

This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

A 755,409 DUPL

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 2 of 132



Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 3 of 132

MAGNETOS

FOR AUTOMOBILISTS

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 6 of 132



MAGNETOS

FOR AUTOMOBILISTS

HOW MADE AND HOW USED

A Handbook of

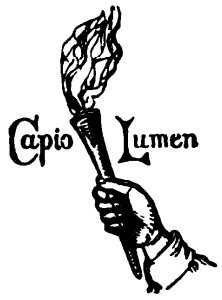
PRACTICAL INSTRUCTION IN THE MANUFACTURE AND ADAPTATION OF THE MAGNETO TO THE NEEDS OF THE MOTORIST

BY

S. R. BOTTONE

LATE OF THE COLLEGIO DEL CARMINE, TURIN

AUTHOR OF "THE DYNAMO," "IGNITION DEVICES," ETC.



WITH THIRTY-FIVE ILLUSTRATIONS

LONDON

CROSBY LOCKWOOD AND SON

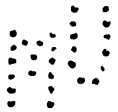
7, STATIONERS' HALL COURT, LUDGATE HILL

1907

[*All rights reserved*]

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 8 of 132

Engin
TL
213
.B15



PREFACE

In view of the present growing popularity of the Magneto among all classes of motorists, the Author feels that no apology is needed for putting before the public such simple explanations as will enable the tyro to comprehend and apply the principles on which this system of ignition is built up.

He has endeavoured, therefore, so far as is permissible within the limits of this slight work, to give a brief outline of the history, construction, and function of the magneto as generally used by motorists, in the hope that an amateur provided with a machine of this type may not be at a loss should slight repairs or adjustments be required when the services of an electrical expert are not obtainable, and may even, given the requisite tools, skill, and patience, be able, in an emergency, to make the magneto for himself.

302149

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 10 of 132

Although widely different methods of obtaining the electrical current are adopted in the two contrasting systems—the principle in the one being "chemical changes," and in the other the movement of conductors within the field of force—yet it must be recognised that the sole *raison d'être* of each is the generation of this necessary current. Either system can, therefore, be easily substituted for the other, without any great change in the wiring, fitting, etc., of accompanying machinery.

But the favour that the magneto system has found with the motoring public is not surprising, when the many advantages of that system in avoiding the trouble and expense entailed by constantly re-charging accumulators, as well as the attendant danger of spilt acid and burnt-out coils, are considered.

S. R. BOTTONE.

WALLINGTON,
September, 1907.

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 11 of 132

CONTENTS

CHAPTER I

THE MAGNETO: ITS HISTORY AND THEORY

PAGE

Importance of ignition—Faraday's discovery—Medical magneto—Breguet's igniter—Siemens' Armature—Methods of cutting lines of force—Commutator—"Lines of force" and "field of force"—Theory of the Magneto—Essential parts of the Magneto . 1

CHAPTER II

COMPONENT PARTS OF THE MAGNETO

Material and form of magnets—Size of magnets—Compound magnets—Hints on fitting magnets—Clearance between armature and pole-pieces—Armature with or without shield—Contact of armature with machine—Fitting spindle to armature—Winding armature—Pattern of bearings—Insulation of front bearing—Closed and open circuits—Contact breaker actuated by two-to-one gear—Breaking contact—Making contact—Alternative contact-breaker or plug . . 15

CHAPTER III

MAGNETISATION

Magnetising field magnets—Permanent magnet—Electromagnet—Continuous-current dynamo—Wire helix—Temper 40

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 12 of 132

CHAPTER IV

THE ARMATURE SCREEN AND ITS FUNCTION

PAGE

Advantage of shield—Effect of shield when in line with pole-pieces—At right-angles—Inclined to pole-pieces—Influence on current—"Timing" by use of shield—Retardation and advance of spark—Control of shield—Principle of "timing"—High tension—Sparking by tappet rod and cam—Modified shields and armatures 47

CHAPTER V

HIGH TENSION MAGNETOS

Induced currents—Intensity and volume of induced currents—Back currents—Condenser: its materials and construction—Position of condenser—Simms-Bosch high tension magneto—Eisemann high tension magneto—Gianoli high tension system 62

CHAPTER VI

A FEW PRACTICAL HINTS

To insure correct timing—Adjustments of lever—Adjustments of tappet rod or cam—Ignition by alternating currents—"High" and "low" tension compared . 78

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 13 of 132

MAGNETOS FOR AUTOMOBILISTS

CHAPTER I

THE MAGNETO: ITS HISTORY AND THEORY

Importance of ignition—Faraday's discovery—Medical magneto—Breguet's igniter—Siemens' Armature—Methods of cutting lines of force—Commutator—"Lines of force" and "field of force"—Theory of the Magneto—Essential parts of the Magneto.

1. Importance of Ignition.—Of all the accessories which conduce to the perfection of action in the motor-car, and in the chauffeur to the feeling of security while travelling, there is perhaps none, with the exception only of the engine itself, that plays so important a part as the means adopted for ignition. Not only must it be certain, but it must be also perfectly under control; so that the explosions should not only take place without fail, but also at the exact time when required. In another place * we have treated pretty fully

* See "Ignition Devices for Gas and Petrol Motors." Guilbert Pitman.

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 14 of 132

on the use of the coil and accumulator for this particular purpose. Here we propose showing how the magneto machine (and its congeners, the dynamo coil, the Eisemann, etc.), are constructed, along with the directions for use, suitability for special purposes, defects and their remedies. In order that the reader may form an intelligent idea of the mode in which these machines act, it will be necessary for us to preface our papers with a few remarks on the origin of the magneto, and the improvements which have been introduced therein in obedience to the demands made for special purposes.

2. Faraday's Discovery.—In 1831 Faraday showed that the approach or recession of a conductor to the poles of a magnet sets up a current of electricity in that conductor at right angles to the direction of its own motion. From an old print in our possession we gather that the means adopted for showing this result was somewhat similar to that illustrated in our Fig. 1, in which A represents a rod of soft iron wrapped round with a few coils of insulated copper wire, C, one end of this latter being brought into proximity with a little button or disc, B, not however actually touching it. If now the iron rod A be suddenly brought into contact with one of the poles of the magnet M, or as suddenly

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 15 of 132

removed, a brilliant spark will be seen to pass between the point of the wire and the button or disc, due to the sudden flow of current elicited in the coil of wire by its approach to, or recession from, the magnet. The reader must particularly notice that this result is only obtained when one or other of these two movements is taking place; and that the more

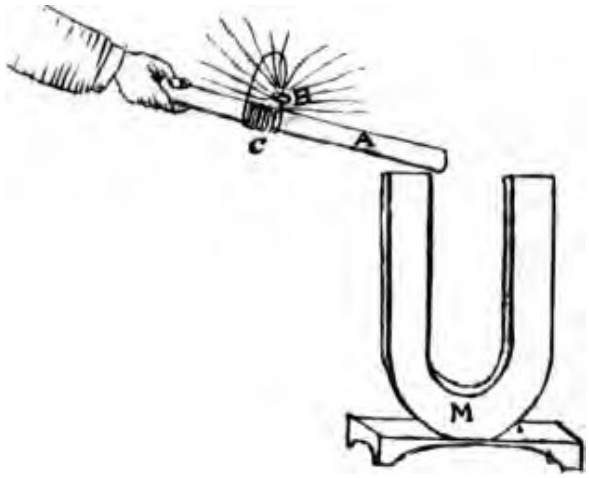


FIG. 1.

powerful the magnet, the greater the number of coils, and the more sudden the motion, the more energetic the spark thus obtained.

