Sheet 1-5 Sheets

I. Stoffel.

Artificial Arm,

No. 45,876. Patented Jan. 10, 1865.

Fig: 1.

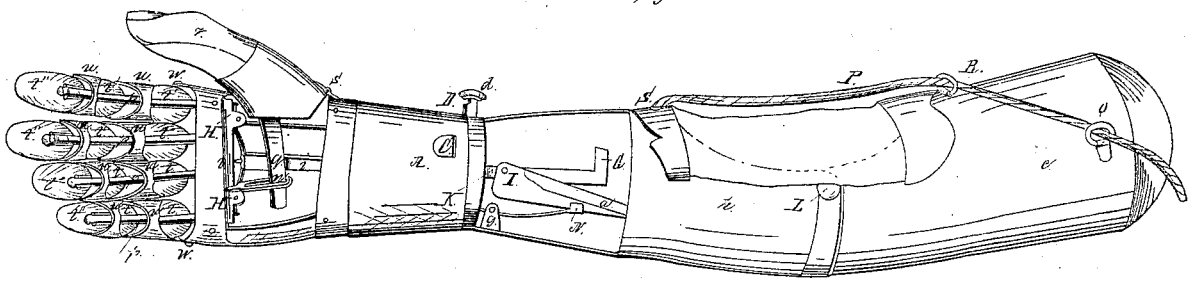
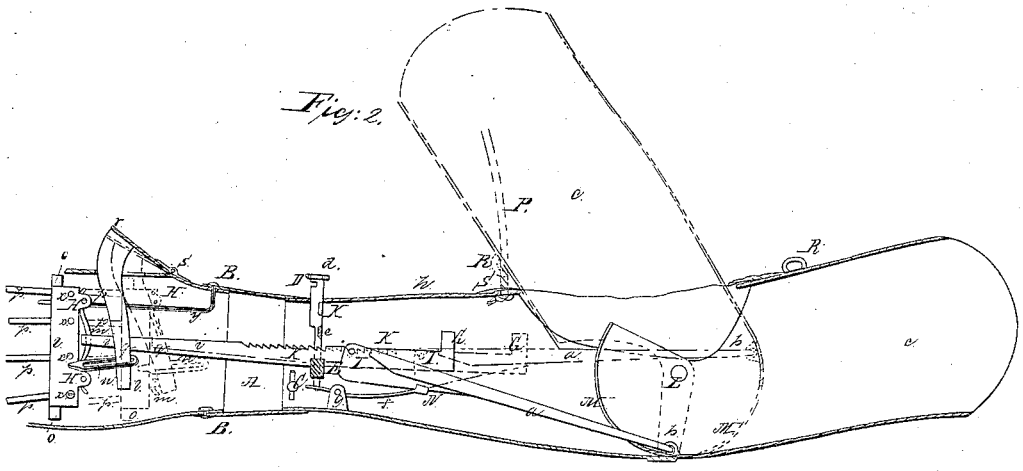


Fig: 2.



Witnesses:

W. O. Kammerhieber

Peter Kerbrechen

Inventor:

Ignatius Stoffel

Sheet 2 - 5 Sheets.

I. Stoffel,

Artificial Arm,

No. 45,876. Patented Jan. 10, 1865.

Fig: 3.

