Dec. 5, 1967 J. V. FREDD 3,356,389

LOCKING DEVICES FOR WELL TOOLS

Filed Aug. 6, 1965 2 Sheets-Sheet 1

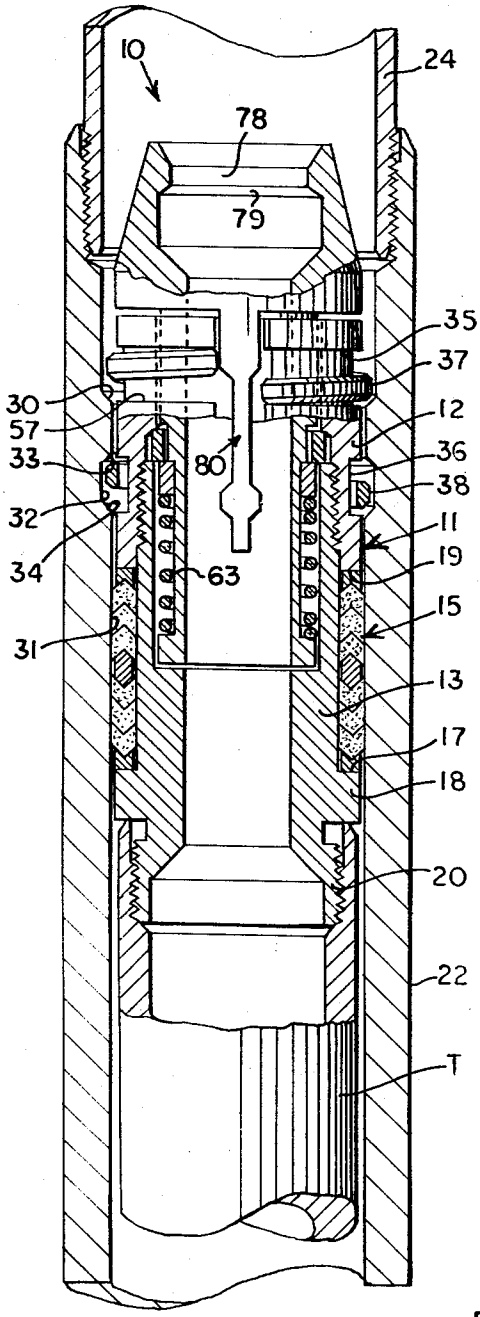


Fig. 1

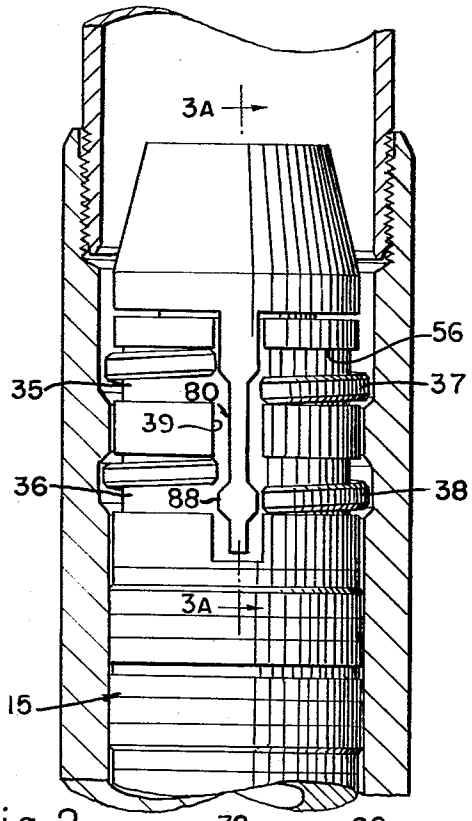


Fig. 2

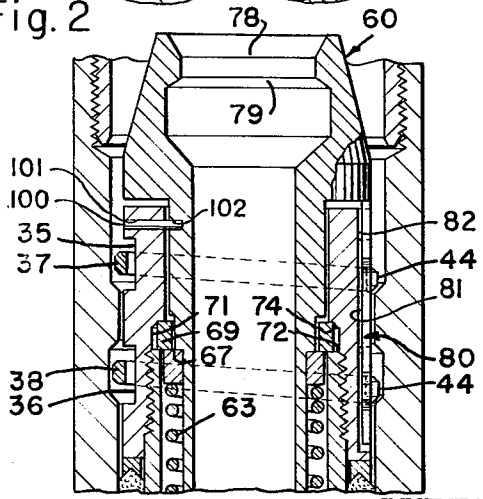


Fig. 3-A

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LOCKING DEVICES FOR WELL TOOLS

