This invention relates to well methods and apparatus, and more particularly to formation testing.

Various methods have been developed for evaluating formation productivity. One technique is known as formation or drill stem testing, in which a temporary completion of the well is carried out in order to obtain a sample of fluid from the formation. Actual production conditions are simulated in the test to determine whether oil may be produced from the formation. If the formation testing is to be carried out in a cased well, it is necessary to perforate the casing and cement that is between the casing and the borehole wall.

Various testing tools have been utilized in which a sample of formation fluid is collected in the tool and subsequently raised to the surface. Often the small capacity of the tool storage chamber does not allow a sufficiently large sample to be collected and thus the results of the test may be improperly evaluated.

Often there may be several formation zones in a well that appear to have favorable production characteristics as determined by logging, core analysis, or other evaluation techniques. When a series of tests is to be run at various depths in a casing, it is necessary to seal the perforations made during the previous test before proceeding with testing at other depths in the well. One method for sequential testing is to cement the packers isolating the formation zone permanently in the well casing, after each test has been completed. This procedure necessarily limits the size of the production tubing which can be run inside the packer mandrel.

Accordingly, it is an object of this invention to provide a test apparatus which yields a sufficiently large sample for reliable evaluation.

It is a further object of this invention to provide an apparatus for testing formation zones at a plurality of depths, without restricting subsequent well operations. It is a further object of this invention to provide a test apparatus which may be conveniently assembled and operated in the field.

These objects are accomplished in accordance with a preferred embodiment of the invention by utilizing a packer with a hollow mandrel that is run in the casing on a tubing string. Resilient sleeves are spaced axially on the packer mandrel to isolate an annular space between the casing wall and the packer mandrel. An opening in the packer mandrel communicates with this isolated annular space. A perforating tool is run on a wire line inside the tubing string until it is seated in the packer. A cam aligns the perforating tool with the opening in the packer mandrel in such a way that when the explosive charges in the tool are detonated, the casing and the cement behind the casing are perforated opposite the opening in the mandrel.

After perforating, the tool is removed from the packer and production testing is carried out through the packer and the tubing string. At the completion of the test, a cementing tool is run on a wire line inside the tubing string to seal off the perforations. The cementing tool is seated in the packer mandrel and a cam aligns the tool with the opening in the mandrel. An articulated cementing head on the tool is then displaced outwardly through the mandrel opening to engage the casing around the perforations. The cementing head has cementing ports that are aligned with the perforations and cement slurry is conducted from a storage chamber in the tool to the ports from which it is squeezed into the perforations. The mandrel and the cementing tool cooperate to position the cementing head at the same depth with respect to the mandrel, as the perforating charges are positioned. The cam arrangement also provides for rotational alignment of the cementing head with the position of the perforating charges. Thus, the ports in the cementing head are aligned with the perforations in the casing. The cementing tool confines the cement to the perforation and thus the cement does not interfere with the movements of the packer or other tools through the casing after the cementing operation. Also, only a small quantity of cement is required.

This preferred embodiment is illustrated in the accompanying drawings in which:

FIG. 1 is a cross-sectional view of the packer of this invention, with the perforating tool mounted therein;

FIG. 1A is a detail view of the drag spring sleeve J-slot;

FIG. 2 is a side elevation view of the packer and perforating gun along the line 2—2 in FIG. 1;

FIG. 3 is a cross-sectional view of the lower end of the perforating tool and packer along the line 3—3 in FIG. 1;

FIG. 3A is a cross-sectional view of the perforating tool and packer along the line 3A—3A in FIG. 3;

FIG. 4A is a cross-sectional view of the packer and perforating tool showing the latch assembly with the latch spring in latched position;

FIG. 4B is a cross-sectional view of the packer and the perforating tool, showing the latch assembly with the latch spring in unlatched position;

FIG. 5 is an enlarged cross-sectional view of the perforating tool along the line 5—5 in FIG. 1;

FIG. 6 is an enlarged cross-sectional view of the intermediate portion of the perforating tool and the packer mandrel, prior to detonation of the perforating charges;

FIG. 7A is a cross-sectional view of the lower portion of the packer with the cementing tool mounted in the packer prior to displacement of the cementing head into engagement with the casing;

FIG. 7B is a cross-sectional view of the casing and tubing string and the upper portion of the cementing tool;

FIG. 8A is an enlarged cross-sectional view of the intermediate portion of the packer mandrel and the cementing tool with the cementing head displaced against the casing;

FIG. 8B is a cross-sectional view of the upper portion of the cementing tool and the packer mandrel.

