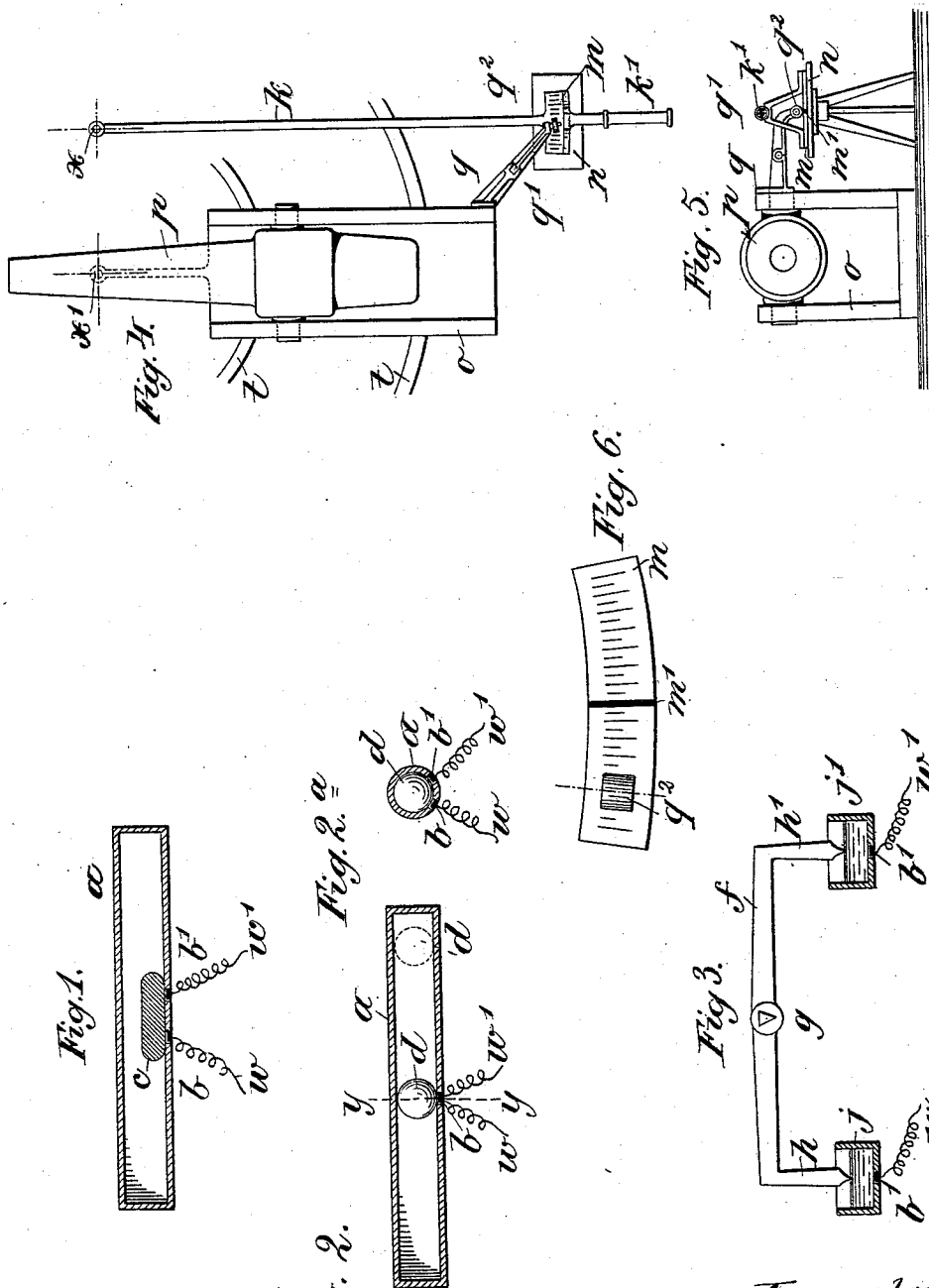


L. MAUTNER v. MARKHOF.
APPLIANCE FOR SIGHTING GUNS.

No. 470,942.

Patented Mar. 15, 1892.