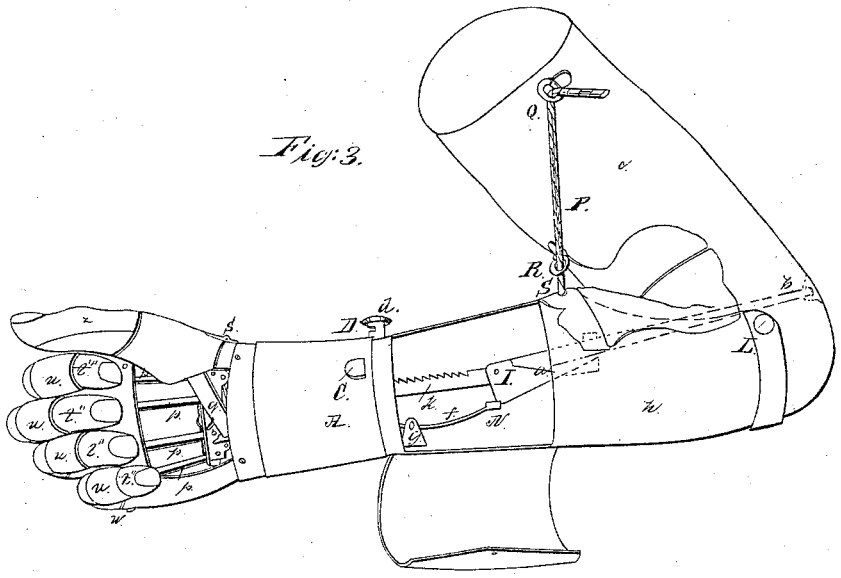
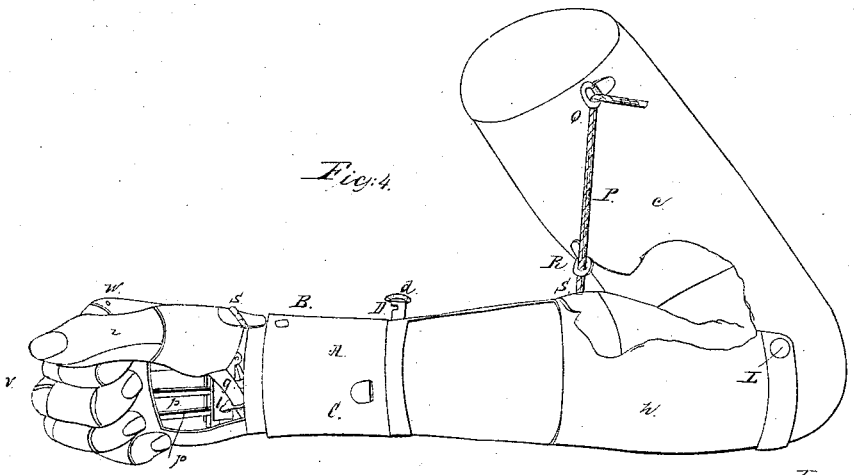


Fig: 4.



Witnesses:
W. v. Kammerhueber
Peter Freibuchen

Inventor:
Ignatius Stoffel

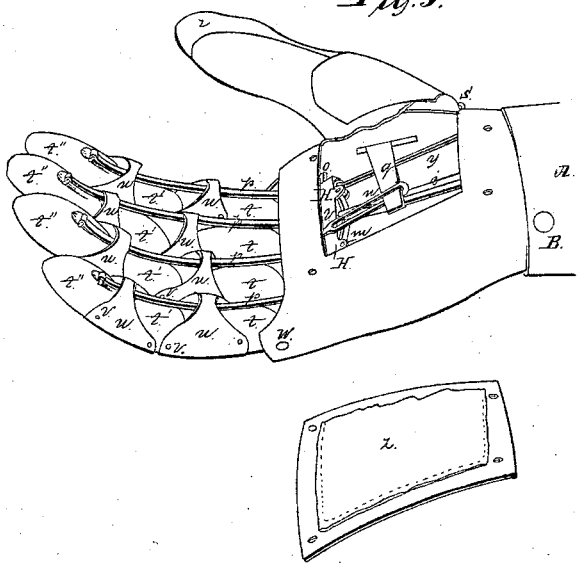
Sheet 3 - 5 Sheets.

I. Stoffel,

Artificial Arm,

No. 45,876. Patented Jan. 10, 1865.

Fig: 5.



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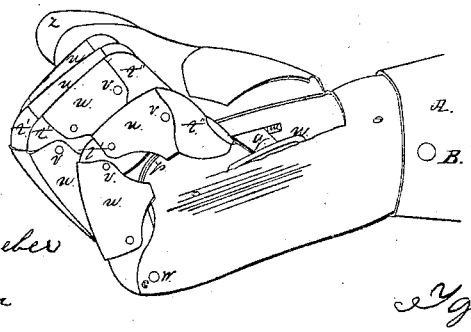


Witnesses:

H. v. Kammerhueber

Peter Kierbuchen

Inventor

Ignatius Stoffel

Sheet 4 - 5 Sheets.

I. Stoffel,

Artificial Arm,

No. 45,876. Patented Jan. 10, 1865.

