Feb. 28, 1961 K. F. NYSTROM 2,973,102

UNDERFRAME WITH RECOILING CENTER SILL

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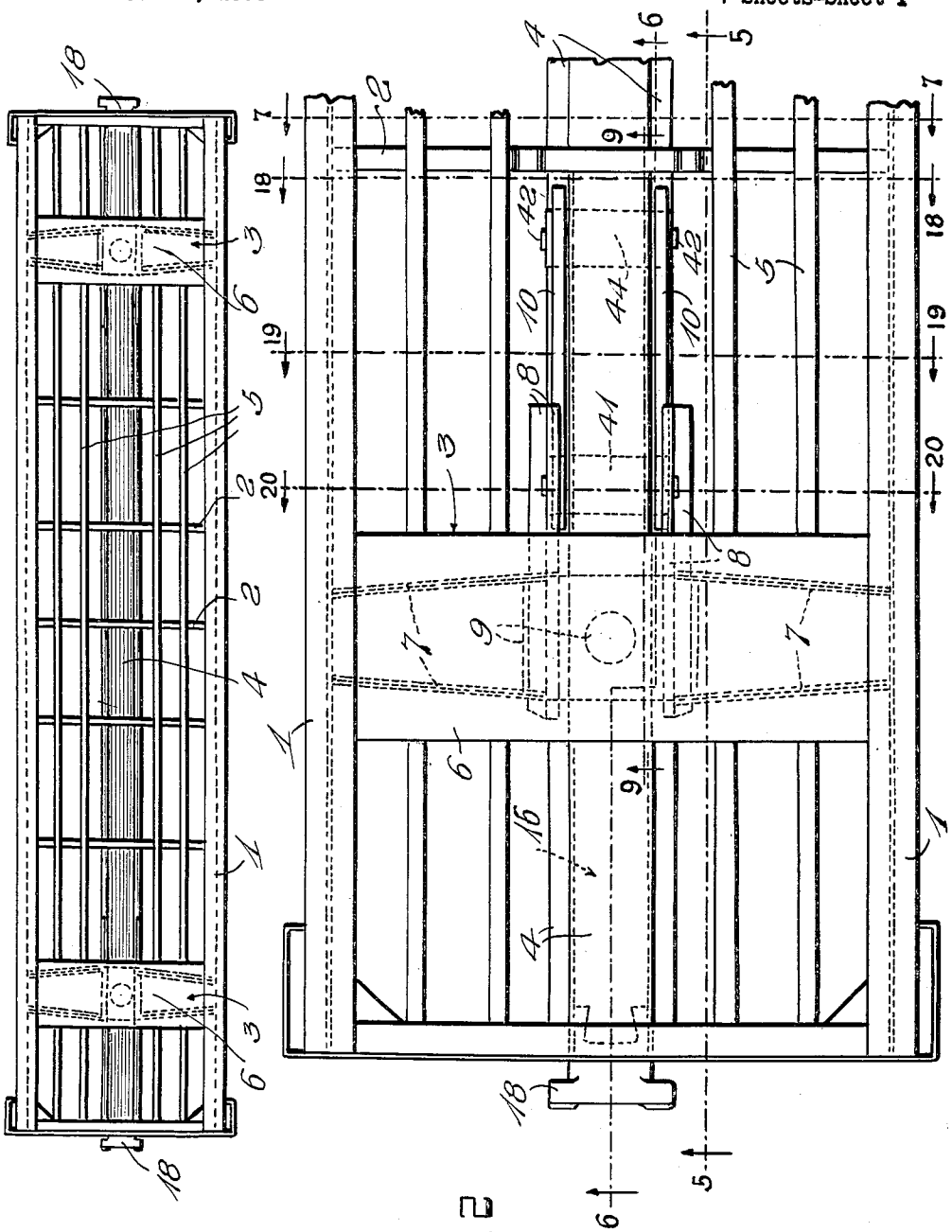

FIG. 1

FIG. 2

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UNDERFRAME WITH RECOILING CENTER SILL

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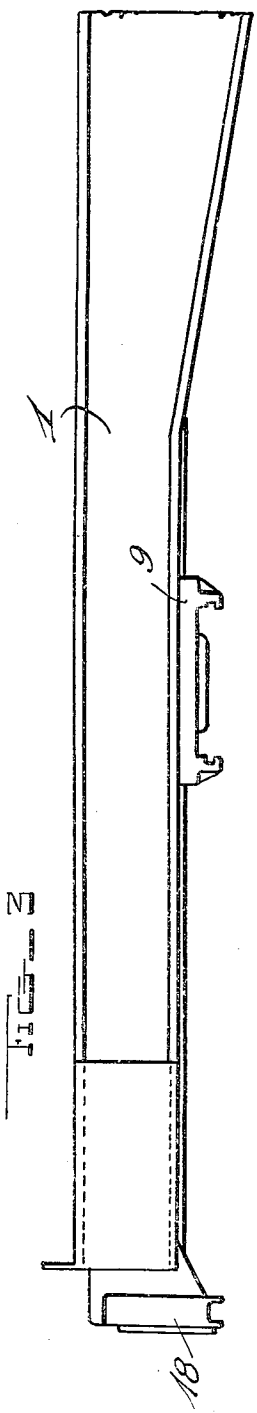