Witnesses
Ella S. Johnson
B. W. Sommers

Inventor
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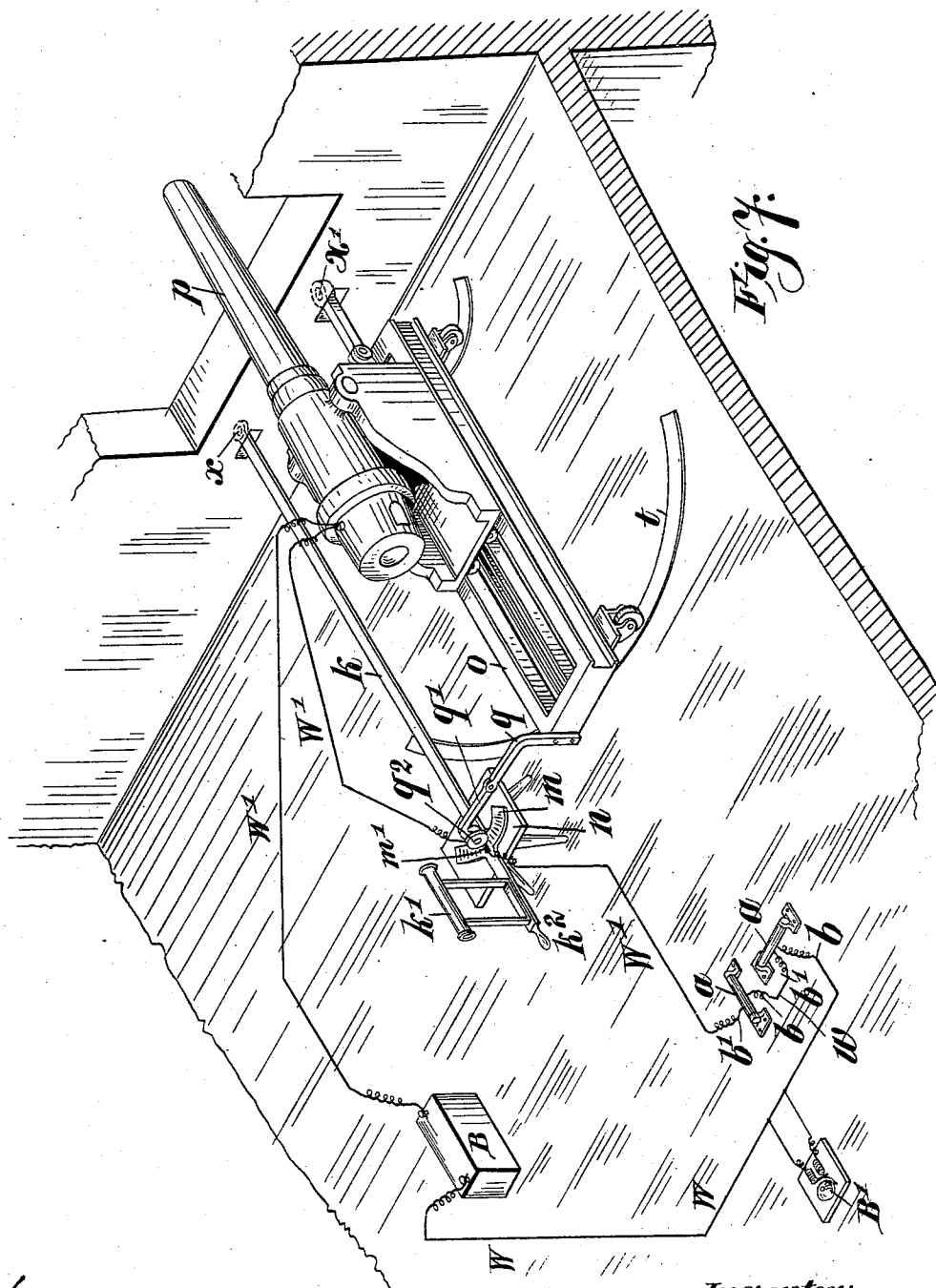
(No Model.)

2 Sheets—Sheet 2.

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By Henry M. M. Atty.

UNITED STATES PATENT OFFICE.

