laterally, its shearing risks to be incomplete or with a deformed residual material which does not allow the subsequent closing phase of the well through the sealing element. The passage of the cutting elements provides that the rod is sheared after a complete crushing of the section which only occurs in the central part of the rod.

The area of the tool joint, subjected to the action of the cutting elements, tends to break with reduced crushing and with unforeseeable fracture lines; consequently some metal debris may remain entrapped, blocking the stroke of the shearing elements and thus preventing the closing of the well.

Embodiments of the present invention seek to provide a valve that overcomes the drawbacks of the known art, allowing the well to be closed even after a possible ineffective intervention of the BOPs.

According to embodiments of the present invention, a safety valve for extraction wells of hydrocarbons is provided, which allows the tubular drilling material possibly present in the safety valve to be cut and the closing of the well with a hydraulic-seal.

According to embodiments of the present invention, a safety valve for extraction wells of hydrocarbons is provided, that is capable of exerting the shearing action of the tubular material with a higher capacity than conventional BOPs, considering the worst stress conditions created in correspondence with the wellhead, currently not contemplated by said BOPs. In particular, the safety valve according to embodiments of the invention is capable of severing a wide range of tubular elements in its

interior, among which: casings having an outer diameter preferably ranging from 1” to 20”, with a wall thickness preferably up to about 20 mm, drill pipes having an external diameter preferably ranging from 1” to 10”, with a wall thickness preferably up to about 20 mm and tool joints having an external diameter preferably ranging from 1” to 10”, with a wall thickness preferably up to about 40 mm.

According to a first aspect of the present invention, there is provided a safety valve assembly AV comprising a valve body 2 in which there is a passage duct 24, preferably straight, configured for the passage of a production and/or drilling line designed for containing and transporting, through a tubular element 26, extraction fluids or other fluids to be extracted from an underground reservoir, said valve assembly AV being provided with a punch 4 sliding linearly in a controlled mode along the axis A2 which intersects the longitudinal axis of the tubular element and a counter-punch 3, positioned diametrically opposite to the punch 4, sliding linearly in a controlled mode along said axis A2 which intersects the longitudinal axis of the tubular element the counter-punch 3 is configured so as to have a hollow part suitable for slidingly receiving a section of tubular material of the tubular member and the punch 4 in its interior, in the linear movement during the

shearing operation, wherein the counter-punch is configured so as to create two different shearing planes.

According to a second aspect of the present invention, there is provided an intervention method for closing an extraction well under emergency conditions by closing the valve assembly as defined in the first aspect, comprising the following phases:

- centering the tubular element with respect to the passage duct thanks to the "V"-shaped configuration of the punch and counter-punch;
- incising the tubular element;
- shearing the tubular element;
- withdrawing the engravers;
- removing the tubular section;
- interrupting the flow of fluids through the valve assembly;
- creating a hydraulic-seal inside the valve assembly;
- blocking the closing collar;
- extracting the sheared upper portion of the tubular element from the valve body.

According to a third aspect of the present invention, there is provided an extraction well comprising:

- a cemented anchoring pipe, or in any case anchored or fixed to the seabed or other geological formation in which there is an underground reservoir to be exploited, wherein the pipe is situated close to the surface of the seabed or other geological formation in question;

- a wellhead situated in correspondence with or in the proximity of the first anchoring pipe;
- a safety valve assembly as defined in the first aspect and assembled on the wellhead;
- a tubular element, typically metallic, at least partially contained inside the well and oriented in the same axial direction as the well itself; the tubular element is internally hollow and designed for containing and transporting fluids and other substances extracted through the well, among which hydrocarbons (oil or natural gas), water, sludge, rock debris and/or soil debris.

There is disclosed an extraction well comprising the valve assembly AV object of the present invention, as described hereunder.

There is disclosed a method for managing an extraction well under emergency conditions, comprising the valve assembly AV, as described hereunder.

Further characteristics of the invention are indicated in the dependent claims, which are an integral part of the present description.

The characteristics and advantages of the present invention will appear evident from the following description of a non-limiting embodiment example, with reference to the figures of the enclosed drawings, in which:

- figure 1 is a schematic view of the drilling system comprising the safety valve according to the invention, positioned on an underwater wellhead, and the relative auxiliary systems useful for its functioning;
- figure 2 is an axonometric view with parts of the safety valve in a sectional view, with components removed for the sake of clarity, which shows the valve body, the punch and the counter-punch with the relative actuation mechanisms;
- figure 3 is an axonometric view with parts of the safety valve in a sectional view, with components removed for the sake of clarity, which shows the valve body, the punch and the counter-punch with the relative actuation mechanisms, the incising devices and the relative actuation mechanisms;
- figure 4 is a view with parts of the safety valve in a sectional view, with components removed for the sake of clarity, which shows the valve body, the punch and the counter-punch with the relative actuation mechanisms, the incising devices and the relative

CLAIMS

1. A safety valve assembly comprising a valve body in which there is a passage duct, preferably straight, configured for the passage of a production and/or drilling line designed for containing and transporting, through a tubular element, extraction fluids or other fluids to be extracted from an underground reservoir, the valve assembly being provided with a punch sliding linearly in a controlled mode along the axis (A2) which intersects the longitudinal axis (A1) of the tubular element and a counter-punch, positioned diametrically opposite to the punch, sliding linearly in a controlled mode along the axis which intersects the longitudinal axis of the tubular element the counter-punch being configured so as to have a hollow part suitable for slidingly receiving a section of tubular material of the tubular member and the punch in its interior, in the linear movement during the shearing operation, wherein the counter-punch is configured so as to create two different shearing planes.