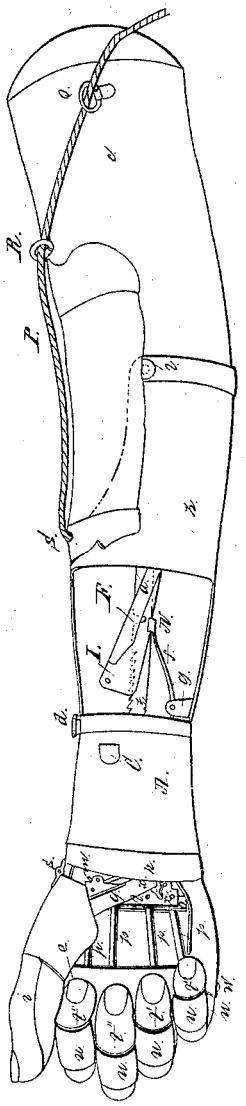


Fig. 1.

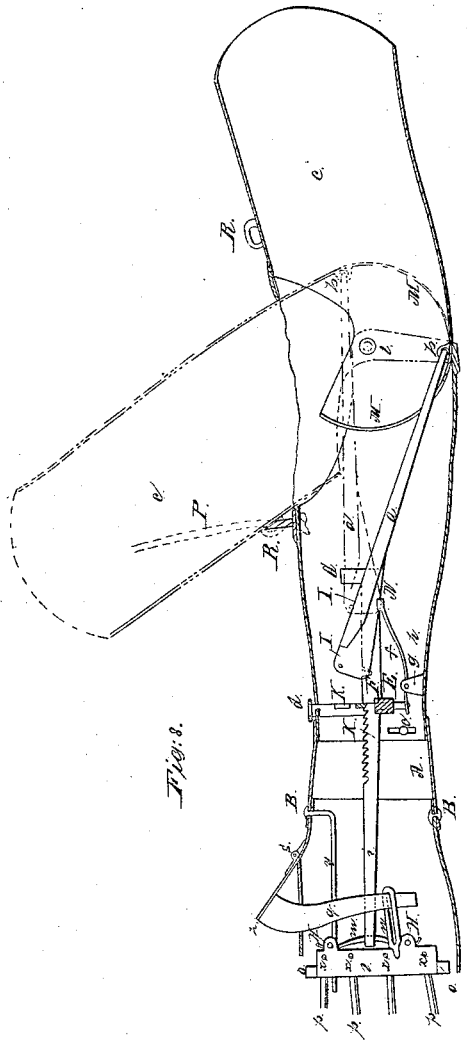


Fig. 2.

Witnesses:

W. v. Kammerhueber.

Peter Reinbuchen

Inventor:

Ignatius Stoffel

Sheet 5-5 Sheets.

I. Stoffel,

Artificial Arm,

No. 45,876. Patented Jan. 10, 1865.

Fig: 11.

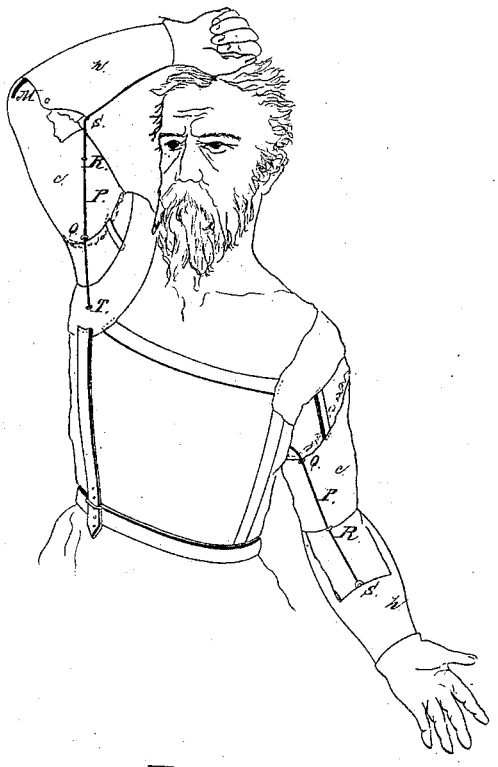


Fig: 12.

