Oct. 31, 1950 G. H. GORDON ET AL 2,528,050

SPARK GAP APPARATUS

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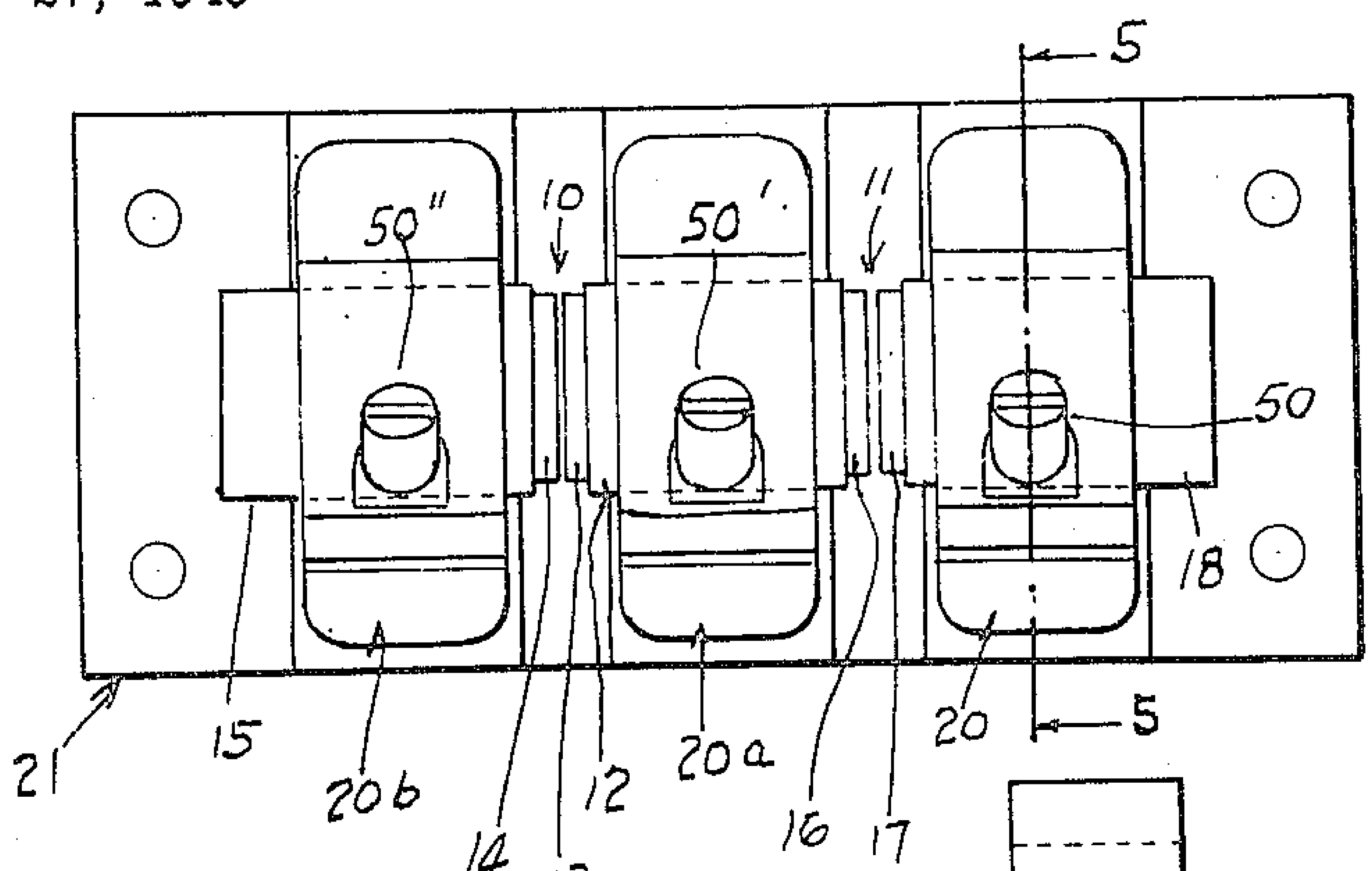

