

**On the detection of needles and other steel instruments impacted in the human body : being part of a lecture delivered at the Aldersgate School of Medicine / by Alfred Smee.**

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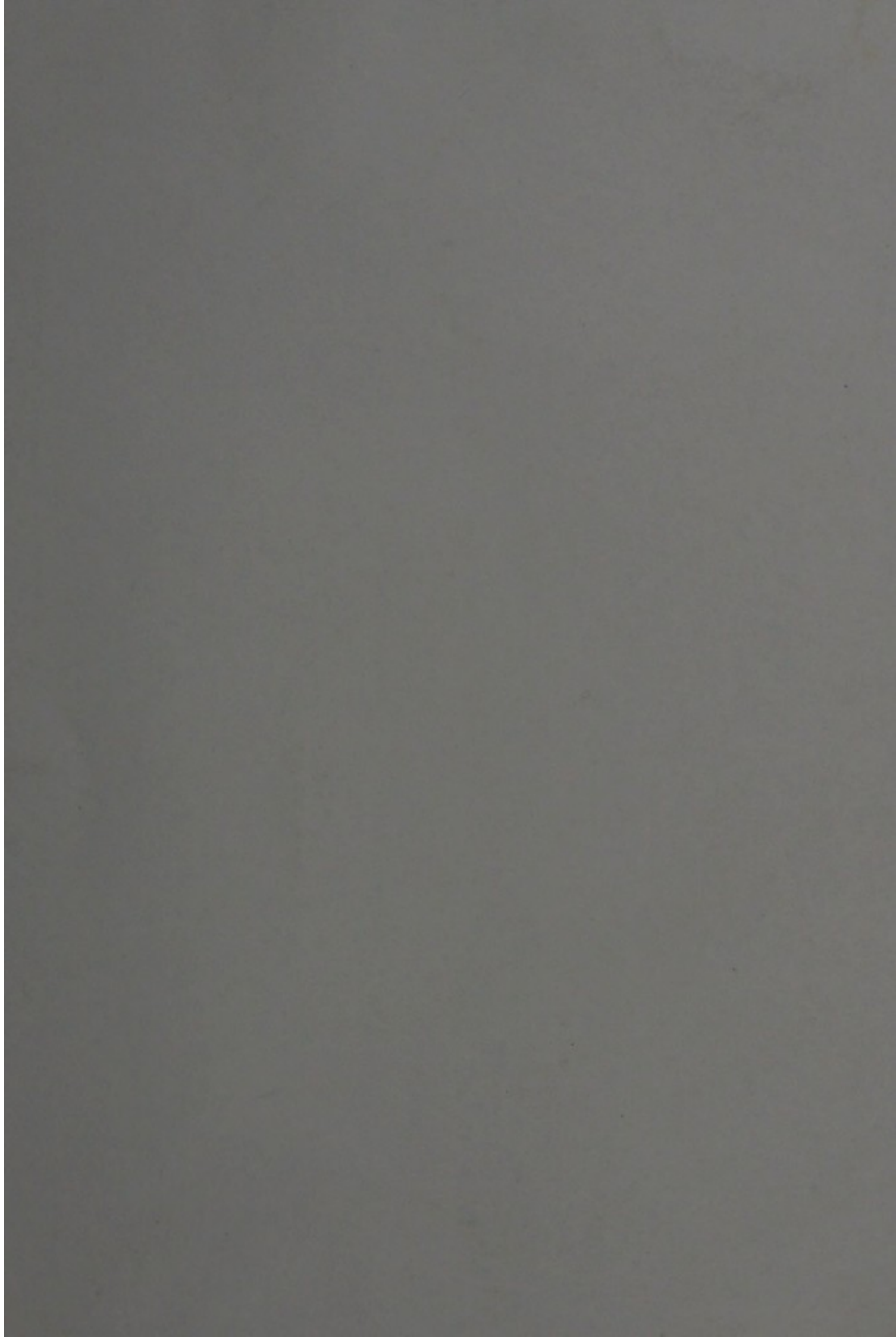
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ON THE  
**DETECTION OF NEEDLES**

AND

**OTHER STEEL INSTRUMENTS**

IMPACTED IN THE HUMAN BODY.