FIG. 4

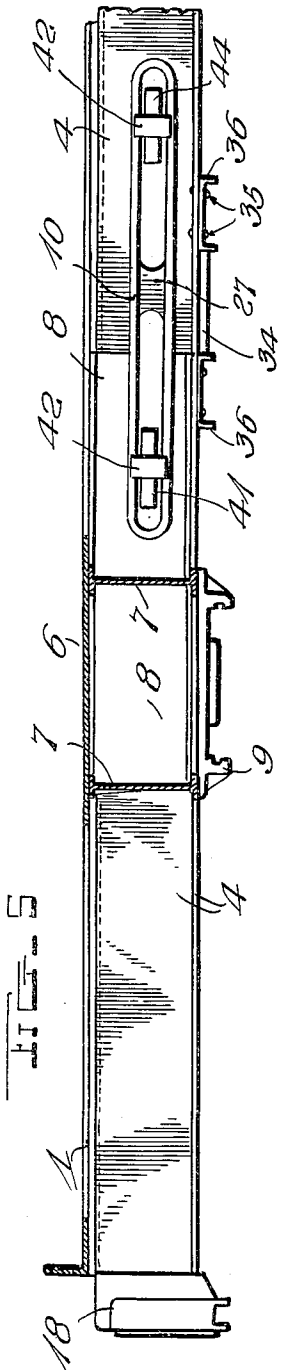

FIG. 5

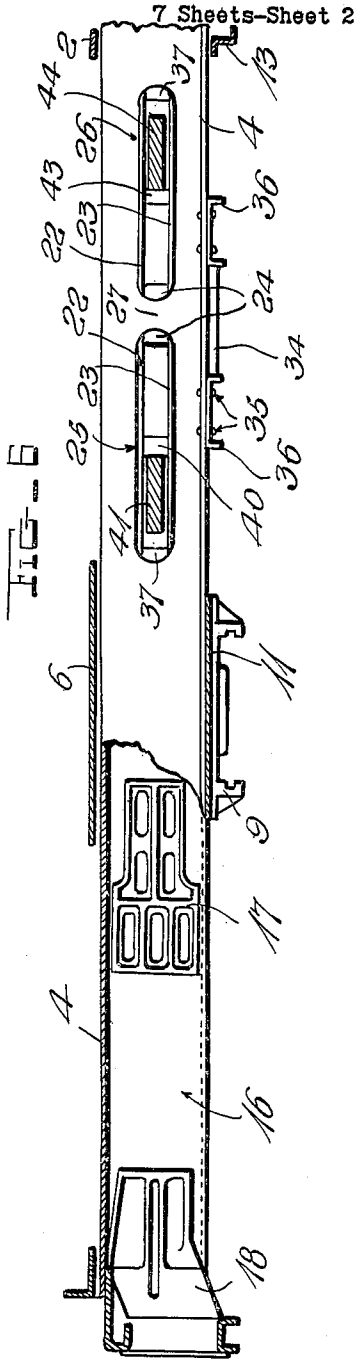

FIG. 6

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UNDERFRAME WITH RECOILING CENTER SILL

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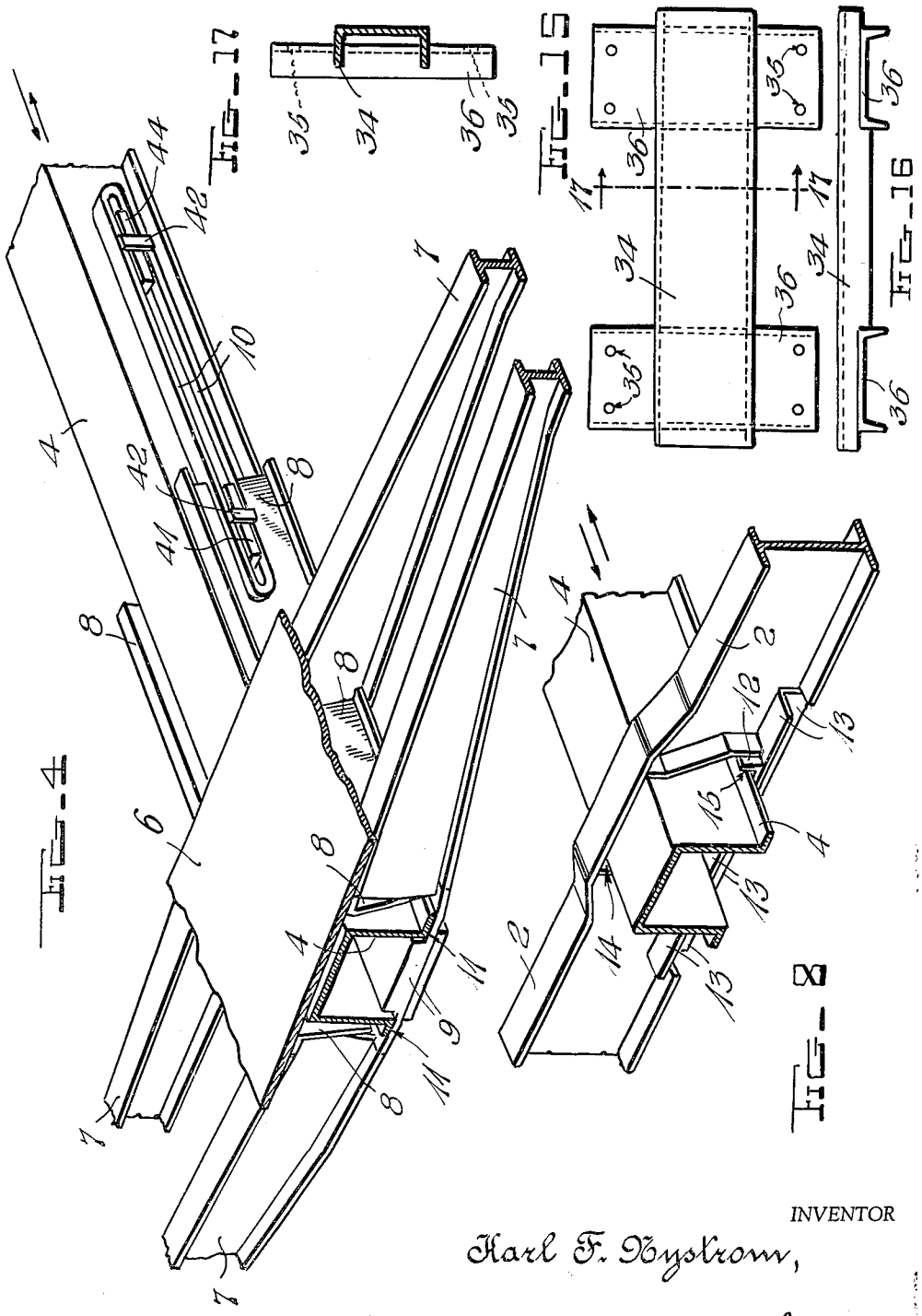

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UNDERFRAME WITH RECOILING CENTER SILL

