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BUMPER SUB POSITION INDICATOR

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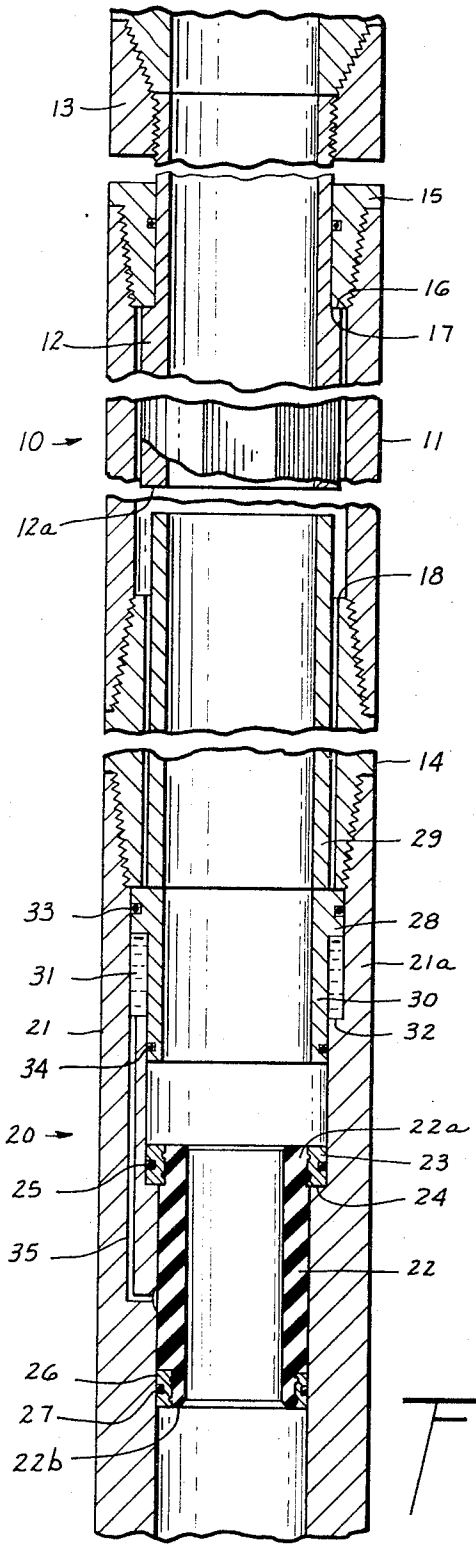


Fig. 1

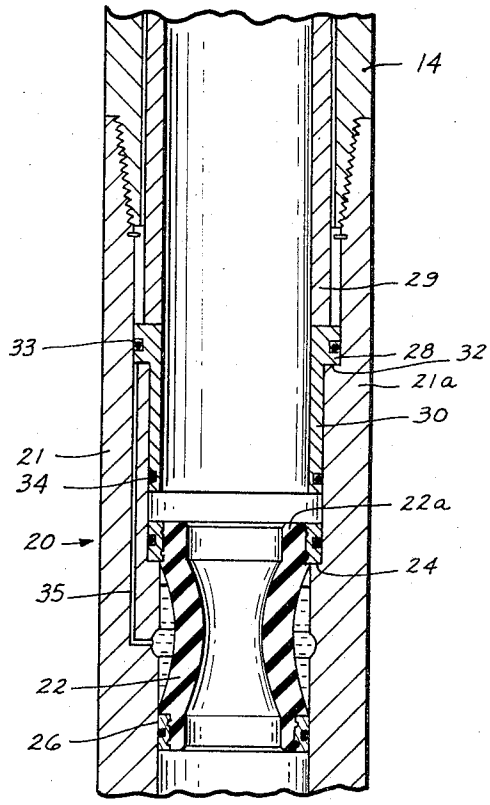


Fig. 2

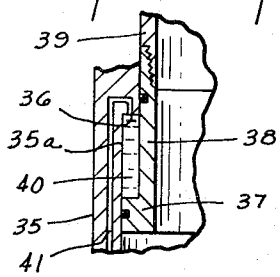


Fig. 3

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BUMPER SUB POSITION INDICATOR

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This invention relates generally to apparatus for providing a surface indication when the two telescoping sections of a bumper sub located in a string of drill pipe are in a preselected position relative to each other. In particular, this invention relates to apparatus that provides such surface indication with a pressure signal transmitted to the surface through the drilling fluid being circulated through the pipe string.

