No. 827,916. PATENTED AUG. 7, 1906.

I. KITSEE.

SUBMARINE TELEGRAPHY.

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Fig. 1

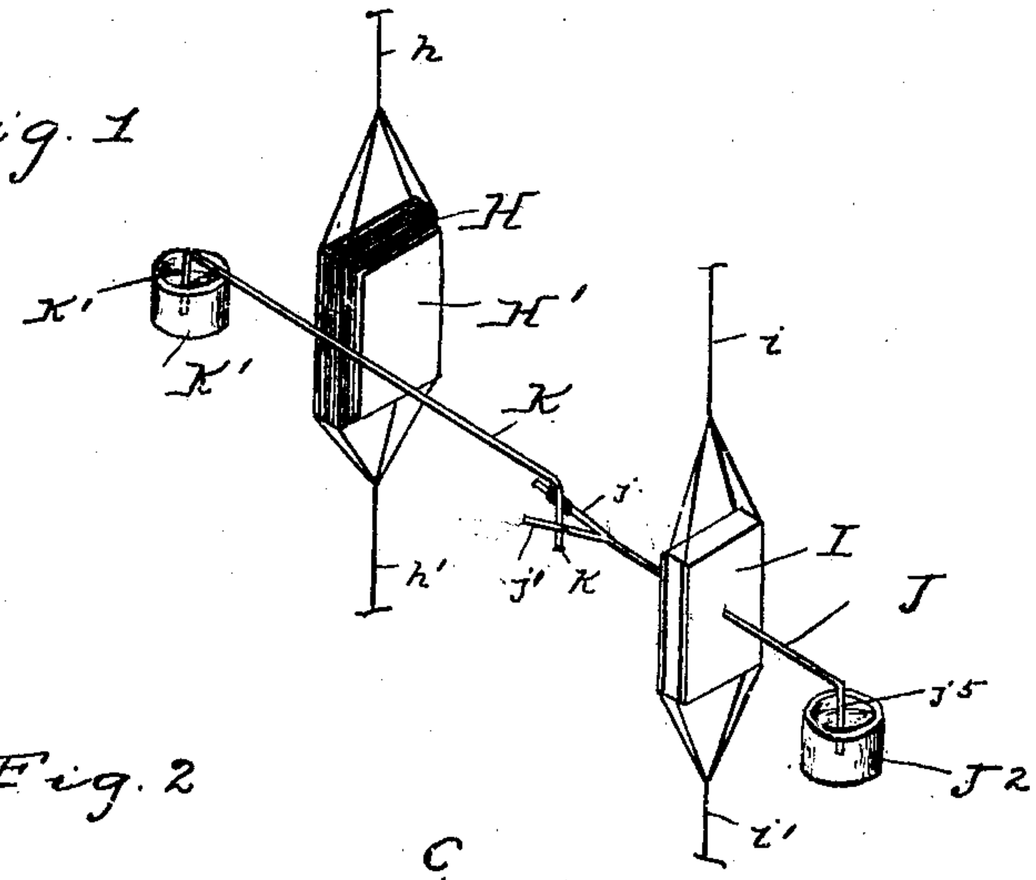
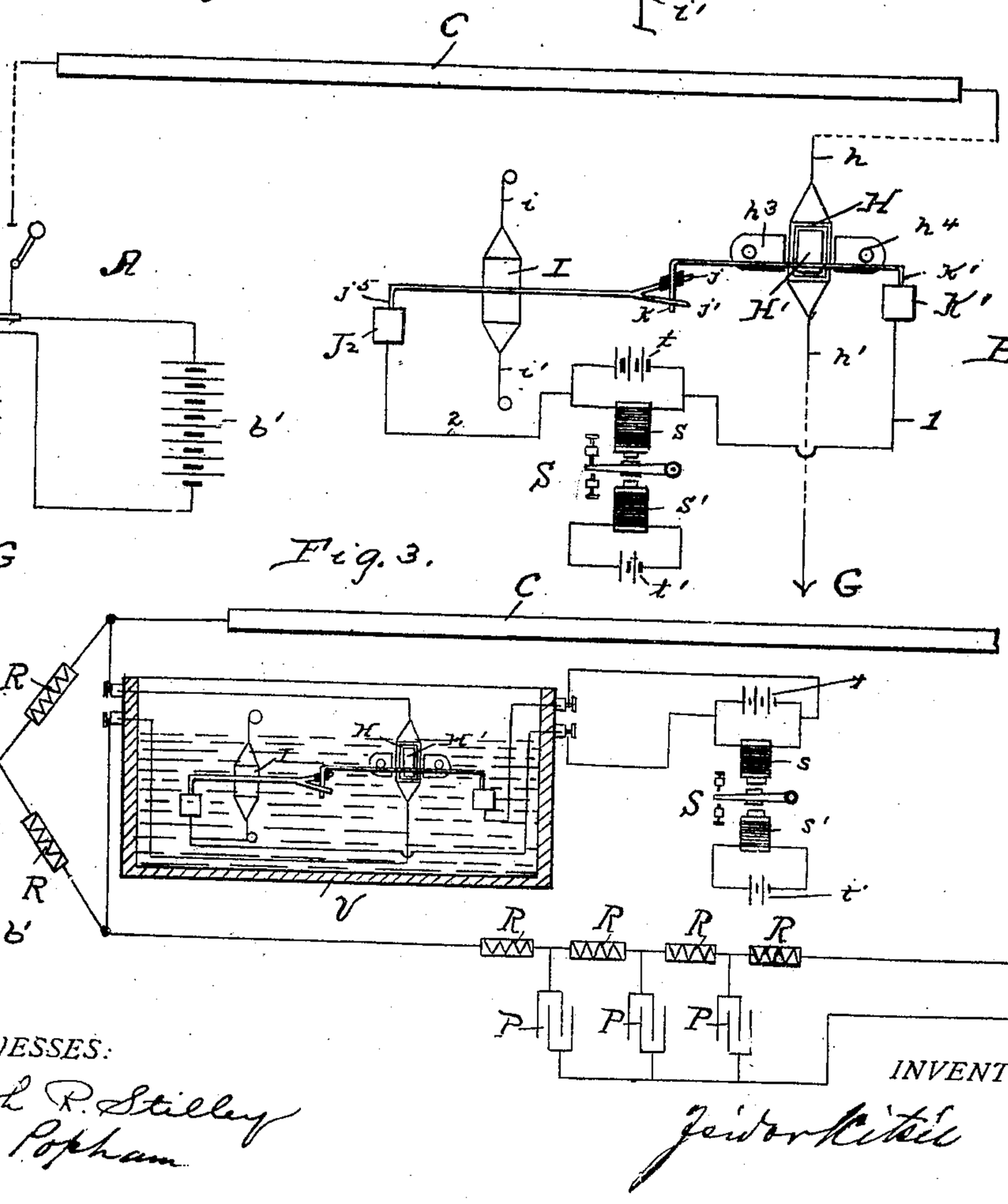


