

May 17, 1966

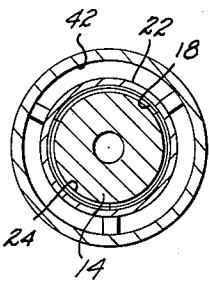
E. L. CONDRA

3,251,418

OIL WELL SCRAPER

Filed April 13, 1964

2 Sheets-Sheet 1



INVENTOR.

ELMO L. CONDRA

BY

William C. Babcock
ATTORNEY

May 17, 1966

E. L. CONDRA
OIL WELL SCRAPER

3,251,418

Filed April 13, 1964

2 Sheets-Sheet 2

FIG. 6

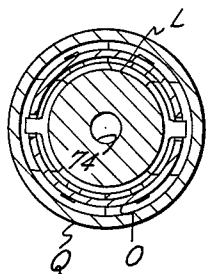


FIG. 3

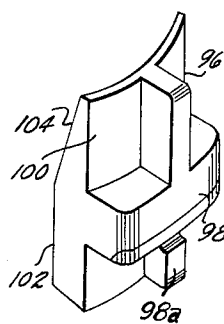


FIG. 7

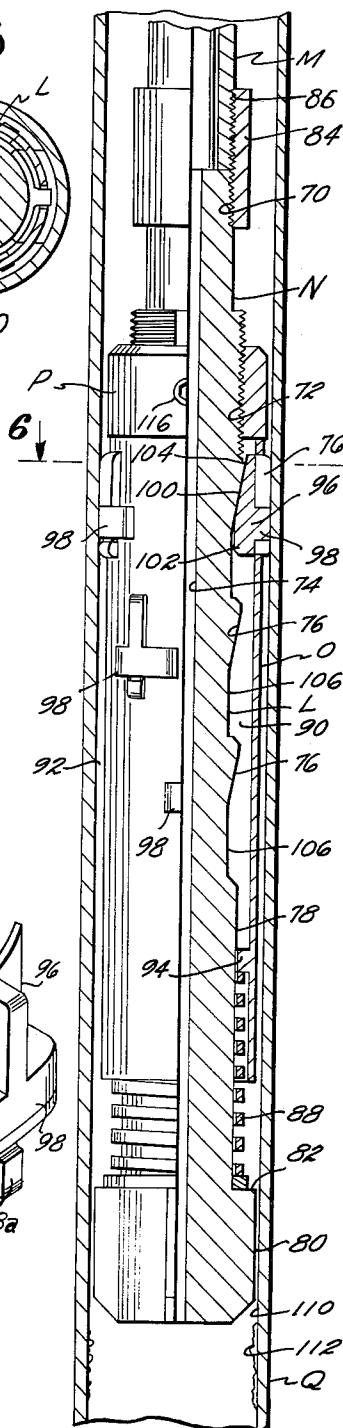
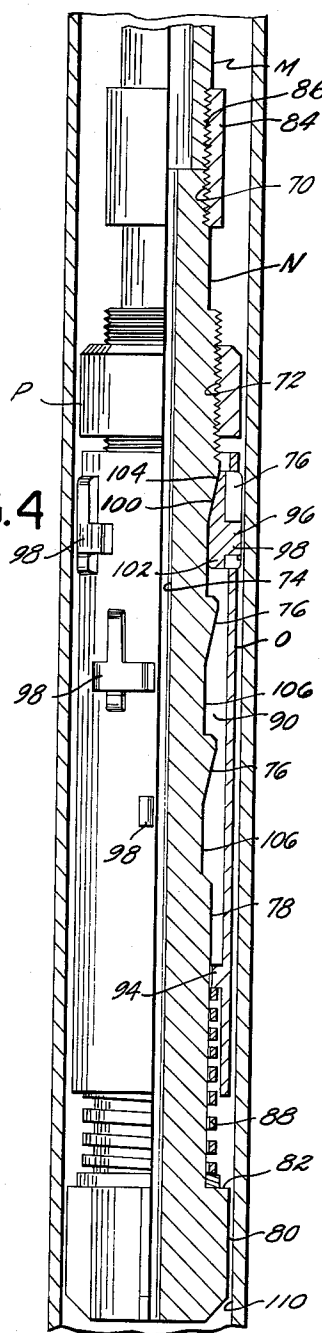


FIG. 4



INVENTOR
ELMO L. CONDRA

BY

William C. Babcock
ATTORNEY

1

3,251,418

OIL WELL SCRAPER

Elmo L. Condra, 1860 Coronado Ave., Long Beach, Calif.
Filed Apr. 13, 1964, Ser. No. 359,342
12 Claims. (Cl. 166-173)

The present invention relates generally to the petroleum industry, and more particularly to a scraper for removing foreign material from tubular members that may vary in the internal diameter thereof.