3. Medical Magneto.—As soon as the results of Faraday's experiments were made known, numerous applications were devised for utilising the current thus obtainable, and the well-known medical magneto, of which we present an illustration at Fig. 2, was among the earliest practical

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 16 of 132

uses to which the discovery was put. We are, however, more concerned with the application of such machines to the purposes of ignition than to any other, and will consequently pass on to notice a form of igniter which embodies



FIG. 2.

many of the good points existing in our present instruments.

4. Breguet's Igniter.—The one to which we refer was devised by Mons. Breguet, and is represented at our Fig. 3. Here we have a compound magnet, AA, built up of three or four thinner ones screwed together. The ends of this are made smaller than the rest, and rounded off so that two bobbins, BB′, may be fixed upon them, the poles of the magnets passing through, and just projecting on the farther side. The keeper

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 17 of 132

(or armature) C is mounted on a bent lever, D,

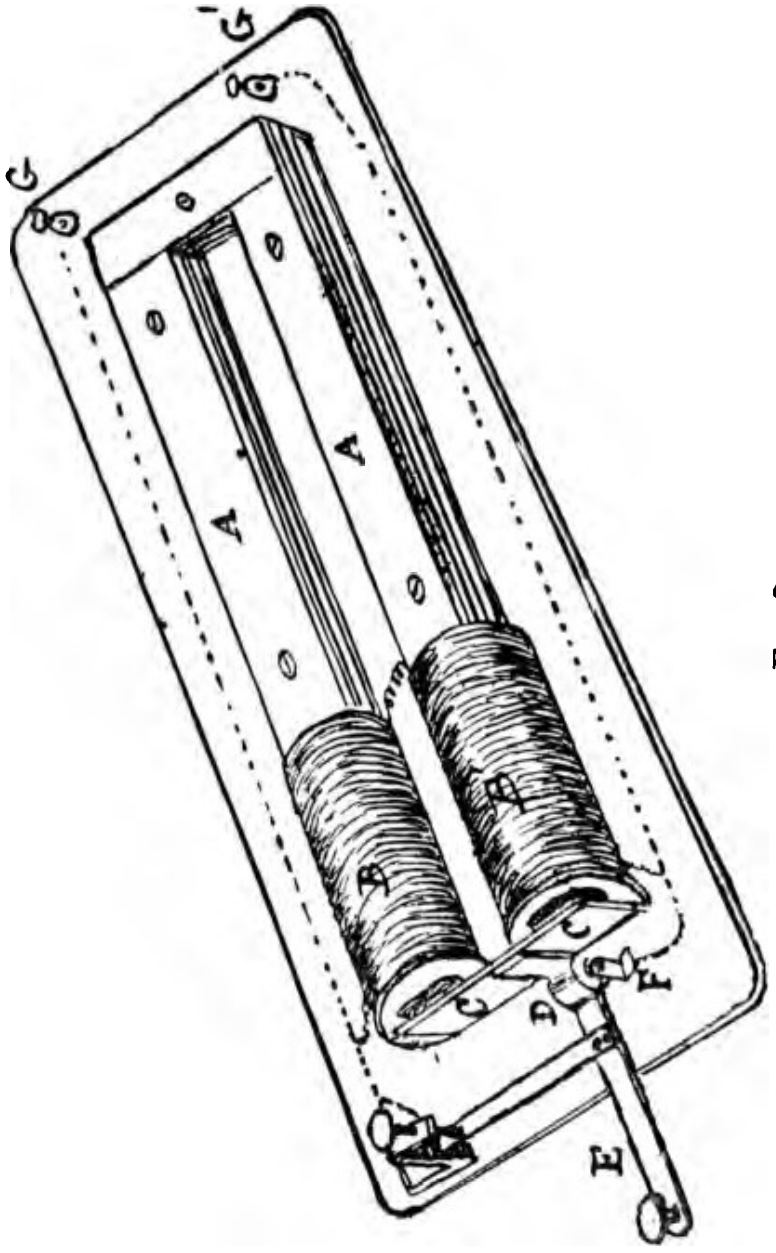


FIG. 3.

turning on pivots, one of which is seen at F. This is so arranged that when the handle E is

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 18 of 132

pressed down the keeper is suddenly withdrawn from contact with the poles. One end of the wire round B is fastened to a corresponding end of that on B′, the other two ends from the bobbins being taken underneath the board, and then connected to the binding screws GG′. The dotted lines show the course of the wires. If now a blow be struck on the handle E the keeper is immediately separated from the poles, and as a result an instantaneous current passes round the bobbins and between the binding screws GG′. If a fuse be placed between these it will at once be ignited, and by placing the finger and thumb on them the shock may be distinctly felt.

5. Siemens' Armature.—But ingenious and simple as this arrangement is it does not lend itself conveniently to application in automobilists' work. For this purpose a modification of the well-known Siemens' armature is the one most usually employed. We will, therefore, next consider the construction of a simple instrument of this type. We will begin by studying the armature, of which we give an illustration in its wound condition at Fig. 4. Here we have a cylinder of soft iron, usually built up of laminations, of which the length is about three times the diameter; on two sides this is deeply channelled out, so as to present the section of

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 19 of 132

an "H-girder." This armature is supported at its two ends by a spindle passing through it, which spindle rests on suitable bearings, where at one end is arranged a pulley, or other convenient means of imparting motion to the armature, and at the other a device known as a commutator, or collector, by means of which the electricity set up in the wire (with which the channels in the armature are wound) can be collected and sent to the outer circuit, where

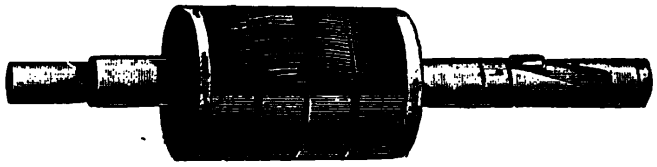


FIG. 4.

they are to be utilised. Bridging over the armature is placed a compound magnet (Fig. 5), usually fitted with pole-pieces, as indicated by transverse lines. These magnets serve to produce "a field of force" across the space occupied by the armature, and it is just by cutting the "lines of force," which pervade this space, that the flow of current is evoked.

6. Methods of cutting Lines of Force.— It is indifferent to the success of this operation whether the armature be moved or whether a light iron shield be interposed between the poles

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 20 of 132

of the magnet and the armature, and, therefore, both methods have been adopted by different makers. Of course, in the latter case the shield itself is moved while the armature remains

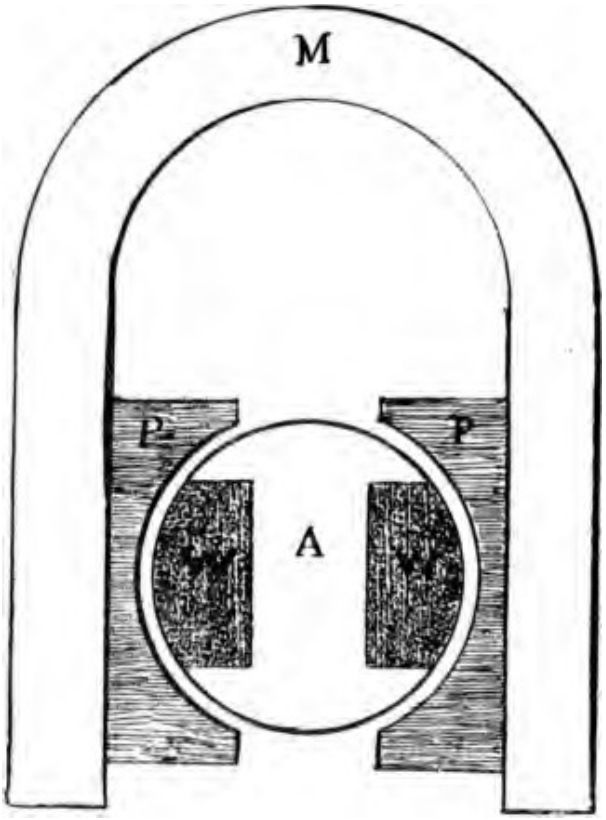


FIG. 5.

