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2,544,601

INSERT ORIFICE AND TOOL THEREFOR

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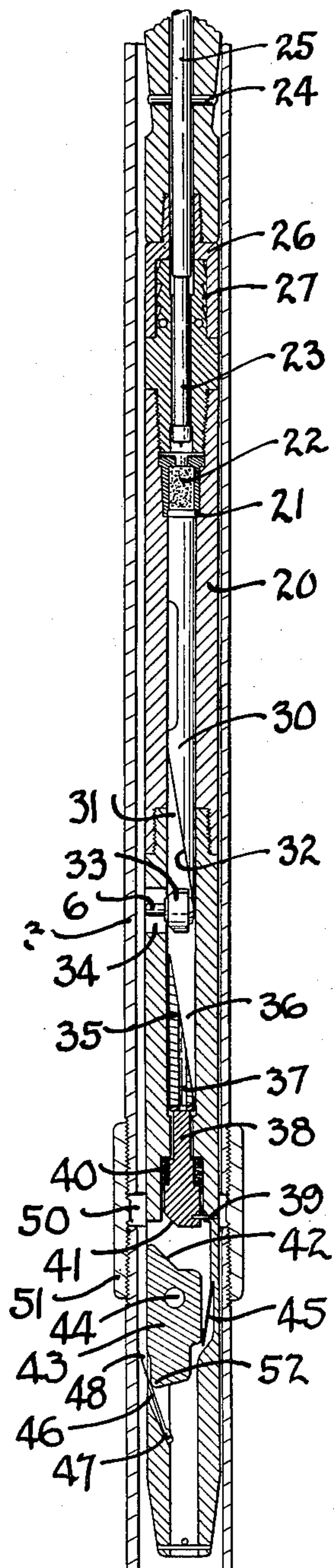