In the production of oil from wells in many fields, it is common for the interior of the tubular members through which the oil flows to become encrusted with foreign material, such as paraffin or the like. Such foreign material when deposited seriously restricts the flow of oil through the tubular member so affected.

The primary purpose in describing the present invention is to provide an apparatus that can be used to efficiently remove such foreign deposits from the interior of tubing strings and the like while the same remain in place in a well.

Another object of the invention is to supply a scraper that can be positively adjusted to a desired transverse cross section to remove foreign material from tubular members of varying internal diameters.

Still another object of the invention is to provide a device that can be fabricated from standard commercially available materials, has a relatively simple structure, is easy to use, is free from the use of springs and one that cannot become stuck in a well.

These and other objects and advantages of the invention will become apparent from the following description of two forms thereof, and from the drawings illustrating the same in which:

FIGURE 1 is a combined side elevational and vertical cross sectional view of a first form of the device in a position to scrape the interior of a tubular member;

FIGURE 2 is the same view as shown in FIGURE 1, but with the device having been moved vertically to a position where the scraper blades are freely movable relative to the interior surface of the tubular member;

FIGURE 3 is a combined side elevational and vertical cross sectional view of a second form of the device in a position to scrape the interior of a tubular member;

FIGURE 4 is the same view of the device as shown in FIGURE 3, but with the device having been moved vertically to a position where the scraper blades are freely movable relative to the interior surface of the tubular member;

FIGURE 5 is a transverse cross sectional view of the device shown in FIGURE 1 and taken on the line 5-5 thereof;

FIGURE 6 is a transverse cross sectional view of the device shown in FIGURE 3 and taken on the line 6-6 thereof; and

FIGURE 7 is a perspective view of one of the scraper blades used in the second form of the device.

Referring now to FIGURES 1, 2 and 5 for the general arrangement of the first form of the device it will be seen to include an elongate tubular body A formed from steel or other suitable rigid metallic material. Body A has a bore 8 extending longitudinally therethrough.

The body A has first and second external threads 10 and 12 formed on the lower and upper portions thereof as best seen in FIGURE 1. The tubular body A also has first and second longitudinally spaced frusto-conical portions 14 and 16 respectively, projecting outwardly therefrom, and situated between threads 10 and 12. The portions 14 and 16 have circumferentially extending first and second cam surfaces 46 and 48 defined thereon that slope upwardly and outwardly from the tubular member A.

2

A threaded tubular connector B of conventional design is provided that engages threads 9 on the upper part of body A and the threaded lower end of a tubing or drill string C. The string C supports the scraper, referred to as a whole by the letter D, on the lower end thereof.

A cylindrical guide E is provided that includes an upper portion 22 that has a tapped bore 24 extending longitudinally therethrough that engages second threads 12. By rotating guide E on second threads 12 the guide can be raised or lowered relative to tubular body A for reasons that will be explained later. A cylindrical skirt 26 depends from upper portion 22. The skirt 26 has a number of parallel, circumferentially spaced slots 28 that extend upwardly from the lower edge thereof as can best be seen in FIGURE 2.

A number of scraper blades F are provided, each of which is preferably formed from a plate of hard material such as steel or the like. Each blade F includes a first portion 30 that is slidably mounted in one of the slots 28 and projects outwardly therefrom. A second portion 32 of each blade F is disposed in an annulus shaped space 34 that is defined between skirt 26 and tubular body A. Each second portion 32 includes an upwardly projecting extension 36 and a downwardly projecting extension 38.

The outer extremity of each first portion 30 is defined by a straight edge 40 that can be brought into scraping contact with the interior surface 42 of a tubular member H that is to have foreign material 44 encrusting the same scraped therefrom. Each upper extension 36 has a cam face 18 formed on the inner part thereof, with each face 18 being in slidable contact with first cam surface 46. Also, each second portion 30 has a cam face 20 formed on the interior thereof that is in slidable contact with second cam surface 48.

