

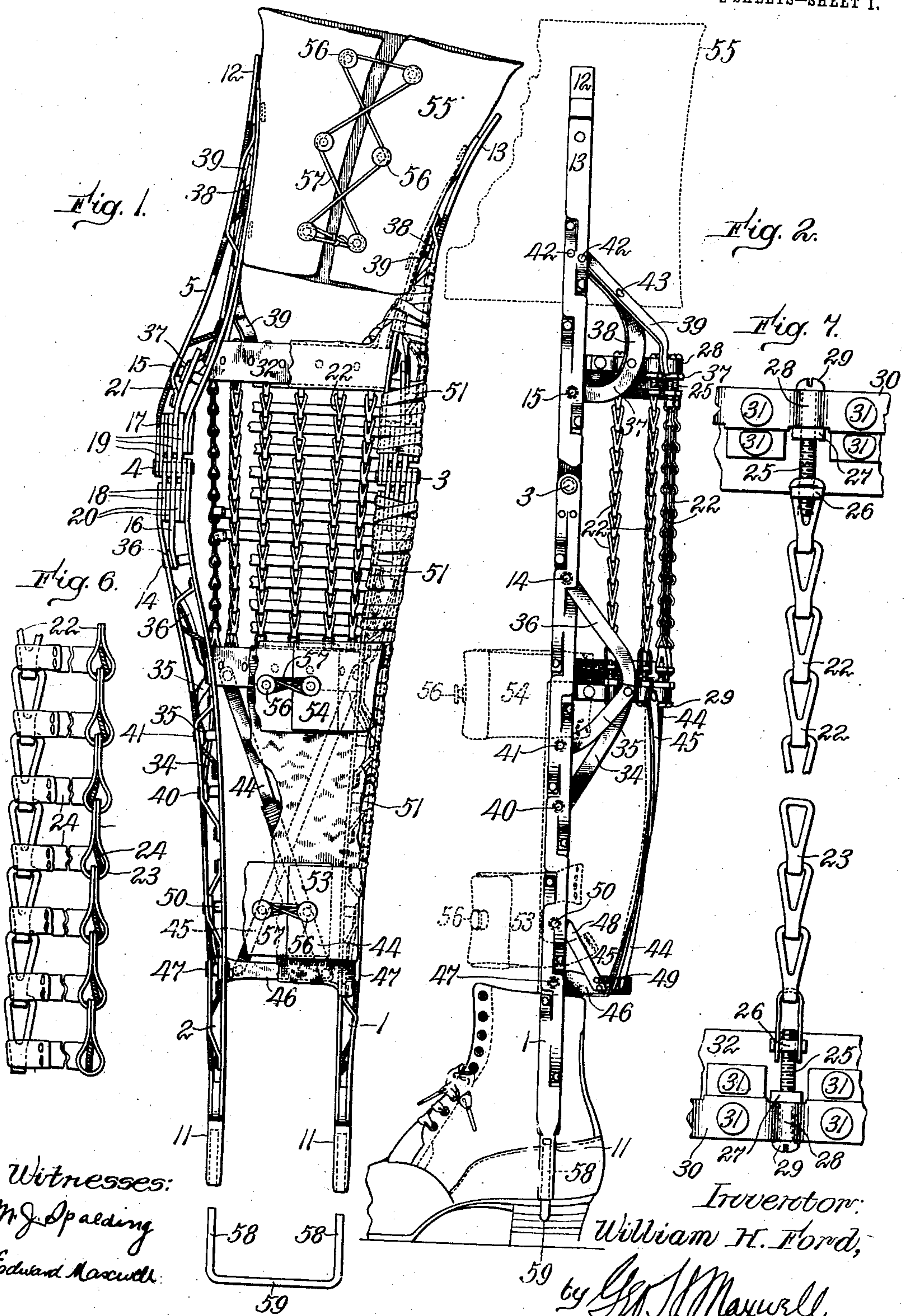
No. 894,264.

W. H. FORD.
LEG BRACE.

PATENTED JULY 28, 1908.

APPLICATION FILED DEC. 5, 1907.

2 SHEETS—SHEET 1.



Witnesses:
M. J. Spalding
Edward Macmillan

Inventor:
William H. Ford,

by *Geo. J. Maxwell,*
Attorney.