A, the armature; W, the wires or conductors lying in the channel; M, the magnet; P, the pole-pieces.

stationary, so that the armature is alternately exposed to, or shielded from, the inductive effects of the lines of force.

7. Commutator.—We may point out here that if the two ends of the wire wound round the

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 21 of 132

armature are tested during one entire revolution of an unshielded armature, the direction of current flowing will be found to change *twice* with each complete revolution. This, usually speaking, is of no consequence for ignition purposes; but when it is desired that the current should go always in one direction, this object can be easily attained by connecting the two ends of the wire to two semicircular metal cheeks, supported on an insulating sleeve fitted on the spindle, usually at the end opposite to that at which the pulley is affixed. This arrangement of collector, as it *commutes* the direction of the currents which are alternately on the one side and the other, to one uniform direction, is known as a "commutator," and this requires two "brushes" which, sweeping against the cheeks of the commutator, allow the current to be collected and sent where required.

8. "Lines of Force" and "Field of Force." —It will be well for the student to make a simple experiment in order to form a conception of what is meant by "lines of force" and "field of force." By "lines of force" are meant certain imaginary lines in which magnetism is exerting its power; by "field," is meant the entire space where these lines are passing or where the force is being exerted. Let the reader procure an ordinary horseshoe magnet, and lay it on a flat table, cover

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 22 of 132

it with a sheet of writing-paper, and sift over it, from a height, a pinch or two of very fine iron filings. He will see that the filings will arrange themselves in a certain definite order, crowding pretty closely together in the space between the poles of the said magnet, and becoming more diffused into curved lines as they recede from

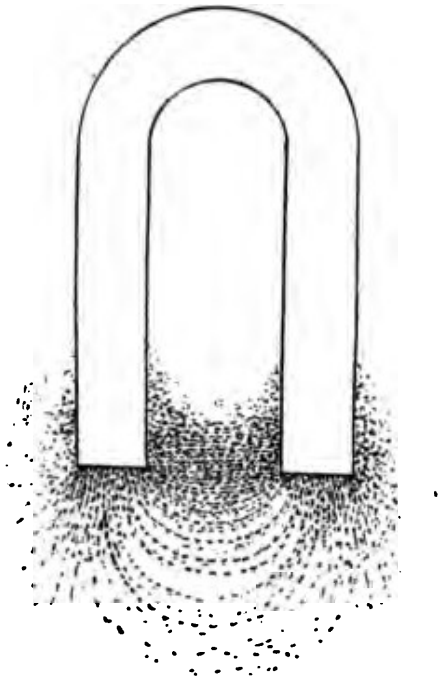


FIG. 6.

those points. If the paper be gently tapped while the sifting operation is being performed, the outlines of these "lines" will be more distinctly visible, and if the paper has been previously dipped in melted paraffin wax and allowed to get quite cold before sifting on the filings, it will be

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 23 of 132

possible, by cautiously removing the paper after having scattered thereon the said filings, to get a permanent record of the positions of these lines of force by gently warming the paper over a spirit lamp, when the wax will melt and retain the filings in the position they had taken up. Our Fig. 6 will give a general idea of the arrangement of such filings when scattered over the poles of a parallel-limbed horseshoe magnet. The reader must bear in mind that such a representation shows the lines of force in *one plane only*; while, as a matter of fact, these lines surround the magnet in every direction, becoming, however, feebler as they are more distant from the poles.

9. Theory of the Magneto.—We may now recapitulate the main facts that we have learnt before proceeding to explain the construction of the different forms of magnetos now actually employed. In the first place, we have to form a conception that every magnet is surrounded by lines of force, radiating from its two poles, which lines form catenary curves which become more open and more diffused as the distance from the poles becomes greater. Secondly, that any conductor moved so as to cut these lines of force is affected by them; so that a current is set up in the conductor at right angles to the direction of motion. Thirdly, that the intensity of the current

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 24 of 132

thus elicited is dependent upon the number of lines cut in a given time, or, what amounts to the same thing, to the strength of the magnet and to the rapidity of the motion. Fourthly, that the most convenient form on which the conductor or conductors can be arranged, in order to maintain a continuous motion, is that of a cylindrical body. Fifthly, that this cylindrical armature along which the conductor or conductors (wires) are wound longitudinally, should preferably be of soft iron, as this metal has the property of drawing towards itself the lines of force emanating from the magnet, and consequently of concentrating their effect upon the space occupied by the conductors. Sixthly, that it is the sudden change of magnetic condition set up by the lines of force on the conductors that gives rise to the flow of current; hence it is indifferent whether this change is brought about by alternately exposing the conductors to the influence of these lines, and then withdrawing them from it, as obtains when the armature is rotated, or whether the same result is brought about by alternately shielding and exposing the armature to the effects of the said lines, by causing a soft iron shield (which shield concentrates the lines of force upon *itself*) to rotate between the poles of the magnet and the armature, which in this case is held stationary. Seventhly, that the

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 25 of 132

current thus set up is alternate in direction; and, in order to render such a current available in one direction only, it is necessary to make use of a "commutator."

10. Essential Parts of the Magneto.—In order that the learner may form a clear idea of the relative positions of the armature and the magnet or magnets in a magneto igniter, we present the reader at Fig. 7 with an illustration of the essential parts, in which we represent at A, the armature as lying longitudinally between the pole pieces of a compound magnet M, the jaws of

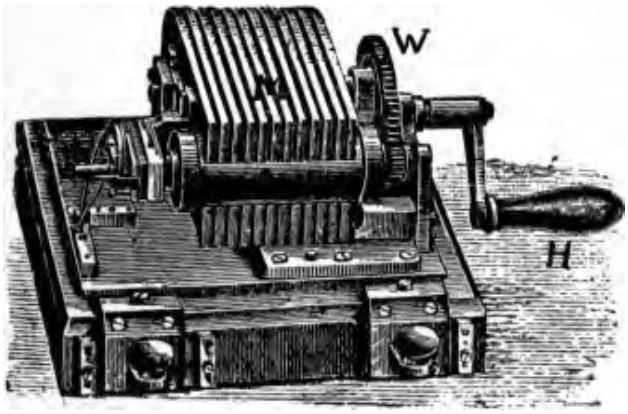


FIG. 7.

which are bored out so as to permit the armature to rotate in close proximity to them; the rotation being imparted in this case by means of a handle, H, driving a cog-wheel, W, which in its turn engages in the teeth of a smaller cog-wheel, and

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 26 of 132

thus insures great rapidity of motion. The reader will readily understand that in the actual machine the motion will be imparted by some moving part of the engine or the car, not by a handle; and likewise, that the bearings and terminals, by means of which the current is conducted to the spot at which it is desired to produce the spark, are for the sake of compactness affixed to and form part of the magnets themselves. By this means it is possible to arrange the *timing* apparatus, which is of the highest importance for the successful working of the igniter (on the body of the magneto itself), without unduly increasing its bulk.

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 27 of 132

CHAPTER II

COMPONENT PARTS OF THE MAGNETO

Material and form of magnets—Size of magnets—Compound magnets—Hints on fitting magnets—Clearance between armature and pole-pieces—Armature with or without shield—Contact of armature with machine—Fitting spindle to armature—Winding armature—Pattern of bearings—Insulation of front bearing—Closed and open circuits—Contact breaker actuated by two-to-one gear—Breaking contact—Making contact—Alternative contact-breaker or plug.

