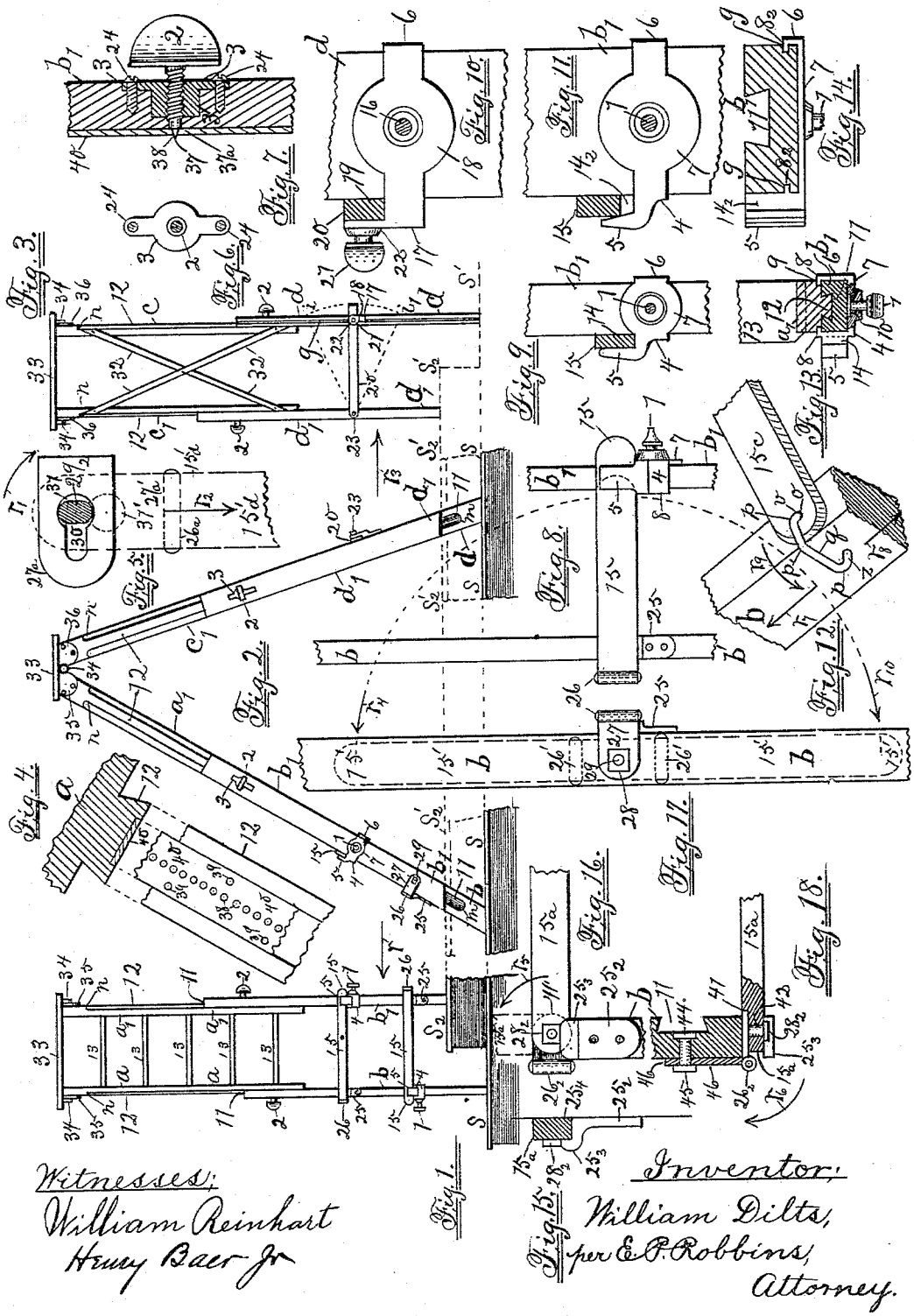
(No Model.)

# W. DILTS.

## STEP LADDER.

No. 359,716. Patented Mar. 22, 1887.



