United States Patent [19]

Slattery et al.

[11] 3,830,580

[45] Aug. 20, 1974

[54] COUPLER

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[51] Int. Cl. B60d 1/06

[58] Field of Search 403/90, 122, 126, 141, 403/143, 321, 325, 326; 280/511, 512, 513

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Attorney, Agent, or Firm—Wolfe, Hubbard, Leydig, Voit & Osann, Ltd.

[57] ABSTRACT

A coupler ballhead receiving socket has a longitudinally extending slot adjacent it in the mounting bracket that is long enough to accommodate a channel-shaped latch having an upwardly and forwardly extending handle portion for first tilting the latch with the ballhead retaining clamp, that is pivotally connected to the front end portion of the latch, rearwardly to an open position holding the clamp in retracted relationship to the socket. The clamp is pivotally connected to the socket at its one end and to the front end of the latch at its other end, where a grasshopper type spring is provided urging the clamp normally toward closed position and at the same time urging the latch downwardly toward locked position with its lower portion disposed inside the slot. At the rear end of the slot a ledge is defined and in the fully retracted position of the clamp, a shoulder on the front end of the lower portion of the latch rests on this ledge to retain it in the fully retracted position of the latch, but in the locked position of the latch a shoulder on the rear end of the lower portion bears against the rear end of the slot to prohibit any rearward movement of the latch, so that the clamp is accordingly held firmly in its closed position. It is a simple matter to change the configuration of the latch by removal of the front and rear shoulders. If the rear shoulders are removed the clamp can be opened by entry of the ball, the remaining shoulders holding the clamp in open position and requiring the latch to be closed manually. This is a convenience feature which does not reduce the security with which the ball is retained by the coupler. If the front shoulders are removed too, the clamp is urged open by the entering ball and then automatically closed, this being a safety feature because the clamp cannot lock in open position. With a ball in place in the coupler, the geometry of the clamp securely clamps the ball. The latch has security, also, with the locking shoulders. These shoulders require that the latch be manually opened before the coupler is placed on the ball and then manually closed once the coupler is on the ball. This is normal procedure. However, for the convenience of customers who use their trailer many times such as travel trailer owners, one or both of the locking shoulders can be removed and the latch will automatically open or automatically open and close.