A rigid cup G is provided that has a cylindrical sidewall 50 and a bottom 52. The bottom has an opening 54 therein. Tubular member A extends through opening 54. The cup G is vertically movable relative to body A. A ring 56 projects outwardly from tubular body A, and serves as a stop to limit the upward movement of cup G on the tubular member.

A helical spring 58 encircles the lower portion of the tubular body A as can best be seen in FIGURES 1 and 2. An internally threaded tubular collar 60 of conventional design engages the first threads 10. The collar 60 serves to support a bit, or other tubular member K below the tubular body A and in coaxial alignment therewith.

Spring 58 is of such length that the upper end thereof bears against the cup G and the lower end against the upper surface of collar 60. The upper edge of sidewall 50 of cup G is in contact with edge surfaces 62 of blades F. The spring 58 tends to move cup G and the scraper blades F upwardly relative to the tubular body A. As such upward movement takes place the cam faces 18 and 20 on blades F slide upwardly relative to cam surfaces 46 and 48 on tubular body A, and the blades F are moved outwardly radially, relative to the tubular body.

The degree of outward radial movement of the blades F can be regulated by rotating the guide E on tubular body A to a position where the upper extremities 64 of the slots 28 are contacted by edges 66 of blades F when the edges 40 of the blades are just in scraping contact with the cleaned interior surface 42 of tubular member H. The tubing or drill string C can now be rotated by power means (not shown), and as the scraper assembly D is moved downwardly through tubular member H foreign material 44 will be scraped from the interior thereof. It will be particularly noted that irrespective of the downward force exerted on the scraper D, the blades F will not move outwardly any further radially than the distance for which they were originally set by rotating guide E relative to tubular body A.

To prevent inadvertent rotation of guide E on body A, a lock nut J is provided that engages first threads 10 and is in abutting contact with the upper edge of the guide E.

The spring 58 while relatively light in structure, is of sufficient length and strength as to maintain the upper edge of cup G in contact with edges 62 of scraper blades F. When the scraper D is being lowered into tubular member H, the blades F may be in frictional contact with either the interior surface 42 thereof or the encrusted material 44, depending on the radial adjustment of the blades relative to the guide E. Due to this frictional engagement, the blades F tend to resist moving downwardly with the scraper D, and as a result the cam faces 18 and 20 move downwardly relative to first and second cam surfaces 46 and 48 to move the blades F outwardly the maximum limit for which the device is adjusted. Thus, as the scraper D is moved downwardly in tubular member H, the blades F may be caused to engage the interior surface 42 of tubular member H with any desired pressure, so long as the pressure is not so great as to preclude downward movement of the scraper D in the tubular member.

When the scraping operation is completed, a force is exerted on string C and scraper D that is sufficient to move the two upwardly. The blades F initially resist this upward movement, with the cam faces 46 and 48 moving upwardly relatively to cam surfaces 18 and 20. This upward movement of cam faces 46 and 48 relative to cam surfaces 18 and 20 is made possible by spring 58 being compressed as collar 60 moves upwardly relative to the blades F. As upward movement of the scraper D takes place the weight of the blades F is transferred through cup G to the spring 58 to compress the same. When the spring 58 is compressed as shown in FIGURE 2, the scraping edges 40 of blades F are separated from the interior surface 42 of tubular member H, and the scraper D can be easily withdrawn from the tubular member without danger of it becoming stuck or jammed therein. The upper and lower ends of the edges 40 of the blades F, develop into tapered portions 40a to eliminate the possibility of the blades jamming into spaces defined in drill string collars (not shown) between adjacent ends of lengths of drill pipe therein.

Should the blades F frictionally contact the interior surface 42 of tubular member H in being withdrawn therefrom, the blades due to this frictional engagement will immediately compress spring 58 to the extent that the blades can move inwardly as above described to permit the continued upward movement of the scraper D.

From the above description it will be apparent that no matter how forcefully the scraper D is lowered in tubular member H, the blades F can only move outwardly a desired maximum amount to contact the interior surface 42. This outward radial movement of the blades F in the scraper D is positive, and assures that the entire interior surface 42 of tubular member H will be subjected to a scraping action of constant force providing that the interior cross section of the tubular member H is uniform.