11. Material and Form of Magnets.—The first requirements for making up a magneto are:—1, the magnets; 2, the pole-pieces; 3, the bearings; 4, the armature. Beginning by the magnets, these are made of the best shear steel, such as that produced at the Allevard works, though, provided the steel be capable of being forged, and afterwards being made dead hard, the particular brand is of no great moment. The presence of *manganese* is, however, to be avoided, as such steel is practically incapable of due magnetisation; on the other hand, the presence of a small percentage of *tungsten* seems to favour the retention

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 28 of 132

of a high degree of magnetism. The usual form given to the magnets is that of a horse-shoe with parallel limbs, of which the width is usually from two to three times that of the thickness. Single magnets are not generally used. It is customary to build up each magnet of the set (of which there are usually three), by fitting two, or even three, magnets straddling one over the other, each additional magnet being a trifle wider in expanse between the limbs than the one within it.

12. Size of Magnets. — The sizes usually adopted for these magnets run about $2\frac{1}{4}$ in. or $2\frac{1}{2}$ in. in expanse between the limb, 6 in. in height, and $4\frac{3}{4}$ in. in width. In the smaller magnetos, such as are used for motor-cycles and similar light automobiles, somewhat lesser dimensions will be found to give sufficient strength; but for large cars in which more space is available, it is wise to use the larger sizes, though it is not essential that the magnets should be of any extraordinary size, provided the combination (compound magnet) have sufficient magnetism to lift a weight of not less than thirty pounds attached to an iron plate put across their poles. In the larger magnetos the lifting power may rise even to forty-five pounds.

13. Compound Magnets.—At Figs. 8 and 8A we give illustrations in section and elevation

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 29 of 132

(with dimensions) of a compound magnet attached to its pole-pieces, each single magnet (of which there are three) being built up of two laminations,

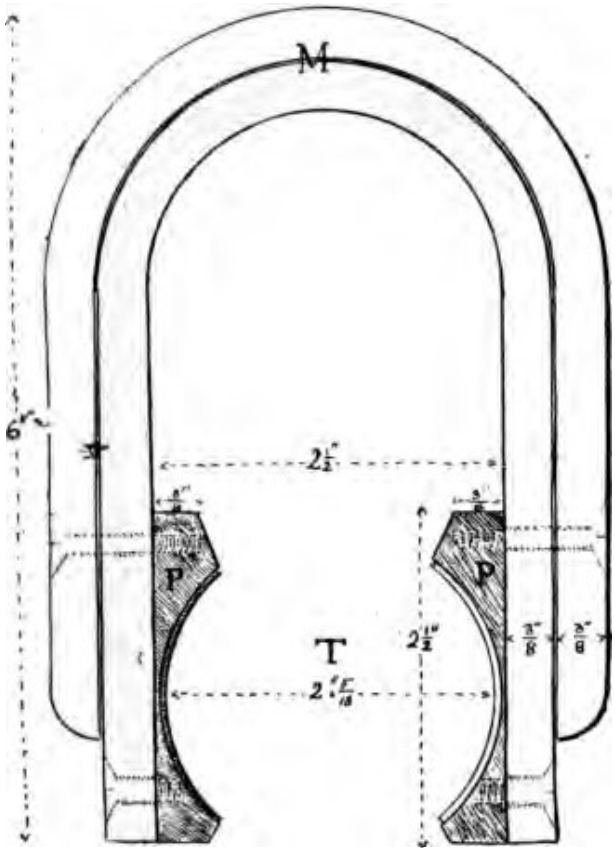


FIG. 8.—Sectional Front Elevation.
M, Compound magnet; P, Soft-iron pole-pieces; T, Tunnel for armature.

forged so as to fit accurately, the larger over the smaller, holes being drilled through both at the points indicated, and countersunk on their outsides to admit of the insertion of the flat-headed

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 30 of 132

screws, which serve to fasten the individual magnets not only to each other, but also to the two soft iron blocks which constitute the pole-pieces. It must be remembered that the dimensions given

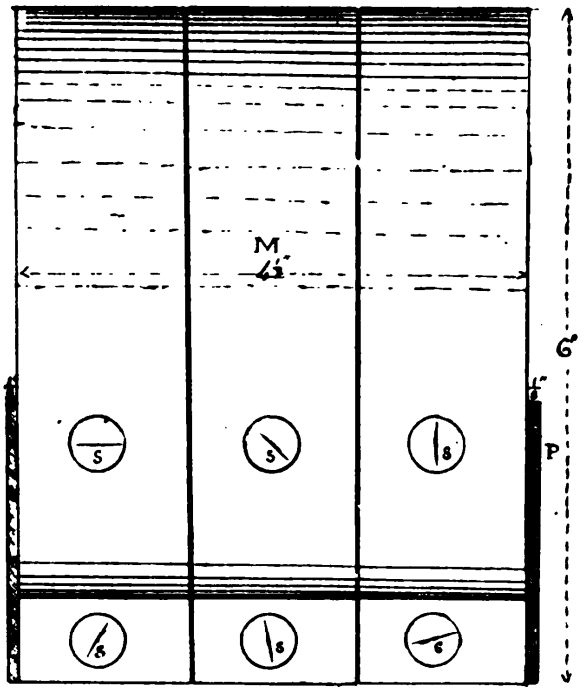


FIG. 8A.—Side Elevation.
M, Compound magnet; P, Pole-pieces, salient portions; S, Screws uniting magnets and poles.

are those suitable for a medium-size magneto; but the operator must be prepared to find in trade great departures both in the sizes and patterns of the different magnetos, according to the taste and requirements of the manufacturers. Thus, for instance, he will find in some cases the

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 31 of 132

individual laminæ which constitute each single magnet to be two, or even three in number, very rarely one only, and still more rarely exceeding three. In like manner in very small magnetos, two compound magnets only may be employed to embrace the pole-pieces, the usual number, however, being three.

14. Hints on Fitting Magnets.—In any case, it must be borne in mind that all work, in the way of drilling holes, fitting, cleaning up, or otherwise working upon the steel, of which the magnets are constructed, must be executed *before the steel is hardened and previous to magnetisation*, because it would be practically impossible to perform any such work after the steel had been hardened, and, even if it were possible, it would be greatly to the detriment of the magnetism imparted to them. For this reason, having decided upon the size of the armature to be inserted, the operator will do well to fit the pole-pieces to the magnets as the next operation, leaving the hardening and the magnetisation of the steel until all fitting is completed. In order to facilitate the operation of putting the magnets together without risk of mistakes as to polarity, the operator will do well at this point to mark all the constituent magnets on one and the same side with a letter N, by the aid of a steel letter-punch, remembering when he

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 32 of 132

comes to the operation of magnetising the individual laminæ so to act as to produce north poles at the extremities thus marked.

15. Clearance between Armature and Pole-pieces.—In the accompanying figures, which illustrate a machine in which a movable shield is made to oscillate between the pole-pieces and the armature, the latter being immovable, the dimensions given for the armature are such as to admit of the insertion and motion of the said shield between the two. It must be noted that, in order that the full power of the magnet may be exerted upon the wiring of the armature when the shield is shifted, the tunnel must be bored out so as to leave the very minutest possible clearance between the two; since, as magnetic forces act with a strength which is inversely proportional to the square of their distances, a very trifling increase in clearance makes a very great difference in electrical output. For this reason, the clearance given between an armature (or its shield) and the pole-pieces does not usually exceed the thickness of a sheet of writing-paper, or, say, $\frac{1}{100}$ in.