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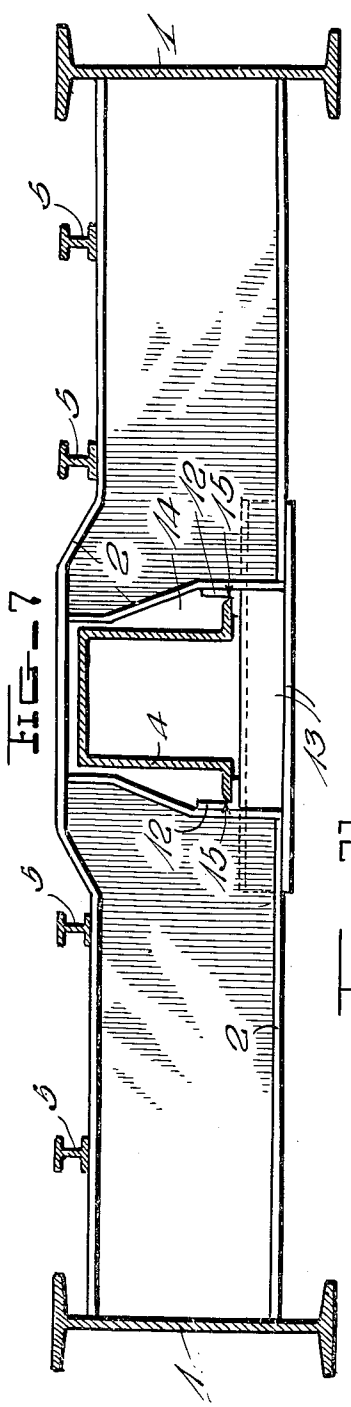

FIG-7

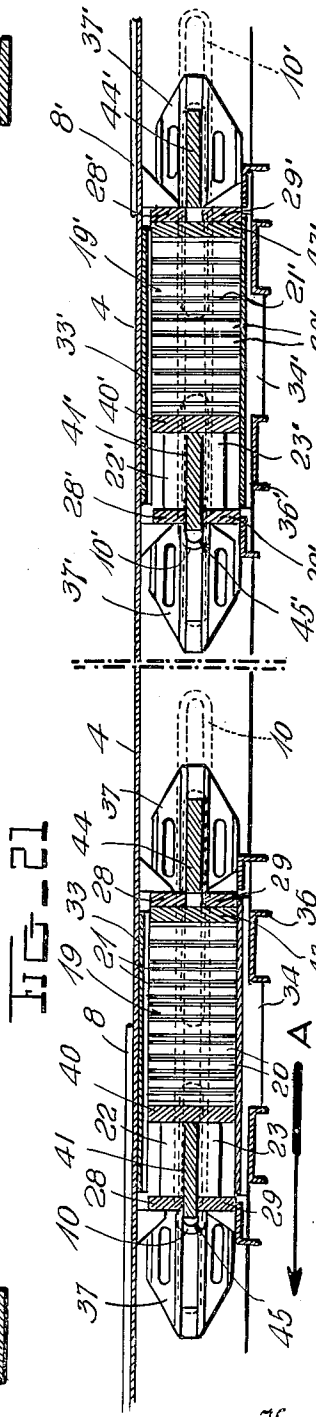

FIG-21

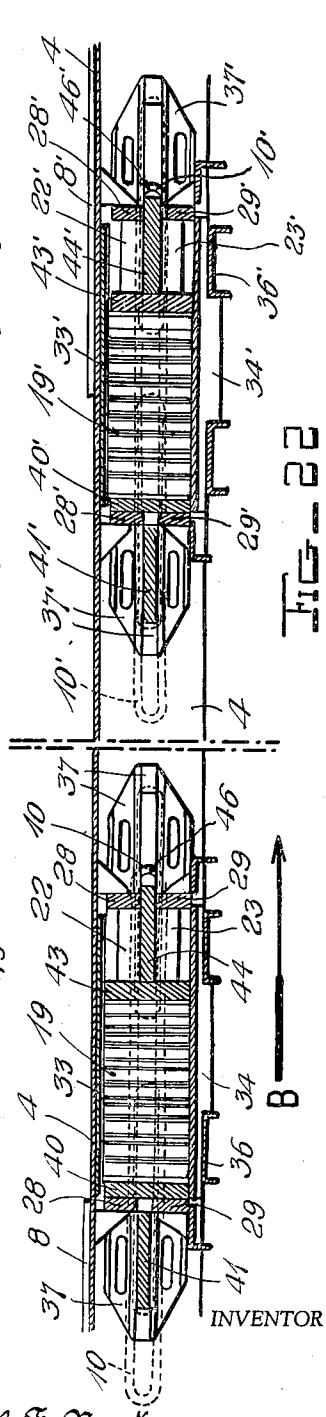

FIG-22

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Feb. 28, 1961 K. F. NYSTROM 2,973,102