A second form of the device is shown in FIGURES 3, 4 and 6 that includes an elongate tubular body L that has first and second threads 70 and 72 formed on the upper portion thereof. A bore 74 extends longitudinally through body L. The body L has a number of longitudinally spaced, circumferentially extending cam faces 76 that project upwardly and outwardly therefrom as best seen in FIGURES 3 and 4. The body L below the lowermost of the cam faces 76 has a cylindrical surface 78 defined thereon. The lower end of the body L is defined by an enlarged portion 80 that provides a ring shaped body shoulder 82.

An internally threaded collar 84 is provided that engages first threads 70 and threads 86 formed on the lower end of a tubing string M. The collar 84 serves to hold the second form of the device, referred to as a whole by the letter N, in a depending position from the

tubing string M. A helical spring 88 encircles the cylindrical surface 78 of body L, and with the lower end of the spring resting on the shoulder 82.

A cylindrical guide O extends longitudinally over the cam faces 76. The guide O and body L cooperate to define an annulus shaped space 90 there between. Guide O as may best be seen in FIGURES 3 and 4 has a number of longitudinally and circumferentially spaced cross shaped slots 92 formed therein. The guide O also has a ring 94 that extends inwardly therefrom, and is located in the lower portion of the guide. Ring 94 is in abutting contact with the upper end of spring 88, which spring is in compression.

A large lock nut P engages the second threads 72. The upper edge of guide O bears against the lower surface of nut P, due to compression on spring 88 when the second form of the device N is assembled as shown in FIGURES 3 and 4.

A number of scraper blades 96 are provided that are defined by a cross 98 that projects outwardly from an arcuate shaped shell 100. Each shell 100 has a lower, straight walled, inner arcuate surface 102 and an upper interior cam surface 104 that slopes upwardly and outwardly and can slidably contact one of the cam faces 76. Each blade 96 is of such dimensions that the cross 98 thereof is slidably supported in one of the cross shaped slots 92, with the shell 100 disposed in annulus shaped space 90. The body L as can best be seen in FIGURES 3 and 4 has a number of cylindrical sections 106 situated between cam faces 76.

The blades 96 are of such dimensions that when the sections 106 of body L and surfaces 102 most adjacent thereto are in a common horizontal zone, the blades 96 can be moved inwardly relative to body L to the extent that the outer scraping surfaces of cross 98 are flush with the exterior surface of guide O as shown in FIGURE 4. The shell 100 prevents the blades 96 being moved outwardly through slots 92.

Spring 88 is at all times in compression and tends to move guide O and blades 96 upwardly relative to body L. Such upward movement causes cam surfaces 104 to move upwardly relative to cam faces 76, with the blades 96 being moved outwardly relative to guide O as a result thereof. By rotating nut P, the nut can be moved upwardly on threads 72 to limit the upward movement of guide O and blades 96 relative to body L due to the compressed spring 88 to a desired degree. The desired degree will be that at which the outer surfaces of the blades 96 are disposed in scraping contact with the interior surface 110 of tubular member Q. When the second form of the device is moved downwardly through the member O, foreign material 112 will be scraped from the interior thereof by the horizontal portions of the blades 96. The slots 92 are formed in sufficient number in guide O and so circumferentially spaced thereon as shown in FIGURES 3 and 4 that as the second form of the device is moved downwardly in tubular member Q the entire interior surface of the member is subjected to a scraping action, and without the second form of the device being required to be rotated. Nut P is held at a desired adjusted position on body L by a set screw or bolt 116.

After the second form of the device has been used to remove foreign material 112 from tubular member Q, a force is exerted on drill string M and the second form of the device sufficient to move the two upwardly through the tubular member. The blades 96 due to frictional contact with the interior surface 110 or foreign material 112 tend to resist such upward movement and as a result spring 88 is further compressed by body L moving upwardly relative to blades 96. This upward relative movement of body L relative to blades 96 results in cam faces 76 moving upwardly relative to cam surfaces 104. Blades 96 are now free to move inwardly relative to guide O to positions as shown in FIGURE 4

5

where the blades offer no substantial resistance to the upward movement of the second form of the device through tubular member Q. If the blades 96 frictionally contact the interior surface 110 as the second form of the device is being raised upwardly through tubular member Q, the spring 88 is immediately further compressed as above described to permit inward movement of the blades relative to guide O. Should it be desired the lower portion 98a of the horizontal part of cross 98 can be hard faced to minimize wear thereon as the scraping operation takes place.