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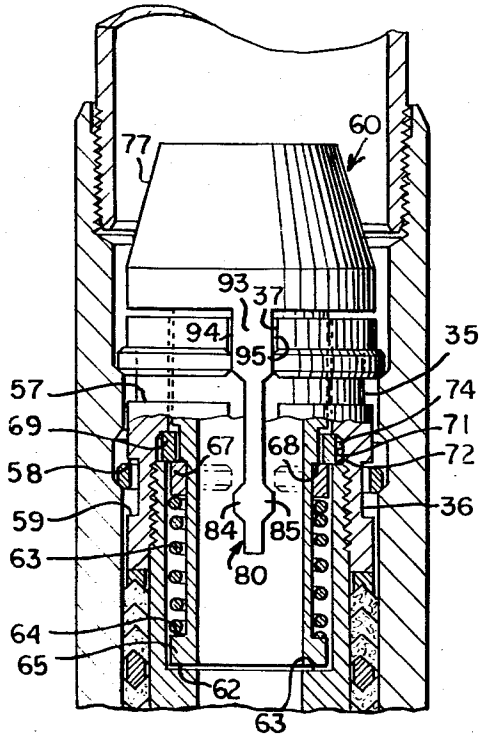


Fig. 3

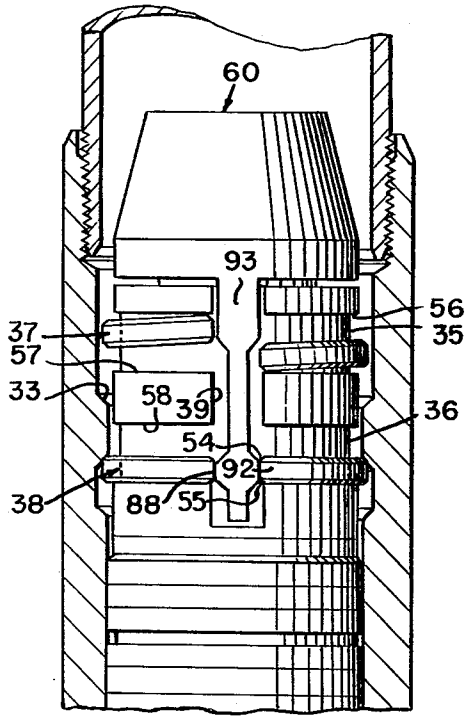


Fig. 4

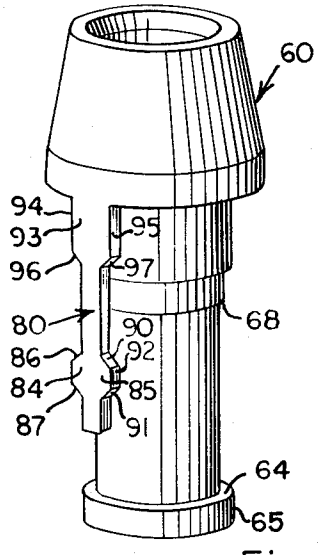


Fig. 5

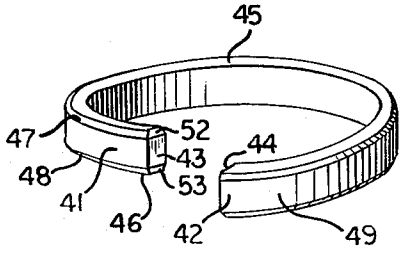


Fig. 6

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United States Patent Office 3,356,389
Patented Dec. 5, 1967

3,356,389

LOCKING DEVICES FOR WELL TOOLS

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Filed Aug. 6, 1965, Ser. No. 477,754
18 Claims. (Cl. 285—3)

ABSTRACT OF THE DISCLOSURE

A locking device for well tools having a split locking ring contractible to pass a locking shoulder in a well conductor and engageable with locking members disposed between the ends of the split ring to hold the ring in locking position, said ring being movable out of engagement with the locking members to permit the ring to contract to pass the locking shoulder of the well conductor; and a tool having a longitudinally spaced pair of such rings for locking against movement of the tool in either direction in the well conductor and releasable to permit the tool to be withdrawn from locked position.

This invention relates to tools and more particularly to a latch tool for releasably securing other tools in a predetermined position in a flow conductor.

An object of this invention is to provide a new and improved latch tool which is releasably securable in a predetermined position in a flow conductor.

Still another object is to provide a latch tool having retractable latch means mounted thereon engageable with longitudinally spaced internal shoulders of a flow conductor for holding the latch tool against longitudinal movement in the flow conductor.