LUDWIG MAUTNER VON MARKHOF, OF VIENNA, AUSTRIA-HUNGARY.

APPLIANCE FOR SIGHTING GUNS.

SPECIFICATION forming part of Letters Patent No. 470,942, dated March 15, 1892.

Application filed November 6, 1890. Serial No. 370,505. (No model.) Patented in Germany October 5, 1889, No. 53,135; in France October 28, 1889, No. 201,577; in Belgium October 28, 1889, No. 88,223; in Italy December 31, 1889, XXIII, 26,400, and LII, 30, and in Austria-Hungary January 31, 1890, No. 42,758 and No. 67,032.

To all whom it may concern:

Be it known that I, LUDWIG MAUTNER VON MARKHOF, a subject of the Emperor of Austria, and a resident of Vienna, in the Province of Lower Austria, in the Empire of Austria-Hungary, have invented certain new and useful Improvements in Appliances for Sighting Guns, (for which I have obtained Letters Patent in Austria-Hungary, No. 42,758 and No. 67,032, dated January 31, 1890; in Germany, No. 53,135, dated October 5, 1889; in France, No. 201,577, dated October 28, 1889; in Belgium, No. 88,223, dated October 28, 1889, and in Italy, No. 26,400, Vol. XXIII, and No. 30, Vol. LII, dated December 31, 1889;) and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

In sighting guns two adjustments are required—namely, in the vertical and horizontal axial planes of the gun tube or barrel—as is well known; and my invention has for its object to provide appliances for the lateral adjustment that have no fixed relation to the gun and are operated independently thereof and may therefore be located above or below or beside the gun.

The further object of my invention is to avail myself of these appliances for the purpose of automatically firing the gun or for the purpose of giving a signal, preferably audible, which to the gunner will be equivalent to the command "fire."

The further object of my invention is to provide appliances whereby upon the vertical adjustment of the gun it will either be automatically fired or a signal given to the gunner which shall be the equivalent for the command "fire."

Finally, my invention has for its object to so combine these appliances as that the gun will not be fired or the signal given, as the case may be, until both adjustments are effected.

The appliances for the lateral adjustment of the gun may consist of a telescope arranged above, below, or by the side of the gun, or of a tube without lenses, or of a dioptric or other sights of usual form, and to this sighting device is rigidly connected a segment-scale whose central or zero graduation is in the plane of the axis of rotation of the lateral adjustment of the sighting device. The segment-scale is constructed of a non-conducting material—such as ebonite or vulcanite—and is provided with a metallic index. The segment-scale rests upon a normally-horizontal table, and an arm secured to the gun or its carriage carries a contact-roller that rests upon the scale. The index which constitutes the other contact is adjustable on the segment-scale according to the lateral deviation of the projectile for a given firing distance.

In firing upon a moving target account must also be taken in the adjustment of the index of the angle of the sight-line relatively to the target during the flight of the projectile, and this angle may be readily obtained or found by causing the sighting device to follow the movement of the target for a period of time equal to the known time of flight of the projectile. If now the gun is adjusted laterally on its vertical axis of rotation and the contact-roller comes in contact with the index on the segment-scale, the gun will be properly sighted, and at the same time an electric circuit will be closed and the gun fired or the signal for firing given.

The appliances for giving the proper elevation of the gun are intended for guns whose support is liable to motion, such as ships' guns, and the elevation is given them under the assumption that the carriage rests upon a horizontal support or on a support having a definite inclination, and when such support rocks it is the duty of the gunner who sights the gun to fire the same at the moment when the sight-line passes through the target, or, in other words, when the axis of the gun-barrel is in a horizontal plane.

By means of the appliances which form the subject-matter of this part of my invention

the moment of firing—that is to say, the moment when the sight-line passes through the target or is in a horizontal plane—is automatically determined and the gun fired or the signal for firing the gun automatically given. These appliances consist, essentially, of two independently-movable contacts, the movements of both being controlled by those of their support—namely, the ship. These contacts are so arranged relatively to each other as to come in contact when their planes coincide—as, for instance, when both are in a horizontal plane—whether momentarily only or for a longer or shorter period of time, and thereby close an electric circuit, whereby the gun is fired or the signal for firing is given.

