Sept. 9, 1958 E. G. BOICE 2,851,253

DRILL BIT

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Fig. 1

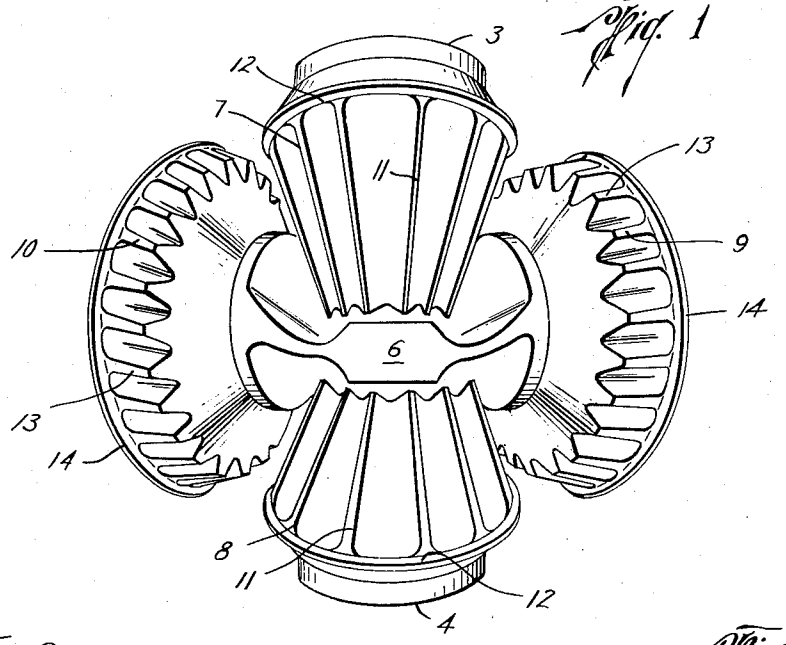

Fig. 2

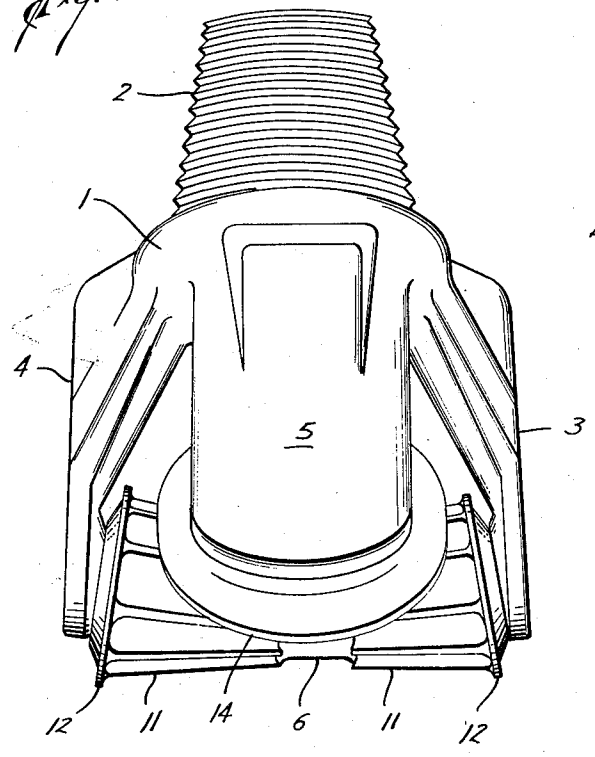

Fig. 6

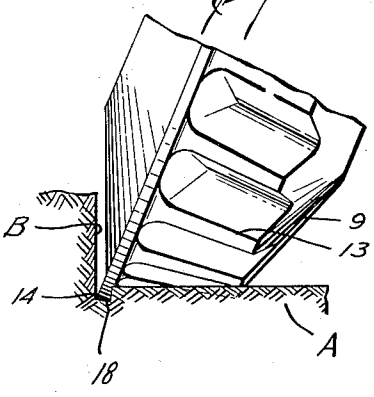

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Fig. 3

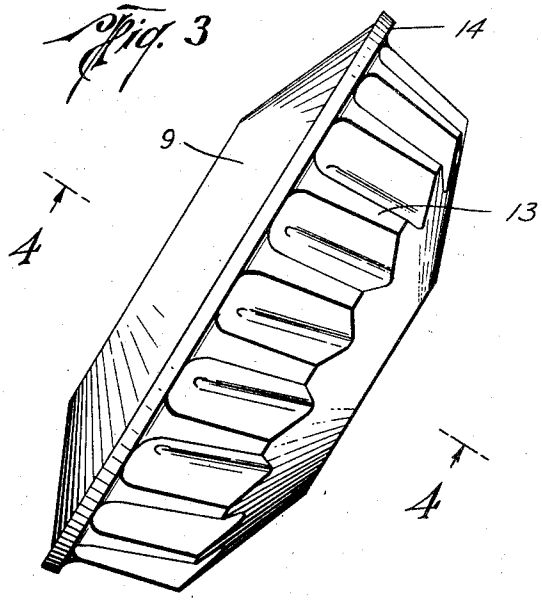
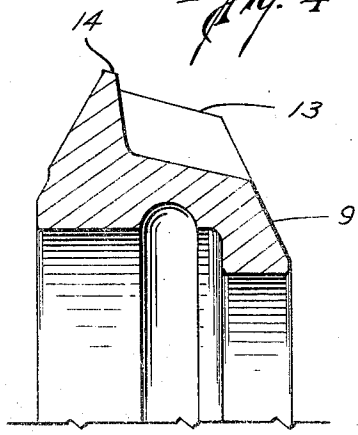


Fig. 4



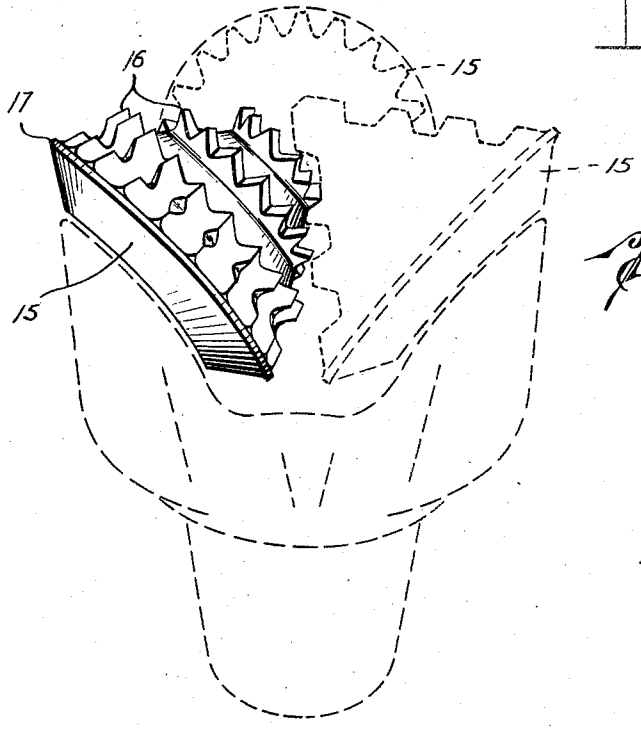


Fig. 5

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DRILL BIT

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7 Claims. (Cl. 255—347)

This invention relates generally to drill bits, and more particularly to bits for deep well drilling.

One of the general objects of the invention is to provide a new and improved drill that will more efficiently drill hard and medium-hard formations.

Another object of the invention is to provide new and improved well drill rollers having the teeth thereon arranged to produce a more effective action in disintegrating material at the bottom of the well being drilled.

A further object is to provide a well drill roller having teeth theron which may be connected together by a web that extends radially beyond the teeth, to support and cooperate with the teeth during the drilling operation.

A further object is to provide a new and improved well drill roller wherein the teeth or cutting elements on the same roller may engage the formation simultaneously at different levels, in order to facilitate the removal of particles of the formation at the bottom of the bore hole being drilled.

A further object is to provide a new and improved well drill roller having teeth thereon, and wherein, on the same roller, a cutting element extends radially beyond the teeth on the roller so that during the drilling operation the extended cutting element will cut a narrow circular groove in the formation at the bottom of a bore hole thereby reducing the lateral support of the formation circumscribed by the circular groove, thus facilitating the removal of particles of the formation by the well drill.

Another object is to provide a roller bit that will during the drilling operation cut a kerf in the gage portion of the bottom of the hole so that the formation within the area circumscribed by the kerf will not be supported by the surrounding formation and may be removed more readily.

