

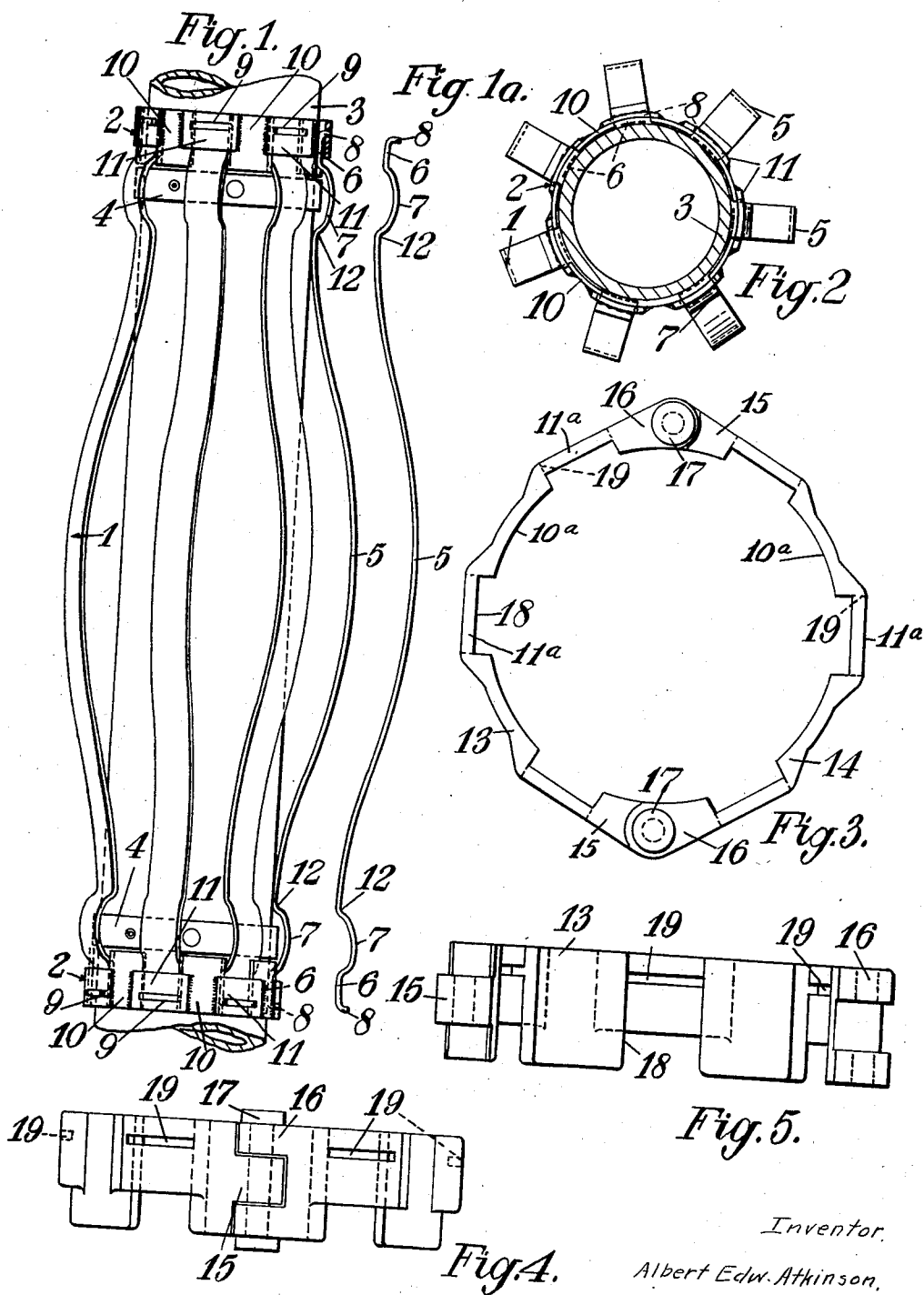
June 8, 1954

A. E. ATKINSON

2,680,488

DEVICE FOR CENTRALIZING CASINGS IN BOREHOLES

Filed Nov. 27, 1950



Inventor.
 Albert Edw. Atkinson,
 by *Hall & Houghton*
 Attorneys.

