

[54] **MECHANICAL LATCH**

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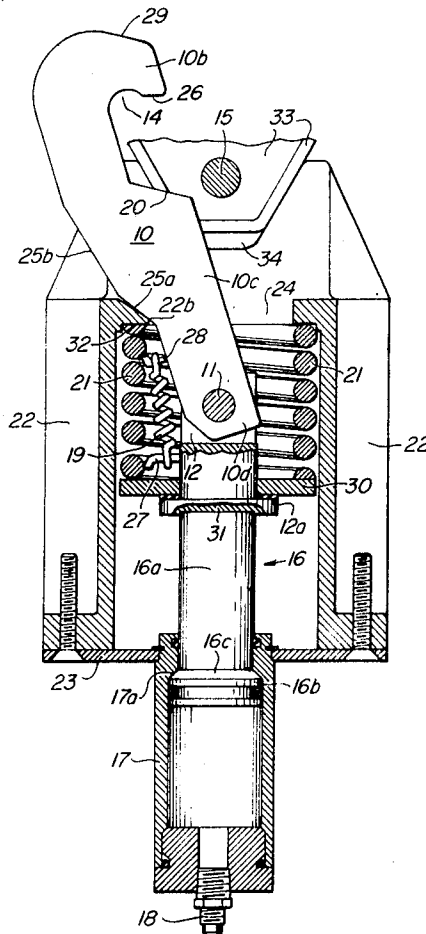
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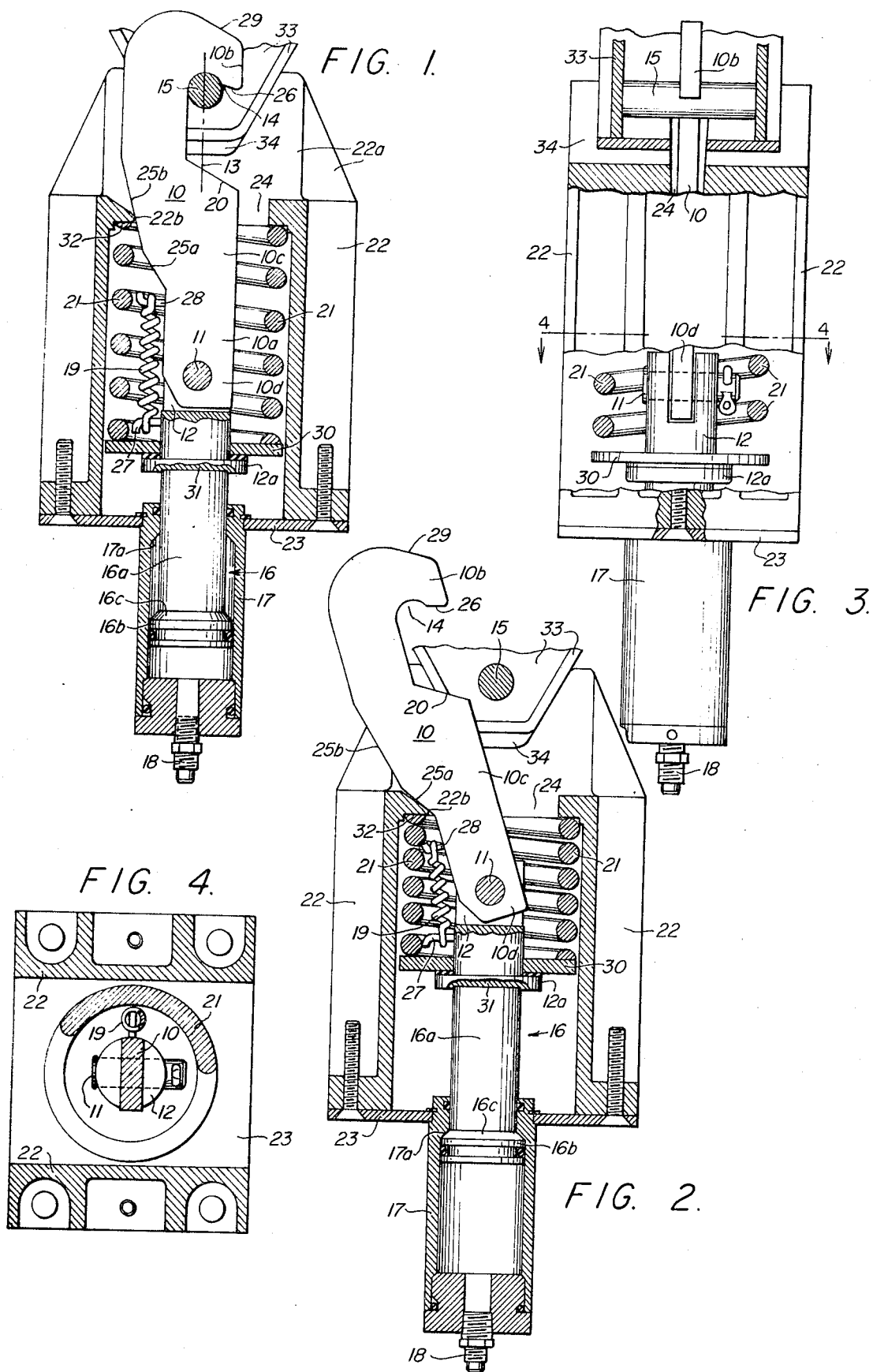
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ABSTRACT

