Title: BLOWOUT PREVENTER, FLOW REGULATOR AND RECOVERY DEVICE

Abstract: A blowout preventer, flow regulator and recovery device, comprising a lower part or valve (10) that is placed over a well pipe (P), and an upper part having a channel (16) and plates (32) to close it. The large end (15) of the valve is placed over the well pipe through which fluid is flowing out. The small end (13) of the valve is connected to the channel. A sleeve (80) connected to the return pipe (20) is placed over the well pipe. Positioning rings (98, 100 and 102) are attached to a high pressure pipe (24), that can fit inside the well pipe.

FIG. 1
Published:

— with international search report (Art. 21(3))

— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

— with information concerning request for restoration of the right of priority in respect of one or more priority claims (Rules 26bis.3 and 48.2(b)(vii))
BLOWOUT PREVENTER, FLOW REGULATOR AND RECOVERY DEVICE

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

The present invention relates to apparatus and methods for preventing, stopping and/or controlling the escape of oil, gas or other fluid from wells or pipes.

2. DESCRIPTION OF THE PRIOR ART

As shown by recent events in the Gulf of Mexico, oil well blowouts are a serious threat to the environment, and can be very costly. There is a need for reliable devices for recovering from blowouts. None of the prior inventions discussed below are equivalent to the present invention.

U.S. Patent No. 1,543,456 issued on June 23, 1925, to Robert Stirling, discloses a blowout preventer, without the explosive charges and pistons or the Bernoulli effect of the instant invention.

U.S. Patent No. 3,548,848, issued on December 22, 1970, to Gerhardt C. Stichling, discloses explosively actuated valves, but does not disclose their use in a blowout control device, as in the instant invention.

U.S. Patent No. 3,681,923, issued on August 8, 1972, to Winfield H. Hyde, discloses a method and apparatus for controlling subnatant oil seepage, without the use of plates to cut off flow or the Bernoulli effect, as in the instant invention.

U.S. Patent No. 3,745,773, issued on July 17, 1973, to Byron H. Cunningham, discloses a safety off-shore drilling and pumping platform, with a funnel-shaped catchment basin, but
without the use of plates to cut off flow or the Bernoulli effect, as in the instant invention.

U.S. Patent No. 3,766,979, issued on October 23, 1973, to John T. Petrick, discloses a well casing cutter and sealer, but does not disclose pistons moving the plates, as in the instant invention.

U.S. Patent No. 3,980,094, issued on September 14, 1976, to Fritz Schroder and Klaus Rossel, discloses a quick action slide valve with a sliding plate, but does not disclose the pistons moving the plates of the instant invention.

U.S. Patent No. 3,980,138, issued on September 14, 1976, to Duane L. Knopik, discloses an underground fluid recovery device, but does not disclose a funnel that is placed over a pipe from which fluid is escaping, as in the instant invention.

U.S. Patent No. 4,215,749, issued on August 5, 1980, to Roy R. Dare and Jeff L. Merten, discloses a gate valve for shearing workover lines to permit shutting a well, using a shear plate and pistons. The instant invention is distinguishable, in that in it the plates are explosively activated and/or retractable by gears.

U.S. Patent No. 4,220,207, issued on September 2, 1980, to Neil W. Allen, discloses a sea floor diverter, without the use of the Bernoulli effect, as in the instant invention.

U.S. Patent No. 4,301,827, issued on November 24, 1981, to Rajam R. Murthy and Billy J. Rice, discloses a guided-float accumulator suitable for use with a hydraulic system for an oil well blowout preventer, using reaction forces that oppose Bernoulli effect forces, rather than making use of Bernoulli effect forces as in the instant invention.

U.S. Patent No. 4,323,117, issued on April 6, 1982, to Laurance Pierce, discloses a method and means for emergency shearing and sealing of a well casing, with shear ram blades
driven by impellers, but without gears for retraction as in the instant invention.

U.S. Patent No. 4,376,467, issued on March 15, 1983, to Neil W. Allen, discloses a sea floor diverter, without the use of the Bernoulli effect, as in the instant invention.

U.S. Patent No. 4,440,523, issued on April 3, 1984, to Jerome H. Milgram and James Burgess, discloses a separating collector for subsea blowouts, but without air or other fluid being pumped down to create a Bernoulli effect, as in the instant invention.

U.S. Patent No. 4,456,071, issued on June 26, 1984, to Jerome H. Milgram, discloses an oil collector for subsea blowouts, but does not disclose the use of gear-movable plates or the Bernoulli effect, as in the instant invention.

U.S. Patent No. 4,523,639, issued on June 18, 1985, to Roland M. Howard, Jr., discloses ram-type blowout preventers, with a piston and a locking mechanism to hold the plate in the channel after the pipe has been cut, but does not disclose a flange to limit motion of the piston, as in the instant invention.

U.S. Patent No. 4,531,860, issued on July 30, 1985, to Eugene R. Barnett, discloses a deep sea oil salvage means, with a large flexible sleeve, but without the use of the Bernoulli effect as in the instant invention.

U.S. Patent No. 4,568,220, issued on February 4, 1986, to John J. Hickey, discloses a system for capping and/or controlling undersea oil or gas well blowouts, but without the use of the Bernoulli effect, as in the instant invention.

U.S. Patent No. 4,605,069, issued on August 12, 1986, to McClain et al., discloses a method for producing heavy, viscous crude oil, but it is not a blowout recovery device, as is the instant invention.
U.S. Patent No. 4,619,284, issued on October 28, 1986, to Jean-Jacques Delarue and Claude Ego, discloses a pyrotechnic valve that may either close an initially open pipe or open an initially closed pipe, but does not disclose its use in a blowout control device, as in the instant invention.

U.S. Patent No. 4,790,936, issued on December 13, 1988, to John L. Renfrow, discloses a collapsible oil spillage recovery system, without the use of the Bernoulli effect, as in the instant invention.

U.S. Patent No. 4,969,676, issued on November 13, 1990, to Joseph L. LaMagna, discloses an air pressure pick-up tool using the Bernoulli effect, but it is not a blowout recovery device, as is the instant invention.

U.S. Patent No. 5,012,854, issued on May 7, 1991, to John A. Bond, discloses a pressure release valve for a subsea blowout preventer that is hydraulically operated, without making use of the Bernoulli effect, nor disclosing that the plates are explosively activated and/or retractable by gears, as in the instant invention.

U.S. Patent No. 5,064,164, issued on November 12, 1991, to Tri C. Le, discloses a blowout preventer with metal inserts resembling the plates in the instant invention, but does not disclose explosive actuation or movement of the plates by gears, as in the instant invention.

U.S. Patent No. 5,156,212, issued on October 20, 1992, to Thomas B. Bryant, discloses a method and system for controlling high pressure flow, such as in containment of oil and gas well fires, but does not disclose pistons whose movement is limited by flanges, as in the instant invention.

U.S. Patent No. 5,199,496, issued on April 6, 1993, to Clifford L. Redus and Peter L. Sigwardt, discloses a subsea pumping device incorporating a wellhead aspirator, using the Bernoulli effect, but does not disclose a funnel placed over
a pipe from which fluid is escaping, as in the instant invention.

U.S. Patent No. 5,213,444, issued on May 25, 1993, to Carl D. Henning, discloses an oil/gas collector/separator for underwater oil leaks, but does not disclose the use of the Bernoullii effect, as in the instant invention.

U.S. Patent No. 5,735,502, issued on April 7, 1998, to Bryce A. Levett and Mike C. Nicholson, discloses a blowout preventer with ram blocks resembling the plates in the instant invention, and is hydraulically actuated. The instant invention is distinguishable in that it has pistons whose movement is limited by flanges.

U.S. Patent No. 6,026,904, issued on February 22, 2000, to James A. Burd and Kenneth J. Huber, discloses a method and apparatus for commingling and producing fluids from multiple production reservoirs, but it is not a blowout recovery device, as is the instant invention.

U.S. Patent No. 6,059,040, issued on May 9, 2000, to Leonid L. Levitan, Vasily V. Salygin and Vladimir D. Yurchenko, discloses a method and apparatus for the withdrawal of liquid from wellbores, but unlike the instant invention, it is not a blowout recovery device.

U.S. Patent No. 6,119,779, issued on September 19, 2000, to Larry Joe Gipson and Stephen Leon Carn, discloses a method and system for separating and disposing of solids from produced fluids, but unlike the instant invention, it is not a blowout recovery device.

U.S. Patent No. 6,125,928, issued on October 3, 2000, to Tarmo Ninivaara, Tero Hurtta and Juhani Ninivaara, discloses a system for controlling and stopping oil drilling fires, including drilling through a pipe wall, but without the use of plates moved by gears, as in the instant invention.
U.S. Patent No. 6,244,560, issued on June 12, 2001, to Chris Dale Johnson, discloses a blowout preventer ram actuating mechanism, with pistons and a hydraulic booster, but without movement of the ram by gears, as in the instant invention.

U.S. Patent No. 6,354,568, issued on March 12, 2002, to Alec Carruthers, discloses a sliding plate valve, but does not disclose pistons whose movement is limited by flanges, as in the instant invention.

U.S. Patent No. 6,601,888, issued on August 5, 2003, to Lon Mcllwraith and Andrew Christie, discloses contactless handling of objects, using the Bernoulli effect, but unlike the instant invention, it is not a blowout preventer.

U.S. Patent No. 6,739,570, issued on May 25, 2004, to Hans-Paul Carlsen, discloses a valve element, which may be used for closing a channel in a blowout preventer, but does not disclose pistons whose movement is limited by flanges, as in the instant invention.

U.S. Patent No. 7,243,713, issued on July 17, 2007, to C. Steven Isaacks, discloses a shear/seal assembly for a ram-type blowout prevention system. The instant invention is distinguishable, in that it discloses plates that are explosively activated and/or retractable by gears.

U.S. Patent No. 7,367,396, issued on May 6, 2008, to Frank Benjamin Springett and James D. Brugman, discloses blowout preventers and methods of use, that sever wellbore tubulars, but not the use of gears for moving plates, as in the instant invention.

U.S. Patent No. 7,814,979, issued on October 19, 2010, to Frank Benjamin Springett and James D. Brugman, discloses blowout preventors and methods of use, but not the use of gears for moving plates, as in the instant invention.

containing oil from a deep water oil well, but does not disclose the use of the Bernoulli effect, as in the instant invention.

U.S. Patent No. 8,016,030, issued on September 13, 2011, to Jose Jorge Prado Garcia, discloses an apparatus and method for containing oil from a deep water oil well, but does not disclose the use of the Bernoulli effect, as in the instant invention.

U.S. Patent No. 8,066,070, issued on November 29, 2011, to Frank Benjamin Springett and James Dennis Brugman, discloses blowout preventers and methods of use, that sever wellbore tubulars, but not the use of gears for moving plates, as in the instant invention.

U.S. Patent No. 8,434,558, issued on May 7, 2013, to Aaron R. Swanson, James P. Dwyer and Todd J. Talbot, discloses a system and method for containing borehole fluid, but does not disclose plates moved by gears, as in the instant invention.