UNDERFRAME WITH RECOILING CENTER SILL

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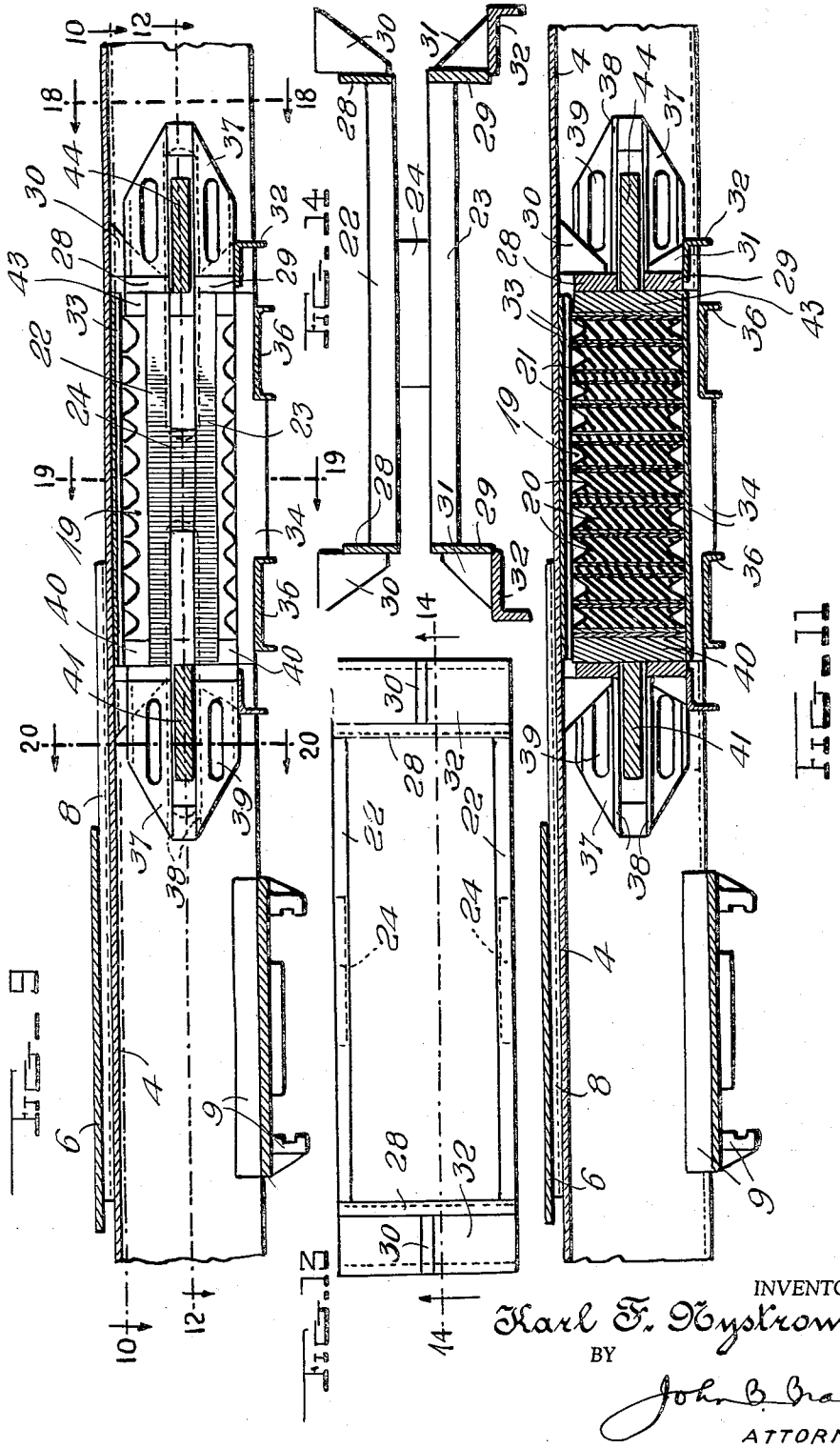

FIG. 11

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Feb. 28, 1961 K. F. NYSTROM 2,973,102

UNDERFRAME WITH RECOILING CENTER SILL

Filed Dec. 15, 1958 7 Sheets-Sheet 6

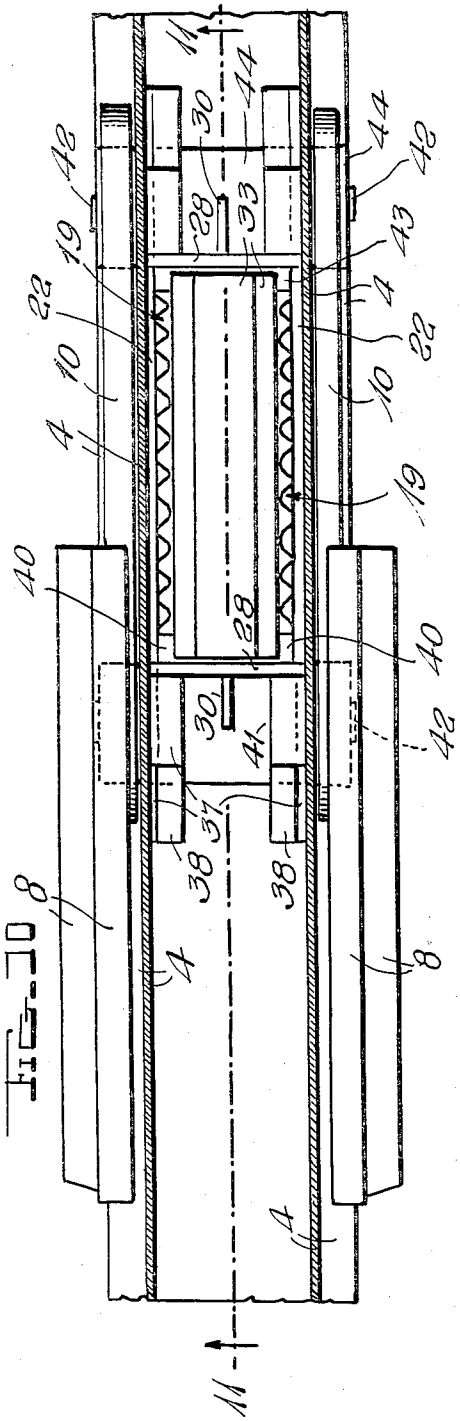

FIG. 10

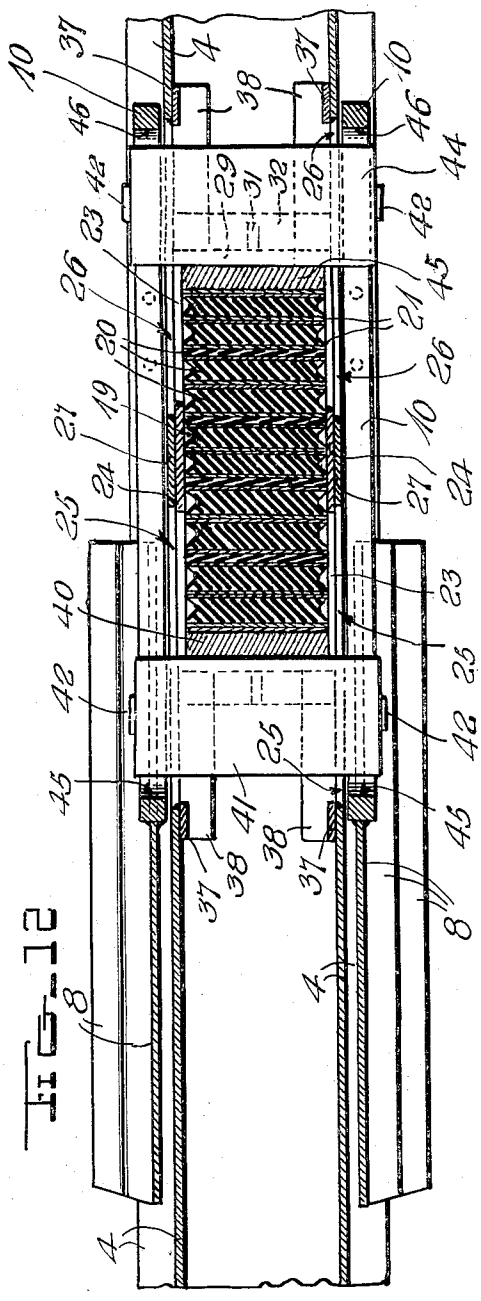

FIG. 12

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UNDERFRAME WITH RECOILING CENTER SILL

