

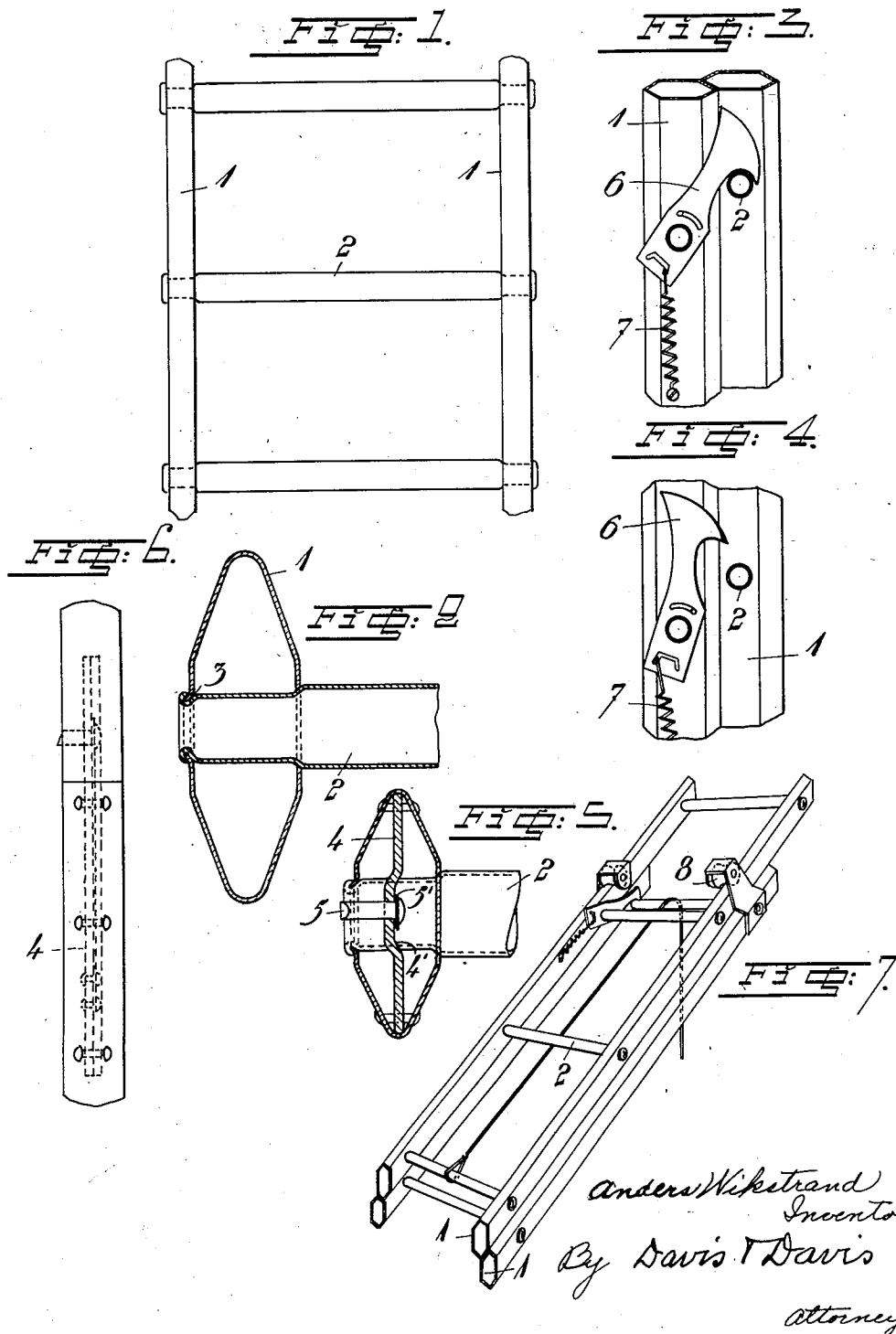
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LADDER LIKE STRUCTURE

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## UNITED STATES PATENT OFFICE

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## LADDER-LIKE STRUCTURE

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This invention refers to a ladder consisting of steel tubing with the ladder rungs pressed onto the two opposed walls of the said tubings of the ladder by means of pressing tools, so that a ladder of small weight and solid construction is obtained. The side tubings of the ladder are suitably given a flattened six sided or oval cross section so that sufficient strength combined with minimum weight results. The ladder rungs are suitably so fastened to the upright tubes that a turning of the rungs when the ladder is in use is prevented. In order to make transportation of a long ladder easier it can be composed of several sections so made that the ladder can be pushed together in overlapped relation, locking arrangements being provided to hold the different sections in position, when the ladder is mounted or pulled out.

