

[54] MATERIAL REMOVING BIT

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[58] Field of Search 51/331, 332, 350, 351, 51/352, 354, 206 R, 309; 15/104.19, 104.1, 104.09; 166/172, 170, 171

[56] References Cited
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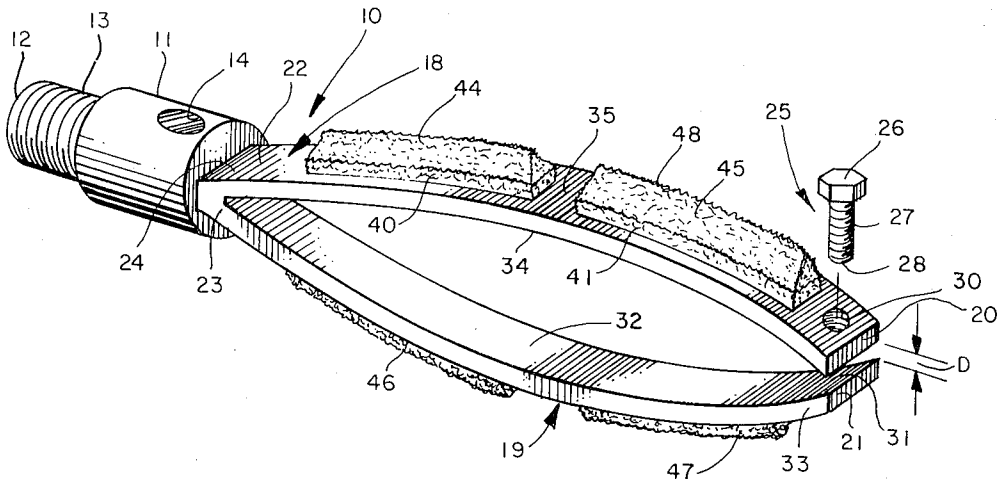
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[57]

ABSTRACT

A rotatable bit or tool for removing material from the inside walls of tubes and pipes, has at least a pair of outwardly bowed cutting blades constructed from metal spring leaf material. One set of blade ends are integrally fixed to a common mounting collar and the opposite set of scraper blade ends are free and spaced from one another. The outer or bowed faces of the scraper blades carry cutting bars constituted by composite rod. Cutting force or scraping pressure against the interior walls of a pipe can be adjusted by cutting pressure regulating means.