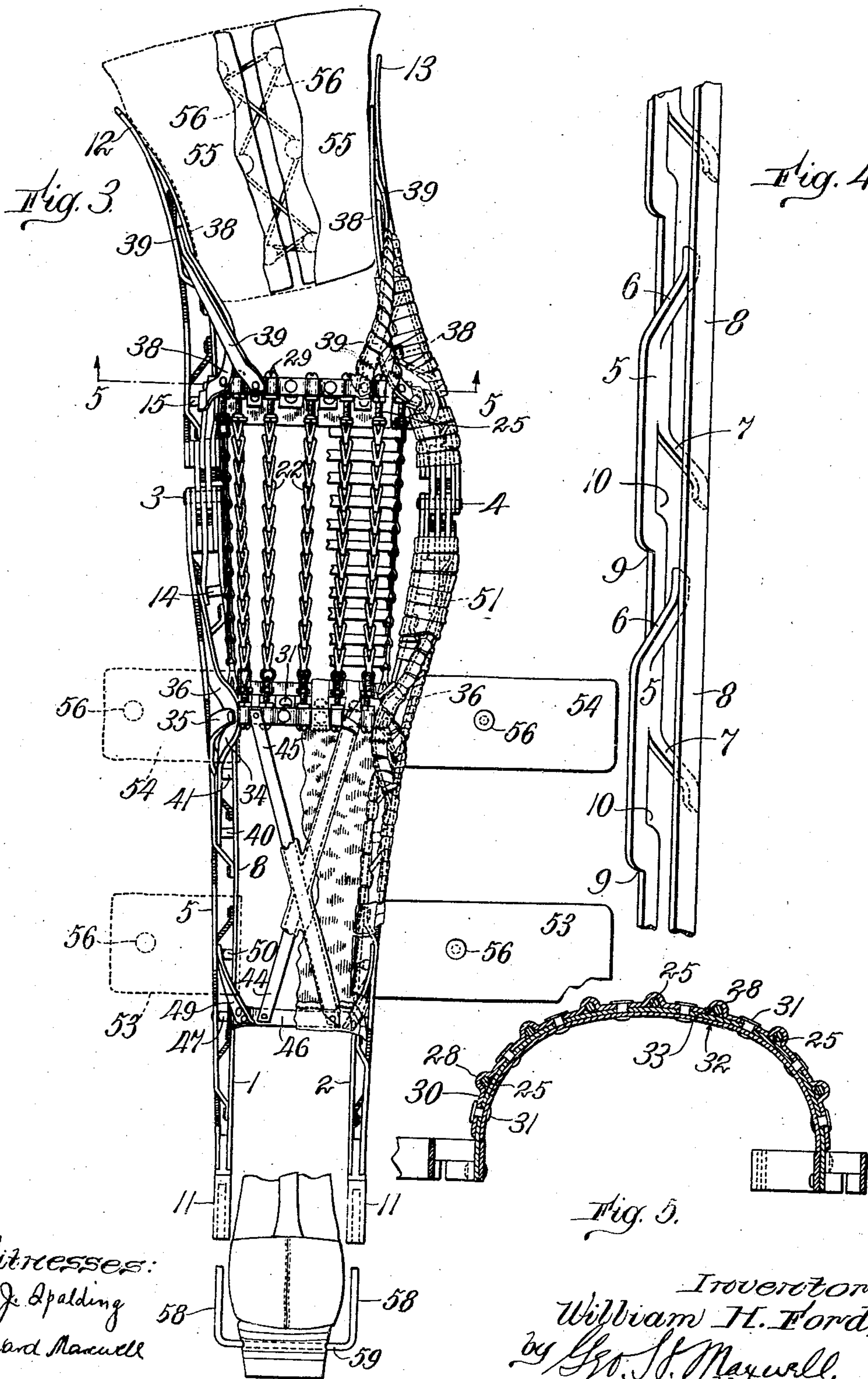
No. 894,264.

W. H. FORD.
LEG BRACE.

PATENTED JULY 28, 1908.

APPLICATION FILED DEC. 5, 1907.

2 SHEETS—SHEET 2.



Witnesses:
M. J. Spalding
Edward Maxwell

Inventor:
William H. Ford,
by Geo. S. Maxwell,
Attorney.

UNITED STATES PATENT OFFICE.

WILLIAM H. FORD, OF LOWELL, MASSACHUSETTS.

LEG-BRACE.

No. 894,264.

Specification of Letters Patent.

