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2,738,019

DEVICES FOR CENTRALIZING CASING IN BOREHOLES

Filed May 12, 1952

4 Sheets-Sheet 1

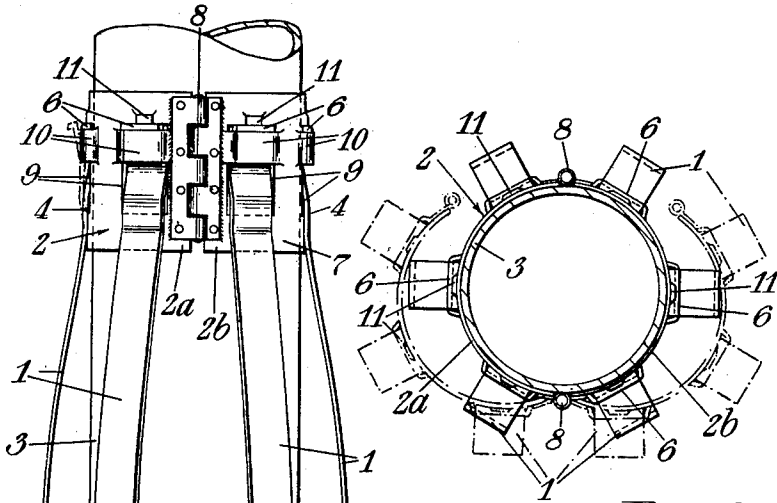


Fig. 3.

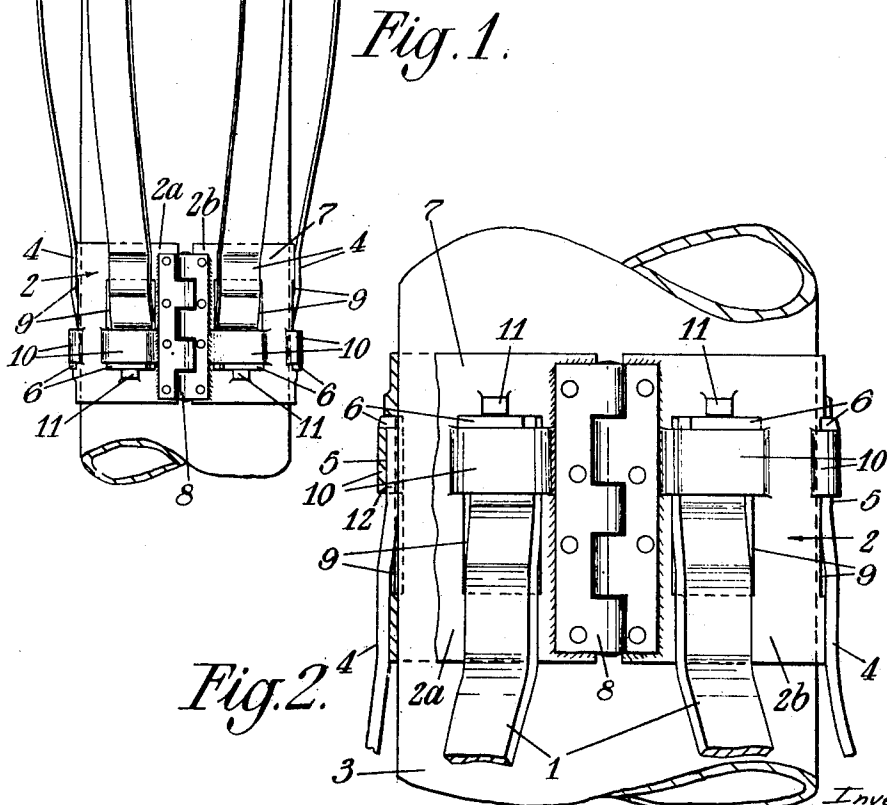


Fig. 2.