16. Armature with or without Shield.—Where a shield is used, as in the low-tension Simms-Bosch and machines of similar type, it usually takes the form shown in Fig. 9, where

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 33 of 132

the dimensions are given. But, where no shield

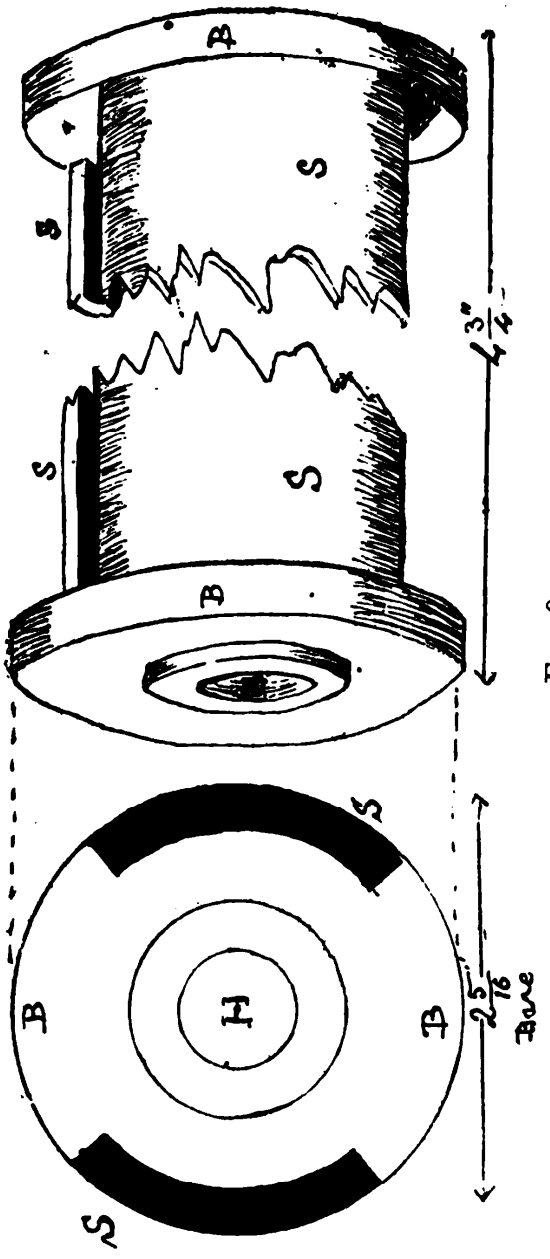


FIG. 9.

S S, The two iron segments forming the "shield"; B B, The circular brass heads to which the segments are attached laterally; H, The central spindle hole, $\frac{1}{8}$ in. diameter.

is used, the relative diameter of the armature is shown at Fig. 10. The armature itself is usually

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 34 of 132

made of good soft iron, and may either be drop-

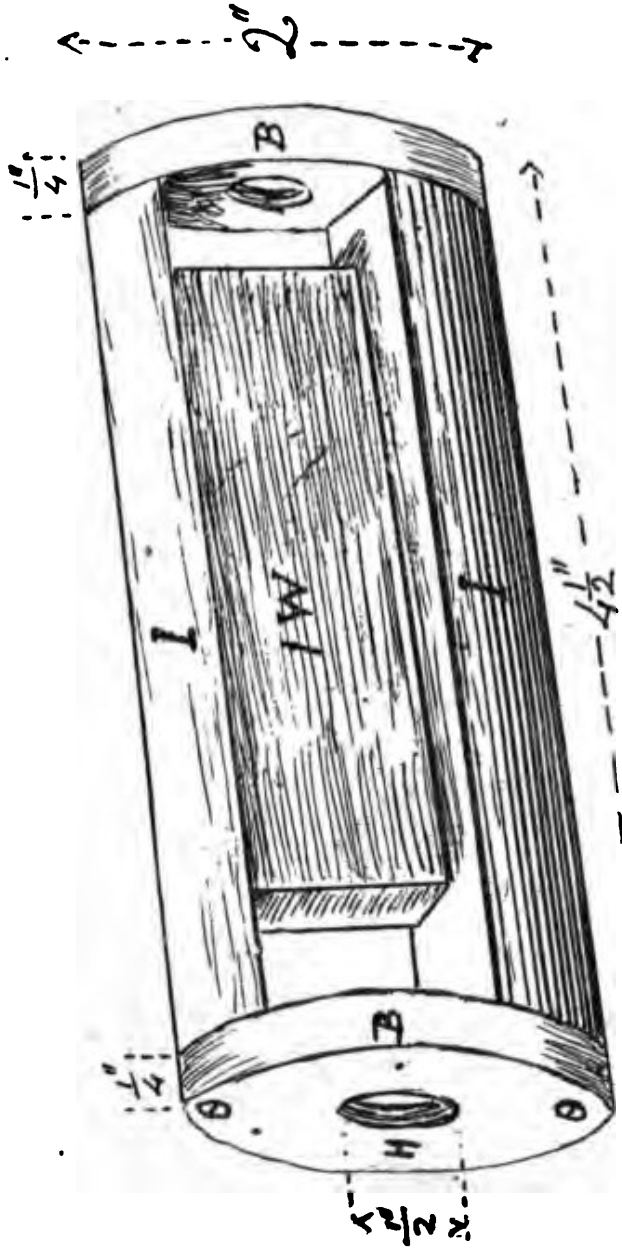


FIG. 10.—Sizes of parts in an Unshielded Armature.
I I, The iron cheeks of armature; I W, The central iron web; H H, Holes for spindle; B B, The brass heads or caps.

forged, of the rough dimensions and shape, or else cast and annealed, the former being preferable.

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 35 of 132

In either case it must be accurately fitted, and finished up on the lathe. If a shield be used, this, which embraces the armature, should have a thickness of $\frac{1}{4}$ in., and, if it were continued to form a perfect cylinder round the armature, would have a diameter of $2\frac{5}{16}$ in., less the clearance that we have stated above. But it must be borne in mind that the shield is not continuous, but consists of two segments, each constituting very nearly one-quarter of an entire circle, being fixed at opposite points in the circumference to two circular brass heads of the same diameter—namely, very nearly $2\frac{5}{8}$ in. These brass heads are usually cast in $\frac{1}{4}$ in. brass, with cylindrical extensions. When an unshielded armature is used, its diameter may be reduced to 2 in., the tunnel in the pole-pieces being bored out to a correspondingly smaller diameter, plus the clearance.

17. Contact of Armature with Machine.—Whether we decide finally to use our armature with a shield or without, there is one point that will have to be borne in mind, and that is, that while the starting-end of the armature winding must be placed in electrical contact with the iron body of the armature (and consequently with the whole mass of the machine) by being caught under the head of a cheese-headed screw inserted therein,

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 36 of 132

the termination thereof must be brought out, carefully insulated (through the spindle, which, for this reason, must be, not only hollow, but carefully bushed internally with ebonite, or some other similar good insulator).