Fig. 1

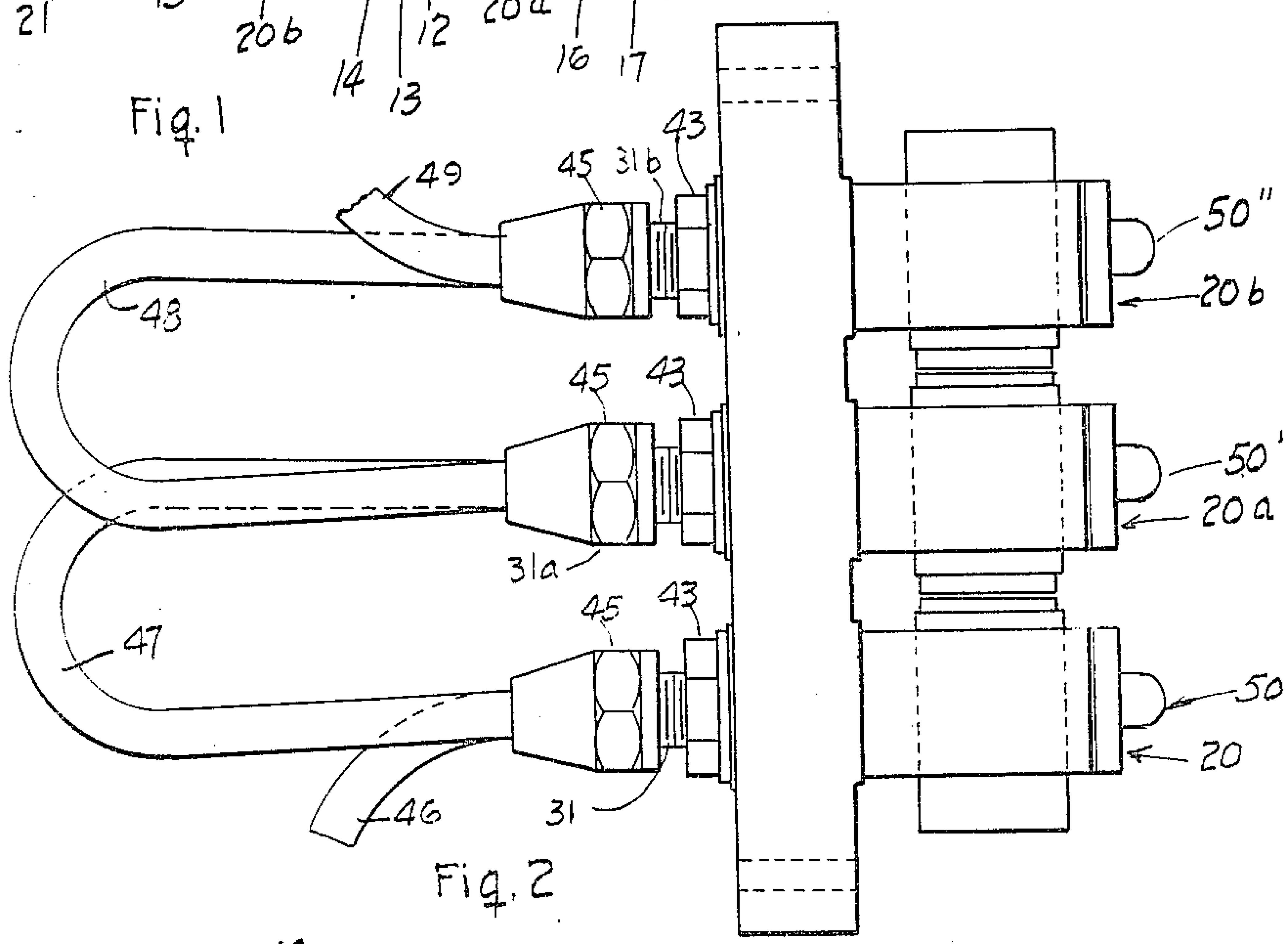

Fig. 2

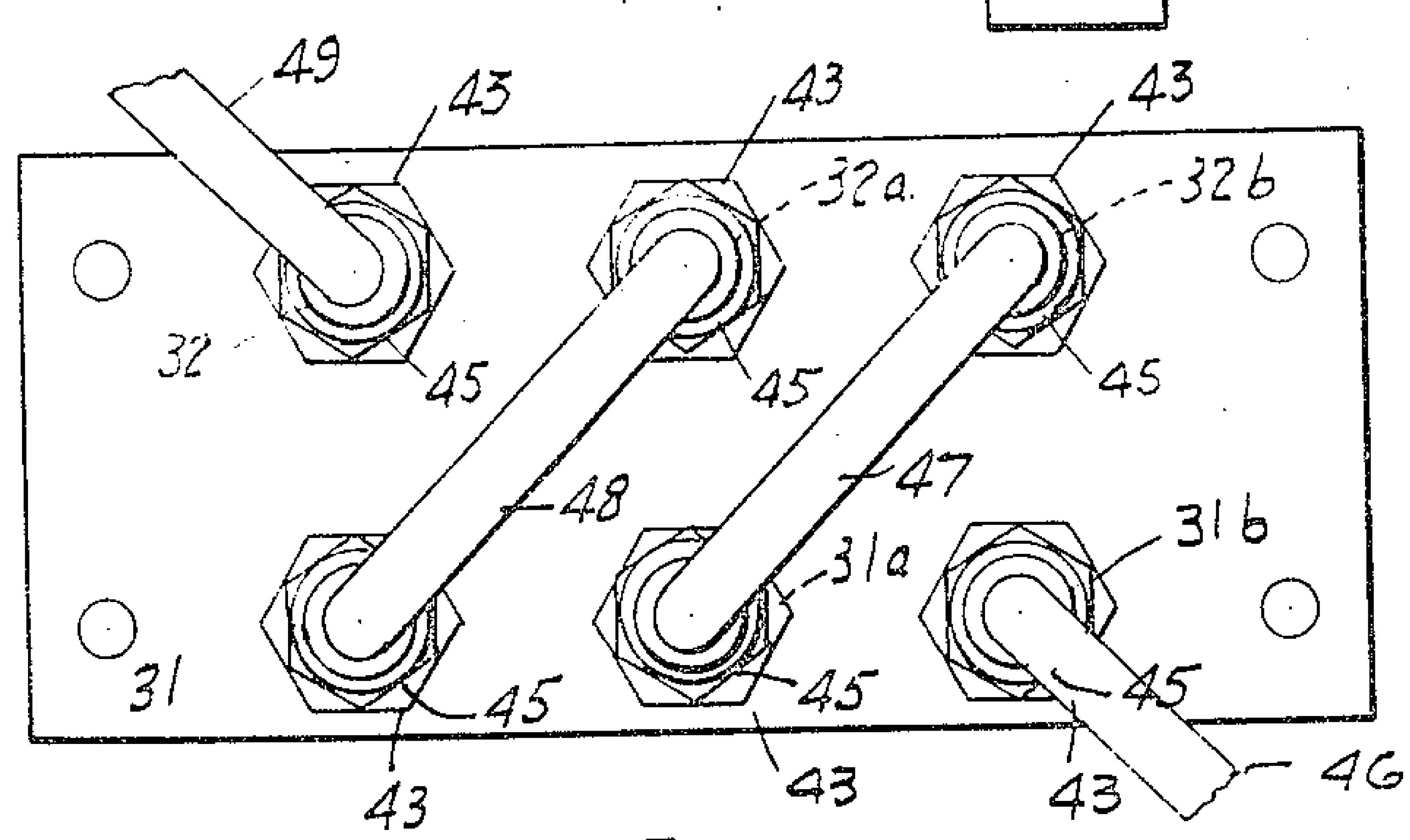

Fig. 3

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