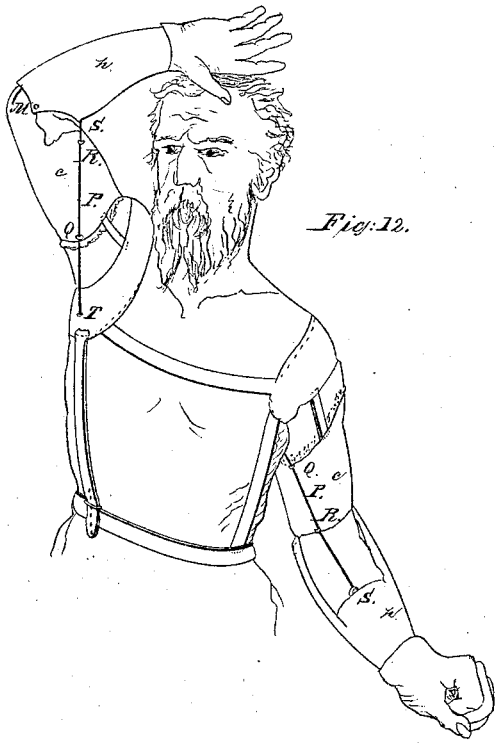


Fig: 9.

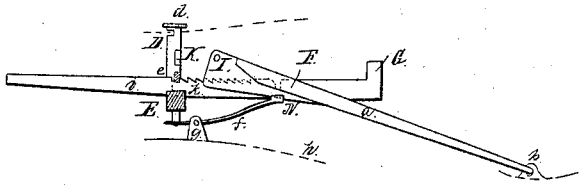
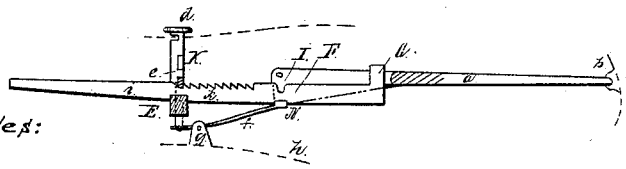


Fig: 10.



Witnesses:

W. v. Kammerhuber
Peter Fesbender

Inventor:

Ignatius Stoffel

UNITED STATES PATENT OFFICE.

IGNATIUS STOFFEL, OF WASHINGTON, DISTRICT OF COLUMBIA.

IMPROVEMENT IN ARTIFICIAL ARMS.

Specification forming part of Letters Patent No. **45,876**, dated January 10, 1865.

To all whom it may concern:

Be it known that I, IGNATIUS STOFFEL, of Washington, in the District of Columbia, have invented a new and useful Improvement in Constructing Artificial Arms and Hands; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the annexed drawings, making part of this specification, in which—

Figure 1 is a perspective view showing the arm and hand extended. Fig. 2 is a section showing the position of the different mechanical parts—first, by black lines, the arm and hand being extended; secondly, by red lines, the arm being bent and hand closed, as shown in Fig. 3, which represents a perspective view of the arm bent and hand closed. Fig. 4 represents the arm in the same position as shown in Fig. 3, the hand being only turned inward around the wrist-joint. Fig. 5 is a side view of the hand when open; and Fig. 6 is a similar view of the hand when closed, explaining more fully the movements of the different parts. Fig. 7 is a perspective view showing the arm extended and hand closed. Fig. 8 is a section showing the position of the different mechanical parts—first, by black lines when the arm is extended and the hand closed; secondly, by red lines when the arm is bent and the hand opened. Figs. 9 and 10 are to explain the operation of the ratchet-bar, catch, and trigging-spring. Figs. 11 and 12 are to explain the manner of attaching the artificial arm or arms to the body, the manner of transmitting motion to the different mechanical parts of the arm and hand, and the different motions which can be performed by my artificial arm and hand.

Similiar letters of reference in each of the several figures indicate corresponding parts.