A mechanical latch of the type widely utilized to retain, in closed position, an automotive truck cab that is pivoted to be swung open and closed above the truck engine (especially such a cab of the tractor unit of a transport truck-trailer combination) is constructed with its pivoted and axially extendible and retractable, hooked, latch element normally resiliently urged, by a relatively small spring, transversely toward its unlatched position, and is constructed for forced movement into latched position, upon axial retraction of the latch element from its axially extended, unlatched position, by camming means that preferably comprise a camming surface extending along the back of the hooked latch element and bearing, as such latch element is retracted, against a confronting portion of a housing within and from which the latch element operates. As normally constructed for hydraulic actuation, the relatively powerful spring that returns the power piston and effects latching following longitudinal extension of the latch element to its unlatched position bears against a seating ring that is freely rotatable and independent of, rather than integral with, the clevis element against which such power piston operates and in which the latch element is pivoted.

15 Claims, 4 Drawing Figures





MECHANICAL LATCH

BACKGROUND OF THE INVENTION

1. Field

The invention is in the field of mechanical latches, especially power-operated mechanical latches of the pivoted latch element type currently in use for latching and unlatching the cab of an automotive truck that has its cab pivoted to be swung open and closed relative to the engine of the truck, see for example Ray S. Brimhall application Ser. No. 743,484 filed Apr. 29, 1968, entitled "Hydraulic System and Mechanical Latch Therefor."

2. State of the Art

A power-operated, mechanical latch of the type concerned has a longitudinally extendible latch element pivoted to swing transversely at some point along its longitudinal travel so as to clear a latch keeper.

In this type of latch as previously constructed, the latch element is of special bell crank formation, having a relatively short, actuating lever arm extending transversely from one end of a relatively long lever arm (which constitutes a hooked latch member of the latch element) in a direction opposite to the open mouth of the hook formation at the opposite end of such hooked latch member, such actuating lever arm being positioned to engage a depending abutment member of the latch housing at a predetermined point along the axial extension stroke of the latch element for forcing the longitudinally oriented and hooked latch member of such latch element to move transversely of its longitudinal axis into an unlatched position. A relatively small spring is arranged to act on the transverse lever arm of the latch element to constantly urge the hooked latch member toward its latching position. As a consequence, positivity of latching action is dependent upon the spring, which is not always dependable, and transverse unlatching movement of the hooked latch member must wait until the relatively short, transverse lever arm reaches the predetermined abutment position.

It is highly desirable in practice to not only have as reliable latching action as possible, but to have such action take place sufficiently slowly that the hooked latch member and the keeper it engages are in proper relative re-latching positions before such latch member moves transversely into position for engagement therewith, and, also, to have the unlatching action take place sufficiently rapidly that unlatching is completely effected before the cab is motivated toward its open position. This is particularly true, because mechanical latches of this type are customarily power-operated hydraulically from a hydraulic system shared in common with the cab raising and lowering mechanism.

A latch of the type concerned also has a powerful return coil spring of compression type for forcing the hydraulically actuated power piston through its retraction stroke following its hydraulically powered extension stroke. In the prior construction, the piston rod of the power piston abuts against a so-called flange member of wholly integral construction that provides a circular flange, against which one end of the return spring presses, and has a so-called bifurcated flange extension, that serves as a clevis in which the latch element is pivotally anchored.

As so constructed, the return spring has a tendency to unwind and to rewind as it expands and contracts, imparting torque to the flange member and tending to

twist the latch element about its longitudinal axis. This is undesirable from the standpoint of the latch element binding against the defining walls of the slot in the housing through which such latch element customarily extends and also from the standpoint of binding action on the keeper and wear on the receiving cradle of the hook.