8 Claims, 2 Drawing Figures



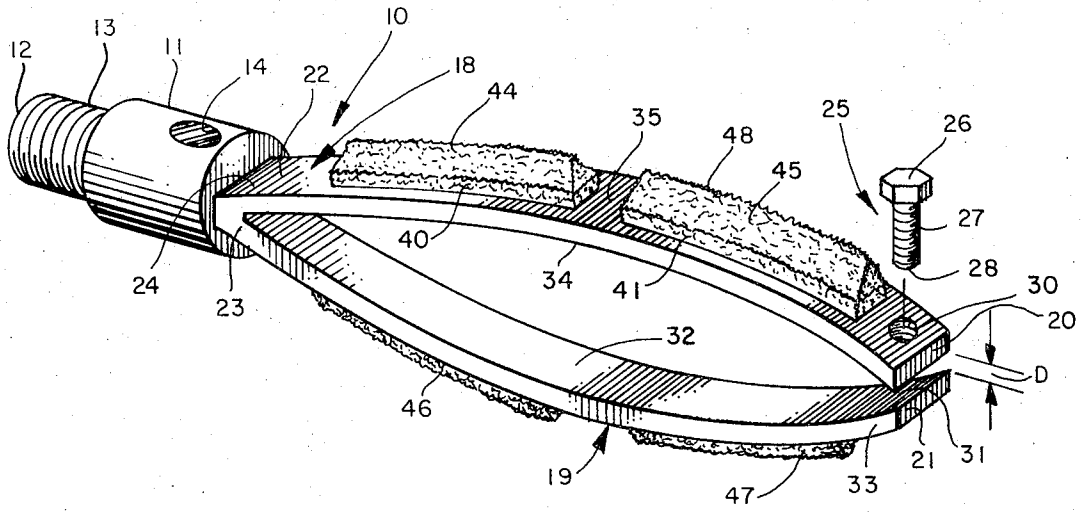


FIG. 1

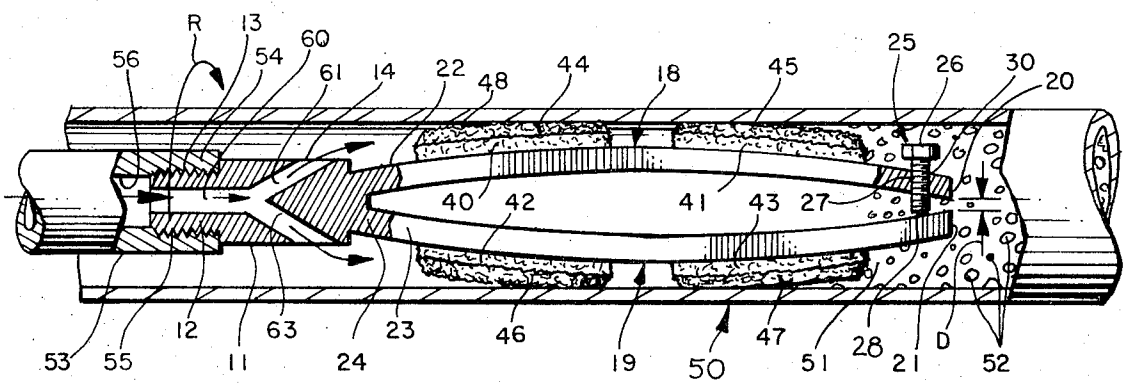


FIG. 2

MATERIAL REMOVING BIT

BACKGROUND OF THE INVENTION

This invention generally relates to material removing bits and more specifically to material removing bits for cutting away plastic coatings applied to interior surfaces of oil well tubing pipe.

Heavy duty tubes or pipes are used in the oil well industry during production operations to conduct salt water to the natural subterranean oil zone. The salt water is for raising the oil level and for increased production.

In order to minimize and delay corrosion effects by the salt water, tough and durable protective coatings of suitable plastic oil epoxy are generally baked onto the interior surfaces of these tubes. These plastic protective coatings eventually deteriorate and break down into flakes and scale, making them unsatisfactory for further normal use.

Rather than junking these tubes after they have become so deteriorated, the tubes are often subjected to salvaging procedures so that they may be subsequently used as bare tubing for different purposes or possibly reconditioned and reclaimed for reuse.

For a salvaging operation to be effective, the plastic flakes and scale must be thoroughly cleaned from the interior periphery of a tube.

Conventional rotary scraping tools carrying borium or similar types of abrasive compounds have been used. A typical tool is disclosed in U.S. Pat. No. 2,998,074 to R. L. Casady et al. for "Oil and Gas Well Cleaning Apparatus."

This invention is concerned with a special tool or bit for efficiently removing plastic coatings from the interior walls of tubes.

SUMMARY OF THE INVENTION

Briefly stated, this invention relates to a rotatable material removing bit for cutting away coatings of material applied to the interior walls of pipes and tubes such as those used in the oil well industry.

Broadly stated, the material removing bit has a mounting collar formed with a neck constructed for connection to a rotating drill rod. A plurality of elongated and outwardly bowed cutting blades constructed from metal leaf spring material are secured by one set of ends to the mounting collar. The other or opposite set of cutting blade ends are free and spaced from one another.

At least one mounting pad is secured to the external or convex face of each scraper blade and carries and abrading bar constructed from composite rod material.

A cutting pressure regulating means is provided and is coupled to the cutting blade set of free ends. It is arranged to control the mutual spacing between the cutting blade free ends.

The composite rod material preferably consists of a composition that is approximately 65 per cent tungsten carbide and 35 per cent matrix rod or binder.

Each scraper blade has at least two mounting pads and the outermost portions of the cutting bars are preferably sharp cutting peaks.

A coolant distribution means is formed in the mounting collar and neck and includes a central passageway in the neck and at least a pair of branch line passageways

in the mounting collar which terminate in exit ports.

In one embodiment of this invention there are two laterally spaced apart scraper blades. The cutting pressure regulating means includes a spacing adjustment aperture formed through the free ends of one cutting blade and a set screw is positioned in the aperture for engagement with a striking area of the other scraper blade.

BRIEF DESCRIPTION OF THE DRAWINGS

The numerous benefits and unique aspects of the present invention will be fully understood when the following detailed description is studied in conjunction with the drawings in which:

FIG. 1 is a perspective, partially exploded view showing a rotatable material removing bit constructed in accordance with this invention; and,

FIG. 2 is a longitudinal sectional view showing the material removing bit coupled to a rotating drill rod and operating to cut away material from the interior surface of a tube.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings and FIG. 1 in particular, a rotatable material removing bit 10 is shown that has a generally cylindrical mounting collar 11 which is partially hollow for a purpose to be described. A smaller diameter neck portion 12 is formed with external threads 13. A coolant fluid exit port 14 is formed through the side wall of mounting collar 11.

Extending outwardly from mounting collar 11 is a pair of cutting blades 18 and 19 constructed from metal leaf spring material. The cutting blades 18 and 19 are bowed outwardly and away from one another and are generally coterminous and symmetrically shaped. The cutting blades 18 and 19 terminate at their distal portions in free ends 20 and 21 which are laterally spaced from one another. The proximal portions of scraper blades 18 and 19 are fixed ends 22 and 23 which converge and merge in a junction 24 that is integrally formed with or rigidly fixed to mounting collar 11.