Another object is to provide a new and improved well drill roller having a more effective form of cutting element to remove the formation from the outer gage portion of the bore hole being drilled.

Another object is to provide a new and improved roller having cutting elements arranged thereon to stabilize the roller during the drilling operation.

Other objects and advantages of the invention will become apparent from the following description and the accompanying drawings wherein are set forth by way of example certain embodiments of the invention.

Fig. 1 is a bottom plan view of a cross roller bit embodying the invention.

Fig. 2 is a side elevation view of the bit shown in Fig. 1.

Fig. 3 is a detail view of a side roller showing a circumferentially extending web on the gage cutting portion of the roller.

Fig. 4 is a fragmentary section view taken along line 4—4 of Fig. 3.

Fig. 5 is an isometric view of a cone bit embodying the invention.

Fig. 6 is a detail view of a portion of a side roller embodying the invention showing the roller in operating position on the formation at the bottom of a bore hole.

Figs. 1 and 2 illustrate a cross roller bit employing a number of conventional parts and the new and improved rollers provided by the invention. In these figures, a bit head **1** has the usual threaded shank **2** by which the bit may be attached to the lower end of a drill stem (not shown). The head **1** may have the usual depending legs **3**, **4**, **5** and bridge **6** to support the usual pins (not shown) upon which may be rotatably mounted the new and improved cross rollers **7** and **8** and side rollers **9** and **10**. The cross rollers **7** and **8** each have a row of axially disposed teeth **11** thereon. The outer ends of the teeth **11** are connected together by a web or cutting element **12**. This web extends radially beyond the teeth **11** as is clearly shown in Figs. 1 and 2.

The side rollers **9** and **10** are similar to each other and to the cross rollers **7** and **8** in construction. The side rollers **9** and **10** each have a row of teeth **13**. A web or cutting element **14** connects together the teeth **13** at the outer or gage cutting portion of the rollers **9** and **10**. The web **14** extends radially beyond the teeth **13** of the side rollers **9** and **10** to assist in cutting and maintaining the gage of the bore hole, and supports the teeth **13**, during the operation of the bit.

In operation, a drill bit is attached to the lower end of a drill stem (not shown), and rotated upon the bottom of a bore hole. Thus the rollers are caused to rotate, and as weight is applied to the bit by the weight of the drill stem, the teeth or cutting elements of the rollers will crush, chip or scrape the formation upon which the bit is rotated. The particles of formation thus dislodged will be carried out of the bore hole by drilling fluid which is pumped down through the drill stem and bit head, returning to the surface of the earth in the space between the drill stem and the wall of the bore hole being drilled.

One of the most important desired functions of the side rollers **9** and **10** is to cut and maintain the gage or diameter of the bore hole being drilled, so that succeeding drill bits, or other equipment, can be lowered to the bottom of the bore hole without having to ream down an undergage hole. The gage portion of the bore hole is difficult to remove and maintain because the formation at the gage or outer portion of the bore hole is supported by the side wall of the hole thus making it more difficult to dislodge, also, there is more material to be removed from the gage or outer portion of the bore hole because it is a greater distance from the center or the bore hole.

In my invention I provide more efficient cutting element arrangement to cut and maintain the gage of the bore hole by providing more material at the outer or gage cutting portions of the side rollers **9** and **10** in the form of a radially extended web **14**. This web **14** cuts a narrow kerf in the formation thereby reducing the support of the formation circumscribed by the kerf making it easier to disintegrate and remove from the hole bottom by the drill bit.

Also the cross rollers **7** and **8** may be provided with webs to cut additional kerfs in the formation to permit easier removal thereof.

Also, the webs **14** on the side rollers **9** and **10** and the webs **12** on the cross rollers **7** and **8**, rolling in kerfs in the hole bottom stabilize the rollers from moving in an outboard or inboard direction with respect to the drill bit axis of rotation, because the webs act as flanges tending to keep the rollers in their respective paths during the drilling operation.

Figs. 3 and 4 show in detail a side roller **9** of the type shown in Figs. 1 and 2, and previously described. The roller **9** has a circumferential row of teeth **13** and a circumferentially extending web **14** connecting the outer ends of the teeth **13** together. The web **14** extends radial-

ly beyond the teeth **13** as is clearly shown in Figs. 3 and 4.