The use of the first and second forms of the device has been previously described in detail and need not be repeated.

Although the forms of the invention hereinbefore shown and described are fully capable of achieving the objects and providing the advantages hereinbefore mentioned, it is to be understood that they are merely presently preferred embodiments of the invention, and that I do not mean to be limited to the details thereof other than as defined in the appended claims.

I claim:

1. A device capable of being mounted on the lower end of a tubing or drill string and when so mounted can be used to remove foreign material adhering to the interior surface of the tubular member, which member can vary in internal diameter between first and second limits, including:

(a) a rigid elongate body having first and second external threads formed on the lower and upper end portions thereof respectively, and said body having first and second longitudinally spaced frusto conical portions projecting outwardly therefrom and situated between said first and second threads, said first and second portions defining first and second circumferentially extending cam surfaces that slope upwardly and away from said body;

(b) means for removably connecting the lower end of said tubing or string to the upper end of said body to support the latter in a depending position therefrom;

(c) a tubular guide that includes an upper internally threaded portion that engages said first threads, and a cylindrical skirt that extends downwardly from said portion and is positioned outwardly from said body to define an annulus shaped space therewith, said skirt having a plurality of circumferentially spaced, parallel slots therein that extend upwardly from the lower edge of said skirt;

(d) a plurality of rigid blades, each of said blades having a first portion that is slidably mounted in one of said slots, and a second portion that is disposed in said annulus shaped space, with each of said second portions defining first and second longitudinally spaced cam faces that are in slidable abutting contact with said first and second cam surfaces;

(e) a rigid cup having a cylindrical sidewall, and a bottom in which a bore is formed that slidably engages said elongate body below said second cam surface, with the upper edge of said cylindrical sidewall being in abutting contact with said blades;

(f) an internally threaded collar that engages said first threads;

(g) a compressed helical spring that encircles said elongate body, with the ends of said spring in abutting contact with the upper surface of said collar and the lower surface of said bottom; and

(h) a lock nut that engages said second threads, which nut when rotated in a direction to move upwardly relative to said elongate body allows said guide, cup and blades to also move upwardly relative thereto, with said blades moving outwardly to the extent that they are in dragging contact with the interior surface of said tubular member to be scraped,

6

but upon exertion of an upward force of sufficient magnitude on said elongate body said spring is further compressed to allow said elongate body to move upwardly relative to said guide, cup and blades to the extent that said blades can move inwardly to said cam surfaces to positions where said device can be moved upwardly through said tubular member.

2. A device as defined in claim 1 which in addition includes a circumferentially extending ring that projects outwardly from said tubular body below said second frusto conical portion, and said ring capable of being contacted by said bottom to prevent said cup moving upwardly on said tubular body greater than a predetermined distance.

3. A device as defined in claim 2 in which said blades have second portions that project upwardly in said annulus-shaped space above the uppermost part of said slots.

4. A device as defined in claim 3 in which said first cam faces are formed on said second blade portions.

5. A device as defined in claim 2 in which said blades have second portions that project downwardly in said annulus-shaped space below the upper edge of said cup.

6. A device as defined in claim 5 in which said second cam faces are formed on said second blade portions.

7. A device capable of being mounted on the lower end of a tubing or drill string and when so mounted can be used to remove foreign material adhering to the interior surface of a tubular member, which member can vary in internal diameter between first and second limits, including:

(a) a rigid elongate body having external threads formed on the upper portion thereof, said body having a plurality of longitudinally spaced frusto conical portions projecting outwardly therefrom below said threads, said portions defining a plurality of circumferentially extending cam surfaces that slope upwardly and outwardly from said elongate body, and said body having an enlarged lower end portion that defines a circumferentially extending body shoulder;

(b) means for removably engaging said threads and the lower end of said string for supporting said body in a depending position therefrom;

(c) a tubular guide concentrically mounted on said elongate body and extending longitudinally over said frusto conical portions, said guide and elongate body cooperating to define an annulus shaped space therebetween, said guide having a plurality of longitudinally and circumferentially spaced slots therein, and said guide having a circular ring that extends inwardly from the lower interior portion thereof;