A scraping pressure regulating means 25 is provided at the set of free ends 20 and 21 associated with scraper blades 18 and 19. The scraping pressure regulating means 25 is shown in the form of a spacing adjustment element 26 which is a set screw having a threaded shank 27 and a butt end 28. Formed through free end 20 is a spacing adjustment aperture 30 formed with internal threads to receive and interengage with the shank 27 of set screw 26. The regulated or adjusted spacing between free ends 20 and 21 is represented by designation D. A striking area 31 formed by the concave undersurface or face 32 becomes engaged by butt end 28 during scraping operations to limit the size of gap distance D.

Cutting blade 19 has a concave undersurface 32 and a convex upper surface 33. Similarly, cutting blade 18 has a concave undersurface 34 and a convex upper surface 35. A pair of tandemly arranged mounting pads 40 and 41 are fixed on the convex upper surface 35 of cutting blade 18. Similarly, a pair of tandemly aligned and longitudinally spaced mounting pads 42 and 43 are fixed to the convex upper surface 33 of cutting blade 19.

Cutting bars 44, 45, 46, and 47 are securely anchored to the outermost surfaces of their corresponding mounting pads 40, 41, 42, and 43. In each case the abrading bar terminates outwardly in a sharp cutting peak 48. Also in each case the abrading bar consists of a special highly effective material, i.e., composite rod. The particular composite rod contemplated by this invention is approximately 65 per cent tungsten carbide and 35 per cent matrix rod or binder. Moreover, the tungsten carbide portion of the composite rod consists of the following materials present in the indicated percentages: tungsten — 81 per cent, cobalt — 13 per cent, titanium — 4 per cent, and tantalum — 2 per cent. The matrix rod or binder portion of the composite rod consists of the following ingredients present in the indicated percentages: copper — 43 per cent, zinc — 40 per cent, nickel — 10 per cent, and silicon — 7 per cent. The outer sections of the abrading bars are essentially triangular in cross section.

Referring now primarily to FIG. 2, the rotatable material removing bit 10 is shown under operating conditions within a large heavy duty tube or pipe 50, of the kind used in the oil well industry during oil production.

The interior circular periphery 51 is coated with a tough and durable protective coating of plastic material or epoxy which has commenced deteriorating into flakes and scales represented by designation 52.

A rotating drill rod 53 is secured to and drivingly engaged with the material removing bit 10. Specifically, the portion of the drill rod 53 shown is a box 54 formed with internal threads 55 and a central coolant passageway 56. The external threads 13 of neck 12 are interengaged with the internal threads 55 of box 54.

A coolant distribution means is provided. A central passageway 60 is formed through neck 12 and communicates with a pair of diverging branch line passageways 61 and 62 formed in mounting collar 11. Branch line passageways 61 and 62 terminate in coolant exit ports 14 and 63 respectively. The drill rod 53 is shown rotating in a given direction indicated by arrow R so that the composite rod cutting bars 44, 45, 46, and 47 may be brought into cutting engagement with the tube interior periphery 51 and flakes, etc., 52.

The mounting collar 11 may be enlarged to a diameter slightly smaller than that of tube 50 in order to operate as a "pipe drift." Pipe drifts are used for quality control purposes in checking for and partially correcting imperfections in the form of dents, bumps, crushed segments, etc. It serves as a type of mandril driven through the pipe to detect and sometimes correct imperfection areas by becoming temporarily jammed or lodged prior to deformation and possible restoration.

Thus, the material removing bit 10 of this invention may be modified to serve the dual purpose of scraping and cutting away interior surface material and acting as a pipe drift.

OPERATION

Keeping the above construction in mind it can be understood how the previously described disadvantages of conventional prior art material removing bits are overcome or substantially eliminated by this invention.

When an oil well industry tube 50 commences to deteriorate into flakes 52, etc., then the rotatable material removing bit 10 of this invention may be used in a salvaging operation. A particular bit 10 is chosen having

a general size and shape sufficient to accommodate the particular size of tube 50.

The cutting pressure regulating means 25 is adjusted to control the cutting pressure or tension against the interior walls 51 of tube 50. When the spacing adjustment element 26 is arranged to achieve a relatively large gap D between blade free ends 20 and 21 then this mechanical action will result in a relatively great cutting pressure. Alternatively, when the spacing adjustment element 26 is arranged to result in a relatively narrow or small gap D then diminished cutting pressure will result. The cutting pressure regulating means is adjusted to achieve a cutting pressure sufficient to cut away the hard durable epoxy coating or the like on tube walls 51.