It is often desirable to know when a bumper sub in a pipe string is in a preselected position. For example, when the sub is being used to control the weight on a bit, it is desirable to know when the sub is closed. By "closed" it is is meant that the two telescoping sections of the sub have telescoped the full extent for which the sub is designed and any further lowering of the pipe string will increase the weight on the bit. Conversely, it may be desirable on occasions to know when the sub is fully open, i.e., when the two telescoping sections have moved apart to the extent allowed. Knowing this, the driller can lower the pipe string to prevent the weight on the bit from decreasing as the bit continues to drill.

Therefore, it is an object of this invention to provide novel apparatus for producing a surface detectable pressure signal in the drilling fluid being circulated in a string of drill pipe when a bumper sub in the string is in a preselected position.

It is another object of this invention to provide apparatus for producing a surface detectable pressure signal in the drilling fluid being circulated in a string of drill pipe when a bumper sub in the string is in a preselected position, said signal producing apparatus being controlled directly by the bumper sub.

It is yet another object of this invention to provide such apparatus that is simple in construction and positive in operation.

These and other objects, advantages, and features of this invention will be apparent to those skilled in the art from a consideration of this specification and attached drawings.

A preferred embodiment of the invention will now be described in detail in connection with the attached drawings in which,

FIGURE 1 is a vertical sectional view through a bumper sub equipped with the signal producing apparatus of this invention when the bumper sub is not in the preselected position;

FIGURE 2 is a vertical sectional view of such apparatus when the bumper sub is in the preselected position; and

FIGURE 3 is an alternate arrangement of a portion of the apparatus for producing a signal when the sub is in another preselected position.

Bumper sub **10** in FIGURE 1 has two telescoping sections. The first telescoping section includes mandrel **12** and upper connector sub **13**. The upper sub connects the first telescoping section to the portion of drill string above the bumper sub.

The other telescoping section of the bumper sub includes tubular member **11**, within which mandrel **12** is located, and lower connector sub **14**. Cap **15**, attached to the upper end of member **11**, provides a downwardly facing annular shoulder **16** to engage upwardly facing shoulder **17** on the mandrel and limit the downward travel of the second telescoping section relative to the

first. Lower sub **14** provides an upwardly facing annular shoulder **18** to engage lower end **12***a* of mandrel **12** and limit the downward travel of the first telescoping member relative to the second one. When end **12***a* of mandrel **12** is in engagement with annular surface **18** on the lower connector sub, the bumper sub is closed and the weight of the tubular string above the bumper sub can be transmitted to the bit or whatever is connected to the drilling string below the bumper sub. Conversely, when the two interengaging shoulders **16** and **17** are in engagement, the bumper sub is fully open and some or all of the weight of the drilling string below the bumper sub can be carried by the upper string.

Connected into the drill string below the bumper sub is the apparatus of this invention, generally indicated by the number **20**. It includes tubular body **21**, which is connected directly to the lower end of bottom sub **14** of the bumper sub, so the drilling fluid flowing through the drill string will pass through the bore of the body. Located in the bore of the body is sleeve **22**. The sleeve is made of flexible material preferably an elastomer, such as rubber. Means are provided for holding upstream end **22***a* of the sleeve open and against movement downstream with the drilling fluid to cause the drilling fluid to flow through the sleeve as it travels through the bore of the body. In the embodiment shown, the upper end of the sleeve is bonded to annular ring **23** which rests on an upwardly facing annular shoulder **24** formed in the bore of the body by increasing the diameter of the bore above that point. The annular ring is provided with seal **25** which engages the enlarged bore of the body and provides a seal between the upper end of the sleeve and the body. This insures that all of the drilling fluid that passes through the body, also passes through the sleeve. Lower end **22***b* of the sleeve is bonded to annular ring **26** to hold the lower end of the sleeve open. Seal **27** carried by ring **26** provides a seal between the lower end of the sleeve and the body.