OBJECTIVES

In the making of the present invention, it was a principal object to provide reliable latching action, without dependence on a relatively small spring for the purpose. It was also an object to achieve unusually rapid unlatching action and relatively slow latching action, so that timing of the hydraulic motivations in a hydraulic system shared between latch operation and cab lifting and lowering need not be so critical as in prior systems of the type concerned. A further purpose of the invention was to eliminate the tendency for the latch element to twist about its longitudinal axis and thereby cause binding and wear that would otherwise not take place.

SUMMARY OF THE INVENTION

To achieve the objectives of the invention, a latch of the type concerned is constructed differently from those constituting the prior art and the operation is different. Instead of moving the latch element into latching position by means of a relatively small spring that cannot safely be relied upon, the latch element is moved into latching position by much more reliable means, i.e., by camming means motivated preferably by the powerful return spring. Thus, cooperative camming surfaces are advantageously located, respectively, on the back of the hooked latch member and on the confronting wall of the housing through which such latch member longitudinally extends. In fact, the usual relatively short, transverse lever arm member of the latch element is preferably removed altogether, since it is no longer necessary that it be present to engage an abutment member which ordinarily extends a predetermined distance into the interior of the housing for moving the hooked latch member transversely from latched to unlatched position.

Such unlatching movement is carried out in the present invention by a relatively small spring, which may be and preferably is a tensile coil spring anchored intermediate the length of the hooked latch member that, in and of itself, constitutes the latch element of the new device. If it is desired to use the usual bell crank formation for the latch element and the usual small compression spring, this can be done; but, if so, the short transverse lever arm member thereof must extend, contrary to prior practice, in the direction faced by the open mouth of the hook portion of the hooked latch member.

As a safety factor in the unlatching of the latch element if the small spring fails to function effectively, it is preferable that a portion of the element, forward face of the shank of the hooked latch member confronting the open mouth of the hook portion thereof be positioned and arranged for camming action against the keeper during the extension stroke of the latch element.

To preclude any twisting of the latch element about its longitudinal axis by reason of torque imparted by the return spring, it is advantageous that such spring rest upon a seating ring independent of and rotatable with

respect to the clevis element in which the latch element is pivoted, and, to provide secure seating for the opposite end of the return spring as well as to accommodate the keeper bar mount as it moves into latching position with respect to the latch device of this invention, all at minimum cost, it is desirable that the housing be of inverted U formation, in contrast to the prior art U formation, with the power piston assembly carried by the housing cover rather than by the housing bottom.

THE DRAWINGS

A specific construction of hydraulically powered mechanical latch representing the best mode presently contemplated of carrying out the invention is illustrated in the accompanying drawings, in which:

FIG. 1 represents a longitudinal, vertical, axial section of the mechanical latch in latched position relative to a keeper bar and showing the latch element and power piston in side elevation and the clevis element largely in elevation;

FIG. 2 is a corresponding view showing the same latch in unlatched position;

FIG. 3 is a view in front elevation with portions of the front wall of the housing broken out to show interior working parts; and

FIG. 4 is a view showing a horizontal section taken on the line 4-4 of FIG. 2.

DETAILED DESCRIPTION OF ILLUSTRATED EMBODIMENT

In its illustrated form, the mechanical latch of the invention comprises an elongate, hooked, latch element 10 having one of its ends 10a pivotally mounted at 11 by means of a clevis element 12 that is extendible and retractible along the longitudinal axis 13 of such latch element. The opposite, latching end of latch element 10 is formed as a hook 10b having a laterally open mouth 14 for receiving a keeper bar 15 of structure, such as a swingable cab of an automotive truck, that is to be latched to structure with which the mechanical latch device is associated, such as the chassis or frame of the truck that has the swingable cab.

Means in the form of a hydraulically powered piston 16, operating in a cylinder 17 and actuated on its extending power stroke by pressure fluid supplied from any suitable source, such as the hydraulic system of the automotive truck previously referred to, through conventional pipe and fitting 18, serves to extend latch element 10 along its longitudinal axis 13.

As indicated in FIG. 2, the power extension stroke of piston 16 forces latch element 10 through the longitudinal portion of its unlatching stroke with respect to keeper bar 15. For moving latching hook 10b laterally, i.e., transversely of longitudinal axis 13 into the unlatched position of FIG. 2 so keeper bar 15 can be moved from its latching position, as is necessary when a pivoted truck cab is to be swung back from its normal closed position on a truck chassis to provide access to the engine and other working parts of the truck, a relatively small, tensile, coil spring 19 is provided in such manner (to be explained hereinafter) as to constantly urge hooked end 10b of latch element 10 transversely, i.e., laterally of the device. Thus, unlatching occurs immediately after hook 10b clears keeper bar 15.