22 Claims, 10 Drawing Figures

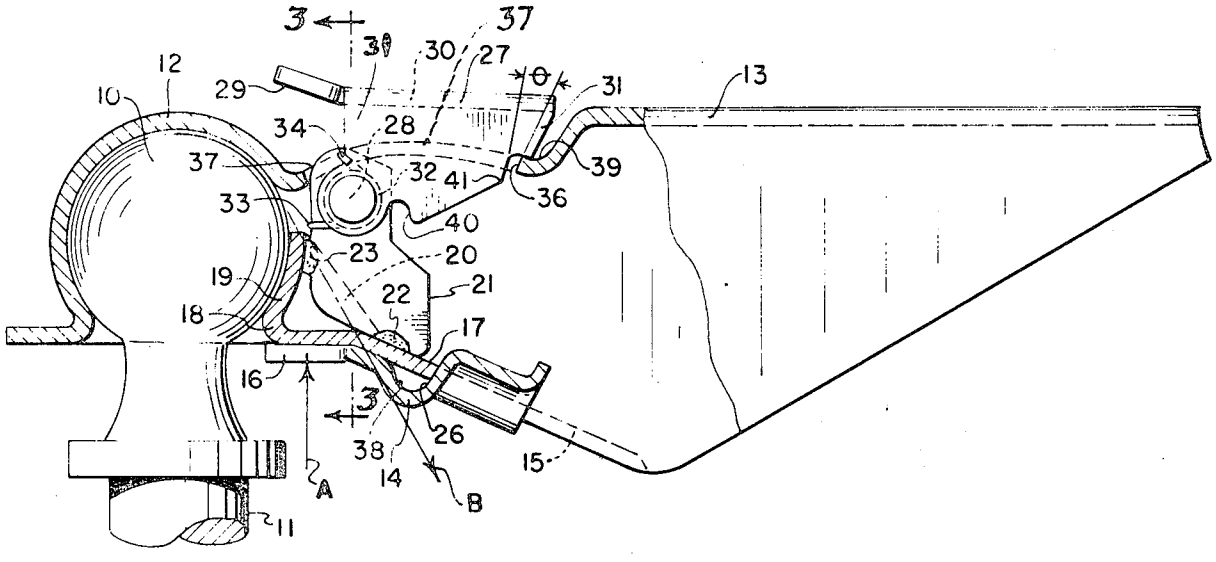


FIG. 1

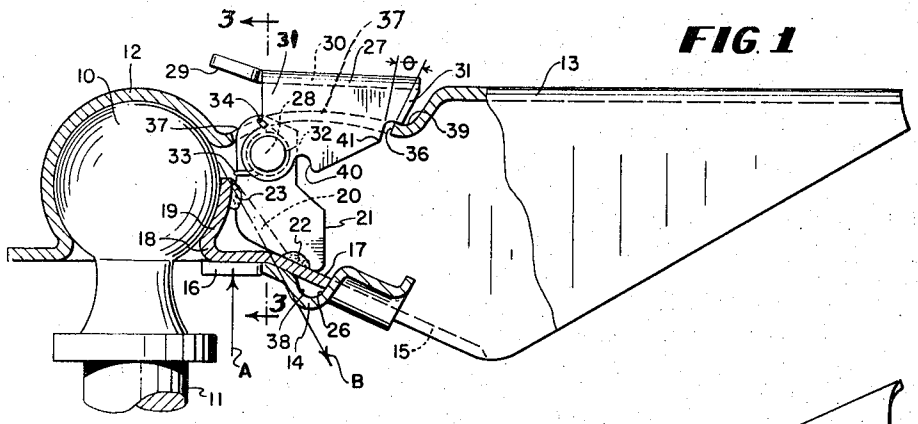
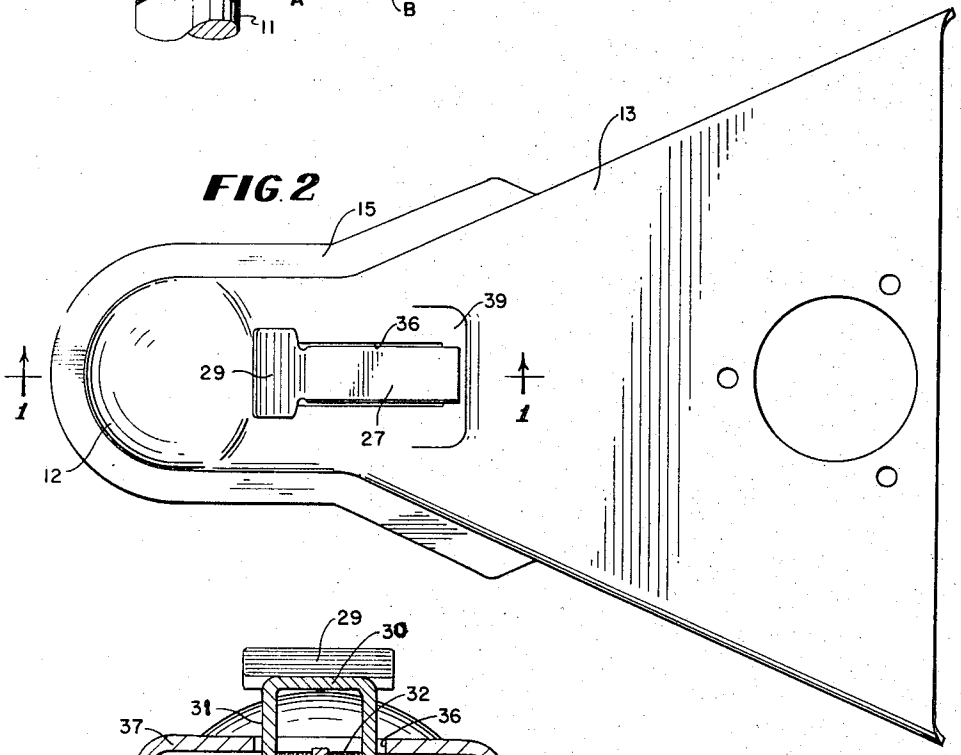