18. Fitting Spindle to Armature.—We will, therefore, now pass to the consideration of the means usually adopted to fasten the heads and the two extremities of the spindle to the core of the armature. This we have partially illustrated in our last figure (Fig. 10), as being effected by means of screws passing through the brass heads into the iron of the armature; but, as it is essential that the armature should be absolutely central in its tunnel (or between the two cheeks of the shield), with the minutest possible clearance, it is also necessary that its attachment to the two heads should be rigid and immovable. To meet this requirement, on the inner faces of the brass heads, at a distance of about $\frac{1}{8}$ in. from the circumference, are cut, whilst it is rotating on the lathe, two chamfers, one on each, of about $\frac{1}{16}$ in. width, and of similar depth, and on the heads of the armature core itself are produced two corresponding ridges that fit exactly into the said chamfers, and thus ensure perfect centricity and rigidity. The back spindle (by which we understand the one to which action would be

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 37 of 132

imparted by means of a dog clutch or cardan joint) will consist in a round steel rod of about 2 in. in length and $\frac{3}{4}$ in. in diameter, one end of which has a shoulder turned down to enable it to fit into a $\frac{1}{2}$ in. hole made in the centre of the corresponding armature head, into which it is sweated and burred over. The other end of the spindle consists in a steel tube, about $\frac{1}{2}$ in. in diameter, $2\frac{1}{4}$ in. in length, with a shell of $\frac{1}{8}$ in. thickness. One end of this should be threaded for a length of about $\frac{1}{4}$ in., to enter in a hole in the centre of the front armature head, and then burred over, to render it absolutely immovable. This tube, forming the front shaft, is now to be fitted with an ebonite bushing, reaching from end to end internally, and projecting at the outer extremity for about $\frac{1}{8}$ in. beyond the front of the spindle, to which it is to be firmly attached by means of a little shellac varnish applied to the ebonite externally before it is finally driven in. When this has been done, a $\frac{1}{8}$ in. hole is put through the centre of the ebonite bushing from end to end, and into this will be afterwards inserted a copper rod, $\frac{1}{8}$ in. in diameter, bearing at one end a mushroom-shaped brass cap, of the same diameter as the ebonite bushing; and at the other, reaching through the hole in the front armature head,

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 38 of 132

where, when required, it can be attached to the terminating wire of the armature winding.

Fig. 11 will give a clear idea of the mode in which the front spindle is bushed and connected to the armature windings; and this mode of connection will hold good whether the armature itself be rotated or oscillated, or whether it

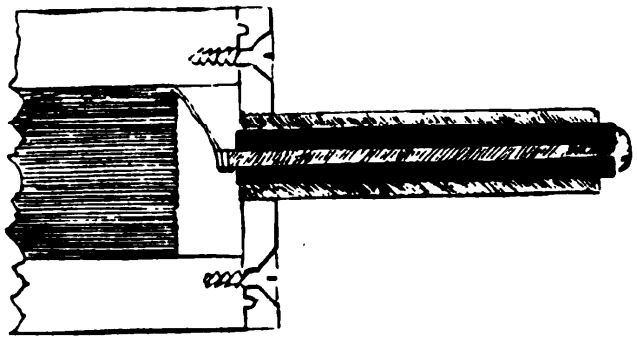


FIG. 11.—Section of front spindle, showing connection of armature wiring to the insulated central rod and stud.

remains motionless while a revolving or oscillating shield (embracing the armature) be employed to vary the intensity of the field of force.

19. Winding Armature.—To wind the armature, we shall require from $\frac{1}{2}$lb. to $\frac{3}{4}$lb. of No. 26 double cotton-covered wire; but before proceeding to the winding, the web of the armature, as also the inner cheek of the armature channel, should be carefully "dressed" with silk ribbon dipped in shellac varnish, so as to ensure adhesion and to prevent the wire, which will be afterwards laid

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 39 of 132

on, from accidentally coming into contact with the metal of the armature itself.

These being dry, the next operation is to insert a small screw in one of the inside faces at the back end of the armature; and, under the head of this screw, is caught a little loop of the said wire, the end of which has been previously bared, to ensure good metallic contact. This being done, the wire is wound as evenly as possible round the web, longitudinally on the channel, care being taken that each succeeding coil lies close to its neighbour—so close, in fact, that the wire of the succeeding layer shall not sink in between any space left in the subjacent layer. Each complete layer, as it is wound on, should receive a coat of good shellac varnish, and the winding continued in this manner with one length of wire until the channel is nearly filled up, when a transverse binder of phosphor bronze wire should be bound round the armature in a little channel previously turned therein, with the end of preventing the armature winding from rising from its place by centrifugal tendency. It is usual and advisable to put a little strip of thin mica over the wire at the place where the binding wire crosses it; and, finally, to fasten down the binding wire by means of a drop of solder applied with a hot bit. The free end of the armature

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 40 of 132

winding is now bared and carefully soldered to the projecting extremity of the $\frac{1}{8}$ in. copper rod which extends from the brass cap at the end of the front bearing right through the bushing of the front spindle; and, to avoid any accidental short-circuiting which might arise from any unobserved contact between the armature wires and the inner cheek of the front brass head, to "dress" the inner surface of this said brass head with a piece of jean dipped in shellac varnish and thus fastened thereto. We have purposely left the exact amount of wire to be employed somewhat vague, because it will depend very largely upon the size of the armature and the character of the spark it is desired to obtain. But, in the case under consideration, of which we have given dimensions, from 8 oz. to 10 oz. will generally be found sufficient. The gauge of the wire is also of importance. Coarse wire gives a fatter spark than fine wire; but, in order to get as high a tension with a coarse wire, say, No. 22 or No. 24, as with the finer previously mentioned, the armature (and consequently the field magnets) must be larger in proportion, to admit of a larger quantity of wire being wound on.

20. Pattern of Bearings.—The bearings next demand our attention. These take varied forms in the hands of different makers, in accordance

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 41 of 132

with their different requirements. A very common pattern is that shown at Fig. 12, in which we have a gunmetal plate about $\frac{1}{4}$ in. thick, of the same width as the base of the magneto below, but becoming somewhat narrower as it approaches the bend of the magnets. On this plate is cast at the same time a conical box about 1 in. deep, and a nozzle or collar 1 in. in diameter, which will

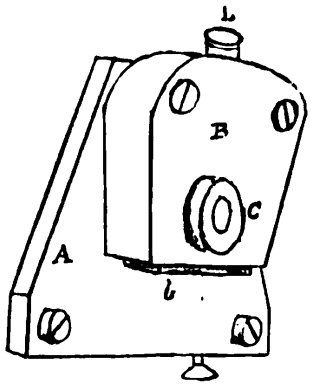


FIG. 12.—Elevation of back bearing.
A, Gunmetal plate; B, Recessed box; C, The nozzle or bearing proper; *b*, Bottom cover; L, Lubrication cap.

afterwards be bored to take the armature spindle. The conical box is cast hollow (except where the nozzle or collar traverses it), and herein are arranged the ball bearings (if such be used), the means of lubrication, such as "wick," "ring," or Stauffer's, etc., at the option of the maker. In many cases the bearing-box is furnished with a well-fitting cover *b*, held in place by two lateral

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 42 of 132

bowed springs (see Fig. 13, *s s*), in which the recessed box is shown in front section. All these fittings are to be made practically water-tight, as in a well-constructed magneto it is essential that the working portions should be so thoroughly

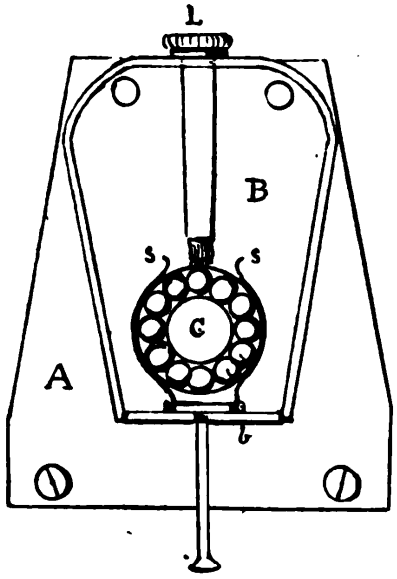


FIG. 13.—Elevation of back bearing.