Fig. 5 shows a cone bit employing the new and improved substantially conical rollers **15**. The roller **15** has circumferentially disposed rows of teeth **16** and a circumferentially extending web or cutting element **17** connecting the ends of teeth **16** in the same row together. The web **17** extends radially of the roller beyond the teeth **16**. The web **17** thus serves to support the teeth, and to cut a narrow kerf in the formation during the drilling operation.

Fig. 6 is a typical illustration of the action of the new and improved roller upon the formation. A portion of the side roller **9** having teeth **13** and web **14** is shown in operating position on the bottom of a bore hole. The web **14** is shown producing a kerf **18** in the formation A, and the teeth **13** are shown operating on the formation within the area defined by the kerf **18** but at a different level. The web **14** serves to cut and maintain the bore of the hole B.

In the actual use of a well drill employing the new and improved rollers, I have found that the cutting elements on the roller drill faster and tend to retain their original configuration and relationship. Even when the cutting elements are approximately half-worn away, the web still extends radially beyond the other cutting elements on the same roller.

It will be understood that the invention is not limited to the particular embodiments herein shown and described. Various changes within the scope of the following claims will be apparent to those skilled in the art.

Having disclosed and described my invention, I claim:

1. A roller bit having a head, a substantially conical roller cutter rotatably mounted in said head, the axis of rotation of said cutter extending downwardly and inwardly substantially toward the longitudinal axis of said head, the base end of said cutter being outermost, said cutter having a circumferentially extending web at its base end to define the wall of the hole by cutting a kerf in the gage portion of the bottom of the hole and teeth connected to said web and extending inwardly longitudinally of said cutter to operate upon the formation at the bottom of the hole within the area circumscribed by said kerf said web extending radially beyond the cutting edge of the teeth.

2. A roller bit having a head, a roller cutter rotatably mounted in said head, the axis of rotation of said cutter extending downwardly and inwardly substantially toward the longitudinal axis of said head, said cutter having a circumferentially extending web at its outermost end to define the wall of the hole by cutting a kerf in the gage portion of the bottom of the hole and teeth connected to said web and extending inwardly longitudinally of said cutter to operate upon the formation at the bottom of the hole within the area circumscribed by said kerf said web extending radially beyond the cutting edge of the teeth.

3. A roller bit having a head, a roller cutter rotatably mounted in said head, the axis of rotation of said cutter extending downwardly and inwardly substantially toward the longitudinal axis of said head, said cutter having a circumferentially extending web at its outermost end to cut a kerf in the gage portion of the bottom of the hole and teeth extending inwardly longitudinally of said cutter to operate upon the formation at the bottom of the hole within the area circumscribed by said cutter said web extending radially beyond the cutting edge of said teeth.

4. A roller bit having a head, a roller cutter rotatably mounted in said head, the axis of rotation of said cutter extending downwardly and inwardly substantially toward the longitudinal axis of said head, said cutter having circumferentially extending cutting means at its outermost end to cut a kerf in the gage portion of the bottom of the hole and means to operate upon the formation at the bottom of the hole within the area circumscribed by said kerf said first mentioned means extending radially beyond the cutting edge of said second mentioned means.

5. A drill bit comprising a bit head, cross rollers and gauge rollers rotatively mounted in the lower portion thereof, each of said gauge rollers having teeth thereon extending longitudinally thereof, and having an annular web at its base and connecting the said teeth together, said web extending radially beyond the cutting edge of said teeth to cut a kerf in the gauge portion of the bottom of the hole.

6. A roller bit comprising a head, a roller rotatively supported in said head, the said roller having a row of axially disposed teeth thereon, an annular web connecting the outer ends of said teeth together at the outermost end of said roller, the said web extending radially beyond the cutting edge of said teeth to cut a kerf in the gauge portion of the bottom of the hole.

7. In a roller bit comprising a head, a roller cutter rotatively supported in said head, the said cutter having substantially axially extending teeth thereon, that improvement which consists in providing teeth extending axially from one end face thereof to the other end face, a web at one end of said cutter abutting end faces of the teeth adjacent said end of the cutter to provide a circumferential web connecting said teeth together, the said web extending radially beyond the cutting edge of said teeth to cut a kerf in the bottom of a hole.

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