Oct. 16, 1962 E. C. RECHTIN 3,058,189

JACKING APPARATUS FOR TUBULAR PILES AND CAISSONS

Original Filed Dec. 27, 1956 3 Sheets-Sheet 1

Fig. 1

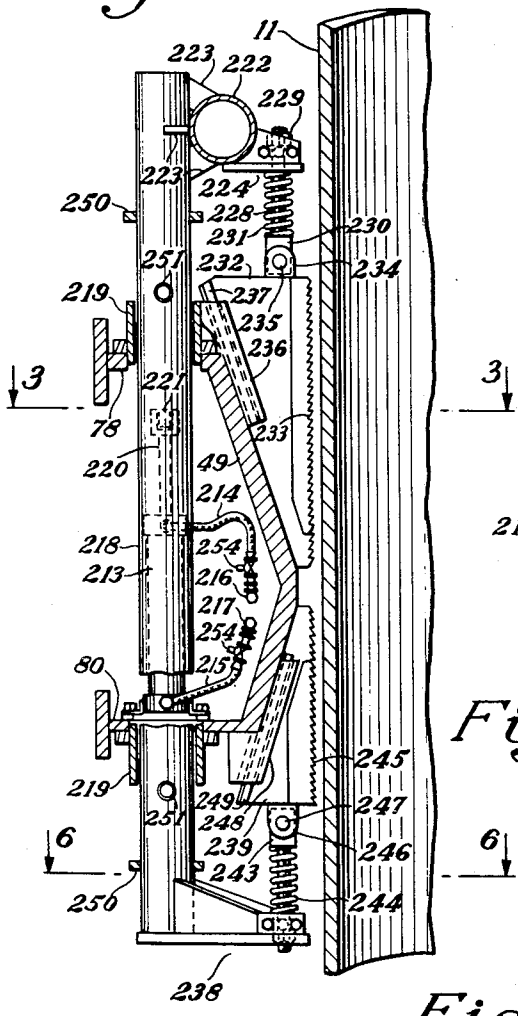


Fig. 5

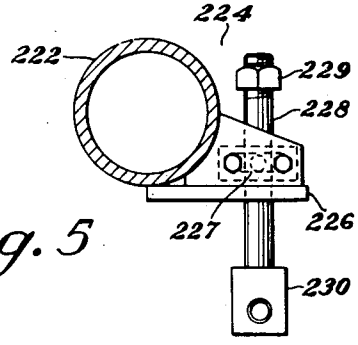


Fig. 6

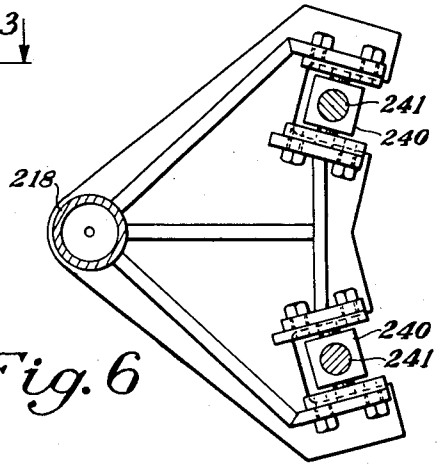
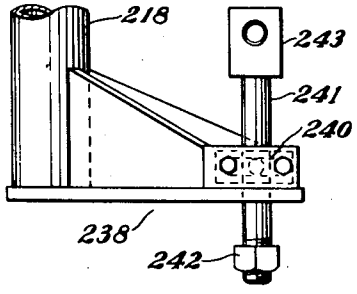