Fig. 2



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SUBMARINE TELEGRAPHY.

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To all whom it may concern:

Be it known that I, ISIDOR KITSEE, of the city and county of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in Submarine Telegraphy, of which the following is a specification.

My invention relates to an improvement in submarine telegraphy; but it is also applicable to long-distance telegraphy on land.

The object of my invention is to supply the submarine cable with a device with the aid of which sounders or other electromagnetic devices may be actuated and incidentally thereby to increase the receiving capacity of the cable.

The peculiarities of submarine telegraphy are such that for the usual Morse sounder or relay different instruments had to be substituted, of which the siphon-recorder of Lord Kelvin is one of the most ingenious types today in use. In broad outlines the conditions which prevent the employment of the usual instrument employed in land telegraphy are as follows: first, a very low current has to be used, for the reason that the employment of heavy current is apt to rupture the insulation of the cable; second, the capacity of the cable is such that a great part of the current employed is lost in transmission; third, the great length of time necessary to clear the cable results in what is technically called "the moving of the zero;" fourth, it was found necessary to telegraph with both currents (positive and negative) on account of what is technically called "choking of the cable." The transmission is therefore a slow one, and twelve to fifteen words per minute is the average rate of submarine telegraphy on long cables. In my invention I have taken into consideration all these peculiarities of the submarine cable, and the instruments, as illustrated in the drawings, are devised for the purpose of overcoming all the difficulties enumerated.

As will be clear from a glance at the drawings, I have made use of part of the device known as the "recording-siphon," because in practice it is best to use a device with the action of which persons in charge are already acquainted. This device consists, generally speaking, of a delicately-suspended coil with its core placed between two stationary magnets, and the principle of this device is that magnets will exert an influence on the coil in proportion to the current flowing in said coil, and this varying influence will move the coil either in one or the other direction, according to the direction of the flow. The action of the instrument is practically the same if the permanent magnets are replaced by electromagnets in series connected to the cable and the coil replaced by free swinging soft iron without helices.

As said above, I have made use of the recording-siphon for the reasons stated; but it is obvious that the so-called "reflecting" galvanometer-needle may be used. In fact, such instruments as are capable of being used to-day as receiving instruments may be altered to suit my purposes.

Referring now to the drawings, Figure 1 is a perspective view in diagram showing one of the receiving devices. Figs. 2 and 3 are electrical diagrams illustrating the mode of connecting this receiving device to the cable and local circuit.

A is the sending-station.

B is the receiving-station.

a is the sending-key.

b and *b'* are the batteries.

G is the ground; H, the coil; H', its core.

h h' are the suspending-wires for the coil H.

h^3 h^4 are the magnets.

K is the contact-arm attached to the coil H, having the projections *k'* and *k*.

K' is the contact-cup in proximity to the projection *k'*.

J is the contact-arm secured to the frame I.

i i' are the cords for suspending the frame I.

j j' are the fork projections of the contact-arm J.

j^5 is the projection of the contact-arm J in proximity to the contact-cup J^2.

S is the sounder; but instead of providing the sounder, as usually, with only one electromagnet and providing the armature with a spring, so as to be always in an upward position, I provide this sounder S with the two electromagnets *s* and *s'*, for the purpose as will hereinafter be more particularly specified. The electromagnet *s* is normally closed through the battery *t*, and the electromagnet *s'* is normally closed through the battery *t'*. The electromagnet *s* is also connected through wire 1 with contact-cup K' and through wire 2 with contact-cup J^2.

In Fig. 3 I have illustrated the device usu-

ally employed in duplexing the cable. This device consists of the resistances R and the condensers P. In this figure, I have placed the receiving instrument with its relaying devices into the containing vessel V. This vessel may be filled with any of the suitable liquids, such as light oil or distilled water, the purpose of this liquid being only to prevent the rise of temperature at the moment of breaking the contact. It is necessary that this liquid should be of a resistance high enough so as to be practically insulated.

I will first describe the working of the receiving instrument in conjunction with the relaying device. As said above, I make use of part of the recording device as used today; but instead of providing the suspeneded coil with the glass tube, one end of which is placed in a vessel containing ink and the other end of which is placed in proximity to a moving tape of paper I provide the coil with a conducting-rod, one end of which is placed in a vessel containing a suitable conducting fluid—such, for instance, as acidulated water—and the other end is placed between the forks of a second conducting-rod.