Inasmuch as a true horizontal position has to be fully determined when appliances of the nature referred to are employed, I employ two sets of such contacts arranged at an angle to each other, for instance as is the case with ordinary leveling devices, in which two spirit-levels in different planes—*i. e.*, at an angle to each other—are used for leveling, and these sets of contacts are circuited in series, so that the circuit will not be closed unless the supports for both sets of contacts are in a horizontal position. This part of my invention may be carried out in various ways. For instance, appliances operating on the principle of the spirit-level may be employed. In this case a tube of non-conducting material provided at its longitudinal center with two metallic contact buttons or anvils and containing a globule of mercury may be combined with a similar tube arranged in a different plane, and instead of a globule of mercury a metallic sphere may be employed. The same results may be obtained by means of two mercury-cups and a balance-beam suspended on knife-edge bearings in gimbals combined with like appliances whose balance-beam lies in a different plane, the beams having arms of equal length, both dipping into the mercury of their cups whenever the cups and beams are in a true horizontal position. Finally, two pendulums vibrating in different planes and adapted to come in contact with anvils or buttons whenever their vertical axial planes are in coincidence or a pendulum having universal vibration—*i. e.*, adapted to vibrate in all directions—and a single contact-button may be used, as will be readily understood.

To provide for long-continued rolling or keeling of the ship, the contact devices are arranged upon a plate adapted to revolve on an axis parallel with the longitudinal axis of the ship and provided with means for adjusting the same, so as to compensate for as well as indicate the heeling-angle, in order that the angle of inclination of the gun may be increased or decreased in proportion to said heeling-angle.

When the appliances for lateral and vertical adjustment are combined for co-operation, the contacts must be circuited in series, so that the circuit will not be closed unless

or until contact takes place in all the elements of the appliances.

That my invention may be fully understood, I will describe the same in detail, reference being had to the accompanying drawings, in which—

Figure 1 shows in longitudinal section a construction and arrangement of movable contact based upon the principle of the spirit-level. Fig. 2 is a like view in which one of the contacts consists of a sphere. Fig. 2^a is a section taken on line *y y* of Fig. 2. Fig. 3 is a sectional elevation showing a beam-contact combined with mercury-cups. Fig. 4 is a top plan view of a ship's gun and the appliances for lateral adjustment. Fig. 5 is a rear elevation thereof, and Fig. 6 is a top view of the segment-scale. Fig. 7 is a perspective view illustrating the electrical and the sighting appliances combined with a ship's gun.

Similar letters of reference indicate like parts wherever such may occur in the drawings just described.

Referring more particularly to Figs. 4, 5, and 7, *o* indicates the gun-carriage; *t*, the track for the same; *p*, the gun, and *a'* the horizontal axis of rotation about which the gun moves.

To the carriage *o* is secured an arm *q*, in whose outer end is mounted a contact-roller *q'*, that is adapted to travel over a segmental scale *m*, constructed of a non-conducting material, such as ebonite or vulcanite, and *m'* is a metallic index adjustable on the scale in any desired manner. The object of the scale is to admit of the lateral adjustment of the sighting device relatively to the target, especially if the latter is in motion—as, for instance, a ship—so that the gun may be trained accordingly. To this end the segment-scale is provided with distance as well as angle graduations and rests upon a table *n*, that should necessarily be parallel with the plane of motion of the sighting device. The scale is secured to or forms part of a rod *k*, pivoted at its outer end *x* and having at its inner end a handle portion *k'*, that supports the sighting device—as, for instance, a telescope *k'*, though any other sighting device may be used. The adjustable metallic contact *m'* and the gun, if the latter is to be fired automatically, are inclosed in the electric circuit of a suitable battery B, in which circuit are also included one or more auxiliary circuit-closers, employed to automatically close said circuit, and a signal-bell B' for use when the gun is not to be fired automatically for the purpose of giving the signal to fire or for simply signaling the closure of the electric circuit. The auxiliary circuit-closers for automatically closing the electric circuit must be so constructed as to close said circuit when the gun-support lies in a horizontal plane in order to insure accurate firing, and this may be accomplished in various ways.