BEING PART OF A LECTURE

DELIVERED AT

THE ALDERSGATE SCHOOL OF MEDICINE.

By **ALFRED SMEE, F.R.S.**

SURGEON TO THE ROYAL GENERAL DISPENSARY, TO THE CENTRAL LONDON  
OPHTHALMIC INSTITUTION, TO THE BANK OF ENGLAND, TO THE  
PROVIDENT CLERKS' MUTUAL BENEFIT ASSOCIATION, AND  
LECTURER ON SURGERY AT THE ALDERSGATE  
SCHOOL OF MEDICINE, ETC. ETC.



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## ON THE DETECTION OF NEEDLES, &c.

### IN THE HUMAN BODY.

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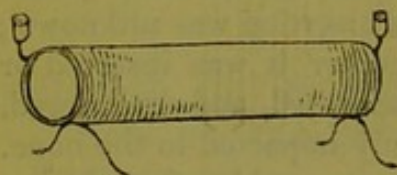
WHEN the foreign body, retained in the wound, is either iron or steel, we have means by which we may readily and effectually determine its presence. Portions of steel are particularly liable to be introduced into the body, in the shape of needles, or as parts of cutting instruments; and, especially in the former case, cause irremediable injury. Some time since, I had a case under my care, where a small portion of a needle was introduced into one of the joints of the finger, but of which no indication existed beyond the effects which might have been expected from the presence of a foreign body. The exact spot of its insertion was unknown; and indeed it was equally uncertain whether it was inserted or not. Subsequently, the joint swelled, suppurated, and discharged, and a small piece of needle was found firmly impacted in the bone. Now, a very small piece of foreign matter is capable of producing these disastrous results; and, on having weighed the piece discharged in this case, I found that it scarce amounted to the 1-7th of a grain. To this case I shall again draw your attention, when I come to my lectures on the diseases of the joints, because it shewed accidentally, on the human subject, the course of the inflammation and suppuration of the part, the subsequent ulceration of the cartilages and osseous tissue, and, finally, the course of the reparative process, by the termination of the inflammation by ankylosis. On reference to my note-book, for the purpose of studying this case, it occurred to my mind that, had I known that the needle was actually present, and could have demonstrated its exact spot, I might possibly have averted the present inconvenience of a stiff joint to the unfortunate sufferer; and, after having carefully considered the matter, a plan suggested itself to my mind for the detection of needles in future cases. You are all acquainted with the curious condition which steel assumes under certain circumstances, whereby it evinces properties which are called magnetic; you know, more-



over, that like magnetic poles repel, and opposite attract each other. You have, therefore, but to render a piece of enclosed steel a magnet, and you will be able not only to ascertain its presence, but to determine by its polarity its general direction ; and, by the amount of magnetism it evinces, you may even infer its probable bulk.

When you suspect the presence of a piece of needle, or other steel instrument, you must subject the suspected part to a treatment calculated to render the needle magnetic ; and there are two principal methods by which this object may be effected. The first, by transmitting a galvanic current, at right angles, to the suspected part ; the second, by placing a large magnet near the part affected, so that the object may be magnetized by induction. You may accomplish the first end, by taking a copper wire, covered with cotton, or still better with silk, (in fact, you may employ the covered wire as generally used for the formation of electro-magnets,) and wind it round the parts suspected to contain steel, several times, so that the same current may act at right angles, many times, upon the piece of steel ; you may then take a galvanic battery (one of my little tumbler batteries will amply suffice), and connect one end of the wire to the zinc, the

Fig. 1.



other to the platinized silver. The adjoining cut, *fig. 1*, will shew the general arrangement which may be adopted to effect this object. The current might be continued for half an hour, or more, when the steel would become magnetized, and thereby give strong indications of its presence.

For my own part, I should use the second plan, or the plan of magnetizing by induction, to render the needle magnetic. For this purpose, I have employed a temporary electro-magnet, which I magnetized by the voltaic battery ; and you will find, that, by keeping the part affected as close as possible to the instrument, for about half an hour, you will sufficiently obtain the desired object.