Referring to FIG. 1, a casing 2 is run in a bore hole 4 and cement 6 has been placed in the annular space between the casing 2 and bore hole 4. A packer 8 is
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3 threadedly secured to the lower end of a string of tubing 10. The packer includes a latch collar 12 which is internally threaded at one end to receive the lower end of the tubing 10. The opposite end of the latch collar 12 is threadedly secured to a mandrel 14. A pair of swabbing cups 16 are mounted on the outside of the mandrel 14 and are held in place between a sleeve 18 and a shoulder 20 on the mandrel. The swabbing cups 16 are formed of a resilient material which engages the casing 2 and prevents the flow of fluid axially through the annular space between the mandrel 14 and the casing.

The intermediate portion of the mandrel 14 has a radial opening 22 through the wall of the mandrel. As shown in FIG. 2, the opening 22 is in the form of an elongated slot. Below the opening 22, another pair of swabbing cups 24 is mounted on the exterior of the mandrel 14. The swabbing cups 24 are clamped between a shoulder 26 on the mandrel and the end of a sleeve 28 on the mandrel. The swabbing cups 24 are similar to the cups 16 and seal against fluid flow between the mandrel 14 and the casing 2. Thus, the cups 16 and 24 isolate the annular space between them from fluid communication with the interior of the casing 2 above and below the cups 16 and 24, respectively.

A guide shoe 30 is threadedly secured to the lower end of the mandrel 14. The shoe 30 has a drag spring sleeve 32 for guiding movement of the interior cup face of the shoe. The sleeve 32 includes a plurality of slips 34 which are attached to the sleeve by longitudinal straps 36. A drag spring 38 overlies each of the straps 36 for urging the slips 34 against the shoe 30 and resisting movement of the slips relative to the casing 2. The shoe 30 has a tapered surface 40 under the slips 34. This is to prevent displacement of the shoe relative to the slips causes the slips to be displaced outwardly against the casing.

Movement of the sleeve 32 relative to the shoe 30 is controlled by a J-slot in a conventional manner. The sleeve 32 has a pin or lug 42 which projects into the J-slot 44 in the outer surface of the shoe 30. The J-slot is shown schematically in FIG. 1A. While the mandrel 14 is being lowered through the casing, the pin 42 is in the position shown in full lines in FIG. 1A and thus the slips 34 are in the position shown in FIG. 1, although the drag springs 38 engage the casing 2. When the desired depth is reached, the pin 42 is displaced from the short leg of the J-slot 44 by lifting up on the tubing string 10 and rotating the tubing string counterclockwise. This moves the pin 42 to the long leg of the J-slot. This forces the sleeve 32 to slide longitudinally along the shoe 30, thereby causing the slips 34 to be displaced outwardly against the casing by the tapered surface 40. By setting down the weight of the tubing on the slips 34, the slips are tightly wedged against the casing and the mandrel 14 is secured against downward movement relative to the casing. The approximate position of the pin 42 when the slips are set is shown in dotted lines in FIG. 1A. The slips 34 may be retracted by picking up on the tubing string. In order to move the mandrel downward, it is necessary to rotate the tubing string in a counterclockwise direction after lifting the mandrel to return the pin 42 to the position shown in full lines in FIG. 1A.

The shoe 30 has a central passage 46 which is closed at its lower end by a threaded plug 48 to form a receptacle. The passage 46 includes a tapered shoulder 50 (FIG. 3) which forms the bore of a ring 52 which forms the central axis of the sleeve 56. The ribs 54 permit sand or other solid matter which may enter the mandrel through the opening 22 to pass between the ribs 54 and into the passage 46 below the sleeve 56. The packer 8 is adapted to receive either a perforating tool 60, as shown in FIG. 1, or a cementing tool 62, as shown in FIGS. 7A and 7B. Both the perforating tool 60 and the cementing tool 62 are suspended by substantially identical connectors to the end of a wire line 64 (FIG. 7B). The wire line 64 is secured to the packer 8 and a pair of bars 68 extends between the connector body 66 and a latch spring sleeve 70 (FIG. 7A). The connector body supporting the perforating tool is attached to a similar latch spring sleeve 72 on the perforating tool 60 and a pair of bars 74, as shown in FIG. 1. The sleeve 72 is mounted on a guide 76. The guide 76 has grooves on opposite sides for receiving the bars 74, as shown in FIG. 5. Since the wire line is connected with the sleeve 72 by the bars 74, the weight of the tool causes the guide 76 to move downwardly relative to the sleeve 72.