A, The gunmetal plate; B, The recessed box (partly in section); C, The nozzle, cup, or bearing proper, showing the balls; *b*, Bottom cover, retained by springs *s s*; L, Lubrication (wick here shown).

enclosed as to prevent the admission of water, oil, or dirt of any kind. For this same reason it is customary to enclose the space between the top of the pole-pieces and the edges of the brass plates constituting the faces of the bearings, with a sheet of fairly stout zinc, faced internally with

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 43 of 132

cloth or felt, and retained in position by short screws entering into the top edges of the said bearings, of which there are two—one at each end of the spindle.

21. Insulation of Front Bearing.—These bearings may both be cast from the same pattern; but it must be noted that, as the front end (that at which the armature wire projects through the insulated spindle) carries the first contact-stud, by means of which the current flowing from the armature is taken to the "plug" in the combustion chamber, it must be insulated: to this end provision must be made for the insertion of two $\frac{1}{4}$ in. bolts, one at each lower extremity of this (the front bearing), which support the stout ebonite insulating rods, and the bracket. The bottom of the magnets, with their pole-pieces, is closed by a stout rectangular base, either in zinc or aluminium, and this is sometimes furnished with a flange at right angles to the said base, by means of which the magneto can be fixed to any desired and suitable portion of the body of the car. The operator will remember that *no holes*, except those previously mentioned, for fixing the magnets to the pole-pieces, are to be made in the magnets, so that all the attachments above mentioned are screwed either directly into holes made in the pole-pieces, or indirectly to the same

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 44 of 132

by means of screws fitting in the front- and back-plates, which serve as bearings. Hence, the screws that hold the magnets to the pole-pieces must be stout and strong, and not less than twelve in number, six on each side. We proceed to show the arrangement of the insulated fixed

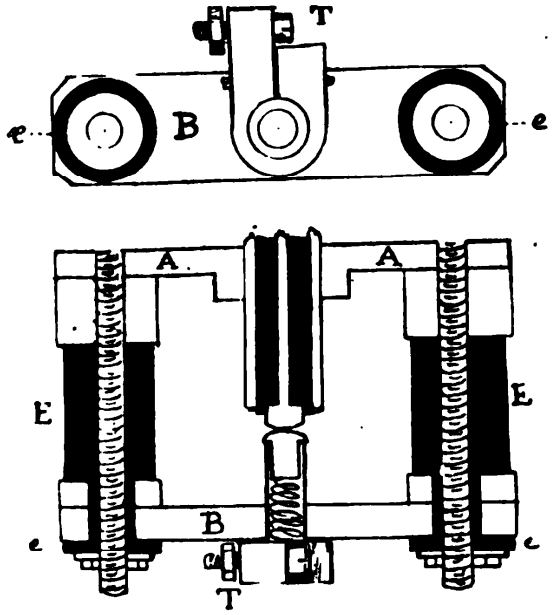


FIG. 14.

contact on the front bracket, by means of which the moving contact-stud can deliver its current to the plug, notwithstanding its rotary or oscillatory motion. To effect this purpose the cross-bracket B, shown in elevation and section at Fig. 14, is insulated from the front bearing-plate A by stout ebonite pillars E E, and washers *e e*, while it, with its attached-terminal T, is in contact with

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 45 of 132

the live or outer armature wire through the fixed contact-stud (which is kept constantly pressing against the moving stud) by means of a little coiled spring let in the bearing at *b*.

22. Closed and Open Circuits.—The reader will notice that in the illustration we have supposed the magneto to be running on the *closed* circuit; that is to say, that the circuit is complete from one end of the armature wire to the other through the frame of the car, except only when an interruption is made in the circuit intentionally by means of the tappet. But, although this is the plan usually adopted, there are many magnetos in the market in which the contrary system is adopted; that is to say, in which the magneto runs on the *open circuit:* this means that no current passes until contact is made by the tappet, when the spark at the plug takes place. A little careful examination of the portions already illustrated will render the construction of such a magneto (without the movable shield or screen) perfectly clear and intelligible.

23. Contact Breaker Actuated by Two-to-one Gear.—We may now pass to describe the mode in which the current flowing from the armature is allowed to pass, or is interrupted in its passage to the sparking-plug, by means of a contact-breaker actuated by the two-to-one

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 46 of 132

gear, so as to produce a spark in the combustion-chamber at the desired instant. The reader will remember that the spark produced is what is termed an "induction" spark, the strength of which is dependent on the induction set up by the numerous convolutions of wire (coiled round

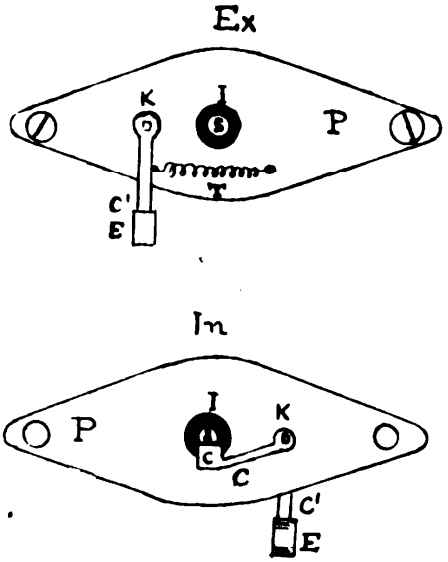


FIG. 15.—Contact breaker.
Ex., Seen from outside the combustion chamber; In., Seen from inside the combustion chamber.

the armature) upon one another at the moment of making or breaking contact at any point in the circuit, and that, unless this sudden make or break in the circuit occurs, the E.M.F. of the current set up by the mere rotation or other movement of the armature would not have sufficient tension to produce a spark at the

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 47 of 132

sparking plug. Although many means are adopted to secure this result, the annexed sketch (Fig. 15) will give an idea of a typical method of breaking (in the case of machines of the closed-circuit type) or of making this contact (in those of the open-circuit type). The reader must bear in mind that this contact-breaker very rarely forms part of the magneto proper, and that except only in the case in which the current from the magneto is made to actuate a coil is this required; but the current generated by the armature is taken off the terminal T, which projects, as shown at Fig. 14, direct to the plug by means of a sufficient length of well-insulated flexible cable known as "high-tension flexible."

24. Breaking Contact.—Let us suppose that we have a cylinder of some hard, infusible insulator, I (such as soapstone), of sufficient length to reach from the outside of the combustion chamber to its interior, into which it can be inserted as usual by means of a threaded cap, or (if it takes the shape, as in the illustration, of an oblong square) by means of side screws fitted to the outside of the said chamber. Through the centre of the aperture passes a stout steel rod, S, faced at one portion, where it is flattened, with a speck of platinum. This central rod is placed in connection with the live wire proceeding from the

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 48 of 132

magneto by means of the said "flexible." Working in the plate P of this contact-breaker, we have a straight arm, C, bearing at its inner extremity, close to the steel rod, a little square. This is borne at K by a short spindle, which forms a trunnion for this arm extending from the inside to the outside of the cylinder; and bearing a cranked extension, C′, on the outside, this extension being at right angles to the inner arm C. By means of a coiled spring, T, this arm is drawn towards the centre of the contact piece, so that the little square C is retained in contact with the central rod S, unless C′ be forcibly drawn aside by anything striking against its lower extremity, E, when, of course, the contact between S and C being interrupted, a vivid spark would occur, and thus fire the explosive mixture.

