

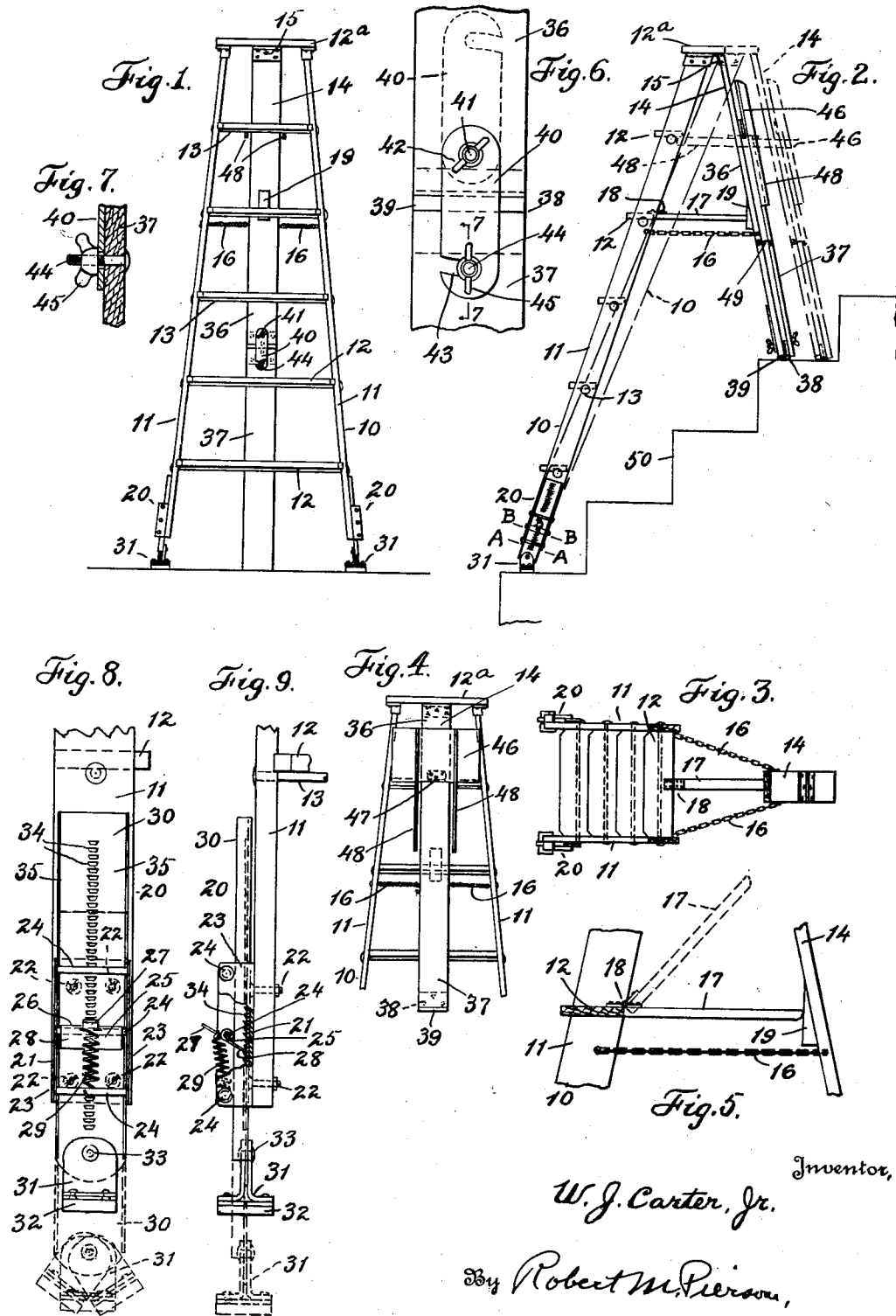
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ADJUSTABLE LADDER

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## UNITED STATES PATENT OFFICE

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## ADJUSTABLE LADDER

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This invention relates to ladders, and it has for its object to provide an improved adjustable foot attachment for articles of this class.