U.S. Patent Application Publication No. 2009/0050828, published on February 26, 2009, to Jeffrey Charles Edwards, discloses blowout preventers with a housing having a throughbore resembling the channel in the instant invention, which may be closed by a pair of opposed rams, but does not disclose limitation of movement by flanges, explosive actuation, or movement by gears, as in the instant invention.

U.S. Patent Application Publication No. 2010/0171331, published on July 8, 2010, to Stefan Jonas and Lutz Redmann, discloses a Bernoulli gripper for holding two-dimensional components such as silicon-based wafers, but it is not a blowout recovery device, as is the instant invention.

U.S. Patent Application Publication No. 2013/0206421, published on August 15, 2013, to Giambattista De Ghetto and Paolo Andreussi, discloses equipment for the conveying and recovery of hydrocarbons from an underwater well, but does not
disclose the use of a sleeve that fits over a well pipe or the use of positioning rings, as in the instant invention.

U.S. Patent No. 8,205,678, issued on June 26, 2012, U.S. Patent No. 8,418,767, issued on April 16, 2013, and U.S. Patent No. 8,555,979, issued on October 15, 2013, all to Philip John Milanovich, the inventor and applicant herein, all disclose a blowout preventer with a Bernoulli Effect Suck-Down Valve. The instant invention is distinguishable, in that it includes a sleeve that is placed over the open end of the well pipe, and positioning rings attached to the high pressure pipe.

U.S. Patent No. 8,316,872, issued on November 27, 2012, and U.S. Patent No. 8,567,427, issued on October 29, 2013, both to Philip John Milanovich, the inventor and applicant herein, disclose blowout preventers using plates propelled by explosive charges. The instant invention is distinguishable, in that in it the plates are moved by pistons, whose movement is limited by flanges.

British Patent No. 2 175 328, published on November 26, 1986, to Richard Theodore Mitchell, discloses an oil well drilling apparatus, including a blowout preventer stack, without the use of explosive charges, or movement of the plates by pistons moved by gears, as in the instant invention.

Canadian Patent No. 2 506 828, published on October 29, 2006, inventors Dean Foote and Scott Delbridge, discloses a blowout preventer with rams that are hydraulically rather than explosively actuated, or moved by pistons moved by gears, as in the instant invention.


None of the above inventions and patents, taken either singly or in combination, is seen to describe the instant
invention as claimed.

SUMMARY OF THE INVENTION

The present invention is a combined blowout preventer and recovery device, having an upper part and a lower part. The lower part includes a large frustoconical funnel or valve, made of metal or other suitable material. The large end of the funnel is placed over a well pipe through which oil (or natural gas or other fluid) is flowing out. The small end of the valve is connected to a return pipe. A high pressure (air separating) pipe with a smaller diameter is inserted into the well pipe. Air is pumped under high pressure through the high pressure pipe, separating the oil and forcing the oil that is not kept down in the well pipe by the pressure up through the return pipe. A sleeve is suitably dimensioned and configured to be placed over a portion of the well pipe adjacent to the open end of the well pipe, with the sleeve being connected to the return pipe. A locking collar is attached to the sleeve. Cylindrical positioning rings are attached to the high pressure pipe, can fit inside the well pipe, and may have different diameters, heights and shapes, to help position the valve, funnel and sleeve onto the well pipe. A sharp edge extends from the sleeve, by which irregularities in the well pipe can be cut. Lasers or other cutting devices attached to extension arms, that can also cut irregularities in the well pipe. Grinders can remove cement or other material from the well pipe. The slope of the funnel can be changed. The funnel and/or valve can be removed and raised to the surface with the aid of floats.

The upper part includes one or more blocks (made of metal, concrete or other suitable material), having a cylindrical channel. The return pipe is connected to the channel in the
blocks. The oil (or other fluid) will initially flow through the channel. Alongside the channel are one or more circular plates, having diameters somewhat larger than the diameter of the channel. One or more pistons are attached to each of the plates. Explosive charges, or other means of movement, move the pistons, which move the plates. There is a passage in the blocks for each of the pistons, the passage having a narrow portion adjacent to the channel and a wide portion away from the channel. A flange on each piston, on an end of the piston opposite the plate to which it is attached, prevents the end of the piston from moving into the narrow portion of the passage, thus limiting the movement of the plate to which the piston is attached. There may be a plurality of pistons attached to each plate, and varying lengths of the pistons, and/or of the narrow and wide portions of the passages, can cause the plates to move varying distances. Gears having teeth can engage teeth on the pistons to move the plates out from the channel after the explosive charge has been fired. The plates may be moved out from the channel part way or all the way. The gears may also be an alternative means for moving the plates into the channel, either part way or all the way.

The upper and lower parts are claimed both in combination and separately as independent inventions.

Accordingly, it is a first object of the invention to provide a blowout preventer and recovery device, that combines ease of attachment to a well pipe in its lower part, with means for securely shutting off or controlling flow in its upper part.

It is a second object of the invention to prevent damage to the environment from oil well blowouts.

It is a third object of the invention to prevent economic loss from oil well blowouts.
It is a fourth object of the invention to prevent damage to the environment from any kind of fluid escaping from a pipe.

It is a fifth object of the invention to prevent economic loss from any kind of fluid escaping from a pipe.

It is a sixth object of the invention to create a safer environment for any fluid carrying pipe or pipe-like structure.

It is a seventh object of the invention to provide a control or shutoff mechanism that can be reopened.

It is an eighth object of the invention to provide a control or shutoff mechanism that can be repeatedly opened and shut.

It is a ninth object of the invention to provide an apparatus and method that is compatible with other blowout preventers and recovery devices.

It is a tenth object of the invention to provide a blowout preventer and recovery device that is manageable in size, weight and configuration.

It is an eleventh object of the invention to provide a blowout preventer and recovery device that can be sized appropriately to its need and usage.

It is a twelfth object of the invention to provide a blowout preventer and recovery device that can be used initially or retrofitted.

It is a thirteenth object of the invention to provide a blowout preventer and recovery device that has an immediate response time, thus saving lives and investment.

It is a fourteenth object of the invention to provide a blowout preventer and recovery device that has a shorter activation time than the prior art.

It is a fifteenth object of the invention to provide a blowout preventer and recovery device using plates, wherein if some plates are defective, they can be drilled through, and it will still be effective because of a multiple plate design.
It is a sixteenth object of the invention to provide a blowout preventer and recovery device, wherein stacking of plates gives multiple options for control.

It is a seventeenth object of the invention to provide a blowout preventer and recovery device that is easy to install or replace.

It is a seventeenth object of the invention to provide a means for fitting oil or gas wells with flow regulators to control and/or resume the flow of oil or gas.

It is an eighteenth object of the invention to provide a blowout preventer and recovery device that has moving parts.

It is an eighteenth object of the invention to provide a means for fitting oil or gas wells with flow regulators to control and/or resume the flow of oil or gas.

It is an eighteenth object of the invention to provide a blowout preventer and recovery device that is removable and recoverable.

It is a twentieth object of the invention to provide a blowout preventer and recovery device with a removable and recoverable funnel.

It is a twenty-first object of the invention to provide a blowout preventer and recovery device that does not leave the well site.

It is a twenty-second object of the invention to provide a blowout preventer and recovery device that is usable in deep water, in shallow water, and on land.

It is a twenty-third object of the invention to provide a blowout preventer and recovery device that is safer to use than existing blowout recovery devices.

It is an twenty-fourth object of the invention to provide a blowout preventer and recovery device that is more controllable.

It is a twenty-fifth object of the invention to provide a blowout preventer and recovery device that is movable in all directions in three dimensions.
It is a twenty-sixth object of the invention to provide a blowout preventer and recovery device that is more environmentally friendly and limits the environmental impact of blowouts.

It is a twenty-seventh object of the invention to provide a blowout preventer and recovery device with a lock-on collar.

It is a twenty-eighth object of the invention to provide a blowout preventer and recovery device with a collar that is adjustable and removable.

It is a twenty-ninth object of the invention to provide a blowout preventer and recovery device with considerably less mass and weight.

It is a thirtieth object of the invention to provide a blowout preventer and recovery device with considerably less height and width.

It is a thirty-first object of the invention to provide a blowout preventer and recovery device that is easy to ship and handle.

It is a thirty-second object of the invention to provide a blowout preventer and recovery device that is reusable.

It is a thirty-third object of the invention to align the funnel and valve using cylindrical positioning rings.

It is an thirty-fourth object of the invention to provide a blowout preventer and recovery device that limits liability.

It is a thirty-fifth object of the invention to provide a blowout recovery valve that is more cost effective.

It is a thirty-sixth object of the invention to provide a blowout preventer and recovery device having a funnel with a floatation system that can cause it to float to the surface of a body of water.

It is a thirty-seventh object of the invention to provide a blowout preventer and recovery device having a funnel that can be flattened out.
It is a thirty-eighth object of the invention to provide a blowout preventer and recovery device with a jointed and seamed funnel.

It is an object of the invention to provide improved elements and arrangements thereof in an apparatus for the purposes described which is relatively inexpensive, dependable and fully effective in accomplishing its intended purposes.

These and other objects of the present invention will become readily apparent upon further review of the following specification and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical sectional view of the first preferred embodiment of the invention.

FIG. 2 is a vertical sectional detail view of a block having two plates in the first preferred embodiment of the invention.

FIG. 3 is a vertical sectional detail view, along lines 3-3 in FIG. 7, of a block having one plate in the first preferred embodiment of the invention, before the explosive charge is fired.

FIG. 4 is a vertical sectional detail view, along lines 4-4 in FIG. 8, of a block having one plate in the first preferred embodiment of the invention, after the explosive charge has been fired.

FIG. 5 is a vertical sectional detail view, along lines 5-5 in FIG. 9, of a block having one plate in the first preferred embodiment of the invention, showing the plate covering two-thirds of the channel.

FIG. 6 is a vertical sectional detail view, along lines 6-6 in FIG. 10, of a block having one plate in the first preferred embodiment of the invention, showing the plate covering one-third of the channel.
FIG. 7 is a horizontal sectional detail view, along lines 7-7 in FIG. 3, of a block having one plate in the first preferred embodiment of the invention, before the explosive charge is fired.

FIG. 8 is a horizontal sectional detail view, along lines 8-8 in FIG. 4, of a block having one plate in the first preferred embodiment of the invention, after the explosive charge has been fired.

FIG. 9 is a horizontal sectional detail view, along lines 9-9 in FIG. 5, of a block having one plate in the first preferred embodiment of the invention, showing the plate covering two-thirds of the channel.

FIG. 10 is a horizontal sectional detail view, along lines 10-10 in FIG. 6, of a block having one plate in the first preferred embodiment of the invention, showing the plate covering one-third of the channel.

FIG. 11 is a vertical sectional detail view, along lines 11-11 in FIG. 14, of the lower portion of the first preferred embodiment of the invention, showing the funnel in a lowered position.

FIG. 12 is a vertical sectional detail of the lower portion of the first preferred embodiment of the invention, showing the funnel in a raised position.

FIG. 13 is a vertical sectional detail of the lower portion of the first preferred embodiment of the invention, with the funnel having been removed.

FIG. 14 is a horizontal sectional detail view, along lines 14-14 in FIG. 11, of the lower portion of the first preferred embodiment of the invention, showing the funnel in a lowered position.