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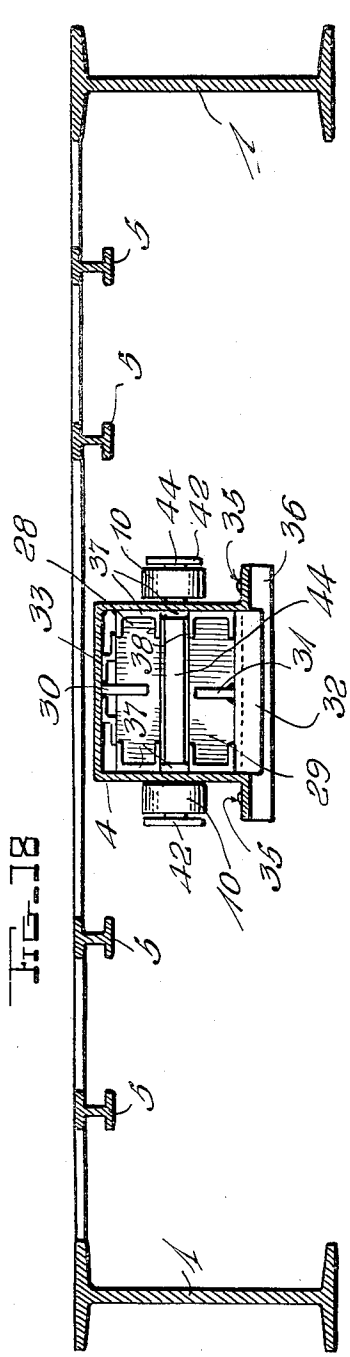

FIG. 18

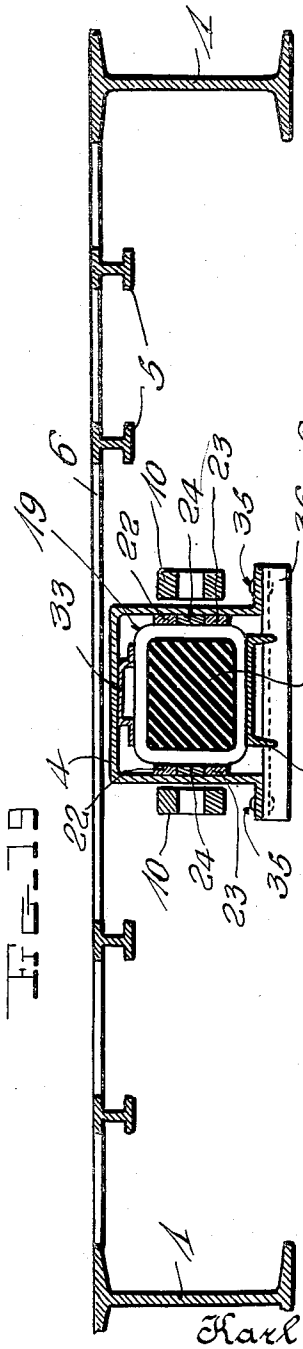

FIG. 19

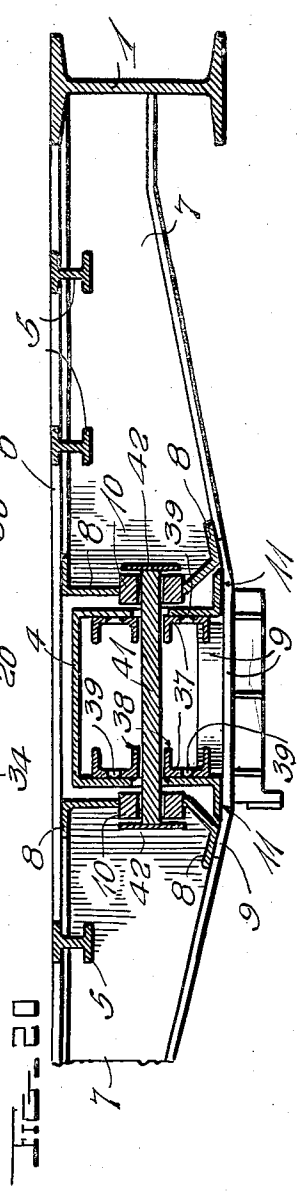

FIG. 20

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United States Patent Office 2,973,102 Patented Feb. 28, 1961

2,973,102

UNDERFRAME WITH RECOILING CENTER SILL

Karl F. Nystrom, Chicago, Ill., assignor to International Steel Company, Evansville, Ind., a corporation of Indiana

Filed Dec. 15, 1958, Ser. No. 780,299

8 Claims. (Cl. 213—8)

My invention relates broadly to railway car underframing and more particularly to a railway car center sill underframe structure which floats with respect to the associated railway car underframing and carries recoil units in either end thereof for restricting its longitudinal movement and for absorbing shock loads applied to the ends thereof.

One of the objects of my invention is to provide a novel construction of recoil underframe for railway cars forming an efficient recoil arrangement applicable to American Association of Railroads standard railway car center sill structures.

Another object of my invention is to provide a recoil type center sill for railway cars which provides very substantial protection for lading during hump yard and freight train operation.

Another object of my invention is to provide a recoil type center sill for railway cars in which approximately only one-half of the center sill end load is transmitted through the center sill between the railway car bolsters.

Another object of my invention is to provide a recoil type center sill for railway cars in which approximately one-half of the center sill end load is absorbed by a solid resilient gear in either end of the center sill.

Still another object of my invention is to provide a railway car center sill which is floating with respect to the railway car underframe and bolsters and is coupled to same by means of keys floating with respect to both the center sill and the railway car underframe and bolsters.