In proximity to the receiving-coil H, connected to the cable and ground, respectively, the relaying device I is placed, capable of moving in unison with the first-mentioned coil. This device is illustrated in the drawings as a plain coil or a receptacle rectangular in shape, suspended in a manner and with fibers alike to the manner and fibers of the first-mentioned coil. This movable device is also provided with a conducting-rod, one end of which is placed in a receptacle containing a conducting fluid—such, for instance, as diluted sulfuric acid—and the other end of which terminates in two prongs, one of which prongs is as to its inner surface provided with an insulating material for the purpose as will hereinafter be made clear and the other prong of which is left conducting. The two cups containing the conducting fluid are also of conducting material and are connected, as illustrated, to one electromagnet of the sounder S. This sounder, as stated in the description of the drawings, is provided on the under part, as well as the upper part of the armature, with an electromagnet, and both of these electromagnets have their own normally closed electric separate circuits. As illustrated in the drawings, the circuit of the lower magnet is provided with two cells and the circuit of the upper magnet is is provided with three cells. The tendency of the lower electromagnet is to impart to the armature *a* what is technically called "downstroke," and the tendency of the upper electromagnet is to impart to the armature *a* what is technically called "upper stroke," and as the force of the battery of the upper magnet is greater than the force of the battery of the lower magnet it is obvious that normally the armature would be in a position so as to touch the upper contact. If now, through the movement of the coil H, induced by the incoming electric impulse, the end *k* of the rod K comes in contact with the conducting-fork end *j'* of the rod J, the battery *t* will be short-circuited and the electromagnet *s* will therefore be demagnetized and the armature will be drawn downward by the force of the electromagnet *s'* and will stay there till the effect of the electric impulse has passed. This arrangement is necessary in such delicate relaying devices, for the reason that otherwise the sparking and sticking of a circuit when broken is greatly enhanced through the presence of electromagnetic devices in said circuit. In this arrangement when the circuit is broken through the moving away of the end *k* from the prong *j'* the circuit of the electromagnet is made and the chance of sticking and sparking is therefore lessened; but to obviate the bad effects from the rise of temperature due to the breaking of the circuit I have provided, as illustrated in Fig. 3, the containing vessel V, filled with a cooling liquid, such as oil or distilled water, and it is believed that with both of these arrangements, one with the sounder and the one as shown in Fig. 3, all bad effects due to sparking or sticking or rise of temperature are obviated.

From the above it is obvious that if the curved end of the conducting-rod connected to the movable coil is in contact with the contacting prong of the rod of the second coil an electric circuit will be established consisting of the following parts: battery *t*, wire 2, cup with its conducting fluid J^2, the curved end j^5 of the rod J, the fork end *j'* of said rod, the curved end *k* of the rod K with its opposite curved end *k'* dipping into the conducting solution contained in the cup K', connected through wire 1 to the other terminal of the battery *t*, and as this path is of less resistance than the path through the electromagnet s^4 it is obvious that the force of this electromagnet will be more or less lessened and its power to hold upward the armature will be decreased.

For better identification I call the coil connected to the cable the "receiving-coil" or "receiving device," and the second coil the "relaying-coil" or "relaying device." Wherever, therefore, I make use of the term "receiving-coil" I understand by it the coil connected to the cable, and wherever I make use of the term "relaying-coil" I understand by it the device adapted to move in unison with the receiving-coil through the action of the curved end of the rod K, placed between the prongs of the rod J. Normally when no current is flowing the receiving-coil rests at zero, and the relaying-coil is at rest at the same point. In this position of the two coils the bent end of the rod K is about midway