UNITED STATES PATENT OFFICE

2,680,488

DEVICE FOR CENTRALIZING CASINGS IN BOREHOLES

Albert Edward Atkinson, Hinchley Wood, Esher,
England

Application November 27, 1950, Serial No. 197,698

Claims priority, application Great Britain
December 15, 1949

11 Claims. (Cl. 166—4)

1

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 secured at their ends to spaced rings which are adapted to be fitted to the exterior of the casing so that the bowed portions of the springs can engage the wall of the borehole. The main purpose of such devices is to ensure that the casing occupies a position at or near the centre of the borehole for the introduction of cement between the casing and the wall of the hole. The casing is liable to be subjected to considerable side thrust, for example if the hole is not straight or has a sinuous form, and such may be sufficient to flatten the springs on one side of the casing so that the latter will be eccentrically disposed in the hole. Since the clearance between the wall of the hole and the casing is small, there is a limit to the dimensions of the springs which can be employed and such are usually of standard sizes. It is the object of the present invention to provide an improved device capable of centralizing casing under greater side thrusts than has hitherto been possible, and without substantially increasing the spring dimensions. A further object is to provide a simple, convenient and relatively inexpensive construction which fulfils the above requirements.

The invention consists in a device of the kind described 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 load.

The invention also consists in a device of the kind described in which the bowed springs are formed or provided, at one or both ends, with a mounting extension which in the free condition of the spring occupies a position displaced from its working position on the end ring, so that when in working position, the bowed portion of the spring is initially stressed to increase its resistance to lateral load. Preferably such displaced extensions are provided at both ends of each spring.

The invention further comprises providing a connection between the spring end extensions and the end rings including a lug or angled portion on the spring extension engaged in an aperture or between abutments on the ring so that individual relative movement in the longitudinal direction of the device is prevented.

According to a further feature of the invention, the springs comprise a bowed portion and an integral extension at one or both ends which is displaced in the free condition of the spring as

2

previously described and is adapted to be mounted in the end ring so as to stress the spring when the device is applied to the casing. The mounting portion of the extension may be joined to the bowed portion by an outwardly cranked portion to provide a convenient clearance for the usual stop ring secured to the casing and against which the end ring of the device abuts when the casing is displaced in the borehole.

In the accompanying drawing,

Figure 1 is an elevation of a centralizing device constructed according to the invention and mounted on a borehole casing;

Figure 1a is an elevation of one of the springs in free condition;

Figure 2 is an end view of the device;

Figure 3 is an end view of a modified form of device;

Figure 4 is a side elevation of the modified device;

Figure 5 is a side elevation of the inside of one of the connected elements forming the modified device.

In carrying the invention into effect according to one convenient mode as illustrated in Figures 1 and 2, the device comprises an annular series of bowed springs 1 secured 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. The rings 2 are positioned on the casing by stop rings 4 which are welded or otherwise secured to the casing in accordance with usual practice. According to the invention, each of the steel springs 1 is formed with a bowed portion 5 having integral end extensions 6 adapted to be connected to the end rings 2 and which extensions 6, in the free condition of the spring, are relatively inclined in such a manner that when brought into alignment when the rings are mounted on the casing, the bowed portion 5 is stressed to increase its resistance to applied load. Figure 1 shows the springs in stressed condition and when free, i. e. when disconnected from the end rings, the extensions 6 will be relatively inclined outwardly with respect to a plane surface upon which the spring is laid as will be clearly seen in Figure 1a. It will be seen that when bringing such extensions into alignment as shown, the central portion of the spring is stressed and its outward bowing tends to increase. Each extension 6 is joined to the bowed portion 5 by an outwardly cranked portion 7. The ends of the straight portions 6 are turned outwardly to form lugs 8 which are adapted to enter correspondingly shaped slots 9