This invention relates to certain new and important improvements whereby artificial arms and hands may be attached to the stumps of the upper arm, (humerus,) and whereby motion may be transmitted to the different parts of the same by certain movements of the stump; and it consists, first, in the peculiar construction of the fork-lever *a*, pivoted to the curved part, representing the elbow at *b*, leaving the whole space of the metallic tube *c*, representing the upper arm, for the reception of the stump; second, in the peculiar construction of the trigger *d* with the catch *e* and trigger-spring *f*, pivoted at *g* to the artificial forearm *h*, by which arrangement the fork-lever may be detached from the rod *i* and the hand kept closed independent from the movement of the arm or stump; third, in the construction of the rod *i* and ratchet-bar *k*, connected with the stirrup *l* by the spring *m*, securing to the artificial arm the elasticity of the cartilages of the natural arm; fourth, in the peculiar construction of stirrup *l* with guide *n* and elastic projections *o o*, receiving the lower ends of springs *p p p p* and thumb-lever *q*, by which arrangement the movements will be performed noiselessly, and the removal of one or all of the springs *p p p p* for the purpose of repair will be greatly facilitated; fifth, in the peculiar construction of the fingers representing the phalanxes by wooden blocks joined by metallic articulations and operated by the springs *p p p p*, avoiding all levers, cat-gut, or strings; sixth, in the arrangement and peculiar construction of the thumb *r* with thumb-lever *q*, swinging around joint *s*; seventh, in the construction of the wrist-joint; eighth, in covering the palm of the hand and the inner surface of the thumb with an elastic substance, such as india-rubber, buckskin, or equivalent; ninth, in the manner of transmitting the motions of the stump of the upper arm to the different parts of the artificial arm.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation.

The motions of the limbs which take place in obedience to the commands of the will are executed by muscles connected in certain masses and united to tendons, which are fixed to the bones. They constitute the voluntary muscles. The muscles are capable of contracting and thereby performing most of the animal motions. Some motions are not executed by muscles, but by the elasticity of the cartilages, which may restore it after it has been moved out of its natural state.

According to the preceding views, I represent the four tendons of the "flexor profundus" by the elastic metallic bands or steel springs *p p p p*, fastened at their upper ends to the last phalanxes *t'' t'' t'' t''*, by hinge-joints or their equivalent, and at their lower ends to the stirrup *l* by means of the screws *x x x x*. This stirrup *l* consists of a metallic case of

the shape shown on the drawings, inclosing two india-rubber bands projecting on both sides at *o o*, which india-rubber bands separate the springs *p p p p* from the metallic case of stirrup *l*, permitting a change of their inclination to each other without causing noise or friction. The projecting portions *o o* of the india-rubber will prevent any friction or noise in case the stirrup *l* should come in contact with the metallic case forming the palmar region of the hand. The stirrup *l* is guided by the rod *y* in its forward and backward movements.

The phalanxes are made of wood, and hollow if required, and one end of them will be hemispherical, the last phalanxes to be shaped like the fingers' ends, and receive in small cavities the upper ends of the springs *p*. The phalanxes *t t t t* and *t' t' t' t'* and the springs *p p p p* are inclosed by the metallic guides *u u u u*, receiving the pins *v v v v*, which pass through the center of the hemispherical part of the phalanxes *t' t' t' t'* and *t'' t'' t'' t''*. Through the center of the hemisphere of the phalanxes *t t t t* passes an axis, *w*, connecting the four fingers with the metallic casing representing the palmar region of the hand, to which, at the proper place, is hinged the thumb *r* with the hinge-joint *s*. That part of the thumb which will rest upon the forefinger when the hand is closed is to be covered with india-rubber or buckskin, to give an elastic pressure and thereby to facilitate the holding of small or thin objects. The lower part of the thumb is provided with the thumb-lever *q*, passing through the eye of guide *n* on the stirrup *l*.

The palm of the hand is formed by a metallic plate, *z*, covered with buckskin to receive the pressure of the finger ends or of the object taken hold of, and screwed to the metallic casing mentioned above. Thus it may easily be removed to inspect or repair the mechanism.

By moving the stirrup backward—viz., toward the elbow—the fingers will be contracted and the thumb, by the action of the thumb-lever *q* and guide *n*, pressed against the forefinger, the eye of guide *n* being of such length as to allow the fingers to bend to a certain extent before the thumb is moved. By moving the stirrup forward—viz., toward the fingers—these will be extended and the thumb drawn outward.

The lower part of the metallic hand-casing is properly curved and pivoted to the metallic socket A by the pivots B B, to allow a limited in and outward movement of the hand. The socket A incloses the fore end of the metallic tube *h*, representing the forearm, and is secured to that tube by the pins C C, running in two slits, allowing to turn the socket and with it the hand around the axis of the forearm.

The lower part of the stirrup *l* is provided with two pins, H H, which serve as rests for the strong spring *m*, to which the rod *i* and ratched bar *k* are attached, both being guided in their fore and backward movement by the cross-bar E, secured to tube *h*.