FIG. 15 is a horizontal sectional detail view, along lines 15-15 in FIG. 12, of the lower portion of the first preferred embodiment of the invention, showing the funnel in a raised position.
FIG. 16 is a horizontal sectional detail view, along lines 16-16 in FIG. 11, of the lower portion of the first preferred embodiment of the invention.

FIG. 17 is a top detail view of the well pipe with the cylindrical positioning rings inserted, in the first preferred embodiment of the invention.

FIG. 18 is a top detail view of the largest positioning ring, in the first preferred embodiment of the invention.

FIG. 19 is a top detail view of the middle positioning ring, in the first preferred embodiment of the invention.

FIG. 20 is a top detail view of the smallest positioning ring, in the second preferred embodiment of the invention.

FIG. 21 is a vertical sectional view drawn along lines 21-21 of FIG. 23 of the second preferred embodiment of the invention, showing the position of the plate before the explosive charge has been fired.

FIG. 22 is a vertical sectional view drawn along lines 22-22 of FIG. 24 of the second preferred embodiment of the invention, showing the position of the plate after the explosive charge has been fired.

FIG. 23 is a horizontal sectional view drawn along lines 23-23 of FIG. 21 of the second preferred embodiment of the invention, showing the position of the plate before the explosive charge has been fired.

FIG. 24 is a horizontal sectional view drawn along lines 24-24 of FIG. 22 of the second preferred embodiment of the invention, showing the position of the plate after the explosive charge has been fired.

FIG. 25 is a vertical sectional view drawn along lines 25-25 of FIG. 27 of the third preferred embodiment of the invention, showing the position of the plate before the explosive charge has been fired.
FIG. 26 is a vertical sectional view drawn along lines 26-26 of FIG. 28 of the third preferred embodiment of the invention, showing the position of the plate after the explosive charge has been fired.

FIG. 27 is a horizontal sectional view drawn along lines 27-27 of FIG. 25 of the third preferred embodiment of the invention, showing the position of the plate before the explosive charge has been fired.

FIG. 28 is a horizontal sectional view drawn along lines 28-28 of FIG. 26 of the third preferred embodiment of the invention, showing the position of the plate after the explosive charge has been fired.

FIG. 29 is a vertical sectional view of the second preferred embodiment of the invention, showing the plate after it has been drilled through to reopen the pipe.

FIG. 30 is a vertical sectional view of the second preferred embodiment of the invention, showing a block with two plates.

FIG. 31 is a vertical sectional view of the second preferred embodiment of the invention, showing three blocks on a pipe.

FIG. 32 is a vertical sectional view drawn along lines 32-32 of FIG. 36 of the fourth preferred embodiment of the invention, showing the position of the plate before any explosive charge has been fired.

FIG. 33 is a vertical sectional view drawn along lines 33-33 of FIG. 37 of the fourth preferred embodiment of the invention, showing the position of the plate after the explosive charge for the piston has been fired.

FIG. 34 is a vertical sectional view drawn along lines 34-34 of FIG. 38 of the fourth preferred embodiment of the invention, showing the position of the plate after it has been retracted to cover two-thirds of the channel.

FIG. 35 is a vertical sectional view drawn along lines 35-35 of FIG. 39 of the fourth preferred embodiment of the
invention, showing the position of the plate after it has been
retracted to cover one-third of the channel.

FIG. 36 is a horizontal sectional view drawn along lines 36-
36 of FIG. 32 of the fourth preferred embodiment of the
invention, showing the position of the plate before any
explosive charge has been fired.

FIG. 37 is a horizontal sectional view drawn along lines 37-
37 of FIG. 33 of the fourth preferred embodiment of the
invention, showing the position of the plate after the
explosive charge for the piston has been fired.

FIG. 38 is a horizontal sectional view drawn along lines 38-
38 of FIG. 34 of the fourth preferred embodiment of the
invention, showing the position of the plate after it has been
retracted to cover two-thirds of the channel.

FIG. 39 is a horizontal sectional view drawn along lines 39-
39 of FIG. 35 of the fourth preferred embodiment of the
invention, showing the position of the plate after it has been
retracted to cover one-third of the channel.

FIG. 40 is a vertical sectional view of the fourth preferred
embodiment of the invention, showing a block with two plates.

FIG. 41 is a vertical sectional view of the fourth preferred
embodiment of the invention, showing three blocks
connected by pipes.

FIG. 42 is a vertical sectional view drawn along lines 42-42
of FIG. 44, showing the fifth preferred embodiment of the
invention before the valve is sucked down onto the pipe from
which the first fluid is escaping.

FIG. 43 is a vertical sectional view drawn along lines 42-42
of FIG. 44, showing the fifth preferred embodiment of the
invention after the valve is sucked down onto the pipe from
which the first fluid was escaping.

FIG. 44 is a horizontal sectional view drawn along lines 44-
44 of FIG. 42, showing the fifth preferred embodiment of the
invention.

FIG. 45 is a vertical sectional view drawn along lines 45-45 of FIG. 47, showing the sixth preferred embodiment of the invention before the valve is sucked down onto the pipe from which the first fluid is escaping.

FIG. 46 is a vertical sectional view drawn along lines 46-46 of FIG. 47, showing the sixth preferred embodiment of the invention after the valve is sucked down onto the pipe from which the first fluid was escaping.

FIG. 47 is a horizontal sectional view drawn along lines 47-47 of FIG. 45, showing the sixth preferred embodiment of the invention.

FIG. 48 is a vertical sectional view of the seventh preferred embodiment of the invention.

FIG. 49 is a vertical sectional view of the eighth preferred embodiment of the invention.

FIG. 50 is a vertical sectional view drawn along lines 50-50 of FIG. 52, showing the ninth preferred embodiment of the invention before the valve is sucked down onto the pipe from which the first fluid is escaping.

FIG. 51 is a vertical sectional view drawn along lines 42-42 of FIG. 44, showing the ninth preferred embodiment of the invention after the valve is sucked down onto the pipe from which the first fluid was escaping.

FIG. 52 is a horizontal sectional view drawn along lines 44-44 of FIG. 42, showing the ninth preferred embodiment of the invention.

FIG. 53 is a detail view of the second gasket of the ninth preferred embodiment of the invention in an open position.

FIG. 54 is a detail view of the second gasket of the ninth preferred embodiment of the invention in a closed position.

FIG. 55 is a vertical sectional view drawn along lines 57-57 of FIG. 57, showing the tenth preferred embodiment of the
invention before the valve is sucked down onto the pipe from which the first fluid is escaping.

FIG. 56 is a vertical sectional view drawn along lines 55-55 of FIG. 57, showing the tenth preferred embodiment of the invention after the valve is sucked down onto the pipe from which the first fluid was escaping.

FIG. 57 is a horizontal sectional view drawn along lines 56-56 of FIG. 54, showing the tenth preferred embodiment of the invention.

FIG. 58 is a vertical sectional view drawn along lines 58-58 of FIG. 61, showing the eleventh preferred embodiment of the invention before the valve and sleeve are lowered down onto the well pipe.

FIG. 59 is a vertical sectional view, showing the eleventh preferred embodiment of the invention after the valve and sleeve are lowered down onto the well pipe.

FIG. 60 is a vertical sectional, showing the eleventh preferred embodiment of the invention after the valve and sleeve are lowered down onto the well pipe, and the funnel has been removed.

FIG. 61 is a horizontal sectional view drawn along lines 61-61 of FIG. 58, showing the eleventh preferred embodiment of the invention, with the funnel in a lowered position.

FIG. 62 is a horizontal sectional view drawn along lines 62-62 of FIG. 59, showing the eleventh preferred embodiment of the invention, with the funnel in a raised position.

FIG. 63 is a horizontal sectional view drawn along lines 63-63 of FIG. 58, showing the eleventh preferred embodiment of the invention.

FIG. 64 is a top detail view of the well pipe with the cylindrical positioning rings inserted, in the eleventh preferred embodiment of the invention.
FIG. 65 is a top detail view of the largest positioning ring, in the eleventh preferred embodiment of the invention. FIG. 66 is a top detail view of the middle positioning ring, in the eleventh preferred embodiment of the invention. FIG. 67 is a top detail view of the smallest positioning ring, in the eleventh preferred embodiment of the invention.

Similar reference characters denote corresponding features consistently throughout the attached drawings.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention is a blowout preventer and recovery device, that may be used with well pipes from which oil, gas or other fluid is flowing, under a body of water or on land. It combines a lower part that is attached to the well pipe, and an upper part that shuts off or limits the flow.

FIG. 1 is a vertical sectional view of the first preferred embodiment of the invention, showing the lower part 10 of the invention as it is about to be lowered onto a well pipe. The upper part 12 of the invention comprises blocks 14 with channels 16 that are connected by middle return pipes 18. A lower return pipe 20 connects the lower part of the invention to the channel in the lowest block in the upper part of the invention. An upper return pipe 22 extends from the channel in the highest block. A high pressure pipe 24 extends alongside the block, through the lower return pipe into the lower part of the invention. The high pressure pipe is retained by braces 26 a suitable distance from the explosive charges 28 that propel the pistons 30 that propel the plates 32 across the channels. Any number of the blocks may be stacked in a "Christmas tree". The blocks may be directly attached without middle pipes. There may be no upper pipe. Alternatively, a well pipe may pass through the channel, in
which case the plate must be capable of cutting through it.

FIG. 2 is a vertical sectional detail view of a block 14 having two plates 32 in the first preferred embodiment of the invention. The two plates will enter the channel 16 from different directions when the explosive charges 28 are fired. Blocks may also have three or more plates. Plates may enter the channel from any number of different directions.

FIG. 3 is a vertical sectional detail view, along lines 3-3 in FIG. 7, of a block having one plate in the first preferred embodiment of the invention, showing the position of the plate 32 before the explosive charge 28 in the chamber 34 has been fired by the receiver/ignitor 36. The receiver/ignitor may be activated by radio waves, laser, sound, electricity, or any other suitable means. The piston 30 ends in a flange 38, and is attached to the plate 12 at its opposite end. The piston is propelled by the explosive charge and propels the plate. (Alternatively, the piston and plate may be propelled by hydraulic, pneumatic, mechanical or electrical means, or by any other suitable means.) The piston and plate move in a passage having a wider portion 40 and a narrower portion 42. The flange prevents the end of the piston from moving into the narrow portion of the passage, thus limiting the movement of the plate to which the piston is attached. Two or more pistons may be attached to each plate. The distance that pistons move the plates may be varied by the length of the pistons and/or the lengths of the wider and narrower portions of the passages. When there is more than one piston attached to a plate, the other pistons and their charges may serve as backups if a charge fails. (The movement of the plate may also be limited by the upper front edge 44 and lower front edge 46 engaging the female element 48, with sloping lower edge 50, on the opposite side of the channel 16.)
The gear 52 has teeth 54 that can engage teeth 56 on the underside of the piston, to move the plate completely or partially out from the channel 16. (The gear may also be used as an alternative to the explosive charge, to move the plate completely or partially into the channel. Alternatively, the plates can be drilled through to reopen the channel.) The block 14 is connected to middle return pipes 18. Oil, gas or other fluid can flow though channel 16. There may be screw threads 58 on the pipes near ends 60 of the channel. Gases produced when the explosive charge is ignited can pass through vent 62 and one-way valve 64 into the channel.