The material removing bit 10 is drivingly engaged to a rotatable drill rod 53 by way of interengaging neck 12 with box 54.

With the abrading bars 44, 45, 46, and 47 in frictional engagement with tube walls 51, rotation in direction R by the drill rod 53 will cause the epoxy or other protective coating to become cut away from tube wall 51. During cutting action the coolant liquid, such as water is pumped through coolant passageway 56, into central passageway 60 and branch line passageways 61 and 62 in order to be eventually forced to the cutting region for coolant purposes and assisting to carry away debris.

The sharp points of tungsten associated with the bars 44, 45, 46 and 47 which are mounted on the pads 40, 41 42 and 43 accomplish the cutting of metal and epoxy from the inner walls of the tubes or pipes. The actual bar or rod stock may be fabricated in different sizes and the tungsten particles may vary, for example between one-sixteenth to one-eighth of an inch, from between one-eighth to three-sixteenths of an inch, or from three-sixteenths to one-fourth of an inch, etc. The actual size applied to the mounting pads and the rotational speed of the material removing bit 10 as well as the longitudinal travelling speed collectively determine the amount of epoxy or metal that can or will be removed.

The epoxy is compressed or deposited in pores of the metal and so the removal of some metal generally confining or encapsulating the epoxy will prove necessary, however, the amount of metal that must be removed will ordinarily be nominal, e.g., one to five thousandths of an inch depending upon the size of the tungsten particles and rotational and travel speeds of the bit 10.

The material removing bit 10 works much like many cutting tools associated with lathes. When a point of the tungsten wears down or recedes to a level where it can no longer effectively or efficiently remove metal, then the cutting bar may be replaced. When the tungsten sharp points are reduced to this level, then they would commence scraping or abrading which type of mechanical action is not sufficient to accomplish the job required.

From the foregoing it will be evident that the present invention has provided a rotatable material removing bit in which all of the various advantages are fully realized.

What is claimed is:

1. A rotatable material removing bit, comprising:
 - a. a mounting collar having a neck constructed for connection to a rotating drill rod;

- b. at least two elongated and outwardly bowed cutting blades constructed from metal leaf spring material, having a set of inner cutting blade ends secured in cantilevered relationship to the mounting collar and an outer set of cutting blade ends spaced from one another; 5
 - c. at least one mounting pad secured to the external or convex face of each cutting blade, carrying an abrading bar constructed from composite rod material; and, 10
 - d. cutting pressure regulating means including a spacing adjustment aperture formed through an outer end of one cutting blade with a set screw positioned in the aperture for engagement with a striking area of the other cutting blade. 15
2. The structure according to claim 1 wherein the composite rod material consists of approximately 65 per cent tungsten carbide and 35 per cent matrix rod or binder. 15
3. The structure according to claim 2 wherein the tungsten carbide consists of approximately 81 per cent tungsten, 13 per cent cobalt, 4 per cent titanium and 2 per cent tantalum, and, 20
- the matrix rod or binder consists of approximately 43 per cent copper, 40 per cent zinc, 10 per cent nickel and 7 per cent silicon. 25
4. The structure according to claim 1 wherein; each cutting blade has at least two mounting pads and the outermost portions of the abrading bars are sharp cutting peaks. 30
5. The structure according to claim 1 including: a coolant distribution means in the mounting collar and neck. 30
6. The structure according to claim 5 wherein; the coolant distribution means includes a central passageway in the neck and at least a pair of branch line passageways in the mounting collar that terminate in exit ports. 35

- nate in exit ports.
7. A rotatable material removing bit, comprising:
- a. a mounting collar having a neck constructed for connection to a rotating drill rod;
 - b. at least two elongated and outwardly bowed cutting blades constructed from metal leaf spring material, having a set of inner cutting blade ends secured in cantilevered relationship to the mounting collar and an outer set of cutting blade ends spaced from one another;
 - c. at least two mounting pads secured to the external or convex face of each cutting blade;
 - d. an abrading bar with a sharp cutting peak secured to the outermost portion of each support pad, the abrading bar being constructed from composite rod material, consisting of approximately 65 per cent tungsten carbide and 35 per cent matrix rod or binder;
 - e. a coolant distribution means in the mounting collar and neck, including a central passageway in the neck and at least a pair of branch line passageways in the mounting collar that terminate in exit ports; and,
 - f. cutting pressure regulating means including a spacing adjustment aperture formed through an outer end of one cutting blade with a set screw positioned in the aperture for engagement with a striking area of the other cutting blade.
8. The structure according to claim 7 wherein: the tungsten carbide consists of approximately 81 per cent tungsten, 13 per cent cobalt, 4 per cent titanium and 2 per cent tantalum, and, the matrix rod or binder consists of approximately 43 per cent copper, 40 per cent zin, 10 per cent nickel and 7 per cent silicon.
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