5 Of the accompanying drawing, Fig. 1 is a front elevation showing a stepladder provided with a preferred form of my invention, the ladder being unfolded or extended for use on a level floor or ground.

10 Fig. 2 shows the ladder in side elevation on a stairway, and indicates two positions thereof.

Fig. 3 is a plan view on a section plane taken just above the bracing strut and chains.

15 Fig. 4 is a partial rear elevation with the rear leg and platform in folded condition, as viewed from the right of Fig. 2.

Fig. 5 is a detail vertical section showing the operation of the wedging strut.

20 Fig. 6 is a detail front elevation showing the lock for holding the rear leg extended.

Fig. 7 is a section on the line 7-7 of Fig. 6.

25 Fig. 8 is a side elevation showing the lower portion of one of the ladder side rails and the adjustable foot attachment thereon.

Fig. 9 is a front elevation of the latter parts.

30 The ladder structure here illustrated is of the folding three-legged or tripod form which can be more easily leveled and adjusted to uneven surfaces than a four-legged structure, although the invention is of broader application and could be applied to other stepladders or to rung ladders of the leaning type.

35 10 is the front part or ladder proper, of the usual stepladder construction including side rails 11, cross steps or foot supports 12 and tie-rods 13 under the steps, but it is made somewhat wider than the usual stepladder in order to give a sufficient length of front base line to avoid upsetting. 14 is a single rear leg of special construction hinged at its upper end at 15 in the usual manner to the topmost step 12<sup>a</sup> in foldable relation to the ladder 10.

40 For limiting the spreading movement of the leg 14 with relation to the ladder 10, I connect the edges of said leg with the side rails 11 somewhat above the middle of the

ladder by means of a pair of flexible tension members 16, preferably taking the form of chains as shown, which diverge in straight V-fashion from the leg to the side rails when said leg is spread out, as best seen in Fig. 3. 55 When the leg is folded against the ladder these chains sag in loops between the two. For holding the parts rigidly in spread relation, I provide a wedging strut 17 whose front end is hinged at 18 to one of the ladder steps 12 just above the chains 16 so that it may be folded upwardly against the ladder 10 when not in use, the rear end of said strut engaging a wedge 19 fixed to the inner or front side of the leg 14 and having its front or acting face slightly inclined in a downward and forward direction from the vertical. This strut 17 is shown in broken lines disengaged from the wedge 19 and it will be evident that when forced down against said wedge to or toward the full line position it forces the leg 14 rearwardly against the resistance of the chains 16 and thus provides an extremely rigid connection of the parts which is not subject to loosening by wear, 75 because any loosening can be taken up by merely forcing the strut more tightly against the wedge. The strut can be readily disengaged from the wedge by giving it a sharp blow with the hand from below.

80 The lower ends of the front legs formed by the ladder side rails 11 are provided with longitudinally-adjustable foot devices 20 constituting a preferred embodiment of the invention herein claimed, whereby the relative height of the front ladder feet may be changed as desired to level and adjust the ladder. Each of these devices is of an extensible ratchet and pawl type and comprises a channel-shaped, sheet-metal bracket plate 21 having a middle web detachably secured in an upright plane by upper and lower pairs of bolts 22 to the lower portion of the ladder rail 11, and side flanges 23 projecting outwardly at right angles to said web and connected by a series of three tie-rods 24. The bolts 22 and their holes in the web of bracket plate 21 are located between the side flanges of said bracket plate so that the latter and its sliding foot structure, to be described, may 100

occupy substantially the full width of the ladder rail. A sheet-metal check pawl 25 is formed with aligned tubular hinge members forming a hub portion 26 pivotally surrounding the middle one of the tie-rods 24, an outwardly-projecting heel portion 27 for engagement by the user's foot to release said pawl, and a wide tongue-blade 28. A pawl-projecting spring 29 has its upper end hooked over the heel 27 and its lower end anchored on the lower one of the tie-rods 24.