As shown in FIG. 4B, the sleeve 72 is retained on the guide 76 by a shoulder 78. A latch spring assembly 80 is positioned between the sleeve 72 and the surface of the guide 76. The spring assembly 80 is secured at its base to the guide 76 and includes a plurality of elongated spring elements 82 which are biased outwardly toward the position shown in FIG. 4A. When the sleeve 72 is displaced upwardly, however, as shown in FIG. 4B, the spring elements 82 are displaced inwardly by the sleeve and lie against the tube 76. The sleeve 72 is provided with openings 84 in alignment with the elements 82 to permit the spring elements to swing outwardly when the sleeve is displaced downwardly. Downward travel of the sleeve is limited by a shoulder 86 on a tubular portion 88 of the perforating tool.

The collar 12 on the packer 8 includes an outwardly tapering interior portion 90 and a downwardly facing shoulder 92 against which the ends of the elements 82 may abut when the elements are displaced outwardly to the position shown in FIG. 4A. The spring elements 82 prevent upward movement of the tool 60 relative to the packer 8, when the elements 82 are in engagement with the shoulder 92.

The remainder of the tool 60 includes a tubular portion 94 and a shaft portion 96. The portions 94, 96 and 98 are rigidly secured together by screw threads. The shaft portion 96 includes an axial cam 98 (FIG. 3) which cooperates with a lug 100 projecting inwardly from the interior wall of the packer 8 in FIG. 4A. When the lug engages the cam 98, the cam 98 includes a longitudinal groove portion 102. When the perforating tool 60 is lowered into the packer 8, the cam 98 strikes the lug 100 and applies a torque to the perforating tool as it is being lowered to direct the lug 100 into the groove 102. Thus, the lug and the groove cooperate to orient the perforating tool in a predetermined rotational relation with respect to the packer mandrel 14.

The lower end of the shaft 96 has a blunted point 104 which rests on the ribs 54 of the ring 52. The lug 100 does not engage the closed end of the groove 102 when the point rests on the ribs 54 and therefore the axial position of the perforating tool is determined by the engagement of the point 104 with the ribs 54, rather than by the lug 100. Furthermore, the distance between the point 104 and the elements 82 corresponds to the distance between the ribs 54 and the shoulder 92. Accordingly, when the point 104 engages the ribs 54, the free ends of the spring elements 82 are in position to engage the shoulder 92, when the spring sleeve 72 is displaced downwardly, as shown in FIG. 4A.

Referring to FIG. 6, the tubular portion 94 includes a pair of explosive charges 106 which are aligned with openings 108 in the tubular portion 94. The openings 108 are temporarily sealed by caps 110. The explosive charges 106 may be of the conventional projectile type that is ordinarily used for perforating well casings. The charges
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106 are rigidly mounted in a frame 112, so that they are not displaced out of position while the perforating tool is being lowered through the production tubing. The explosive charges are detonated by electric filaments and current is supplied to the filaments by lead wires 114 and 116. The lead wires are connected in circuit with a switch at the surface of the ground for detonating the charges 106 at the appropriate time.

The cementing tool 62 is shown in FIGS. 7A, 7B, 8A and 8B. The tool 70 that is suspended by the bars 68 from the wire line connector 66 is mounted on a tube 118. A latch assembly 120 similar to the assembly 80 on the perforating tool is mounted on the tube 118 and it includes spring elements 122 corresponding to the spring elements 82. The tube 118 includes shoulders corresponding to the shoulders 78 and 86 (FIG. 4B) for limiting the upward and downward movement, respectively, of the sleeve 70 relative to the tube 118.

A cartridge 124 containing a slow burning power type charge is mounted at the upper end of the tube 118, as shown in FIG. 8B. Electric current for igniting the cartridge is supplied through a lead wire 125. The cartridge is clamped between a shoulder 126 in a tubular extension 128 and a shoulder 130 in the tube 118. A free piston 132 is mounted in the bore of the tube 118 and has a plurality of sealing rings 133. Spaced axially downward from the piston 132 is a plug 134. The piston 132 and the plug 134 cooperate with the bore of the tube 118 to form a fluid chamber. A second plug 136 is mounted in the tube 118 to form a cement slurry chamber between the plug 134 and the plug 136.