(d) a plurality of rigid blades, each of said blades having a first portion that is slidably mounted in one of said slots, and a second portion that is disposed in said annulus shaped space, with each of said second portions defining a longitudinally extending cam face that is in slidable abutting contact with one of said cam surfaces;

(e) a helical spring that encircles said elongate body, with the lower end of said spring abutting against said body shoulder and the upper end of said spring against said ring, and said spring at all times tending to move said guide upwardly relative to said elongate body;

(f) a lock nut that threadably engages said threads, which nut when rotated in a direction to move upwardly on said elongate body allows said compressed spring to move said guide upwardly thereon, with said guide capable of being so disposed relative to said tubular body as to move said blades outwardly to the extent that they are just in dragging contact with the interior surface of said tubular member that is to be scraped, but upon an upward force being exerted on said elongate body said spring being further compressed to allow said elongate body to

7

move upwardly relative to said guide and blades to the extent that said blades can move inwardly relative to said cam surfaces to positions where said device can be moved upwardly through said tubular member.

8. A device as defined in claim 7 in which each of said slots is in the shape of a cross that has longitudinal and transverse portions and each of said blades includes a cross shaped member that is slidably movable in one of said slots.

9. A device as defined in claim 7 in which said slots and blades are provided in sufficient number and so spaced circumferentially relative to said guide that the entire interior surface of said tubular member is contacted by said blades as said device is moved downwardly through said member.

10. A device as defined in claim 7 in which said second portions of said blades are arcuate spaced shells disposed in said annulus shaped space, and said cam faces formed on the upper interior portions of said shells.

11. A device as defined in claim 10 in which said body has a plurality of cylindrical sections between said frusto-conical portions, and said shells have arcuate shaped interior surfaces below said cam faces that can abut against said sections when the outer surfaces of said cross shaped members are substantially flush with the outer surface of said guide.

12. A device capable of being mounted on the lower end of a tubing or drill string and when so mounted can be used to remove foreign material adhering to the interior surface of a tubular member, which member can vary in internal diameter between first and second limits, including:

- (a) a rigid elongate body, the upper portion of which is exteriorly threaded and from which body a plurality of longitudinally spaced frusto-conical portions project outwardly below said threads that define a plurality of circumferentially extending cam surfaces which slope upwardly and outwardly;
- (b) first means for removably engaging said upper portion and the lower end of said string to support said body in a depending position therefrom;
- (c) a plurality of rigid blades circumferentially spaced about said body, which blades are provided with inwardly disposed cam faces that are in longitudinally slidable contact with said cam surfaces;
- (d) a transversely projecting member supported from the lower portion of said body;

8

(e) a compressed helical spring which encircles said body, with the lower end of said spring resting on the upper end of said projecting member;

(f) tubular means for holding said rigid blades in fixed longitudinal relationship, with the upper end of said helical spring being in contact with said tubular means; and

(g) a lock nut that engages said threads on said upper portion of said elongate body, which nut when rotated in a direction to move upwardly relative to said elongate body allows said tubular means and blades to also move upwardly relative thereto, with said blades moving outwardly to the extent that they are in dragging contact with the interior surface of said tubular member to be scraped, but upon exertion of an upward force of sufficient magnitude on said elongate body said spring is further compressed to allow said elongate body to move upwardly relative to said tubular means and blades to the extent that said blades can move inwardly relative to said cam surfaces to positions where said device can be moved upwardly through said tubular member.

References Cited by the Examiner

UNITED STATES PATENTS

1,995,095	3/1935	Fitzpatrick	166—176
2,203,966	6/1940	Otis	166—174
2,464,390	3/1949	Hammer	166—173
2,515,377	7/1950	Miller	166—55.3
2,710,657	6/1955	Scivally	166—173
3,105,555	10/1963	Villalon	166—174

References Cited by the Applicant

UNITED STATES PATENTS

1,010,954	12/1911	Rasmussen.
1,422,762	7/1922	Hatfield.
1,604,736	10/1926	De Forest.
1,770,207	7/1930	Helmling.
2,218,776	10/1940	Parker.
2,627,925	2/1953	Scivally.
2,667,931	2/1954	Baker.
2,695,673	11/1954	Coyle.
2,712,853	7/1955	Irwin.

CHARLES E. O'CONNELL, *Primary Examiner.*
D. H. BROWN, *Assistant Examiner.*