Another object is to provide a latch device having lock means for releasably preventing movement of the latch means toward retracted position wherein the latch device is released for upward movement from the flow conductor upon an upward force being exerted on the lock means.

A further object is to provide a latch tool having a mandrel on which is mounted a split spring latch ring, the split ring extending outwardly of the mandrel to engage an internal stop of the flow conductor to arrest movement of the latch tool in one direction through the flow conductor wherein the latch ring is contractible to permit movement of the mandrel past the stop and a lock means movably mounted on the mandrel and engageable with the latch ring for preventing contraction of the latch ring.

A still further object is to provide a latch tool wherein the lock means is movable out of engagement with the split lock ring to permit it to contract about the mandrel and permit movement of the latch tool past the stop.

A still further object is to provide a latch tool wherein the split ring is of helical configuration whereby its free ends are spaced both circumferentially and vertically from one another, the latch ring being positioned in an annular external recess of the mandrel with its free ends engaging the facing shoulders of the mandrel defining the annular recess and holding the ring properly positioned against vertical movement as a unit in the recess.

A still further object is to provide a latch tool wherein the one free end of the latch ring is moved into alignment with the other free end upon its engagement with the stop and movement of the mandrel relative thereto.

A further object is to provide a latch device having one latch ring engageable with an upwardly facing stop of a flow conductor to limit downward movement of the latch device through the flow conductor and with a second latch ring engageable with a downwardly facing stop of the flow conductor to limit upward movement of the latch tool through the flow conductor.

Additional objects and advantages of the invention will

be readily apparent from the reading of the following description of a device constructed in accordance with the invention, and reference to the accompanying drawings thereof, wherein:

FIGURE 1 is a vertical partly sectional view showing the latch tool embodying the invention positioned in a landing nipple of a flow conductor connected to the string of tubing;

FIGURE 2 is a vertical view of the latch device;

FIGURE 3 is a vertical partly sectional view showing the upper spring ring in position preventing downward movement of the latch tool in the landing nipple;

FIGURE 3–A is a vertical fragmentary sectional view taken on line 3–A—3–A of FIGURE 2;

FIGURE 4 is a fragmentary vertical view showing the latch tool in position wherein the lower spring ring is limiting upward movement of the latch device in the landing nipple;

FIGURE 5 is a perspective view of the lock member of the well tool; and,

FIGURE 6 is a perspective view of a spring ring or latching ring of the latch tool.

Referring now to the drawings, the latch tool **10** embodying the invention includes a tubular mandrel **11** having an upper latch ring section **12** and a lower seal carrier section **13**, the upper end of the seal carrier section being threaded in the lower end portion of the upper latch ring section. A suitable seal assembly **15**, which may be of the chevron type, is disposed on the lower mandrel section and its downward movement thereon is limited by its engagement with the upwardly facing annular shoulder **17** provided by an external annular flange **18** of the lower mandrel section. Upward movement of the seal assembly on the lower mandrel section is limited by its engagement with the downwardly facing annular end surface or shoulder **19** of the upper mandrel section. The lower mandrel section has a reduced externally threaded lower end portion **20** by means of which any suitable tool T may be connected to the mandrel to be supported thereby in a landing nipple **22** which is connected in and constitutes a section of a flow conductor such as a string of tubing **24**. It will be apparent that the opposite end portions of the landing nipple are internally threaded in order that upper and lower tubing sections may be secured to the landing nipple.

The internal diameter of the landing nipple intermediate its ends is decreased to provide the upwardly facing annular top stop shoulder **30** and a seal surface **31** engageable by the seal assembly **15**. The seal surface is located below an internal annular latch recess **32** of the landing nipple whose upper and lower ends are defined by the upper and lower annular inwardly divergent annular shoulders **33** and **34** of the nipple.

The upper mandrel section **12** has upper and lower external annular recesses **35** and **36** in which are received the inner portions of the spring latch rings **37** and **38**, respectively. An external longitudinal recess **39** of the upper mandrel section opens to the upper end of the upper mandrel section and intersects the upper and lower latch ring recesses thereof.

The two latch rings are identical in structure and are preferably of helical form having their upper and lower free end portions **41** and **42** spaced vertically from each other. The latch rings have facing vertical end or stop surfaces **43** and **44**, top and bottom surfaces **45** and **46**, and upper and lower external cam surfaces or shoulders **47** and **48** which extend divergently inwardly from their vertical external surfaces **49** to their top and bottom surfaces, respectively. The upper free end portion **42** of each latch ring has upper and lower end cam surfaces **52** and **53** which extend divergently from opposite ends of its stop surface **43** to its top and bottom surfaces **45** and **46**,

respectively. Similarly, the lower free end portion **42** of each latch ring has upper and lower end cam surfaces **54** and **55** which extend divergently from opposite ends of its stop surface **44** to its top and bottom surfaces.