Other and further objects of my invention reside in the construction of the center sill recoil units whereby each unit is uniformly compressed by a center sill end load as set forth more fully in the specification hereinafter following by reference to the accompanying drawings, in which:

Fig. 1 is a top plan view of the underframing of a railway car incorporating the underframe construction and recoiling center sill of my invention;

Fig. 2 is an enlarged plan view of one end of the plan view shown in Fig. 1;

Fig. 3 is a side elevational view of the end of the railway car underframing shown in Fig. 2 and particularly showing the body bolster bottom center plate casting providing attaching means for the railway car truck or wheel assembly;

Fig. 4 is a perspective view, partly cut away, of a fragmentary portion of the railway car underframing showing the construction of and the relation between the body bolster assembly and the recoiling center sill of my invention;

Fig. 5 is an elevational view partly in section taken substantially along line 5—5 of Fig. 2;

Fig. 6 is a view taken substantially along line 6—6 of Fig. 2, and particularly showing that portion of the center sill containing the striking casting and its associated draft gear and rear draft lugs in vertical section, and that portion of the center sill containing the recoil element in side elevation;

Fig. 7 is a cross-sectional view taken substantially along line 7—7 of Fig. 2 and particularly showing the manner in which the recoiling center sill is supported by a cross-bearer member;

Fig. 8 is a perspective view of a portion of the recoiling center sill of my invention; passing through a cross-bearer member, the view being taken from the opposite side of the cross-bearer member as the view shown in Fig. 7;

Fig. 9 is a vertical longitudinal sectional view of the recoiling center sill of my invention with one side wall thereof removed, the view being taken substantially along line 9—9 of Fig. 2, and particularly showing in elevation a side view of the guiding and reinforcing members making up the pocket containing the cushion gear;

Fig. 10 is a horizontal sectional view taken substantially along line 10—10 of Fig. 9 equivalent to a top view of the center sill with the top thereof removed to show the relation between the various members of the recoil mechanism and particularly showing the spaced relation between the movable center sill and the stationary members of the underframing;

Fig. 11 is a vertical sectional view taken substantially along line 11—11 of Fig. 10 and particularly showing the relation between the cushion gear, cushion gear followers, and cushion gear keys;

Fig. 12 is a transverse sectional view taken substantially along line 12—12 of Fig. 9 and particularly showing the alignment of the link bar slots with the slots provided in the center sill and the clearance provided between the guide bar reinforcing members;

Fig. 13 is a top plan view of the members comprising the cushion gear pocket;

Fig. 14 is a vertical sectional view taken substantially along line 14—14 of Fig. 13;

Fig. 15 is a top plan view of the assembly which forms the bottom of the cushion gear pocket;

Fig. 16 is a side elevational view of the assembly shown in Fig. 15;

Fig. 17 is a cross-sectional view taken substantially along line 17—17 of Fig. 15;

Fig. 18 is a cross-sectional view taken substantially along lines 18—18 of Figs. 2 and 9 and particularly showing in elevation an end view of the recoil mechanism;

Fig. 19 is a cross-sectional view taken substantially along lines 19—19 of Figs. 2 and 9 and particularly showing the relation of the members forming the cushion gear pocket;

Fig. 20 is a cross-sectional view taken substantially along lines 20—20 of Figs. 2 and 9 and particularly showing the manner in which the center sill passes through the bolster assembly and the manner in which the cushion gear keys are associated with both the stationary and movable portions of the underframing;

Fig. 21 is a vertical sectional view taken substantially along the longitudinal center axis of the recoiling center sill, the view being foreshortened to permit the illustration of sufficient details and showing in section the recoil mechanism in either end thereof and the action of said recoil mechanisms when a force is applied to the end of said recoiling center sill so as to move it in the direction shown by arrow A; and

Fig. 22 is a view similar to that shown in Fig. 21 but showing the action of the recoil mechanisms when a force is applied to the end of the center sill so as to move it in the direction shown by arrow B.

My invention is directed to a center sill column which extends from one end of the railway car underframing to the other and is movably keyed with respect to said underframing. The center sill consists of standard rolled sec-

tions and contains in either end thereof in front of each underframe bolster a regulation friction or rubber draft gear behind the striking casting welded to each end of said center sill for installation of a coupler assembly. In the rear of the body bolsters on either end of said center sill a resilient cushion gear is applied in a pocket provided in said center sill.

Slots for floating keys are provided in the center sill. These slots are reinforced by lug members and between the lug members the slots are reinforced by guide bars. The guide bars and lug members constitute the cushion gear pocket and contain said resilient cushion gear therein. The keys pass through said center sill but do not contact said center sill and float in link bar guide members anchored to each body bolster on either side of said center sill.

When a load is applied to one end of the center sill it moves in the direction the force is applied, carrying the floating keys into the link bar limits, thus causing the keys to move in the slots provided in the center sill and compress the resilient cushion gears of the recoil mechanisms as the center sill continues in its travel. The center sill will stop moving when the energy is absorbed by the resilient cushion gears in either end of said center sill and will then bounce back or automatically restore to the neutral position by the action of the energy stored in the compressed resilient cushion gears.

The link bar guide anchors, on the end of the center sill which has a compression force applied to it, are put under a tension load while the anchor members at the opposite end of the sill are put under a compression load. The tension and compression loads are reversed on the anchor members when a compression load is applied to the opposite end of the center sill.

Referring to the drawings in more detail the principal framework of the railway car underframe consists of main side longitudinal framing sills **1**, cross-bearer members **2**, supporting secondary longitudinal beams **5**, bolster assemblies shown at **3**, and a floating center sill **4**. Bolster assemblies **3** consist of bolster top cover plate **6**, body bolster bottom center plate casting **9**, bolster web members **7**, anchor plate members **8** securely connected to the top cover plate, bottom center plate casting and associated web members, and link bar members **10** securely fastened to the bolster assembly through anchor plates **8**. The body bolster bottom center plate casting **9** provides for the attachment and locking of a railway car truck assembly, carrying the railway car wheels, to the railway car underframing.

The recoiling center sill is floating with respect to the rest of the railway car underframing and is free to move longitudinally under force within certain prescribed limits with respect to the remainder of the underframing. The weight of the floating center sill is vertically supported by bearing surfaces **11** of bottom center plate casting member **9** of each bolster assembly **3** and by bearing members **12** secured to each cross-bearer member **2** and supported on same by support member **13**. The pass-through space in each cross-bearer member **2**, as shown at **14**, is relatively snug around the center sill **4** and the cross-bearer member **2** besides furnishing a supporting and bearing surface for the center sill **4** also restrains the center sill from bulging or bending by confining the edges of the center sill horizontal flanges as shown at **15**, thus permitting the center sill to move only longitudinally in each cross-bearer member **2**. Thus, each cross-bearer member also acts as a guide for the floating center sill.