It will be observed that a feature of importance lies in making the inner wall of each pair of holes in the side rails larger in diameter than its companion outer hole and also in making the diameter of the tubular rung larger than said larger hole so that when the reduced end of the rung is inserted in the companion holes the shoulder formed by the reduction in the size of the tubing will abut against the inner flattened wall of the side rail. It will be observed also that the reduced end of the rung (which is enclosed within the hollow side rail) is larger than the hole in the outer wall of the side rail so that when the extreme outer end of the rung is reduced sufficiently to pass through said outer hole there will be formed an annular shoulder abutting against the inner face of said outer wall. In this way, when the extreme outer edge of the rung is crimped around the edge of the hole an exceedingly light, strong and rigid structure is produced. The advantage in making the side walls of the rails flat is that the annular shoulders formed on the rung tubes will fit exactly and rigidly all around the hole edges, which of course would be difficult, if not impossible, if the side rails were circular in cross section. Also the making of the outer wall of the side rail flat makes it possible to ream or crimp the extreme outer end of the rung solidly against the edge of the hole all around.

The invention is illustrated in the accompanying drawing, whereby

Fig. 1 shows the ladder from the front and Fig. 2 shows the same in cross section.

Figs. 3 and 4 show different positions of the locking arrangement for the locking of two ladder sections of a pulled out ladder.

Figs. 5 and 6 show another form of means for the mounting of the different ladder sections, Fig. 5 being a cross section of a side tube of the ladder, and Fig. 6 being a side view of a tube from the front.

Fig. 7 is a perspective view of a sectional ladder.

The ladder is composed of the side tubes 1 and of the ladder rungs 2, fastened therein. The cross section of the side tubes has the cross section of a flattened hexagon or oval, while the ladder rungs are desirably made from tubes of any shape in cross section and the holes for the ladder rungs in the side tubes should be made comparatively small, in order not to weaken the resistance of the side tubes more than necessary. At the erection of the ladder, the ends of the ladder rungs 2 are pushed into holes 3 in the side tubes, made at certain intervals, whereafter the material of the ladder rungs by the aid of a tube press or the like is forced out so that a reliable connection is made between the ladder rungs and the side tubes. The pressing operation is made in such a manner, that the extreme outer edge of each rung-tube is bent outwardly and backwardly so as to crimp over and tightly enclose the edge portions of the holes 3, so that the turning of the ladder rungs, when in use, is prevented in an effectual way.

In order to make the transport or the storing of the steel ladder easier, the same is suitably divided into sections and the opposed tube ends are thereby formed in such a way, that they can be inserted into each other, and locking arrangements, hereinafter described, form a reliable locking of the different sections of the ladder, when they are mounted together for use.

A suitable form of means for a reliable connection between the different sections of the ladder is shown in the Figures 5 and 6, according to which in the inside of the side tubing iron longitudinal plates 4 are arranged, the lengthwise edges of which are well fitted into two opposed angles of the side tubing of the ladder, and said plates 4 are strengthened by a pressed ridge 4, into which a flat spring carrying a locking pin 5 or the like is arranged, which is meant for snapping into a hole in the side tubing in order to lock the adjacent sections of the ladder to each other.

Another suitable form of means for the easier handling of the steel ladder in transportation is the slidable form as shown in Fig. 7, whereby the ladder is pushed together for transport and drawn out when in use. In this case the one section is suitably made narrower, than the adjoining one and slidable into the same. Through the chosen and above described cross section of the side tubing an excellent guiding is obtained by the one section on the other one and aside from this, one or more locking arrangements are mounted in order to fix the different ladder sections in working position. These locking devices can suitably consist of automatically snapping hooks 6, as shown in Fig. 4, catching the ladder rungs near the one or both the side tubings, so that full safety is gained for the stability of the ladder. Such a device is shown in Figs. 3 and 4, which show the locking hook, which is pivotally mounted with a spring arrangement at one or both ends of a ladder rung in one ladder section, and adapted automatically to hook onto one of the ladder rungs in another ladder section. The spring 7 acting upon the hook can be fixed in different positions in the hook, so that in the one position an automatic engagement of the hook with a ladder rung in the other ladder section (Fig. 3) is gained, or in its other position makes a free movement of the ladder sections possible relative to each other (Fig. 4). In order to smooth the movement of the ladder sections relative to each other, rollers 8 suitably can be arranged, which are grooved to engage over the free lengthwise edge of the side tubing.

The details of the invention can naturally be varied, without detracting from the principle of the same.

Having thus described the invention, what I claim and desire secured by Letters Patent is:—

A ladder-like structure comprising side rails of steel tubing having flattened side walls, the opposite flattened walls of each tubing being provided with pairs of coincident holes at spaced intervals, the inner hole being larger than the outer hole, and tubular cross-bars having their ends extend-

ing through said coinciding holes in said side rails, each end of each cross-bar being reduced in diameter so as to form an annular shoulder fitting all around against the edge of the inner hole, the extreme outer end of each cross-bar being further reduced in diameter to pass through and extend beyond the smaller hole in the outer wall of the side rail, this said extreme outer end of the cross-bar being crimped to rigidly embrace the edge of said smaller outer hole all around.

In testimony whereof I have affixed my signature.

ANDERS WIKSTRAND.