In Figs. 1, 2, and 2^a I have shown circuit-closing devices operating on the principle of

the spirit-level. The tube a that contains the moving contact has on opposite sides of its longitudinal center two fixed contacts b and b' , the movable contact being either a globule of mercury c , as shown in Fig. 1, or a metallic sphere d , as shown in Figs. 2 and 2^a, of such dimensions as to have bearing on both the fixed contacts b and b' when the tube a lies in a horizontal plane. The same result may also be attained by a balance-beam f , whose ends are bent downwardly and form contacts that oscillate about the knife-edge bearings of the beam and dip into cups j and j' , that contain mercury, said cups having the fixed contacts b and b' , respectively. The arrangement is such that when the beam lies in a horizontal plane both arms h and h' are in contact with the mercury in the cups, and so close the electric circuit through the beam.

I have hereinbefore stated that for the vertical adjustment of the gun it is necessary that a true horizontal plane should be determined for the contact devices and that for this purpose either two tubes a or two balance-beams f and their mercury-cups are employed and arranged at right angles to each other, as shown in Fig. 7, and in order that the electric circuit may be closed when both tubes are in a horizontal plane the fixed contacts thereof must be connected in series. Thus, for instance, the fixed contact b of one tube may be connected by a wire w with the fixed contact b' of the second tube a , the other fixed contacts b and b' of the two tubes being connected with the circuit-wires W and W' , the former including the signal-bell B' and the latter the adjustable index m' of the graduated scale m and the gun, as shown in Fig. 1; but instead of the contacts described and shown in Figs. 1 to 3 a pendulum or a pair of such arranged to vibrate at right angles may be employed in conjunction with fixed contacts or a universal pendulum—that is to say, a pendulum vibrating on a universal joint may be used in conjunction with suitable contacts.

In practice the circuit-closing devices are preferably mounted upon a table provided with the usual leveling devices, so that a normal firing-level may be determined upon in case of a protracted keeling of the ship, said contact-supporting table being arranged to revolve or to be adjusted on an axis parallel with the longitudinal axis of the ship and is combined with a segment-scale indicating the angular positions of the table relatively to the normal horizontal plane of the ship. These appliances I have deemed unnecessary to illustrate, as they are well known and commonly used in leveling-instruments. When the ship is in a position of equilibrium in quiet water, the contact-support will be horizontal and its index at the zero graduation of its segment-scale. If the ship begins to heel, the support will assume the same relative position and is then adjusted to a horizontal position by means of the leveling devices, the

scale indicating the angle or inclination of the ship to a normal horizontal, and the gun is trained accordingly by increasing or decreasing its vertical sighting-angle relatively to the heeling-angle, according as the side of the ship on which the gun is located is in an elevated or depressed position, and in this case the contacts for all the guns on board are preferably mounted on the same support for obvious reasons.

The operation of the sighting devices may be briefly described as follows: When both gun and target are stationary and the gun has been properly trained vertically, the target is sighted and the contact m' adjusted according to the line of sight. The gun is now trained laterally on its support until the contact-roller q^2 contacts with the index m' , when the electric circuit will be closed and the signal to fire given or the gun fired—that is to say, the electric circuit is closed when the gun and telescope are in parallelism. When the target or the gun is in motion, the target is sighted, the contact-index m' is adjusted according to the distance of the target from the gun and according to the lead of the gun relatively to the time of flight of the projectile, the operator following or keeping the target in sight until the contact-roller q^2 contacts with the index m' or by moving the gun laterally to effect this contact, according as the sighting devices move toward or from the gun.

The described appliances for closing the electric circuit may be modified, in that the arm $q q'$ may be connected with the sighting devices and the segment-scale with the gun. The arm $q q'$ is constructed of two parts hinged together, so as to admit of vertical training of the gun when said arm is secured to the sighting devices and the scale to the gun. Whether the arm is connected to the sighting devices or to the gun-carriage, I prefer to construct it as described, so that it may be turned up out of the way of the segment-scale. Of course if the gun is not to be fired automatically the roller q^2 will be directly connected with the one of the poles of the battery B instead of being connected with the gun, as shown in Fig. 1.