FIG. 2



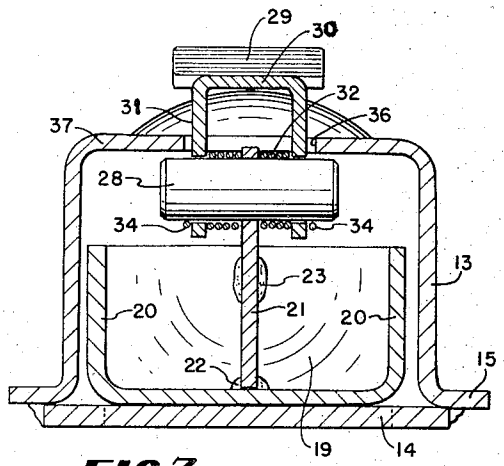


FIG. 3

FIG. 4

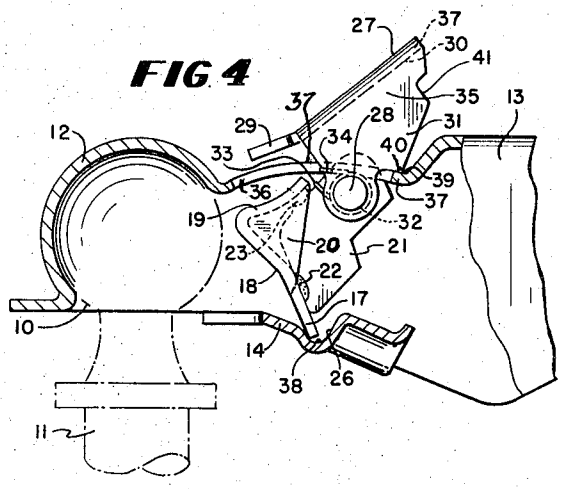


FIG. 5

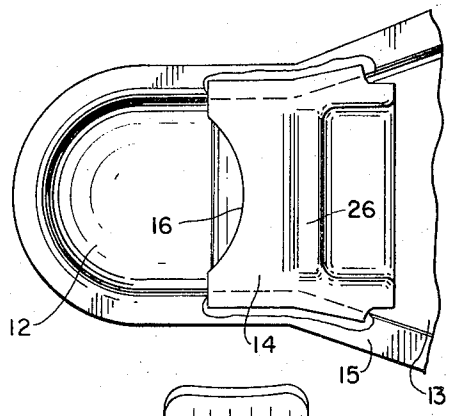


FIG. 6

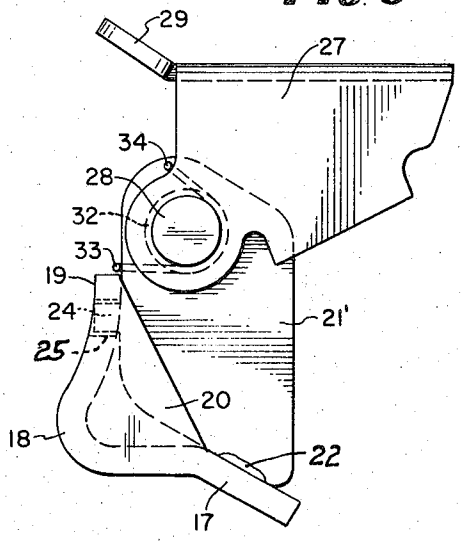
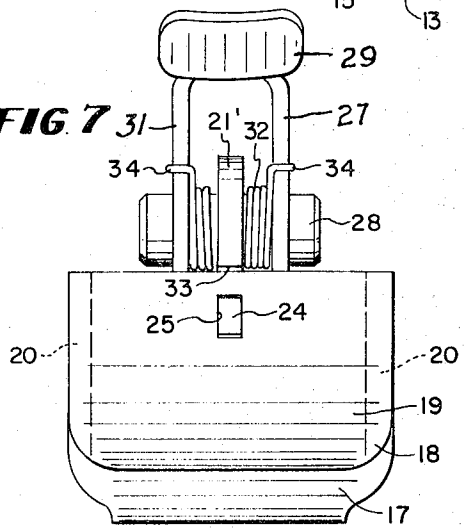


