Claims

1. One-piece construction multi-functional wellbore conditioning system having a tubular body extending along a longitudinal axis X, said system comprising

a trailing eccentric reamer stage (3A),

a leading eccentric reamer stage (3B), and

a drill cuttings agitator (4) being positioned between said trailing and leading eccentric reamer stages,

wherein said drill cuttings agitator (4) comprises

a plurality of first stabilizing blades (8) extending radially outwardly from an outer surface of the tubular body,

a plurality of second stabilizing blades (10) extending radially outwardly from the outer surface of the tubular body,

a plurality of center stabilizing blades (9) extending radially outwardly from the outer surface of the tubular body and arranged axially between the plurality of first stabilizing blades (8) and the plurality of second stabilizing blades (10), and

a plurality of hydrodynamic flutes (7) extending in a longitudinal direction and extending radially inwardly from the outer surface of the tubular body,

where each stabilizing blade of the plurality of first, second and center stabilizing blades (8), (9), (10) is disposed along a circumference coaxial with the tubular body at 90 degrees apart from each other and where the plurality of center stabilizing blades (9) is offset by 45 degrees from the preceding plurality of first stabilizing blades (8) and the following plurality of second stabilizing blades (10),

said flutes being positioned circumferentially between the center stabilizing blades (9).

2. One-piece construction multi-functional wellbore conditioning system in accordance with Claim 1, wherein the trailing eccentric reamer stage (3A) comprises a first set of straight cutting blades (5A) and a first set of straight drift blades (6A), said first set of straight drift blades (6A) being positioned along a circumference coaxial with the tubular body at a distance of 180 degrees from said first set of straight cutting blades (5A) and wherein the leading eccentric reamer stage (3B) comprises a second set of straight cutting blades (5B) and a second set of straight drift blades (6B), said second set of straight drift blades (6B) being positioned along a circumference coaxial with the tubular body at a distance of 180 degrees from said second set of straight cutting blades (5B).

3. One-piece construction multi-functional wellbore conditioning system in accordance with Claim 1, wherein each stabilizing blade of the drill cuttings agitator (4) is straight and is aligned along the longitudinal X axis.

4. One piece construction multi-functional wellbore conditioning system in accordance with Claim 2, wherein each cutting blade of said first and second sets of straight cutting blades (5A), (5B) is parallel to the longitudinal axis X of the tubular body and has on its surface deep helical grooves, said grooves defining crowns, said crowns having at least one cutting element on top and with a flow-by channel formed between each of said cutting blades (5A), (5B), where the bottoms of the grooves stand proud of the surface of flow-by channels.

5. One piece construction multi-functional wellbore conditioning system in accordance with Claim 4, wherein the cutting element is a polycrystalline diamond compact (PDC) cutter insert or tungsten carbide insert (TCI).

6. One piece construction multi-functional wellbore conditioning system in accordance with Claim 5, wherein the cutting blades (5B) of the leading eccentric reamer stage (3B) comprise a combination of PDC and TCI inserts on top of their surface, while the cutting blades (5A) of the trailing eccentric reamer stage (3A) comprise only TCI inserts on top of their surface.

7. One piece construction multi-functional wellbore conditioning system in accordance with Claim 5, wherein each set of the first set of straight cutting blades (5A) and the second set of straight cutting blades (5B) comprises in the rotational direction of the trailing and the leading eccentric reamer stages a first cutting blade and a second cutting blade where the cutting elements of the first cutting blade define with their outermost surface an ideal cylinder having a diameter d1, and the cutting elements of the second cutting blade define with their outermost surface an ideal cylinder having a diameter d2, wherein $d2<d1$.

8. One piece construction multi-functional wellbore conditioning system in accordance with Claim 7, wherein each set of the first set of straight drift blades (6A) and the second set of straight drift blades (6B) comprises two drift blades adapted to provide a plastering effect on the wellbore, where each of said two drift blades defines with its outermost surface an ideal cylinder having a diameter d3, where $d3<d2<d1$.

9. One piece construction multi-functional wellbore conditioning system in accordance with Claim 8, wherein the first cutting blade (5B) of the leading eccentric reamer stage (3B) comprises a combination of PDC and TCI inserts, where the TCI inserts being two types of inserts, i.e. large TCI inserts and smaller TCI inserts, said large TCI inserts being larger than the smaller TCI inserts, and where the large TCIs inserts, the smaller TCIs inserts and the PDCs inserts have different heights (h) measured from the outer surface of the first leading cutting blade (5B), where the height (h1) of the large TCIs inserts is greater than the height (h2) of the smaller TCIs inserts, and the height of the smaller TCIs is greater than the height (h3) of the PDCs inserts, namely $h1>h2>h3$.

10. One-piece construction multi-functional wellbore conditioning system in accordance with any of the preceding Claims, wherein each stabilizing blade of the plurality of first (8) and second (10) stabilizing blades has an elongated shape, a front section, a back section, and a central section, and an upper surface having the shape of a dome defining the contact area, and side walls, where said upper surface slopes downwards near and towards the end of the front section and also near and towards the end of the back section till it meets the surface of said cylindrical body part forming this way a toe and heel having angled faces with different angles measured from the surface of the tubular body in the longitudinal direction X, namely a first angled face T1, a second angled face T2, and a third angled face T3, where the angle of the first angled face T1 is greater than the one of the second angled face T2, and the angle of the second angled face T2 is greater than the one of the third angled face T3.

11. One-piece construction multi-functional wellbore conditioning system in accordance with any of the preceding Claims, wherein all blades of the leading eccentric reamer stage, all blades of the drill cuttings agitator and all blades of the trailing eccentric reamer stage are offset at 45 degrees in respect of the preceding or the following blades along the longitudinal axis X of the tubular body forming this way oblique flow-by channels in respect of the longitudinal axis X.

12. One-piece construction multi-functional wellbore conditioning system in accordance with any of the preceding Claims, wherein each drift blade of said first and second sets of straight drift blades (6A), (6B), each cutting blade of said first and second sets of straight cutting blades (5A), (5B) and each stabilizing blade of the plurality of first, second and center stabilizing blades (8), (9), (10) has with respect to a direction of rotation a leading edge and a trailing edge, where said edges have different radii of curvature.

13. One piece construction multi-functional wellbore conditioning system in accordance with Claim 1, wherein the hydrodynamic flutes (7) are in the form of two diverging paths at the front and back with an ellipse shaped channel between said diverging paths, where said diverging paths are adapted to create as such at the front of the hydrodynamic flutes (7) an inlet for the drilling fluid entering from between the plurality first stabilizing blades (8) and the plurality of center stabilizing blades (9), respectively and an outlet at the back.

14. One piece construction multi-functional wellbore conditioning system in accordance with any of the preceding claims, wherein the tubular body is virtually divided into sections along the longitudinal axis X, where a frustoconical element having an inclination of 15-20 degrees with respect to the longitudinal axis X is formed between two consecutive sections in the longitudinal direction of the tubular body.