Each end of floating center sill **4** contains a standard striking casting **18** welded thereto for receiving a coupler, a standard draft gear pocket shown at **16** behind said striking casting and within said floating center sill for receiving a draft gear associated with the respective coupler, and rear draft lugs shown at **17** welded to the interior side walls of said floating center sill for backing up the associated draft gear in draft gear pocket **16**.

The recoil elements of the recoiling center sill of my invention are located in pockets in the center sill in the rear of the body bolsters on either end of said center sill. Each recoil element consists of a resilient cushion gear **19** comprised of, for example, multi-layers of solid rubber **20** disposed alternately between steel plates **21**, confined within a pocket rigidly attached to the interior walls of the center sill. The sides of the pocket are formed by guide bars **22** and **23** connected by bars **24** and all welded to the interior side walls of the center sill adjacent the slots **25** and **26** in said center sill, the bar members **24** being symmetrically positioned with respect to that portion of the center sill between the said slots as designated at **27** and the open space provided between bars **22** and **23** by bars **24** symmetrically aligning with said center sill slots in a vertical direction so as to also act as reinforcing bars for said slots. The ends of the pocket are formed by cushion gear lug members **28** and **29**, respectively, welded across the ends of guide bar pairs **22** and **23**, said cushion gear lug members **28** being centrally reinforced by bars **30** securely fastened normal to said lug members and the interior central surface of said center sill while said cushion gear lug members **29** are centrally reinforced by bars **31** securely fastened normal to said lug members and reinforcing angle members **32** welded across the bottom interior of the center sill and normal to its side walls. Cushion gear top guide plate **33** of substantially shallow, flanged, channel-shaped cross-section is welded to the interior central surface of the center sill symmetrically positioned with respect to the ends of the cushion gear pocket. The bottom of the cushion gear pocket is formed by cushion gear carrier member **34**, which supports the weight of cushion gear **19**, and is securely fastened to the bottom flanges of the center sill at **35** by means of a support channel member **36** welded normal to either end thereof.

The remaining portion of slots **25** and **26** which are not reinforced by guide bars **22** and **23** are reinforced by reinforcing and guide plate assembly members **37** carrying flanges, shown at **38**, thereon for guiding and rigidity purposes and providing openings **39** therein to allow more weld-joint area and thus a more secure bond between said plate assembly members and the interior side surfaces of the center sill **4**.

As hereinbefore explained, a resilient cushion gear which may be constituted by rubber shown at **19** forming the center sill recoil element is encased within the pocket. Also enclosed within the pocket abutting each end of said resilient cushion gear **19** and the members **28** and **29**, forming the ends of said pocket, are two cushion gear follower members **40** and **43**. These two cushion gear follower members **40** and **43**, one at each end of said cushion gear, are free to move in a longitudinal direction within said pocket as said cushion gear **19** is compressed, guided by the side, top and bottom members forming said pocket. The cushion gear follower members **40** and **43** transmit force, applied to same, evenly over the ends of said cushion gear **19** which they abut, thus compressing said cushion gear.

The recoiling center sill of my invention is movably keyed to the stationary underframing of the railway car by cushion gear keys **41** and **44**. Cushion gear keys **41** and **44** are not connected or attached to either the movable center sill assembly or the stationary portion of the underframing but are respectively movably associated with slots **25** and **26** in the recoiling center sill, along with the guide and reinforcing members associated with said slots, and are movably associated with link bars **10** of the stationary portion of the underframing. Therefore, keys **41** and **44** are free to move longitudinally within link bars **10** of the underframing and associated reinforced slots **25** and **26** of the center sill, but this longitudinal movement is subject to restraint by resilient

cushion gear 19. Keys 41 and 44 are provided with a small weight shown at 42 on either end thereof to act as means to hold the keys in the link bars to prevent said keys from working out. The keys 41 and 44 are floating as far as the center sill is concerned and have no contact with the apertures in the center sill or the reinforcing and guiding members associated with said center sill. The keys, therefore, are arrested on the bottom members of the link bars 10, thus having their weight supported by said link bars and being in sliding contact with said link bars 10.

The resilient cushion gears 19 at each bolster have the same capacity in foot pounds, and as they are compressed simultaneously, one-half of the horizontal load applied to the end of the center sill is taken by each resilient gear 19 and therefore only one-half of the applied force is transmitted through that portion of center sill between the bolsters.

As mentioned earlier each resilient cushion gear 19 is composed of units, such as solid rubber 20, between steel plates 21. The edges of the rubber units 20 are so shaped that when subjected to compression the rubber flows uniformly outward. At the full cushion gear travel, for example ten inches of travel, the rubber lies substantially flush or level with the edges of the steel plates 21 and, therefore, is protected against any damage. This compressed condition of the rubber cushion gears is shown in Figs. 21 and 22. A rubber gear is employed since rubber absorbs more energy than a steel spring since it bounces back from an impact a few cycles less than a steel spring. Since the center sill is positively guided in a longitudinal direction during each movement of the gear, since the sill is restricted from horizontal movement, and a positively guided flat cushion gear follower plate 40 and 43 transmits compression force to each rubber cushion gear, uniform compression of said gears is insured thereby providing proper performance at all times.

The center sill moves a fixed distance, for example, ten inches, in either direction from the neutral position, as shown in Figs. 21 and 22, the neutral position being shown in the remainder of the drawings. The rubber cushion gears 19 being free to act in both buff and draft thereby insuring maximum available capacity from an impact delivered from either end of the center sill.

Fig. 21 illustrates a foreshortened center sill showing a recoil mechanism in either end thereof, the recoil element on the right-hand side being referred to by corresponding prime numbers for explanation purposes. When an impact is delivered to the end of center sill 4 acting in the direction shown by arrow A, the center sill moves in the direction of arrow A (refer also to Fig. 12), carrying with it the rubber cushioned gears 19 and 19', cushion gear followers 40, 43, 40' and 43' and all other members comprising the cushion gear pockets. As keys 41, 44, 41' and 44' are floating with respect to anchor plates 8 and 8' and link bars 10 and 10' and center sill 4, they will be carried along by any member coming into contact with them. As follower members 40 and 40' move to the left they contact keys 41 and 41' thus carrying them to the left until they abut the ends of link bars 10 and 10', respectively, shown at 45 and 45', thus arresting the travel of the said keys and follower plate members. As the center sill continues to move toward the left anchor 8 is put under a compression load while link bar 10', associated with anchor 8', is under tension. Thus keys 41 and 41', respectively, exert forces in the opposite direction upon follower members 40 and 40' which, in turn, evenly transmit the force to rubber cushion gears 19 and 19' resulting in a compression of said cushion gears. Fig. 21 shows the maximum travel of center sill 4 in the direction shown by arrow A, for example 10'' of travel to the left. It will be noted that the rubber of units 20 and 20' has flowed uniformly outward and is substantially flush with the edges of steel plates 21 and 21' and that keys 41 and 41' have caused follower members 40 and 40' to slide along cushion pocket guide members 22, 23 and 22' and 23', in a direction back into the cushion gear pockets, so as to respectively compress said rubber cushion gears 19 and 19'.