30 is a three-sided, channel-shaped, sheet-metal foot stem slidably mounted against and guided by the bracket plate 21 between the middle web of the latter and the tie-rods 24, and having at its lower end a foot 31 provided with a non-slipping tread member 32 of rubber or other suitable material. This foot is laterally extended to give it sufficient tread surface and also to adapt its upper side for being stepped on and held down by the user's foot in adjusting the height of the ladder. Said foot may be movably articulated to the stem 30 in any suitable manner, as by a simple pivot or hinge joint 33, to swing in a fore-and-aft plane as indicated by the broken-line positions in Fig. 8, or a universal joint, such as is well known in ladder feet, may be substituted.

The flat stem 30 is formed with a vertical row of ratchet teeth 34 struck outwardly from the metal of its intermediate web portion for engagement by the edge of the tongue blade 28 on the pawl 25, said row of teeth being flanked by plain portions 35 of the web which act as stops or rests for the edges of the blade projecting laterally beyond the teeth, thereby providing a ratchet and pawl connection between the bracket plate and foot stem of exceptional strength and rigidity to sustain the ladder and the weight supported thereby. As will be seen in Fig. 9, the pawl blade 28, located mainly within the channel of the stem 30, is positioned at an angle of less than 45 degrees to a plane normal to the direction of sliding movement of the stem, so that when the weight of the ladder is imposed, a major component of lateral force is exerted on the pawl, causing the stem to be tightly wedged against the web of the bracket plate 21.

The rear leg 14 of the ladder is made with upper and lower sections 36, 37 connected by a hinge 38 so that the sections when extended in line with each other may provide a leg of ordinary length, but said leg may be shortened to a predetermined smaller length by folding the lower section upwardly in the rear of the upper section as indicated in Figs. 2 and 4. The length of said lower section is preferably made substantially a multiple, such as three, of the height of the individual steps of an ordinary stairway. A suitable tread-pad 39 may, if desired, be at-

tached to the lower end of the upper section for use when the leg is shortened.

To hold the leg sections 36, 37 rigidly in extended relation, I provide a locking plate 40 pivoted to the upper section on a bolt 41 which is provided with a clamping thumb-nut 42 on its inner or forward end to hold said plate against turning from either its downward position as shown in full lines in Fig. 6, or its upward position as shown in broken lines. The lower end of plate 40 is laterally slotted at 43 to provide a hook for embracing a keeper bolt 44 on the inner end of which is a clamping thumb-nut 45 to hold the locking plate firmly against the lower leg section in its downward position.

46 is a platform of the usual type for supporting a pail or other object near the upper end of the ladder, said platform being hinged at 47 to the upper section 36 of the rear leg so as to fold upwardly in the rear of said leg when not in use, and provided with a pair of stop-bars 48 for engaging the under side of one of the ladder steps to hold the platform in its horizontal operative position as indicated in broken lines in Fig. 2. When the lower leg section 37 is folded up against the upper section 36 and the platform 46 is also folded upwardly as shown in Fig. 4 and in full lines in Fig. 2, the upper portion of said lower section is received in parallel relation between the stop-bars 48 of the platform. A hook 49 is provided to hold the sections of the rear leg in folded relation. The stairway is indicated at 50 in Fig. 2.

In operating this ladder structure, assuming the rear leg 14 to be extended as in Fig. 1 but folded against the ladder 10 and the platform 46 folded up as shown in Fig. 4, the structure is arranged as a stepladder for use on the floor or the ground by spreading the leg and holding it in spread relation to the ladder by forcing the wedging strut 17 against the wedge 19, which places the chains 16 under tension and thus provides a firmly braced tripod structure. The ladder in this condition may be leveled by stepping on one or the other or both of the feet 31 to hold them down while raising the corresponding side or sides of the ladder. This allows either or both of the brackets 21 to slide upwardly on their foot stems 30 and carry their pawls 25 upwardly over a number of ratchet teeth 34 corresponding to the amount of extension, and each pawl will then catch on one of the teeth and sustain the weight of the ladder front in the new position. To reduce the extension of the foot stems it is merely necessary to retract the pawls 25 by the user pressing the heels 27 with foot or hand against the tension of the springs 29 and then releasing the pawls at the new position. Due to the absence of retracting springs for the foot stems 30, each of them retains its adjustment when the pawl 25 is retracted, and is then retract-

ible to the desired extent by imposing the weight of the ladder. This adjustment is independently made on the two sides and may be either simultaneously or successively carried on and is quickly and easily performed.