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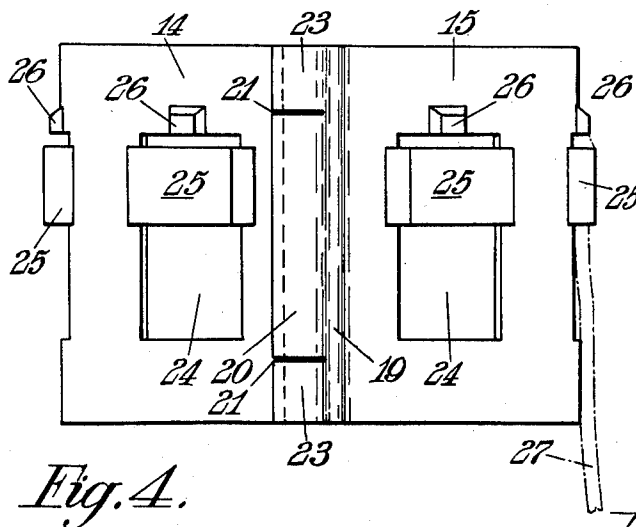
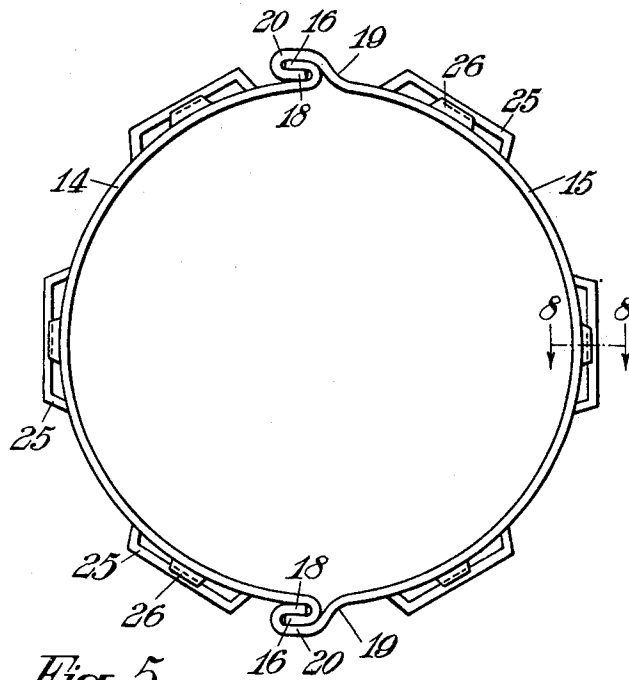
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4 Sheets-Sheet 2



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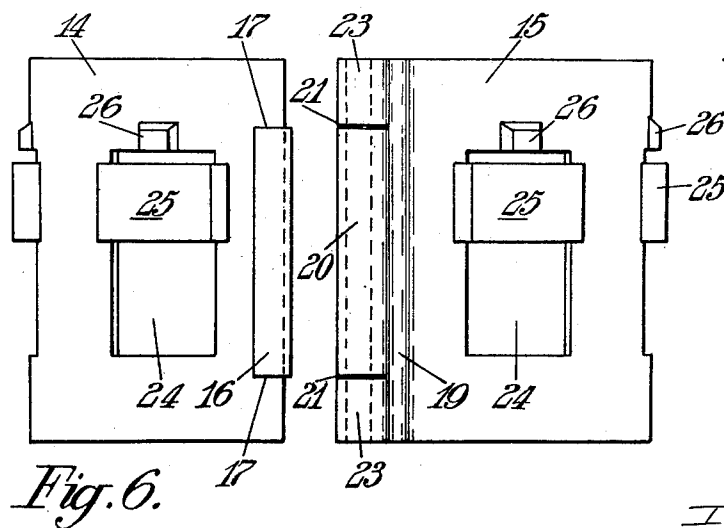
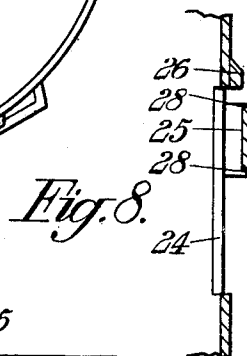
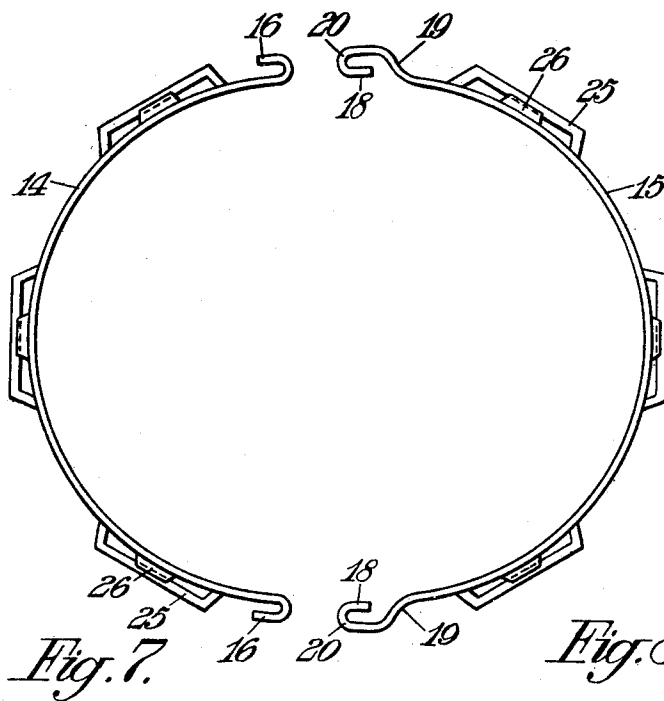
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4 Sheets-Sheet 3



