Feb. 17, 1953

G. H. HUFFERD

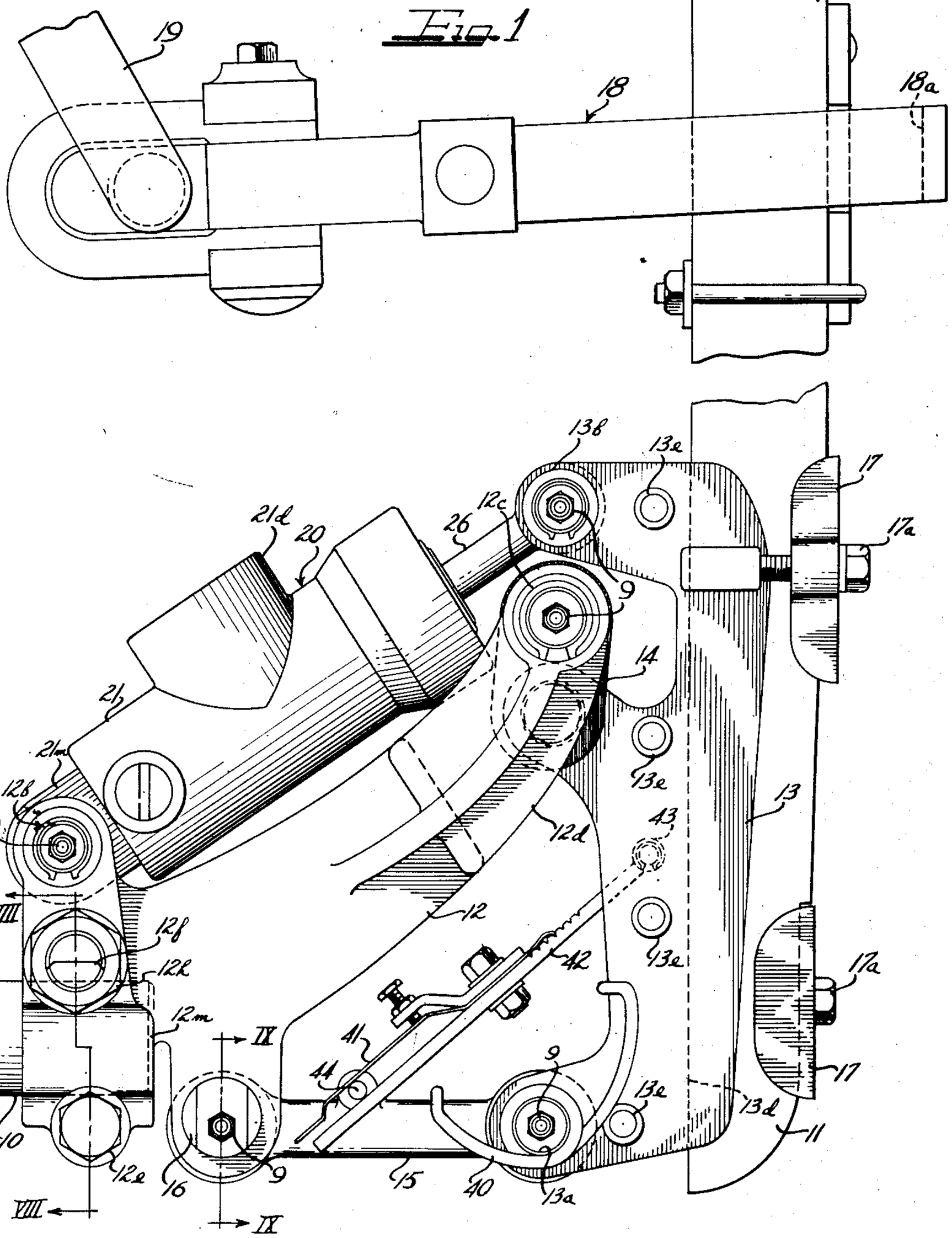
2,628,692

HYDRAULIC CHECK

Filed July 9, 1948

5 Sheets-Sheet 1

Fig. 1



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HYDRAULIC CHECK

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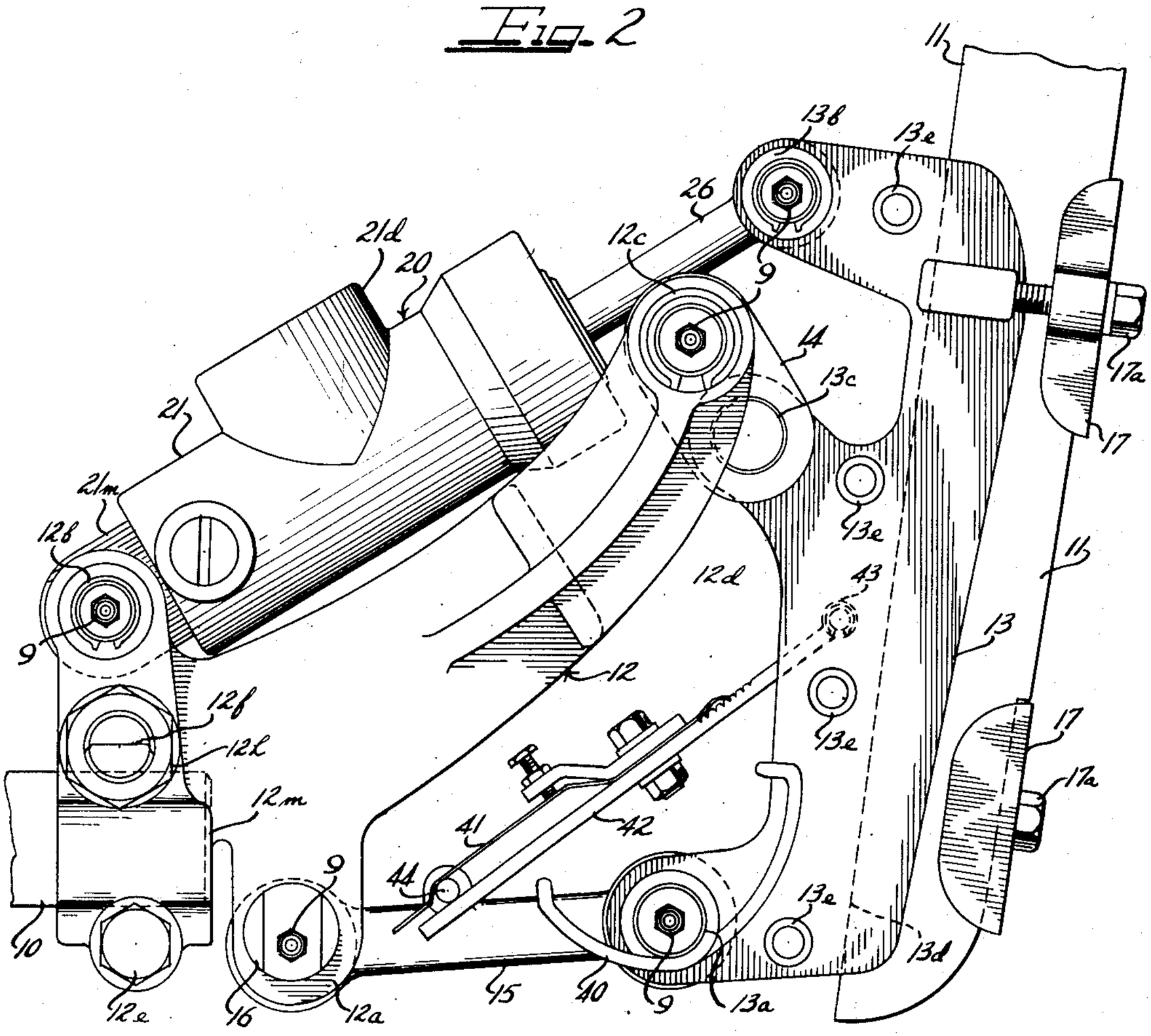
5 Sheets-Sheet 2

