

**Feb. 16, 1937.**

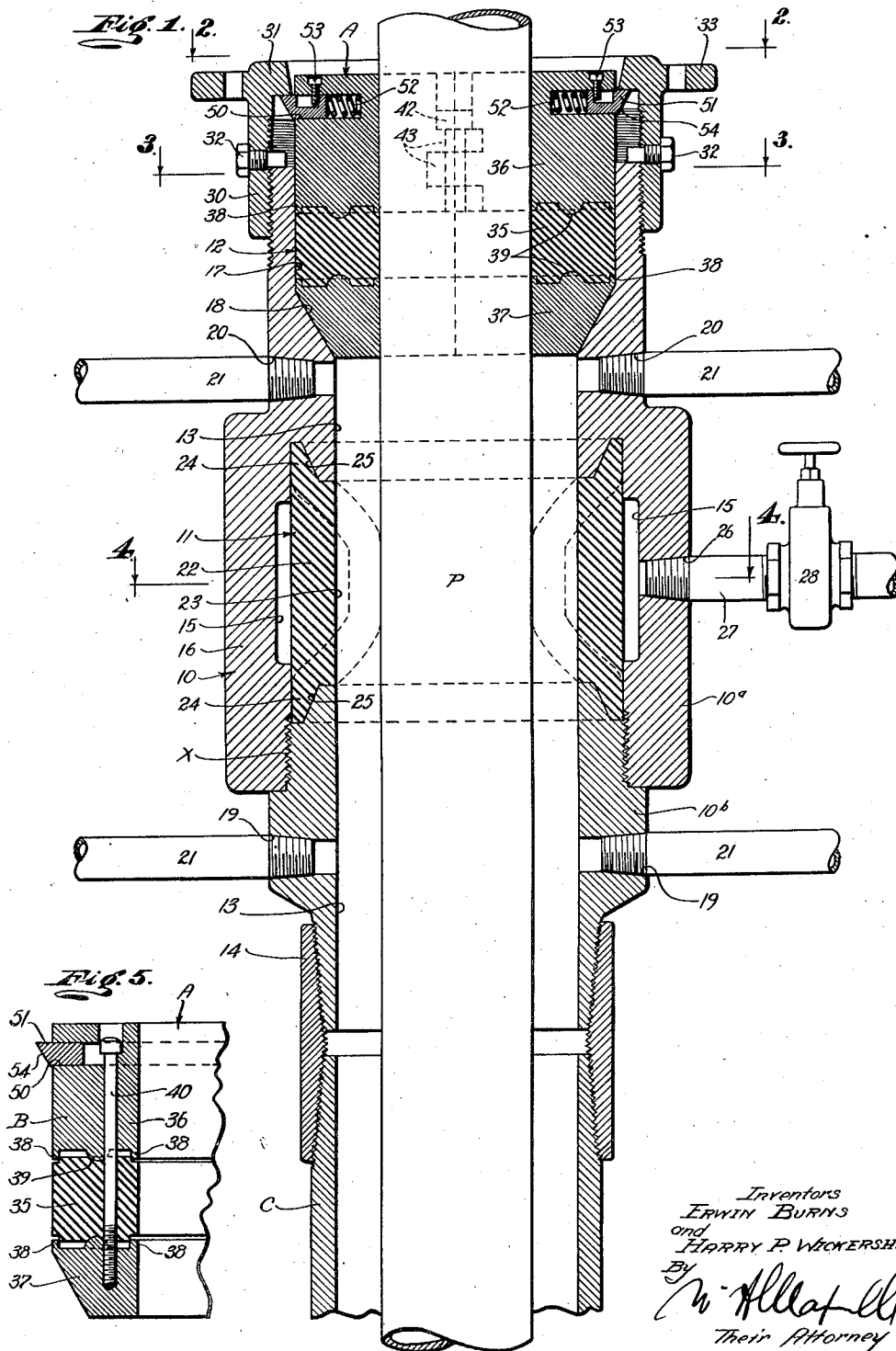
E. BURNS ET AL

**2,071,197**

## BLOW-OUT PREVENTER

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BLOW-OUT PREVENTER

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*Fig. 2.*

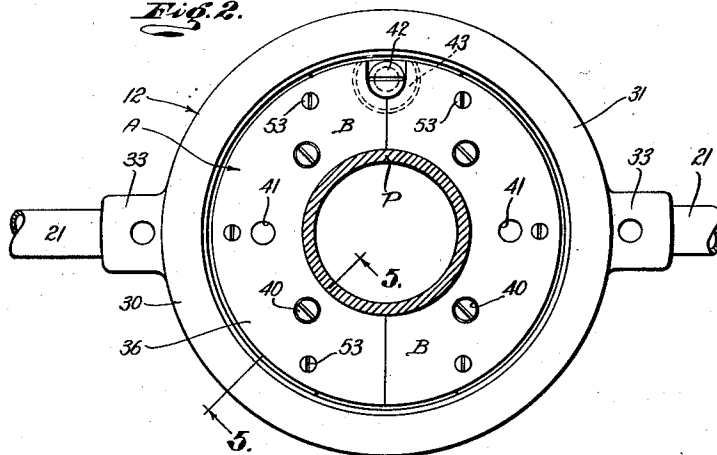


*Fig. 3.*

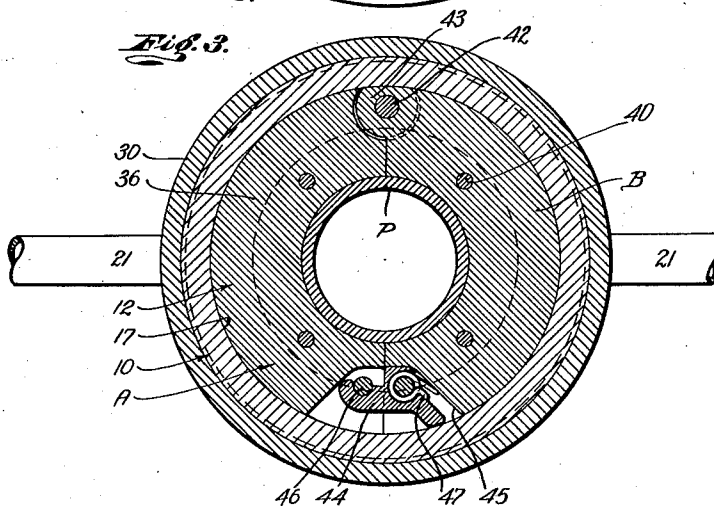
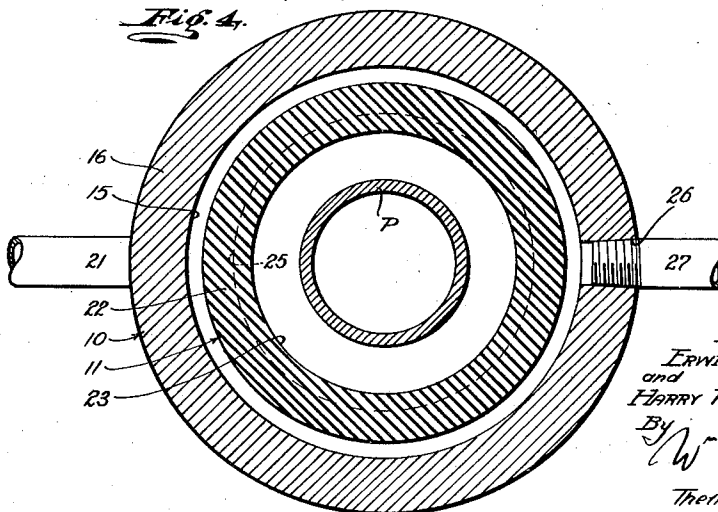


*Fig. 4.*



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## UNITED STATES PATENT OFFICE

2,071,197

## BLOW-OUT PREVENTER

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## 1 Claim. (Cl. 286—26)

This invention relates to a device for use on a well and relates more particularly to a control head or blowout preventer for the upper end of a well casing. A general object of this invention is to provide a simple, practical and effective blowout preventer that is instantly operatable to control or seal off the upper end of a well.