The top surface **45** of the upper latch ring at its upper free end portion engages the top shoulder **56** of the upper mandrel section defining the top end of the upper latch recess **35** and its bottom surface **46** at its lower free end portion engages the shoulder **57** defining the bottom end of the upper latch recess to hold the latch ring against vertical movement as a unit on the mandrel. Similarly, the top and bottom surfaces of the lower latch ring at its upper and lower end portions engage the top and bottom shoulders **58** and **59** of the upper mandrel section defining the top and bottom ends of the lower latch recess **46** for the same purpose.

A tubular lock member **60** extends downwardly into the mandrel and its downward movement thereinto is limited by the engagement of its downwardly facing annular end surface or shoulder **62** with the upwardly facing internal annular shoulder **63** of the lower mandrel section **13**. Upward movement of the lock member in the mandrel is yieldably resisted by a spring **63** disposed about the lock member whose lower end portion engages the annular upwardly facing shoulder **64** provided by the lower end external annular flange **65** of the lock mandrel and whose upper end portion bears against the annular bottom end shoulder of a split ring **67**. The split ring is slidable on the lock member and its upward movement thereon is limited by the engagement of its top end surface with the downwardly facing annular shoulder **68** of the lock member. The outer portions of the split ring extend outwardly of the lock member so that the annular top shoulder of the split ring is engageable with the bottom end surface of a split snap ring **69**. The outer portions of the snap ring extend into an annular internal recess **71** of the mandrel whose lower end is defined by the annular top end surface **72** of the lower main mandrel section and whose upper end is defined by the annular downwardly facing shoulder **74** of the upper mandrel section **12**. The engagement of the bottom and top end surfaces of the snap ring with the shoulders **72** and **74** of the mandrel prevents longitudinal movement of the snap ring in the main mandrel. The snap ring is inherently of a greater external diameter than the internal bore of the upper and lower main mandrel sections above and below the recess **71**. The snap ring **69** and the split ring **67** can, of course, be expanded radially to pass over the flange **65** of the lock member during the assembly of the tool.

It will be apparent that when upward force is exerted on the lock member causing it to move upwardly in the mandrel, the split ring **67** engages the snap ring **69** whereupon further upward movement of the lock member relative to the main mandrel can take place only against the resistance offered by the spring **63**. The upper enlarged end portion **77** of the lock member is provided with an internal annular flange **78** which provides a downwardly facing shoulder **79** engageable by suitable flexible line running and pulling tools by means of which the latch tool, together with any tool T connected to its lower end, may be lowered through the string of tubing to the landing nipple or be removed therefrom.

The lock member has an elongate external lock bar **80** which extends downwardly from its upper end portion **77**. The inner surface **81** of the lock bar is spaced from the outer surface **82** of the lock member below its upper end portion. The lock bar extends downwardly into the longitudinal external recess **39** formed on the exterior of the upper main mandrel section **12**. The lock bar **65** adjacent its lower end has a pair of oppositely extending bosses **84** and **85**. The lower boss **84** has upper and lower outwardly convergent shoulders **86** and **87** and a vertical outer stop surface **88**. Similarly, the boss **85** has outwardly convergent upper and lower shoulders **90** and **91** and an outer stop surface **92**. The upper end portion **93** of the lock bar is enlarged to provide the oppositely facing side stop surfaces **94** and **95** and the inwardly and downwardly convergent cam surfaces **96** and **97**.

When the lock member is in its normal lower locking position on the mandrel, the upper enlarged portion **93** of the lock bar extends downwardly into the upper portion of the top latch recess **35** with its cam shoulders **96** and **97** spaced below the top annular shoulder **56** of the upper main section defining the upper end of the latch recess, and the bosses **84** and **85** are positioned above the shoulder **59** defining the bottom of the lower latch recess **36**.