The electro-magnet might be made of the horse-shoe form, if we knew the direction of the object ; but, in that case, we should not require its use at all, as the proof of the existence of the needle is our only aim. I have used the horse-shoe magnet, but should prefer in most cases an electro-magnet like this, made for me by Messrs. Horne, of Newgate Street, which is made of a simple straight bar of soft iron, wound round with wire. You will perceive by the adjoining diagram that the iron has a plate of brass (B) fixed on both ends to retain the wire (*w*) *in situ* ; and you may also perceive that the two ends of the wire are attached to



binding screws (*s*), *fig. 2*. Your chemical lecturer has, doubtlessly,

Fig. 2.

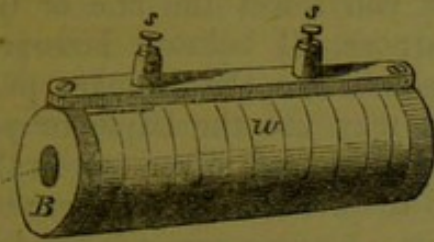
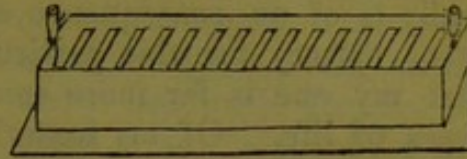
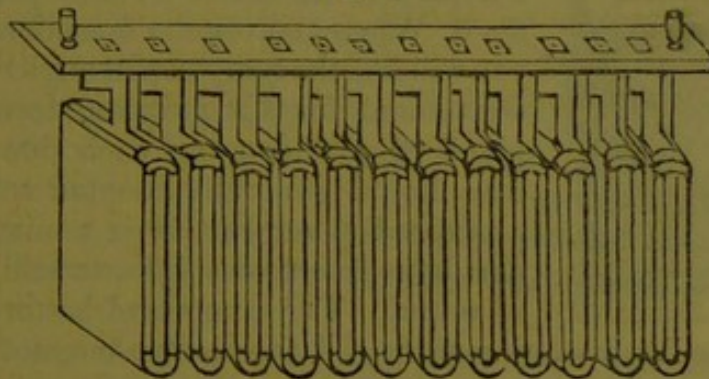


Fig. 3.



made you aware that the magnetic effect, *cæteris paribus*, is proportionate to the power of the battery ; accordingly, you must select a voltaic combination suitable for the desired object. You might use a Cruikshanks' battery, made of alternate pieces of wire and copper soldered together, *fig. 3*. You might use one of the old Woollaston batteries, made of a plate of copper, surrounding a plate of zinc, *fig. 4*. You might employ

Fig. 4.



one or more Daniell's batteries, which consist of an outer copper cylinder (*c*) with a solution of sulphate of copper (*s*), and an inner porous vessel (*p*) containing zinc (*z*) and dilute acid (*A*), *fig. 5*. You might employ the battery invented by Mr. Grove :

Fig. 5.

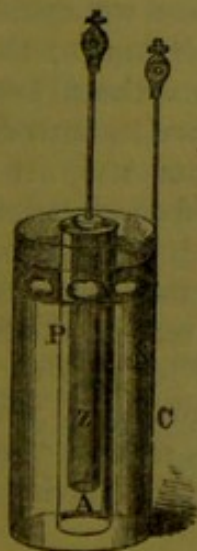


Fig. 6.

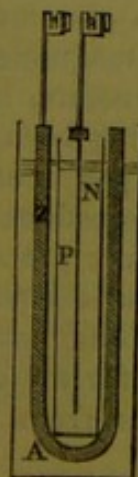
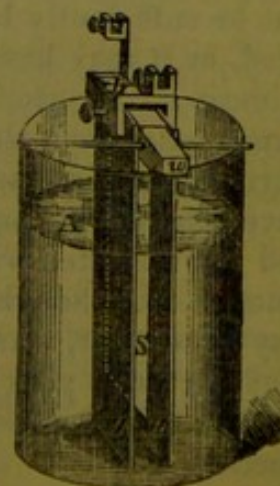


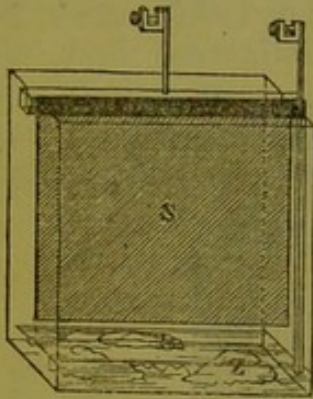
Fig. 7.