Means actuated by one of the telescoping sections of the bumper sub are provided to collapse sleeve **22** to restrict the flow of drilling fluid through the bore of body **21** and create a pressure signal in the drilling fluid that is detectable at the surface. In the embodiment shown, such means are arranged to collapse the sleeve when the bumper sub is closed. Annular piston **28** is located in upper section **21***a* of body **21**. This section of the body has a bore of increased diameter which combines with depending sleeve **30** of annular piston **28** to form an annular chamber **31** between piston **28** and upwardly facing annular shoulder **32**. Seals **33** and **34** are carried by the piston and the sleeve, respectively, to prevent the escape of fluid from chamber **31**. The chamber is connected to the bore of body **21**, intermediate the ends of sleeve **22**, by passageway **35**.

Thus, by filling chamber **31** with a fluid, preferably a liquid, downward travel of piston **33** will force the fluid through passageway **35** into the bore of body **21** behind sleeve **22**. The fluid will collapse the sleeve, as shown in FIGURE 2, and restrict the flow of drilling fluid and create a surface detectable pressure signal therein. To cause this to occur when the bumper sub is closed, tubular extension member **29** is mounted on piston **28** and extends upward into tubular member **11**. The extension member is long enough to be engaged by end **12***a* of mandrel **12** and force piston **28** downward to collapse the sleeve, when the bumper sub is closing. If the drill string is raised to open the bumper sub the sleeve will force the fluid behind it back through passageway **35** into chamber **32** and open up the bore through the body to the fullest extent possible.

This same apparatus can be employed to indicate when the bumper sub is open by simply reversing the action

of the piston in the fluid chamber, as shown in FIGURE 3. In this embodiment, the bore of body **35** is provided with a section **35***a* of increased internal diameter to provide a downwardly facing annular shoulder **36**. Annular piston **37** is slidably mounted in bore section **35***a* of body **35** for movement upward relative thereto. Sleeve **38** is integrally attached to the piston to combine with the piston and the bore of the body to form annular fluid chamber **40**. The sleeve is connected to tubular extension member **39** which is connected to mandrel **12**. Thus, upward movement of the mandrel will displace the fluid from fluid chamber **40**, through passageway **41**, and collapse a sleeve (not shown) in the manner described above.

From the foregoing, it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth, together with other advantages which are obvious and which are inherent to the apparatus and structure.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

The invention having been described, what is claimed is:

1. Apparatus for indicating at the surface when the two telescoping sections of a bumper sub, located in a string of drill pipe through which drilling fluid is being pumped, are in a preselected position relative to each other, said apparatus comprising, a tubular body adapted to be connected in a pipe string to one of the telescoping

sections of a bumper sub, said body having a passageway therethrough for the passage of drilling fluid, a sleeve of flexible material located in the passageway, means for holding the upstream end of the sleeve open and against movement downstream with the drilling fluid to cause drilling fluid flowing through the opening in the body to flow through the sleeve, means for providing a seal between the ends of the flexible sleeve and the body, a fluid chamber, a passageway connecting the chamber to the opening in the body intermediate the ends of the sleeve, and means actuated by the other telescoping section for forcing the fluid in the chamber into the opening to collapse the sleeve and restrict the flow of drilling fluid therethrough to produce a pressure signal in the drilling fluid when the two telescoping sections of the bumper sub are in the preselected position.

2. The apparatus of claim **1** in which the fluid chamber comprises a section of increased diameter in the opening through the body and an annular piston member movable axially in said opening, said piston being moved axially to force fluid out of the chamber and collapse the sleeve by said other telescoping section of such bumper sub.

3. The apparatus of claim **1** in which the downstream end of the sleeve is free to move axially of the opening.

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