In the drilling of oil and gas wells high pressures often develop very quickly and with little or no warning. High pressures sometimes develop in a well so rapidly that there is insufficient time to position and actuate the usual or typical packing assemblies employed in blowout preventers with the result that the well is allowed to get out of control.

An object of the invention is to provide a blowout preventer for the upper end of a well casing that includes an emergency packing means that may be instantly actuated to control the well in the event that high pressures develop.

Another object of the invention is to provide a blowout preventer including an emergency packing means normally positioned for immediate actuation by fluid pressure to control the well and prevent a blowout, and a principal or main packing means that may be easily and quickly positioned and actuated to dependably and effectively seal off the well.

Another object of the invention is to provide a blowout preventer having an emergency packing means that is normally arranged in the body of the device where it is flush with the interior wall of the body to not interfere with the passage or operation of tools through the body and that may be instantly actuated to temporarily fully close off the body opening or seal about a drill pipe or other tool that may be extending into the well.

Another object of the invention is to provide a blowout preventer of the character mentioned in which the emergency or secondary packing means may be actuated to temporarily seal or close off the well casing to permit the repair or replacement of the packer of the principal packing means.

Another object of the invention is to provide a blowout preventer of the character mentioned including a single simple and inexpensive body for carrying both the emergency packing means and the principal packing means.

A further object of the invention is to provide a blowout preventer of the character mentioned in which ports are provided in the body below each of the packing means for the escape of gas pressure and for the introduction of mud

or fluid to kill the well when either packing means is in use.

Other objects and features of our invention will be better and more fully understood from the following detailed description of a typical preferred form and application of the invention, throughout which description reference may be had to the accompanying drawings, in which:

Fig. 1 is a longitudinal detailed sectional view of the blowout preventer showing the packer in position in the body to seal about a drill pipe and illustrating in broken lines the manner in which the auxiliary packing sleeve may seal with the pipe. Fig. 2 is a top or plan view taken as illustrated by line 2—2 on Fig. 1. Figs. 3 and 4 are transverse detailed sectional views taken as indicated by lines 3—3 and 4—4, respectively, on Fig. 1 and Fig. 5 is a fragmentary longitudinal sectional view of the packer removed from the body taken substantially as indicated by line 5—5 on Fig. 2.

The blowout preventer of the present invention includes, generally, a body 10 for arrangement on the upper end of a well casing C, packing means 11 for temporarily sealing or closing off the upper end of the casing, and a main or principal packing means 12 for sealing off the well.

The body 10 is an elongate tubular structure adapted to be attached to the upper end of the well casing C so that its central longitudinal opening 13 forms a continuation of the opening of the casing. The body 10 may be attached to the well casing C in any suitable or practical manner. In the particular application of the invention illustrated in the drawings the lower end portion of the body 10 is externally screw-threaded and is connected to the casing C by a coupling 14. The body 10 is cylindrical in its general configuration and is of substantial length. An annular channel or recess 15 is provided in the wall of the body opening 13. The recess 15 is spaced between the opposite ends of the body and is provided to carry the emergency packing means 11 as will be more fully described. An annular outwardly projecting enlargement 16 is provided on the body 10 to provide the necessary or suitable wall thickness at the recess 15.

The upper portion 17 of the body opening 13 is of increased diameter providing an annular internal shoulder 18 in the body. The shoulder 18 is provided to support the packer of the means 12 and is inclined downwardly and inwardly. The invention provides ports 19 in the wall of the body 10 below the recess 15 and similar ports 20 in the wall of the body below the shoulder 18.

The ports 19 and 20 may be threaded to receive the end portions of pipes or conduits 21. The lower ports 19 are provided to permit the escape of gas under pressure and to facilitate the introduction of mud into the well to kill the well when the auxiliary or emergency packing means 11 is in operation. The upper ports 20 are provided for similar purposes and may be utilized when the principal packing means 12 is operated to seal or close off the upper end of the body 10.