Fig. 2



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HYDRAULIC CHECK

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Fig. 3

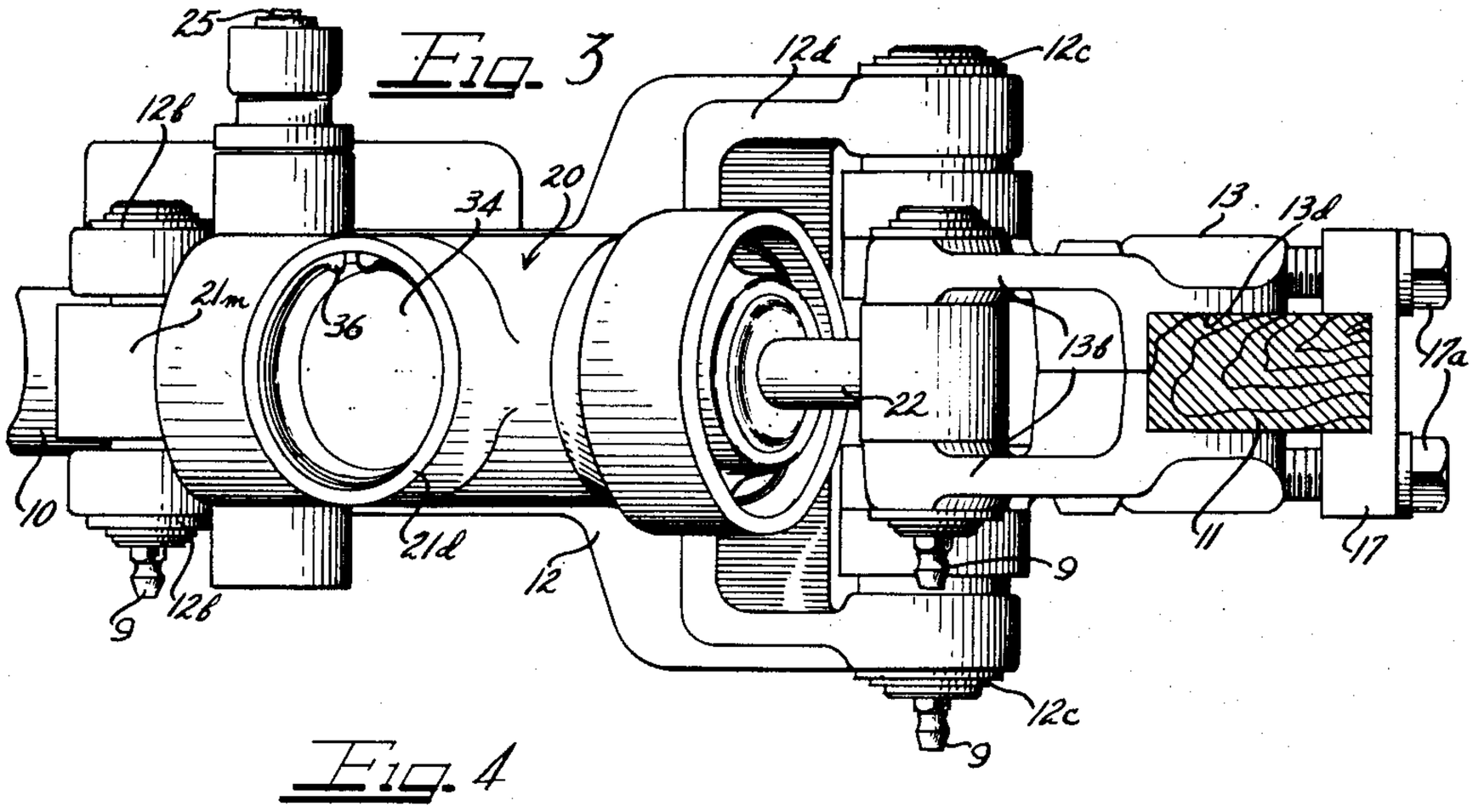


Fig. 4

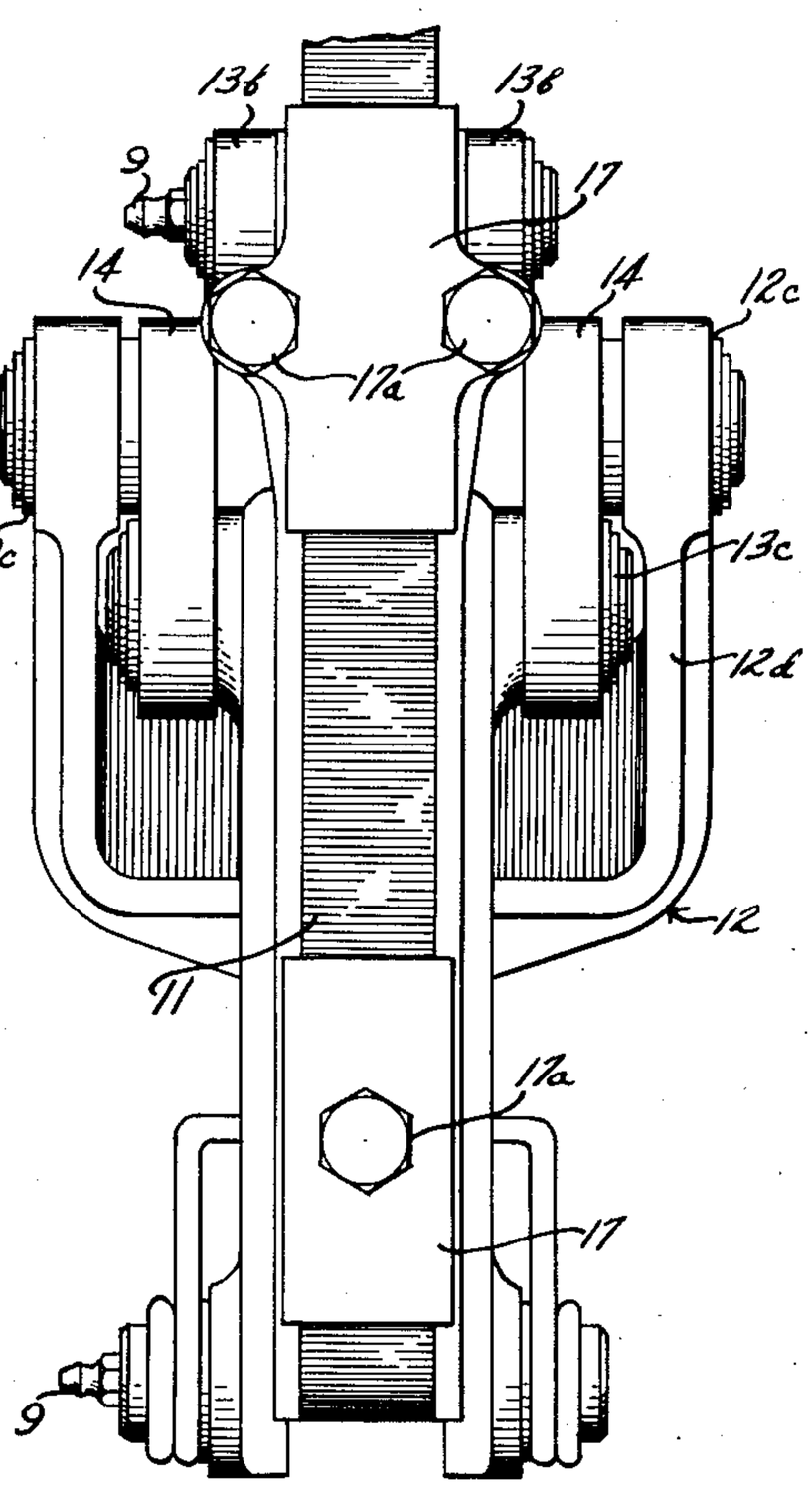
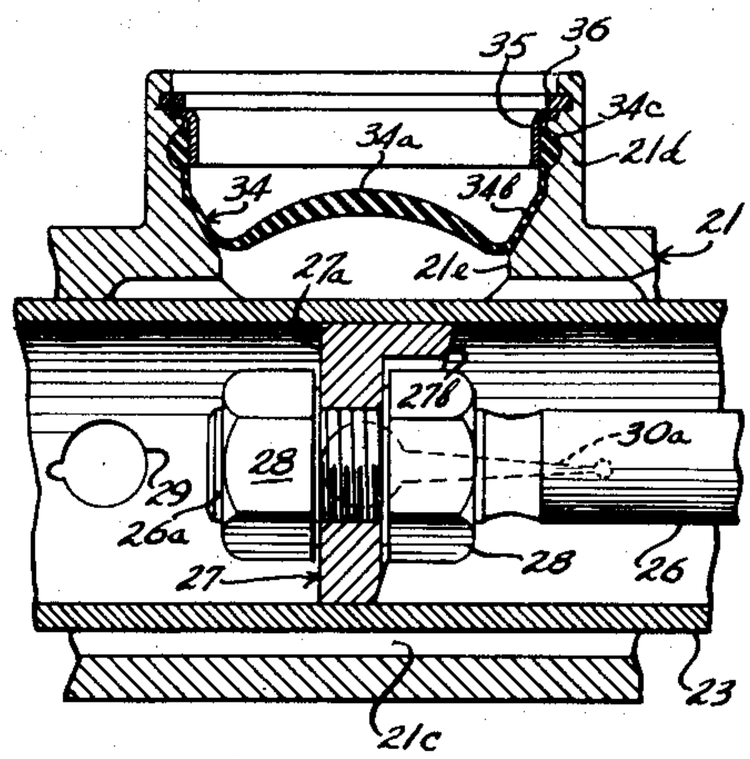