FIG 1

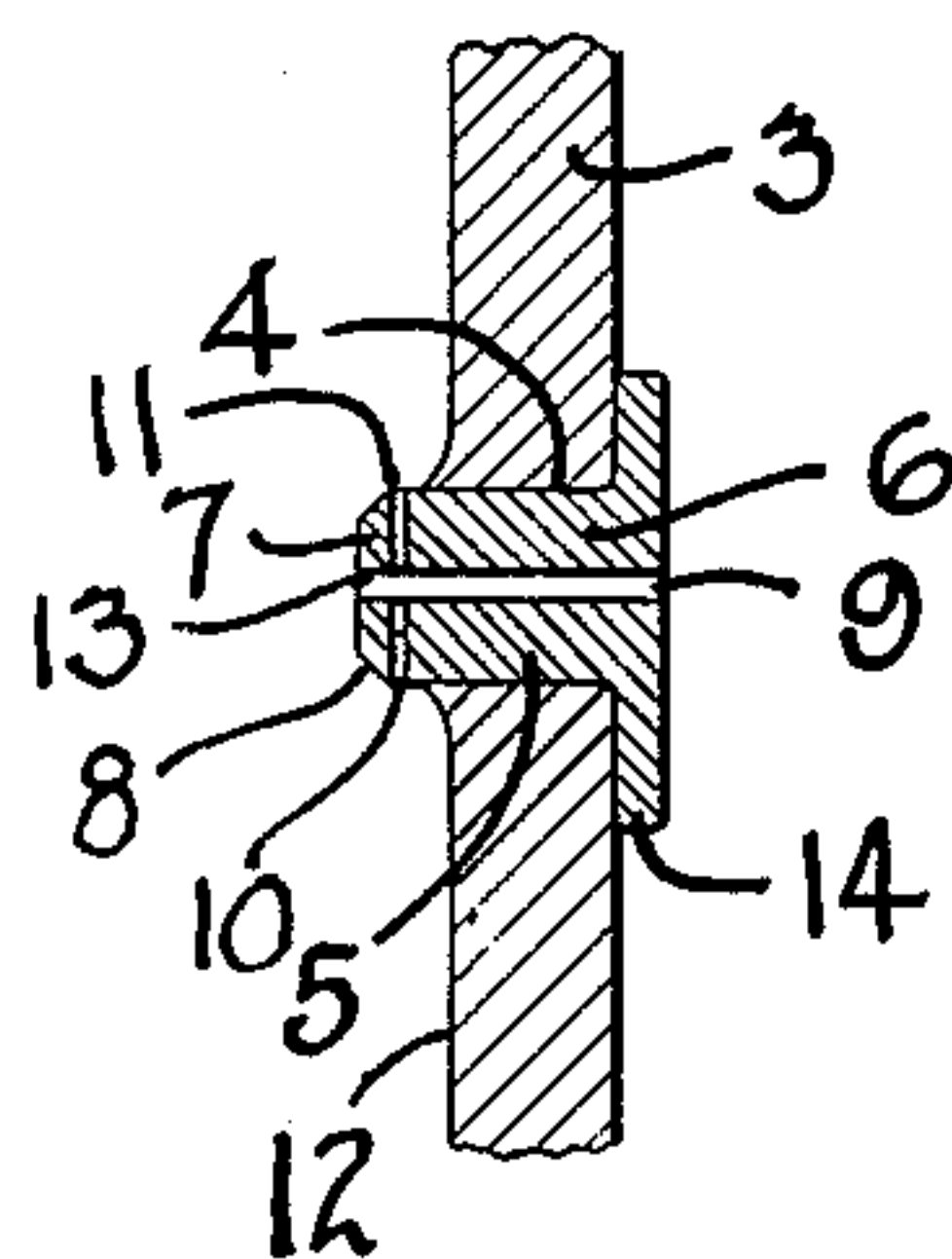


FIG 2

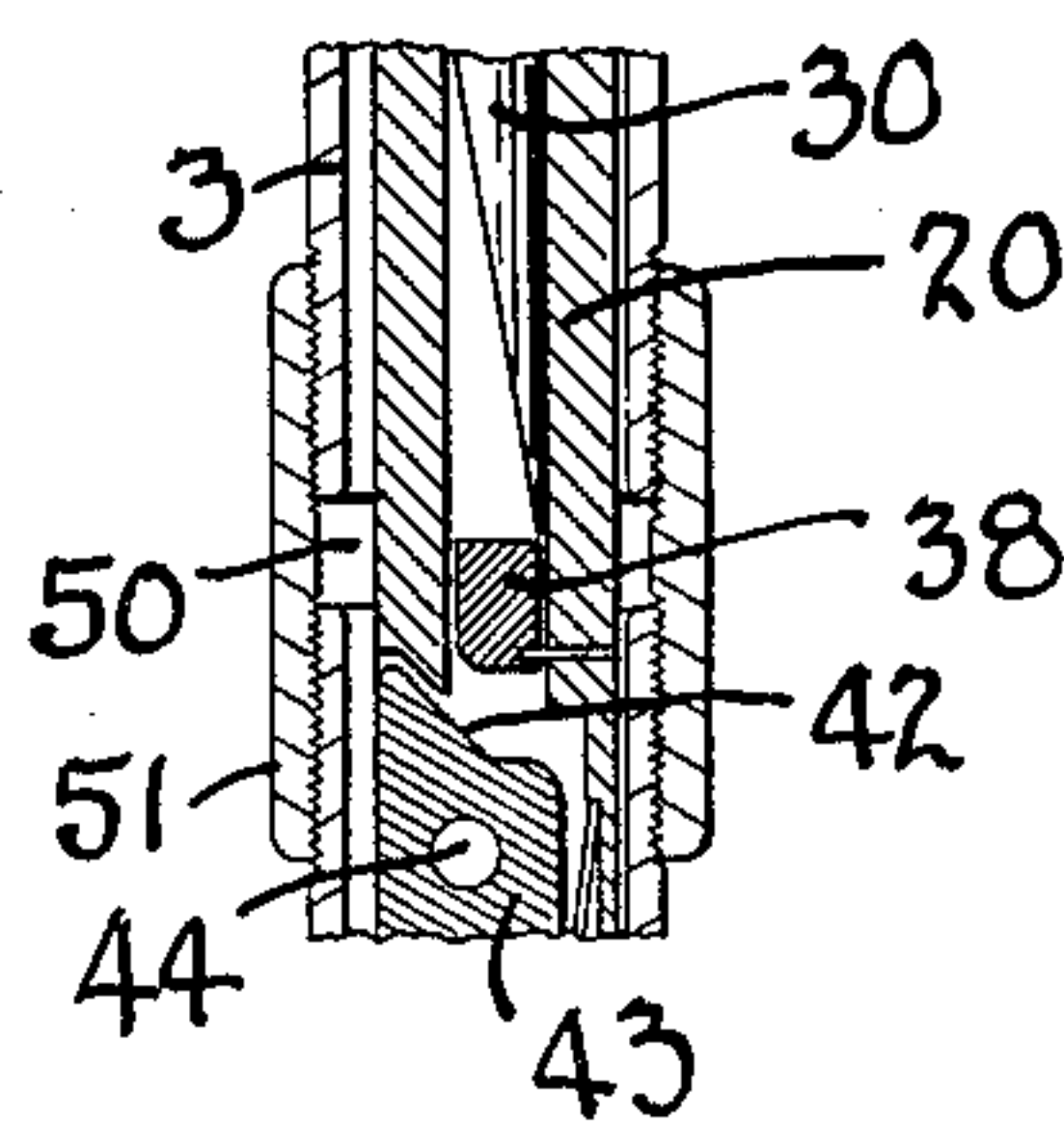


FIG 3

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INSERT ORIFICE AND TOOL THEREFOR

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12 Claims. (Cl. 166—6)

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The invention relates to an insert orifice and a tool for accomplishing such insertion.

The invention relates generally to that type of tool shown and described and claimed in my copending applications, Serial Number 453,008, filed July 31, 1942 now Patent No. 2,426,106 granted August 19, 1947, for Explosively Inserting Orifices in Pipe in Wells; Serial Number 570,914, filed January 1, 1945 for Flow Button for Well Pipe; and Serial Number 571,580 filed January 6, 1945 for Means and Method of Inserting Strainers in Casings.

In operation of tools of the present type great difficulty is encountered in insuring that the orifice member is properly inserted in the pipe. This is due to the fact that the tool is down in the well bore and is being operated in the tubing, the tubing usually contains oil or water and if operated in a casing or pipe, other oil, water or other liquid such as drilling mud may be present. These materials interfere with the operation of the tool and it is desirable to know that the tool has actually operated and that the operation of inserting the orifice member has occurred at a predetermined location. To accomplish the foregoing, the present invention contemplates a particular type of orifice member or insert button which will insure that there is an opening through the pipe in which the orifice member is inserted by providing a lateral inlet or passage in the button from the periphery thereof adjacent the end which projects through the pipe because often the longitudinal passage in the orifice member may become clogged or closed by a fragment of the metal of the pipe during the inserting operation.

Another object of the invention is to provide a positive mechanism for locating the tool relative to a coupling or collar in a pipe in such a manner that when the tool is operated and the insertion of the orifice member accomplished, the tool will be automatically released so as to signal the surface by the dropping of the tool as an indication that the operation is completed.

Other and further objects of the invention will be readily apparent when the following description is considered in connection with the accompanying drawings, wherein:

Fig. 1 is a vertical sectional view, illustrating the tool being positioned in the pipe.

Fig. 2 is an enlarged sectional view illustrating the construction of the orifice button.

Fig. 3 is a broken detailed sectional view of a modified form of the supporting mechanism of the tool.

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In the operation of inserting orifice members in the pipe in the well, it has been found that the punching operation performed by the orifice member in penetrating the metal in some instances results in a small slug or piece of metal of the pipe becoming lodged in the outer end of the orifice because the outer end of the orifice member performs the punching operation. Of course if the orifice is clogged or closed by a piece of such metal, the flow therethrough is either impaired or prevented so that the entire operation is defeated.