FIG. 7



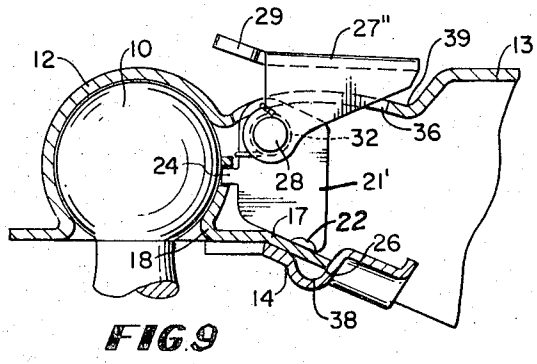


FIG. 9

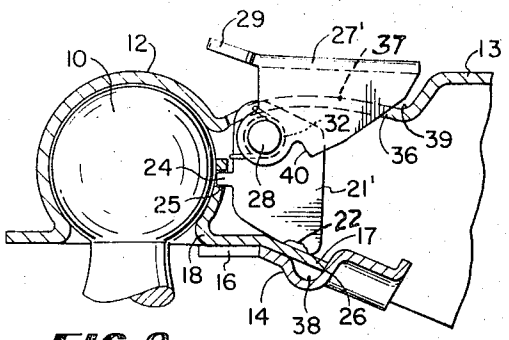
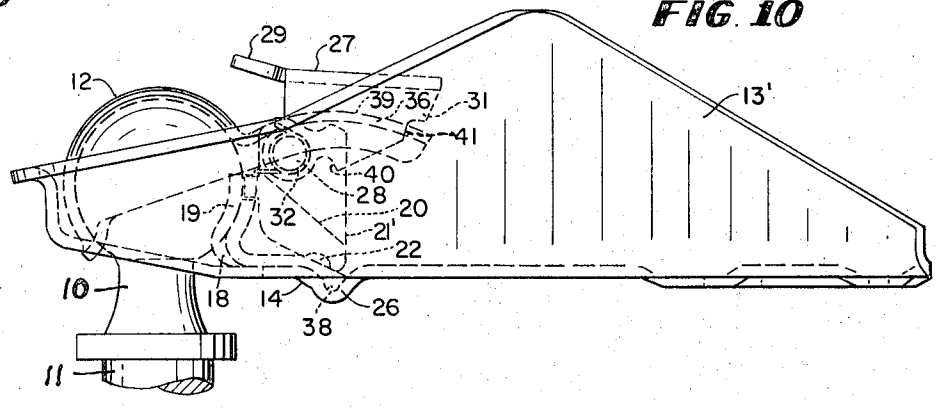


FIG. 8

FIG. 10



COUPLER

This invention relates to a ball and socket type coupler for towed vehicles.

The present coupler, despite the simplicity of construction, offers many advantages over earlier couplers of much more complicated and expensive construction. For example:

1. This coupler is a rolling or pivoting ball clamp coupler that is self-locking because of the geometrical arrangement of the ball clamp relative to the other coupler parts and to the ballhead;

2. While it is usually in the form of a top mounted coupler attaching to the top surface of the trailer draw-bar or tongue, it may also be designed for underslung mounting with very little change in construction;

3. It incorporates a simple two-part subassembly consisting of a channel-shaped latch pivotally connected at one end to one end of the ballhead retaining clamp and has a grasshopper type spring incorporated in this pivotal connection, which, with the clamp fulcrummed on a transverse shoulder alongside the base of the ballhead receiving socket at its other end, urges the clamp normally toward closed position, and at the same time urges the latch downwardly toward locked position, thereby accomplishing with a few parts of simple construction what prior couplers with much more complicated and expensive constructions, could not accomplish or at least not nearly as satisfactorily;

4. The ballhead receiving socket has a longitudinally extending slot adjacent it in the mounting bracket portion that is long enough to accommodate the elongated channel-shaped latch, and at the rear end of this slot a ledge is defined, which, in the fully retracted position of the clamp, accommodates a shoulder on the front end of the lower portion of the latch to retain it in the fully retracted position of the latch. A shoulder on the rear end of the lower portion of the latch bears against the rear end of the slot to prohibit any rearward movement of the latch, so that the clamp is accordingly held firmly in its closed position;

5. By correct angulation of the rear shoulders on the latch relative to the rear end of the slot, the latch will open automatically with the clamp to allow entry of the ballhead in the socket, without sacrificing safety insofar as the ballhead being securely retained in the socket is concerned;

6. It is a simple matter to change the configuration of the latch by removal of either the front or the rear shoulders, or both; if the rear shoulders are removed, the clamp can be opened by entry of the ball as the remaining shoulders hold the clamp in open position and require the latch to be closed manually, that being a convenience feature that again does not reduce the security with which the ball is retained by the coupler, but if the front shoulders are removed also, the clamp is urged open by the entering ball and then automatically closed, this being a safety feature, from the standpoint that the clamp cannot be locked in open position;