It will be seen that by pulling the bar *k* and rod *i* backward, the force used will be transmitted to the stirrup *l* by means of spring *m*, regulating thereby the pressure, and representing the elasticity of the cartilages of the natural arm.

The rod *i* is provided with a notch, F, at a certain distance from, and with a hook, G, at the end. This notch F is to receive the pin I of the fork-lever *a*, constructed as represented in the drawings, and pivoted to the hollow curved end of the upper arm, representing the elbow. The metallic tube *c* is pivoted to the tube *h* at L L, the center of curvature, and at the end of this curvature is a slit, M, for the passage of the fork-lever *a*.

All parts of the described mechanism are constructed of such proper dimensions that when the arm will be extended the hand will be opened and the pin I of fork-lever *a* will rest in the notch F of rod *i*.

From the foregoing it will be easily perceived that by bending the arm—viz., by turning the forearm around the pivots L L—the point *b*, carrying the end of the fork-lever *a*, will be drawn backward, as shown in Fig. 2 by the red lines, and the pin I of the fork-lever *a*, resting in the notch F of rod *i*, will therefore transmit this motion to the stirrup *l*, whereby the fingers of the hand will be closed. By extending the arm the point *b* will be moved forward, and this movement will be transmitted by means of pin I to the rod *i* and stirrup *l*, whereby the fingers of the hand will be opened.

Near to the socket A is placed the trigger *d*, with the catch *e*, guided by the cross-bar E, and connected at the lower end with the trigger-spring *f*, which is itself pivoted to the tube *h* at *g*. The trigger *d* is provided with a notch, D, and a pin or projection, K. The latter is to serve as a stop by drawing the trigger outward. The former will keep the trigger in its position when pulled inward. It will be seen that by pulling the trigger inward the end N of spring *f* will be pressed upward, and thereby lifting the pin I of the fork-lever out of the notch F. Then the arm may be freely bent without moving the fingers of the hand, because the fork-lever slides over the rod *i*, as fully explained by Fig. 8; but when the trigger is pulled inward while the arm is bent the catch *e* will take hold of the ratchet-bar *k*, fixed to rod *i*, and the end N of spring *f* will be pressed upward, thereby lifting the pin I of the fork-lever out of the notch F, as in the former case. Then the arm may be freely moved in any way without opening the hand or otherwise changing the position of the fingers. Therefore, when the trigger is drawn out, the hand will be open, while the arm is stretched, and will be more or less closed by bending the arm and reversed. When the trigger is pulled inward while the arm is stretched, the hand

will remain open by bending the arm to any extent; but when the trigger is pulled inward while the arm is bent, the hand will remain more or less closed and the arm can be moved freely.

The spring P (shown in blue lines on several of the figures) passes through the rings Q and R, fixed to the tube *c*, and is fastened with one end to the tube *h* at S, and with the other end to a proper point, T, (Figs. 11 and 12,) of the bandage, securing the artificial arm to the stump and body. By this arrangement the arm will be bent more or less by corresponding movements of the stump, increasing the distance between the pivots L L of the fore and upper arm and the fastening-point T of the string to the bandage.

Having thus fully described the construction and operation of my invention, I will now state what I claim as new and desire to secure by Letters Patent:

1. The peculiar construction of my artificial hand and wrist joint, the palmar region of which is represented by a hollow metallic case with an elastic palm, the phalanxes *t t t t*, *t' t' t' t'*, and *t'' t'' t'' t''*, operated by the springs *p p p p*, representing the four tendons of the flexor profundus, and articulated by the guide-rings *u u u u*, representing the tendinous bands at the corresponding places of the natural hand, also the hinged thumb and the thumb-lever *q*, representing the "flexor brevis pollicis," in combination with the stirrup *l* and the spring *m*, by which arrangement the elasticity of the cartilages of the natural hand is secured, as described within.

2. The peculiar construction of rod *i* and ratchet-bar *k*, in combination with the fork-lever *a*, fastened to the elbow, and the construction and arrangement of the trigger *d* with catch *e* and trigger-spring *f*, as specified, and for the purpose set forth.

3. The arrangement of the rings R and Q, guiding the string P, as described within.

IGNATIUS STOFFEL.

Witnesses:
W. I. KAMMERHUEBER,
PETER VIERBERCHEN.