The present invention is therefore best illustrated in Fig. 2 where the pipe 3 has been perforated at 4 by the orifice button 5. This button is made up of a cylindrical body 6 having its outer end 7 slightly beveled at 8. A longitudinal passage or orifice 9 has been formed in the body but a transverse passage 10 has also been provided which intersects the orifice 9 adjacent the outer end of the button so as to brace the openings 11 which are exposed beyond the outer periphery 12 of the pipe 3, thus, even though the outer end 13 of the longitudinal orifice 9 should become blocked or obstructed by a small slug of metal, the button would still be operative because the flow could enter the lateral passage 10. The outer end 13 might also be abutting a portion of the wall of the formation or a small grain of material might become lodged therein. The transverse passage therefore insures a more satisfactory operation of the orifice member. The orifice member 6 has a relatively large flange 14 thereon which contacts the pipe adjacent the portion of the pipe which has been perforated so as to insure proper alignment of the orifice button to prevent its being extruded or punched too far through the pipe.

The operating tool for inserting the orifice button is very similar to that described in my prior copending applications in that it includes a body or housing 20 having a firing chamber 21 therein for the explosive 22. The explosive is arranged to be detonated by a firing pin 23 normally held in position by a shear pin 24 but removable upon a sharp downward movement of the mandrel 25 by any suitable means from the surface. The head 26 is removable if the tool becomes lodged in the well so as to expose the tooth spearhead 27 which is adapted to receive a suitable grappling member for recovering the entire tool.

A wedge member 30 is arranged for sliding movement in the chamber 31 due to the explosive pressure and the wedge face 32 is arranged to move the carrier 33 to the left as seen in Fig. 1

so that it will move into the opening 34 and carry the orifice member 6 with it so as to project the orifice button beyond the periphery of the tool and into the pipe 3 in the manner shown in Fig. 2.

An inclined stop 35 is shown as closing the lower end of the chamber 31 and is arranged to receive the wedge member 30. It seems obvious in the operation, however, that this chamber will be filled with liquid when the tool is disposed in the well bore or the pipe 3 which is filled with liquid. The downward movement of the wedge member 30 therefore causes a sharp increase in pressure on any liquid which may be deposited in the area 36 adjacent the bottom of the chamber. The stop member 35 is provided with a passage 37 extending through the bottom thereof and the passage is normally closed at its base by the abutment thereagainst of the plunger 38. This plunger is retained in position by a shear pin 39 and against the expansion of a coil spring 40 arranged around the plunger.

The sharp increase in pressure in the housing on the liquid due to the operation of the inserting mechanism and the sharp downward movement of the wedge member 30 is intended to shear the pin 39 so as to allow the plunger 38 to snap downwardly with a very sharp movement. The beveled face 41 on this plunger is arranged to engage the beveled face 42 of a dog 43 pivoted at 44 in the housing of the tube. This dog is in the nature of a supporting member for the tool and when the tool is lowered, it will be in the position of Fig. 1 where it is normally urged outwardly by the spring 45 at the rear thereof but is retained against such movement by a leaf spring 46 which is temporarily anchored at 47 in the housing. This spring 46 has the outer end 48 thereof projecting beyond the periphery of the tool so that it will snap along the inside of the pipe 3 as the tool is lowered. When the approximate elevation at which the orifice member is to be inserted is reached, the lowering movement of the tool is stopped and the tool then raised slowly so that the end 48 of this spring 46 will move into a recess 50 formed between the ends of the adjacent pipe sections which are joined by the coupling 51. The ends of the pipe secured into the coupling provide shoulders which are engaged by the spring 46, and continued upward movement of the tool either breaks the spring 46 or causes it to be released from the holding means 47 so as to allow the lower corner 52 of the dog 43 to snap outwardly beyond the periphery of the tool. If the tool is now lowered, the toe 52 will engage in the recess 50 and come to a stop upon the upper end of the lower section of the pipe and stop the downward movement of the tool so that the tool is firmly anchored. The distance of the orifice member 6 above this toe 52 is of course known so that the elevation of the perforation relative to the pipe coupling will also be known. The tool can now be operated to insert the orifice member by detonating the explosive 22. The plunger 38 now moves sharply downwardly and the beveled face 41 thereof will strike the beveled face 42 of the dog 43. This will kick the dog in a counter-clockwise direction about the pivot 44 so as to retard the toe 52 from engagement with the pipe and the tool will drop sharply from its supported position. The dropping of the tool can be readily ascertained at the surface by providing a slack in the cable if the tool is cable operated or slack in the string of

pipe or string of rods if they are used to operate the tool.