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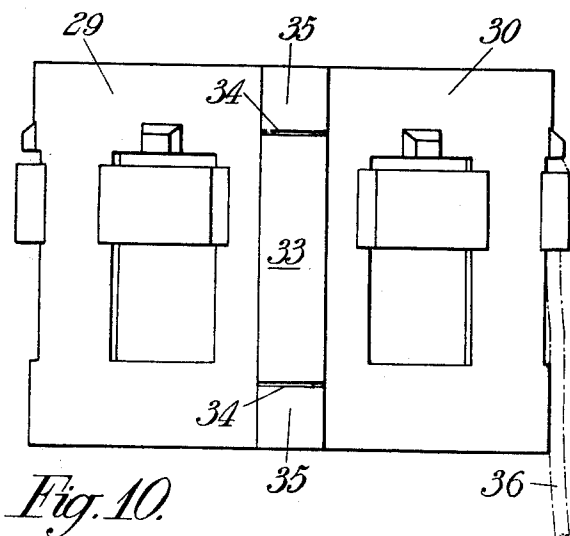
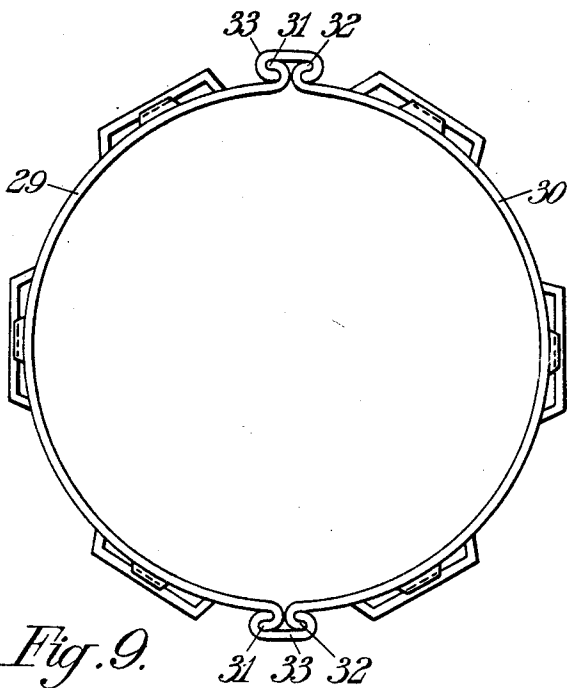
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DEVICES FOR CENTRALIZING CASING IN BOREHOLES

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DEVICES FOR CENTRALIZING CASING IN BOREHOLES

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Application May 12, 1952, Serial No. 287,399

Claims priority, application Great Britain May 22, 1951

12 Claims. (Cl. 166—241)

This invention relates to devices for centralizing casing in boreholes in conjunction with well drilling and like operations, of the kind comprising an annular series of bowed springs connected at their ends to spaced rings which are adapted to be fitted to the exterior of the casing or pipe so that the bowed portions of the springs can engage the wall of the borehole.