Fig. 7



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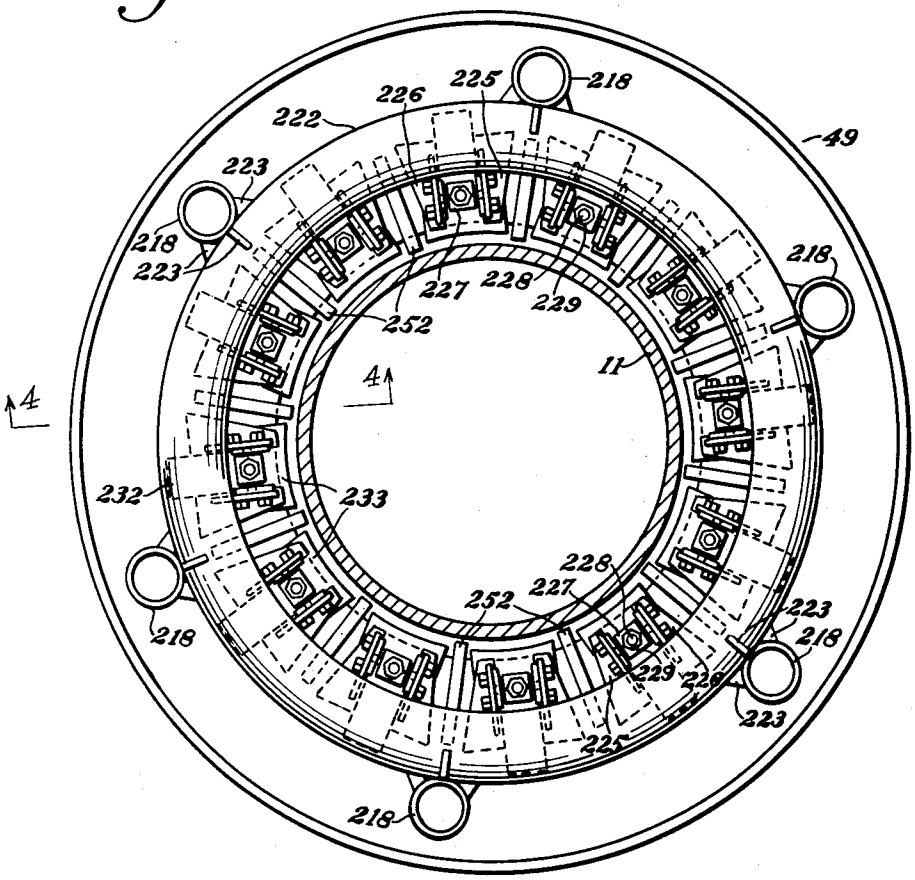
ATTORNEY

