Abstract: A rotary drag bit (110) exhibiting enhanced cutting efficiency and extended life is provided. The rotary drag bit comprises a bit body having a face surface, and a plurality of cutters coupled to the face surface of the bit body. The plurality of cutters comprises at least one pilot cutter (162) and a rotationally trailing larger, primary cutter (164) at substantially the same radius and, optionally of slightly less exposure. The pilot cutter (162) is sized and positioned to pre-fracture the formation and perform an initial cut, while the primary cutter (164) removes weakened, remaining formation material along the same rotational path. A method to pre-fracture subterranean formations using a rotary drag bit (110) having a pilot cutter configuration is also provided.
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What is claimed is:

1. A rotary drag bit, comprising:
   a bit body (110) with a face (112), a blade (118), and a longitudinal axis (C/L), the
   bit body (110) configured to rotate about the axis (C/L), the bit body (110) having a cone
   region (170), a nose region (172), a shoulder region (174), a flank region (175), and a gage
   region (176);
   at least one pilot cutter (162) located on the blade (118) having a first diameter
   disposed at a radius from the longitudinal axis (C/L) including a cutting surface (113) of a
   first lateral extent protruding at least partially from the face (112) at a first exposure; and
   at least one primary cutter (164) having a second diameter greater than the first
diameter of the at least one pilot cutter (162) disposed at substantially the same radius
from the longitudinal axis (C/L) of the bit body (110) located on the blade (118) thereof in
either the nose region (172) or the shoulder region (174) of the bit body (110), the at least
one primary cutter (164) including a cutting surface (113) of a second, extent protruding at
least partially from the face (112) at a second exposure.

2. The rotary drag bit of claim 1, wherein the at least one pilot cutter (164)
leads the at least one primary cutter (162), taken in a direction of intended bit rotation.

3. The rotary drag bit of claim 1, wherein the second exposure of the at least
one primary cutter (162) is an exposure having an underexposure relatively equal to or
lesser than the first exposure of the at least one pilot cutter (164).

4. The rotary drag bit of claim 1, wherein the second exposure of the at least
one primary cutter (162) is lesser than the first exposure of the at least one pilot cutter
(164).

5. The rotary drag bit of claim 1, wherein the first exposure of the at least one
pilot cutter (162) is lesser than the second exposure of the at least one primary cutter (164).

6. The rotary drag bit of claim 1, wherein the at least one of the at least one
pilot cutter (162) and the at least one primary cutter (164) is one of a TSP cutter and a
PDC cutter.
7. (Canceled)

8. (Canceled)

9. The rotary drag bit of claim 1S, wherein the first cutting element (162) has a relatively smaller lateral extent and the second cutting element (164) has a relatively larger lateral extent rotationally trailing the first cutting element (162), the second cutting element (164) being underexposed with respect to the smaller cutting element (162).

10. The rotary drag bit of claim 18, wherein the bit body (110) comprises more than one blade (118) extending from the face (112) having a first cutter row (141, 145, 149) and a second cutter row (142, 146, 150) rotationally trailing the first cutter row (141, 145, 149), the pilot cutter and the primary cutter comprise a first cutting element (162) having a cutting surface (113) of relatively lesser lateral extent positioned in the first cutter row (141, 145, 149) and a second cutting element (164) having a cutting surface (113) of relatively greater lateral extent positioned in the second cutter row (142, 146, 150).

11. (Canceled)

12. The rotary drag bit of claim 10, wherein the first cutter row (141, 145, 149) and the second cutter row (142, 146, 150) extend generally radially outward from the longitudinal axis (C/L) of the bit body (110).

13. (Canceled)

14. (Canceled)

15. (Canceled)

16. (Canceled)
17. A method to fracture a subterranean formation using a rotary drag bit including a pilot cutter configuration comprising:

providing a rotary drag bit comprising a bit body (110) with a face 9112), a blade (118), and an axis (C/L), the bit body (110) configured to rotate about the axis (C/L), and at least one pilot cutter set (160) comprising two cutters (162, 164) located on either the nose region (172) or flank region (174) of the blade (118) of the bit body (110), each cutter including a cutting surface (113) protruding at least partially from the face of the bit body (110), and one (164) of the two cutters (162, 164) positioned so as to substantially rotationally follow the other (162) of the two cutters (162, 164) along a cutting path upon rotation of the bit body (110) about its axis (C/L), the one (164) of the two cutters (162, 164) rotationally following having the largest diameter of the two cutters (162, 164);

rotating the rotary drag bit under weight on bit to engage a subterranean formation with a rotationally leading cutter (162) of the at least one pilot cutter set to prefrecture the formation and remove a portion of formation material along the cutter path and to engage the formation with the rotationally following cutter (164) laterally outside of the portion engaged with the rotationally leading cutter to remove additional formation material.

18. The method of claim 17, further comprising avoiding substantial engagement of the formation immediately below the rotationally following cutter therewith.

19. The method of claim 17, wherein providing a rotary drag bit comprising at least one pilot cutter set (160) comprises providing a plurality of pilot cutter sets (160).

20. The method of claim 19, wherein the at least one pilot cutter set (160) comprises PDC cutting elements (114).
Applicant has amended claims 1 through 6, 9, 10, 12, and 17 through 20. The amendments have no impact on the description and the drawings. The amendments to independent claims 1 and 17 recite, among other things, that the rotary drag bit includes a pilot cutter and primary cutter located on the same blade in either the nose region or the flank region of a bit body where the primary cutter has a diameter larger than that of the pilot cutter. The amendments to claims 2 through 6, 9, 10, 12, 19, and 20 recite the reference numerals for the elements of the claimed inventions and for consistent usage of terminology in the claims. Claim 17 has been amended in a manner similar to claim 1.