The auxiliary or emergency packing means 11 is provided to temporarily close or seal off the body opening 13 when high pressures suddenly develop in the well or when the packer of the principal packing means 12 is to be replaced. It is an important feature of the invention that the packing means 11 is always available and in position for operation and is adapted to be instantly operated to prevent a blowout when high pressures develop in the well. The means 11 is particularly simple and does not in any way interfere with the free passage and operation of drilling tools through the body 10 or casing C.

The packing means 11 includes an annular body or sleeve 22 of packing or sealing material arranged in the recess 15. The packing sleeve 22 is formed of rubber composition, or the like, and is adapted to be contracted or actuated inwardly to close the body opening 13 or to seal about a drill pipe P, extending through the body to close off the body opening. The opening 23 of the packing sleeve 22 is normally of the same or of slightly less diameter than the opening 13 of the body. In accordance with the invention the packing sleeve 22 is arranged to close the inner side of the annular recess 15 providing or forming a closed chamber about the sleeve. Annular reduced tongues 24 are provided on the opposite ends of the sleeve 22 to fit inwardly diminishing annular grooves 25 in the upper and lower walls of the recess 15. The tongues 24 may be initially of greater thickness than the grooves 25 so that they may be tightly fitted in the grooves. The body 10 may be sectional to facilitate the positioning of the sleeve 22 in the recess 15. In the particular construction illustrated the body comprises an upper major section 10<sup>a</sup> and a lower section 10<sup>b</sup> joined by a threaded connection X extending from the lower groove 25 to the lower end of the enlargement 16. When the sections 10<sup>a</sup> and 10<sup>b</sup> are disconnected the sleeve 22 may be easily inserted in the recess 15 without being distorted. Threading together of the connection X may put the sleeve 22 under a suitable compression strain and more tightly wedge the tongues 24 in the grooves 25. The tongues 24 may be cemented or otherwise secured in the grooves 25 to dependably attach the sleeve to the body 10 and to seal the opposite ends of the closed chamber of the recess 15.

While we have shown the drill pipe P extending through the body 10 and the sleeve 22 in packing or sealing engagement with the pipe, it is to be understood that the packing sleeve 22 may be designed and proportioned to be capable of sufficient inward contraction to close off or control the body opening when the drill pipe is removed from the well and to seal about a polygonal member or tool such as a polygonal drill that may be extending through the body 10. The sleeve 22 is adapted to be actuated or contracted by fluid under pressure admitted to the recess 15. A port 26 is provided in the wall of the

body 10 to communicate with the recess 15. A conduit 27 extends from the port 26 to a suitable source of fluid pressure (not shown). A valve 28 may be provided in the conduit 27 to control the admission of fluid pressure to the recess 15. When fluid under pressure is admitted to the recess 15 through the conduit 27 the packing sleeve 22 is expanded or actuated inwardly to tightly seal about the drill pipe P and thus control or prevent the discharge of fluid or gas pressure from the well. It is to be noted that this actuation of the packing means 11 is instantaneous and does not require the handling or manipulation of a packer or tools.

The main or principal packing means 12 is adapted to be employed subsequent to the operation of the packing means 11 or when there is sufficient time to assemble and actuate its packer without danger of the well getting out of control. The principal packing means 12 is operable to fully close or pack off the upper end of the body 10 in a manner to effectively control the well or provide for the desired production of the well. The means 12 includes a retaining or actuating member 30 on the upper end of the body 10 and a packing assembly or packer A adapted to be lowered into the enlarged body opening 17 to seal about the drill pipe P. The member 30 is in the nature of a ring or sleeve screw threaded on the upper end portion of the body 10. The member 30 is intended to project above the upper end of the body 10 and has an annular inwardly projecting flange or lip 31 spaced above the upper end of the body. Studs or screws 32 may be threaded through the member 30 to prevent the member from being threaded downwardly an excessive distance on the body. The lip 31 has an internal diameter slightly greater than that of the enlarged body opening 17. Projecting lugs or ears 33 are provided on the member 30 to facilitate its handling and operation.