Having thus described my invention, what I claim is—

1. The combination, with a gun carried by an oscillating support, of sighting devices comprising an adjustable sight independent of the gun, a non-conductive scale connected with the sight, a conductive index adjustable on the scale, a contact connected with the gun and adapted to move over the scale, and a normally-interrupted electric firing or alarm circuit, including said index and contact, for the purposes set forth.

2. The combination, with a gun carried by an oscillating support, sighting devices comprising an adjustable sight independent of the gun, a non-conductive scale connected with the sight, a conductive index adjustable

on the scale, and a contact connected with the gun and adapted to move over the scale, of a normally-interrupted electric firing or alarm circuit including said index and contact, independent contacts in said circuit having motion with the oscillating support for the gun, and a movable circuit-closer, the movements of which are controlled by those of the gun-support, for the purpose set forth.

3. The combination, with a gun carried by an oscillating support, sighting devices comprising an adjustable sight independent of the gun, a non-conductive scale connected with the sight, a conductive index adjustable on the scale, and a contact connected with the gun and adapted to move over the scale, of a normally-interrupted electric firing or alarm circuit including said index and contact, independent contacts included in series in said circuit and having motion with the oscillating support for the gun, and a circuit-closer for each set of contacts, having free motion in different planes, for the purposes set forth.

4. The combination, with a ship's gun and a normally-interrupted electric firing or alarm circuit, of means for automatically closing said electric circuit when the ship assumes a given position, consisting of electric contacts included in said circuit, a support therefor connected with and adjustable relatively to the ship's axis, and a circuit-closer having free motion relatively to the contacts, said motion being controlled by that of the ship, as set forth.

5. The combination, with a ship's gun and a normally-interrupted electric firing or alarm circuit, of means for automatically closing said circuit when the ship assumes a given position, consisting of a plurality of sets of electric contacts included in series in the circuit, a support common to said contacts and adjustable relatively to the ship's axis, and a circuit-closer for each set of contacts, said circuit-closers having free motion in different planes relatively to their respective contacts, said free motion being controlled by the motion of the ship, as set forth.

6. The combination, with a ship's gun, a gun-sight independent thereof, a non-conductive scale connected with the sight, a conductive index adjustable on the scale, a contact movable over said scale and controlled by the motion of the gun, and a normally-interrupted electric firing or alarm circuit includ-

ing the index and contact, of means for controlling the closure of the circuit by the movement of the ship, comprising independent contacts in said circuit, a support for said contacts connected with and adjustable relatively to the ship's axis, and a circuit-closer having free motion relatively to the contacts, said motion being controlled by that of the ship, as set forth.

7. The combination, with a ship's gun, a gun-sight independent thereof, a non-conductive scale connected with the sight, a conductive index adjustable on the scale, a contact movable over said scale and controlled by the motion of the gun, and a normally-interrupted electric firing or alarm circuit including the index and contact, of means for controlling the closure of the circuit by the movements of the ship, consisting of two sets of contacts included in series in the electric circuit, a support for said contacts connected with and adjustable about an axis parallel with the longitudinal axis of the ship, and circuit-closers having free motion relatively to their respective contacts in planes at right angles to each other, said motion being controlled by that of the ship, as set forth.

8. The combination, with a ship's gun, of two tubes of non-conducting material *a*, arranged at an angle to each other, two metallic contacts *b b'*, arranged on opposite sides of the longitudinal center of the tube, and a loose rolling contact contained in said tubes, a support for the latter, and an electric firing or alarm circuit in which the contacts *b b'* of the two tubes are included in series, substantially as and for the purpose set forth.

9. The combination, with a ship's gun, of two tubes of non-conducting material *a*, arranged at an angle to each other, two metallic contacts *b b'*, arranged on opposite sides of the longitudinal center of the tube, and a loose rolling contact contained in said tubes, a support for the latter adjustable about an axis parallel with the longitudinal axis of the gun, and an electric firing or alarm circuit in which the contacts *b b'* of the two tubes are included in series, substantially as and for the purpose set forth.

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

L. MAUTNER VON MARKHOF.

Witnesses:

NETTIE S. HARRIS,

W. B. MURPHY.