SPARK GAP APPARATUS

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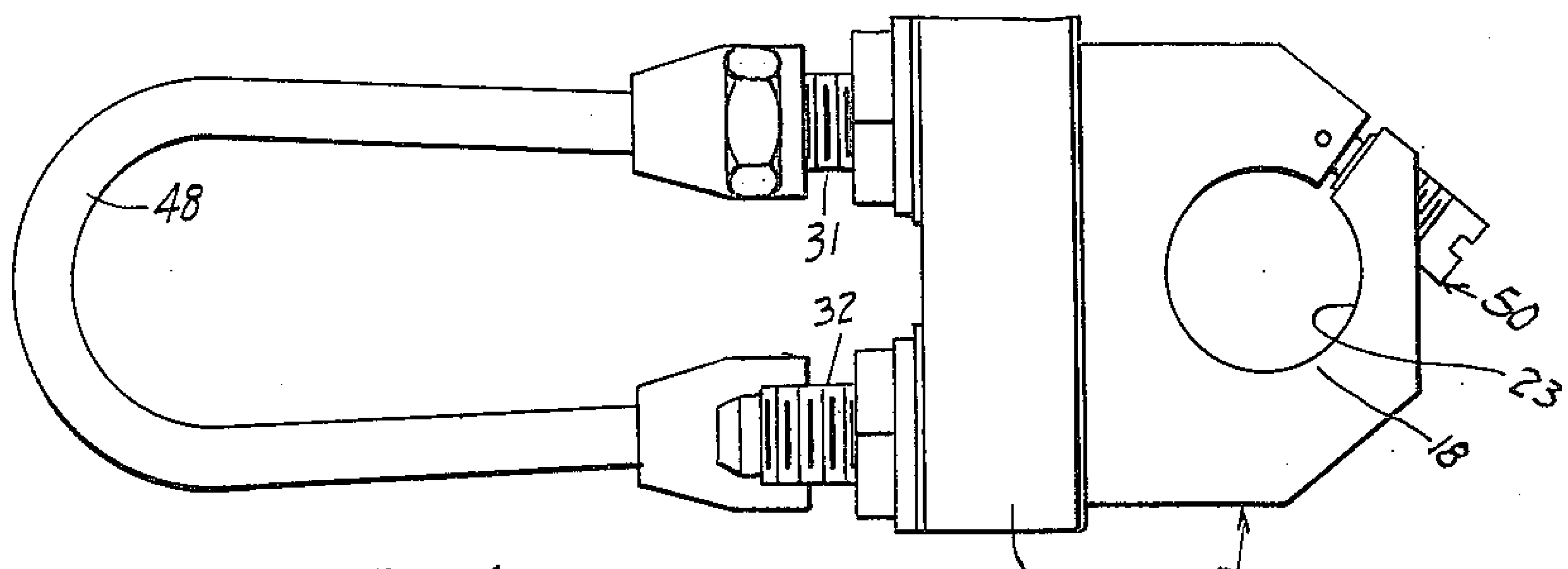

