# United States Patent

**Dixon et al.**

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## [54] WALL CONTACTING TOOL


[72] Inventors: **James W. Dixon**, Edmonton, Alberta, Canada; **Samuel T. Crews, Jr.**, Houston, Tex.

[73] Assignee: **Smith International, Inc.**



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[52] **U.S. Cl.** ..... **175/325**, 308/4 A

[51] **Int. Cl.** ..... **E21b 17/10**

[58] **Field of Search**..... 175/325, 320, 323, 76, 408; 308/4 A



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 3,454,308 | 7/1969 | Kennedy | 175/323 X |
| 2,084,421 | 6/1937 | Wright | 175/325 X |
| 2,973,996 | 3/1961 | Self | 175/323 X |
| 3,292,708 | 12/1966 | Mundt | 308/4 A X |
| 2,088,770 | 8/1937 | Skinner | 175/320 X |
| 2,589,534 | 3/1952 | Buttolph | 175/325 X |



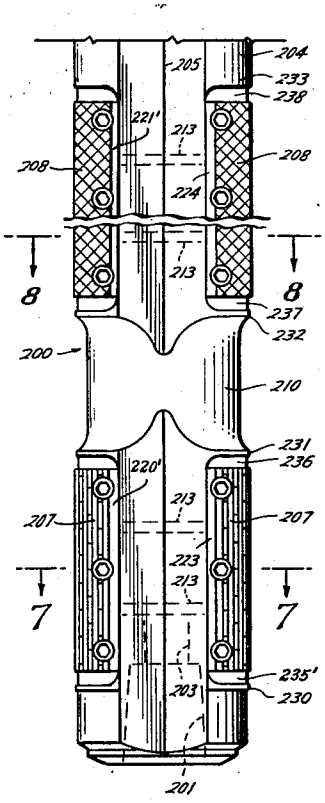
*Primary Examiner*—David H. Brown
*Attorney*—Murray Robinson, Ned L. Conley, Robert W. B. Dickerson and Bill B. Berryhill



[57] **ABSTRACT**

A drill string wall contacting tool, suitable for deviation control and/or bit stabilization is provided with replaceable wall contacting elements. Generically the tool is of the rotating fixed blade stabilizer type wherein the wall contacting elements rotate with the drill string but are fixed relative thereto, there being fluid passages in the sides of the tool which divide it azimuthally into a plurality of blades at whose periphery are the wall contacting surfaces. Preferably the tool is a four bladed stabilizer of the species known as a square drill collar. The wall contacting tool is grooved longitudinally at its outermost periphery, i.e., the corners of the square drill collar, and includes field replaceable wear elements received in the grooves and secured in place by screws or bolts. Preferably the grooves are rabbets, i.e., having two plane sides that are perpendicular to each other and the wear elements have correlative surfaces, whereby the wear elements can be screwed or bolted to both sides of the rabbet without tightening of the screws to one side drawing the strips away from the other side. In the case of a square drill collar, in order to provide greater depth to each rabbet and a larger arcuate wall contacting surface for each wear pad, and at the same time allow sufficient longitudinal fluid passage space between the wear pads, the sides of the collar between the rabbets are relieved as compared to the flat sides of the usual square drill collar.


**14 Claims, 11 Drawing Figures**



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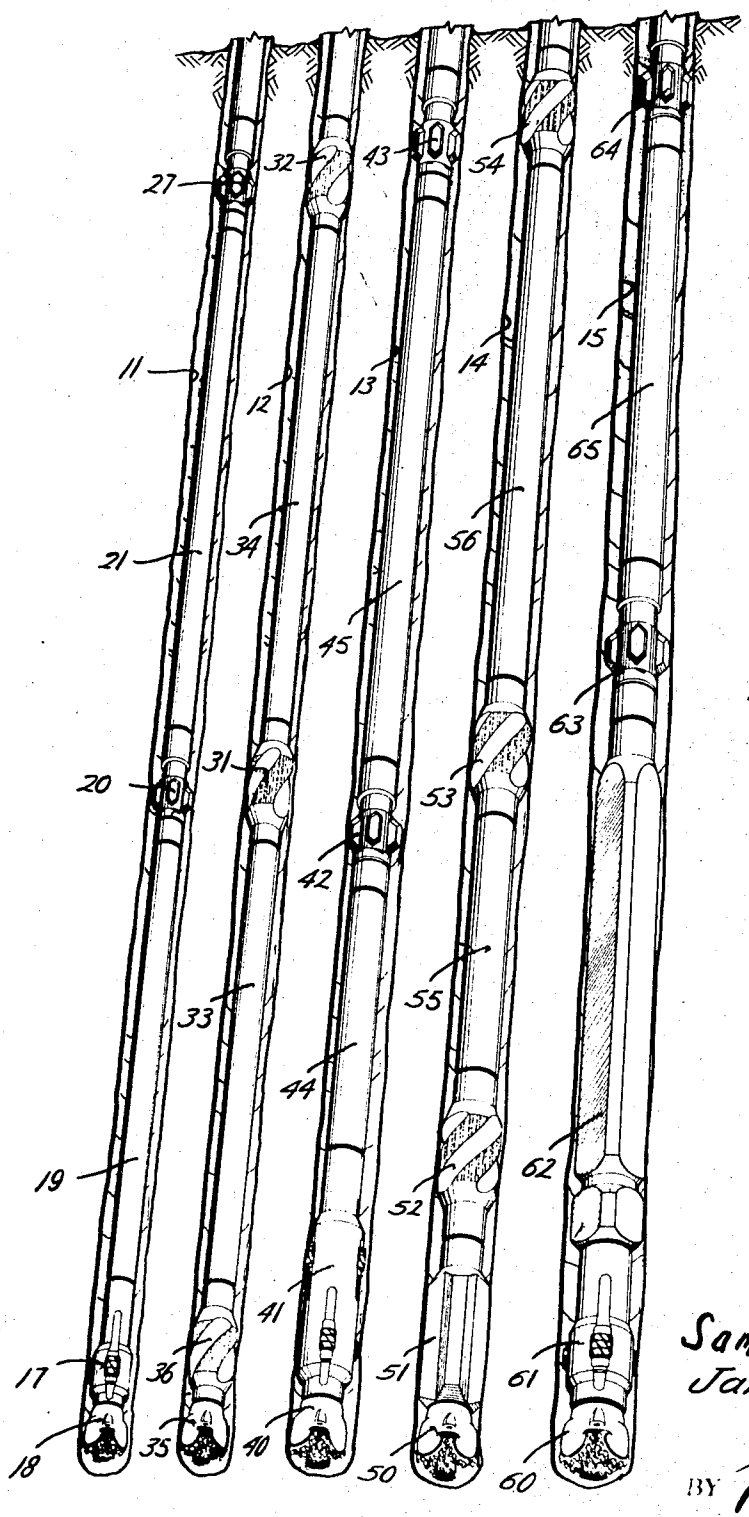