For using the stepladder on a stairway as shown in Fig. 2, the locking plate 40 on the rear leg is loosened by unscrewing the clamping nuts 42 and 45, and is turned upwardly to its broken-line position as shown in Fig. 6, and the lower section 37 of the leg 14 is folded up in the rear of the upper section 36 and retained in this position by the hook 49. The front of the ladder may then be rested by its feet on the floor or on one of the steps of the stairway 50 and the leg section 36 in this case will then rest on the third step up. The number of steps taken in may be greater or less according to the length in which the ladder is built. Stairway steps vary slightly in height and width and should the leg rest too near the front edge of its supporting step for complete safety as shown in full lines in Fig. 2, the extensible foot devices 20 provide a convenient means for increasing the inclination of the ladder by merely raising the ladder front with respect to the feet 31 in the manner previously indicated, as from the lower-end position A—A to B—B, so that the ladder will take a position such as represented in broken lines, thus increasing its base and bringing the leg 14 closer to the rear edge of its supporting step.

It will be evident that the foot attachments 20 could be used upon an ordinary rung ladder or on any stepladder differing in construction from that described, although they have a peculiar advantage in permitting the described change of angle in using a stepladder of this type on a stairway, and it will be further evident that other features may be used in other connections although here coacting in an improved manner. It is also possible to vary the particular form and relation of the several parts without departing from the scope of the invention as defined in the claims.

I claim:

1. A foot attachment for ladders comprising a channel-shaped bracket plate having an attaching web and side members connected by a fixed pivot rod acting as a brace for said members, a pawl having a hub portion journaled on said rod and also having a tongue blade and a releasing heel, a foot, and a flat stem on said foot, slidable on the bracket, between the latter's web and pivot rod, and formed with plain marginal portions acting as stops for the tongue blade of the pawl and with an intermediate row of ratchet teeth engaged by said blade.

2. A foot attachment for ladders comprising a bracket plate formed for attachment to a ladder rail and provided with a pawl having a blade, a foot, and a stem on said foot, slidable on the bracket plate and con-

sisting of a three-sided sheet-metal channel embracing the pawl blade and having a row of ratchet teeth struck out of its intermediate web portion, and a plain flanking pawl-rest portion, for engagement with the pawl.

3. A foot attachment for ladders comprising a bracket for attachment to the ladder rail, a pawl pivoted to said bracket and having an engaging edge, and a foot structure slidable on the bracket and including a stem formed with a row of pawl-engaged ratchet teeth transversely narrower than the length of the pawl edge and with a plain web portion parallel with said edge and forming a pawl rest alongside of the row of ratchet teeth.

4. A foot attachment for ladders comprising a bracket for attachment to the ladder rail, a foot structure slidable on the bracket and including a channel shaped sheet metal stem having outwardly-turned side flanges and an intermediate web formed with a relatively-narrow row of ratchet teeth struck out of the metal of said web and with plain pawl-rest portions flanking said row of teeth, and a pawl pivoted to said bracket and having an engaging edge substantially filling the width of the stem channel for coaction with the ratchet teeth and with the pawl-rest flanking portions of said stem.

5. A foot attachment for ladders comprising a ladder bracket, a foot structure slidable thereon and having an outwardly-open channel stem formed with ratchet teeth and with a plain flanking pawl-rest portion, and a pawl having a blade positioned at an angle of less than 45 degrees to a plane normal to the direction of sliding movement of said stem, within the latter's channel, for coaction with said teeth and pawl-rest portions.

In witness whereof I have hereunto set my hand this 20th day of November, 1931.

WILLIAM J. CARTER, JR.