Fig. 7



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HYDRAULIC CHECK

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5 Sheets-Sheet 4

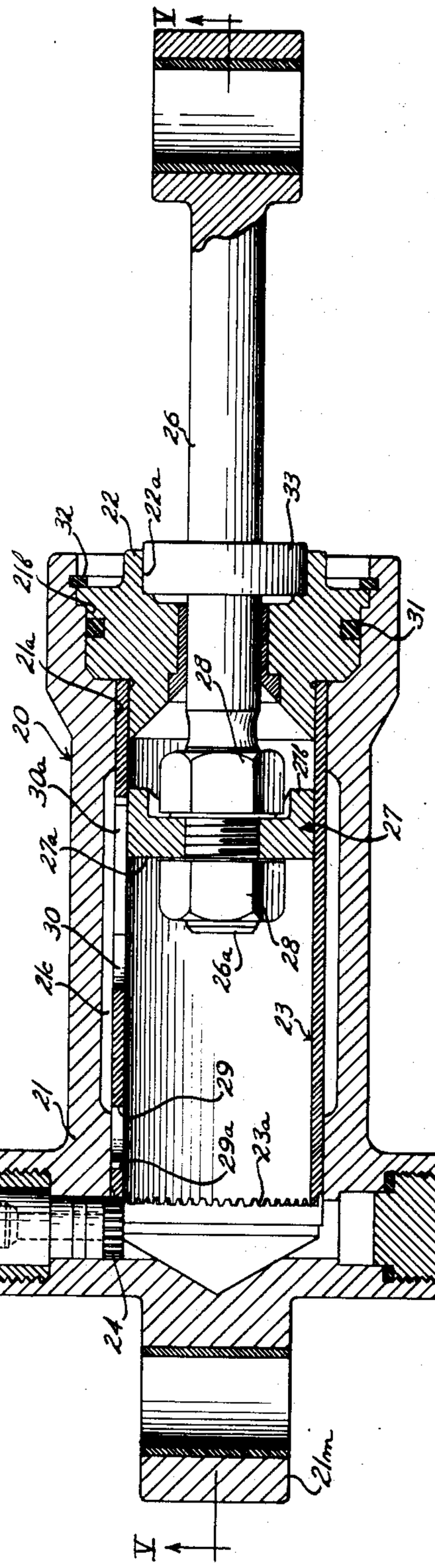

Fig. 5

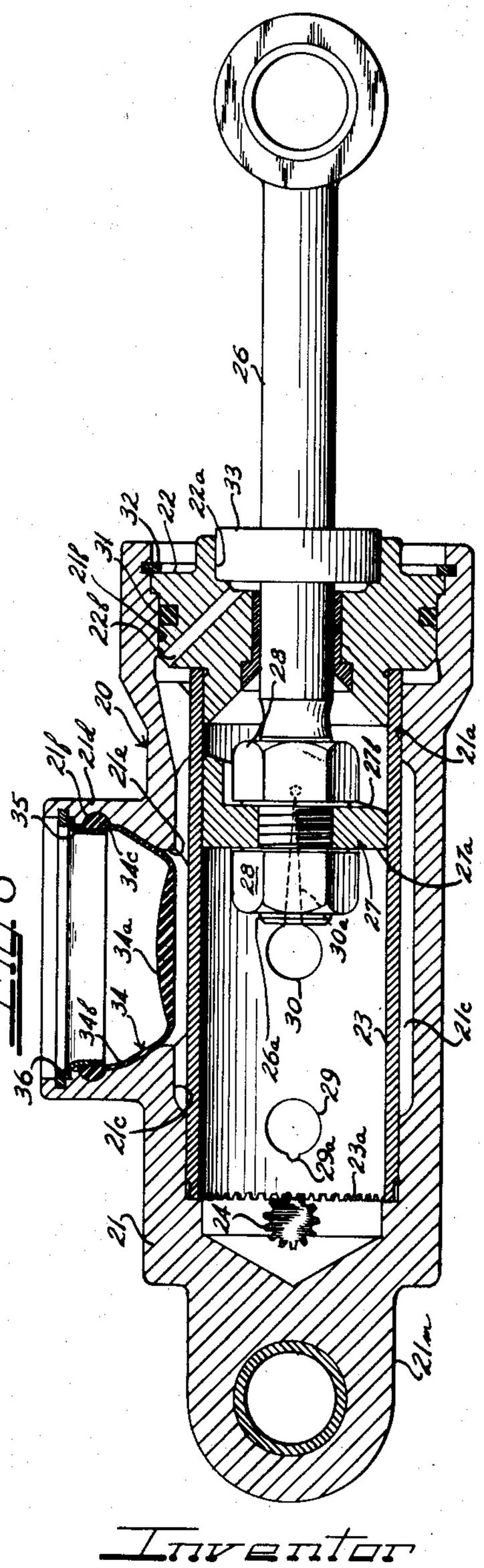

Fig. 6

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HYDRAULIC CHECK

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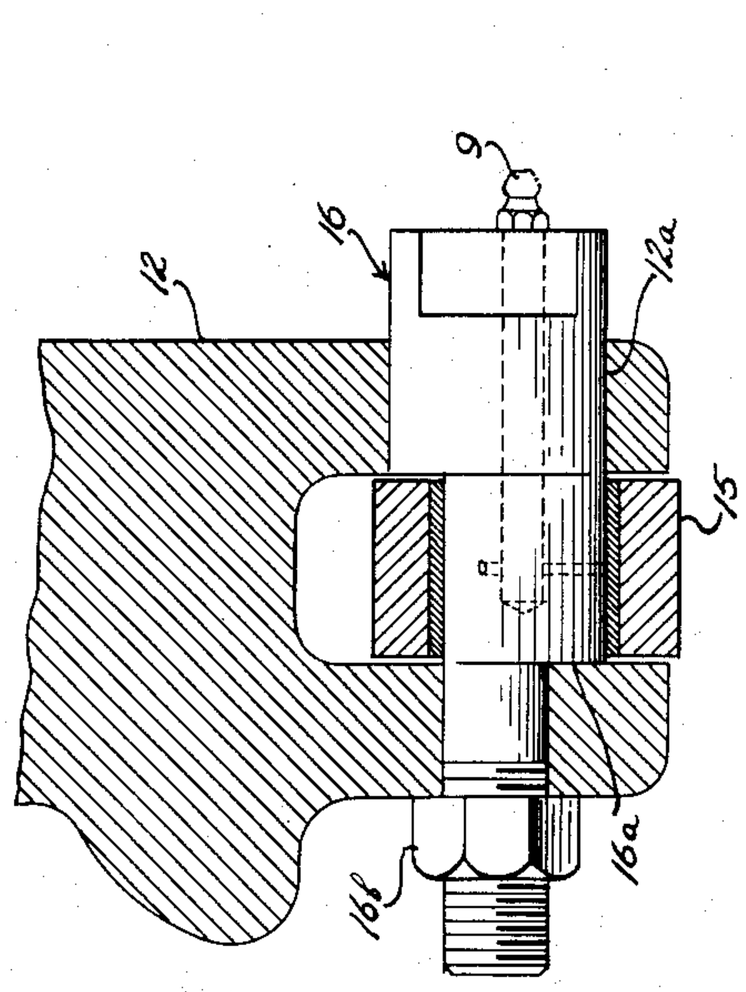

Fig. 9

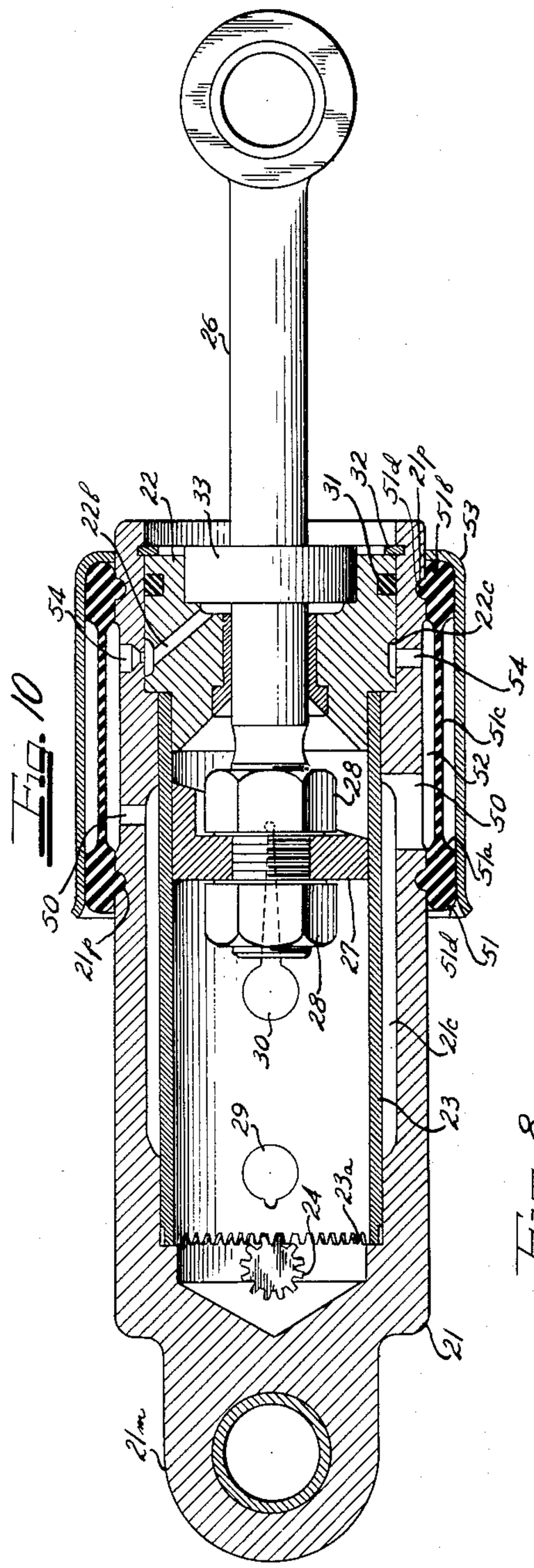

Fig. 10

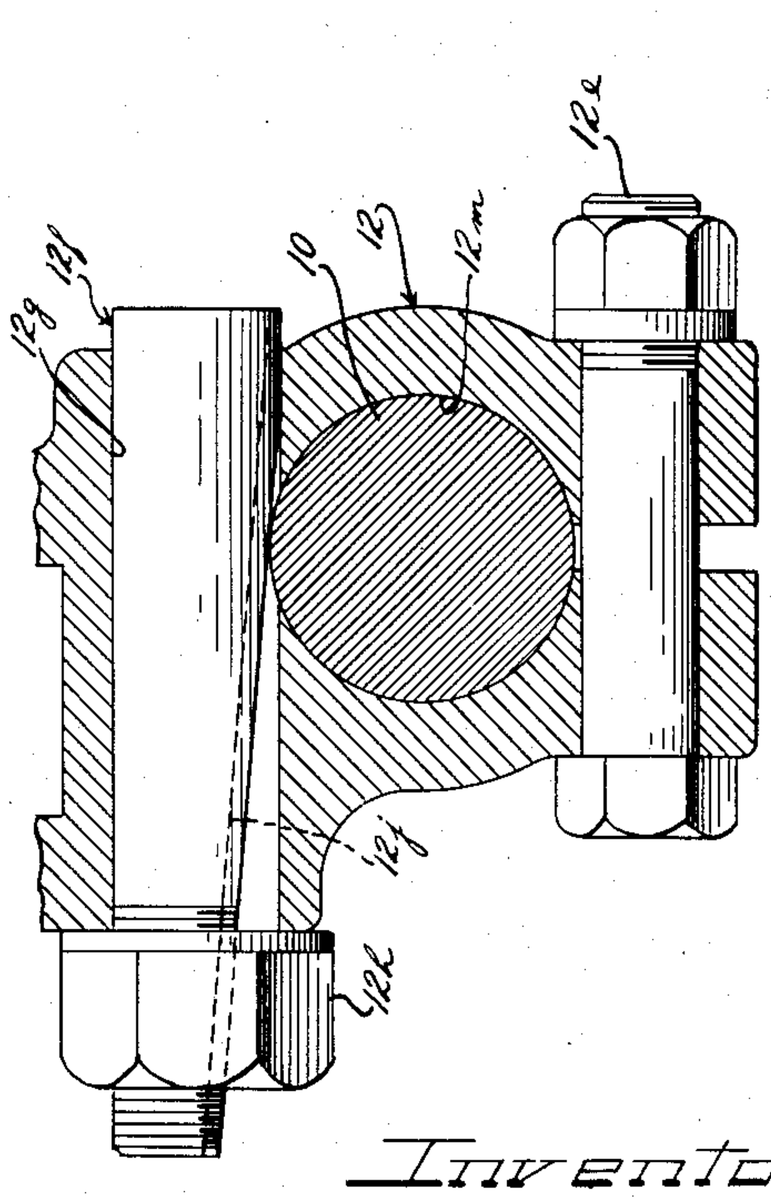

Fig. 8

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Patented Feb. 17, 1953

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UNITED STATES PATENT OFFICE

2,628,692

HYDRAULIC CHECK

George Hiram Hufferd, Cleveland, Ohio, assignor to Houdaille-Hershey Corporation, Detroit, Mich., a corporation of Michigan

Application July 9, 1948, Serial No. 37,950

13 Claims. (Cl. 188—97)

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This invention relates to an hydraulic check unit, and particularly to an improved hydraulic check unit adaptable for use in checking the movements of the picker stick of a loom.