Fig. 1

PRIOR ART

Samuel T. Crews, Jr.
James W. Dixon
INVENTORS

BY Murray Robinson

ATTORNEY

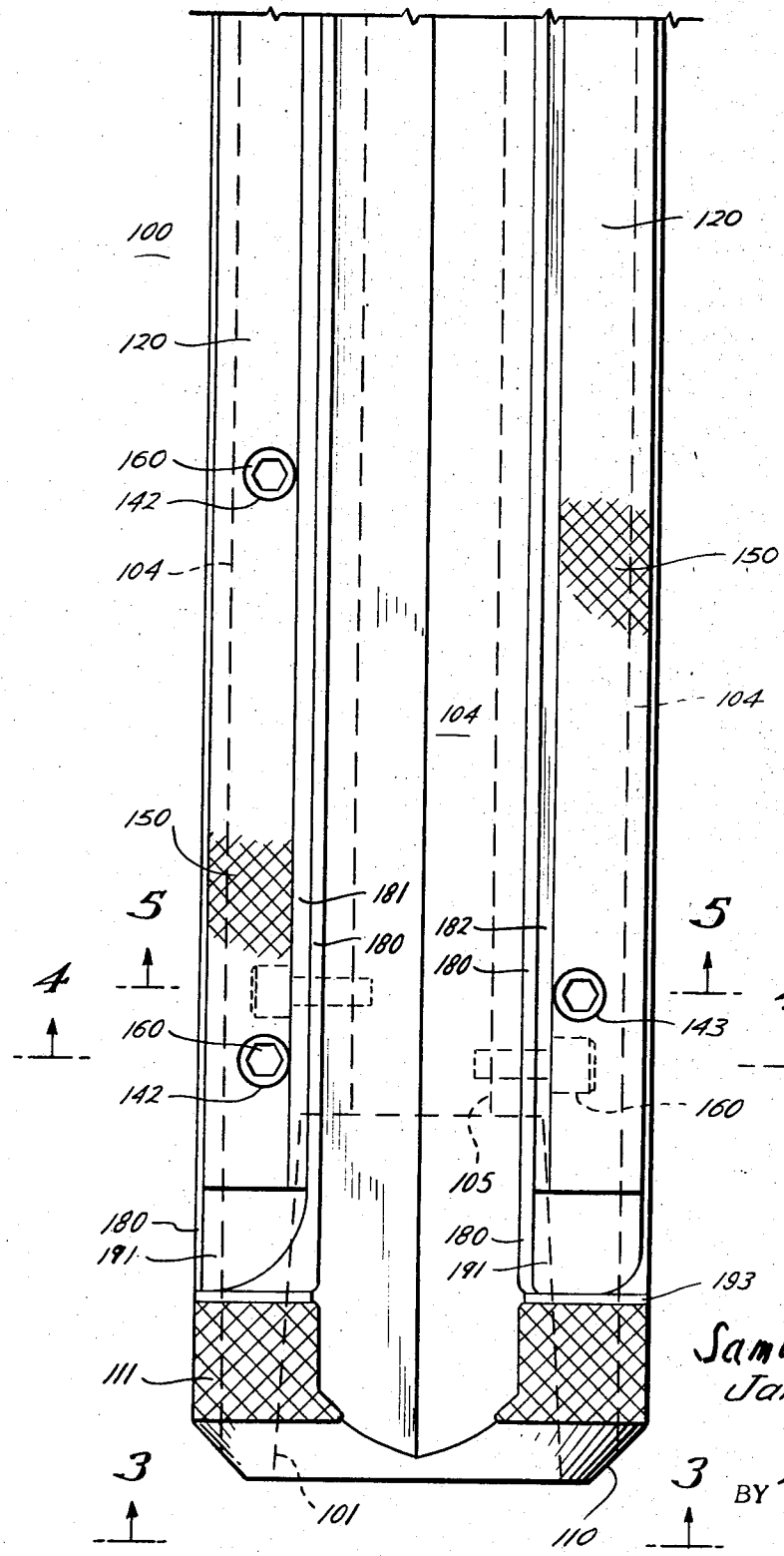



Fig. 2A

Samuel T. Crews, Jr.
James W. Dixon
INVENTORS

BY Murray Robinson
ATTORNEY

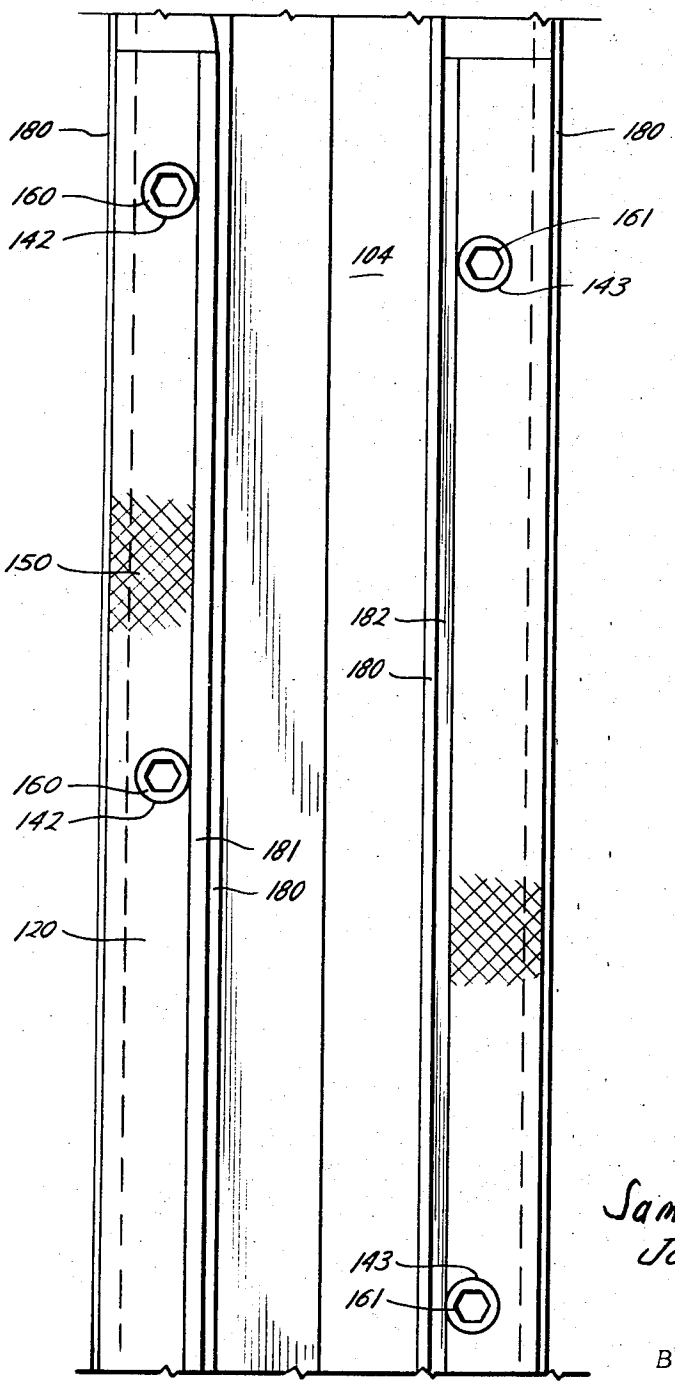



Fig. 2B

Samuel T. Crews, Jr.
James W. Dixon
INVENTORS

BY Murray Robinson

ATTORNEY

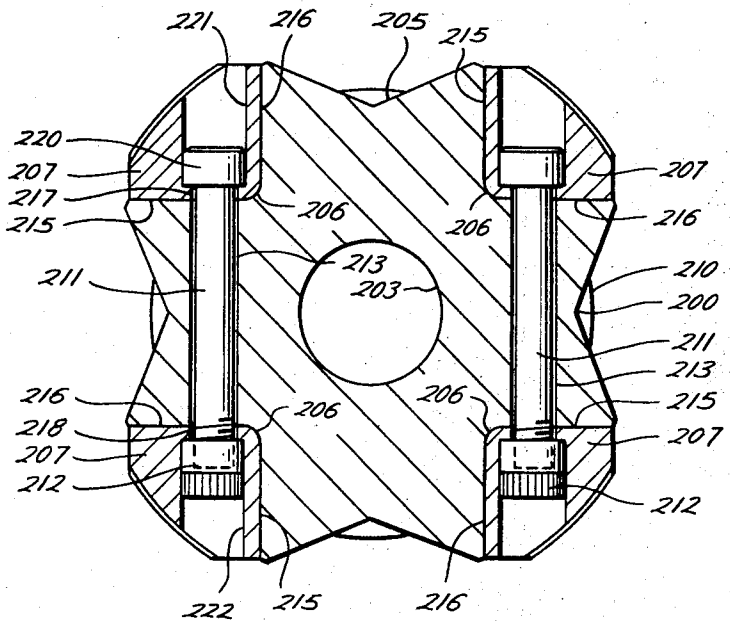



Fig. 8

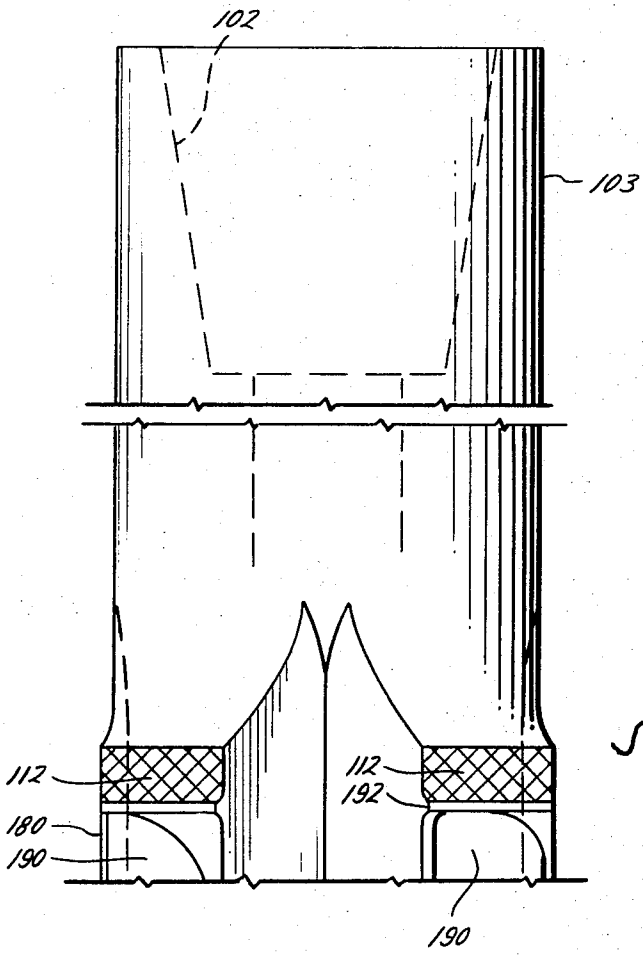



Fig. 2C

Samuel T. Crews, Jr.
James W. Dixon
INVENTORS

BY Murray Robinson

ATTORNEY

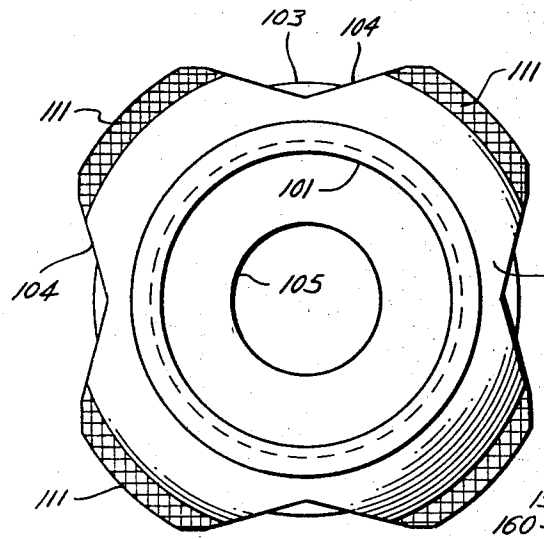



Fig. 3

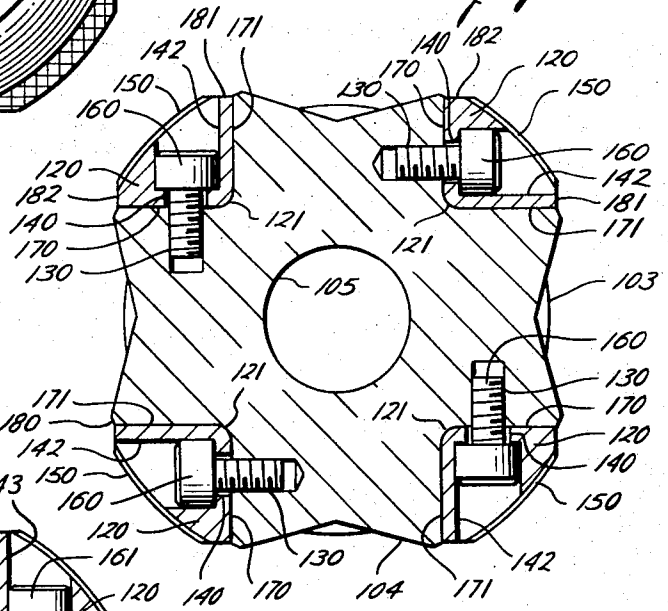



Fig. 4

Fig. 5

Samuel T. Crews, Jr.
James W. Dixon
INVENTORS

BY Murray Robinson
ATTORNEY

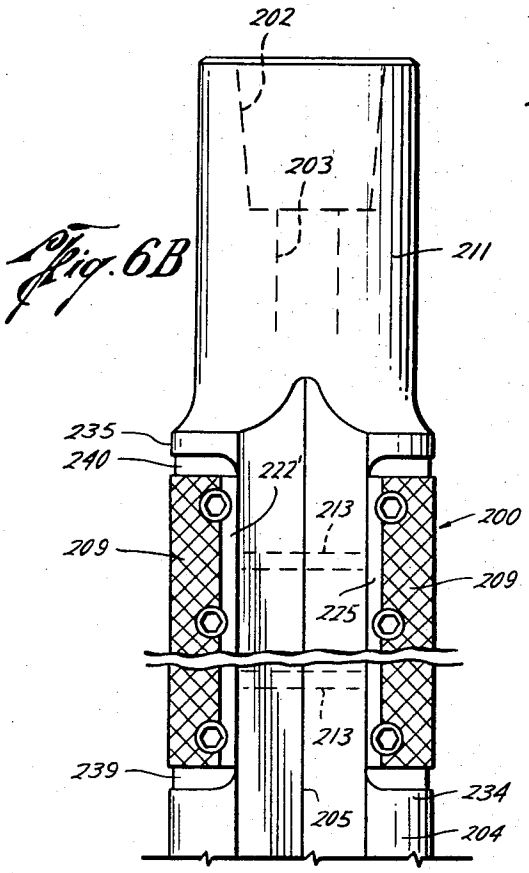



Fig. 6B

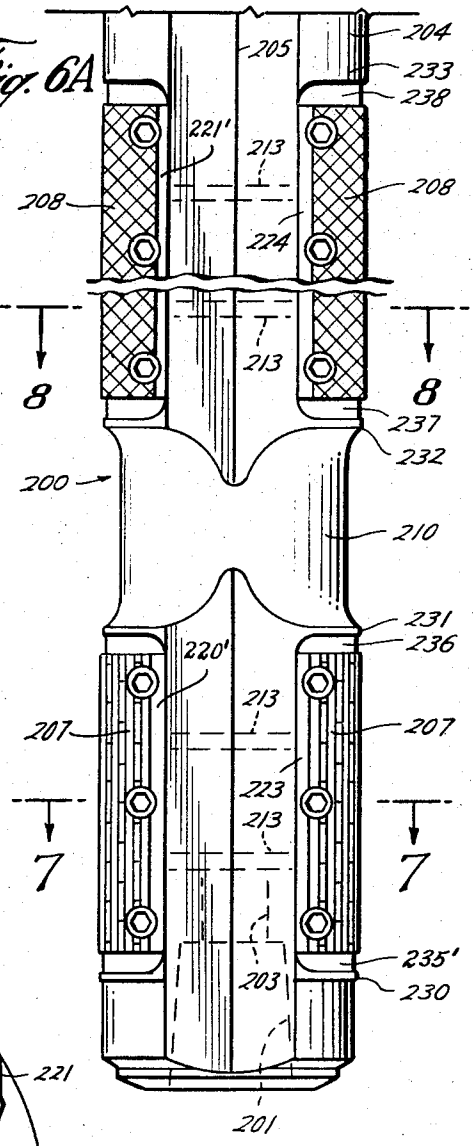



Fig. 6A

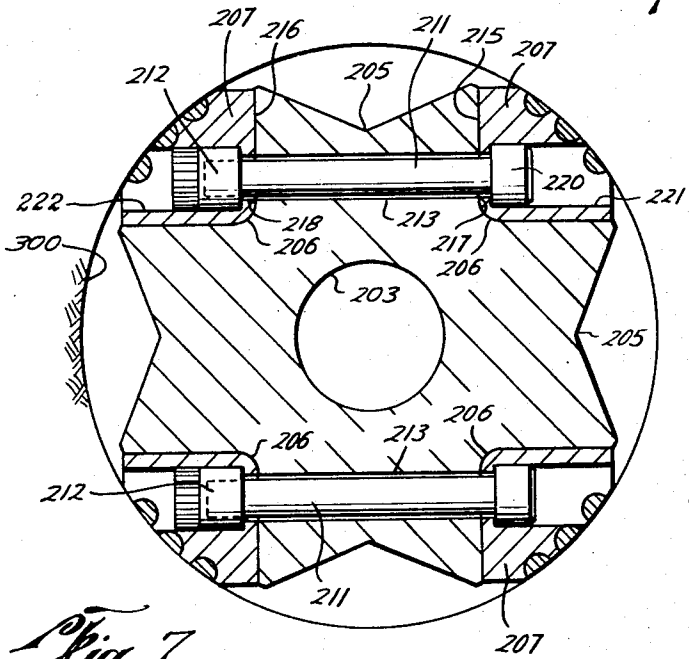



Fig. 7

Samuel T. Crews, Jr.
James W. Dixon
INVENTORS

BY Murray Robinson
ATTORNEY

# WALL CONTACTING TOOL

## BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention pertains to earth boring equipment used in the rotary system of drilling and more particularly to drill string wall contacting tools, for deviation control and/or bit stabilization, such as rotating, fixed blade stabilizers, and especially to so called square drill collars used in packed hole drilling. The invention concerns field replaceable wall contacting elements for such tools.

There are two general types of drill string stabilizers, the non-rotating type and the rotating type. The non-rotating type of stabilizer employs a wall contacting member having an axial bore. Rotatably mounted in the bore is a mandrel connectable at its ends to other drill string members for rotation therewith while the wall contacting member can remain fixed in the hole except for axial motion