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JACKING APPARATUS FOR TUBULAR PILES AND CAISSONS

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Fig. 2



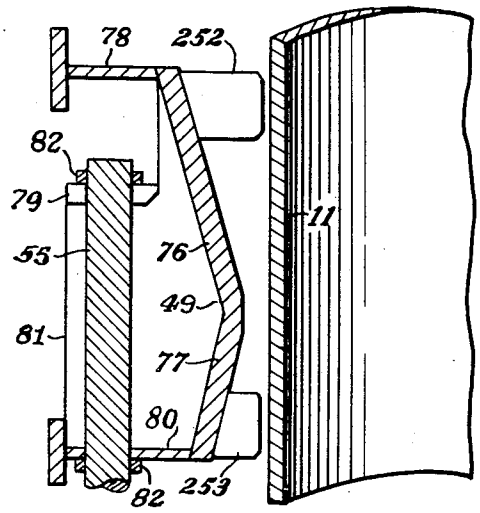


Fig. 4

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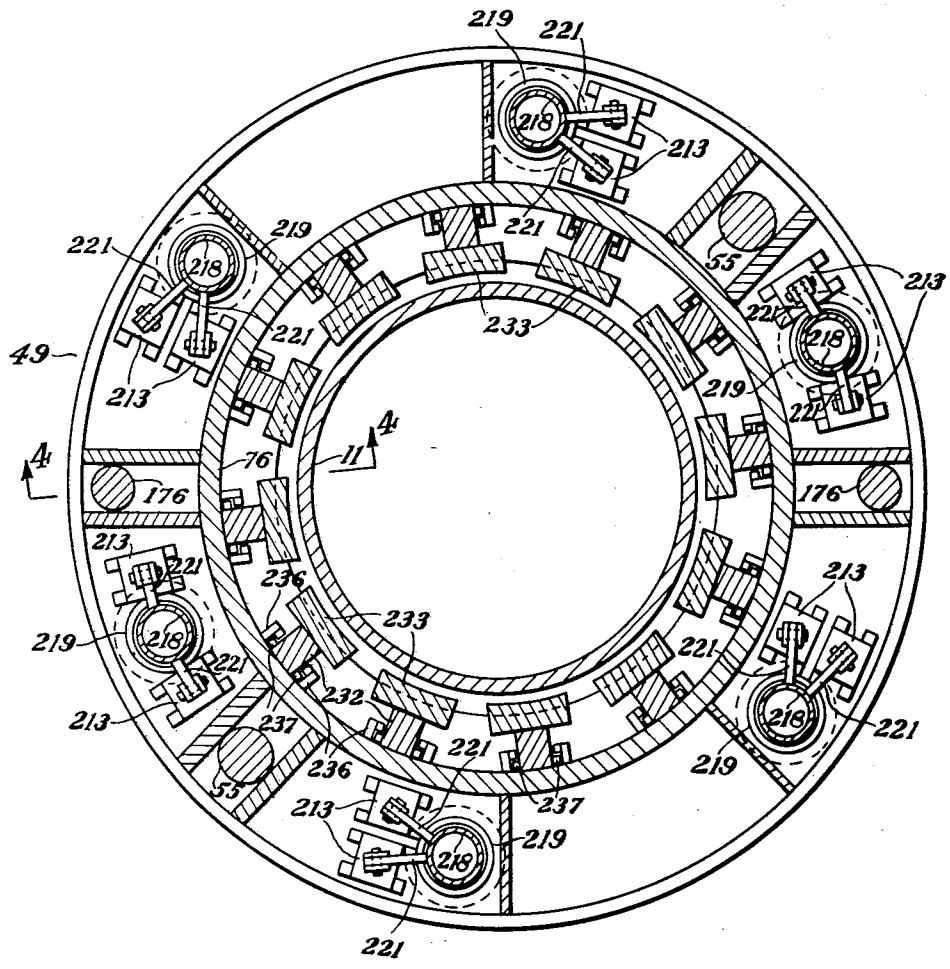
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JACKING APPARATUS FOR TUBULAR PILES AND CAISSONS

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Fig. 3



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United States Patent Office 3,058,189 Patented Oct. 16, 1962

3,058,189

JACKING APPARATUS FOR TUBULAR PILES AND CAISSONS

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Original application Dec. 27, 1956, Ser. No. 630,998, now Patent No. 2,969,648, dated Jan. 31, 1961. Divided and this application May 22, 1959, Ser. No. 815,152

11 Claims. (Cl. 24—263)

This application is a division of an earlier filed copending application for "Mobile Drilling Platform and Method of Operation," filed December 27, 1956, Serial No. 630,998, which latter application (now U.S. Patent 2,969,648) is a continuation-in-part of an earlier filed and then copending, but now abandoned, application for "Mobile Drilling Platform and Method of Operation," filed July 26, 1955, Serial No. 524,518.

The subject of this invention is a jacking or gripping mechanism for exerting a longitudinal thrust on a tubular member such as a pile, caisson or the like. This jacking or gripping mechanism is particularly useful in association with mobile platforms employed in offshore operations such as, for example, drilling oil wells in marine locations. In such connection, the jacking or gripping mechanism can be utilized to exert a thrust on a pile or caisson whereby to lower and drive said pile or caisson into the marine floor, to extract and raise said pile or caisson from the marine floor, to lower or raise a submersible foundation secured to caissons or tubular members actuated by said jacking or gripping means, to secure an operating platform to driven piles, or for similar operations.

Briefly, the jacking or gripping mechanism comprises an annular yoke formed with upper and lower oppositely tapered conical sections, which yoke receives in its annulus a tubular member upon which the longitudinal thrust is to be exerted, upper and lower wedging means engageable respectively between the upper and lower conical sections of the yoke and the tubular members, positioning means to position selectively the upper or lower wedging means into operative engagement between the yoke and the pile thereby permitting selectively an upward or a downward thrust upon the tubular member, and means to raise or lower said yoke.

One of the objects of this invention is the provision of an improved jacking or gripping mechanism for selectively gripping, pushing and pulling the tubular member such as a pile or caisson.

Another object of this invention relates to the means for positioning selectively the upper or lower wedges in the yoke.

A further object of this invention is the provision of means to permit the wedge in the yoke to adjust to the eccentricity of the tubular member in the annulus of the yoke.

Other and further objects of this invention will be apparent during the course of the following description.

While the best embodiment of the invention known is herein described, said invention is capable of embodiment in many different forms, and the illustrated embodiment is, therefore, to be regarded only as typical, and the invention is not to be confined thereto.