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# UNITED STATES PATENT OFFICE.

WILLIAM DILTS, OF CINCINNATI, OHIO, ASSIGNOR OF ONE-HALF TO ROBERT C. SMITH, OF SAME PLACE.

## STEP-LADDER.

SPECIFICATION forming part of Letters Patent No. 359,716, dated March 22, 1887.

Application filed December 16, 1886. Serial No. 221,701. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM DILTS, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Step-Ladders, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to improvements in step-ladders.

The object of my invention is to produce a step-ladder which can be extended to different lengths, which will be adapted to rest firmly upon uneven surfaces, and which will be simple of construction and manipulation, and not expensive to manufacture.

The invention consists, primarily, in producing independent extensibility and adjustability for each of the four upright-supports of a step-ladder, so that the ladder may be placed in any position whatever and yet be capable of resting firmly, even where each upright stands upon a different level from the others; and the means invented for attaining this end consists of a continuous tongue on one part and a corresponding groove on the other part of each upright, so that the two parts may be slid lengthwise to different positions and always have continuous and firm intervening bearings.

The invention comprises, also, removable and adjustable rungs for the lower portions of the ladder and suitable rung-attachments, and the various attachments and features hereinafter fully set forth.

Figure 1 is a front view, Fig. 2 a side view, and Fig. 3 a back view, of my extension step-ladder, the front supports or uprights being designated by *a* and *a'* and their extensions by *b* and *b'*, the back supports or back uprights by the letters *c* and *c'* and their extensions by *d* and *d'*, and the ladder being shown standing sidewise upon a stairway *s*, $s^2$, and having the upright-extensions *b'* and *d'* on the near side, Fig. 2, resting upon the next higher step to that upon which the uprights *b* and *d* rest. When looking in the direction of the arrows $r\,r^2$, the front and back sides of the ladder are seen in Figs. 1 and 3 as when looking at Fig. 2. In Fig. 2 the near upright-extensions *b'* and *d'* are shown resting upon the upper step, $s^2$, which is shown dotted, thus giving a view of the inner sides of the lower ends of the extensions *b'* and *d'*. The remaining figures show details of construction, which will be fully explained in connection with the following description.

The same letters or numbers designate the same parts in all of the figures, and the prime letters or numbers the dotted positions of these parts.

The upper portion of my extension step-ladder is of substantially the same construction as an ordinary non-extensible step-ladder, and comprises the front uprights, *a* and *a'*, supporting steps 13 in the usual manner, the back supports, *c* and *c'*, braced in a suitable manner, as shown at 32, suitable hinges, 34, hinge-castings 35, and top step, 33. This portion of the ladder is complete in itself, and can be used separately, when so desired, it being easy to quickly remove or connect the extension-section.

The uprights *a a'* and *c c'* (shown) each have their exterior edges cut away from points *n*, near their upper ends, continuously to their lower ends in such manner as that a continuous dovetail tongue, 12, Figs. 1, 2, 3, and 4, will extend along the exterior of each of the uprights from the points *n* to their lower ends. The tongue 12 could be a separate piece attached to the side of the upright; but greater strength and less expense in manufacturing will be had by cutting the edges of the uprights away, as shown in the figures. This can be best done by machinery adapted to that end.

The lower uprights or upright extensions *b b'* and *d d'* each have a continuous dovetail groove, 11, extending along the middle of their inner sides from the points *m*, near their lower ends, upward. The extension *b*, say, is attached to the corresponding upright *a*, by inserting the lower end of the tongue 12 of *a* within the upper end of the groove 11 of *b* and sliding the part *b* upon the part *a*. All of the upright extensions are similarly attached to the corresponding uprights and may be slid lengthwise to any desired position, so that the lower ends of the extensions *b b'* and *d d'* are all on a level or all on different levels.