A sleeve 138 is threadedly secured to the lower end of the tube 118 and a mandrel 140 extends through the sleeve 138 in telescoping relation, as shown in FIGS. 8A and 8B. The sleeve 138 has a plurality of elongated slots 142 and jar pins 144 which are secured in the mandrel 140 extend outwardly through the slots 142. The slots 142 permit limited axial movement of the sleeve 138 relative to the mandrel 140. The sleeve 138 is biased upwardly relative to the mandrel 140 by a spring 146 which is compressed between opposed shoulders on the sleeve and mandrel.

A cementing head 148 is mounted in the cementing tool 62 below the mandrel 140. A pair of toggle links 150 connect the cementing head 148 with the mandrel 140. One end of each link 150 is hingedly mounted on a pin projecting outwardly from the mandrel 140 and the links 150 extend in parallel relation on opposite sides of the cementing head 148. Another pair of parallel toggle links 154 is pivotally mounted on a bearing at the top of the shaft 156 which corresponds to the shaft 96 on the perforating tool 60, as shown in FIG. 1. The lower end of each link 154 is pivotally mounted on a pin 158 at the top of the shaft 156. The opposite end of each link 154 is supported on a pin 160 projecting outwardly on opposite sides of the cementing head 148. The pin 160 also supports the ends of the links 154 in overlapping relation, as shown in FIG. 8A. The cementing head 148 is biased radially outward by a leaf spring 162 which is secured at one end in the mandrel 140 and at the opposite end in the shaft 156. The cementing head, the toggle links, and the spring are enclosed in a flexible tubular cover 166.

The cementing head 148 includes a pair of ports 168 which are spaced apart approximately the same distance as the explosive charges 106 in the perforating tool 60. Water is forced through the ports to form a seat which bears against the perforating casing 2, as shown in FIG. 8A. A conduit 172 in the cementing head 148 communicates with the bores 168. A flexible hose 174 is attached at one end to the cementing head in fluid communication with the conduit 172 and at the opposite end to the hose communicates with a passage 176 in the mandrel 140.

The shaft 156 on the lower end of the cementing tool 62 is substantially the same as the shaft 96 on the perforating tool 60. The shaft 156 includes a blunt point 104 and a cam 98' which correspond to the point 104 and cam 98, respectively, of the tool 60.

In operation, the packer 8 is made up on the end of a string of production tubing and run in the casing 2 to the depth of the lowest proposed test formation. The tubing string is rotated to cause the pin 42 in the drag spring sleeve 32 (FIG. 1) to move into the long portion of the J-slot 44. The drag springs 38 engage the casing 2 and resist movement of the sleeve 32 relative to the casing 2. Lowering the tubing string causes the sleeve 32 to be displaced outwardly by the tapered surface 40 until they grip the casing. In this manner, the slips 34 secure the mandrel 14 against downward movement relative to the casing. Surface slips may then be applied to the tubing string to take up the remaining tubing weight.

The perforating tool 60 is then attached to the end of the wire line by means of the connector 66 and lowered through the production tubing until it reaches the mandrel 14. The weight of the tool causes the sleeve 72 to be raised relative to the tube 76 and therefore the spring elements 82 are retracted against the surface of the tube 76, as shown in FIG. 4B. When the point 94 at the bottom of the perforating tool has come to rest on the ribs 54 of the ring 52, the perforating tool is at the desired depth relative to the mandrel 14. The lug 100 cooperates with the cam 98 to turn the perforating tool, if necessary, to align the explosive charges 106 with the opening 22, as shown in FIG. 2. When the wire line is lowered and the downward movement of the bars 74 permits the sleeve 72 to move downward relative to the tube 76, thus exposing the spring elements 82, which swings outwardly to engage the shoulder 92. Thus, the perforating tool is rigidly secured in the mandrel and can move outwardly or downwardly relative to the mandrel. The latching of the spring elements 82 can be perceived at the surface. The perforating charges 60 are then fired by electric current conducted through the conduits 114 and 116 to perforate the casing directly opposite the casing 22.

After the casing has been perforated, an upward pull is applied to the wire line to draw the sleeve 72 over the spring elements 82 and thus retract them into the position shown in FIG. 4B. Further upward movement of the wire line raises the perforating tool to the surface. Fluid flows from the formation through the perforations into the interior of the mandrel and upwardly through the production tubing to the surface. If desired, an acid wash may be made to clear drilling mud from the test perforations. After a predetermined interval, the well is shut in.