It should be observed that a safety factor may and preferably is provided by a camming surface 20 at the front of shank 10c of latch element 10 confronting

mouth 14 of the hook and operable against keeper bar 15 as longitudinal extension of such latch element continues toward latching position, to positively cam the latch element transversely away from latching position and to thereby release the keeper bar.

Although power piston 16 or some other instrumentality could conceivably be employed to retract latch element 10, as, for example, by connecting piston rod 16a to such latch element and by hydraulically powering the return stroke of piston 16, it is preferred to utilize a relatively large and powerful return spring 21 for this purpose, as in the prior art. However, here the construction is such that this compression-type, coil spring does not impart undesirable torque to clevis element 12, i.e., to the extendible and retractible means that pivotally mounts latch element 10, as will appear hereinafter.

In the present embodiment, the clevis element and its associated portion of the latch element are disposed within a housing frame 22 of inverted U formation, having a cover plate 23 removably attached across the legs of the U. The arrangement is such that the hooked end portion 10b of latch element 10 always projects beyond the housing so formed, through an accommodation slot 24 in the transverse bend portion 22a of inverted U frame 22. Hydraulic cylinder 17 extends through and is rigidly attached to cover plate 23 as shown, and the shank portion 16a of power piston 16 projects from piston head 16b and operates within the housing.

Here, return spring 21 functions to not only return piston 16 to its retracted position in cylinder 17, but also, in contrast with the prior art, to power latching movement of latch element 10 relative to keeper bar 15. Thus, the back of latch element 10 may be provided with a camming surface 25 (in this instance, having portions 25a and 25b of mutually different slopes) for functional coaction with confronting camming surface 22b of housing frame 22. As return spring 21 forces piston 16, clevis element 12, and latch element 10 through the retraction, i.e., latching stroke, camming surface portion 24a of less steep slope first bears against functionally related camming surface 22b of the housing and moves the hooked end portion 10b of the latch element transversely at a rapid rate toward keeper bar engaging position, and, thereafter, camming surface portion 25b of steeper slope similarly moves such hooked end portion 10b at a slower rate into full latching position. As first moved, an additional camming surface 26 which is preferably provided on the tip of the hook at the hook mouth 14 and outwardly of the bed of the hook, is brought into position to cam or to help cam hook 10b into latching position if need be.

It should be noted that the opposite, pivoted end 10a of the latch element 10 is advantageously provided with a toe portion 10d at the hook mouth side of such latch element as a stop for abutment against clevis element 12 to positively limit latching travel.

Relatively small spring 19, which serves to constantly urge latch element toward unlatched position, is advantageously anchored at its respectively opposite ends by a pin 27, projecting from clevis element 12, and by a similar pin 28, projecting from shank 10c of the latch element intermediate the length thereof at a location that will provide desired mechanical advantage in the lever system concerned. Also, as a safety feature, a camming surface 29 is advantageously provided on

hook 10b for coaction with keeper bar 15 to move latching element 10 to its unlatched position in the event spring 19 fails for one reason or another.

To preclude the imposition of torque on clevis element 12 by return spring 21, as occurs in the prior art, the corresponding end of such return spring is carried by a seating ring 29, which is rotatably mounted on base flange 12a of such clevis element by means of an anti-friction washer 30 of nylon or the like. Thus, any circular movement imparted by return spring 21 as it contracts and expands is taken up by idling rotation of seating ring 29 with respect to clevis element 12 and is not transmitted as torque to latch element 10.

Since piston 16 is desirably separate from clevis element 12, as in the prior art, it has been found advantageous to provide a receiving recess 31 for the terminal end of piston shank 16a of confronting surface of the clevis element. This tends to maintain the entire assembly centered. To prevent possible shifting of the other end of return spring 21, a circular seat 32 therefor is desirably provided in the inner face of transverse bend portion 22a of housing frame 22.

To accommodate keeper bar mount 33 as it moves into latching position, bend portion 22a of housing frame 22 is advantageously recessed exteriorly, as at 34.

For obtaining the desired formation of housing frame 22 at minimum cost, such frame is preferably fabricated by casting techniques.

It has been found advantageous to make piston 16 of a tough and corrosion resistant plastic material, such as nylon (specifically Nylon Zytel 7110-33), rather than from metal as in the prior art, and to bevel corresponding surfaces 16c and 17a of piston and cylinder, respectively, preferably at a 45° angle or thereabouts, in order to withstand the combined mechanical and hydraulic pressures found to be active on these parts of the device.