between the fork ends of the rod J. If now a current is sent over the line-wire, inducing a movement in the receiving-coil in a direction so that the bent end will move toward and come in contact with the conducting prong *j'*, it is evident that the circuit described above will be established and the sounder S will be actuated. If now the current ceases, the movement of the coil will be in the opposite direction—that is, it will tend to regain its zero-point; but the rapidity with which one impulse follows the other will not allow the coil to regain entirely its original position, and the second impulse will tend to move the coil in the same direction as the first, but farther than the first. If the prongs between which the rod of this coil moves are stationary, then it may happen that the result of the different impulses will only be a slighter or stronger pressure on one or the other of the prongs. For this reason I have made the second coil in the same manner as the first coil—that is, capable of the movement of which the first coil is capable. The first impulse sent over the line-wire will move the curved end *k* of the rod K toward and in contact with the prong *j'*, and no matter how slight this contact may prove it suffices to make operative the local sounder or other translating device. The ceasing of this impulse will, if only to the minutest degree, induce in the receiving-coil an opposite movement, and will therefore break the contact between the curved end and the prong; but as no force is present to induce any movement in the second or relaying coil the prong will remain in the first position. Therefore the contact will be broken till the second impulse arises. No matter, therefore, how far the zero-point moves the incoming impulse will always tend to make and will make contact between the curved rod and the prong, and the ceasing of the impulses or the incoming impulse in the opposite direction will always tend to break and will break the contact between these two points, thereby establishing or breaking the circuit containing the battery *t*.

Coming now to the translating end, as illustrated in Figs. 2 and 3, it will be seen that the usual double key, whereby an impulse of one polarity is sent over the cable to designate a dot and an impulse of the opposite polarity is sent over the cable to designate a dash, is replaced by a single key, with the aid of which only impulses of one polarity can be sent over the cable; but as in such a system the choking of the cable would result I have recourse to an arrangement whereby this "choking" is avoided, and this arrangement consists in placing a battery in opposition to the sending-battery in the circuit between the key and the ground. This opposing battery should have a force slightly greater than the force of the transmitting-battery. The mode of working with this system is as follows: The operator depresses the key and sends a dot or dash, as the case may be, over the line. In releasing the key the greater force of the opposing battery will result therein that the impulse of opposite polarity will be automatically transmitted over the line. This impulse is not strong enough to actuate the receiving device; but it has force enough to clear the line of the remaining part of the transmitted current. In practice the space between the two prongs should be very small, so that the arm has not to travel a long distance before encountering one or the other of the prongs. It is necessary to say that the successful working of the instrument depends to a large degree on the careful adjustment of the local circuit, on the degree of strength of the current, its electrolyte as well as oxidizing action, and it should be one of the duties of the person in charge of such device to carefully test every day his instrument to see if everything is in working order.

I have described the contact-cups as containing a liquid; but it is obvious that any conducting material may be placed in same. The liquid is preferred, for the reason that the contact with same is easier made than with a solid material. It is also obvious that instead of the device as used in the siphon-recorder and as illustrated in Figs. 1 and 2 any other device capable of performing the same function can be substituted. I have called the rectangular piece I a "frame" or "coil," so as to give an alike designation to alike parts of the receiving device and the relay; but it is understood that the part I may consist of a coil of wiring, as is necessary for the receiver.

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

1. Means to translate the received impulses of submarine or other cables, said means embracing a receiving device provided with a free swinging coil, mechanical means adapted to move in unison with said swinging coil, a local circuit, a source of current for said circuit, a transmitting device for said circuit and means whereby through the contacting of part of the mechanical means with part of the receiving device a shunt around part of the translating device is made or broken.

2. Means to relay a telegraphic receiving device, said means embracing the receiving device proper, a mechanical relay provided with contacting means, said mechanical relay adapted to move in unison with the movable part of the receiving device, a local circuit containing one coil of a translating device, a second local circuit containing the second coil of said translating device, a shunt for one of said coils, one terminal of said shunt con-

nected electrically with part of the receiving device, the second terminal connected with part of said relaying device, and means whereby through the contact of part of the receiving device with part of the relaying device, said shunt-circuit is closed.

In testimony whereof I hereby sign my name, in the presence of two subscribing witnesses, this 8th day of February, A. D. 1904.

ISIDOR KITSEE.

Witnesses:
EDITH P. STILLEY,
H. C. YETTER.