Referring now to the drawings, in which like numerals represent like parts in the several views:

FIG. 1 represents a partial sectional view in elevation of this invention, showing the wedge positioner and annular yoke adjacent a tubular member such as the pile or caisson of U.S. Patent 2,969,648.

FIG. 2 represents a view in plan of this invention, showing the annular yoke and wedge positioner and the tubular member gripped thereby.

FIG. 3 represents a section in plan, taken along the line 3—3 of FIG. 1, showing particularly the orientation of the air cylinders which actuate the wedge positioner.

FIG. 4 represents a section in elevation, taken along the line 4—4 of FIGS. 2 and 3, showing the annular yoke, one of the piston rods employed to raise, hold stationary, or lower the annular yoke relative to the foundation structure, and the centering guides and tubular member.

FIG. 5 represents a detail of the upper bracket assembly of the wedge positioner, with the spring omitted for purposes of clarity.

FIG. 6 represents a section in plan, taken along the line 6—6 of FIG. 1, showing in detail the lower bracket assembly of the wedge positioner with the spring omitted for purposes of clarity.

FIG. 7 represents a detail of the lower bracket assembly of the wedge positioner as viewed in elevation, with the spring omitted for purposes of clarity.

The gripping or jacking apparatus comprises annular yoke **49** with upwardly and outwardly tapered conical section **76** surmounting in vertically registering relationship a downwardly and outwardly tapered conical section **77**. An upper flange **78**, plates **79** and a lower flange **80** are also provided. Webs **81**, located about the perimeter of annular yoke **49**, are secured to conical sections **76** and **77**, to plates **79**, and to lower flange **80**, thereby stiffening said annular yoke **49**. Piston rods **55** extend through lower flange **80** and plates **79**, and may be secured thereto by stops or nuts **82** bearing against the upper and lower faces respectively of the said plates **79** and lower flange **80** whereby relative movement between piston rods **55** and annular yoke **49** is prevented.

Piston rods **55** are connected to hydraulic cylinders, as shown in U.S. Patent 2,969,648, whereby annular yoke **49** may be raised, held stationary, or lowered, relative to the said hydraulic cylinders and connected foundation structure. Depending upon which set of wedges **232** or **239** is engaged between annular yoke **49** and the pile **11**, the said pile **11** is raised, held stationary or lowered, all as explained in U.S. Patent 2,969,648.

Several air cylinders **213** are secured to the yoke **49**, as, for instance, to and above lower flange **80**. Lines **214** and **215** serve those portions of each air cylinder **213** above and below, respectively, the piston (not shown) in said air cylinder **213**. Lines **216** and **217** are indicated in FIG. 1, and run around (not shown) annular yoke **49** serving, respectively, all lines **214** and **215**, and further, are connected to a suitable source of compressed air (not shown) for actuation of said air cylinders **213**. Pipe guides **218** are vertically slidably mounted in collars **219**, the latter extending through in secured relation to upper flange **78** and lower flange **80** of annular yoke **49**. Pipe guides **218** are secured to piston rods **220** of air cylinders **213** by means of members **221**. Wedge ring **222** is supported above annular yoke **49** by pipe guides **218**, being secured to the latter by members **223**. Spaced around wedge ring **222**, and secured thereto, are upper bracket assemblies **224**, one at each wedge location, and each comprising pieces **225** and **226**. Block **227** is pivotally mounted to and between pieces **225** and **226**, and slidably receives bar **228**. Bar **228** is provided at its upper end, above block **227**, with nut **229**, and is secured at its lower end to block **230**. Spring **231** is mounted around bar **228** in interposed relation between the top of block **230** and the bottom of block **227**, so as to urge apart said blocks **230** and **227**. Upper wedge **232**, provided with enlarged face **233**, has ears **234** pivotally mounted to block **230** by means of pin **235** extending through said ears **234** and block **230**. Spaced members **236**, secured to yoke **49** and with keyways formed therein, slidably receive keys **237** secured to