3
in the end rings of the device. The end rings may be formed in any convenient way to receive the spring extensions, the arrangement being such that when the springs are connected to the rings 2 and the device is mounted on the casing 3, the extensions 6 are forcibly brought into alignment or into a position parallel with the longitudinal axis of the device so that the bowed portion 5 is stressed outwardly, and the lugs 8 on the ends of the springs enter the ring slots 9 and thereby prevent relative longitudinal movement of the individual springs. The form of ring shown is built up from curved sections by welding but casting or other suitable methods may be employed. Each ring comprises an inner series of curved sections 10 uniformly spaced so that the ends 6 of the springs may enter between them. These sections are connected by an outer series of curved sections 11 which overlap and bridge the inner sections 10 to which they are welded or otherwise secured, each of said outer sections having a transverse slot 9 to receive the spring lug 8. The sections may be formed from suitably curved plate and the inner sections 10 are longer in the direction of the ring axis than the outer sections 11. A ring built up in this manner will have a castellated cross-section and affords the advantage of a somewhat larger area for fluid flow outside the casing.

The arrangement is such that when the springs are assembled in the rings as described above and the rings are mounted on the casing, each spring bow 5 is initially stressed outwardly by the displacement of its extensions into alignment or into a position approaching alignment, this displacement being effected by the engagement of the inner ends of the extensions (or the outer ends of the bow portion) with the casing to force such portions or the springs apart, and since the outer ends of the spring extensions are held within the rings, this displacement increases the bowing of the spring and affords it initial stress. It will be seen that, in effect, the ends 12 of the bow 5 constitute fulcrums and the extensions 6 act as levers to apply the initial stress, as a result of which the spring bows are capable of resisting a considerably greater load than in their free condition, not only when the load is first applied, but throughout the range of deflection of the bow. Also the mode of connecting the springs to the end rings prevents relative longitudinal motion between the springs and rings, so that no spring can act individually should it alone be subject to stress in passing a kink or obstruction in the hole, such spring being afforded the collective resistance of all the springs in resisting elongation by flattening. The cranked portions 7 at the end of the spring bows afford a convenient clearance for the usual stop rings 4 which are secured to the casing within the end rings of the centralizing device.

Any desired number of springs may be provided, the number generally varying in accordance with the casing diameter. The springs are generally disposed to lie parallel with the axis of the casing, but they may be inclined thereto if desired.

In order to permit the fitting of the device to casing having enlarged screwed ends, the modified construction shown in Figures 3, 4 and 5 may be adopted. Each ring is split and comprises two halves 13 and 14 which are provided with pairs of complementary hinge portions 15, 16 as shown in Figures 3 and 4 and connected together by pins 17. Each ring portion comprises a series of curved sections 10a which correspond to the sec-

tions 10 of Figures 1 and 2 and these sections 10 are connected by integral straight sections 11a which correspond to the sections 11 of Figures 1 and 2, the sections 10a and 11a being arranged to afford recesses 12 and the sections 11a being formed with slots 19. The recesses 12 are adapted to receive the spring extension parts 6 and the slots 19 receive the spring lugs 8. The operation of the modified device is otherwise as described in the previous example.

The mode of connecting the springs to the ring and the ring constructions described in the above examples may be variously modified within the scope of the appended claims.

I claim:

1. A casing centralizer 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 are assembled therewith about the exterior of a bore hole casing with their bowed portions outwardly directed, particularly characterized in that the springs have end portions that in their unassembled condition lie in planes that are inclined outwardly relative to the planes they occupy when assembled on the end rings, and in that the end rings comprise means for anchoring the end portions of the springs thereto, such anchoring means comprising longitudinally spaced abutment means constraining the spring end portions, when the device is assembled, to lie in planes inwardly inclined with respect to the first mentioned planes, whereby the assembled springs are strained in a direction to increase the outward bowing of their central portions and thereby increase the resistance of said portions to flattening under lateral loads.