7. An upwardly and forwardly extending handle portion is provided on the front end of the channel-shaped latch so that if finger pressure is applied downwardly on the forward end of the latch to disengage the rear shoulders from the end of the slot against the action of the spring torque, the clamp can be swung away from the ballhead and locked in retracted position by engagement of the front shoulders on the ledge at the rear end of the slot, and

8. The geometry in this coupler is such that any downward force on the ballhead tends to rotate the clamp farther in the holding direction to increase the clamping action, and also any rearward horizontal force applied by the ballhead to the clamp only results in the ballhead being more firmly clamped, due partly to the location of the shoulder in the rear of the socket and partly to the novel design of the clamp.

The invention is illustrated in the accompanying drawings, in which:

FIG. 1 is a view partly in side elevation and partly in longitudinal section on the line 1—1 of FIG. 2 of a coupler made in accordance with our invention;

FIG. 2 is a plan view of FIG. 1;

FIG. 3 is a cross-section on the line 3—3 of FIG. 1;

FIG. 4 corresponds to the sectioned portion of FIG. 1 but shows the ball clamp locked in released position by the latch;

FIG. 5 is a bottom view of FIG. 4 with the ballhead removed;

FIGS. 6 and 7 are a side view and a front view, respectively, of a subassembly of a ball clamp and latch member, showing a modified or alternative construction, which by virtue of a lug and slot connection requires only a single weld, as compared to the two-weld construction of a similar assembly shown in FIGS. 1, 3 and 4;

FIG. 8 is a view similar to FIG. 1, but showing the assembly of FIGS. 6 and 7 and showing a modified form of latch member with a catch projection on one end only;

FIG. 9 is like FIG. 8, but showing another modified form of latch member with no catch projections, and

FIG. 10 shows a coupler similar to that of FIG. 1 but having the bracket designed for underslung mounting.

Similar reference numerals are used to designate corresponding parts throughout these views in the accompanying specification.

Referring first to FIGS. 1 to 5 of the drawings, the reference numeral 10 designates the ballhead that is mounted by means of its shank 11 on the towing vehicle, and 12 designates the socket provided on the forward end of a stamped sheet metal bracket 13, suitably secured to the top of a trailer draw-bar or tongue, although it should be understood that this invention is not limited to top mounting but is applicable also, as shown in FIG. 10 at 13', to underslung mountings. The bracket 13 is generally channel-shaped in cross-section and has a transversely extending longitudinally ribbed plate 14 welded at its opposite ends onto the outwardly directed flanges 15 on the bottom of the channel bracket directly behind the socket 12, the front edge portion of the plate 14 being cut away on an arc as most clearly indicated at 16 in FIG. 5 to provide clearance at the rear of the socket for the ballhead 10 in entering the socket.

The plate 14 provides a support for one side 17 of a stamped sheet metal generally L-shaped ball clamp 18, the other side 19 of which is concave to fit the curvature of the ballhead 10. Two pieces may be joined together by welding to define the clamp 17–19 but the clamp is preferably made in one piece and stamped to the channel shape shown with parallel side walls 20 in-