As is well known, a loom picker stick continuously undergoes a cycle of movements involving very high rates of acceleration and deceleration at a cyclic rate approaching 180 or more cycles per minute. A picker stick is generally mounted on each end of the lay of the loom and its path of movement is controlled by well known linkages so that while the picker stick describes a generally pivoting movement, the top end thereof moves in a substantially straight line path. On its inward stroke, the picker stick accelerates and throws the shuttle at a very high velocity through the warp shed to the other side of the loom where a similar picker stick catches the shuttle and decelerates the shuttle, preliminary to throwing the shuttle back across the loom. Since the rate of production of any loom is determined primarily by the cyclic rate of the shuttle movements, there has been a continuous effort to increase the rate of shuttle cycles so that present day looms operate at 180 or more picks per minute. Obviously, the acceleration and deceleration forces exerted by and upon the picker stick when operating at such high cyclic rate, are of tremendous magnitudes, hence it is of extreme importance that the movement of the picker stick be smoothly decelerated on either its inward or outward stroke in such a manner as to prevent the development of excessive forces thereon. At the same time, the picker stick must be accurately positioned with respect to the shuttle box before the shuttle returns so that in each cycle, the shuttle engages the picker stick at the substantially identical position and the picker stick stops the shuttle each time at the same position in the shuttle box.

If the forward or inward movement of the picker stick is not properly controlled, then, when the shuttle is expelled from the shuttle box, the shuttle is likely to be thrown "wild" and thus produce defective cloth. Of course, due to the high cyclic rate of operation, it is also very essential to yieldingly bring the picker stick to rest as soon as possible after its shuttle throwing stroke has been delivered. The checking of the movement of the picker stick on its outward stroke is equally important, because the impact of the incoming shuttle must be smoothly absorbed in such manner that the shuttle will not rebound but will be brought to rest at a predetermined position in the shuttle box. Again, such checking action must be accomplished within a comparatively short travel of the picker stick.

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It has heretofore been proposed to employ an hydraulic checking device for effecting the necessary checking actions required for proper operation of the picker stick. However, since any such checking device must necessarily be of the double acting type and furthermore, since all looms vary slightly in their operating characteristics so that independent adjustment of the checking action exerted by the hydraulic checking device in either direction of its movement is required to be made upon not only the initial assemblage of the checking device to the loom but at frequent intervals thereafter, due to variations in the loom operating characteristics produced by temperature, humidity, or wear of components, it is readily apparent that conventionally constructed, double acting hydraulic check units are not ordinarily suitable for such application.

Accordingly, it is an object of this invention to provide an improved hydraulic check unit, and particularly, a double acting hydraulic check which is unusually adaptable to checking the movements of the picker stick of a loom.

Another object of this invention is to provide an improved double acting hydraulic check unit wherein the checking action in either direction of operation of the check may be conveniently independently adjusted, and particularly a construction wherein the effective checking action in at least one direction of operation may be manually varied by the simple manipulation of a control member and without requiring the disassemblage of the check or any interruption in operation of the machine to which the checking unit is applied.

A further object of this invention is to provide an hydraulic check unit of the type wherein throttling apertures in a cylinder element permit a controlled by-pass of fluid around a piston, and characterized by the formation of the peripheral portion of at least one face of the piston with a generally helical configuration, so that an axial adjustment of the checking action may be accomplished through relative rotation of the piston and the throttling apertures.

Still another object of this invention is the provision of an hydraulic check unit capable of effecting successive checking actions at a high cyclic rate by the by-pass of fluid around a piston element through throttling apertures in a cooperating cylinder, and particularly characterized by the provision of an expansible fluid chamber in communication with the throttling apertures which chamber increases its volume automatically to accommodate any excess fluid flow through the throttling apertures which does not imme-

diately flow to the other side of the piston element, thereby preventing the build-up of excessive pressures in the hydraulic check units and thus eliminating unpredictable variations in the checking action when the unit is operated at a high cyclic rate.

Still another object of this invention is to provide an improved double acting hydraulic check unit for looms or similar applications wherein the effective checking force in at least one direction of operation of the check unit may be conveniently manually adjusted without requiring disassembly of the check unit or interruption of operation of the machine to which it is applied.

The specific nature of the invention as well as other objects and advantages thereof will become apparent to those skilled in the art from the detailed description of the annexed sheets of drawings which, by way of preferred example only, illustrate one specific embodiment of the invention.

On the drawings:

Figure 1 is a side elevational view of a portion of a control linkage for a picker stick of a loom which linkage embodies an hydraulic check unit constructed in accordance with this invention;

Figure 2 is a partial view of Figure 1 but illustrating the position of the elements of the linkage when the picker stick is positioned at its shuttle contacting or neutral position;

Figure 3 is a top plan view of the picker stick control linkage with the components thereof in the position of Figure 1;

Figure 4 is a front elevational view of Figure 1;

Figure 5 is a sectional view of an hydraulic check unit embodying this invention, taken along a plane passing through the longitudinal axis thereof;

Figure 6 is a sectional view taken on the plane VI—VI of Figure 5;

Figure 7 is a partial sectional view similar to Figure 6 but illustrating the manner in which the expansible fluid reservoir chamber accommodates any excess of fluid being by-passed around the piston;

Figure 8 is a partial sectional view taken on the plane VIII—VIII of Figure 1;

Figure 9 is a partial sectional view taken on the plane IX—IX of Figure 1; and

Figure 10 is an axial sectional view of a modified construction of an hydraulic check unit.

As shown on the drawings:

While this invention will be particularly described and illustrated in connection with the application of an hydraulic check unit to checking the movements of a picker stick of a loom, it will be obvious to those skilled in the art that such application is merely exemplary and the hydraulic check unit embodying this invention is obviously adaptable to many other applications.

Referring to Figure 1, the numeral **10** indicates the rock shaft of a loom while the numeral **11** indicates a conventional picker stick. Picker stick **11** is supported for oscillating movements with respect to the rock shaft **10** by a linkage which controls the movement of the picker stick so that the top end of the stick traverses a substantially horizontal, straight line path. Such linkage, which is described in detail in my copending application, Serial No. 37,951, filed concurrently herewith, now Patent No. 2,566,890, may comprise a primary bracket **12**, rigidly secured to the rock shaft **10**, and a secondary bracket **13** which is connected to primary bracket **12** by a pair of pivoted links **14** and **15**. Link **14** may constitute two identical parallel link elements. The location of the pivot points of links **14** and **15**, as well as the relative dimensions of such links are selected in the manner described in detail in my above referred to copending application, so that the picker stick **11** can move only in a path which will result in the upper end of the stick moving along the lay (not shown) in a substantially horizontal, straight line path.

Thus, primary bracket **12** constitutes an integral casting having a split cylindrical recess **12***m* formed therein to receive the end of a rock shaft **10** and being clamped to rock shaft **10** by a bolt **12***e* and a key **12***f* (Figure 8). Key **12***f* is disposed in a transverse aperture **12***g* in bracket **12** which communicates with recess **12***m*. Key **12***f* is of longitudinally tapering configuration and is drawn into engagement with shaft **10** by a nut **12***h*. The surface of key **12***f* contacting shaft **10** is of concave configuration to provide a pair of parallel biting edges **12***j*.