up and down the holes as the drill string is run in and out of the hole and during drilling and other manipulations of the drill string. The rotating type stabilizer employs a member having means at its ends for making connection to other drill string elements for rotation therewith and carrying at its outer periphery wall contacting surfaces. The wall contacting surfaces of the stabilizer rotate with the drill string relative to the axis of the hole being bored. Though of general applicability, the present invention is particularly intended for rotating stabilizers.

In the rotary system of drilling employing a liquid circulating through the drill string and the annulus between the drill string and well bore, it is necessary that a stabilizer include not only fluid passage means therethrough to form part of the drill string flow passage but also fluid passage means therethrough to form part of the annulus flow passage. The latter fluid passage means usually are at the outer periphery of the tool with the result that the wall contacting portion of the tool is not continuous around the circumference of the tool but instead consists of a number of parts azimuthally spaced apart by the fluid passage means. Rotating stabilizers are further classifiable according to whether such wall contacting parts are formed as blades fixed relative to the remainder of the stabilizer or are formed as rollers mounted for rotation about axes eccentric to the central axis of the tool. In the latter case, even though the remainder of the tool rotates with the drill string, the wall contacting portions of the tool roll on the wall of the well bore. This is in contrast with the wall contacting portions of fixed blade rotating stabilizers which must slide over the wall of the well bore as the drill string rotates. The present invention is especially intended for stabilizers of the latter rotating fixed blade type.