FIG. 4 is a vertical sectional detail view, along lines 4-4 in FIG. 8, of a block having one plate in the first preferred embodiment of the invention, showing the position of the plate after the explosive charge for the piston has been fired, in which it is completely blocking the channel to prevent any fluid from passing through it. FIG. 5 is a vertical sectional detail view, along lines 5-5 in FIG. 9, of a block having one plate in the preferred embodiment of the invention, showing the position of the plate after it has been retracted to cover two-thirds of the channel, thus reducing and regulating the flow of oil or other fluid, but not completely blocking it. FIG. 6 is a vertical sectional detail view, along lines 6-6 in FIG. 10, of a block having one plate in the preferred embodiment of the invention, showing the position of the plate after it has been retracted to cover one-third of the channel, allowing greater flow, but still reducing it. The gear may be rotated by a motor or other suitable means. The gear may be lowered so as not to impede the movement of the piston and plate when the explosive charge is fired, and raised to mesh with the teeth in the piston.

FIG. 7 is a horizontal sectional detail view, along lines 7-7 in FIG. 3, of a block having one plate in the first
preferred embodiment of the invention, showing the position of the plate before any explosive charge has been fired. The portion of the passage 66 in which the plate moves may be wider horizontally, even it is the same height vertically as the portion of the narrower passage 42 in which only the piston moves. Grooves 68 in the plate and grooves 70 in the female element allow fluid to escape so that it does not impede the movement of the plate.

FIG. 8 is a horizontal sectional detail view, along lines 8-8 in FIG. 4, of a block having one plate in the first preferred embodiment of the invention, showing the position of the plate after the explosive charge for the piston has been fired. FIG. 9 is a horizontal sectional detail view, along lines 9-9 in FIG. 5, of a block having one plate in the preferred embodiment of the invention, showing the position of the plate after it has been retracted to cover two-thirds of the channel. FIG. 10 is a horizontal sectional detail view, along lines 10-10 in FIG. 6, of a block having one plate in the preferred embodiment of the invention, showing the position of the plate after it has been retracted to cover one-third of the channel.

Which plates have been activated may be indicated by displayed numbers, colors or indentations. The invention may be monitored visually on site or remotely by television, radio, wired connections, or any other suitable means. The movement of the gears and pistons may be measured and calibrated. The plates and pistons may be made of metal, high impact plastic or glass, or any other suitable material.

FIG. 11 is a vertical sectional detail view, along lines 11-11 in FIG. 14, of the lower portion of the first preferred embodiment of the invention, showing the funnel in a lowered position. A sleeve 80 is suitably dimensioned and configured to be placed over a portion of the well pipe P adjacent to the
open end E of the well pipe, with the sleeve being connected to the return pipe 20. The sleeve is shown above the well pipe, before it is placed over it, and before the funnel 11 is sucked down onto the well pipe P from which a first fluid (such as petroleum) is escaping. The funnel has a hollow frustoconical shape, and has a smaller end 13 and a larger end 15 that is suitably dimensioned and configured to be placed over the well pipe. The lower return pipe 20 is connected to the smaller end of the funnel. The high pressure pipe 24 passes through the return pipe and the funnel, and is suitably dimensioned and configured to be inserted into the well pipe P. A second fluid (such as air) is pumped through the high pressure pipe at a pressure greater than that of the first fluid, causing the first fluid to be separated by the second fluid in a space S adjacent to an end of the high pressure pipe that has been inserted into the pipe through which the first fluid is escaping. A portion of the first fluid that is not held back by the greater pressure of the second fluid will flow through the valve and the return pipe at an accelerated velocity, but at a reduced pressure due to the Bernoulli effect, thus helping to suck the valve down onto the well pipe P.

FIG. 12 is a vertical sectional detail of the lower portion of the first preferred embodiment of the invention, showing the funnel 11 in a raised position, and the sleeve surrounding the top portion of the well pipe, after the valve is sucked down onto the well pipe P from which the first fluid was escaping. A first gasket 21 within the valve prevents the first and second fluids from leaking out between the valve and the well pipe P. Inside the valve, adjacent to its smaller end, there are channels 23 to further accelerate the flow of the first and second fluids toward the return pipe. (The channels may be small pipes.) Adjacent to the smaller end of
the valve there is a turbine comprising blades 25 driven by motor 27, that can rotate to further accelerate the flow of the first and second fluids through the return pipe. A portion of the first fluid (e.g., oil) that is not held back by the greater pressure of the second fluid (e.g., air) will flow through the sleeve and then the return pipe. The sleeve may have two or more telescoping segments, or it may be in one piece without moving parts. The sleeve may be made of a rigid material with a fixed diameter, or of a flexible material with a variable diameter. Preferably, the sleeve has an interior surface 88 that can grip an exterior surface of the well pipe.

FIG. 13 is a vertical sectional detail of the lower portion of the preferred embodiment of the invention, with the funnel having been removed. Grinding devices 120 attached to the extension arms 110 can remove cement or other material from the well pipe, so that the sleeve can fit over it. One or more cutting devices 108 are attached to the extension arms, that can cut the well pipe. Preferably, the extension arms are moveable, and the grinding and cutting devices can rotate around the well pipe. The cutting devices may be lasers, electric saws, pneumatic or hydraulic cutters, or any other suitable means for neatly cutting the well pipe, so that bent or ruptured portions of the well pipe can be removed, to allow the invention to be attached to an intact portion of the well pipe. Preferably, a sharp edge 94 extends from a lower rim 96 of the sleeve, by which irregularities in the well pipe can be cut.

FIG. 14 is a horizontal sectional detail view, along lines 14-14 in FIG. 11, of the lower portion of the first preferred embodiment of the invention, showing the funnel in a lowered position. FIG. 15 is a horizontal sectional detail view, along lines 15-15 in FIG. 12, of the lower portion of the preferred embodiment of the invention, showing the funnel in
a raised position.

The slope between the smaller end 13 and the larger end 15 of the funnel 11 can be adjusted. The funnel is shown in a lowered position in FIGS. 11 and 14, and in a raised position in FIGS. 12 and 15. (The possible positions of the funnel are not limited to the two positions shown.) The funnel is comprised of leaves (114 in FIGS. 14 and 15) that are pivotally connected by joints (116 in FIGS. 11 and 12) to the return pipe 16. The seams 118 are closed when the funnel is in a lowered position (as in FIG. 14) and separated when the funnel is in a raised position (as in FIG. 15). The funnel can be removed and raised to the surface of a body of liquid with the aid of floats 112 attached to the funnel. The leaves may be released from the joints by mechanical means, by an explosive charge, or by any other suitable means. The funnel can be reused after it is separated. The floats may be permanently buoyant, or inflated when needed.

FIG. 16 is a horizontal sectional detail view, along lines 16-16 in FIG. 11, of the lower portion of the first preferred embodiment of the invention. A locking collar 82, attached to the sleeve, can lock the sleeve around the portion of the well pipe adjacent to the open end of the well pipe. A power source 84 for locking the locking collar using bolts 120 can apply sufficient force to pierce the well pipe and lock the locking collar onto the well pipe using attachment members 86, without causing the well pipe to collapse. Preferably, the sleeve and the locking collar are generally cylindrical. The attachment members preferably are evenly spaced around the locking collar. Preferably, there are one or more pressure sensors 90 and an alerting system 92 that is activated when the pressure sensors detect excessive pressure of the sleeve against the well pipe, to prevent the well pipe from being collapsed. The connection between the sensors and the
alerting system may be wired or wireless. Alerts may be audible, visible, etc.

One or more positioning rings (98, 100 and 102 in FIGS. 11-13) are attached to the high pressure pipe 24, that can fit inside the well pipe P. Preferably, there are a plurality of the positioning rings, that are attached by arms (104 in FIGS. 17-20) to the high pressure pipe, with the diameters of the rings increasing with their distance from an open end of the high pressure pipe. Preferably, the positioning rings are generally cylindrical. The positioning ring 98 at the greatest distance from the open end of the high pressure pipe has a beveled lower rim (106 in FIGS. 11-13). This ring preferably has an outside diameter at or just under the inside diameter of the well pipe. The main purpose of the positioning rings is to make it easier to correctly position the funnel and sleeve over the well pipe, but they can also contribute to the Bernoulli effect. FIG. 17 is a top detail view of the well pipe P with the cylindrical positioning rings inserted, in the first preferred embodiment of the invention.

FIG. 18 is a top detail view of the largest positioning ring 98, in the first preferred embodiment of the invention. FIG. 19 is a top detail view of the middle positioning ring 100, in the first preferred embodiment of the invention. FIG. 20 is a top detail view of the smallest positioning ring 102, in the first preferred embodiment of the invention. (There may be a different number of positioning rings from what is shown in the drawings.)

The present invention also comprises a method of preventing and recovering from blowouts, comprising the steps of:

placing a larger end of a valve adjacent to an open end of a well pipe through which a first fluid is escaping, the valve having a smaller end that is connected to a return pipe;
moving the valve into alignment with the well pipe;
fastening a sleeve over a portion of the well pipe adjacent
to the open end of the well pipe, said sleeve being connected
to the return pipe;
inserting a high pressure pipe into the well pipe;
pumping the second fluid, at a higher pressure than that of
the first fluid, through the high pressure pipe into the well
pipe;
separating the first fluid by the second fluid in a space
adjacent to an end of the high pressure pipe that has been
inserted into the well pipe;
accelerating a portion of the first fluid that is not held
back by the greater pressure of the second fluid, causing it
to flow through the sleeve and the return pipe at an increased
velocity, but at a reduced pressure due to the Bernoulli
effect, thus supplying suction that helps to move the valve
down onto the well pipe;
placing one or more blocks around portions of the return
pipe, with each block having a channel that surrounds the
pipe, and with each block having one or more plates that are
initially to one side of the channel, one or more pistons
attached to each plate, and an explosive charge for each
piston, that when fired, can propel the plate to which the
piston is attached across the channel to reduce the flow of
the fluid;
retaining the blocks on the pipe; and
firing one or more of the explosive charges, causing one or
more of the pistons to move through a passage in the blocks
for each of the pistons.

The invention may comprise further steps of:
grinding cement and irregularities in the well pipe, using
one or more grinding devices, so that the sleeve can be placed
over its open end;
moving the valve into alignment with the well pipe, with the aid of one or more positioning rings attached to the high pressure pipe, that can fit inside the well pipe;

locking the sleeve around the well pipe, using a locking collar attached to the sleeve; and

moving the plates into or out from the channel, using gears having teeth that can engage teeth on the pistons.