In addition, primary bracket **12** defines three spaced pivot bearings **12***a*, **12***b* and **12***c* respectively. Pivot bearing **12***a* is located in slightly depending relationship with respect to rock shaft **10** and provides pivotal support for one end of the link **15**. Pivot bearing **12***a* is preferably of bifurcated construction and thus surrounds the end of link **15**. A pin **16** is provided for pivotally mounting link **15** in pivot bearing **12***a* and that portion **16***a* of the pin **16** which journals link **15** (Figure 9) is eccentrically formed so that limited adjustment of the effective length of link **15** may be obtained by varying the angular position of the pivot pin **16**, in a manner described in more detail in my above referred to copending application. A nut **16***b* retains pivot pin **16** in position.

Pivot bearing **12***b* is also of bifurcated construction and is located directly above the end of rock shaft **10** and provides pivotal support for the cylinder element **21** of an hydraulic check unit **20** to be described in more detail later.

Lastly, pivot bearing **12***c* is defined by a yoke shaped portion **12***d* of primary bracket **12** and such pivot bearing is disposed in generally triangularly spaced relationship with respect to pivot bearings **12***a* and **12***b* and pivotally journals one end of the links **14**.

The secondary bracket **13** is of generally reversed E-shaped configuration and may be conveniently formed by a riveted assemblage of two half parts, as indicated by rivets **13***e*. The back side of the upright portion of bracket **13** is suitably apertured as indicated at **13***d* so as to conform to and snugly partially surround the bottom portion of the picker stick **11**. Picker stick **11** is rigidly clamped in recess **13***d* by a plurality of U-shaped clamps **17** which are secured to secondary bracket **13** by bolts **17***a*.

Secondary bracket **13** likewise defines three pivot bearings which are respectively located in the ends of its arm portions. Thus, a bifurcated pivot bearing **13***a* is formed in the end of the lowermost arm portion and pivotally journals the other end of link **15**. A bifurcated pivot bearing **13***b* is mounted in the end of the top arm portion and pivotally journals the end of the piston rod **26** of the hydraulic check unit **20**. Lastly, a pivot bearing **13***c* is provided in the end of the intermediate arm and pivotally journals the other ends of links **14**. All of the pivot bearings heretofore mentioned except pivot bearing **12***a*, em-

body conventional pivot pins and grease fittings 9.

Conventional mechanism is provided for producing the required cyclic movements of the picker stick 11. Thus, a lug strap 18 is provided having a looped portion 18*a* surrounding the intermediate portion of picker stick 11. Lug strap 18 is supported and horizontally oscillated by an actuating link 19 which is cam driven in timed relationship to the movements of the loom and rock shaft 10 in accordance with well known procedure. It is therefore sufficient to point out that, periodically, the lug strap 18 shifts the picker stick 11 from its extreme outward position to its extreme inward position and in so doing, accelerates the picker stick 11 so rapidly that the shuttle (not shown), which is in contact with the upper end of the picker stick 11, is violently thrown to the other side of the loom. After the shuttle is thrown, the inward movement of the picker stick 11 is checked by the hydraulic unit 20 in a manner to be described and the picker stick 11 is brought to rest. Thereupon, a torsion spring 40, operating between secondary bracket 13 and link 15 is effective to urge the picker stick 11 outwardly at least to an intermediate neutral position illustrated in Figure 2 wherein a spring stop 41 carried by an arm 42 pivotally secured at 43 to secondary bracket 13, engages a fixed pin 44 transversely mounted in link 15. At this point, the picker stick 11 is properly positioned to receive the initial contact by the shuttle, when the shuttle is thrown back from the other side of the loom. The construction of the leaf spring stop 41 is described in detail and claimed in my copending application, Serial No. 37,951, filed concurrently herewith, now Patent No. 2,566,890, and reference should be had thereto for a more detailed description.

Upon the contact of the returning shuttle with the top end of the picker stick 11, the stick 11 is violently driven outwardly, and such outward movement must be checked by the hydraulic unit 20 to rapidly and smoothly bring the picker stick 11 to rest without producing a rebounding of the shuttle therefrom or permitting excessive forces to be developed in the picker stick 11 or any portion of its control linkage. Furthermore, the picker stick 11 must be brought to rest in substantially the same position each time so that the shuttle is properly positioned in the shuttle box.

As is well known, the operating characteristics of a loom vary substantially with temperature and humidity conditions as well as with wear of various component parts thereof. As a result, it is essential that the checking action exerted by the hydraulic check unit 20 be conveniently manually adjustable at least with respect to the effective checking action exerted upon the outward, or shuttle checking stroke of the picker stick 11 while the loom is operating, so that optimum conditions of checking, and hence uniform loom operation may be maintained.

Referring particularly to Figures 5 through 7, the hydraulic unit 20 embodying this invention is seen to comprise a cylinder casing 21 having a hollow bore 21*a* therein closed at one end and counterbored at the other end, as indicated at 21*b* to receive a piston rod bearing support member 22. At the closed end of the casing 21 an integral bearing lug 21*m* is formed by which the casing is pivotally secured to pivot bearing 12*b* of the primary bracket. A sleeve 23 is inserted

in the main bore portion 21*a* of cylinder casing 21 and is rotatably adjustable therein. Such adjustment may be effected in any convenient manner, for example, by a pinion 24 which is journaled in a generally radial extending aperture 21*c* provided adjacent the closed end of cylinder casing 21. The pinion 24 is preferably manually rotatable, such as by a flexible shaft 25 which is suitably co-rotatably secured to the pinion 24 by a coupling 25*a*. Gear teeth 23*a* are formed on the end face of sleeve 23 and mesh with pinion 24. Hence, upon rotation of the flexible shaft 25 by a suitable control knob (not shown), which may be located on the machine in any convenient position for the operator, the angular position of the sleeve 23 in the cylinder casing may be varied.

A piston rod 26 is provided which is slidably journaled in a sleeve bearing insert 22*a* mounted in the central bore of the bearing support ring 22. The inner end of piston rod 26 is threaded as indicated at 26*a*, and a piston 27 is adjustably positioned on such threaded end by a pair of opposed nuts 28.

The piston 27 is of generally cup-shaped configuration and, while its bottom end face 27*a* is substantially perpendicular to the axis of the piston rod 26, the opposite face is shaped so that at least a portion of the periphery of such face is generally helically inclined with respect to the piston rod axis as indicated at 27*b*. For example, such portion 27*b* may be formed by cutting the rim portion of piston 27 at an acute angle to the axis of the piston.

The entire interior of the piston casing 21 is filled with a suitable hydraulic fluid. In order to provide a controlled checking action upon relative movements between the piston 27 and the bearing sleeve 23, the bearing sleeve 23 is provided with a plurality of axially spaced throttling apertures 29 and 30 respectively. Such recesses are connected in fluid communication exteriorly of piston 27 in any convenient manner, such as by the main bore 21*a* of the piston casing 21 being radially enlarged throughout its central portion to provide a reservoir chamber 21*c*. It is therefore apparent that any time the piston 27 is positioned intermediate the throttling apertures 29 and 30, fluid will be by-passed around the piston by flow through the throttling apertures 29 and 30 and the communicating recess or chamber 21*c*.

The effective fluid passage areas of the throttling apertures 29 and 30 which are exposed in any particular position of the piston 27 of course determines the rate of flow of fluid around the piston and hence, determines the effective checking action exerted upon the axial movements of the piston. Such throttling apertures are therefore complexly shaped in an axial direction to provide the desired checking characteristics required at each particular axial position of the piston 27. Thus the throttling aperture 29, which is effective to check the inward stroke of the picker stick 11 after the shuttle has been thrown, has a relatively short and narrow axial extension 29*a* so that the movement of the piston 27 to the left as viewed in Figures 5 and 6 is very rapidly checked after the piston once begins to override the throttling aperture 29. In contrast, the throttling aperture 30, which effects the checking of the picker stick after it is contacted by the shuttle thrown from the other side of the loom, permits a much greater length of travel of the piston 27 and a more gradual increase of the

fluid checking action. Thus, the throttling aperture **30** is provided with a tapering axial extension **30***a*.