In patent application No. 197,698, filed November 11, 1950, now Patent No. 2,680,488, there is described a device of the above kind in which the bowed springs are connected to their end rings in such a manner that the bowed spring portions can be initially stressed to increase their resistance to lateral loads, the springs being fulcrumed upon the casing or pipe for this purpose. It is one of the objects of the present invention to provide an improved device of the kind described which affords greater freedom of relative rotation between the device and the casing or pipe. Another object is to provide an improved device which can be employed in conjunction with a single stop ring or equivalent means only, which affords longitudinal lost motion between the device and the casing or pipe.

A further object of the invention is to provide a device of the kind referred to above in which initial stressing of the bowed springs is effected by an engagement or fulcrum of a part or parts of the spring upon one or both of the end rings.

A further object is to provide a device according to the preceding paragraph in which one or both of the end rings is extended axially to provide a continuous peripheral portion upon which the springs are engaged. The springs may be similar to those described in the above mentioned patent application but with the outwardly bent portions omitted.

A further object is to provide a device according to either of the two preceding paragraphs, applied to a casing or pipe having a single stop ring or equivalent stop lugs.

In the accompanying drawings,

Figure 1 is a side elevation of a centralizing device constructed and arranged according to the invention;

Figure 2 is a side elevation, partly in section, to an enlarged scale of one of the end rings of the device;

Figure 3 is an end view of the device, showing the position of the ring when opened out;

Figure 4 is a side elevation of a modified form of end ring;

Figure 5 is an end view of the ring of Figure 4;

Figure 6 is a side elevation of the separated ring halves before joining;

Figure 7 is an end view of the ring halves of Figure 6;

Figure 8 is a section taken on the line 8—8 of Figure 5;

Figure 9 is an end view of a further modified form of end ring;

Figure 10 is a side elevation of the end ring of Figure 9.

In carrying the invention into effect according to one convenient mode as illustrated in Figures 1 to 3, the device comprises an annular series of bowed springs 1 se-

cured at their ends to spaced rings 2 which are fitted to the exterior of the bore hole casing 3 so that the bowed portions of the springs can engage the wall of the bore hole. Each of the springs 1 is formed as described in patent application No. 197,698 of November 27, 1950, but with the outwardly bent portions omitted. Each spring comprises a bowed portion having at each end an intermediate or parallel portion 4 joined to an end or extension portion 5 having at its end a turned out lug 6. The spring is formed so that when in free condition and disconnected from the end rings, the integral spring extensions 5 will be inclined outwardly with respect to a plane surface upon which the spring is laid. This position is shown in chain dotted lines in Figure 1 for one end of the spring. Such formation results in the spring being stressed when the said extension portions at the opposite ends of each spring are brought into aligned relation when the spring is mounted on the rings. The end rings 2 are of greater axial length than the rings described in the above mentioned patent application and have a substantially peripherally continuous portion 7 at their inner ends upon which the intermediate portions 4 of the springs are engaged when the spring end is secured to the ring, thereby affording a fulcrum for the stressing of the spring. Each of the end rings is split and is formed by a pair of half rings 2a and 2b connected by hinges 8. By removing one of the hinge pins the ring can be opened as shown by broken lines in Figure 3 for removal from the casing. Each ring or ring half is formed with a series of axially extending rectangular openings 9 in which the spring ends can be received. Lugs or bridge portions 10 of shallow channel shape extend across the said openings towards the outer end of the ring to leave a narrow slot at said end to receive the turned out lugs 6 at the spring ends. The lugs or bridge portions 10 may be formed integrally with the rings or may be welded thereto as may be desired. Stop members 11 are formed, or welded, on the ring at the outer end of each of said slots to form an abutment for the spring end. The arrangement is such that when the springs are connected to the rings and assembled on the casing or pipe 3, each spring bow is initially stressed by the displacement of the spring extension portions 5 by engagement of the intermediate portions 4 with the end rings to force such portions of the springs apart. The inner edges of the bridge pieces 10 may be chamfered as shown at 12 if desired to facilitate insertion of the springs. When using such an arrangement, there is no engagement between the springs and the casing or pipe so that the latter is free to turn inside the device and is not subject to frictional drag.