2. The valve assembly according to the previous claim 1, wherein the punch and the counter-punch have a "V"-shaped configuration in the part which comes into contact with the tubular element.

3. The valve assembly according to any of the previous claims, wherein the punch and the counter-punch are configured for incising the surface of the tubular element.

4. The valve assembly according to any of the previous claims, wherein at least one engraver for each cutting plane is assembled on the valve, the engravers being configured with cutter-holder bars, preferably having a rectangular section, sliding linearly along axes substantially orthogonal to the axis A1 and lying on incision planes, with cutters being installed on the cutter-holder bars and the valve body being designed with cavities suitable for the passage of the engravers.

5. The valve assembly according to claim 4, wherein the valve assembly is provided with from four to six engravers for each cutting plane, upper and lower, said engravers having a specular arrangement with respect to the plane comprising the axis A1 and the axis A2.

6. The valve assembly according to any of the previous claims, wherein the valve assembly is provided with an upper incision system which incises the surface of the tubular element, said incisions contained in an upper incision plane, parallel to the upper cutting plane (TS), lying above TS at a distance preferably ranging from 0.1 mm to 10 mm from TS measured in the direction of the axis A1.

7. The valve assembly according to any of the previous claims, wherein the valve assembly is provided with a lower incision system which incises the surface of the tubular element, said incisions

contained in a lower incision plane, parallel to the lower cutting plane (TI), lying below TI at a distance preferably ranging from 0.1 mm to 10 mm from TI measured in the direction of the axis A1.

8. The valve assembly according to claims 4 to 7, wherein the engravers can be selectively engaged in the shearing process in a number depending on the diameter of the tubular element that passes through the valve body.

9. The valve assembly according to claims 4 to 8, wherein the engravers effect incisions on the surface of the tubular element, said incisions having a penetration depth preferably ranging from 0.1 mm to 5 mm.

10. The valve assembly according to any of the previous claims, wherein the seals of the stems of the hydraulic pistons are protected from well fluids by means of elastic bellows, preferably metallic or made of PTFE.

11. The valve assembly according to any of the previous claims, wherein it comprises a closing collar, substantially cylindrical, sliding along the axis A1 of the valve body and preferably positioned below the punch.

12. The valve assembly according to any of the previous claims, wherein it comprises two hydraulic chambers positioned between the passage duct and the external surface of the closing collar; said chambers not communicating with each other.

13. The valve assembly according to any of the previous claims, wherein the chambers of the closing collar and the volumes confined by the protection bellows are filled with an inert fluid and kept at the same pressure as the well fluids which pass through the valve body by means of pressure-compensating devices.

14. The valve assembly according to claims 11 to 13, wherein it comprises at least one blocking pin equipped with a spring and corresponding grooves in the closing collar.

15. The valve assembly according to any of the previous claims, wherein a recess is situated in the lower surface of the punch, guaranteeing a correct seat for the closing collar; said recess comprising a sealing gasket.

16. The valve assembly according to any of the previous claims, wherein it comprises a remote power and control system installed at a predefined distance from the well; said remote power and control system being operatively connected to the valve assembly by means of electric and hydraulic connections.

17. An intervention method for closing an extraction well under emergency conditions by closing the valve assembly according to claim 11 when dependent on claim 4 and on claim 2, comprising the following phases:

- centering the tubular element with respect to the passage duct thanks to the "V"-shaped configuration of the punch and counter-punch;
- incising the tubular element;
- shearing the tubular element;
- withdrawing the engravers;
- removing the tubular section;
- interrupting the flow of fluids through the valve assembly;
- creating a hydraulic-seal inside the valve assembly;
- blocking the closing collar;
- extracting the sheared upper portion of the tubular element from the valve body.

18. A method according to claim 17, comprising the following phases for re-opening the extraction well by re-opening the valve assembly

- unblocking the closing collar and opening the hydraulic-seal of the valve assembly;
- moving the closing collar back;
- withdrawing the punch into the initial position, freeing the passage duct.

19. An extraction well comprising:

- a cemented anchoring pipe, or in any case anchored or fixed to the seabed or other geological formation in

which there is an underground reservoir to be exploited, wherein the pipe is situated close to the surface of the seabed or other geological formation in question;

- a wellhead situated in correspondence with or in the proximity of the first anchoring pipe;
- a safety valve assembly having the characteristics according to one or more of claims 1 to 16 and assembled on the wellhead;
- a tubular element, typically metallic, at least partially contained inside the well and oriented in the same axial direction as the well itself; the tubular element is internally hollow and designed for containing and transporting fluids and other substances extracted through the well, among which hydrocarbons (oil or natural gas), water, sludge, rock debris and/or soil debris.

20. The extraction well according to claim 19, also comprising one or more blow-up preventers or other safety valves, assembled above the valve assembly.