Patented July 28, 1908.

Application filed December 5, 1907. Serial No. 405,144.

To all whom it may concern:

Be it known that I, WILLIAM H. FORD, a citizen of the United States, residing at Lowell, in the county of Middlesex and State of Massachusetts, have invented an Improvement in Leg-Braces, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

The primary object of my invention is to reduce the weight and cumbersome character of the usual leg brace, my invention also including simplicity, economy and durability of construction. To these ends I do away entirely with the usual heavy style structure and thick, stiff and unyielding leather, and provide a form of light lace-like style bridge work, so constructed that although frail looking and exceedingly light, it has ample strength even for a heavy person and rough usage, and in connection with this light bridge work I provide beneath the knee joint a link or chain-like net so constructed as to be perfectly flexible for all necessary movements, adjustable to any angle or relative position, incapable of kinking, smooth and agreeable in feeling, and readily repaired, and I also provide a special support or supporting joint for the brace in connection with the heel of the shoe, which relieves the wearer of considerable of the weight of the brace.

The above, with other advantages, will be more apparent in the course of the following description of the constructional details, taken in connection with the accompanying drawings, in which I have illustrated a preferred embodiment of the invention.

In the drawings, Figure 1 is a view in front elevation of a brace constructed according to my invention, parts being broken away or removed for clearness of illustration; Fig. 2 is a view in side elevation thereof, showing the same in connection with a shoe; Fig. 3 is a rear elevation of the device, partly broken away; Fig. 4 is a perspective view of a portion of the bridge work; Fig. 5 is a cross-sectional view on the line 5—5; Fig. 6 is a longitudinal sectional view of a fragment of the chain portion beneath the knee, and Fig. 7 is an enlarged detail in front elevation, showing the adjustability of the chain support.

As before stated, my primary aim is to secure strength, lightness and economy of construction. And accordingly I provide oppo-

site uprights or main side supports 1, 2, pivoted respectively at 3, 4, intermediate their lengths, their construction being such that very light metal is used, no rule joints are necessary, and notwithstanding the fact that I employ a bridge work construction, there are no external points to catch and the construction readily receives a leather covering. As each upright or side support has the same general construction it will be sufficient to refer to the details shown in Fig. 4 for an understanding thereof. A strip 5 of metal, preferably thin stiff steel, has portions 6, 7, bent inwardly therethrough alternately on the opposite sides and extending in opposite directions as clearly shown in Fig. 4, the ends of the parts 6, 7 being bent parallel to the body portion of the strip 5 and soldered, brazed or otherwise secured to a straight flat strip 8 of similar material.

The parts 6, 7, form strong rigid braces between the straight flat member 8 and the flat crooked member 5, the stamping out of the members 6, 7 therefrom resulting in angular cut-away portions 9, 10, so that the strip 5 has a zigzag or crooked appearance although having its main portion flat and in substantially the same plane. The opposite flat members 5, 8, gradually diverge from the lower socket ends 11 to the joints 3, 4, and thence converge upwardly to a thin edge at their upper terminals 12, 13, thereby getting maximum bracing effect. Adjacent the joints 3, 4, I introduce also transverse bolts or heavy rivets 14, 15 to which are secured intermediate metal hinge strips or plates 16, 17, and immediately next to the joint pintle I provide a plurality of hinge plates 18, 19, separating blocks or plates 20 being preferably interposed for making a practically solid and extremely strong and free-turning joint. One of the bent down brace portions of the strip 5 is preferably secured to the plate 17 as indicated at 21 for giving still further rigidity to the joints and strength to the construction.

It will be understood that the joints 3, 4, are intended to coincide with the joint at the knee of the wearer, and in order that the back side of the leg under the knee may be supported and the brace prevented from permitting the knee joint to bend beyond its normal position, I provide a chain-like rear support, consisting of a series of vertical chains