The usual stabilizer is of short length compared to the length of drill pipe and drill collars; for example, a stabilizer may be three feet long as compared to thirty feet for the length of a drill pipe or drill collar. The purpose of such a short tool is simply to center the drill string. However, it is also known to combine a stabilizer with a drill collar. The functions of a drill collar include providing weight at the lower end of the drill string and also providing rigidity to the lower end of the drill string. To achieve such functions drill collars have great wall thickness as compared to drill pipe, the outer



diameter of a drill collar being only enough smaller than hole bore to provide an adequate annulus for fluid passage. This is in contrast with the construction of an ordinary stabilizer wherein the wall thickness of the portion of the tool providing an internal fluid passage is considerably less than that of a drill collar in order that the fluid passages between the blades be as large as possible.

The combination of the functions of a rotating fixed blade stabilizer and a drill collar results in a structure known as a square drill collar, a thick walled member of more or less square cross section, the diagonals between corners being of full hole-bore diameter, the corners being rounded to provide more extended wall contacting surfaces than sharp corners would provide, the flats at the sides of the collar providing exterior (annulus) fluid passages. Such a thick walled member is especially adaptable to the present invention.

In point of fact, to provide rigidity and weight, a drill collar should be a long member, but because of resemblance to square drill collars in cross sectional shape and wall thickness, certain rotating fixed blade stabilizers are colled short square drill collars. The present invention is equally applicable to short square drill collars and to ordinary square drill collars having a length comparable to that of round drill collars.

2. Description of Prior Art

In the case of a wall contacting tool of the rotating, fixed blade type, such as a square drill collar, the portion of the tool that contacts the hole wall slides relative to the surface of the hole wall as the drill string rotates in the hole and is thereby subject to much more abrasion than a tool which slides over the hole wall only when the tool moves axially in the hole. When the wall contacting surface of the tool wears away, the axis of the tool can move to a position substantially eccentric to the hole axis prior to the tool contacting the wall of the hole, so that the tool no longer performs its function. To prolong the life of such a tool it is known to apply tungsten carbide or other hard material to the wall contacting surfaces of the tool; however even tools provided with hard surfaces may wear out rapidly when used in hard abrasive formations. When the stabilizer's wall contacting surfaces wear out, they can be built back up by welding on new metal and hard facing material, but this requies that the tool be sent to a shop for such rebuilding. That means that a driller must carry an extra one or more of such tools in his stock of spare parts or risk being shut down pending repair of the wall contacting tool.

It is an object of the present invention to provide wall contacting tools having field replaceable wall contacting elements,to provide such tools that are economical to manufacture and which are reliable in use, the replaceable wear elements not being likely to come off and junk the hole.