FIG. 21 is a vertical sectional view drawn along lines 21-21 of FIG. 23 of the second preferred embodiment of the invention 210, showing the position of the plate 212 before the explosive charge has been fired. The block 214 has a cylindrical channel 216 with ends 218 configured so that it can be inserted over the open end E of pipe P through which fluid (such as petroleum or natural gas) can escape. (The pipe may be a well pipe or riser, undersea or on land.) An explosive charge 219 in chamber 220 when fired will propel the plate across the channel to block the flow of fluid. A receiver/ignitor 222 when ignite the explosive charge when it receives a radio, electrical, sonic or other signal to do so. When the charge is fired, the plate will move in passage 224 with far end 226. Vents 228 will allow gases from the charge to escape through one-way valves 230 into the pipe above the plate. The upper edge 232 of the side of the plate facing the pipe is inclined so that it can cut through the walls of the pipe, and to enable fluid to escape upward in the pipe. The lower edge 234 of the side of the plate facing the pipe is slightly inclined, and the lower edge 236 of the far end of the passage is also slightly inclined, to insure that the plate can move through the passage and close off the pipe even if the edge of the plate and the far end of the passage become slightly misaligned. The edge 238 of the plate facing the charge is blunt or rounded, so that the plate will be
propelled by the charge. Plate reversal stops 240 are above and below the plate before the charge is fired. A back flow preventer 242 is above the plate before the charge is fired, in the back flow preventer passage 244 with lower end 246 below the plate. There is a back flow preventer charge 248 in the back flow preventer passage above the back flow preventer before the charge 219 is fired. When the block is placed over and around the pipe, cement C is placed over the pipe and the side of the block into which the pipe is inserted, and allowed to harden, to create a tight seal and prevent fluids (such as seawater or oil) from leaking in or out. Any other suitable means may be substituted for cement to seal any space between the pipe and channel and retain the block on the pipe. The block is made of metal, concrete, or other suitable material.

FIG. 22 is a vertical sectional view drawn along lines 22-22 of FIG. 24 of the second preferred embodiment of the invention, showing the position of the plate 212 after the explosive charge has been fired. The far end 226 of the passage 224 prevents the plate from moving too far and bypassing the channel. The inclination of the lower edge 234 of the plate should match the inclination of the lower surface 236 of the far end of the passage, to more effectively prevent the escape of fluid. The upper edge 232 and lower edge 234 of the plate form a knife-like blade that is a male element, while the upper and lower surfaces of the end of the passage form a female element, that matingly engage to create a tight seal that prevents fluid from escaping. The plate reversal stops 40 move into the passage and prevent the plate from moving back, locking it in place. The plate reversal stops may be actuated by springs that are released by a trigger mechanism or motion detector when the plate passes, by a timer after the charge is fired, or by any other suitable means. (Alternatively, other locking mechanisms may be used to keep
the plate in place. The charge above the back flow preventer is fired after the charge in chamber 220, and propels the back flow preventer 242 through its passage 244 until it rests against far end 246, thus sealing the passage behind the plate and preventing fluid from escaping. A locking pin or other suitable mechanism may keep the back flow preventer in place. The charge above the back flow preventer may be fired in response to a trigger mechanism or motion detector when the plate passes, by a timer after the main charge is fired, or by any other suitable means. Gases from the charge ignited above the back flow preventer can escape through vents 228. Tunnels 258 passing through upper portions of the plates enable some of the fluid to escape from near edges of the plates to near the centers of the plates into the pipe, above that plates that are blocking its flow. The bottoms of the plates are solid, with no tunnels.

FIG. 23 is a horizontal sectional view drawn along lines 23-23 of FIG. 21 of the second preferred embodiment of the invention, showing the position of the plate before the explosive charge has been fired. Grooves or channels 250 radiate outward from the center of the upper surface of the plate 212, except on the side of the plate facing the charge. There are also grooves or channels 252 in the far end of the passage. Openings 260 at opposite ends of the tunnels though the upper portion of the disk are also shown.

FIG. 24 is a horizontal sectional view drawn along lines 24-24 of FIG. 22 of the second preferred embodiment of the invention, showing the position of the plate after the explosive charge has been fired. It can be seen that the plate 212 is circular and has a somewhat larger diameter than the cylindrical pipe P, so that it can effectively seal the pipe and stop the flow of fluid. The grooves or channels 50 in the plate enable fluid to escape into the interior of the
pipe above the plate as the pipe is cut and blocked off by the plate. The grooves and tunnels prevent fluid in the passage from impeding movement of the plate, to ensure unobstructed closure so that it can cut off the flow in the pipe. The grooves and tunnels do not go all the way to the leading edge of the plate, to ensure a seal with the end of the passage. The plate is preferably made of hardened metal, which is thick and hard enough to cut through the pipe and stop the flow, but thin and soft enough that it can be drilled through to reopen an oil or gas well.

There may be a plurality of plates in a single block. There may be a plurality of blocks used on a single pipe or well. This arrangement may be referred to as a "Christmas tree". This will allow the blowout preventer to be used multiple times to prevent multiple blowouts, as it may not be necessary to fire all of the plates to stop a blowout, and the plates that have been fired may be drilled through to reopen the well, while leaving the unfired plates in their original positions for future use.

FIG. 25 is a vertical sectional view drawn along lines 25-25 of FIG. 27 of the third preferred embodiment of the invention 254, showing the position of the plate before the explosive charge has been fired. The third preferred embodiment is the same as the second preferred embodiment, except that there is no pipe going through the block, and cement is not used. The block 214 is screwed over the lower pipe L, and the upper pipe U is screwed into the block, using screw threads 256. The fluid flows directly through the channel 216 between the lower pipe and the upper pipe. The lower pipe may be well pipe.

The upper pipe may be a riser.

FIG. 26 is a vertical sectional view drawn along lines 26-26 of FIG. 28 of the third preferred embodiment of the invention, showing the position of the plate after the explosive charge
has been fired. The plate does not need to cut through a pipe, but blocks the channel directly. As it does not need to cut through the pipe, the plate may be thinner than in the first preferred embodiment, which will make it easier to drill through to reopen the well.

FIG. 27 is a horizontal sectional view drawn along lines 27-27 of FIG. 25 of the third preferred embodiment of the invention, showing the position of the plate before the explosive charge has been fired. FIG. 28 is a horizontal sectional view drawn along lines 28-28 of FIG. 26 of the third preferred embodiment of the invention, showing the position of the plate after the explosive charge has been fired.

FIG. 29 is a vertical sectional view of the second preferred embodiment of the invention, showing the plate after it has been drilled through to reopen the pipe. FIG. 30 is a vertical sectional view of the second preferred embodiment of the invention, showing a block with two plates. FIG. 31 is a vertical sectional view of the second preferred embodiment of the invention, showing three blocks on a pipe. There may be similar arrangements for the third preferred embodiment of the invention.

FIG. 32 is a vertical sectional view drawn along lines 32-32 of FIG. 36 of the fourth preferred embodiment of the invention 260, showing the position of the plate 212 before the explosive charge 219 in the chamber 20 has been fired by the receiver/ignitor 222. The receiver/ignitor may be activated by radio waves, laser, sound, electricity, or any other suitable means. A piston 262 ending in a flange 64 is attached to the plate 212. The piston is propelled by the explosive charge and propels the plate. (Alternatively, the piston and plate may be propelled by hydraulic, pneumatic, mechanical or electrical means, or by any other suitable means.) The piston and plate move in a passage having a wider
portion 266 and a narrower portion 268. The flange prevents
the end of the piston from moving into the narrow portion of
the passage, thus limiting the movement of the plate to which
the piston is attached. (As before, the movement of the plate
may also be limited by the upper front edge 232 and lower
front edge 234 engaging the female element 226, with sloping
lower edge 236, on the opposite side of the channel 216.) The
gear 270 has teeth 272 that can engage teeth 274 on the
underside of the piston, to move the plate completely or
partially out from the channel 216. (The gear may also be
used as an alternative to the explosive charge, to move the
plate completely or partially into the channel. Alternatively, the plates can be drilled through to reopen the
channel, as in FIG. 29.) The block 276 is connected to an
upper pipe U and a lower pipe L. Oil, gas or other fluid can
flow though channel 216. There may be screw threads 256 on
the pipes near ends 218 of the channel. As before, gases
produced when the explosive charge is ignited can pass through
vent 228 and one-way valve 230 into the channel.

FIG. 33 is a vertical sectional view drawn along lines 33-33
of FIG. 37 of the third preferred embodiment of the invention,
showing the position of the plate after the explosive charge
for the piston has been fired, in which it is completely
blocking the channel to prevent any fluid from passing through
it. FIG. 34 is a vertical sectional view drawn along lines
34-34 of FIG. 38 of the third preferred embodiment of the
invention, showing the position of the plate after it has been
retracted to cover two-thirds of the channel, thus reducing
and regulating the flow of oil or other fluid, but not
completely blocking it. FIG. 35 is a vertical sectional view
drawn along lines 35-35 of FIG. 39 of the third preferred
embodiment of the invention, showing the position of the plate
after it has been retracted to cover one-third of the channel,
allowing greater flow, but still reducing it. The gear may be rotated by a motor or other suitable means. The gear may be lowered so as not to impede the movement of the piston and plate when the explosive charge is fired, and raised to mesh with the teeth in the piston.

FIG. 36 is a horizontal sectional view drawn along lines 36-36 of FIG. 32 of the fourth preferred embodiment of the invention, showing the position of the plate before any explosive charge has been fired. The portion of the passage 278 in which the plate moves may be wider horizontally, even it is the same height vertically as the portion of the narrower passage 268 in which only the piston moves. As before, grooves 250 in the plate and grooves 252 in the female element allow fluid to escape so that it does not impede the movement of the plate. FIG. 37 is a horizontal sectional view drawn along lines 37-37 of FIG. 33 of the third preferred embodiment of the invention, showing the position of the plate after the explosive charge for the piston has been fired. FIG. 38 is a horizontal sectional view drawn along lines 38-38 of FIG. 34 of the fourth preferred embodiment of the invention, showing the position of the plate after it has been retracted to cover two-thirds of the channel. FIG. 39 is a horizontal sectional view drawn along lines 39-39 of FIG. 35 of the fourth preferred embodiment of the invention, showing the position of the plate after it has been retracted to cover one-third of the channel.

FIG. 40 is a vertical sectional view of the fourth preferred embodiment of the invention, showing a block with two plates, that will enter the channel from different directions when the explosive charges are fired. Blocks may also have three or more plates. Plates may enter the channel from any number of different directions. Two or more pistons may be attached to each plate. The distance that pistons move the plates may be
varied by the length of the pistons and/or the lengths of the
wider and narrower portions of the passages. When there is
more than one piston attached to a plate, the other pistons
and their charges may serve as backups if a charge fails.

FIG. 41 is a vertical sectional view of the fourth preferred
embodiment of the invention, showing three blocks 280
connected to upper pipe U, middle pipes M, and lower pipe L.
Any number of the blocks may be stacked in a "Christmas tree".
The blocks may be directly attached without middle pipes.
There may be no upper pipe. Alternatively, a well pipe may
pass through the channel, in which case the plate must be
capable of cutting through it.

Which plates have been activated may be indicated by
displayed numbers, colors or indentations. The invention may
be monitored visually on site or remotely by television,
radio, wired connections, or any other suitable means. The
movement of the gears and pistons may be measured and
calibrated. The plates and pistons may be made of metal, high
impact plastic or glass, or any other suitable material. The
invention may be placed anywhere in the flow line. Multiple
apparatus of the invention may be placed in series or in
parallel. A back flow preventer and tunnels in the plates may
be used with the third preferred embodiment, as in the first
and second preferred embodiment.

