assembly about its pivotal support.

2. In a disconnecting switch, in combination, a fixed support, a contact assembly pivotally mounted on said support, a main switch blade for engaging said contact assembly, said contact assembly being actuated about its pivotal support by said blade, an arc horn, an auxiliary blade for engaging the arc horn, said auxiliary blade being disengaged from the arc horn after the main blade is disengaged from the contact assembly, a shield disposed above the arc horn, said shield and said horn being movable relative to each other, and said horn having an upwardly bent portion which is moved along an edge of said shield during movement of the contact assembly about its pivotal support.

3. In a disconnecting switch, in combination, a fixed support, a contact assembly pivotally mounted on said support, a main switch blade for engaging said contact assembly, said contact assembly being actuated about its pivotal support by said blade, an arc horn movable with the contact assembly, an auxiliary blade for engaging the arc horn, said auxiliary blade being disengaged from the arc horn after the main blade is disengaged from the contact assembly, a shield attached to said fixed support, said shield extending over the pivotal support for the contact assembly, and said horn having a portion moved along an edge of the shield during movement of the contact assembly about its pivotal support.

4. In a disconnecting switch, in combination, a fixed support, a contact assembly pivotally mounted on said support, a main switch blade for engaging said contact assembly, said contact assembly being actuated about its pivotal support by said blade, an arc horn movable with the contact assembly, an auxiliary blade for engaging the arc horn, said auxiliary blade being disengaged from the arc horn after the main blade is disengaged from the contact assembly, a shield attached to said fixed support, said shield extending over the pivotal support for the contact assembly, said horn having one edge moved along an edge of the shield during movement of the contact assembly about its pivotal support in one direction, and another edge of the horn being moved along the edge of the shield during movement of the contact assembly about its pivotal support in the opposite direction.

5. In a disconnecting switch, in combination, a fixed support, a contact assembly pivotally mounted on said support, a main switch blade for engaging said contact

assembly, said contact assembly being actuated about its pivotal support by said blade, an arc horn movable with the contact assembly, one end of said arc horn having two downwardly bent diverging wings, an auxiliary blade for engaging the arc horn, said auxiliary blade being disengaged from the arc horn after the main blade is disengaged from the contact assembly during opening of the switch, one of the wings on the arc horn being engaged by the auxiliary blade during closing of the switch, a shield on said fixed support adjacent said arc horn, and said horn being moved along an edge of said shield during opening of the switch and during closing of the switch.

6. In a disconnecting switch, in combination, a fixed support, a contact assembly pivotally mounted on said support, a main switch blade for engaging said contact assembly, said contact assembly being actuated about its pivotal support by said blade, an arc horn movable with the contact assembly, a resilient auxiliary blade having one end attached to the main blade and the other end engaging the arc horn, the other end of the auxiliary blade being disengaged from the arc horn after the main blade is disengaged from the contact assembly, a shield on said fixed support adjacent the arc horn, and said horn



being moved along an edge of said shield by movement of the contact assembly about its pivotal support.

7. In a disconnecting switch, in combination, a fixed support, a contact assembly pivotally mounted on said support, a main switch blade for engaging said contact assembly, said contact assembly being actuated about its pivotal support by said blade, an arc horn movable with the contact assembly, a resilient auxiliary blade having one end attached to the main blade and the other end engaging the arc horn, the other end of the auxiliary blade being disengaged from the arc horn after the main blade is disengaged from the contact assembly, a bumper on the main blade for absorbing energy of the auxiliary blade when it is disengaged from the arc horn, a shield on said fixed support adjacent the arc horn, and said horn being moved along an edge of said shield during opening of the switch and during closing of the switch.

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