he uses for his negative platinum ( $p$ ), and in the inner porous cell he puts strong nitric acid ( $n$ ), and in the outer vessel with the zinc ( $z$ ) dilute sulphuric or muriatic acid ( $A$ ), *fig. 6*. It really is of no consequence whether you select the one or the other battery for this particular purpose. I believe, however, that my one is far more commonly used for the ordinary purposes of life. Of my batteries you may use the triple or pot battery, which consists of a piece of platinized silver ( $s$ ), in the top of which is fixed a piece of wood to prevent contact between the silver and the zinc. To the silver a binding screw is fixed to connect it with any desired object; a strip of zinc ( $z$ ) is placed on each side of the wood, and both are held in their place by a binding screw ( $b$ ), sufficiently wide to embrace the wires and wood, *fig. 7*. You may use the odds and ends form, which consists of a plate

Fig. 8.



of platinized silver ( $s$ ) for the negative pole, suspended in a vessel of acid, and fragments of zinc and mercury ( $z$ ), placed at the bottom of the vessel for the positive pole, *fig. 8*. When you require considerable power, you will find the compound trough battery very convenient for this purpose, formed of two plates of zinc, one on each side the silver. The liquid generally adopted to excite the platinized silver battery is a mixture of one part by measure of sulphuric acid, and seven of water. The compound battery will magnetize a needle, in conjunction with the electro-magnet at the distance of an inch, in the space of two or three minutes.

A powerful permanent magnet would answer as well as the temporary magnet; but permanent magnets are expensive, and not so constantly at hand. When soft iron is impacted in any part of the body, we do not require either the electro or permanent magnet, for on this substance we are unable to confer magnetic properties.

We should never think of taking the trouble of magnetizing a part suspected to contain steel, or iron, unless we could get no indication of its presence without; for, perchance, the object might be sufficiently large to give indication without being magnetized, or it may have been magnetized before its introduction.

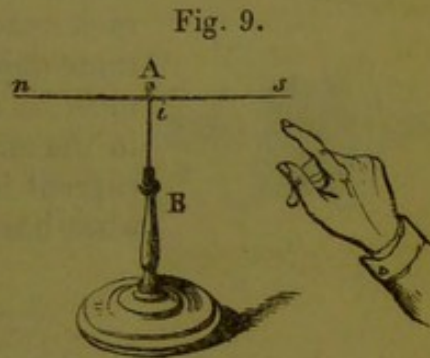
Almost all my steel instruments, in common use, are more or less magnetic, from their having been exposed to electricity whilst performing my electrical experiments; and, therefore, should I have the misfortune to introduce them into my body, they would be indicated without any process to render them further magnetic. Although foreign to a course of lectures on surgery, I may state, that, when handling powerful magnets, you should always put aside your watch, for my own has many a time played me most troublesome pranks from its springs having become magnetic.



To test the existence of a magnet within the body, we may take a magnetized sewing-needle, and suspend it by a piece of silkworm's silk, when it will exhibit certain phenomena upon the approach of the suspected part, provided it contain a piece of magnetized steel. Although this simple contrivance will amply suffice, I, myself, possess a needle, which was made for me by Messrs. Willats, of Cheapside, and which is well adapted for the purpose:

It consists, as you perceive, of a delicate needle, about six inches long, centred upon a small agate cup, resting upon a steel point, so that the smallest possible amount of resistance is offered to its free play, *fig. 9.*

When a part, containing magnetic steel, is brought near the needle, it may be either attracted, or repelled; it may move upwards or downwards; or it may exhibit disquietude according to the position in which the new magnet is held. We may detect the position of the foreign body, when it is of any size, by ascertaining where its north and south poles lie; and these are determined by their repelling and attracting the opposite poles of the magnetic needle. The disquietude, or motion upwards and downwards, merely indicates magnetism, but not the direction of the magnet.