It will be apparent that the end surfaces **43** and **44** of the upper latch ring **37** are engageable with the side stop surfaces **94** and **95** of the lock bar when the top latch ring is in an upper position in the upper latch recess illustrated in FIGURE 3, wherein its top surface **45** engages the mandrel shoulder **56**. Similarly, the end surfaces **43** and **44** of the lower lock ring **38** are engageable with the stop surfaces **88** and **92** of the bosses **84** and **85**, respectively, when the lower latch ring is in its lowermost position in the lower latch recess with its bottom end surface **46** engaging the mandrel shoulder **59**. It will be apparent that when the upper latch ring is in its uppermost position in its mandrel recess **35** with its free end portions **41** and **42** in the same horizontal plane, it is locked against radial contraction by the lock bar; and that it is free to contract to a limited degree when it is in its normal position illustrated in FIGURES 1 and 2 wherein its lower end portion **42** is spaced below the cam shoulder **97** of the lock bar.

It will be apparent that when the lower latch ring is in its lowermost position in its mandrel recess **36** with its free end portions **41** and **42** in the same horizontal plane, it is locked against radial contraction; and that it is free to contract to a limited degree when it is in its normal positions therein illustrated in FIGURE 2 wherein its upper free end portion **41** is spaced above the upper shoulder **86** of the lock bar boss **84**.

When it is desired to land and hold a well tool T, such as a plug, choke, valve or the like, in the landing nipple **22**, such tool T is connected to the lower end portion **20** of the mandrel of the latch tool. A suitable running tool, for example, the type W Otis Running Tool illustrated on page 3745 of the 1964–65 edition of the Composite Catalog of Oil Field Equipment and Services published by World Oil, Houston, Tex., is secured to the lock member by telescoping its lower collet end portion thereinto. The assembly of the running tool, latch tool and the tool T is then lowered by the means of a flexible line through the string of tubing until the latch tool **10** moves downwardly into the upper end of the landing nipple **22**. As the latch tool moves downwardly into the landing nipple, the lower external cam shoulder **48** of the lower latch ring **38** engages the top shoulder **30** of the landing nipple and the camming action therebetween causes the lower latch ring to contract into the lower mandrel recess **36** to permit passage thereof past the upper internal surface of the landing nipple between the internal shoulders **30** and **33** o fthe landing nipple. Such contraction of the lock ring is possible since the end surface **43** of the latch ring is disposed above the boss **84**, and since the lower free end portion **42** of the lower latch ring engages the nipple shoulder **30** and its downward movement is arrested, the continued downward movement of the mandrel and latch member causes the boss **85** to move therebelow.

Downward movement of the mandrel relative to the lower lock ring may be caused by downward jars imparted thereto by the usual string of wire line tools including the running tool by means of which the latch tool and the well tool T are lowered through the tubing.

When the mandrel moves to its lower position in the nipple wherein the lower latch ring is in alignment with the lower latch recess **32**, the lower latch ring moves resiliently outwardly thereinto to the position illustrated

in FIGURE 2 wherein its outer portions are disposed in the lower nipple latch recess 32. At this time the external bottom cam shoulder 48 of the upper latch ring 37 at its lower end portion 42 engages the upper cam shoulder 30 of the landing nipple and similarly the external bottom cam shoulder 48 of the lower latch ring at its lower end portion engages the shoulder 34 of the landing nipple. The seal assembly now sealingly engages the seal surface 31 of the landing nipple so that fluid flow through the nipple can now take place only through the aligned passages 101, 102 and 103 of the tool T, the mandrel section 13 and the lock mandrel, respectively. The running tool is then released from the lock member by downward jars imparted thereto and removed from the string of tubing.

When a downward force is imparted to the latch tool tending to move it downwardly in the landing nipple, as when it is desired to release the running tool therefrom, its mandrel is moved downwardly relative to the latch rings and, since the lower end portion 42 of the latch rings 37 and 38 engage the mandrel shoulder 97 and 91, respectively, of the mandrel, the ends of each of the latch rings are moved into alignment with one another. The end surfaces 43 and 44 of the upper latch ring move into engagement with the stop surfaces 94 and 95 of the lock bar which then prevent contraction of the latch ring. The camming engagement of the cam shoulder 54 of the upper latch ring with the lock bar cam shoulder 97 moves the upper latch ring, if it is circumferentially misaligned into proper position relative to the lock bar. The engagement of the cam shoulder 48 of the upper latch ring with the landing nipple shoulder 30 now limits any downward movement of the latch mandrel.

