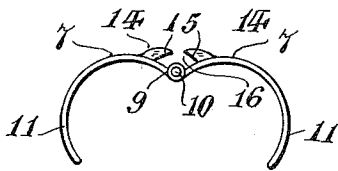
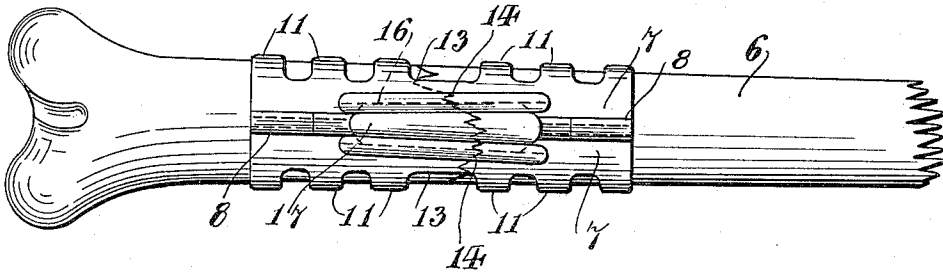


J. X. SMITH.  
 FRACTURE CLAMP.  
 APPLICATION FILED JAN. 29, 1915.

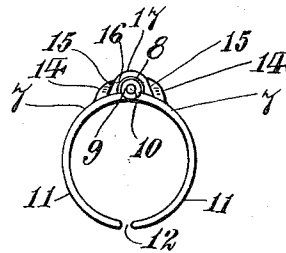
1,156,440.

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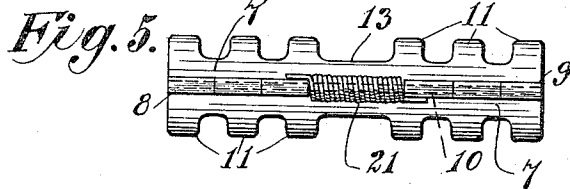
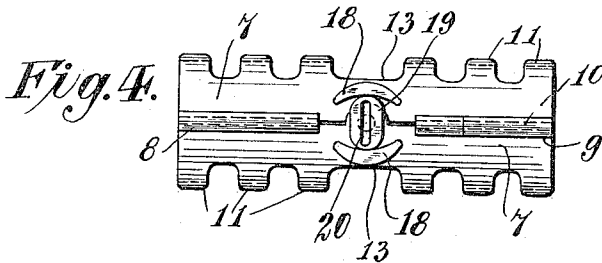
*Fig. 1.*



*Fig. 2.*



*Fig. 3.*



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# UNITED STATES PATENT OFFICE.

JOHN X. SMITH, OF WATERTOWN, NEW YORK.

## FRACTURE-CLAMP.

1,156,440.

Specification of Letters Patent.

Patented Oct. 12, 1915.

Application filed January 29, 1915. Serial No. 4,978.

*To all whom it may concern:*

Be it known that I, JOHN X. SMITH, a citizen of the United States, and resident of Watertown, in the county of Jefferson and State of New York, have invented certain new and useful Improvements in Fracture-Clamps, of which the following is a specification.

My invention relates to a surgical clamp or splice of general application and particularly relates to a bone clamp designed to secure fixation of the bone fragments in case of fractures.

The universal method used at present in bone setting is to splice the fragments to each other by means of an apertured plate through which screws are passed into holes drilled into the parts of the bone on opposite sides of the fracture. This operation requires surgical skill of the highest type and is not possible under all conditions.

Among the objects of my invention are to eliminate numerous obvious objections to the perforating of the bone and to provide a simple form of clamp which will hold the parts of the bone securely against all relative movement without injury to the same and at the same time permit a free circulation to stimulate the production of osseous tissue.

I attain these objects broadly by providing a cylindrical clamp formed of a plurality of spaced apart and hinged rings for encircling and securely gripping the bone on opposite sides of the fracture and providing a means for locking the rings in their set position.