Fig. 4

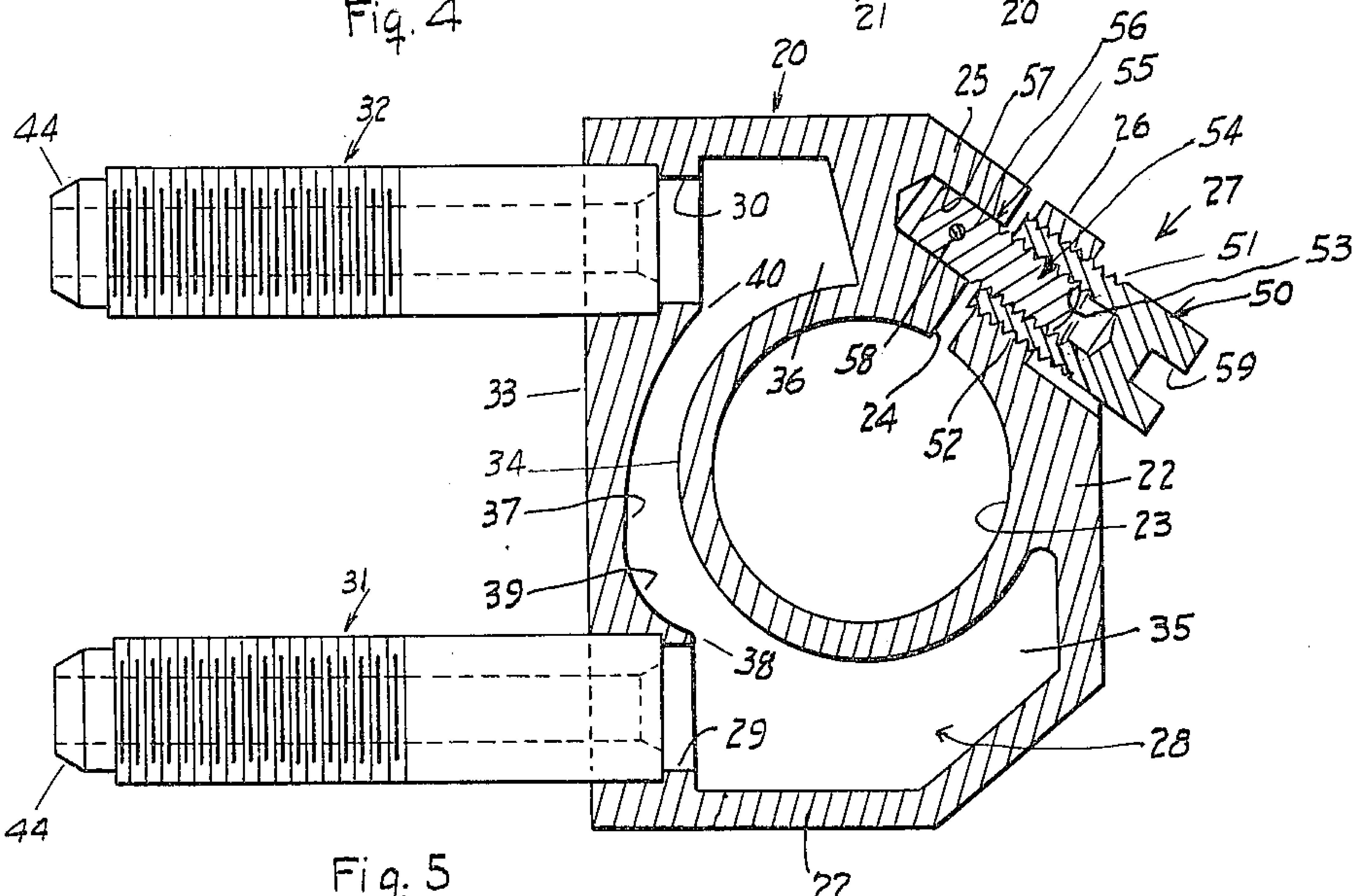

Fig. 5

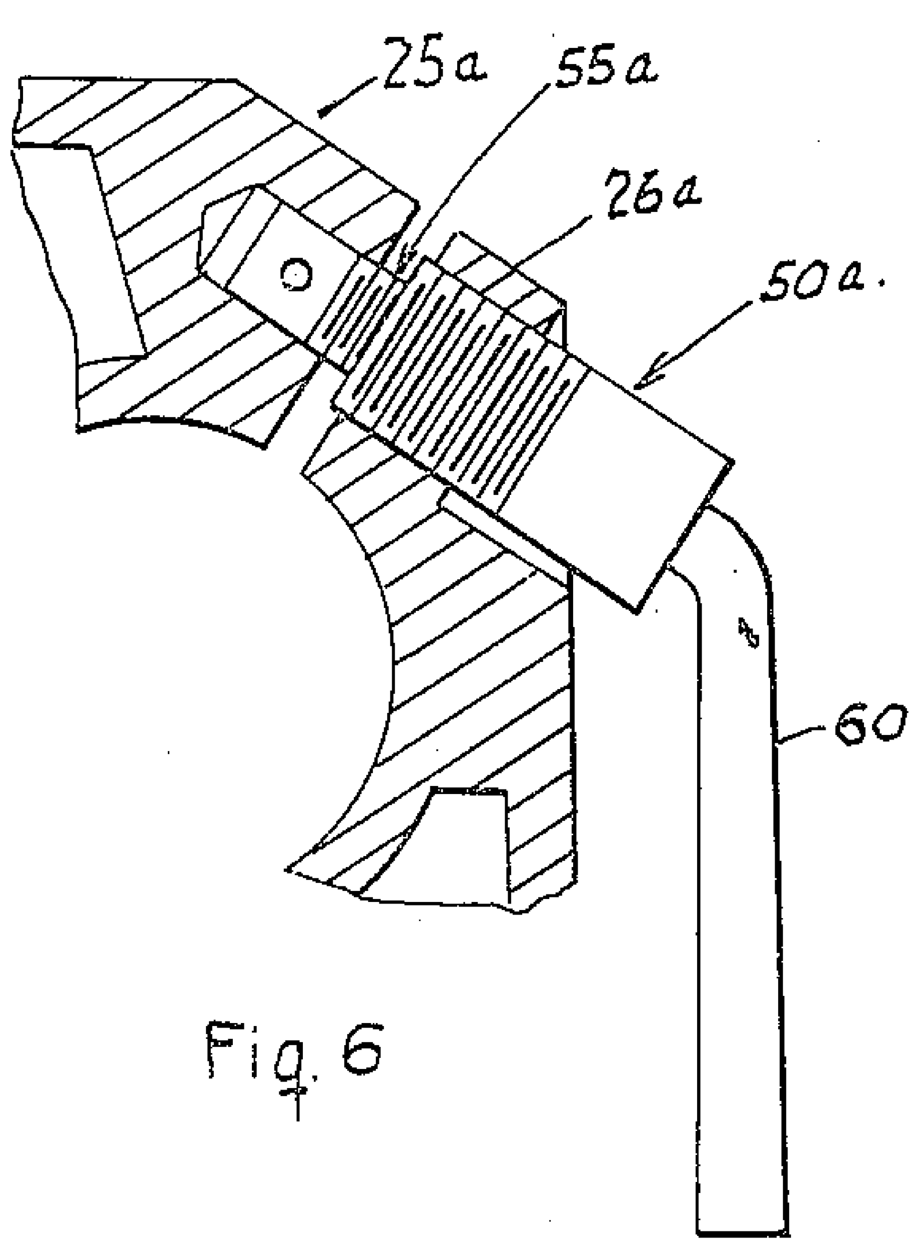

Fig. 6

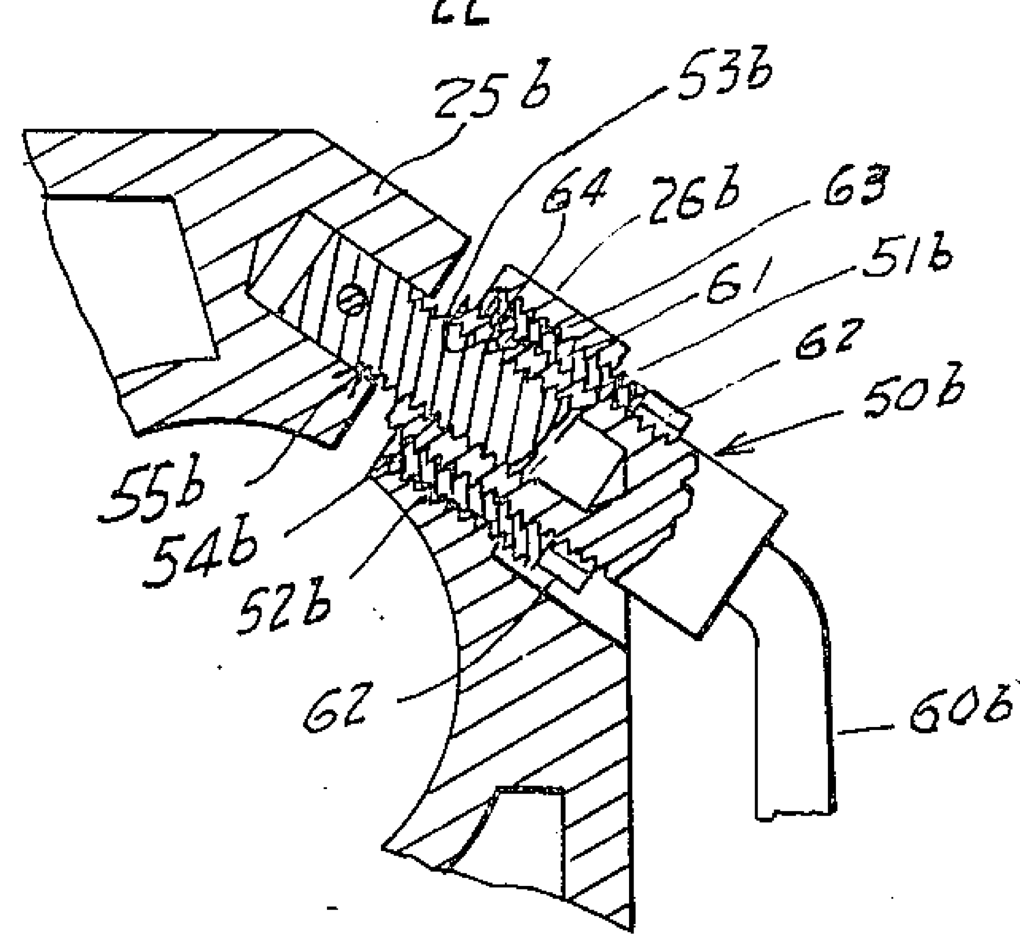

Fig. 7

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SPARK GAP APPARATUS

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5 Claims. (Cl. 250—38)

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This invention relates to electric spark gap apparatus or means which may be used in any system in which a high potential electric current jumps a gap or gaps between electrodes. More specifically the invention may be embodied in spark gap means in which a cooling fluid is used to cool the electrodes. The principal object of the invention is to provide new and improved spark gap means of these types.

In the drawings accompanying this specification, and forming a part of this application, there are shown, for purposes of illustration, several forms which the invention may assume, and in these drawings:

Figure 1 is a front view of an embodiment of the invention,

Figure 2 is a side view of the embodiment of Figure 1,

Figure 3 is a rear view of the embodiment of Figure 1,

Figure 4 is an end view of the embodiment of Figure 1,

Figure 5 is a cross-sectional view, on an enlarged scale, of a detail of the embodiment of Figure 1, taken on the line 5—5 of Figure 1, and

Figures 6 and 7 are fragmentary cross-sectional views of different embodiments of details.