Various means may be used for securing the

upright extensions to the uprights in any such positions. I prefer a set-screw or a binding-screw. In Figs. 1, 2, and 3 these parts are shown so secured by means of set-screws 2. In Figs. 6 and 7 the details of the preferred form of set-screw are shown. In Figs. 4 and 7 a piece of strap-iron, 40, is shown secured, as by means of tacks or screws 39, to the exterior of the tongue 12. In Fig. 4 the piece 40 is shown inserted in the tongue 12, so as to come flush with the exterior surface of the tongue, and is shown as having a continuous row of holes, 38, in line with the point of the set-screw 2 of Fig. 7. In Fig. 7 the set-screw 2 is shown secured in a nut, 3, which is set into the exterior of the extension *b'* and suitably secured, as by screws 24. The section of *b'* is through the middle of the slot 11 in *b'* and the nut 3. The mid-section of the strap-iron 40 is shown in place against the bottom of the groove 11, but one hole, 38, being shown for the set-screw point 37. Fig. 6 shows the exterior of the nut 3.

The point 37 of the set-screw 2 could be forced into the wood of the tongue 12, where no metal piece 40 is used. Were the tongue 12 made of hard wood this would be practicable; but when made integral with the rest of the upright *a*, of soft wood, the point 37 would eventually cut away and injure the center of the tongue 12.

The set-screw 2, as shown in Fig. 7, has a shoulder, $37^a$, adapted to bind against the surface of the strap 40. At the same time the point 37 bears hard within the hole 38. This construction insures a secure fastening for the uprights and their extensions.

In Figs. 9 and 13 a casting, 7, is shown clamped to the upright-extension *b'*, by means of a set-screw, 1, having a washer or flat bearing, 10, at its inner end adapted to bear against the exterior surface of the extension *b'*. The set-screw used for fastening the extensions to the uprights could have such an end bearing, which could be made to bind against the exterior surface of the tongue 12. This would be preferable to forcing the point 37 of the set-screw 2 into the wood of the tongue 12. By leaving the ends of the uprights *a a'* and *c c'*, solid above the points *n*, and the ends of the extensions *b b'* and *d d'* solid below the points *m* greater strength and durability of the said parts will be attained.

By providing each of the uprights *a a' c c'* of a step-ladder with an independently-adjustable extension, provision will be had for standing the ladder firmly upon uneven surfaces and for standing the ladder sidewise upon a stairway, as shown in Figs. 1, 2, and 3; but this would not provide the extension step-ladder contemplated in this application.

The step-ladder herein set forth is intended to be capable of such extension that one size of ladder may be made to anwer for several different sizes, as such ladders have been previously constructed. To this end it becomes necessary to provide the extensions *b* and *b'*, with rungs or steps also, for while a step-ladder having the extension-pieces *b b'* and *c c'* (only) would provide for the adjustability desired for uneven surfaces, there would be no means constituting a part of the ladder which would enable the user to conveniently mount the first stop (13) were these parts *b b'* and *c c'* made as long as is intended with my construction.

I provide rungs for the extensions, and, in order to provide for the independent adjustability of the upright-extensions at the same time, I make these rungs removable or adjustable, or both. The simplest removable rung (so simple as not to require illustration) may be a round rung held loosely at its ends within holes in the parts *b b'*, and be removed or replaced by being moved endwise within the said holes, or be a flat rung held in gaps cut in the front edges of the extensions *b* and *b'*, or gaps formed in pieces secured at suitable heights along the front edges of the parts *b* and *b'*. While such removable rungs would be covered by the broad claims for movable rungs which follow this description, they would not be preferred, on account of ease of loss or displacement. The removable rungs and attachments preferred are illustrated in Figs. 1, 2, 5, 8, 9, 11, 12, 13, 14, 15, 16, 17, and 18. Two such rungs are shown in Figs. 1 and 2, placed slightly farther apart than the steps 13 on the upper section, since they are used more as a means of access to the steps 13 than to stand upon. These two rungs and the attachments shown are identical in construction, but are arranged the reverse way across the ladder, for a reason to be explained later.

In Fig. 8 the upper ring and attachments shown in Figs 1 and 2 are shown on a larger scale, but in the same position as in Fig. 1. Fig. 17 is a view of the hinge 26 of the rung 15 and of the side of the upright extension *b* when looking toward the left side of *b* in Figs. 1 and 8.