## SUMMARY OF THE INVENTION

According to the invention the portions of a wall contacting tool bearing hole wall contacting surfaces are made as separate parts from the remainder of the tool. Such separate parts constitute wear elements. The wear elements are releasably secured to the remainder of the tool by means of releasable fasteners such as screws or bolts or other suitable releasable fastener

means. The wear elements are fitted into correlative supporting grooves in the remainder of the tool. Preferably the grooves are rabbets, i.e., grooves having two plane sides that are perpendicular to each other whereby the tightening of fasteners holding the wall contacting portions to one side of the rabbet will not draw such portions away from the other side of the rabbet as in the case of a groove having an acute angle between its sides, nor be impeded by movement toward such other side, as in the case of a groove having an obtuse angle between its sides. The holes in the wear elements through which pass the fasteners are large enough to provide slight freedom of motion or play transverse to the lines of action of the fasteners, whereby tightening of the fasteners to draw the wear elements against one side of the groove will not draw the holes for the other fasteners out of register with the holes in the tool body that receive the fasteners.

In preferred embodiments of the invention the wall contacting tool is in the form of a square drill collar and the releasable wear elements are faced with hard material such as tungsten carbide. The wear elements are each disposed in a groove at a corner of the collar, and in order to provide greater depth to each groove and a larger arcuate wall contacting surface for each wear strip and at the same time allow sufficient longitudinal fluid passage space between the wear strips the sides of the stabilizer between the rabbets are releived as compared to the flat sides of the usual square drill collar. According to one species of the invention the wear elements are releasably secured to the remainder of the square drill collar by screws passing through holes in the wear elements into threaded holes in the remainder of the tool. In another embodiment of the invention the wear elements are secured to the body by bolts passing through holes in the wear elements and through holes in the remainder of the tool and extending from one wear element to another.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a section through an earth formation illustrating several drilling assemblies using a variety of known wall contacting tools;

FIGS. 2A, 2B, and 2C together form an elevation showing a short square drill collar embodying one species of the invention;

FIGS. 3–5 are sections through FIGS. 2A, 2B, and 2C at planes 3—3, 4—4, and 5—5;

FIGS. 6A and 6B together form an elevation showing a square drill collar embodying another species of the invention; and

FIGS. 7 and 8 are sections through FIGS. 6A and 6B at planes 7—7 and 8—8.

Referring first to FIG. 1 there is shown a vertical section through an earth formation penetrated by five bore holes 11–15. In hole 11 is shown a drilling assembly suitable for small diameter bore holes in softer formations, i.e., soft to medium hard, and including a roller cutter reamer-stabilizer 17 (see U.S. Pat. No. 3,306,381 issued Feb. 28, 1967, on the application of W.R.Garrett et al.) adjacent the drill bit 18, an ordinary round drill collar 19, a non-rotating stabilizer (see U.S. Pat. Nos. 3,063,759 and 3,320,004 issued Nov. 13, 1962 and May 16, 1962 on the applications of S.C. Moore et al. and W.R. Garrett, respectively) another round drill collar 21, and another non-rotating, blade stabilizer 22.

In hole 12 is shown a drilling assembly suitable for small diameter bore holes in harder formations, i.e. hard to medium hard, and including three helical fixed blade rotating stabilizers 30, 31, 32 (see U.S. Pat. No. 3,28,5678 issued Nov. 15, 1968 on the application of W.R. Garrett, et al) separated by ordinary round drill collars 33, 34, the lowermost stabilizer 32 being adjacent drill bit 35.

In hole 13 is shown a drilling assembly suitable for medium diameter bore holes in harder formations and including adjacent the bit 40 a roller cutter reamer-stabilizer 41, a pair of fixed blade rotating stabilizers 42, 43 and a plurality of round drill collars 44, 45.

In hole 14 is shown a drilling assembly suitable for medium diameter bore holes in softer formations including above the bit 50 a short square drill collar 51, a plurality of helical fixed blade stabilizers 52, 53, 54, and ordinary round drill collars 55, 56.

In hole 15 is shown a drill assembly suitable for large diameter bore holes in harder formations and including adjacent drill bit 60 a roller cutter reamer-stabilizer 61, a square drill collar 62, and a pair of blade stabilizers 63, 64 and an ordinary round drill collar 65.

Referring now to FIGS. 2A, 2B, 2C, 3, 4, and 5 there is shown a wall contacting tool in the form of a short square drill collar 100 including an internally threaded tapered box 101 at its lower end providing means for making a rotary shouldered connection to an externally threaded tapered pin on a drill bit and including an internally threaded tapered box 102 at its upper end providing means for making a rotary shouldered connection to an externally threaded tapered pin on another drill string member. The smooth cylindrical unthreaded exterior portion 103 of box 102 provides a tong engageable surface for use in making and breaking the threaded connections at the ends of the tool. Since the tool is typically only about 3 feet long, only one such surface is needed for making and breaking connection at both ends of the tool. The portion of the tool below box 102 and tong surface 103 may be called the tool body. The body may be described as being an elongated, generally cylindrical member having a plurality of, preferably four, longitudinally extending grooves 104 providing external fluid passage means to allow drilling fluid to flow past the tool between the tool and the wall of a bore hole. The grooves 104 are illustrated as being V section grooves having flat sides but other suitable shapes of cross section may be employed. Through the axis of the tool is a cylindrical hole 105 providing internal fluid passage means to allow drilling fluid to flow through the tool between drill string members connected at the ends of the tool.

The lower end of the tool has an annular bevel 110 and immediately adjacent thereto the outer periphery of the tool is provided with areas 111 of hard facing material, e.g., welded on sintered tungsten carbide. Additional areas 112 of hard facing material are disposed around the outer periphery of the tool adjacent the tong area 103. It will be noted that the body of the tool is of larger outer diameter than tong area 103, but the distance between the depths of opposing grooves 104 is less than the tong area diameter. With an ordinary square drill collar the distance between opposing flats

would be as great or larger than the diameter of the tong area. However, it will be noted that even at the depths of grooves **103**, the wall thickness X (FIG. **5**) of the tubular tool is of the same order of magnitude as the inner diameter Y of the tool, which is characteristic of a drill collar and is one characteristic which distinguishes a square drill collar from other fixed blade rotating stabilizers.