tegral with the opposite side edge portions of the two legs of the generally L-shaped clamp 17–19 to lend considerable strength and rigidity to this part, further strength and rigidity being added by the bracing effect of a generally rectangular plate 21 set in the middle of the clamp in a vertical plane with the lower edge portion welded to the inner side of the leg 17, as at 22, and the vertical front edge portion, as at 23, to the inner side of the leg 18. In lieu of the weld 23 we may, as shown in FIGS. 6 and 7, have a lug 24 on the vertical front edge of the plate 21' entered tightly in a slot 25 in the adjacent leg of the L-shaped clamp 17–19, only the bottom edge of the plate 21' being welded, as before at 22. A transverse shoulder 26 is defined in the ribbed portion of the plate 14 against which the rear end of the clamp 17–19 has abutment in the closed position, as shown in FIG. 1, and relative to which the clamp 17–19 fulcrums when the coupler is opened by means of the latch 27. The latter is pivotally connected by a cross-pin 28 to the clamp 17–19 by connection with the upper end of plate 21 or 21'. The latch 27 is of elongated channel-shaped sheet metal construction and has an upwardly and forwardly extending handle portion 29 defined at the front end of the web portion 30 of the channel, while the two spaced parallel flanges 31 thereof disposed on opposite sides of the upper end portion of the plate 21 or 21' carry the opposite end portions of the pin 28 with sufficient space left on opposite sides of the plate 21 or 21' for the two coils of a grasshopper type spring 32, the cross-connecting middle portion 33 of which, as best seen in FIGS. 6 and 7, bears against the forward edge of the plate 21 or 21', while the outwardly bent ends 34 of the two coils bear against the two flanges 31 of the latch 27, tending to swing the clamp 17–19 clockwise inwardly toward the ballhead 10 and at the same time urging the latch 27 normally outwardly and downwardly in the slot 36 to locked position. The web 37 of the channel-shaped front end portion of the bracket 13 in which the elongated slot 36 is provided, is of arcuate form with the fulcrum point 38 for the clamp 17–19 in the ribbed portion of plate 14 as a center, as clearly appears in FIGS. 1 and 4. At the outer end of the slot 36 a ledge 39 is defined transversely relative to the rear end of the slot, on which the front shoulders 40 defined on the lower edges of the side walls 31 of the channel-shaped latch 27 are arranged to rest to hold the latch 27 in its open position, as shown in FIG. 4, holding the ball clamp 17–19 in fully retracted position against the action of the spring 32. In the normal closed position of the latch 27 the rear shoulders 41 defined at the outer end of the side walls 31 of the channel-shaped latch 27 have abutment with the outer or rear end of the slot 36 to hold the latch 27 securely in its closed position.

In operation, to release the ballhead 10, the operator first exerts downward pressure on the handle 29 on the front end of the latch 27 to overcome the torque of the spring 32 and pivot the latch in a counter-clockwise direction about the pin 28, thus disengaging the rear shoulders 41 from the outer or rear end of the slot 36 and allowing the ball clamp 17–19 to pivot clockwise about the fulcrum point 38, whereupon he can give the latch 27 an outward or rearward push to engage the front shoulders 40 on the ledge 39, as seen in FIG. 4, to lock the clamp 17–19 in open position. It requires only a slight forward push on the latch to disengage the shoulders 40 and allow the latch 27 with clamp 17–19 to return to normal position after the ballhead 10 is returned to socket 12.

Arrow A in FIG. 1 indicates the direction in which the ballhead 10 normally enters socket 12. This can be accomplished automatically by simply correlating the approach angle θ of the outer or rear shoulders 41 of the latch to the angle of the outer or rear end of the slot 36, as shown in FIG. 1. The automatic opening feature can be provided as a matter of convenience at the option of the customer. The ballhead 10 is nevertheless just as securely locked in place in the socket 12 as if the latch 27 was designed only to be opened manually. The inner of front shoulders 40 can be engaged on the ledge 39 in the extreme open position of the latch 27 to lock the latch and clamp 17–19 releasably in open position.

The outer or rear shoulders 41 can be eliminated, as shown on latch 27' in FIG. 8, to allow the clamp 17–19 to be opened automatically by the entering ballhead. The remaining inner or front shoulders 40 will lock the clamp in open position by engagement on the ledge 39, requiring manual release in closing. For that, only slight finger pressure against the latch from behind is enough to disengage shoulders 40 from ledge 39 whereupon the latch 27 moves forwardly or inwardly under spring pressure to closed position. This places the ball clamp 17–19 behind the inserted ballhead 10 with the shoulder 18 squarely under the ballhead 10 a sufficient amount to securely retain it in the socket 12. Any downward force on the ball in the opposite direction of the arrow A in FIG. 1, tends to rotate the clamp 17–19 in a counter-clockwise direction and, therefore, tends to increase the ball clamping action. Any rearward horizontal force on the ballhead 10, as for example in the direction of the arrow B, in FIG. 1, will likewise increase the ball clamping action due to the abutment of the clamp 17–19 with the shoulder 26, the thrust along the line of the arrow B being obviously below the fulcrum point 38. Hence, it is clear that the ballhead 10 is not capable of exerting a force on the clamp 17–19 in any direction so as to cause it to become unlatched at 27. The latch 27 functions as a safety device as well as a means to apply forces on the clamp 17–19 in a direction to cause it to open or close.

The novelty of this coupler should be clear from the above; it lies in the geometry of the rolling ball clamp 17–19 and the latch 27 cooperating therewith, and also in the spring 32 which enables use of only light finger pressure for positively opening or closing the clamp 17–19 and still permit automatic opening and closing action.