The flat rung 15 has a hinge, 26, connecting it with a part, 27, which is pivoted by means of the bolt 28 29 to the exterior side of the extension *b*. The other end of the rung, 15, rests in a gap, 14, Fig. 9, formed between the front edge of the extension *b'*, and a projection, 5, upon the casting 7, which is clamped to the extension *b'*. The hinge end of the rung 15, which should have some play between it and the front edge of the extension *b* rests upon a casting, 25, secured to the extension *b*. The free end of the rung 15 may be lifted out of the gap 14, or over the projection 5, and swung around forward until its back surface comes flush with the exterior side surface of the extension *b*, when the rung will extend perpendicularly outward from the hinge 26. If we now look at the extension *b*, as shown in Fig. 17, the rung 15 will be occupying a position in line with its position in Fig. 8. When in this position, the rung 15 may be swung about the pivot 29, as indicated by the dotted arc, either in the direction of the arrow $r^4$ (upward) to

the position 15′, or in the direction of the arrow $r^{10}$ (downward) to the position 15′. When so placed alongside of the extension *b*, it may be secured in various ways, as by having its free end slipped beneath a spring, or by having this end held by a button, &c.

In Fig. 5 a pivot, $29^2$, corresponding to that 29 in Fig. 17 has an oblong cross-section, and the part $27^a$, corresponding to 27 in Fig. 17, has a hole, 31, having a diameter equal to the greatest diameter of pivot $29^2$, communicating with a slot, 30, having its shortest diameter equal to the least diameter of the pivot $29^2$, so that when the part $27^a$ is in the horizontal position it will be retained in place by the pivot $29^2$, and when turned downward in the direction of the arrow $r'$, the slot 30 will slip over the pivot $29^2$, and the rung hang suspended in the dotted position, and on account of the relative proportions of the slot 30 and the cross-section of the pivot $29^2$, the piece $27^a$, and consequently the attached rung $15^a$, will be prevented from swinging about the pivot and remain in position at the side of the extension *b*, as at 15′ in Fig. 17. By placing the slot 30 on the other side of the hole 31 the rung $15^a$ may be maintained at the side of the upright *b*, projecting in an upward direction. By hinging one of two such rungs to the extension *b* and the other to the extension *b′*, as in Fig. 1, they will not be in each other's way when placed at the sides of the extensions; but since provision has been made for supporting a rung at the side of the upright extension, either above or below the pivot 29, as just shown, if more than one such rung be hinged to the same extension, as *b*, then one of these may be extended upward and the other downward, so that three or more such rungs may be practically attached to the same ladder.

The casting 7 is shown in Figs. 8, 9, and 13 as having a projection, 5, forming with the front face of the extension *b′* a gap, 14, within which the free end of the rung 15 is placed and held when the latter is in use. As shown in Fig. 13, this casting 7 has parts 4, 6, and 7, which bear against the front, back, and side, respectively, of the extension *b′*, and the parts 4 and 6 have inwardly-extending tongues, 8, adapted to catch behind the inner edges of the extension *b′*, whereby the casting 7 is held to the upright, while being free to slide along it. The casting 7 has a set-screw, 1, having a flat inner end, 10, adapted to bear against the exterior surface of the extension *b′*, by means of which the casting may be clamped at any desired point along the extension. As shown in Fig. 13, only, the corresponding upright, *a′* has rabbets 9 at the corners, within which the tongues 8 may slide. These rabbets could of course be formed in the inner edges of the extension *b′*. The preferable casting 7, however, is shown in Figs. 11 and 14, where the extension *b′* has grooves *g* in its front and back faces and near its outer edges, and the casting 7 has tongues $8^2$ in corresponding positions. Here, as in Figs. 8, 9, and 13, a set-screw, 1, serves to clamp the casting 7 to the extension *b′*. The gap $14^2$ in this modification, however, is wedge shape, and narrower than the rung 15, as shown in Fig. 11, so that when the rung is forced into the gap it is thus firmly secured.