A centralizing device as described above can be used in conjunction with the usual pair of casing stop rings such as are illustrated in the patent application referred to previously but if desired a single stop ring or its equivalent may be employed. A single stop ring is shown at 13 in Figure 1. Instead of a stop ring, two or more lugs may be welded or otherwise secured to the casing or pipe so that they serve as the equivalent of a ring. The use of such stop lugs is permissible with a centralizing device as described above by reason of the end rings being peripherally continuous at their inner ends, i. e. there are no openings within which such stops could be accidentally engaged. When using a single stop, lost motion is afforded between the casing and the device, and when movement of the casing is reversed it will travel the distance between the end rings before engaging the device. This may be an advantage in some circumstances since the device will thereby be jarred. Also when setting or picking up casing slips for the addition of a new length of casing the small movement of the casing involved will not displace the centralizing device.

Instead of joining the ring halves by hinge members and

pins as previously described, a modified form of connection as illustrated in Figures 4 to 8 may be employed. Two ring halves 14 and 15 are provided and these may conveniently be formed from sheet metal of suitable thickness. The ends of the ring half 14 are each formed with an outwardly and rearwardly extending fold portion 16 the ends of which are cut away at 17 so that this fold portion is of shorter longitudinal extent than the ring. The ends of the ring half 15 are each formed with an inwardly and rearwardly directed fold portion 18 which is radially offset at 19. The disposition of the two folds 16 and 18 is such that they can be interengaged as shown in Figure 5 to form a complete ring. The fold portion 18 extends the full length of the ring and the outer portions 20 of the said fold are partially separated from the main part thereof by slits or saw cuts 21; the part 22 between the slits being equal in length to that of the outward fold 16. The arrangement is such that after the ring halves have been assembled as shown in Figures 4 and 5, preferably by a longitudinal sliding of the two halves, the portions 23 lying outside the slits 21 can be flattened down, as for example by hammering, so that they lie adjacent the ends 17 of the short fold portion 16 and thereby secure the ring halves against relative longitudinal displacement. Each ring half is provided with openings 24, bridge portions 25, and stop members 26 as described in the previous example for receiving the springs, one of which is indicated by broken lines at 27 in Figure 4. The ends of the bridge portions 25 may be chamfered at 28 (Figure 8) to facilitate insertion of the springs. The arrangement is otherwise as described in the previous example.

In a further modified construction as shown in Figures 9 and 10, the ring halves 29, 30 have their adjacent ends formed with similarly shaped outwardly folded portions 31 and 32. These folded portions are engaged and connected by a pair of strips 33 which are of C-section as shown in Figure 9. The strips 33 have slits or saw cuts 34 in their outer sides leaving end portions 35, and the outward folds 31, 32 of the half ring edges are shorter than the ring so that they extend only to the slits 34. When the ring halves are assembled by sliding the C-strips 33 over the fold portions as shown, the end portions 35 of the strips are flattened as by hammering so that the connection is secured. The arrangement is otherwise as described in the previous examples, and one of the springs is indicated at 36 in broken lines in Figure 10.

It will be appreciated that with the construction according to the invention, it is not possible readily to disengage the bowed springs from the end rings once they have been assembled thereon, since by the very nature of the prestressed springs, special tools are necessary to force the spring ends into the ring openings and under the bridge portions and to force the springs longitudinally until their turned out lugs engage in the slots, the tool being then removed. When assembled, the blades and end rings form a unitary whole, similar to the known riveted centralizers, irrespective of whether the centralizer is on the casing or not. Thus the dismantling of an assembled unit would be an extremely difficult operation, but is not normally required. If desired by the user, the end rings and springs can be dispatched separately for assembly on site.