Any upward force imparted to the mandrel, moves the mandrel upwardly relative to the upper end portion 41 of the lower latch ring 35 until the bottom surface 46 of such end portion engages the shoulder 59 of the mandrel due to the engagement of the top cam surface 47 of the latch ring with the shoulder 33 of the landing nipple. The free end portions of the lower latch ring are thus in alignment with one another and their end stop surfaces 43 and 44 are moved into engagement with the stop surfaces 88 and 92 of the lower bosses of the lock bar. The camming engagement of the lower cam shoulder 53 of the lower latch ring with the upper shoulder 86 of the boss 88 insures that the latch ring is properly positioned on the mandrel to permit the lock bar bosses to move between its free end portions. The latch mandrel and the tool T are thus latched or locked in the landing nipple against accidental displacement therefrom.

If it is thereafter desired to remove the latch tool, and any tool connected thereto, from the landing nipple, a suitable pulling tool, such as the type GR Otis Pulling Tool illustrated on page 3746 of the Composite Catalog of Oil Field Equipment and Services, 1964–65 edition, is connected to a flexible or wire line by the usual set of wire line tools and is lowered into the tubing. When the lower end portion of such pulling tool telescopes into the upper end of the lock member, expansible means of the pulling tool engage the downwardly facing shoulder 79 of the flange 78 of the lock member so that an upward pull then imparted to the flexible line causes an upward pull to be imparted to the lock member. The mandrel is moved upwardly with the lock mandrel until its upward movement is arrested due to the engagement of the lower latch ring 38 with the annular upwardly facing shoulder 59 of the mandrel. A further upward force then imparted to the lock member moves it upwardly relative to the mandrel against the force exerted by the spring 44. The camming engagement of the shoulder 33 of the landing nipple with the upper cam shoulder 47 of the lower latch ring now tends to contract the ring and, when upward movement of the lock member relative to the main mandrel moves the bosses 84 and 85 upwardly out of alignment with the end surfaces 43 and 44 of the lower latch ring, the lower latch ring contracts. As the lower latch ring contracts inwardly into the lower latch recess, the mandrel is released for upward movement in the landing nipple and the latch tool can be removed from the tubing.

It will now be apparent that a new and improved latch device has been illustrated and described having radially contractible resilient split latch rings or members whose free end portions are circumferentially spaced from one another whereby the latch rings are lockable against contraction by stop surfaces of a lock bar which are movable between the free end portions.

It will further be seen that the lock member is biased downwardly toward its locking position relative to the latch rings and the mandrel on which the latch rings are mounted and is movable upwardly relative thereto to its inoperative position wherein it does not prevent contraction of the rings.

It will further be seen that while the latch rings are preferably helical in form, i.e., sections of a helix, they may be circular in form, i.e., segments of a circle. The helical form of the latch rings is preferred since it restricts vertical movement of the rings on the mandrel and ensures that only one free end of each latch ring initially engages a landing nipple shoulder as the latch tool moves longitudinally in the nipple. When the latch rings are of circular form, they may be moved to tilted positions relative to the longitudinal axis of the mandrel, and if the movement of the latch tool is relatively swift in the string of tubing, the engagement of such circular latch rings when in tilted position with the shoulder of the landing nipple might cause faulty operation of the latch tool or damage thereto.

It will further be seen the latch tool may be provided with only the upper or lower latch ring if it is to be held in the landing nipple against movement in one longitudinal direction only. If only the lower latch ring is employed to latch the tool against upward movement only, the running tool must be of such type that it does not require downward jarring to cause it to release from the latch member and could be, for example, of the type securable to the latch member by a shear pin which would be sheared by a force smaller than that required to overcome the force of the spring 63 so that once the latch tool is positioned in the landing nipple with the lower latch ring in the latch recess 32, an upward pull exerted on such running tool would cause the shear pin to fail before the spring would permit upward movement of the latch member.

The lock member 60 may be releasably secured to the mandrel by a shear pin 100 which extends through the radial passage 101 of the mandrel into an aligned bore 102 of the lock member in order that the lock member be held in its lower locking position while the latch device is being lowered through the flow conductor. The latch device may thus be lowered through the flow conductor without any movement taking place between the lock member and the mandrel until the downward movement of the upper latch ring 37 is arrested by its engagement with the stop shoulder 30 of the landing nipple, and the latch device is then locked against removal from the landing nipple in either direction until a pulling tool engages the flange 78 of the latch member and an upward force is exerted thereon which first shears the shear pin 100 and then moves the lock member upwardly to its inoperative position.

The foregoing description of the invention is explanatory only, and changes in the details of the construction illustrated may be made by those skilled in the art, within the scope of the appended claims, without departing from the spirit of the invention.