The ladder may be so situated sometimes that there would not be sufficient room to swing the rung out in front, in order to swing it alongside of the upright extension, or to swing it from that position. Figs. 15, 16, and 18 show a modification, where the rung may be swung into and out of position for use even in such a confined space. Here the piece 46 is shown pivoted at 44 45 to the side of the upright extension *b*, as was the piece 27 in Fig. 17, and as having the hinge $26^2$, like that, 26, of Fig. 17; but the hinge part 41 has a stud-bolt, $42\,28^2$, projecting forward, and the rung $15^a$ is pivoted to this stud, so as to swing in the direction of the arrow $r^5$, Fig. 16, while the hinge part 41 remains in the position shown.

A casting, $25^2$, secured to the front of the extension *b′*, has a projection, $25^3$, forming a gap, $25^4$, Fig. 15, with the extension *b′*, within which the hinge part 41 and the pivoted end of the rung $15^a$ rest when the latter is in place. In swinging this rung $15^a$ to the side of the extension *b′*, it is raised out of the gap $25^4$ and then swung in the direction of the arrow $r^5$, Fig. 16, until it stands in front of the upright extension, as in the dotted position $15'^a$, when it, together with the hinge part 41, Fig. 18, is swung in the direction of arrow $r^6$ around the edge of the extension *b′*, after which, by pulling upon the rung, the parts straighten out and swing from the pivot 44 45, and may be suitably secured at the side of the extension *b′*.

A simpler modification for the same purpose is shown in Fig. 12, in perspective, where the extension *b* has a rod, *q*, bent around its outer front edge, and which has one end, *z*, bent on an easy curve at *p*, so as to project at right angles from the extension *b* and be secured in a hole in its side, the other end, *v*, of the rod *q* being similarly bent, so as to project at right angles from the front of the upright extension and be similarly secured in the extension. The rod *q* has an easy bend, *p*, also where it curves around the edge of the extension.

As shown in Fig. 12, the rung $15^c$ has a hole, *o*, in its end, through which the rod *q* passes. The rung $15^c$ is shown in the position occupied when in use. When not wanted, it may be swung directly upward or downward or outward, and around upon the bent rod *q* into a position at the side of the extension *b*, as indicated by the arrows $r^9$, $r^7$, and $r^8$.

The object of having the casting 7 adjustable along the upright extensions is to be able to always place the rung 15 horizontal, no matter what the relative positions of the extensions *b* and *b′* may be.

In ladders having long extension-sections, the back upright extensions, *d* and *d′*, should

be suitably braced. In Fig. 3 a brace, 20, is shown pivoted at 23, and adapted to swing in the dotted arc *i i'*.

A casting, 18, Figs. 3 and 10, has parts 17, 6, and 18 bearing against the front, back, and the exterior side of the extension *d*, and the parts 17 and 6 have tongues like those, $8^2$, of Fig. 14, which slide in grooves *g*, Fig. 3, and this casting is clamped to the extension *d* by means of a set-screw, 16. This casting has a projection, 17, in front, extending upward and forming, with the back face of the extension *d*, a gap, 19, and the projection 17 has a boss, 22, and a set-screw, 21. When this casting is secured to the extension by means of the set-screw 16 in the position shown in Fig. 3, and the free end of the brace 20 is placed in the gap 19 and secured by means of the set-screw 21, the upright extensions *d* and *d'* are firmly braced. The brace 20 is made long, so that the casting 18 may be at any position between *i* and *i'*, and the free end of the brace be secured thereby without having to move the casting each time the extensions *d* and *d'* are adjusted relative to each other.

I claim—

1. A step-ladder having front and back upright-supports hinged together at the top and steps or rungs supported by the front uprights, and each of the uprights having a continuous dovetailed tongue on its exterior, in combination with an extension for each said upright having a continuous dovetailed groove, within which the said tongue on the upright bears and is guided, and the said upright and extension having suitable means, as a set-screw, whereby they may be secured together in any desired position, substantially as and for the purposes set forth.