If the ballhead 10 in entering socket 12 automatically does not urge the latch 27 back far enough to engage the front locking shoulders 40 on ledge 39 to hold the latch in open position, manual operation of the latch 27 to the locked open position shown in FIG. 4 is necessary to ease the uncoupling operation. In other words, these are convenience features and do not reduce the security with which the ballhead 10 is retained in the socket 12.

In FIG. 9 we have illustrated a further variation in which both the front and rear shoulders 40–41 are omitted on the latch 27''. With this construction the clamp 17–19 can, of course, be displaced by the ballhead 10 in entering the socket 12, the latch 27'' moving freely upwardly relative to slot 36 to whatever extent is necessary in accordance with the displacement

of the clamp 17–19, so that the coupler opens and closes automatically. The feature here is safety primarily, because the clamp 17–19 obviously cannot become locked in the open position and yet the ballhead 10, once entered in the socket 12, is just as securely held therein by reason of the novel construction of clamp 17–19 and its support.

It is believed the foregoing description conveys a good understanding of the objects and advantages of our invention. While a preferred embodiment of the invention has been illustrated and described, this is only for the purpose of illustration, and it is to be understood that various modifications in structure will occur to a person skilled in this art.

We claim:

1. In a coupler of the class described having a ballhead mounted on a substantially vertical axis, a socket to receive the same and a supporting bracket for the socket carrying it on a substantially vertical axis, the improvement consisting, in combination, an elongated slot provided in said bracket extending longitudinally of the bracket away from the closed end of the socket, the bracket also carrying in vertically spaced relation to the slot a transversely extending support on the same side of the socket as the slot, the support having an upwardly extending shoulder transversely of the socket adapted to serve as a ball clamp fulcrum, an elongated latch disposed normally longitudinally of and in the slot, a ball clamp having fulcrum engagement with the aforesaid shoulder and normally holding the ballhead in the socket with freedom for universal rotary movement relative thereto, and means providing a pivotal connection between adjoining ends of the ball clamp and the latch, said means including spring means urging the ball clamp and latch to swing in opposite directions about the pivotal connection, whereby, with the latch disposed in its normal position in the slot, to prevent displacement of the ballhead from the socket, said latch being movable manually about the pivotal connection and then endwise of the slot away from the socket while the ball clamp fulcrums on the aforesaid shoulder to permit disconnection of the ballhead and socket.

2. A coupler as set forth in claim 1 wherein a ledge is defined on said bracket transversely relative to that end of the slot remote from the socket and wherein the latch has a shoulder on that end thereof adjacent the socket arranged to rest on said ledge in the extreme open position of the latch to retain the latch releasably in that position.

3. A coupler as set forth in claim 1 including a manually operable handle on one end of the latch facilitating manually moving the latch from closed to open position and vice versa.

4. A coupler as set forth in claim 1 including a manually operable handle on one end of the latch adjacent the socket projecting outwardly from the latch facilitating manually moving the latch from closed to open position and vice versa.

5. A coupler as set forth in claim 1 wherein the latch is of channel cross-section with the web of the channel outermost and wherein the web has an extension on that end of the latch adjacent the socket adapted to serve as a manually operable handle to facilitate manually moving the latch from closed to open position and vice versa.

6. A coupler as set forth in claim 1 wherein the ball clamp is of generally L-shaped stamped sheet metal construction with an upright plate secured by two of its edges to the inner side of the two legs of the L-shaped clamp, the plate having the pivotal connection for the latch connected thereto at one end thereof.

7. A coupler as set forth in claim 1 wherein that end of the slot in the bracket remote from the socket is inclined outwardly at an acute angle relative to the vertical axis of the ballhead and socket, and the latch has the adjacent end thereof also inclined outwardly at a smaller acute angle relative to the vertical axis of the ballhead and socket, the included angle between the said end of the slot and the adjacent end of the latch being such that the clamp and latch are movable automatically to retracted position upon and to permit entry of the ballhead.

8. A coupler as set forth in claim 1 wherein the latch has shoulders defined on opposite ends thereof which in the closed position of the latch abut opposite ends of the slot in the bracket to limit endwise movement of the latch and accordingly retain the clamp in a position retaining the ballhead in the socket.