Referring now to FIGS. **2**, **4**, and **5**, extending substantially the full length of the body of the tool are wear elements in the form of metal strips **120** received in correlative grooves **121**. Preferably there are four such strips received in four such grooves. The grooves for the wear strips are formed midway between the grooves **104** that provide the external fluid passages of the tool, and preferably the number of fluid passage grooves equals the number of wear strips and wear strip grooves. As shown, grooves **121** are rabbets, that is, they are V grooves having two planar sides that are perpendicular to each other, and the grooves are disposed so that the planes bisecting the angles of the grooves are radial with respect to the tool axis. One side of each rabbet is provided with a series of threaded sockets **130**, pointing in a counter clockwise direction as viewed looking up along the tool axis and the other side of each rabbet is provided with a series of sockets **131** pointing in a clockwise direction as viewed looking up the tool axis, as shown in FIGS. **4** and **5**. Each socket lies in a plane perpendicular to the tool axis and preferably successive sockets in each side of one rabbet are coplanar with successive sockets in the corresponding sides of the other rabbets but are staggered relative to successive sockets in the non corresponding sides of the same and other rabbets. At the ends of the tool the staggered planes carrying the clockwise and counterclockwise directed sockets are, nevertheless, closely adjacent, to provide retention means at both sides of each wear strip adjacent the ends thereof.

Each wear strip is provided with a series of holes **140** registering with sockets **130** and a series of holes **141** registering with sockets **131**. The dimension of the holes **140**, **141**, at least in the direction of planes parallel to the planes defined by the axes of sockets **130**, **131** (e.g., the planes of FIGS. **4** and **5**) are slightly larger than the diameters of sockets **130**, **131**, to assure registry of the holes and sockets.

Each of the holes **140**, **141** is enlarged at its outer terminus to receive the head of an Allen screw as will be described hereinafter. Such enlargements, as shown at **142**, **143**, are of greater diameter or at least of greater dimension, in the direction of planes parallel to the planes of FIGS. **4** and **5**, than the diameters of the heads of the screws.

The diameters of sockets **130**, **131** are preferably all equal and the dimensions of each wear strip and rabbet are preferably the same as those of the other wear strips and rabbets, so that the wear strips are interchangeable.

The wear strips have cylindrically curved outer peripheries coated with hard facing material **150**, similar to hard faced areas **111**, **112**.

The wear strips are secured to the body of the tool by counterclockwise pointing allen screws **160** (FIG. **4**) and clockwise pointing Allen screws **161** (FIG. **5**) which pass through holes **140**, **141** into threaded sockets **130**, **131**. Screws **160** can be tightened to draw the strips against flat sides **170** of each groove **121** without pulling the strips away from the groove sides **171** and without interfrence from sides **171** since the latter are perpendicular to sides **170**. Screws **161** can likewise be tightened to draw the strips against the flat sides **170** of grooves **121** without interference from sides **170** and without pulling the strips away from sides **170**. The heads of the Allen screws bear against the shoulders formed by the junctures of the holes **140**, **141**, with their enlarged outer ends **142**, **143**, to draw the strips tightly against the sides of the rabbet grooves.

The wear strips are of such radial extent as to extend beyond the generally cylindrical outer periphery **180** of the body of the tool **100**. The diameter of the tool as measured between the wall contacting surfaces **150** of the tool is therefore greater than the diameter of the body of the tool. The edges **181**, **182** of the strips that protrude beyond the sides of the rabbets are bevelled in planes at right angles to the sides of the rabbets so that the angle between each edge **181**, **182** and the adjacent outer periphery **180** of the tool body is obtuse, whereby the edges tend to slide over protuberances in the wall of the well bore, thereby preventing the strips from being torn off the tool.

The portions of the body of the tool at each end of the rabbets **121** flare out as shown at **190**, **191** to flanges **192**, **193** of the same diameter as the wear surfaces **150** to protect the ends of the strips from hanging up on wall protuberances as the tool is moved axially in the hole. These flanges also support and are protected by the hard facing **111**, **112** at the ends of the tool.

Referring now to FIGS. **6A** and **6B** there is shown a square drill collar **200** which may be of a length typical of drill collars, e.g., 30 feet. The tool is provided at each eand with internally threaded boxes **201**, **202**, and has an internal axial flow passage **203**. The outer periphery of the tool is generally cylindrical as indicated at **204** with axially extending shallow V grooves **205** providing external flow passages between the exterior of the tool and the wall of the well bore indicated at **300**.

At intervals along the length of the tool, e.g. adjacent the upper and lower ends, the tool is provided with rabbets **206** extending axially between the V-grooves, and lying in these rabbets are wear strips **207**, **208**, **209** similar to the construction previously described as the first embodiment of the invention. The wear strips are hard faced at their outer peripheries to provide wall contacting surfaces. The hard facing of strips **207** is illustrated as of a special type disclosed in U.S. Pat. No. 3,285,628, issued Nov. 15, 1966, on the application of W. R. Garrett. The hard facing of the strips **208**, **209** may be of the welded on sintered tyngsten carbide type previously mentioned.

Typically, the wear strips **209** adjacent the upper end of the tool, and the wear strips **208** near the lower end of the tool, are about 3 feet long, whereas the lowermost wear strips **207** are around one foot in length. If desired, additional groups of wear elements can be disposed at intervals along the length of the collar between the groups **208** and **209**. It is desirable to restrict the lengths of the strips. The strips **207** are spaced from the strips **208** by an annular smooth cylindrical tong engageable surface **210** of a diameter inter-

mediate between the minimum distance between opposite grooves **205** and the diameter of the cylindrical portion **204** of the tool. Another smooth cylindrical tong engageable surface **211** is provided at the upper end of the tool above wear strips **209**.

Referring now also to FIGS. **7** & **8**, except as modified by their manner of fastening to the body, i.e. the remainder of tool, the strips **207, 208, 209** are of shape and cross section the same as the wear strips of the first described embodiment of the tool. The wear strips are held in place by bolts and nuts **211, 212**, which extend through holes **213** in the tool body from one flat side **215** of one rabbet **206** to the adjacent flat side **216** of an adjacent rabbet. The bolts extend through holes **217, 218** in the strips, the head **220** of each bolt being received in an enlarged portion **221** of hole **217** and the nut **212** being received in an enlarged portion **222** of hole **218**.