This signal to the operator indicates clearly that the orifice member must be inserted because the tool would not be kicked loose unless the wedge 30 had moved downwardly a sufficient distance to create a pressure to shear the pin 39 and furthermore if the orifice button is not completely inserted, the opening 34 would hang up on the orifice member if it were only partially inserted in the pipe and there would be no dropping of the tool.

It seems obvious that a positive signal has therefore been provided to indicate to the operator that his tool has functioned and that the orifice member is inserted.

Fig. 3 shows a modified form of the plunger 38 wherein the stop member 35 has been omitted and the member 30 is arranged to mechanically strike the plunger a positive blow so as to knock it down against the face 42 of the supporting dog.

It has been found in actual operation that the location of the tool is so accurate and positive that in some instances it has been used for the purpose of cutting off the pipe 3 by repeatedly inserting the orifice button and punching it into the pipe in a different circumferential position than the previous insertion. After a number of insertions of this sort have been made, it seems clear that the pipe is substantially weakened and if the pipe is stuck in the hole, it can now be pulled in two by an upward pull thereon due to the weakened area where the orifice buttons have been inserted. This is of course an expediency for removing stuck pipe from wells.

Broadly the invention contemplates the particular type of orifice button which will facilitate flow under all conditions and an inserting tool which will signal that the insertion has been performed in a satisfactory manner.

What is claimed is:

1. In combination, an inserting mechanism, an orifice creating member carried thereby, means to support said inserting mechanism in the well, and means operable by the inserting mechanism for releasing said support means.

2. In an orifice member inserting tool, an inserting mechanism, means to support the tool in inserting position in the well, and means operable by the inserting mechanism for releasing said support means, said first means including a pivoted dog and said last means including a plunger to engage and pivot said dog.

3. An insert orifice member for pipe in wells including a cylindrical body, an orifice therein, and a transversely extending inlet passage in said orifice member, adjacent the outer end of said body and intersecting said orifice.

4. An insert orifice button for pipe in wells including a cylindrical body, an orifice therein, and a transverse inlet passage in said orifice button adjacent the outer end of said body and intersecting said inlet passage, and a flange on the inner end of said body to fit the inside of the pipe and limit the inserting movement of the orifice.

5. In an orifice member inserting tool, an inserting mechanism, means to support the tool in inserting position in the well, and means operable by the inserting mechanism for releasing said support means from the pipe, said first means including a pivoted dog and said last means including a hydraulically operable plunger to engage and pivot said dog.

6. In an orifice member inserting tool, an inserting mechanism, means to support the tool in inserting position in the well, and means operable by the inserting mechanism for releasing said support means from the pipe; said first means including a pivoted dog and said last means including a mechanically operable plunger to engage and pivot said dog.

7. A tool for inserting orifice members in a string of pipe in a well bore having pipe coupling recesses therein, comprising a housing, means carried by the housing to locate the tool in the pipe and including a movable anchor pivoted in said housing and movable outwardly into a coupling recess, means in said housing normally urging said anchor in a direction outwardly of said housing into extended position in a pipe coupling recess, a retainer on said housing initially confining said anchor in retracted position against outward movement by said urging means, said retainer initially extending outwardly of said housing and being engageable in a coupling recess and releasable from anchor confining position upon upward movement of said tool past a pipe coupling recess so that said anchor is released to be moved into such recess by said urging means upon subsequent downward movement of said tool, a plunger device in said housing movable to retract said anchor by engagement therewith, releasable means initially holding said plunger out of engagement with said anchor, an orifice member inserting mechanism movably mounted in said housing movable to punch an orifice member through the pipe, and means in said housing engageable and operable by said inserting mechanism upon movement thereof to move said plunger so that said tool is automatically released when the member is inserted in the pipe.