upper wedge 232. Thus, upon actuation of air cylinders 213, upper wedge 232 is movable downwardly and inwardly into engagement between annular yoke 49 and pile 11, or outwardly and upwardly out of engagement. At the lower end of each pipe guide 218 is lower bracket assembly 238 simultaneously serving two lower wedges 239. Pivotally mounted to each lower bracket assembly 238 are two blocks 240, each of which slidably receives a bar 241. Each bar 241 is provided at its lower end, below block 240, with a nut 242, and is secured at its upper end to block 243. Spring 244 is mounted around bar 241 in interposed relation between the top of block 240 and the bottom of block 243, so as to urge apart said blocks 240 and 243. Lower wedge 239, provided with enlarged face 245, has ears 246 pivotally mounted to block 243 by means of pin 247 extending through said ears 246 and block 243. Spaced members 248 secured to yoke 49, and with keyways formed therein, slidably receive keys 249 secured to lower wedge 239. Thus, upon actuation of air cylinders 213, lower wedge 239 is movable upwardly and inwardly (FIG. 1) into engagement between annular yoke 49 and pile 11, or downwardly and outwardly out of engagement. From the foregoing description, it will be apparent that if it is desired to place upper wedges 232 into frictional engagement between annular yoke 49 and pile 11, air cylinders 213 are pressurized above their respective pistons through lines 214, thereby lowering pipe guides 218, wedge ring 222, and upper wedges 232. Conversely, when it is desired to place lower wedges 239 into frictional engagement between annular yoke 49 and pile 11, air cylinders 213 are pressurized below their respective pistons, thereby raising pipe guides 218 and lower wedges 239.

Other details of this invention include stop rings 250 secured to pipe guides 218 and adapted to bear against collars 219, thus defining upper and lower limits of movement of said pipe guides 218 and preventing over-travel of the latter which might damage the system. The "neutral" position of pipe guides 218, wherein neither upper wedges 232 nor lower wedges 239 are in frictional engagement between annular yoke 49 and pile 11, is definable and maintainable by pins 251 insertable through pipe guides 218 to bear against collars 219 as shown in FIG. 1. Adequate centering of annular yoke 49 about pile 11 is provided for by securing inwardly extending guides 252 and 253 to conical sections 76 and 77, respectively, of said annular yoke 49. Following good engineering practice, valves 254 may be placed in lines 214 and 215 to isolate individual air cylinders without interfering with the operation of the other air cylinders.

Although the invention has been shown and described in considerable detail, it is not to be limited to the exact construction shown and described, but may include such substitutions, modifications or equivalents thereof as are embraced within the scope of the invention or as pointed out in the claims.

What is claimed is:

1. An apparatus to grip a pile member, said apparatus comprising an annular yoke receiving said pile member and formed with a first inclined surface and a second inclined surface, a first member insertable between said first inclined surface and said pile member to unidirectionally engage said yoke and said pile member in a first direction, a second member insertable between said second inclined surface and said pile member to unidirectionally engage said yoke and said pile member in a second direction, a third member slidably mounted to said yoke, first resilient means pivotally secured to said third member and also pivotally secured to said first member, second resilient means pivotally secured to said third member and also pivotally secured to said second member, and means to reciprocate said third member relative to said yoke to engage said first member between said yoke and said pile member and simultaneously to disengage said second member or selectively to engage said second member between said yoke and said pile member and simultaneously to disengage said first member, further including means to restrict substantial movement of said annular yoke in a direction parallel to the longitudinal axis of said pile member during reciprocation of said third member.

2. Apparatus to grip a member comprising a yoke, first means operatively interposable between said yoke and said member to unidirectionally engage said yoke and said member in a first direction, second means operatively interposable between said yoke and said member to unidirectionally engage said yoke and said member in a second direction, third means reciprocably mounted to said yoke for movement in a direction parallel to the axis of the member, and resilient means operatively interposed between said third means and said first and second means, whereby reciprocation of said third means resiliently engages said first means between said yoke and said member and simultaneously disengages said second means or selectively resiliently engages said second means between said yoke and said member and simultaneously disengages said first means, further including fourth means to restrict substantial movement of said yoke in a direction parallel to the longitudinal axis of the member during reciprocation of said third means.

3. Apparatus as in claim 2, said third means comprising a rod member slidably mounted to said yoke, and raising and lowering means connected to said rod member to reciprocate the same relative to said yoke, and said resilient means comprising first spring means operatively interposed between said rod member and said first means, and second spring means operatively interposed between said rod member and said second means.