The rate of decrease of width of the throttling aperture extension **30***a* is, of course, proportioned according to well known design procedure to provide the desired degree of throttling at each successive axial position of the piston **27** as the piston rod **26** moves to the right as viewed in Figures 5 and 6, so that the piston **27**, and hence the picker stick and shuttle will always be stopped at substantially the same position.

As was heretofore indicated, it is practically impossible to adjust the check unit for the picker stick of a loom to exactly provide the desired checking characteristics prior to assemblage of the unit in the loom and observation of the operation of the loom. This is particularly true with respect to the checking of the outward stroke of the picker stick, wherein much greater energy forces must be absorbed and yet the picker stick must be accurately brought to rest in a predetermined relationship with respect to the shuttle box. The described construction permits a very accurate adjustment of the checking effect with respect to the axial position of the piston **27** during the outward movement of the piston rod **26**, which corresponds to the outward movement of the picker stick. By rotating the sleeve **23** through the described manual adjusting mechanism, the effective angular position of the throttling aperture **30** with respect to the helically extending portion **27***b* of the face of piston **27** is shifted, and, as a result, a variation is effected in the amount of checking action produced at any particular axial position of the piston **27**, as it moves to the right as viewed in Figures 5 and 6. It is therefore apparent that the checking action may be accurately adjusted after the check unit is assembled to the loom and while the loom is operated, and hence variations in the operating characteristics of the loom may be readily compensated for by adjustment of the rotational position of the sleeve **23** with respect to the piston **27**.

To prevent fluid leakage from the cylinder casing **21**, a sealing ring **31** is mounted in an annular groove provided in the periphery of the bearing support **22** and such ring sealingly engages the cylindrical wall of the counterbore **21***b*. The bearing support block **22** is retained in assembly by a snap ring **32** which is inserted in a suitable groove provided in the outer end of counterbore **21***b*. To prevent fluid leakage along the shaft of piston rod **26**, a sealing unit **33** is mounted in surrounding relationship to such rod and disposed in a counterbore **22***a* formed in the outer end of the bearing support block **22**. Such sealing unit may obviously comprise any one of several well known arrangements and will therefore not be described or illustrated in detail. The bearing support block **22** is provided with a drain aperture **22***b* communicating between the counterbore **22***a* and the reservoir chamber **21***c* of the cylinder casing **21**. Hence, any fluid that is forced outwardly between the piston rod **26** and the bearing sleeve **23** will be pulled back into the reservoir chamber **21***c* on the next stroke of the piston.

In the normal operation of the hydraulic check heretofore described, the fluid displaced by the axial movement of the piston will of course flow from one end to the other of the enclosed chamber through the flow paths provided by the throttling apertures **29** and **30** and the reservoir

chamber **21***c*. When the hydraulic check unit is employed in applications which involve relatively slow movement of the piston rod **26**, such by-pass fluid flow will take place without any substantial hindrance. However, when applied to checking the movements of the picker stick of the loom, or similar applications, the acceleration of the piston rod **26** is so rapid that an excess of fluid tends to accumulate in the reservoir chamber **21***c* during the movement of the piston rod in either direction, and particularly during the inward movement of the piston which corresponds to the shuttle throwing stroke of the picker stick. This is due to the fact that the movement of the piston rod is so fast that the throttling aperture which is remote from the piston position cannot immediately pass all of the fluid pumped forced into the reservoir chamber **21***c* through the active throttling aperture by the movement of the piston. Hence, the pressure of the fluid in the reservoir chamber **21***c* tends to build up and such build up would adversely affect the consistency of operation of the hydraulic check. To eliminate such possibility, this invention provides a deformable wall for a portion of the reservoir chamber **21***c* and such wall will yield outwardly upon any build up of pressure in the reservoir chamber **21***c* to accommodate any excess of fluid which might be pumped into the chamber by the rapid movements of the piston.

Thus, the cylinder casing **21** may be provided with an integral radial protuberance **21***d* which defines a bore **21***e* of relatively large area. A closure element **34** is mounted in the bore **21***e* and such closure element is formed of resiliently deformable material, such as rubber, and is arranged to readily expand in response to any pressure build up in the reservoir chamber **21***c* to substantially increase the volume of the reservoir chamber **21***c*. Thus, the closure element may be formed in a generally cup-shaped configuration, including a relatively thick base portion **34***a* and annular side wall portions **34***b*. The top rim of the side wall portions **34***b* is thickened as indicated at **34***c* and such portions fit snugly in a suitable annular groove **21***f* provided in the bore **21***e*. The closure **34** is retained in position in the bore **21***e* by a retainer ring **35** of angular cross section which, in turn, is retained in the bore **21***e* by a snap ring **36** mounted in a suitable groove provided adjacent the outer end of the bore **21***e*.

With the closure element constructed as described, a relatively large increase in effective volume of the reservoir chamber **21***c* may be produced by the outward expansion of the closure element. Due to the increased thickness of the base portion **34***a*, the closure element will tend to flex along its side wall portions in the manner specifically illustrated in Figure 7 of the drawings.

Referring to Figure 10, there is disclosed a modification of this invention wherein the expansibility of the reservoir chamber is substantially increased. In this construction, wherein similar numerals refer to corresponding parts of the modification heretofore described, the reservoir chamber **21***c* communicates with the exterior of the cylinder casing **21** through a plurality of radial apertures **50**. An expansible sleeve **51** is then mounted in surrounding relationship to the cylinder casing **21** and retained in assembly therewith by a surrounding metallic sleeve member **53**. Expansible sleeve **51** is formed of rubber

or rubber-like material and comprises relatively thickened portions 51*a* and 51*b* disposed in each axial end thereof and an intermediate thin-walled web portion 51*c* integrally uniting the thickened portion. Inwardly projecting ribs 51*d* on end portions 51*a* and 51*b* cooperate with grooves 21*p* on casing 21 to anchor expansible sleeve 51 thereto. Web portion 51*c* is radially spaced outwardly from the periphery of cylinder casing 21 and thus defines an expansion chamber 52 therebetween. As a further feature, the bleed passage 22*b*, which is provided in the bearing support block 22 to bleed back fluid accumulating between the piston rod seal 33 and the base of counterbore 22*a*, communicates directly with an annular groove 22*c* on bearing support block 22 and thence with radial apertures 54 provided in the cylinder casing 21 and thus permits the fluid to bleed directly into the expansion chamber 52.

The operation of this modification is substantially similar to that heretofore described. When an excess of fluid is pumped into the reservoir chamber 21*c* due to the very rapid acceleration of the piston 27, the resulting pressure increase deforms the web portion 51*c* of the deformable sleeve 51 outwardly to substantially increase the volume of the expansion chamber 52. In this manner, the excess fluid is accommodated without producing any substantial increase in fluid pressure within the cylinder casing 21.

From the foregoing description, it is apparent that this invention provides an hydraulic check unit which is of unusually simplified construction when the multiplicity of functions performed and the adjustments provided are considered. The described unit will not only accomplish smooth uniform checking of axial movements of the piston rod in either direction at a high cyclic rate, but will positively and accurately limit the extreme axial positions of the piston rod in each cycle. Furthermore, the checking action exerted by the unit may be axially shifted with respect to the piston position while the unit is in operation. It is therefore clear that a hydraulic check unit checked in accordance with this invention permits not only improved operation, but higher speed operation of a loom with a great reduction in wear and breakage of the loom components due to the reliable and accurate checking of the picker stick movements.