The packing assembly or packer A is adapted to be arranged in the enlarged body opening 17 and may be compressed or actuated by the member 30 to effectively pack off the upper end of the body. The packer A may be varied somewhat in construction, etc., without departing from the broader aspects of the invention. However, it is preferred to employ the improved packer illustrated in the drawings as it may be easily and quickly assembled in the body and actuated to provide a positive leak tight seal. The packer A may be designed to seal about the drill pipe P as illustrated in the drawings or may be designed to fully close off the upper end of the body opening when the tools are removed from the well. In the case illustrated the packer A comprises two sections B formed of a split annular body of packing 35, a split collar 36 on the upper end of the packing and a split collar 37 on the lower end of the packing. This laminated assembly is split at diametrically opposite points into the two semi-circular sections B. The packing 35 and the collars 36 and 37 are proportioned to be readily passed downward into the enlarged body opening 17. Lips 38 may be provided adjacent the interior and exterior surfaces of the collars 36 and 37 to confine or retain the edge portions of the packing 35. Wedge shaped ridges or tongues 39 may be provided on the inner ends of the collars to expand the packing 35 inwardly and outwardly when the assembly is subjected to a compression strain. Pins 40 extend through openings in the collar 36 and the

packing 35 and thread into openings in the collar 37 to retain the collars and packing in their proper assembled positions. The lower collar 37 is provided with a downwardly and inwardly tapered periphery to seat on the shoulder 18 and support the packer in the opening 17. Openings 41 may be provided in the upper collar 36 to receive the threaded ends of lifting or suspending tools.

The two sections B of the packer A are hinged together by a pin 42 passing through openings in meshing or interengaging parts 43 on the adjacent ends of the sections. The sections B may be swung apart or opened so as to be easily assembled about the drill pipe P. Latch means is provided for automatically latching the free or outer ends of the sections B together when the packer is assembled about the pipe P. A latch 44 is pivoted in a recess 45 in the upper collar segment of one section B and is adapted to cooperate with a pin 46 passing through a similar recess in the opposing end of the upper collar segment of the other section. The end or nose of the latch 44 projects from the end of the collar segment and a spring 47 normally yieldingly urges the latch into an operative position for engaging the pin 46. During drilling the packer A may be suspended in the well derrick in a position where it may be allowed to swing inwardly against the drill pipe P so that the inner sides of the hinged ends of the sections B strike the pipe and cause the sections to be pivoted together, whereupon the latch 44 automatically cooperates with the pin 46 to latch the sections together about the drill pipe. The packer may then be slid or lowered downwardly into the enlarged body opening 17.

Means is provided on the packer A to be engaged by the flange or lip 31 of the member 30 when the packer is dropped or lowered into the opening 17 of the body. An annular groove 50 is provided in the periphery of the upper collar 36. A split ring 51 is arranged in the groove 50 for cooperating with the lip 31. The ring 51 includes a substantially semi-circular section or segment in the groove portion 50 of each section B. The segments of the ring 51 are shiftable radially in the groove 50 and are normally urged outwardly by springs 52. Pins 53 limit the outward movement of the ring 51. The portion of the ring 51 which projects beyond the periphery of the packer has a downwardly and inwardly inclined lower surface 54 and a flat horizontal upper side or surface. When the packer A has been arranged or assembled about the pipe P as above described and is lowered into the opening 17 the inclined surface 54 of the ring 51 cooperates with the lip 31 causing the ring to be forced inwardly against the action of the springs 52. This retraction of the ring 51 permits the packer A to enter the opening 17 so that the lower collar 37 seats on the shoulder 18. The springs 52 automatically return the ring 51 to its projecting position where its upper side is engageable by the lip 31. The member 30 may be threaded downwardly to actuate or compress the packer to seal about the pipe P and to seal with the wall of the opening 17.