9. A coupler as set forth in claim 8 wherein the end of the slot in the bracket remote from the socket is inclined outwardly at an acute angle relative to the vertical axis of the ballhead and socket, and the latch has the shoulder on the adjacent end thereof also inclined outwardly at a smaller acute angle relative to the vertical axis of the ballhead and socket, the included angle between the said end of the slot and the shoulder on the adjacent end of the latch being such that the clamp and latch are movable automatically to retracted position and open position, respectively, upon entry of the ballhead in the socket allowing such entry without manual operation of the latch to open position and clamp to retracted position to permit entry of the ballhead.

10. A coupler as set forth in claim 6 wherein the pivotal connection includes a pivot pin and the spring means is a grasshopper type spring having two axially spaced coils interconnected by a middle loop, said coils being mounted on the pivot pin on opposite sides of the upright plate through which the pin extends, the connecting loop on the spring bearing against one of said pivotally connected parts and the ends of the coils being connected to the other of said pivotally connected parts to urge the latch in one direction and the clamp in the opposite direction toward the ballhead.

11. A coupler as set forth in claim 1 wherein the geometrical relationship of the coupler parts recited is such that whereas the clamp held by the latch retains the ballhead in the socket once entered therein, the latch and clamp are movable automatically by entry of the ballhead in the socket to open position and retracted position, respectively, to permit entry of the ballhead without manual operation of the latch to open position so as to move the clamp to retracted position.

12. A coupler as set forth in claim 1 wherein the ballhead is disposed above its support and the socket therefor is top mounted with its open side down.

13. A coupler as set forth in claim 1 wherein the ballhead is disposed above its support but the supporting bracket for the socket is underslung.

14. A coupler as set forth in claim 1 wherein the slotted portion of the bracket is struck on an arc, the cen-

ter of which is below and approximately at the fulcrum point for the ball clamp.

15. A coupler as set forth in claim 1 wherein the latch has a shoulder on that end nearest the socket arranged to be engaged on the bracket at the opposite end of the slot in the open position of the latch to retain it in that position.

16. A coupler as set forth in claim 1 wherein the latch has a shoulder on that end nearest the socket arranged to be engaged on the bracket at the opposite end of the slot in the open position of the latch to retain it in that position, subject to release by manual pressure on the latch from behind, whereupon the latch and ball clamp return under spring action to normal operative position.

17. A coupler as set forth in claim 1 wherein the latch has a shoulder on the far end remote from the socket, the angularity of which in relation to the angularity of the adjacent end of the slot is such that the clamp and latch are movable automatically to retracted position and open position, respectively, upon entry of the ball-head in the socket allowing such entry without manual operation of the latch to open position and clamp to retracted position to permit entry of the ball-head.

18. A coupler as set forth in claim 1 wherein the latch has a smooth upwardly inclined bottom surface extending away from the socket end of the slot and riding slidably on the end of the slot remote from the socket, whereby to permit entry of the ballhead into the socket against only the resistance of the spring connection between the latch and ball clamp.

19. A coupler as set forth in claim 1 including a vertical plate secured in the ball clamp and extending upwardly therefrom to the latch, the plate having a horizontally extending pin carried thereby pivotally connected to the latch and providing a support for the spring means, which is in the form of a grasshopper type spring having bearing engagement at one end on the plate to urge the ball clamp in one direction relative to the pivot pin and bearing at the other end on the latch to urge it in the opposite direction relative to said pivot pin.

20. A coupler as set forth in claim 19 wherein the latch has two portions pivotally engaging the pin on opposite sides of and spaced from the plate, and wherein the grasshopper spring has two spring loaded coils carried on the pin on opposite sides of the plate with a cross-connecting portion between the coils bearing on one edge portion of the plate to urge the ball clamp in one direction, while the outer ends of the two coils have connections with the spaced portions of the latch to urge it in the opposite direction.

21. A coupler as set forth in claim 1 wherein the clamp is of generally channel-shaped sheet-metal construction with a concave cross-wall for confining abutment with the ballhead, there being a plate set upright in the clamp for reinforcement thereof in transverse relationship to the crosswall and secured at a bottom edge to a bottom wall of the clamp and at a front edge to the back of the cross-wall of the clamp.

22. A coupler as set forth in claim 21 wherein one of the two edge portions of the plate mentioned has a lug defined thereon which for securement to the clamp is engaged in a slot provided therefor in a wall of said clamp.

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