Although it is advantageous to utilize coacting camming surfaces as camming means to positively cause transverse movement of the latch element as it is being retracted along its longitudinal axis and convenient to provide the latch-element-confronting one of these surfaces by means of a protective housing for the latch mechanism, as here illustrated, such camming means can take other forms and such confronting one of coacting camming surfaces can be provided by other structures than a housing.

Whereas this invention is here illustrated and described with respect to a certain preferred form thereof, it is to be understood that many variations are possible without departing from the inventive concepts particularly pointed out in the claims.

We claim:

1. A mechanical latch, comprising an elongate latch element having a keeper-engaging, laterally open hook portion at one of its ends and being pivotally mounted at its other end; means for extending and retracting said latch element along its longitudinal axis; extendible and retractable means pivotally mounting said other end of the latch element, such mounting means being extendible and retractable by said means for extending and retracting the latch element; spring means constantly urging said latch element transversely toward unlatched position; and camming means for positively moving said latch element transversely into latching position as it is retracted.

2. A mechanical latch in accordance with claim 1, wherein the camming means comprises camming surfaces, one formed on the back of the hook portion of said latch element and the other provided by confronting stationary structure.

3. A mechanical latch in accordance with claim 2, wherein housing means are provided within and from which the latch element is operable, the other camming surface being provided by a surface of said housing means which confronts the camming surface of the latch element during longitudinal travel of said latch element.

4. A mechanical latch in accordance with claim 3, wherein the camming surface formed on the back of the hook portion of the latch element has an initial relatively non-steep portion and a subsequent relatively steep portion arranged to provide differential rates of latching action.

5. A mechanical latch in accordance with claim 4, wherein the tip of the hook portion at its open mouth is outwardly provided with a camming surface for coaction with a latch keeper in the latching of the latch element.

6. A mechanical latch in accordance with claim 1, wherein the extendible and retractable means pivotally mounting the other end of the latch element is a clevis element having a base flange; the means for extending and retracting the latch element along its longitudinal axis includes means operative on the clevis element for extending it and the latch element and a return coil spring operative on the clevis element for retraction purposes; an independent seating ring rotatably mounted on said base flange; and stationary reaction means for one end of said coil spring, the other end of said spring bearing against said seating ring.

7. A mechanical latch in accordance with claim 6, wherein the means operative on the clevis element is the terminal end of a power piston; and the underside of said clevis element is recessed to receive said terminal end of the piston.

8. A mechanical latch in accordance with claim 6, wherein the unlatching spring means is an elongate tensile coil spring anchored to the clevis element at one of its ends and to the latch element intermediate the length thereof at the other of its ends.

9. A mechanical latch in accordance with claim 1, wherein the means for extending and retracting the latch element along its longitudinal axis includes a hydraulically actuated power piston and cylinder combination, the piston thereof including a piston head and shank molded integrally from a tough plastic material, the forward face of said piston head in the direction of piston extension being beveled at its rim and the cylinder of said combination being correspondingly beveled internally to mate with the beveled rim of said piston head at the termination of the extension stroke of said piston.

10. A mechanical latch in accordance with claim 1, wherein the outer end of the hook portion is provided with a camming surface adapted to coact with the latch keeper to move the latch element to its unlatching position in the event the spring means fails to function.

11. A mechanical latch, comprising an elongate latch element having a keeper-engaging, laterally open, hook portion at one of its ends and being pivotally mounted at its other end; a housing within and from which said latch element is operable; a hydraulically actuated

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power piston and cylinder assembly having its cylinder engaging said housing with its piston operably disposed to extend said latch element along its longitudinal axis, extendible and retractible means pivotally mounting said other end of the latch element so that the opposite hooked end thereof projects from said housing, such mounting means being extendible by said piston; a return spring for retracting the latch element and its pivotal mounting means; spring means constantly urging said latch element transversely toward unlatched position; and camming surface means formed on the back of said hook member for coaction with the confronting surface of the housing from which the latch element projects, so as to move the latch element transversely into latching position.

12. A mechanical latch in accordance with claim 11, wherein the housing comprises a frame of U formation,

and a cover plate extending across the legs of the U, the transverse bend of the U being slotted and the latch element extending through the slot, and the cylinder of the power piston and cylinder assembly being attached to said cover plate exteriorly of the housing so that the piston operates within the housing.

13. A mechanical latch in accordance with claim 12, wherein the inner face of the transverse bend of the U frame is formed as a seat for the corresponding end of the return spring.

14. A mechanical latch in accordance with claim 13, wherein the transverse bend of the U frame is recessed externally to accommodate the mount of a latch keeper.

15. A mechanical latch in accordance with claim 14, wherein the housing U frame is a casting.

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