The present invention also comprises a method of preventing
blowouts and regulating flow, comprising the steps of:

placing one or more blocks around portions of a pipe through
which fluid can flow, with each block having a channel that
surrounds the pipe, and with each block having one or more
plates that are initially to one side of the channel, one or
more pistons attached to each plate, and an explosive charge
for each piston, that when fired, can propel the plate to
which the piston is attached across the channel to reduce the
flow of the fluid;
retaining the blocks on the pipe; and
firing one or more of the explosive charges, causing one or more of the pistons to move through passages in the blocks for each of the pistons.

The present invention may comprise further steps of moving the plates partially or completely out from (or into) the channel, using gears having teeth that can engage teeth on the pistons.

The following are the features in the applicant's U.S. Patent No. 8,205,678, issued on June 26, 2012:

FIG. 42 is a vertical sectional view drawn along lines 42-42 of FIG. 44, showing the fifth preferred embodiment of the invention before the funnel 310 is sucked down onto the pipe P (which may be a well pipe or riser) from which a first fluid (such as petroleum) is escaping. The funnel has a hollow frustoconical shape, and has a smaller end 312 and a larger end 314 that is suitably dimensioned and configured to be placed over the pipe. A return pipe 316 is connected to the smaller end of the funnel. A high pressure pipe 318 passes through the return pipe and the funnel, and is suitably dimensioned and configured to be inserted into the pipe P. A second fluid (such as air) is pumped through the high pressure pipe at a pressure greater than that of the first fluid, causing the first fluid to be separated by the second fluid in a space S adjacent to an end of the high pressure pipe that has been inserted into the pipe through which the first fluid is escaping. A portion of the first fluid that is not held back by the greater pressure of the second fluid will flow through the valve and the return pipe at an accelerated velocity, but at a reduced pressure due to the Bernoulli effect, thus helping to suck the valve down onto the pipe P.
FIG. 43 is a vertical sectional view drawn along lines 42-42 of FIG. 44, showing the first preferred embodiment of the invention after the valve is sucked down onto the pipe P from which the first fluid was escaping. A first gasket 320 within the valve prevents the first and second fluids from leaking out between the valve and the pipe P. Inside the valve, adjacent to its smaller end, there are channels 322 to further accelerate the flow of the first and second fluids toward the return pipe. (The channels may be small pipes.) Adjacent to the smaller end of the valve there is a turbine comprising blades 324 driven by motor 326, that can rotate to further accelerate the flow of the first and second fluids through the return pipe. FIG. 44 is a horizontal sectional view drawn along lines 44-44 of FIG. 42, showing the fifth preferred embodiment of the invention.

FIG. 45 is a vertical sectional view drawn along lines 45-45 of FIG. 47, showing the sixth preferred embodiment of the invention before the valve is sucked down onto the pipe from which the first fluid is escaping, which is the same as the fifth preferred embodiment, except that the high pressure pipe 318 is in an alternative position, passing outside the return pipe 316 and through a side of the valve 310.

FIG. 46 is a vertical sectional view drawn along lines 45-45 of FIG. 47, showing the sixth preferred embodiment of the invention after the valve is sucked down onto the pipe from which the first fluid was escaping. FIG. 47 is a horizontal sectional view drawn along lines 47-47 of FIG. 45, showing the sixth preferred embodiment of the invention.

FIG. 48 is a vertical sectional view of the seventh preferred embodiment of the invention, in which there is a secondary air supply 328 with valve 330, that can be used to keep the blades 324 turning. The high pressure pipe 318 is shown retracted back up into the valve, which is also a means
of keeping the blades turning.

FIG. 49 is a vertical sectional view of the eighth preferred embodiment of the invention, in which there are valves 332 in the high pressure pipe 318 just below the blades 324 that can keep the blades turning. Note that the valve can be sucked down both by pressure from the well, and by pressure from outside sources (that supply air to the high pressure pipe or a secondary air supply or electricity or fuel to the motor 326.)

The following were the new features in the first Continuation-In-Part, patent Application No. 13/533,964, filed on June 26, 2012, now U.S. Patent No. 8,418,767, issued on April 16, 2013, which is a ninth preferred embodiment of the invention, shown in FIGS. 50-54:

1. Jets 334 (shown in FIGS. 50, 51 and 52) on an exterior surface of the valve 310, through which a second fluid may be released to move the valve into alignment with the pipe P through which the first fluid is escaping. The second fluid is supplied to the jets through a second high pressure pipe 336 with branches 337, and the jets each have a plurality of nozzles 338 that point in different directions. The second fluid will usually be air, and the air may be supplied through a compressed air pipe. (Alternatively, electric motors may be used to move the valve.)

2. Sensing devices 340 selected from the group comprising lights and cameras, sonar, and global positioning system devices, on movable arms 342 (shown in FIGS. 50, 51 and 52) that can be extended from the valve, by which the position of the valve relative to the pipe through which the first fluid is escaping can be determined, so that it can be moved into alignment with said pipe using the jets (or motors). The arms may be moved between an extended position (shown in solid
lines) and retracted position (shown in broken lines). The arms will generally be in an extended position when the sensing devices are used. There may be two arms, each moved by a motor 344, than can each rotate 180 degrees, giving 360 degree coverage of the surrounding area.

3. A stopper or plug 346 (shown in FIGS. 50 and 51) surrounding a portion of the high pressure pipe 318 inside the valve, the stopper having an upper portion 348 with a diameter that is the same as the interior diameter of the pipe through which the first fluid is escaping, and a sloping lower portion 350, and a piston 352 that can push the stopper down into the pipe though which the first fluid is escaping. The lower portion must be smaller than the diameter of the pipe P, so that it can enter the pipe to a sufficient distance to close off the flow of the first fluid. The sloping or tapered shape of the lower portion may help in positioning the valve and stopper onto pipe P, as well as helping to seal off the flow of the first fluid. The high pressure pipe must, of course, have a smaller diameter that the pipe through with the first fluid is escaping. The piston may be moved by an explosive charge, hydraulics, compressed air, electricity, springs, or any other suitable means. The stopper increases the Bernoulli effect by its shape and position in the valve. One-way locks 354 may prevent the stopper from being destroyed by the flow of the first fluid and pressure.

4. One-way valves 356, (shown in FIGS. 50 and 51) through which the second fluid can be released through a portion of the high pressure pipe inside the valve, to increase the Bernoulli effect, while preventing the first fluid from escaping. The one-way valves pass through the walls of the high pressure pipe and the stopper. The one-way valves allow the second fluid (e.g., air) to enter the pipe through which the first fluid (e.g., oil) is flowing, and stop
the flow of the first fluid once the stopper is activated.
5. A plurality of turbines 357 (shown in FIGS. 50 and 51) in the return pipe 316 to accelerate the flow of the first fluid. The entire system, including the turbines, may be powered by air, electrical-wire, an electrical power pack, springs, or other suitable means. The turbines are stacked in the return pipe to increase suction.
6. A second gasket 358 (shown in FIGS. 50-52, and in detail in FIGS. 53 and 54) at the larger end of the valve, the gasket having a circular rim 360 from which extend overlapping plates 362 pivotally attached to the rim, wherein the plates can be simultaneously rotated from an open position (shown in FIGS. 50 and 53), in which they do not block the valve from being placed over the pipe from which the first fluid is escaping, to a closed position (shown in FIGS. 51 and 54), in which they contact said pipe and prevent the first fluid from escaping to the surrounding space. The gasket may be opened and closed by a draw string 364, a spring control spool powered by a battery pack, or any other suitable mechanism. The plates may be pivotally connected to the circular rim by springs or other suitable means.

The following were the new features in applicant's U.S. Patent No. 8,555,979, issued on October 15, 2013, which is a tenth preferred embodiment of the invention, shown in FIGS. 55-57:
1. Positioning arms 366 extending from the valve, said positioning arms being able to move the valve into alignment with the pipe through which the first fluid is escaping, and then to hold it in place. The positioning arms each have a plurality of segments 368, and the segments are connected by motor driven joints 370 by which they can be moved. The positioning arms each have an inner segment 372 attached to
the valve. The positioning arms each have an outer segment 74
with a gripping surface 376. The tapering shape of the
stopper may also aid the correct positioning of the valve and
stopper onto the pipe P by the positioning arms. Once they
are in position, the second gasket 358 can be closed around
pipe P, as shown in FIG. 56.

2. Propellers 364 on or near the end of the high pressure
(air separating) pipe, that can rotate to accelerate flow of
the first fluid into the turbines 357, giving the system a ram
jet effect, that works in combination with the Bernoulli
effect. The propellers may also help move the stopper into
the pipe through which the first fluid is escaping, and help
keep the stopper in place.

3. Sensing devices (340 as shown in FIGS. 50, 51 and 52)
selected from the group comprising lights and cameras, sonar,
and global positioning system devices, can be attached to the
positioning arms, by which the position of the valve relative
to the pipe through which the first fluid is escaping can be
determined, so that it can be moved into alignment with said
pipe.

The various parts of the invention may be made of either
rigid or flexible materials.

The following are new features of the present application,
which is an eleventh preferred embodiment of the invention,
shown in FIGS. 58-67:

1. Sleeve for Well Pipe

A sleeve (380 in FIGS. 58 and 59), is suitably dimensioned
and configured to be placed over a portion of the well pipe P
adjacent to the open end E of the well pipe, with the sleeve
being connected to the return pipe 316. FIG. 58 shows the
sleeve above the well pipe before it is placed over it. FIG.
59 shows the sleeve surrounding the top portion of the well
pipe. A portion of the first fluid (e.g., oil) that is not held back by the greater pressure of the second fluid (e.g., air) will flow through the sleeve and then the return pipe. The sleeve may have two or more telescoping segments, or it may be in one piece without moving parts. The sleeve may be made of a rigid material with a fixed diameter, or of a flexible material with a variable diameter.

A locking collar 382, attached to the sleeve, can lock the sleeve around the portion of the well pipe adjacent to the open end of the well pipe. As shown in FIG. 63, a power source 384 for locking the locking collar using bolts 420 can apply sufficient force to pierce the well pipe and lock the locking collar onto the well pipe using attachment members 86, without causing the well pipe to collapse. Preferably, the sleeve and the locking collar are generally cylindrical. The attachment members preferably are evenly spaced around the locking collar. Preferably, the sleeve has an interior surface 388 that can grip an exterior surface of the well pipe. Preferably, there are one or more pressure sensors (390 in FIG. 63) and an alerting system 392 that is activated when the pressure sensors detect excessive pressure of the sleeve against the well pipe, to prevent the well pipe from being collapsed. The connection between the sensors and the alerting system may be wired or wireless. Alerts may be audible, visible, etc. Preferably, a sharp edge 394 extends from a lower rim 396 of the sleeve, by which irregularities in the well pipe can be cut.

2. Positioning Rings

One or more positioning rings 398, 400 and 402 are attached to the high pressure pipe, that can fit inside the well pipe. Preferably, there are a plurality of the positioning rings, that are attached by arms (404 in FIGS. 64-67) to the high pressure pipe, with the diameters of the rings increasing.
with their distance from an open end of the high pressure pipe. Preferably, the positioning rings are generally cylindrical. The positioning ring 398 at the greatest distance from the open end of the high pressure pipe has a beveled lower rim (406 in FIGS. 58-60). This ring preferably has an outside diameter at or just under the inside diameter of the well pipe. The main purpose of the positioning rings is to make it easier to correctly position the funnel and sleeve over the well pipe, but they can also contribute to the Bernoulli effect. FIG. 64 shows all of the rings positioned inside the well pipe P. FIGS. 65-67 show each of the rings separately. (There may be a different number of positioning rings from what is shown in the drawings.)