In the illustrated embodiment two spark gaps **10**, **11**, in series, are shown. The spark gaps **10**, **11** are, in this instance, of the rod type, that is, the electrodes are in the form of rods, specifically cylindrical rods or plugs, the ends at the gaps being surfaces at right angles to the common axis of the rods. In the embodiment shown, an intermediate or central plug **12** has, at its left hand end, as viewed in Figure 1, a terminal portion **13** which provides an electrode surface cooperating with an adjacent electrode surface provided by a terminal portion **14** of an end plug **15**, these electrode surfaces providing between them the spark gap **10**. The central plug **12** also has, at its right hand end, a terminal portion **16** which provides an electrode surface cooperating with an adjacent electrode surface provided by a terminal portion **17** of an end plug **18**, these electrode surfaces providing between them the spark gap **11**.

The plugs **18**, **12**, **15** are individually supported by three supports **20**, **20a**, **20b** each comprising clamp means, and the supports are in turn supported by a base **21**.

Referring more particularly to Figure 5, this shows a cross-section of the support **20**, but all of the supports may be and are here shown as identical so that a description of the support **20** will serve for all. The support **20** includes a metallic member **22** having an aperture **23** for the reception of the plug **18**. The member **22** is split into the aperture by a slot **24**. The slot **24** results in two spaced portions **25**, **26** which may be forced apart to a desired extent, due to the resilience of the split metallic member, and may also be forced together, by a screw means **27** as will more fully appear.

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The member **22** has a chamber **28** providing a passage for the flow of cooling fluid. The chamber **28** has an inlet port **29** and an outlet port **30**, to which are connected tubular studs **31**, **32**. The studs **31**, **32** are brazed or otherwise suitably fastened in recesses in a plane face **33** of the member **22** and extend laterally at right angles from that face.

The chamber **28**, in this instance, is defined, in part, by a cylindrical surface **34** concentric with the aperture **23** and surrounding the major circumferential extent of the aperture **23**. The chamber **28** has a slight enlargement **36** opposite the outlet port **30** and an enlargement or extension **35** of considerably greater extent opposite the inlet port **29**. Between the inlet port **29** and the outlet port **30**, the chamber **28** provides a passage defined between a curved line **37** and the cylindrical surface **34**. From a point **38** near the inet port **29** the line **37** recedes from the cylindrical surface **34** to a point **39**, and then gradually approaches and becomes relatively close to the cylindrical surface at a point **40** adjacent the outlet port **30**. The construction and arrangement of the chamber **28** is such that fluid entering the inlet port **29** efficiently flows into the inlet extension **35**, then in cooling contact with the cylindrical surface **34**, and then sweeps into the extension **36**, before flowing out of the outlet port **30**.