What is claimed and desired to be secured by Letters Patent is:

1. A latch tool including: a mandrel having an external

annular recess; a resilient split latch ring disposed about said mandrel in said recess and having outer portions extending outwardly of said mandrel, said latch ring being radially contractible into said recess to a retracted position therein, said latch ring being smaller in longitudinal dimension than said recess and movable longitudinally of said mandrel in said recess, said latch ring having free end portions, said free end portions have facing circumferentially spaced end surfaces; and lock means extending longitudinally of said mandrel and traversing said recess between the free ends of said latch ring and having stop surfaces projecting circumferentially of said recess in a portion of the recess and engageable by said end surfaces of said latch ring to prevent radial contraction of said latch ring to said retracted position when said latch ring is in one extreme longitudinal position in said recess, said latch ring being movable longitudinally in said annular recess between an inoperative releasing position wherein at least one of said end surfaces of said ring is not engageable with one of said stop surfaces and an operative locking position wherein both of said end surfaces of said latch ring are engageable with said stop surfaces of said lock means and contraction of said latch ring is prevented.

2. A latch tool of the character set forth in claim 1 wherein: said annular recess of said mandrel is provided with opposed longitudinally spaced annular shoulders defining the longitudinal limits of said recess, and the free end portions of said latch ring are displaced longitudinally of said mandrel relative to each other and one of said free ends of said latch ring engages one of said shoulders of said annular recess of said mandrel and the other of said free ends of said latch ring engages the opposite shoulder of said recess.

3. A latch tool including: a mandrel having upper and lower external annular recesses; a first latch ring disposed about said mandrel in said upper recess and movable on said mandrel between an upper operative position and a lower inoperative position in said upper recess; a second latch ring disposed about said mandrel in said lower recess and movable on said mandrel between a lower operative position and an upper inoperative position in said lower recess, each of said latch rings having outer portions extending outwardly of said mandrel and having free end portions having facing circumferentially spaced end surfaces; and lock means carried by said mandrel disposed in said annular recesses and providing circumferentially projecting stop surfaces in each of said annular recesses engageable by said end surfaces of each of said latch rings to prevent radial contraction of said latch ring when said latch rings are in said operative positions, each of said latch rings being longitudinally movable in its respective annular recess between an inoperative releasing position wherein at least one of said end surfaces of said ring is not in engagement with one of the stop surfaces of said lock means and an operative locking position wherein both of said end surfaces of said latch ring are engageable with the stop surfaces of said lock means and contraction of said ring is prevented.

4. The latch tool of claim 3, wherein said lock means is movable longitudinally relative to said mandrel between a locking position wherein its stop surfaces are in position to be engaged by said end surfaces of said latch rings and an inoperative position wherein its stop surfaces are not in position to be engaged by said end surfaces.

5. The latch tool of claim 4, and means biasing said lock means to said locking position.

6. A latch device including: a mandrel having a pair of spaced annular external recesses and an upwardly opening longitudinal external recess which also opens laterally to said annular recesses, each of said annular recess being defined by spaced upper and lower facing stop shoulders; a latch ring in each of said recesses, said stop shoulders of said mandrel limiting longitudinal movement of said rings on said mandrel, said rings having outer portions extending outwardly of said mandrel and being contractible radially into said recesses, said rings having free end portions having circumferentially spaced facing end surfaces; and a lock member carried by said mandrel, said lock member having a lock bar disposed in said longitudinal recess of said mandrel extending between said free ends of said latch rings, said lock bar having first stop shoulders engageable with said facing end surfaces of one of said latch rings when said one of said latch rings is in its lowermost position in its recess and second stop shoulders engageable by the end surfaces of the other of said latch rings when it is in its uppermost position in its recess to prevent radial contraction of said latch rings.

7. The latch device of claim 6, wherein said lock member is mounted for limited longitudinal movement relative to said mandrel between a locking position wherein said stop shoulders of said lock bar are in position to be engaged by both end surfaces of each of said latch rings and an inoperative position wherein said stop shoulders are not engageable with both end surfaces of said latch rings.

8. The latch device of claim 7, and means yieldingly biasing said lock member to its locking position.

9. A latch device including: a tubular mandrel having a pair of longitudinally spaced external annular recesses and an upwardly opening longitudinal external recess which opens to said annular recesses, each of said annular recesses providing longitudinally spaced upper and lower facing stop shoulders; a latch ring in each of said annular recesses, each of said latch rings having outer portions extending outwardly of said mandrel, said stop shoulders of said mandrel limiting longitudinal movement of said rings on said mandrel, said rings being contractible radially into said annular recesses, said rings having free end portions having circumferentially spaced facing end surfaces, said rings having upper and lower external outwardly convergent cam shoulders; and lock means disposed in said longitudinal recess providing stop surfaces projecting circumferentially in each of said annular recesses and engageable by said end surfaces of said latch rings to limit radial contraction of said latch rings when said latch rings are in extreme longitudinal positions in said annular recesses, the free ends of each of said latch rings being displaced longitudinally of the mandrel relative to one another and disposed to engage the opposed stop shoulders of the annular recess in which said latch ring is disposed whereby longitudinal movement of the latch ring in its recess is restrained.