3. Cutting Devices

One or more cutting devices 408 are attached to one or more extension arms 410, that can cut the well pipe. Preferably, the extension arms are moveable, and the cutting devices can rotate around the well pipe. The cutting devices may be lasers, electric saws, pneumatic or hydraulic cutters, or any other suitable means for neatly cutting the well pipe, so that bent or ruptured portions of the well pipe can be removed, to allow the invention to be attached to an intact portion of the well pipe.

4. Funnel is Adjustable and Removable

The slope between the smaller end 312 and the larger end 314 of the funnel 310 can be adjusted. The funnel is shown in a lowered position in FIGS. 58 and 61, and in a raised position in FIGS. 59 and 62. (The possible positions of the funnel are not limited to the two positions shown.) The funnel is comprised of leaves (414 in FIGS. 61 and 62) that are pivotally connected by joints (416 in FIGS. 58 and 59) to the return pipe 316. The seams 418 are closed when the funnel is in a lowered position (as in FIG. 61) and separated with the
funnel is in a raised position (as in FIG. 62). The funnel can be removed and raised to the surface of a body of liquid with the aid of floats 412 attached to the funnel. The leaves may be released from the joints by mechanical means, by an explosive charge, or by any other suitable means. The funnel can be reused after it is separated. The floats may be permanently buoyant, or inflated when needed.

The invention also encompasses a method of recovering from blowouts, including the steps of:

placing a larger end of a funnel adjacent to an open end of a well pipe through which a first fluid is escaping, the funnel having a smaller end that is connected to a return pipe;

moving the funnel into alignment with the well pipe, with the aid of one or more positioning rings attached to the high pressure pipe, that can fit inside the well pipe;

fastening a sleeve over a portion of the well pipe adjacent to the open end of the well pipe, said sleeve being connected to the return pipe;

locking the sleeve around the pipe from which the first fluid is escaping, using a locking collar attached to the sleeve;

inserting a high pressure pipe into the well pipe;

pumping the second fluid, at a higher pressure than that of the first fluid, through the high pressure pipe into the well pipe;

separating the first fluid by the second fluid in a space adjacent to an end of the high pressure pipe that has been inserted into the well pipe; and

accelerating a portion of the first fluid that is not held back by the greater pressure of the second fluid, causing it to flow through the sleeve and the return pipe at an increased velocity, but at a reduced pressure due to the Bernoulli
effect, thus supplying suction that helps to move the funnel down onto the well pipe.

It is to be understood that the present invention is not limited to the embodiment described above, but encompasses any and all embodiments within the scope of the following claims.
I claim:

1. A blowout preventer and recovery device, comprising:
   a valve having a smaller end and a larger end, with the
   larger end being suitably dimensioned and configured to be
   placed over an open end of a well pipe through which a first
   fluid is escaping;
   a return pipe connected to the smaller end of the valve;
   a sleeve, suitably dimensioned and configured to be placed
   over a portion of the well pipe adjacent to the open end of
   the well pipe, with the sleeve being connected to the return
   pipe;
   a high pressure pipe passing through the valve, suitably
   dimensioned and configured to be insertable into the well
   pipe;
   one or more blocks, with each of the blocks having a
   channel, with the channel having at least one end that is
   dimensioned and configured so that the block is able to be
   inserted over a portion of the return pipe;
   one or more plates in each of the blocks, initially to one
   side of the channel;
   one or more pistons attached to each of the plates; and
   an explosive charge for each of the pistons, that is able
   to be fired and propel the plate into the channel to reduce
   the flow of the fluid;
   wherein, a second fluid is pumped through the high pressure
   pipe at a pressure greater than that of the first fluid, the
   first fluid being separated by the second fluid in a space
   adjacent to an end of the high pressure pipe that has been
   inserted into the well pipe, and a portion of the first fluid
   that is not held back by the greater pressure of the second
fluid flows through the sleeve and the return pipe at an accelerated velocity, but at a reduced pressure due to the Bernoulli effect, thus supplying suction to help move the valve down onto the well pipe.

2. The blowout preventer and recovery device according to claim 1, further comprising:
   a passage in the blocks for each of the pistons, the passage having a narrow portion adjacent to the channel and a wide portion away from the channel; and
   a flange on each piston on an end of the piston opposite the plate to which the piston is attached, that prevents said end of the piston from moving into the narrow portion of the passage, thus limiting the movement of the plate to which the piston is attached.

3. The blowout preventer and recovery device according to claim 1, further comprising:
   gears having teeth that are able to engage teeth on the pistons to move the plates out from the channel.
4. The blowout preventer and recovery device according to claim 1, further comprising:
   a locking collar, attached to the sleeve, that is able to lock the sleeve around the portion of the well pipe adjacent to the open end of the well pipe; and
   a power source for locking the locking collar;
   wherein said power source is able to apply sufficient force to pierce the well pipe and lock the locking collar onto the well pipe, without causing the well pipe to collapse;
   wherein the sleeve and the locking collar are generally cylindrical; and
   wherein attachment members are evenly spaced around the locking collar, that are able to pierce the well pipe and lock the locking collar onto the well pipe.

5. The blowout preventer and recovery device according to claim 1, wherein:
   the sleeve has an interior surface that is able to grip an exterior surface of the well pipe.

6. The blowout preventer and recovery device according to claim 1, further comprising:
   one or more pressure sensors; and
   an alerting system that is activated when the pressure sensors detect excessive pressure of the sleeve against the well pipe.
7. The blowout preventer and recovery device according to claim 1, further comprising:
   generally cylindrical positioning rings,
   that are attached by arms to the high pressure pipe, and
   are able to fit inside the well pipe,
   with the diameters of the rings increasing with the ring's distance from the open end of the high pressure pipe, and
   with the positioning ring at the greatest distance from the open end of the high pressure pipe has a beveled lower rim;
   wherein the positioning rings contribute to the Bernoulli effect.

8. The blowout preventer and recovery device according to claim 1, wherein:
   a sharp edge extends from a lower rim of the sleeve, by which irregularities in the well pipe are able to be cut.

9. The blowout preventer and recovery device according to claim 1, further comprising:
   one or more cutting devices attached to one or more movable extension arms, that are able to cut the well pipe, and are able to rotate around the well pipe.

10. The blowout preventer and recovery device according to claim 1, further comprising:
    one or more grinding devices, that are able to remove cement and irregularities from the well pipe, so that the sleeve is able to be placed over its open end.
11. The blowout preventer and recovery device according to claim 1, wherein:

- a slope between the smaller end and the larger end of the valve is adjustable; and
- the valve is able to be removed and raised to the surface of a body of liquid with the aid of floats attached to the valve.
12. A blowout preventer and recovery device, comprising:
   a valve having a smaller end and a larger end, with the larger end being dimensioned and configured to be placed over an open end of a well pipe through which a first fluid is escaping;
   a return pipe connected to the smaller end of the valve;
   a high pressure pipe passing through the valve, suitably dimensioned and configured to be insertable into the pipe through which the first fluid is escaping; and
   one or more positioning rings attached to the high pressure pipe, that are able to fit inside the well pipe;
   wherein, a second fluid is pumped through the high pressure pipe at a pressure greater than that of the first fluid, the first fluid is separated by the second fluid in a space adjacent to an end of the high pressure pipe that has been inserted into the well pipe, and a portion of the first fluid that is not held back by the greater pressure of the second fluid flows through the valve and the return pipe at an accelerated velocity, but at a reduced pressure due to the Bernoulli effect, thus supplying suction that helps to move the valve down onto the well pipe; and
   one or more blocks, with each of the blocks having a channel, with the channel having at least one end that is dimensioned and configured so that the block is able to be inserted over a portion of the return pipe;
   one or more plates in each of the blocks, initially to one side of the channel;
   one or more pistons attached to each of the plates; and
   an explosive charge for each of the pistons, that is able to be fired and propel the plate into the channel to reduce the flow of the fluid.
13. The blowout preventer and recovery device according to claim 12, further comprising:
   a passage in the blocks for each of the pistons, the passage having a narrow portion adjacent to the channel and a wide portion away from the channel; and
   a flange on each piston on an end of the piston opposite the plate to which the piston is attached, that prevents said end of the piston from moving into the narrow portion of the passage, thus limiting the movement of the plate to which the piston is attached.

14. The blowout preventer and recovery device according to claim 12, further comprising:
gears having teeth that are able to engage teeth on the pistons to move the plates into or out from the channel.

15. The blowout preventer and recovery device according to claim 12, wherein:
   the positioning rings are generally cylindrical;
   the positioning rings are attached by arms to the high pressure pipe;
   the positioning rings are able to fit inside the well pipe;
   the diameters of the positioning rings increases with their distance from the open end of the high pressure pipe;
   the positioning ring at the greatest distance from the open end of the high pressure pipe has a beveled lower rim; and
   the positioning rings contribute to the Bernoulli effect.

16. The blowout preventer and recovery device according to claim 12, further comprising:
one or more grinding devices, that are able to remove cement and irregularities from the well pipe, so that the valve is able to be placed over the well pipe's open end.
17. A method of preventing and recovering from blowouts, comprising the steps of:

placing a larger end of a valve adjacent to an open end of a well pipe through which a first fluid is escaping, the valve having a smaller end that is connected to a return pipe;
moving the valve into alignment with the well pipe;
fastening a sleeve over a portion of the well pipe adjacent to the open end of the well pipe, said sleeve being connected to the return pipe;
inserting a high pressure pipe into the well pipe;
pumping a second fluid, at a higher pressure than that of the first fluid, through the high pressure pipe into the well pipe;
separating the first fluid by the second fluid in a space adjacent to an end of the high pressure pipe that has been inserted into the well pipe;
accelerating a portion of the first fluid that is not held back by the greater pressure of the second fluid, causing the first fluid to flow through the sleeve and the return pipe at an increased velocity, but at a reduced pressure due to the Bernoulli effect, thus supplying suction that helps to move the valve down onto the well pipe;
placing one or more blocks around portions of the return pipe, with each block having a channel that surrounds the pipe, and with each block having one or more plates that are initially to one side of the channel, one or more pistons attached to each plate, and an explosive charge for each piston, that is able to be fired and propel the plate to which the piston is attached across the channel to reduce the flow of the fluid;
retaining the blocks on the pipe; and
firing one or more of the explosive charges, causing one or more of the pistons to move through a passage in the blocks
for each of the pistons.

18. The method of preventing and recovering from blowouts according to claim 17, comprising the further step of:
   moving the plates into or out from the channel, using gears having teeth that are able to engage teeth on the pistons.

19. The method of preventing and recovering from blowouts according to claim 17, comprising the further steps of:
   grinding cement and irregularities in the well pipe, using one or more grinding devices, so that the sleeve is able to be placed over the well pipe's open end; and
   locking the sleeve around the well pipe, using a locking collar attached to the sleeve.