or linked members 22, whose detailed construction is best shown in Figs. 6 and 7, where it will be seen that I have employed a well-known type of chain, in which each link has an elongated opening 23, and these openings I utilize for receiving transverse narrow strips 24 of leather, which serve the double purpose of maintaining the chains at all times in proper position and also giving a comfortable support to the wearer. In order to control the angle of the brace and the support given by the chains 22 and strips 24, and provide necessary adjustment for different shapes of legs, I have devised a special adjustment for each of the chains 22, consisting of a screw bolt 25 screwing at its inner end into a nut 26 which may be specially formed integrally with or secured to the adjacent end of the chain 22, a check nut 27 being provided for maintaining the desired adjustment and the bolt being arranged to turn freely in a boss or bearing 28 and held therein by a usual slotted head 29 engaging the edges of said bearing 28. The bearings 28 are formed by suitable crimps in a narrow metal band 30 riveted at 31 to a back band or curved support 32 and intermediate strengthening band 33, which are rigidly secured at their ends to the opposite side uprights 1, 2, the back band 32 having considerable width in order to give it proper strength and rigidity to resist the transverse pulls thereon of the chains 22. Said structure is still further rendered immovable by oblique curved struts 34, 35, 36, on the lower band, and 37, 38, 39, on the upper band, these struts being riveted or bolted at their outer ends to the main uprights 1, 2, and at their inner ends to the back bands respectively. The struts 34, 36, are preferably formed from a single piece of metal strap, as clearly shown in Fig. 2, and so also are the struts 37, 38. The outer end of the strut 34 is secured by a bolt 40 as clearly shown in Fig. 1, the strut 35 being secured by a bolt 41, the strut 36 by the bolt 14, the strut 37 by the bolt 15, and the struts 38 and 39 by bolts 42, and also riveted together at 43. To give still further strength and rigidity and also to support the calf of the leg, I provide crossed braces or metal straps 44, 45, which are riveted at their upper ends to the lower back band and at their lower ends to a band 46 riveted or bolted at its opposite ends at 47 to the uprights 1 and 2 respectively, and braced by diagonal struts 48 riveted at 49 thereto, and at 50 to the uprights.

The foregoing construction is exceedingly light and yet is so formed that it effectually resists strains in every direction. One main advantage however is that it relieves the cripple who wears it, of the necessity of carrying the great weight which has heretofore been considered necessary when wearing leg braces. Also this construction is such that

it can very readily be covered with leather, and while I prefer to wind the leather on, this is not deemed necessary. As herein shown, strips of leather are wound around the uprights as indicated at 51 and around the various struts as indicated at 52. Usual heavy tightening or securing bands or straps 53, 54, and 55 are provided, each having buttons 56 and lacings 57 for adjustably securing the leg brace in position about the leg.

At its lower end each upright 1, 2 terminates in sockets 11 already mentioned, consisting of small tubular ends adapted to receive the vertically projecting pin-like ends 58 of a boot stirrup whose horizontal portion 59 passes through the hole made therefor in the heel directly in line with the ankle joint. The stirrup ends 58 normally occupy the sockets 11 and rest against the bottoms of said sockets so that thereby a large portion of the weight of the leg brace is borne by the shoe. When the wearer steps with his or her heel upon the ground, the shock due to the inertia or weight of the leg brace does not come upon the leg of the patient, but is transmitted directly to the heel of the wearer and thence to the ground. In practice I have demonstrated that this conduces greatly to the comfort of the wearer. Also because of this construction the wearer is relieved of the weight of the leg brace when sitting or standing, and yet all the necessary movement of the foot, up and down with relation to the brace, is permitted because of the free movement of the stirrup-ends in their sockets. If the position of the foot requires the heel to move downwardly with relation to the brace, it is perfectly free to do so, the stirrup simply pulling outwardly from the socket ends 11 of the main supports 1 and 2 and when the movement of the foot causes the heel to return to its normal position the members 58 move upwardly again with relation to the sockets 11 into supporting engagement against the bottoms thereof.

The chain-leather construction provides a combined cushion, seat, and joint, and is one of the most important features of my invention as it serves to distribute a large portion of the strains throughout practically the entire length of the brace, whereas the usual brace constructions heretofore have not only required ankle joints but because thereof have brought most of the strain of the brace to bear at the joint and hence have necessitated a large amount of metal and extra weight at this point. By my construction all this is eliminated. The adjustment of the individual chains permits the utmost nicety of position, enabling the surgeon to adjust the brace to any leg. Also my construction makes it feasible to build a stock line of braces which can be readily adapted to all usual legs, thereby obviating the necessity of building each brace for the given leg.

It will be understood that I am not limited to the precise constructional details herein shown and described, as many modifications in shape, arrangement, formation, and combination of parts may be resorted to without departing from the spirit and scope of my invention.