The studs **31**, **32** extend through apertures in the base **21**, and have external threads with which nuts **43** are cooperable, for holding and tightening the plane surface **33** against the base **21**. The terminals of a source of high electric potential may be connected to a stud of the support **20b** and to a stud of the support **20**, if, as in the embodiment illustrated, the spark gaps **10**, **11** are to be in series.

The terminal ends **44** of the studs **31**, **32** are suitably formed for cooperation with unions **45** for connecting conduit means thereto. Referring more particularly to Figures 2 and 3, a conduit **46**, coming from a source of cooling fluid (not shown) is connected to the inlet stud **31b** of the support-clamp **20b**; the outlet stud **32b** of the support clamp 20b is connected by a conduit 47 to the inlet stud 31a of the support clamp 20a; the outlet stud 32a of the support-clamp 20a is connected by a conduit 48 to the inlet stud 31 of the support-clamp 20; and the outlet stud 32 of the support-clamp 20 is connected to a conduit 49. The conduit 49 may lead back to the source of cooling fluid in the case when the cooling fluid system is a closed one.

The conduits 46, 47, 48, 49 are preferably made of insulating material of any suitable kind, desirably flexible, and preferably of high electrical insulating value. The cooling fluid is of any suitable kind, preferably also of high electrical insulating value.

It will be evident that, in the embodiment illustrated, the flow of cooling fluid will be through the respective chambers 28 in the support-clamps 20, 20a, 20b, in series.

Referring now more particularly to Figure 5. The screw means 27 there shown comprises a screw member 50 having external threads 51 cooperable with internal threads in a hole 52 transverse to the portion 26. The screw member 50 has an axial recess having internal threads 53 cooperable with threads 54 on a projection 55 carried by and extending from the portion 25 toward the portion 26. The threaded projection 55 is here shown as a cylindrical stud having an unthreaded end 56 fitting in a recess 57 in the portion 25, a pin 58 extending through a hole in the portion 25 into or through the stud-end 56 to prevent either turning or longitudinal movement of the stud in the recess.

The threads 51, 53 on the screw member 50 and those on the stud 55 are right handed, but the threads provide differential action, the external threads 51 on the screw member 50 being of larger pitch than the threads 54 on the stud. Any suitable number of threads per inch may be used to get a desired differential action.

The screw member 50 is shown in Figure 5 as provided with a kerf 59 to enable turning of the screw member by a screw driver. In Figure 6 the construction is the same as in Figure 5 except that instead of the kerf the screw member 50a is provided with a crank 60 for turning it.

Preferably the plug (such as 18) which is to be inserted into the aperture 23 is of the same diameter as that of the aperture. In order to insert the plug, the screw member 50 is turned clockwise. Such rotation screws the screw member 50 into the portion 26 toward the portion 25. At the same time the stud 55 is screwed into the threaded recess 53 of the screw member 50, which action, by itself, would tend to pull the portion 25 to the portion 26. However, since the screw member 50, by reason of the greater pitch of the threads 51, is screwed into the portion 26 faster than the stud 55 is screwed into the recess 53, the result is that the portions 25, 26 are forced apart. This action resiliently enlarges the aperture 23 so that a plug may be inserted therein.

When the plug has been inserted in the resiliently enlarged aperture 23 and tentatively positioned longitudinally of the axis of the aperture, the screw member 50 may be turned a slight amount counterclockwise, thereby causing the portions 25, 26 to approach each other, thereby gripping the plug. The plug may be again released by clockwise rotation of the screw member 50.

When all of the plugs 15, 12, 13, have been positioned as desired with respect to each other in their respective clamp-supports 20b, 20a, 20, the respective screw means may be tightened by rotating the screw members 50'', 50', 50 counterclockwise. Referring to Figure 5, counterclockwise rotation of the screw member 50 causes it to be screwed out of the portion 26, and at the same time the stud 55 is screwed out of the recess 53 in the screw member 50. Since the screw member 50, by reason of the greater pitch of the threads 51, is screwed out of the portion 26 faster than the stud 55 is screwed out of the threaded recess 53 in the screw member, the portions 25, 26 are pulled toward each other, thereby causing positive contraction of the aperture 23, to tighten the grip on the plug.

Where, as in Figure 6, the screw member 50a is provided with a crank 60 it may be desirable that when the screw member 50a is in the rotative position in which the clamp is desirably tightened, the crank 60 shall be in the position shown in Figure 6, and/or that all of the cranks of the respective clamps shall be in substantially the same angular position. This may be accomplished as illustrated in the embodiment of Figure 7.