From the above action it can be seen that one-half of the center sill end load is absorbed by each recoil mechanism, therefore, only one-half of the end load is transmitted down the center sill length between recoil mechanisms.

In the above described shock absorbing action of the recoil elements, the recoiling center sill returns to the neutral position after the initial end load shock by means of the energy stored in the compressed rubber cushion gears applying restoring force on the compressing keys which transmit it to the link bar members, thus causing the center sill to return to the neutral position with respect to the railway car underframing.

Keys 44 and 44' play no part in the action when an end load is applied to the center sill in the direction of arrow A. As the center sill moves to the left reinforcing and guide plate assemblies 37 and 37' move into contact with keys 44 and 44', thus carrying the keys to the left as a dead-weight from which no work is obtained.

When an end load is applied to center sill 4 in the direction shown by arrow B in Fig. 22, the reverse of the above action occurs. In this illustrated example, the center sill moves to the right with respect to anchors 8 and 8' and link bars 10 and 10', carrying keys 41 and 41' as deadweights and keys 44 and 44' into arrested contact with the ends of link bars 10 and 10', as shown at 46 and 46'. This puts link bars 10 under tension while anchor plates 8' associated with link bars 10' are put under compression, the reverse of the example in Fig. 21. Since keys 44 and 44' are arrested from further movement to the right they exert a reverse force on follower members 43 and 43' causing them to slide on guide bar members 22, 23 and 22', 23' of the pocket assemblies thus compressing rubber cushion gears 19 and 19' as the center sill continues to move to the right. Fig. 22 shows the rubber cushion gears in their maximum compressed condition with the center sill at its maximum travel position to the right, for example ten inches of travel to the right. The return of the recoiling center sill to its neutral position by means of the energy stored in the rubber cushion gears is similar to the recovery action described in connection with Fig. 21.

The efficiency of any freight car today, measured in terms of actual service rendered to the operator, depends primarily upon its principle of operation. The efficiency of the draft gear is no exception to this self-evident truth. The underframe of my invention is, therefore, equipped with the standard pocket all-rubber draft gear associated with the striker casting based on American Association of Railroads figures of record, for example, the Miner draft gear FR–16. This device conforms to standard car construction principles and will provide 39,400 foot pounds of capacity per end at a rated travel of 2¾ inches. Operating in series with this draft gear are two rubber cushion gears providing for example 120,000 foot pounds through 10 inches of center sill travel. The total capacity, therefore, of the recoil underframe with a recoiling center sill of my invention is 159,400 foot pounds at an ultimate load of only 650,000 pounds. This example indicates the high efficiency of the recoiling center sill of my invention.

While I have described my invention in certain preferred embodiments, I realize that modifications may be made and I desire that it be understood that no limitations upon my invention are intended other than may be imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. A railway car underframe with recoiling center sill comprising an underframe structure including body

bolsters on either end thereof, a movable center sill extending through said underframe structure and through said body bolsters, said movable center sill having a striker assembly on either end thereof and a pocket on each end thereof behind said striker assembly and in front of said body bolsters, each of said pockets containing a yieldable cushion gear, a second pocket on each end of said movable center sill in the rear of said body bolsters, a yieldable cushion gear with a movable follower member on each end thereof interposed in each of said second pockets, aligned longitudinal slots provided in each side wall of said movable center sill adjacent each end of each of said second pockets, a key member adjacent either end of each of said second mentioned yieldable cushion gears, said key members extending through said aligned longitudinal slots and extending beyond the side walls of said movable center sill and movably engaging slotted link bar members on either side thereof, a pair of said slotted link bar members being securely fastened to the rear of each of said body bolsters through anchor plate members on either side of said movable center sill, each pair of said slotted link bar members movably engaging said key members of the associated second pocket.

2. A railway car underframe with recoiling center sill as set forth in claim 1 in which the yieldable cushion gears are enclosed in the central hollow portion of said movable center sill.

3. A railway car underframe with recoiling center sill as set forth in claim 1 in which said second mentioned yieldable cushion gears consist of symmetrically arranged metallic plates and layers of elastic material.

4. A railway car underframe with recoiling center sill as set forth in claim 1 in which each of said second pockets include a top guide plate member secured to the upper interior surface of said movable center sill, a bottom cushion gear carrier member enclosing the bottom portion of said center sill, reenforcing guide bars longitudinally extending on either side of said longitudinal slots on the interior side walls of said center sill and end lug members on either end of said pocket transversely extending between the side walls of said center sill on either side of said longitudinal slots.

5. A railway car underframe with recoiling center sill as set forth in claim 1 in which said movable follower members consist of plates having parallel surfaces thereon, one of said parallel surfaces contacting said second mentioned yieldable cushion gear for evenly distributing force applied to the other of said parallel surfaces by the associated key member over the end surface of said second mentioned yieldable cushion gear.

6. A railway car underframe with recoiling center sill as set forth in claim 1 in which said key members are floating with respect to said movable center sill and in sliding contact with said slotted link bar members.

7. A railway car underframe with recoiling center sill as set forth in claim 1 in which said first mentioned pockets and said second pockets are symmetrically arranged on either end of said movable center sill in the central hollow portion thereof, said center sill being positioned in said underframe structure so that said pockets are also symmetrically arranged with respect to said body bolsters.

8. A railway car underframe with recoiling center sill containing symmetrically positioned cushion means in either end thereof and means associated with said cushion means for limiting the longitudinal travel of said recoiling center sill in said railway car underframe and in which the means associated with said cushion means consists of a pair of link bar members fastened to the underframe on either end thereof engaging sliding key members associated with the corresponding cushion means, one pair of said link bar members being subjected to compressive stress while the opposite pair is subjected to tensile stress when an axial load is applied to the center sill.

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