The cementing tool 62 is then filled by unscrewing the tubular extension 122 from the tube 118. The cartridge 124, the plug 134, and the piston 132 are removed. A slurry of quick setting cement of sufficient volume to fill the perforations is poured into the tube 118. The lower plug 136 prevents the slurry from passing into the mandrel 140. The plug 134 is then inserted in the open end of the tube 118 and water is poured on top of the plug 134, after which the piston 132 is inserted to confine the water in the chamber between the piston and the plug 134. The explosive cartridge 124 is then inserted in the end of the tube 118 and the tubular extension 128 is screwed into place.

The cementing tool is lowered on the end of the wire line 64. As the tool passes into the packer 8, the leaf spring 162 urges the cementing head 148 outwardly. As the head 148 approaches the depth of the opening 22, the lug 100 engages the cam 98' to rotate the tool, if necessary, until the head is aligned with the opening 22. The spring 162 then displaces opening 22 and the pointed end 104' of the shaft 156 engages the ribs 54. The mandrel 140 continues to move downward until the flanges 170 on the cementing head engage the casing 2. The sleeve 70 slides downwardly relative to the tube 118 to allow the spring elements 122 to engage the shoulder 92.

When the tool is latched by the spring elements 122, current is supplied through the conduit 125 to the car-
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7 tridge 124. Ignition of the cartridge drives the piston 132 downwardly and the pressure transmitted through the water in the chamber through the plug 134, and through the cementing head 148, where it is placed outwardly through the bores 158 into the perforations in the casing 2. The plug 134 continues to move downward until the plug 134 seats on the plug 136. The pressure transmitted through the water chamber breaks the plug 134 and displaces the water down the passage 176 directly behind the cement slurry. The water follows the cement through the passage 176 and the tube 174. Preferably, the cement is confined in the perforations in the casing 2 and penetrates only a short distance into the cement 6 behind the casing. Thus, only a small amount of cement slurry is used. The piston 132 continues to move downward due to the fluid pressure behind the piston, until the piston seats on the plugs 134 and 136. The pressure behind the piston then serves to hold the cementing head 148 against the casing.

After a sufficient interval of time to allow the cement to set, the tool is unlatched by raising the wire line and thus retracting the spring elements 122. At the same time that the spring elements are unlatched, the gas remaining in the interior of the tube 118 displaces the sleeve 138 upwardly relative to the mandrel 140 and the jar lugs 144 engage the top of the slots 142 to jar the cementing head 148 loose from the casing in the perforations. Thus, the tool does not hang against the casing wall. The cementing tool 63 may then be raised through the production tubing. If desired, the tubing may be swabbed dry to pressure test the perforation cementing.

The packer 8 may be removed or raised to another zone by raising the tubing 16, and thus retractiong the slips 34 along the tapered portion 40 of the shoe 30. When the packer has been raised to a second zone, the tubing string may be lowered again to set the slips 34 and the procedure may be repeated for perforating, testing and cementing at the second zone.

If more than one zone is tested, the wire line tools may be relocated at the site, while the other stages of the test are being carried out. Furthermore, the production test through the packer 8 may be carried out for an extended length of time and the perforations may be cemented long after the completion of the test. Since the cement is placed directly in the perforations, large quantities of cement are not required. Therefore, cementing equipment that is required for cementing off perforated zones in the conventional manner after the test is eliminated.

While this invention has been illustrated and described in one embodiment, it is recognized that variations and changes may be made therein without departing from the invention as set forth in the claims.

I claim:
1. Apparatus for testing formations in a well comprising a packer, means for securing the packer in a tubing string, said packer including a hollow mandrel having a closed end and packer elements on said mandrel, said mandrel having a radial opening therein between said packer elements, means in said mandrel forming a seat, an elongated tool adapted to be inserted in said mandrel, said tool having a transverse locating surface thereon in position to engage said seat means upon insertion of said tool axially into said packer mandrel, a reference point on said tool being spaced axially from said tool locating surface approximately the same distance as said mandrel opening is spaced from said seat means, means in said mandrel forming a receptacle adjacent

said mandrel seat, said receptacle extending axially of said mandrel away from said seat means, said seat means being positioned between said receptacle and said mandrel opening, said seat means including a plurality of ribs projecting toward the center of said mandrel, and means for selectively latching said tool in said mandrel against movement away from said seat means, whereby said packer accurately locates said tool reference point with respect to said mandrel opening.