In the embodiment of Figure 7 an externally and internally threaded sleeve 61 is interposed between a screw member 50b and a transverse threaded hole 52b in the portion 26b. The sleeve 61 is provided with circumferentially spaced kerfs 62 whereby it may be rotated by a spanner wrench, or otherwise. The external threads 63 on the sleeve 61, cooperating with the threaded hole 52b, and the internal threads 64, on the sleeve 61, are right handed but of different pitch, the pitch of the external threads 63 being smaller than the pitch of the internal threads 64, for example.

The external threads 51b on the screw member 50b cooperate with the internal threads 64 on the sleeve 61, and the external threads 54b on a stud 55b cooperate with internal threads 53b in a recess in the screw member 50b. As in the case of the external threads 51 on the screw member 50 of Figure 5, the external threads 51b on the screw member 50b of Figure 7 are of larger pitch than the internal threads 53b.

Assuming that the sleeve 61 is in any given position, rotation of the screw member 50b in clockwise and counterclockwise directions will produce the same results as already described in connection with the screw member 50 of Figure 7. However, if, when the screw member 50b is in the rotative position securing the desired clamp-tightening action, the angular position is not as desired, the crank 60b may be turned to loosen the clamp, and the sleeve 61 rotated in the proper direction to an adjusted position so that when the crank is again turned to tighten the clamp, the crank will assume the position shown in Figure 7, or other desired angular position.

From the foregoing it will be apparent to those skilled in the art that the illustrated embodiments of the invention provide new and improved spark gap apparatus, and accordingly, each accomplishes the principal object of the invention. On the other hand, it also will be obvious to those skilled in the art that the illustrated embodiments of the invention may be variously changed and modified, or features thereof, singly or collectively, embodied in other combinations than those illustrated, without departing from the spirit of the invention, or sacrificing all of the advantages thereof, and that accordingly, the disclosure herein is illustrative only, and the invention is not limited thereto.

We claim:

1. Spark gap means, comprising: an electrode, a support for said electrode, said support having an aperture for reception of said electrode, and having a chamber providing a passage for the flow of cooling fluid adjacent said aperture, and having inlet and outlet ports for said passage at the base of said support, said chamber adjacent said outlet port having an extension away from said port in a direction about said aperture; and said chamber being so constructed and arranged that fluid flowing from said inlet port through said passage will be directed into said extension.

2. Spark gap means, comprising: an electrode; clamp means for holding and supporting said electrode, said clamp means comprising a member having an aperture for the reception of said electrode, said member being split into said aperture to provide portions spaced at said split; one of said portions including a part having a transverse threaded hole; screw means, including external threads constructed and arranged for cooperation with said threaded hole; a projection carried by said other portion and extending toward said one portion, and having external threads at its free end; and said screw means including internal threads constructed and arranged for cooperation with the external threads on said projection.

3. Spark gap means, comprising: an electrode; clamp means for holding and supporting said electrode, said clamp means comprising a member having an aperture for the reception of said electrode, said member being split into said aperture to provide portions spaced at said split; one of said portions including a part having a transverse threaded hole; screw means, including external threads constructed and arranged for cooperation with said threaded hole; a projection carried by said other portion and extending toward said one portion, and having external threads at its free end; said screw means including internal threads constructed and arranged for cooperation with the external threads on said projection; and said internal threads being of different pitch from said external threads cooperable with the threads in said threaded hole.

4. Spark gap means, comprising: an electrode; clamp means for holding and supporting said electrode, including screw means for operating said clamp means; and means, including an externally threaded sleeve cooperable with a relatively stationary threaded hole in said clamp means, said sleeve having internal threads cooperable with said screw means, constructed and arranged to adjust the rotative position said screw means assumes when the desired clamping action is attained.

5. Spark gap means, comprising: an electrode; clamp means for holding and supporting said electrode, said clamp means comprising a member having an aperture for the reception of said electrode, said member being split into said aperture to provide portions spaced at said split; one of said portions including a part having a threaded hole, said part being a sleeve separate from said portion and having external threads cooperable with internal threads in a threaded hole in said portion, the external and internal threads of said sleeve being of different pitch; screw means, including external threads constructed and arranged for coperation with the threaded hole in said sleeve; a projection carried by said other portion and extending toward said one portion, and having external threads at its free end; and said screw means including internal threads constructed and arranged for cooperation with the external threads on said projection.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,764,279	Osborn	June 17, 1930
2,231,783	Tresslar et al.	Feb. 11, 1941
2,300,101	Capita	Oct. 27, 1942
2,318,633	Ries	May 11, 1943
2,381,648	Curtis	Aug. 7, 1945
2,449,552	Gorham et al.	Sept. 21, 1948