Various other objects and advantages of the invention will be in part obvious from an inspection of the accompanying drawings and in part will be more fully set forth in the following particular description of three forms of mechanism embodying my invention, and the invention also consists in certain new and novel features of construction and combination of parts hereinafter set forth and claimed.

In the accompanying drawings: Figure 1 is a side elevation of a fractured bone showing a preferred embodiment of my invention mounted thereon; Figs. 2 and 3 are end elevations of the clamp of Fig. 1 shown in open and in locked positions; and Figs. 4 and 5

are each side elevations of modified forms of the device shown in Fig. 1.

There is illustrated a fractured bone 6 separated from the soft tissue with one form of my clamp in position thereon to hold the parts in their set position. This clamp compresses a pair of plates 7 pivotally connected along a longitudinal edge of each plate by a simple hinge 8 with the knuckle 9 and pin 10 thereof disposed on the outside of the clamp, so as to leave the interior thereof free of projections. Longitudinally spaced fingers 11 project from the edge of each plate opposite the hinged edge and are curved toward the similar fingers projecting from the other plate to form rings with the free ends thereof slightly spaced apart as shown at 12 in Fig. 3, when the clamp is in closed position.

Any number of rings positioned sufficiently close to retain the bone splinters in proper place may be used and are arranged preferably in sets with an open space 13 therebetween so that the clamp may be positioned with the fracture centered in this open space. The fingers co-act to form a substantially cylindrical and ribbed member for engaging the bone with the hinge and adjacent parts of the plates offset from the bone so as to space the plates, or at least a large portion of the same, away from the bone and thus permit of the free circulation through the periosteum longitudinally of the bone.

The two hinged plates are locked in position about the bone against opening movement which locking is provided in the form illustrated in Fig. 1 by means of a pair of lugs 14 fixed to the outside of each plate and each having an undercut edge 15 co-acting to form a key-way 16 therebetween and parallel to the hinge connection. A key 17 has a sliding fit in the key-way and acts, when in position, to prevent an opening movement of the plates about the hinge pin 10. The key-way gradually decreases in cross-section toward one end and the key is in the form of a wedge bar designed to re-act on the lugs and force the fingers into tight binding engagement with the bone as the key is driven along the key-way toward the smaller end thereof. The resiliency inherent in the fingers enhances the binding engagement of these members with the bone.

An alternate form, particularly designed for use in cases where it would be inconvenient to insert the key lengthwise, is illustrated in Fig. 4. In this form a bearing button 18 is fixed to the outside of one of the plates and laps the hinge connection. A cam 19 is pivotally mounted on the other plate opposite the button and is adapted when rotated in one direction to bear on the underside of the button to force the plates into their bone clamping position. A slot 20 in the head of the cam permits the insertion of a suitable tool, such as a screw driver to tighten the cam into engagement with the button.

Under some circumstances the positive locking feature may be eliminated and the plates held resiliently in closed position as shown in the form illustrated in Fig. 5. In this form a coiled spring 21 is carried by the pivot pin 10 and has opposite ends bearing on the plates to hold the fingers closed around the bone.

The device is preferably made of steel, heavily plated with some metal such as silver, as is usual with surgical instruments of this character.

In operation, an incision, of the least possible extent is made in the fleshy part adjacent the bone, the device being opened is then inserted about the bone. Should the fracture be transverse of the bone the clasp is positioned with the fracture between the sets of fingers, and should the fracture be longitudinal of the bone, the clasp is positioned with the fracture opposite the free space adjacent the hinge connection. Should the fracture extend in both directions the clasp is so arranged that the least possible amount of metal is disposed across a fracture. The clasp is usually inserted in position by means of an instrument designed to close the fingers of the clasp about the bone so as to closely conform to the configuration thereof. The key of Fig. 1 is then driven into position in the key-way or the cam of Fig. 3 rotated thereby to lock the fingers in their bone engaging position encircling each of the parts on opposite sides of the fracture. The incision may then be sutured, dressed and finally the clasp is removed after the bone has reunited.