20. The method of preventing and recovering from blowouts according to claim 17, wherein:
   the valve is moved into alignment with the well pipe, with the aid of one or more positioning rings attached to the high pressure pipe, that are able to fit inside the well pipe.
21. A blowout preventer and flow regulator, comprising:
one or more blocks, with each of the blocks having a channel, with the channel having at least one end that is dimensioned and configured so that the block can be inserted over a portion of a pipe through which fluid can flow;
one or more plates in each of the blocks, initially to one side of the channel;
one or more pistons attached to each of the plates;
an explosive charge for each of the pistons, able to be fired to propel the plate into the channel to reduce the flow of the fluid;
gears having teeth that engage teeth on the pistons to move the plates out from the channel;
a passage in the blocks for each of the pistons, the passage having a narrow portion adjacent to the channel and a wide portion away from the channel; and
a flange on each piston on an end of the piston opposite the plate to which the piston is attached, that prevents said end of the piston from moving into the narrow portion of the passage, thus limiting the movement of the plate to which the piston is attached.

22. The blowout preventer and flow regulator according to claim 21, wherein:
the gears move the plates completely out from the channel.

23. The blowout preventer and flow regulator according to claim 21, wherein:
the gears move the plates partially out from the channel.

24. The blowout preventer and flow regulator according to claim 21, wherein:
the gears move the plates completely into the channel.
25. The blowout preventer and flow regulator according to claim 21, wherein:

the gears move the plates partially into the channel.

26. The blowout preventer and flow regulator according to claim 21, wherein there are a plurality of the plates, and the plates enter the channel from different directions.
27. A blowout preventer and flow regulator, comprising:
one or more blocks, with each of the blocks having a channel, with the channel having at least one end that is dimensioned and configured so that the block can be inserted over a portion of a pipe through which fluid can flow;
one or more plates in each of the blocks, initially to one side of the channel;
one or more pistons attached to each of the plates;
a means for moving each of the pistons, able to be activated to propel the plate into the channel to reduce the flow of the fluid;
gears having teeth that engage teeth on the pistons to move the plates out from the channel;
a passage in the blocks for each of the pistons, the passage having a narrow portion adjacent to the channel and a wide portion away from the channel; and
a flange on each piston on an end of the piston opposite the plate to which the piston is attached, that prevents said end of the piston from moving into the narrow portion of the passage, thus limiting the movement of the plate to which the piston is attached.

28. The blowout preventer and flow regulator according to claim 27, wherein:
the gears move the plates completely out from the channel.

29. The blowout preventer and flow regulator according to claim 27, wherein:
the gears move the plates partially out from the channel.

30. The blowout preventer and flow regulator according to claim 27, wherein:
the gears move the plates into the channel.
31. The blowout preventer and flow regulator according to claim 27, wherein there are a plurality of the plates, and the plates enter the channel from different directions.
32. A method of preventing blowouts and regulating flow, comprising the steps of:
   placing one or more blocks around portions of a pipe through which fluid can flow, with each block having a channel that surrounds the pipe, and with each block having one or more plates that are initially to one side of the channel, one or more pistons attached to each plate, and an explosive charge for each piston, able to be fired to propel the plate to which the piston is attached across the channel to reduce the flow of the fluid;
   retaining the blocks on the pipe;
   firing one or more of the explosive charges, causing one or more of the pistons to move through passages in the blocks for each of the pistons; and
   moving the plates, using gears having teeth that engage teeth on the pistons;
   wherein the passage for the pistons has a narrow portion adjacent to the channel and a wide portion away from the channel; and
   wherein there is a flange on each piston on an end of the piston opposite the plate to which the piston is attached, that prevents said end of the piston from moving into the narrow portion of the passage, thus limiting the movement of the plate to which the piston is attached.

33. The method of preventing blowouts and regulating flow according to claim 32, wherein:
   the plates are moved partially into the channel.

34. (currently amended) The method of preventing blowouts and regulating flow according to claim 32, wherein:
   the plates are moved completely into the channel.
35. The method of preventing blowouts and regulating flow according to claim 32, wherein:
   the plates are moved partially out from the channel.

36. The method of preventing blowouts and regulating flow according to claim 32, wherein:
   the plates are moved completely out from the channel.

37. The method of preventing blowouts and regulating flow according to claim 32, wherein there are a plurality of the plates, and the plates enter the channel from different directions.
38. A blowout recovery valve, comprising:
   a valve having a smaller end and a larger end, with the
   larger end being suitably dimensioned and configured to be
   placed over an open end of a well pipe through which a first
   fluid is escaping;
   a return pipe connected to the smaller end of the valve;
   a sleeve, suitably dimensioned and configured to be placed
   over a portion of the well pipe adjacent to the open end of
   the well pipe, with the sleeve being connected to the return
   pipe;
   a high pressure pipe passing through the valve, suitably
   dimensioned and configured to be insertable into the well
   pipe; and
   wherein, when a second fluid is pumped through the high
   pressure pipe at a pressure greater than that of the first
   fluid, the first fluid will be separated by the second fluid
   in a space adjacent to an end of the high pressure pipe that
   has been inserted into the well pipe, and a portion of the
   first fluid that is not held back by the greater pressure of
   the second fluid will flow through the sleeve and the return
   pipe at an accelerated velocity, but at a reduced pressure due
   to the Bernoulli effect, thus supplying suction to help move
   the valve down onto the well pipe.

39. The blowout recovery valve according to claim 38,
   further comprising:
   a locking collar, attached to the sleeve, that can lock the
   sleeve around the portion of the well pipe adjacent to the
   open end of the well pipe.
40. The blowout recovery valve according to claim 39, further comprising:
   a power source for locking the locking collar;
   wherein said power source can apply sufficient force to
   pierce the well pipe and lock the locking collar onto the well
   pipe, without causing the well pipe to collapse.

41. The blowout recovery valve according to claim 40, wherein:
   the sleeve and the locking collar are generally cylindrical;
   and
   attachment members are evenly spaced around the locking
   collar, that can pierce the well pipe and lock the locking
   collar onto the well pipe.

42. The blowout recovery valve according to claim 38, wherein:
   the sleeve has an interior surface that can grip an exterior
   surface of the well pipe.

43. The blowout recovery valve according to claim 38, further comprising:
   one or more pressure sensors; and
   an alerting system that is activated when the pressure
   sensors detect excessive pressure of the sleeve against the
   pipe.

44. The blowout recovery valve according to claim 38, further comprising:
   one or more positioning rings attached to the high pressure
   pipe, that can fit inside the well pipe.
45. The blowout recovery valve according to claim 44, wherein:
there are a plurality of the positioning rings, that are attached by arms to the high pressure pipe, with the diameters of the rings increasing with their distance from an open end of the high pressure pipe.

46. The blowout recovery valve according to claim 45, wherein:
the positioning rings are generally cylindrical;
the positioning ring at the greatest distance from the open end of the high pressure pipe has a beveled lower rim; and
the positioning rings contribute to the Bernoulli effect.

47. The blowout recovery valve according to claim 38, wherein:
a sharp edge extends from a lower rim of the sleeve, by which irregularities in the well pipe can be cut.

48. The blowout recovery valve according to claim 38, further comprising:
one or more cutting devices attached to one or more extension arms, that can cut the well pipe.

49. The blowout recovery valve according to claim 48, wherein:
the extension arms are moveable, and the cutting devices can rotate around the well pipe.
50. The blowout recovery valve according to claim 38, wherein:

the slope between the smaller end and the larger end of the valve can be adjusted; and

the valve can be removed and raised to the surface of a body of liquid with the aid of floats attached to the valve.
51. A blowout recovery valve, comprising:
   a valve having a smaller end and a larger end, with the
   larger end being dimensioned and configured to be placed over
   an open end of a well pipe through which a first fluid is
   escaping;
   a return pipe connected to the smaller end of the valve;
   a high pressure pipe passing through the valve, suitably
   dimensioned and configured to be insertable into the pipe
   through which the first fluid is escaping; and
   one or more positioning rings attached to the high pressure
   pipe, that can fit inside the well pipe;
   wherein, when a second fluid is pumped through the high
   pressure pipe at a pressure greater than that of the first
   fluid, the first fluid will be separated by the second fluid
   in a space adjacent to an end of the high pressure pipe that
   has been inserted into the well pipe, and a portion of the
   first fluid that is not held back by the greater pressure of
   the second fluid will flow through the valve and the return
   pipe at an accelerated velocity, but at a reduced pressure due
   to the Bernoulli effect, thus supplying suction that helps to
   move the valve down onto the well pipe.

52. The blowout recovery valve according to claim 51, wherein:
   there are a plurality of the positioning rings, that are
   attached by arms to the high pressure pipe, with the diameters
   of the rings increasing with their distance from an open end
   of the high pressure pipe.
53. The blowout recovery valve according to claim 52, wherein:
the positioning rings are generally cylindrical;
the positioning ring at the greatest distance from the open end of the high pressure pipe has a beveled lower rim; and
the positioning rings contribute to the Bernoulli effect.

54. The blowout recovery valve according to claim 53, further comprising:
one or more cutting devices attached to one or more extension arms, that can cut the well pipe.
55. A method of recovering from blowouts, comprising the steps of:
   placing a larger end of a valve adjacent to an open end of a well pipe through which a first fluid is escaping, the valve having a smaller end that is connected to a return pipe;
   moving the valve into alignment with the well pipe;
   fastening a sleeve over a portion of the well pipe adjacent to the open end of the well pipe, said sleeve being connected to the return pipe;
   inserting a high pressure pipe into the well pipe;
   pumping the second fluid, at a higher pressure than that of the first fluid, through the high pressure pipe into the well pipe;
   separating the first fluid by a second fluid in a space adjacent to an end of the high pressure pipe that has been inserted into the well pipe; and
   accelerating a portion of the first fluid that is not held back by the greater pressure of the second fluid, causing it to flow through the sleeve and the return pipe at an increased velocity, but at a reduced pressure due to the Bernoulli effect, thus supplying suction that helps to move the valve down onto the well pipe.

56. The method of recovering from blowouts according to claim 55, comprising the further step of:
   locking the sleeve around the pipe from which the first fluid is escaping, using a locking collar attached to the sleeve.
57. The method of recovering from blowouts according to claim 55, wherein:

the valve is moved into alignment with the well pipe, with the aid of one or more positioning rings attached to the high pressure pipe, that can fit inside the well pipe.
FIG. 28
FIG. 41
FIG. 48
FIG. 56
FIG. 57
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - E21 B 33/06 (2014.01 )
CPC - E21 B 33/06 (2014.09)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC(8) - E21B 33/06 (2014.01)
CPC - E21B 33/06, 33/061, 33/062, 34/02 (2014.09)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched.

USPC - 166/63, 75.11, 85.4, 86.1, 97.1, 316, 332.1, 366, 381, 386; 175/all subclasses; 405/52, 60

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PatBase, Google Patents, Google.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
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<tbody>
<tr>
<td>X, P</td>
<td>US 8,651,189 B1 (MILANOVICh) 18 February 2014 (18.02.2014) entire document</td>
<td>1-57</td>
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Date of the actual completion of the international search: 08 October 2014
Date of mailing of the international search report: 03 Nov 2014

Name and mailing address of the ISA/US:

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
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Authorized officer: Blaine R. Copenhaver
PCT Helpdesk: 571-272-4300
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