During the drilling of the well or at any time when there is a possibility of a blowout occurring the body 10 may be positioned on the upper end of the casing C. Under normal conditions the packing sleeve 22 is in its uncontracted condition where the wall of its opening 23 is flush

with the wall of the body opening 13. The member 30 is normally threaded on the body 10, its downward threading being limited by the screws 32. The opening through the device or blowout preventer is normally unobstructed permitting the free operation of tools through the casing. At the first warning of high pressures developing in the well fluid under pressure is passed into the chamber or recess 15 through the conduit 27. This fluid under pressure contracts or actuates the packing sleeve 22 inwardly. If a string of pipe P is extending into the well at the time of actuation of the means 11 the packing sleeve 22 tightly seals against the drill pipe to close off the body opening 13. In the event that there are no tools extending into the well the packing sleeve 22 may be contracted or actuated inwardly to control or close off the upper end of the casing C. Upon the actuation of the means 11 as just described the conduits 21 communicating with the ports 19 may be open to permit the escape of the gas pressure or may be employed to pass mud under pressure into the well as desired or believed necessary.

Immediately following the operation of the packing means 11 as just described the packer A, which may have been suspended in the derrick, is swung inwardly against the drill pipe P so that the inner sides of its sections B strike the pipe adjacent their hinged ends and are thus automatically closed about the pipe. The latch 44 automatically latches with the pin 46 upon the closing or hinging together of the sections A. The packer A is then lowered or dropped into the body of the blowout preventer. The ring 51 is automatically contracted as the packer is passed into the opening 17 through the cooperation of its surface 54 with the lip 31. The springs 52 return the ring segments to positions where their upper sides are engageable by the flange 31. The actuating member 30 is then threaded downwardly to actuate or compress the packer A to cause the packer to seal about the pipe P and seal with the wall of the body opening 17. As previously pointed out the packer A may be designed to seal off the upper end of the body 10 when there are no tools extending through the device. The ports 20 may be employed to permit the escape of gas under pressure or to pass mud under pressure into the well as required. Following the operation of the packing means 12 pressure may be removed from the recess 15 to permit the packing sleeve 22 to return to its normal configuration through its resiliency. The packing means 12 dependably and effectively seals and closes off the upper end of the body 10. In the event that a leak develops about the packer A the packing sleeve 22 may be contracted or actuated inwardly by fluid pressure admitted to the recess 15 to close or seal the body opening 13, whereupon the packer A may be replaced.

The auxiliary or emergency packing means 11 provided by the present invention is instantly operable to control or seal off the upper end of a well casing when a blowout is anticipated. The packing means 11 when actuated allows the packer A to be properly positioned and actuated to dependably seal off the upper end of the body 10 without undue haste. The body 10 of the device is particularly simple and is provided with two sets of ports providing for the proper control of the well when either packing means is in use. The packing means 11 is positioned and available

for immediate use but does not in any way interfere with the normal passage and operation of tools through the device.

- 5 Having described only a typical preferred form and application of our invention, we do not wish to be limited or restricted to the specific form and application herein set forth, but wish to reserve to ourselves any modifications or variations that may appear to those skilled in the art or fall  
10 within the scope of the following claim.

Having described our invention, we claim:

- A head for a well comprising a lower body section to be applied to a well casing and having a passageway therethrough of uniform diameter,  
15 a circumferentially extending lip formed at the upper end of said body section having a flat end portion and an outer and downwardly tapered side wall terminating in a flat circumscribing shoulder, a threaded portion formed on the body  
20 section adjacent said flat circumscribing shoulder and substantially agreeing in outer circumference therewith, a cylindrical tubular packing sleeve of uniform wall thickness having an internal diameter substantially agreeing with the  
25 diameter of the bore through the lower body section and being formed at its lower end with a lip conforming to the lip and shoulder formed

on the body section against which it seats, an upper section threaded at its lower end to engage the threads of the lower section and being formed with a main bore agreeing in diameter with the outside diameter of the tubular expanding packing and a reduced bore at its upper end agreeing with the inside diameter of the tubular expanding packing, a downwardly and inwardly tapered lip carried by the section having a bore of reduced diameter and forming a groove in combination  
5 10 with the wall of the large bore of said upper section, an upwardly extending lip formed on the tubular contractible member and seated within said section, an annular recess formed around the wall of the large bore of the upper section  
15 intermediate its ends whereby an annular space will occur around the median portion of the contractible tubular packing, the longitudinal width of said recess being less than the distance between the ends of the lips formed on the upper  
20 and lower sections and means providing for the introduction of fluid into said annular groove to distend the median portion of contractible packing.

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