It will be observed that the directions of the axes of the bolts **213** alternate at each successive level along the wear strips, those at one level being perpendicular to those at the adjacent levels, FIG. **7** exemplifying the direction of the bolts at one level and FIG. **8** exemplifying their direction at another level.

In contrast with the first embodiment, the bolt heads and nuts fit the enlargements **221, 222** snugly, and the bolts stems fit closely slosely in holes **217, 218**, but there is sufficient difference between the diameters of the bolt stems, and the diameters of the holes **213** or at least the dimensions of holes **213** in directions parallel to the planes of FIGS. **7** and **8** to insure registry of the stems and holes **213** and accommodate whatever lateral movement of one group of bolts is required when a group directed at right angles thereto is tightened. However the clearances of the FIG. **1–5** embodiment can be used in the FIG. **6–8** embodiment if desired.

As in the first described embodiment, the longitudinal edges of the wear strips are beveled as shown at **220', 221', 222', 223, 224, 225** to prevent the strips from hanging up as the tool rotates, and at the ends of the strips the full diameter portions **230–235** of the drill collar protect the strips from catching when the tool moves axially. Flaring portions **235', 236–240** join such full diameter portions with the ends of the rabbets.

It will be noted that due to the fact V-groove passages are provided in the normally flat sides of the square drill collars of the embodiments of the invention heretofore described, and the fact that rounded corners or large arcuate extent are provided, the cross sections of the drill collars are scarcely square. In addition, although tools having four wall contacting elements at any level along the tool length have been described, the invention is also applicable to wall contacting tools having more or less than four wall contacting elements at any level along the length of the tool. Therefore, the subject tools might better be referred to as collar-stabilizers, the word "collar" directing attention to the wall thickness without referring to any particular shape.

While preferred embodiments of the invention have been shown and described, variations thereof can be made by one skilled in the art without departing from the spirit of the invention.

We claim:

1. Wall contacting tool comprising

a body having an internal fluid passage extending from one end thereof to the other,

means at the ends of said body for making connections with other drill string elements,

wall contacting means carried by said body,

releasable means securing said wall contacting means to said body, and

exterior fluid passage means adjacent said wall contacting means,

said body of the tool having grooves in the outer periphery thereof receiving wall contacting means,

said groove means having flat sides that are perpendicular to each other and said wall contacting means having flat sides correlative to those of said groove means,

said releasable means including fastening means holding each flat side of the wall contacting means to the correlative flat side of the groove means,

the fastening means holding a flat side of the wall contacting means to the correlative side of the groove means being independent of the fastening means holding the adjacent flat side of the wall contacting means to the flat side of the groove means that is correlative to said adjacent flat side of the wall contacting means.

2. Tool according to claim 1 wherein said releasable means comprises fastener means extending through holes in said wall contacting means into holes in said body.

3. Tool according to claim 2 wherein said holes in said wall contacting means exceed in dimension perpendicular to the adjacent side of the groove the corresponding dimension of the fastening means that extends therethrough.

4. Tool according to claim 2 wherein said fastener means engages the sides of the holes in said body to hold the fastener means against axial withdrawal.

5. Tool according to claim 2 wherein said fastener means extends clear through said body.

6. Tool according to claim 5 wherein the holes in said body through which extend said fastener means exceed in dimension perpendicular to the adjacent side of the groove the corresponding dimension of the fastening means that extends therethrough.

7. Wall contacting tool comprising

a tubular metal body, the interior space of said tubular body providing an internal fluid passage extending from one end of the body to the other end thereof,

connection means at each end of said body for connecting said tubular body with another drill string member having an internal flow passage therethrough with said internal flow passage of said tubular body in fluid flow communication with the internal fluid passages of such other drill string members,

said tubular body having elongated grooves in the outer periphery thereof,said grooves extending longitudinally from nearer one end of said body to nearer the other end of said body, said grooves each having flat sides and including a generally V shaped section transverse to the length of the groove with the V pointing inwardly toward said internal fluid passage of the tubular body,

wall contacting means carried by said body in said grooves, said wall contacting means each including an integral elongated metal piece having flat sides correlative to the flat sides of the groove and including a generally V shaped section transverse to the length of said metal piece with the V section pointing inwardly toward said internal fluid passage of the tubular body, and

each of said metal pieces having another outwardly facing side provided with hard wear resistant material for contacting the wall of a well bore, said outwardly facing side lying transverse to the bisector of the angle between said flat sides of the metal piece which are correlative to the flat sides of the V section groove in the tool body, and

releasable means securing said wall contacting means to said body,

said releasable means comprising fastener means extending into holes in said body through holes in said metal pieces transverse to the lengths of said metal pieces beginning in said outwardly facing sides of said metal pieces that lie transverse to the bisector of the angle between said flat sides thereof,

said tool body having exterior fluid passage means adjacent said wall contacting means extending lengthwise of said wall contacting means.

**8.** Tool according to the claim **11** wherein the tension axis of each of said fastener means is transverse to the tension axes of the immediately adjacent fasteners means in the same one of said metal pieces.

**9.** Tool according to claim **7** wherein said tool body includes portions of generally cylindrical outer periphery adjacent the ends of said grooves extending radially far enough to overlap the ends of said metal pieces in the grooves and guard the metal pieces against catching when the tool moves axially in a well bore.

**10.** Tool according to claim **7** wherein said exterior fluid passage means are V section grooves whose sides terminate at the outer periphery of the tool closely adjacent the sides of the grooves in which the metal pieces of the wall contacting elements are received.

**11.** Tool according to claim **7** wherein said fastener means each extend through said body from one of said metal pieces to another to hold both of the last said pieces to said body.

**12.** Tool according to claim **11** wherein the tension axis of each of said fastener means is azimuthally displaced about the axis of the tool body with respect to the immediately adjacent fastener means through the same ones of said metal pieces.

**13.** Tool according to claim **7** wherein said fastener means each extend through the respective metal piece transverse to one of the flat sides thereof into the corresponding flat side of the respective groove.

**14.** Tool according to claim **13** wherein said releasable means securing said wall contacting means to said body includes for each of said metal pieces two groups of said fastener means, one group of said fastener means extending through one of said flat sides of each of said metal pieces and the other group of said fastener means extending through the other of said flat sides of each of said metal pieces.

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