4. Apparatus as in claim 2, said third means comprising a rod member having first and second ends and slidably mounted to said yoke, and raising and lowering means connected to said rod member intermediate the first and second ends thereof to reciprocate said rod member relative to said yoke, and said resilient means comprising first spring means operatively interposed between the first end of said rod member and said first means, and second spring means operatively interposed between the second end of said rod member and said second means.

5. Apparatus as in claim 2, further including vertically arranged guide plates secured to said yoke and extending towards said member in close proximity thereto to substantially center said member in said yoke.

6. Apparatus to grip a member comprising an annular yoke receiving said member and formed with a first inclined surface and a second inclined surface, a plurality of first wedges spaced about the member and engageable between said first inclined surface and said member to unidirectionally engage said yoke and said member in a first direction, a plurality of second wedges spaced about the member and engageable between said second inclined surface and said member to unidirectionally engage said yoke and said member in a second direction, positioning means reciprocably mounted to said yoke for movement in a direction parallel to the axis of the member, and resilient means operatively interposed between said positioning means and said first and second wedges, whereby reciprocation of said positioning means resiliently engages simultaneously all of said first wedges between said first inclined surface and said member and simultaneously disengages said second wedges or selectively resiliently engages simultaneously all of said second wedges between said second inclined surface and said member and simultaneously disengages said first wedges, further including means to restrict substantial movement of said annular yoke in a direction parallel to the longitudinal axis of the member during reciprocation of said positioning means.

7. Apparatus as in claim 6, said positioning means comprising rod means slidably mounted to said yoke, and raising and lowering means connected to said rod means to reciprocate the same relative to said yoke, and said resilient means comprising first spring means operatively inter-

posed between said rod means and said first wedges, and second spring means operatively interposed between said rod means and said second wedges.

8. Apparatus as in claim 6, said positioning means comprising rod means slidably mounted to said yoke, and raising and lowering means connected to said rod means to reciprocate the same relative to said yoke, and said resilient means comprising a plurality of first spring means each operatively interposed between one of said first wedges and said rod means, and a plurality of second spring means each operatively interposed between one of said second wedges and said rod means.

9. Apparatus as in claim 6, said positioning means comprising rod means having first and second ends and slidably mounted to said yoke, and raising and lowering means connected to said rod means intermediate the first and second ends thereof to reciprocate said rod means relative to said yoke, and said resilient means comprising first spring means and second spring means operatively interposed between the first and second ends of said rod means and said first and second wedges respectively.

10. Apparatus as in claim 6, further including a plurality of vertically arranged guide plates secured to said yoke and extending inwardly towards said member in close proximity thereto to substantially center said member in said yoke.

11. Apparatus to grip a member comprising:

(*a*) an annular yoke surrounding said member,

(*b*) first and second oppositely inclined wedging surfaces on the inner face of said annular yoke adjacent said member,

(*c*) a plurality of first wedges spaced about the member and engageable between said first inclined wedging surface and said member to unidirectionally engage said annular yoke and said member in a first direction,

(*d*) a plurality of second wedges spaced about the member and engageable between said second inclined wedging surface and said member to unidirectionally engage said annular yoke and said member in a second direction,

(*e*) wedge positioning means having first and second ends and slidably mounted to said annular yoke for movement in a direction parallel to the longitudinal axis of said member,

(*f*) actuating means connected to said wedge positioning means intermediate the first and second ends thereof and operatively interposed between said wedge positioning means and said annular yoke to reciprocate said wedge positioning means relative to said annular yoke and said member,

(*g*) a plurality of first elongated spring means each pivotally secured at one end thereof to said wedge positioning means and also pivotally secured at the other end thereof to one of said first wedges, and

(*h*) a plurality of second elongated spring means each pivotally secured at one end thereof to said wedge positioning means and also pivotally secured at the other end thereof to one of said second wedges,

(*i*) whereby reciprocation of said wedge positioning means engages simultaneously all of said first wedges between said first inclined wedging surface and said member and simultaneously disengages all of said second wedges or selectively engages simultaneously all of said second wedges between said second inclined wedging surface and said member and simultaneously disengages all of said first wedges, and

(*j*) whereby uniformity of engagement with said member among all said first wedges or selectively all said second wedges is provided, further including

(*k*) means to restrict substantial movement of said annular yoke in a direction parallel to the longitudinal axis of said member during reciprocation of said wedge positioning means.

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