2. A casing centralizer according to claim 1, in which the springs have a formation intermediate the end portion which is adapted to be secured to the anchorage means and the bowed portion, which formation lies inwardly of the said end portion when the springs are in unassembled condition to an extent such that when the springs are assembled on the end rings said inward formation fulcrums against the bore hole casing to strain the spring.

3. A casing centralizer according to claim 2, in which the anchorage of the spring ends is effected by interfitting parts on the spring end and ring respectively to afford a detachable connection between the spring and ring.

4. A casing centralizer according to claim 3, in which the interfitting parts comprise an outwardly directed lug on the spring end and pairs of abutments on each ring between which said lug is engaged to prevent longitudinal movement of the spring end relative to the ring.

5. A casing centralizer according to claim 4, in which the pairs of abutments comprise the longitudinally spaced walls of slots in the rings.

6. A casing centralizer according to claim 1, in which the spaced rings are divided longitudinally into separable halves closable about the casing and the springs have a formation intermediate their end portion which is adapted to be secured to the anchorage means and the bowed portion, which formation lies inwardly of the said end portion when the springs are in unassembled condition to an extent such that when the separable ring halves are closed about the casing the springs are strained coincidently with such closing.

7. A casing centralizer according to claim 1 and of the type comprising stop rings secured to the casing in the assembly therewith, further

5

characterised in that the springs have a formation intermediate the end portion which is adapted to be secured to the anchorage means and the bowed portion, which formation lies inwardly of the said end portion when the springs are in unassembled condition to an extent such that when the springs are assembled on the end rings said inward formation fulcrums against the bore hole casing to strain the spring, and in that the springs have outwardly cranked portions between said inward fulcrum formation and their ring engaging portion of an extent sufficient to bridge over said stop rings.

8. A casing centralizer according to claim 7, further characterised in that the outwardly cranked bridging portions of the springs freely bridge the stop rings with substantial clearance, and in that the spaced rings are provided with castellated portions projecting between said leaf springs to positions partially underlying said outwardly cranked bridging portions for abutting against said stop rings to prevent abutment of the intervening portions of the spring ends there-against.

9. A casing centralizer according to claim 8, in which the rings, between said castellated portions, comprise outwardly displaced bays for overlying the end portions of the centrally bowed leaf springs, outwardly of their fulcrum-constituting formations and cranked portions, and pressing said end portions inwardly toward the casing wall.

10. A casing centralizer according to claim 9, in which said bays have circumferentially extending slots therein, and in which the extremities of said leaf spring end portions are upturned and embraced by said slots to lock the springs

6

against longitudinal movement relative to the rings in the assembly thereof with the casing.

11. A casing centralizer of the type having a series of centrally bowed leaf springs that have end portions by which they are secured to spaced rings and assembled therewith about the exterior of a bore hole casing with their bowed portions outwardly directed, particularly characterised in that the spaced rings comprise, in alternate circumferential sections thereof, casing contacting portions and portions radially elevated therefrom to leave spaces therebetween, and in that the bowed leaf springs have end portions formed so that when in unassembled condition the said end portions lie in planes which are inclined outwardly relative to the planes which they occupy when assembled on the end rings and said end portions have a fulcrum-constituting formation which lies inwardly of the terminal portions of the spring ends when the springs are in unassembled condition to an extent such that when the springs are assembled on the end rings said inward formation fulcrums against the bore hole casing to strain the spring in a direction to increase the outward bowing thereof and thereby increase their resistance to lateral loads, said spring ends having a cross section adapted to enter the spaces between the radially elevated portions of the rings and the casing for securing the springs therein.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,775,376	Steps et al.	Sept. 9, 1930
1,820,391	Hartman	Aug. 25, 1931
2,228,649	Welles	Jan. 14, 1941