2. Apparatus for testing formations according to claim 1 wherein said ribs are below said mandrel opening, said tool including a perforating charge directed radially of said tool, said charge being located at said tool reference point.

3. Apparatus for testing formations according to claim 1, said latching means including downwardly facing shoulder means on said mandrel, said slots on said tool, said latching elements being moveable into position to engage said shoulder means to resist upward movement of said tool relative to said mandrel, and means on said tool for selectively disengaging said elements from said shoulder means, whereby said ribs and said shoulder means cooperate to locate the tool reference point at a predetermined axial position in said mandrel.

4. Apparatus for testing formations in a well comprising a packer, means for securing the packer in a tubing string, said packer including a mandrel and packer elements on said mandrel, said mandrel having a radial opening therein between said packer elements means in said mandrel forming a seat, an elongated tool adapted to be inserted in said mandrel, said tool having a transverse locating surface thereon in position to engage said seat means upon insertion of said tool axially into said packer mandrel, a cementing head on said tool being spaced axially from said tool locating surface approximately the same distance as said mandrel opening is spaced from said seat means, means for selectively latching said tool against movement away from said seat means, means for rotationally orienting said tool cementing head with respect to said mandrel opening, said packer mandrel seat means including a plurality of ribs projecting toward the center of said mandrel, said ribs being below said mandrel opening, said cementing head having mounting means including toggle links projecting upwardly and downwardly from said head, said toggle links interconnecting upper and lower portions of said tool and being arranged to displace said head radially of said tool upon movement of said upper and lower portions toward each other, whereby said ribs resist downward movement of the lower portion of said tool while upper portion moves downwardly to displace said head outwardly through said opening.

5. Apparatus for testing formations according to claim 4 wherein said cementing head has a cementing port therein.

6. A cementing tool comprising an elongated body including an upper portion and a lower portion, said upper portion including a tube and a mandrel, said tube and mandrel being mounted in telescoping relation, means on said tube for temporally engaging an adjacent body, means for limiting relative axial movement in one direction of said tube and mandrel, a cementing head, a pair of toggle links, said links connecting said cementing head with said upper and lower portions, said toggle links being arranged to displace said head radially outward from said body upon relative axial displacement of said upper portion toward said lower portion, said limiting means

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including opposed abutments between said tube and said mandrel, said relative axial displacement of said upper portion being in a direction opposite to said one direction, said cementing head having a cementing port therein, and means for selectively conducting cement slurry to said port, and means on said tube responsive to fluid pressure in said conducting means for displacing said tube in said one direction whereby releasing said body engaging means displaces said tube in said one direction relative to said mandrel in response to fluid pressure in said conducting means and engagement of said opposed abutments provides a jar for separating said cementing head from a casing.

7. A cementing tool comprising an elongated body including an upper portion and a lower portion, a cementing head, means mounting said head in said body, said mounting means including means for displacing said head radially outward from said body upon relative axial displacement of said upper and lower portions, said cementing head having a cementing port therein, and means for selectively conducting cement slurry to said port, said conducting means including a fluid chamber in said body for containing cement slurry, an explosive device in a cavity in said body in pressure communication with said chamber, said chamber being between said device and said port, and means for conducting cement from said chamber to said port, whereby cement may be injected into casing perforations upon detonation of said explosive device.

8. The cementing tool according to claim 7 including a piston between said device cavity and said chamber for displacing fluid from said chamber.

9. The cementing tool according to claim 8 wherein said body includes a tube and a mandrel, said fluid chamber being in said tube, said tube and mandrel being mounted in telescoping relation, means on said tube for temporarily engaging an adjacent body, and means for limiting relative axial movement of said tube and mandrel, said mandrel having means for limiting displacement of said piston away from said device, said tube being urged in an opposite direction from said piston displacement in response to fluid pressure in said cavity, whereby a jar is provided when said engaging means is released while a fluid pressure is present in the cavity.

10. The cementing tool according to claim 9 wherein said head displacing means includes toggle links connecting said cementing head with said upper and lower portions, said toggle links being arranged to displace said head radially outward from said body upon axial displacement of said portions toward each other, said fluid chamber being in said tube, means on said tube for temporarily engaging an adjacent body, said mandrel having means forming a seat limiting displacement of said piston away from said device, said tube having a pressure responsive surface urging said tube in an opposite direction from said piston displacement in response to fluid pressure in said cavity, whereby mandrel being secured to one of said links, whereby gas pressure in said cavity urges said cementing head against said casing perforations when said piston is in engagement with said mandrel seat means.

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