It will, of course, be understood that various details of construction may be modified through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. An hydraulic check unit comprising means defining a generally cylindrical chamber adapted to be filled with fluid, a piston axially reciprocable in said chamber, one face of said piston having a portion of its periphery of generally helical configuration, the cylindrical wall of said chamber having a throttling recess therein providing a fluid flow passage around said piston to provide a controlled resistance to axial movement of said piston, and means for relatively angularly shifting said piston and said chamber defining means, thereby varying the axial location of said piston at which a predetermined fluid resistance to movement of the piston is produced.

2. An hydraulic check unit comprising a hollow casing defining a cylindrical bore, a liner sleeve mounted in said bore and adapted to be filled with fluid, a piston axially reciprocable in said liner sleeve, at least a portion of one face of the piston having a periphery generally helically disposed relative to the sleeve axis, said sleeve having a throttling recess in the wall thereof providing a fluid flow passage around said piston and providing controlled resistance to axial movement of said piston, and means for relatively angularly shifting said piston and said sleeve, thereby varying the axial location of said piston at which a predetermined fluid resistance to movement of the piston is produced.

3. An hydraulic check unit comprising a hollow casing defining a cylindrical bore adapted to be filled with fluid, a liner sleeve mounted in said bore, a piston axially reciprocable in said liner sleeve, at least a portion of one face of said piston having a periphery generally helically disposed relative to the sleeve axis, said sleeve having a throttling aperture in the wall thereof, said casing bore being recessed adjacent said throttling aperture to permit fluid flow around said piston, thereby providing a controlled resistance to axial movement of said piston, and means for relatively angularly shifting said piston and said sleeve, thereby varying the axial location of said piston at which a predetermined fluid resistance to movement of the piston is produced.

4. An hydraulic check unit comprising a hollow casing defining a cylindrical bore adapted to be filled with fluid, a liner sleeve mounted in said bore, a piston axially reciprocable in said liner sleeve, at least a portion of one face of said piston having a periphery generally helically disposed relative to the sleeve axis, said sleeve having a throttling recess in the wall thereof permitting fluid flow around said piston to provide a controlled resistance to axial movement of said piston, and means for rotatably adjusting the position of said sleeve in said bore, thereby angularly shifting said throttling aperture with respect to said helical portion of said piston face.

5. An hydraulic check unit comprising a hollow casing defining a cylindrical bore adapted to be filled with fluid, a liner sleeve mounted in said bore, a piston axially reciprocable in said liner sleeve, at least a portion of one face of said piston having a periphery generally helically disposed relative to the sleeve axis, said sleeve having a throttling recess in the wall thereof permitting fluid flow around said piston to provide a controlled resistance to axial movement of said piston, said sleeve having gear teeth formed thereon, and means including a driving gear meshing with said gear teeth for relatively angularly shifting said piston and said sleeve, thereby varying the axial location of said piston at which a predetermined fluid resistance to movement of the piston is produced.

6. An hydraulic check unit comprising a hollow casing defining a cylindrical bore adapted to be filled with fluid, a liner sleeve mounted in said bore, a piston axially reciprocable in said liner sleeve, at least a portion of one face of said piston being generally helically disposed relative to the sleeve axis, said sleeve having a throttling recess in the wall thereof permitting fluid flow around said piston to provide a controlled resistance to axial movement of said piston, said sleeve having gear teeth formed on one end thereof, a pinion journaled in said casing and meshing with said gear teeth, and manually operable means for rotating said pinion, thereby angularly shifting said throttling recess relative to said helical portion of said piston face.

7. An hydraulic check comprising means defining a generally cylindrical chamber adapted to be filled with fluid, a piston rod having a portion thereof axially reciprocable in said chamber, a piston secured to said piston rod portion and axially adjustable thereon, said piston having a peripheral portion of one face generally helically disposed relative to the chamber axis, the cylindrical wall of said chamber having two axially spaced throttling recesses therein respectively cooperating with the opposite faces of said piston to permit a limited flow of fluid around said piston, thereby providing a checking action in either direction of axial movement of said piston, and means for angularly shifting said chamber defining means relative to said piston, thereby permitting independent adjustment of the checking action in one direction of piston movement without effect on the checking action in the other direction of piston movement.

8. An hydraulic check unit comprising a hollow casing defining a cylindrical bore adapted to be filled with fluid, a liner sleeve mounted in said bore, a piston rod having a portion thereof axially reciprocable in said liner sleeve, a piston secured to said piston rod portion and axially adjustable thereon, said piston having a peripheral portion of one face generally helically disposed relative to the chamber axis, said liner sleeve having two axially spaced throttling recesses therein, said casing bore being additionally recessed to provide fluid communication between said throttling recesses, whereby a limited flow of fluid around said piston is permitted in either direction of movement of said piston to produce a checking action, and means for relatively angularly shifting said piston and said sleeve, thereby permitting independent adjustment of the checking action in one direction of piston movement.

9. An hydraulic check unit comprising a hollow casing defining a cylindrical bore adapted to be filled with fluid, a liner sleeve mounted in said bore, a piston rod having a portion thereof axially reciprocable in said liner sleeve, a piston secured to said piston rod portion and axially adjustable thereon, said piston having a peripheral portion of one face generally helically disposed relative to the chamber axis, said liner sleeve having two axially spaced throttling recesses therein, said casing bore being additionally recessed to provide fluid communication between said throttling recesses, whereby a limited flow of fluid around said piston is permitted in either direction of movement of said piston to produce a checking action, said sleeve having gear teeth formed thereon, and means including a driving gear meshing with said gear teeth for relatively shifting said sleeve with respect to said piston, thereby permitting independent adjustment of the checking action on said piston in one direction of piston movement.

10. An hydraulic check comprising a hollow casing adapted to be filled with fluid, a piston reciprocable in said casing, fluid passage means for by-passing fluid around said piston at a limited rate, said casing having a wall aperture communicating with said fluid passage means, and a sleeve of resiliently deformable material mounted on said casing in overlying relation to said wall aperture, said sleeve having axially spaced

end portions engaging said casing in sealing relation and an intermediate web portion radially spaced from said casing forming an expansible chamber in fluid communication with said wall aperture in response to increase of fluid pressure at said aperture.

11. An hydraulic check comprising a hollow casing adapted to be filled with fluid, a piston reciprocable in said casing, said casing having fluid passage means for by-passing fluid around said piston at a limited rate, said casing having a wall aperture communicating with said fluid passage means, and a disk of resiliently deformable material mounted on said casing in overlying relation to said wall aperture, said disk having portions engaging said casing in sealing relation and an intermediate web portion expansible in response to a pressure force from the inside of said casing and automatically forming a chamber accommodating fluid displaced into said fluid passage means by said piston.

12. An hydraulic check comprising casing means adapted to be filled with fluid, a sleeve in said casing means and together therewith forming an annular chamber, a piston reciprocable in said sleeve, said sleeve having throttling passages to by-pass fluid around said piston to provide a predetermined resistance to axial movement of the piston, said casing means having a wall portion made of resiliently deformable material disposed in the exterior thereof and being responsive to pressure increases in said annular chamber to produce an outward flexing of said wall portion for automatically accumulating excess fluid displaced by said piston into said annular chamber.

13. An hydraulic check comprising a hollow casing adapted to be filled with fluid, a piston reciprocable in said casing, fluid passage means in said casing for by-passing fluid around said piston at a limited rate, said casing having a resiliently deformable wall portion in the exterior thereof automatically forming an expansion chamber adjacent said fluid passage means upon displacement of fluid into said fluid passage means by said piston.

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