8. A tool for inserting orifice members in a string of pipe in a well bore having pipe coupling recesses therein, comprising a housing, means carried by the housing to locate the tool in the pipe and including a movable anchor pivoted in said housing and movable outwardly into engagement in a coupling recess, means in said housing normally urging said anchor to extended position in a pipe coupling recess, a retainer on said housing for engaging and confining said anchor in retracted position against movement by said urging means, said retainer extending outwardly of said housing and being engageable in a pipe coupling recess and releasable from anchor confining position upon upward movement of said tool past said pipe coupling recess so that said anchor is released to be moved into said coupling recess by said urging means upon subsequent downward movement of said tool, a plunger device in said housing movable to retract said anchor by engagement therewith, releasable means in said housing initially holding said plunger out of engagement with said anchor, an orifice member inserting mechanism in said housing movable to punch an orifice member through the pipe, and means in said housing engageable and operable by and upon movement of said inserting mechanism to move said plunger so that said tool is automatically released when the orifice member is inserted in the pipe, including liquid in the tool housing between the inserting mechanism and the plunger.

9. An insert orifice button member for pipe in wells including a cylindrical body, an orifice therethru, a transversely extending inlet passage in the outer end of said body and intersecting said

inlet orifice, and means on said button member to engage the pipe to retain the button member in the pipe against outward movement after insertion.

10. A device for supporting a tool in a pipe in a well bore which pipe is provided with couplings with internal recesses between pipe section ends, said device including a hollow body having a member projecting laterally therefrom to be engaged in the recess in a pipe coupling as the tool is raised in the pipe, a pivoted dog in said device held inactive within said body by said member, said member upon engagement in said coupling recess being adapted to shear upon further upward movement of the device relative to the coupling in the pipe releasing said dog for pivoted movement, means in said body urging said dog outwardly of said body about its pivot upon its release from said shear member so that lowering of the device relative to the pipe will permit said dog to move into the recess in said coupling to support said device, and additional means in said body operable by the application of pressure thereto to engage said dog and release it from the recess in the coupling so as to release said device.

11. A tool for inserting orifice flow buttons in pipe having coupling recesses in wells containing liquid under pressure comprising a hollow body, an orifice button carrier in said body movable laterally thereof, an orifice button on said carrier to be punched through the pipe upon lateral movement of said carrier relative to said body, a wedge member slidable in said body with its wedge face engageable with said carrier, an explosive in said body to detonate and move said wedge member and carrier to insert the orifice button in the pipe, a chamber in said body below said carrier and wedge member containing liquid and to receive said wedge member upon detonation of said explosive, a plunger slidable in said body below said wedge member and supporting the liquid in said chamber, a first shear means on said body initially supporting said plunger in retracted position in said body, tool anchor means pivoted in said body below and initially spaced from said plunger and engageable in a coupling recess to there support the tool, means in said body urging said anchor means outwardly into coupling recess engaging position, a movable means on said body initially holding said anchor means in retracted position, said movable means projecting laterally outwardly of said body and engageable in a coupling recess upon upward movement of the tool to move to release said anchor means for movement into said coupling recess, said anchor means being engageable and retractible by said plunger upon shearing of said first shear means upon impact of said wedge member against said liquid and plunger upon detonation of said explosive whereby to release said tool.

12. A tool for inserting orifice members in a pipe in a well bore where such pipe is made up of pipe sections and couplings which provide a recess in the coupling between the pipe ends, comprising a hollow body, an orifice member carrier movably mounted in said body to move laterally thereof, an orifice member carried by said carrier, wedge means positioned in said body and movable to engage and move said carrier to punch said orifice member through the pipe upon lateral movement of said carrier within said body, and an anchoring device movably mounted in said body and operable to anchor and support

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said body and carrier in the pipe against longitudinal movement while said carrier is being moved laterally of said body to punch the orifice member through said pipe, a member holding said anchoring device in retracted position but releasably mounted in said body and projecting from said body below said carrier to engage in said coupling recess upon upward movement of the anchoring device past a coupling recess and to release from said body thereby releasing said anchoring device for outward movement, a member on said body urging said anchoring device outwardly into said coupling recess upon subsequent downward movement of the anchoring device to the recess, means in said body including a plunger below said carrier member movable to engage and retract said anchoring device from said coupling recess by and upon actuation of

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said wedge means so as to automatically release the anchoring device of the tool upon insertion of the orifice member in the pipe, and means on said body releasably holding said plunger in retracted position above said anchoring device, releasable upon actuation of said plunger.

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REFERENCES CITED

The following references are of record in the file of this patent:

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