By means of a device of this character the fragments of the bone are fastened in their set position with little or no possibility of relative shifting. As the bone structure is not drilled the weakening effect of perforating the bone is avoided and the life of the bone is in no way affected. The open spaces allow a free circulation between the parts of the bone and as there is no metal at the fracture, interference with the ossiferous action is minimized.

The circular configuration of the fingers tend to accelerate the circular mending of

the bone tissues and the open space between the ends of the fingers permit the circulation longitudinally of the bone.

Having thus described my invention, I claim:

1. A bone clamp comprising a pair of plates hinged together along longitudinal edges, each of said plates having a plurality of fingers projecting from the edge thereof opposite the hinged edge and curved toward the similar fingers projecting from the other plates thereby to form an inclosing structure, each of said plates having a lug projecting from the outside thereof and co-acting to form a keyway paralleling the hinged edges and a key adapted to be inserted in said key-way thereby to prevent relative opening movement of said plates.
2. A bone clamp comprising a pair of plates hinged together along longitudinal edges, each of said plates having a plurality of fingers projecting from the edge thereof opposite the hinged edge and curved toward the similar fingers projecting from the other plates thereby to form an inclosing structure, each of said plates having a lug projecting from the outside thereof and co-acting to form a wedge shaped key-way paralleling the hinged edges and a key adapted to be inserted in said key-way thereby to force the plates into different clasping position, so as to prevent relative opening movement of said plates.
3. A device of the class described comprising a pair of plates, a hinge connection between adjacent edges of said plates, each plate having a finger projecting from the edge opposite the hinged edge and curved toward the similar finger projecting from the other plate thereby to form a substantially cylindrical clasp with the hinged edges positioned to the outside of the cylindrical outline formed by the fingers so as the hinged part of the device may be spaced from the object clasped by the fingers.
4. A device of the class described comprising a pair of plates, a hinge connection between adjacent edges of said plates, each plate having a finger projecting from the edge opposite the hinged edge and curved toward the similar finger projecting from the other plate, thereby to form a substantially cylindrical clasp with the hinged edges positioned to the outside of the cylindrical outline formed by the fingers so that the hinged part of the device may be spaced from the object clasped by the fingers and means for locking the plates against an opening movement.
5. A bone clasp including a pair of spaced apart ring bands connected together and each band comprising two separate parts adapted partially to encircle the bone on opposite sides of the fracture and leave the fracture free of any contact with the clasp

and means associated with the bands for securely maintaining the same in their bone engaging position.

5 6. A device of the class described comprising a plurality of two part rings having a common hinged connection and a key for locking the parts in position, said rings when in locked position having spaced apart ends to permit free circulation in the bone  
10 structure.

7. A device of the class described comprising a plurality of two part rings, a common hinged connection and means adjacent the connection for locking the parts of each  
15 ring in closed position.

8. A device of the class described comprising a member adapted to be positioned exteriorly of the fractured bone and having a plurality of clamping parts adapted to  
20 encircle or partially encircle the bone fragments, said parts being rigidly connected and a locking device for holding the parts in their bone engaging positions.

9. A device of the class described, com-

prising a plurality of metal bands having 25 free ends and adapted to engage a bone resiliently to hold the parts thereof in position and means connecting said bands intermediate their ends for holding the same rigidly in position relative to each other. 30

10. A device of the class described, comprising a plurality of metal bands having free ends and adapted to engage a bone resiliently to hold the parts thereof in position, and means connecting said bands intermediate their ends for holding the same 35 rigidly in position relative to each other, the free ends of said bands being separable to permit the positioning of the bands about the bone. 40

Signed at New York in the county of New York and State of New York this 25th day of January, A. D., 1915.

JOHN X. SMITH.

Witnesses:

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."