It will be understood that the improvement is not restricted to the above examples, since the details of construction of the end rings and of the mode of connecting the springs thereto may be variously modified. Also if desired, the end rings may be of continuous or integral construction instead of split as previously described.

I claim:

1. A device for centralizing casing in boreholes of the type having a series of centrally bowed leaf springs that have end portions by which they are secured to spaced end rings and assembled therewith about the exterior of a bore hole casing with their bowed portions outwardly directed, particularly characterized by means on the end rings for anchoring the springs thereto and further char-

acterized by the springs being formed so that when in unassembled condition the said end portions which are intended to be secured to the anchoring means and to be engaged by the end rings, respectively, lie in planes which are inclined outwardly relative to the planes which they occupy when secured to the end rings, such that when the springs are assembled upon and secured to the rings the portions of the springs connecting the said end portions to the bowed portions will engage the outer surfaces of the end rings thereby fulcruming the engaging portions thereof upon the end rings inwardly of the anchorage points to increase the outward bowing of the springs and thereby increase the resistance of said bowed portions to lateral loads.

2. A device according to claim 1, in which the springs are fulcrumed upon the exterior of each end ring which is substantially continuous peripherally.

3. A device according to claim 1, in which each of the springs comprises a bowed portion and two end portions, each end portion including a terminal portion connected to the ring and joined to an intermediate portion which in the assembled condition of the springs lies substantially parallel to the ring axis and is engaged and fulcrumed on the end ring.

4. A device according to claim 1, in which each spring end has an outwardly projecting lug and the end rings have openings within which the said lugs are engaged, and an intermediate portion of each spring is fulcrumed upon a peripheral portion of the said ring.

5. A device according to claim 1, in which the end rings have axially extending openings for receiving the spring ends and each opening has a bridge piece extending across it to afford a slot at one end thereof, and each spring end has an outwardly extending lug which in the assembled condition of the springs is engaged within the slot with the adjacent spring portion lying beneath the bridge, thereby affording a detachable spring anchorage.

6. A device according to claim 1, in which the end rings have axially extending openings for receiving the spring ends and each opening has a bridge piece extending across it to afford a slot at one end thereof, and each spring end has an outwardly extending lug which in the assembled condition of the spring is engaged within the slot with the adjacent spring portion lying beneath the bridge, and stop members are provided on the end rings at the outer end of each slot to form an abutment for the spring end, thereby affording a detachable spring anchorage.

7. A device according to claim 1, in which the end rings are longitudinally divided.

8. A device according to claim 1, in which the end rings are longitudinally divided and joined by a pair of hinged members and pins whereby the assembled springs are held in strained condition when the said rings are opened for placing over the casing.

9. A device according to claim 1, in which the end rings are longitudinally divided and the ring parts are secured together by folded joints.

10. A device according to claim 1, in which the end rings are divided longitudinally, and the adjacent ends of the ring parts have respectively inward and outward folds constituting an interfitted joint, one of the mating folds being shorter than the other fold and being overlapped by the other fold, the said overlapping parts being capable of deformation as by hammering to secure the joint.

11. A device according to claim 1, in which the end rings are divided longitudinally and the adjacent ends of the ring parts have respectively inward and outward folds constituting an interfitted joint, one of the mating folds being shorter than the other fold and being overlapped by the other fold, and slits being provided in the overlapping portions to separate said portions from the main part of said fold whereby deformation of said overlapping portions as by hammering to secure the joint is facilitated.

12. A device according to claim 1, in which the end rings are longitudinally divided and the adjacent ends of the ring parts have opposed folds and a C-section strip is engaged with said folds to constitute an interfitted joint which is capable of being deformed as by hammering to secure the connected folds. 5

References Cited in the file of this patent

UNITED STATES PATENTS

1,820,391	Hartman	Aug. 25, 1931
1,889,060	Dennie	Nov. 29, 1932
2,248,160	Crawford	July 8, 1941
2,546,582	Baker	Mar. 27, 1951
2,605,844	Clark	Aug. 5, 1952
2,680,488	Atkinson	June 8, 1954