You will doubtless be surprised when I tell you, that, in this manner, I have detected a piece of needle impacted in the finger of a young woman, although it weighed but the seventh of a grain. This gave such marked indications, that I found out tolerably well the position of its north and south poles, though I could not ascertain the presence of a foreign body in any other way. I tried experiments on smaller pieces, at short distances, such as half an inch to an inch, and I found that a piece of needle, weighing 1-60th of a grain, gave decided indications after having been magnetized, and, perhaps, even a still smaller amount of steel might in some cases be detected.\*

The batteries, electro-magnets, and magnetic needle, you may procure of Messrs. Horne, of Newgate Street; or of Messrs. Willats, of Cheapside; or, by order, of any other instrument-makers: but if you, or any of your friends, meet with doubtful cases of this character, my own apparatus is at your service, and

\* These weights are the nearest fractions, but we ascertained the exact weight of these fragments by the standard balance belonging to the Bank of England: these two portions amounted respectively to the  $\frac{135}{10000}$  and the  $\frac{17}{10000}$  of a grain; the exact weight of the portion alluded to in the former part of the paper was the  $\frac{152}{10000}$  of a grain.

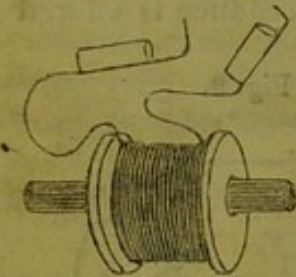


I shall esteem it as a favour if you would allow me to be present at the examination, in order that I may see the varieties which different cases present.

A centred magnetic needle should always accompany the ordinary electro-magnets used for medical purposes; as the medical practitioner, having that machine, might, with this addition alone, always determine the presence of steel particles.

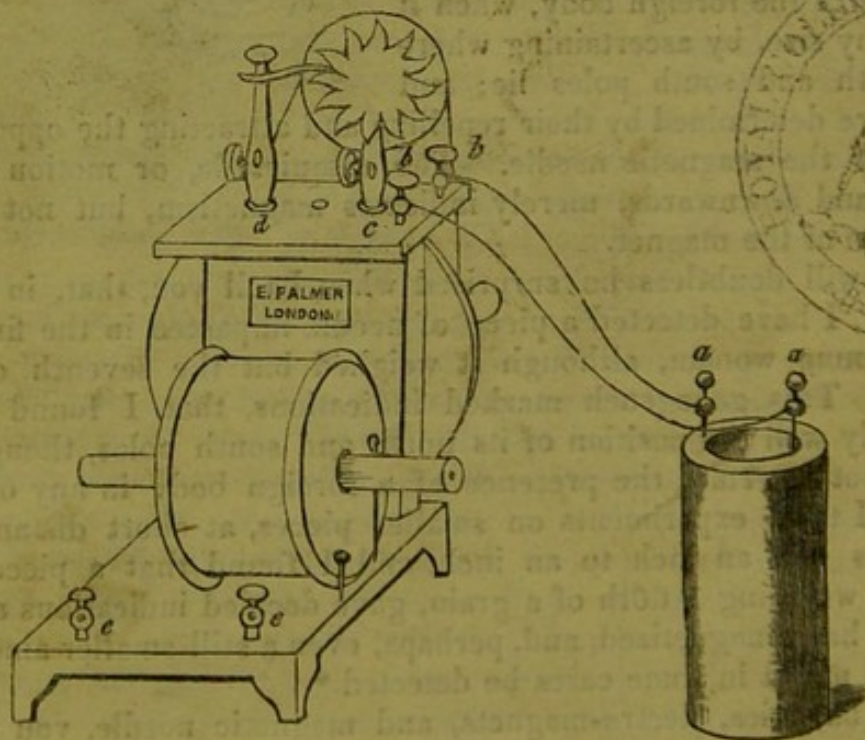
Of medical electrical machines the primary coil machine may be employed; as the bundle of wires, when magnetized, will serve

Fig. 10.



to magnetize the needle, *fig. 10*. The platinum spring machine may be employed in a similar manner, and the bundle of wires in the rack machine may also be used to effect the same object, *fig. 11*. In all these cases you must be careful to continue the voltaic current in the same direction; for, if you reversed the current but one instant, it would tend to undo what has been already done.

Fig 11.



I have now satisfactorily demonstrated to you, that magnetism may be used for the detection of steel particles, impacted within the body, with absolute success; and, though but a very trifling application of natural philosophy to the practice of surgery, I have no doubt that, had it been adopted before, many joints would have been saved; and I confidently anticipate that it will be the means, in future, of frequently saving these parts from destruction.