10. The latch device of claim 9, wherein said lock means is movable longitudinally relative to said mandrel between a locking position wherein its stop surfaces are in position to be engaged by said end surfaces of said latch rings and an inoperative position wherein its stop surfaces are not in position to be engaged by said end surfaces.

11. A latch device for use in a flow conductor having an upper upwardly facing internal shoulder and a lower downwardly facing internal shoulder spaced below the upper shoulder, said latch device including: a mandrel having upper and lower external annular recesses, each of said recesses being defined by upper and lower facing shoulders of said mandrel, said mandrel having an external longitudinal upwardly opening recess, said longitudinal recess opening to said annular recesses; a lock member carried by said mandrel and having a longitudinal lock bar disposed in said longitudinal recess, said lock bar having a pair of upper oppositely facing side stop surfaces and a pair of lower oppositely facing side stop surfaces, said lock member being movable on said mandrel between a lower locking position and an upper inoperative position, said upper side stop surfaces being positioned in the upper portion of said upper recess and said lower side stop surfaces being positioned in the lower portion of said lower latch recess when said lock

member is in said locking position; an upper latch ring in said upper latch recess; and a lower latch ring in said lower latch recess, said latch rings having outer portions extending outwardly of said mandrel, said upper latch ring being engageable with the upper stop shoulder of the flow conductor to limit downward movement of the mandrel in the flow conductor, said lower latch ring being positioned below the lower stop shoulder of the flow conductor when the upper latch ring is engaged with the upper stop shoulder of the flow conductor, said latch rings having free end portions having spaced end surfaces, said upper stop shoulders of said lock member being engageable by said end surfaces of said upper latch ring when said latch ring engages the shoulder of said mandrel defining the upper ends of said upper recess and the upper stop shoulder of the flow conductor to prevent contraction of said upper latch ring and downward movement of the mandrel in the flow conductor, said lower latch ring having free end portions having circumferentially spaced end surfaces which are engageable with said lower stop surfaces of said lock bar when said lower latch ring engages the lower downwardly facing stop shoulder of the flow conductor and its downward movement in the lower recess relative to the mandrel is limited by its engagement with the lower shoulder of the mandrel defining the lower end of said lower annular recess to prevent radial contraction of said lower latch ring and upward movement of said mandrel in the flow conductor.

12. The latch device of claim **11**, wherein said free end portions of said latch rings are spaced vertically from one another to engage said upper and lower shoulders of said mandrel defining said recess when said latch rings are not in latching engagement with the stop shoulders of the flow conductor.

13. The latch tool of claim **11**, and means releasably securing said lock means in said locking position.

14. The latch device of claim **11**, and means biasing said lock member to said locking position.

15. The latch tool of claim **14**, and means releasably securing said lock means in said locking position.

16. The latch device of claim **14**, wherein said upper latch ring has a lower external upwardly inclined cam shoulder and said lower latch rings have external upper and lower outwardly convergent cam shoulders engageable with the upper and lower stop shoulders of the flow conductor whereby said upper latch ring is cammed inwardly toward retracted position upon its engagement with the upper stop shoulder of the flow conductor and said lower latch ring is cammed inwardly toward retracted position upon its engagement with either of the stop shoulders of the flow conductors.

17. The latch devices of claim **16**, wherein said free end portions of said latch rings are spaced vertically from one another to engage said upper and lower shoulders of said mandrel defining said recess when said latch rings are not in latching engagement with the stop shoulders of the flow conductor.

18. The latch device of claim **14**, wherein said free end portions of said latch rings are spaced vertically from one another to engage said upper and lower shoulders of said mandrel defining said recess when said latch rings are not in latching engagement with the stop shoulders of the flow conductor.

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Disclaimer and Dedication

3,356,389.—*John V. Fredd,* Dallas, Tex. LOCKING DEVICES FOR WELL TOOLS. Patent dated Dec. 5, 1967. Disclaimer and Dedication filed Jan. 6, 1983, by the assignee, *Otis Engineering Corp.*

Hereby disclaims and dedicates to the Public the remaining term of said patent.

[*Official Gazette April 5, 1983.*]