Having described my invention, what I claim as new and desire to secure by Letters Patent is,

1. A surgical brace, comprising opposite uprights transversely pivoted intermediate their lengths, and a back support consisting of a plurality of thin flexible members extending lengthwise of the brace past the pivotal region, at the back thereof, and means rigidly supporting the ends of said members at a distance at the rear of said uprights.

2. A surgical brace, comprising opposite uprights transversely pivoted intermediate their lengths, and a back support consisting of a plurality of link chains extending lengthwise of the brace past the pivotal region, at the back thereof, and means rigidly supporting the ends of said chains at a distance at the rear of said uprights.

3. A surgical brace, comprising opposite uprights transversely pivoted intermediate their lengths, and a back support consisting of a plurality of thin flexible members extending lengthwise of the brace past the pivotal region, at the back thereof, means rigidly supporting the ends of said members at a distance at the rear of said uprights, and adjusting means for independently adjusting the effective lengths of said members.

4. A surgical brace, comprising opposite uprights transversely pivoted intermediate their lengths, and a back support consisting of a plurality of thin flexible members extending lengthwise of the brace past the pivotal region, at the back thereof, means rigidly supporting the ends of said members at a distance at the rear of said uprights, and a plurality of thin flexible cross members spaced apart throughout the lengths of said longitudinal members and secured thereto for maintaining said longitudinal members in proper relative position without interfering with the free flexibility of the entire back support.

5. A surgical brace, comprising opposite uprights transversely pivoted intermediate their lengths, and a back support consisting of a plurality of link chains extending lengthwise of the brace past the pivotal region, at the back thereof, means rigidly supporting the ends of said chains at a distance at the rear of said uprights, and a series of transverse leather strips secured at intervals across said plurality of chains.

6. A surgical brace, comprising opposite uprights transversely pivoted intermediate their lengths, and a back support consisting of a plurality of link chains extending length-

wise of the brace past the pivotal region, at the back thereof, means rigidly supporting the ends of said chains at a distance at the rear of said uprights, and a series of leather strips secured through the links of said plurality of longitudinal chains for binding the same together and maintaining proper position irrespective of the flexing thereof.

7. A surgical brace, comprising opposite uprights transversely pivoted intermediate their lengths, and a back support consisting of a plurality of parallel chains, rigid back bands adjacent the opposite ends of said chains, bracing means securing said back bands immovably to said uprights, said bands being provided with vertical bearings, one for each chain, and a threaded connection from the end of each chain to said bearing for independently adjusting the effective lengths of the chains.

8. A surgical brace, consisting of opposite uprights pivoted intermediate their lengths and provided with securing bands for fastening the same in position on the leg, said uprights consisting of a flat main strip of rigid material, an opposite flat strip of rigid material, and oblique bracing portions extending between said members adjacent the opposite edges thereof for rendering the uprights stiff, light and strong.

9. A surgical brace, consisting of opposite uprights pivoted intermediate their lengths and provided with securing bands for fastening the same in position on the leg, said uprights consisting of opposite metal strips of flat material, one of said strips having successive portions thereof bent downwardly obliquely in opposite directions and rigidly secured to the opposite strip.

10. A surgical brace, consisting of opposite uprights pivoted intermediate their lengths and provided with securing bands for fastening the same in position on the leg, said uprights consisting of opposite metal strips of flat material, one of said strips having successive portions thereof bent downwardly obliquely in opposite directions and rigidly secured to the opposite strip, said portions being located successively at the opposite sides of the strip from which they are bent down.

11. A surgical brace, consisting of opposite uprights pivoted intermediate their lengths, a semicircular back supporting band connecting said uprights adjacent one end at one side of their pivots, a similar back supporting band at the other side of said pivots, a third supporting band on the same side of said uprights as said first two mentioned bands, located adjacent one end of said uprights, flexible longitudinal back supports connecting the adjacent bands at the opposite sides of said pivots, and a rigid support connecting said third band with the adjacent back supporting band.

12. A surgical brace, comprising opposite
uprights, means for securing the same in
position on the leg, said uprights at their
lower ends being provided with sockets, and
5 a stirrup adapted to be mounted in the heel
of the wearer, having upturned ends adapted
to freely telescope within said sockets.

In testimony whereof, I have signed my
name to this specification, in the presence of
two subscribing witnesses.

WILLIAM H. FORD.

Witnesses:

EDITH M. BADGER,
THOMAS J. ENRIGHT.