2. In a step-ladder having adjustable supporting-extensions for the front supporting-uprights, the combination of movable rungs with the said upright-extensions, substantially as and for the purposes set forth.

3. In a step-ladder having adjustable supporting-extensions for the front supporting-uprights, the combination of the said extensions, one or more movable rungs, each pivoted at one end to one upright-extension, and so as to swing about the said pivot and around to the side of the extension having this pivot, and also across the ladder, and a suitable support on the other extension for the free end of the rung, as a casting having a gap in which the end of the rung rests, substantially as described.

4. In a step-ladder having adjustable extensions for the front supporting-uprights, the combination of the upright-extension *b*, the pivot 29, hinge-piece 27, hinge 26, and the rung 15, substantially as set forth.

5. In a step-ladder having adjustable extensions for the front supporting-uprights, the combination of the said extensions, a rung pivoted to one of the uprights and having a hinge adjacent the upright to which it is pivoted, and a projecting part, as 25 or $25^2$, for supporting the hinge end of the rung, substantially as described.

6. In a step-ladder having adjustable extensions for the front supporting-uprights, the casting having parts 4 7 6, bearing against the front, side, and back of the upright-extension and having suitable inwardly-extending tongues, as described, and a set-screw and a projection adapted to secure a rung, in combination with the upright-extension, substantially as and for the purposes set forth.

7. In a step-ladder having adjustable extensions for the front supporting-uprights, the casting having parts 4 7 6, bearing against the front, side, and back of the upright-extension and having inwardly-extending tongues $8^2$, and a set-screw as means for securing the casting to the upright-extension and having a projection, 5, with an inclined inner surface, which, with the front of the upright-extension, forms a wedge-shaped rung-gap, $14^2$, in combination with the said upright-extension having grooves *g* in its front and back sides, substantially as and for the purposes set forth.

8. In a step-ladder having adjustable extensions for the back supporting-uprights, the combination of the said extensions, a suitable brace pivoted to one extension and reaching across to the other extension, and a fastening secured to the latter extension for fastening the free end of the said brace, substantially as described.

9. In a step-ladder having adjustable extensions for the back supporting-uprights, the combination of the said extensions, the brace 20, pivoted to one upright-extension and reaching across to the other extension, and the casting 18, having parts 17 18 6, bearing against the front, side, and back of the latter extension and having inwardly-extending tongues, as described, and a set-screw, 16, at the side, and the front part, 17, extending upward and in front of the said extension and forming a gap, 19, with the front of the said extension for the end of the brace 20, and having a set-screw, 21, whereby the free end of the brace 20 may be secured to the said casting, substantially as described.

10. In a step-ladder having a movable rung pivoted at one side, the combination of the pivot having an oblong cross-section and the rung part having a pivot-hole communicating with a slot, whereby the rung may be freely turned about the pivot when the latter is in the hole, but prevented from turning when it is in the slot, substantially as and for the purposes set forth.

11. In a step-ladder having adjustable upright-extensions, the combination, with the tongues 12 on the exterior of the uprights, of attached metal strips 40, having a row of set-screw holes, 38, substantially as and for the purposes set forth.

12. In a step-ladder having uprights provided with external tongues, 12, and upright-

extensions provided with internal grooves, 11, the combination of the said uprights and upright-extensions, nuts suitably secured within or to the bodies of the extensions, and set-screws working in the said nuts and serving to secure the said uprights and upright-extensions together in varied positions, substantially as and for the purposes set forth.

13. In a step-ladder having uprights provided with external tongues, 12, and upright-extensions provided with internal grooves, 11, the combination of the said uprights and upright-extensions, strips of metal 40, attached to the outer surfaces of the tongues 12, and having a row of set-screw holes, 38, nuts suitably secured within or to the bodies of the extensions, and set-screws 2, working in the said nuts, and having points 37, adapted to engage the holes 38 in the metal strips 40, substantially as and for the purposes set forth.

In testimony whereof I now affix my signature in presence of two witnesses.

WILLIAM DILTS.

Witnesses:

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