25. Making Contact.—If it were desired to produce the spark by *making* instead of by *breaking* contact, as in the above example, the same appliance could be made use of; but in this case it would be necessary that the pull of the spring should be exerted in the opposite direction, to ensure that the two pieces C and S should only come in contact the one with the other at the instant when the cam on the two-to-one shaft strikes the prolongation E of the cranked arm. Although this arrangement is perfectly efficient,

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 49 of 132

it labours under the disadvantage of being liable to be blown off the gland of the combustion-chamber under the force of the explosion, and therefore contact-breakers of almost precisely similar principle, but capable of being screwed into the usual threaded hole in the combustion-chamber, are now largely adopted.

26. Alternative Contact-breaker or Plug.—

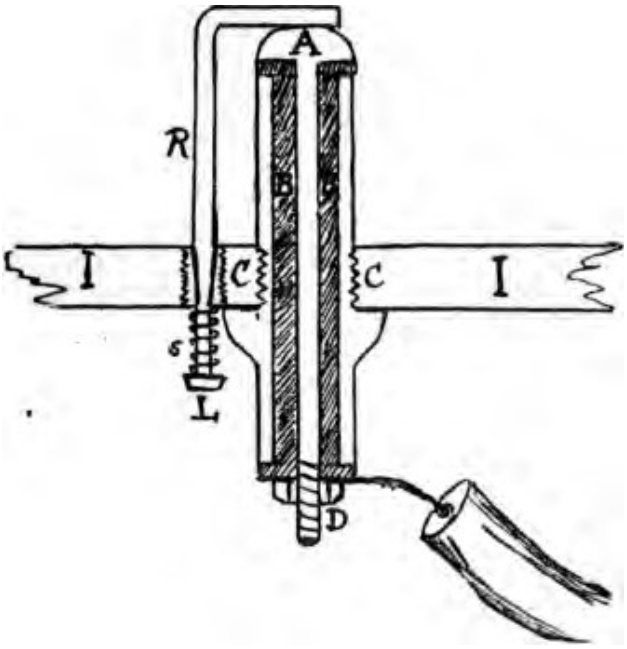


FIG. 16.

In order to render this portion of our subject complete, we illustrate at Fig. 16 another form of contact-breaker (or maker) which is free from the above objection, but which, of course, necessitates the shell of the combustion-chamber being

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 50 of 132

perforated to allow of the passage of the striker-rod. This is usually borne in the centre of a little screwed plug, thus rendering its insertion and withdrawal a matter of comparative ease. The contact-breaker itself consists, then, of two portions—viz., a mushroom-headed metal core, A (usually of cast iron or nickel), passing through the centre of a plug of the ordinary ignition type, from which it is well insulated by means of a steatite or other fire-resisting insulator, B. This fastens into the combustion-chamber, I, by means of its screwed collar, C, and terminates at its outer extremity in a small nut, D, under which is clenched the live wire proceeding from the magneto. The other portion consists in the striker, S, which takes the shape of a rectangular piece of metal, forming an extension of the striker-rod, R. This striker rests against the mushroom head, A (if the magneto is working on the closed circuit), being maintained in that position by the action of a small spring, shown at S, on the outside of the combustion-chamber. The striker-rod itself, where it enters the plug screwed into the combustion-chamber, is slightly coned, with the result that the mere act of explosion tends to close the aperture through which the rod passes more tightly, and thus to prevent any escape of the explosive mixture. The outer end of this

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 51 of 132

same rod, R, terminates in a little stud, L, against which the tappet, or any prolongation thereof, strikes at the moment it is desired to produce the explosion, which it does by suddenly interrupting the contact between the striker, S, and the metal cap, A, when a vivid spark is produced.

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 52 of 132

CHAPTER III

MAGNETISATION

Magnetising field magnets—Permanent magnet—Electro-magnet—Continuous-current dynamo—Wire helix—Temper.

27. Magnetising Field Magnets.—Having thus described the essential parts of the magneto proper, we will turn our attention to the methods usually adopted for magnetising the field-magnets, which hitherto have only been forged, bored, and fitted. They now require hardening in the usual manner, and this operation must be carefully conducted so as to produce the desired amount of hardness without rendering them too brittle. They must be so hard that a file will not touch them; but at the same time they must not be hardened to such an extent as to cause them to break if tapped with a gentle blow from a light hammer. If they be tempered sufficiently to enable them to cut the surface of cast iron, they will be hard enough. If left too soft, although they will take up magnetism more readily, they will, on the other hand, lose the magnetism thus acquired with

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 53 of 132

great ease; if the hardening be carried to the point of brittleness, they will be very slow in acquiring their full magnetism; but, on the other hand, will retain it. There are three methods by which the magnets can be successfully magnetised: 1st, by means of a powerful permanent magnet, known as a "king magnet;" 2nd, by means of a powerful electro-magnet, or a dynamo which is running; and 3rd, by means of a coil of wire round which a current of electricity is flowing. This latter is usually designated "a solenoid."

28. Permanent Magnet.—If a permanent, or king, magnet be used, this had better be of the horseshoe form, and should be very massive, with a space between its limbs nearly as great as that existing between the limbs of the field-magnets which it is proposed to magnetise. The reader will remember that he has been advised to mark one of the poles of each of the magnets made with a letter N, and he will be careful in magnetising these, to render *these* poles north, by placing the S pole of the king magnet on or against this N pole of his new magnets, the N pole of the king magnet at the same time striding over and resting upon the opposite limb of the new magnet. He will then draw the king magnet along the surface of the new magnet in this position until he reaches

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 54 of 132

the bend, when he will return to the poles again, and here lift the king magnet up, and right away from the new magnet. He will then replace it (still in the same position with regard to its poles) on the bend of the new magnet, and stroke along it from bend to extremities, again lifting and replacing on the bend, repeating this operation many times (until, in point of fact, the magnet has acquired as much magnetism as it will take up on *that* surface), remembering always that the final stroke must be from bend to poles, at which point the king magnet must be removed from the new magnet. The new magnet is now reversed—that is to say, its other edge is placed uppermost, and subjected to the same stroking treatment, great care being, of course, taken that the correct poles be used in juxtaposition (the S. pole of the king magnet against the N. pole of the new magnet, and *vice versâ*), otherwise the magnetism already imparted will be annulled. We still have to magnetise the new magnets on their wider faces; and this is best done by placing the king magnet (with its poles in the correct position) on the wide face of the bend, and then stroking the magnet from end to end a sufficient number of times, never allowing the poles of the king magnet to pass beyond those of the new one, and finishing by lifting and removing the king magnet when it

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 55 of 132

arrives at the middle of the bend, and *not* when it is near the poles.

To do this work efficiently, the king magnet itself must be of sufficient strength to lift at least 30lb.

29. Electro-magnet.—If a "king magnet" of sufficient power be not available, even better results can be obtained by the use of an electro-

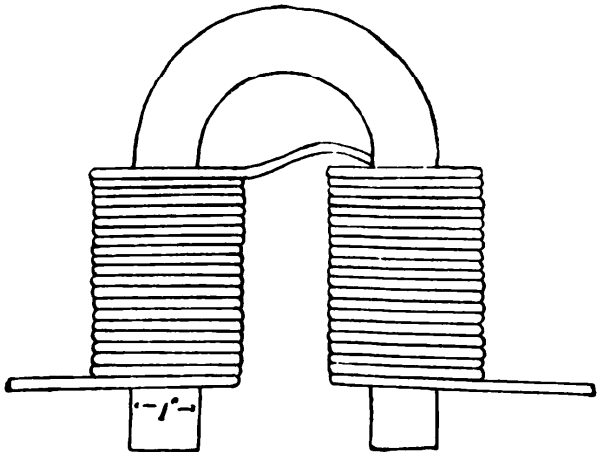


FIG. 17.

magnet of the form and approximate dimensions given in Fig. 17, made from a bar of round, soft iron, 1 in. diameter, 18 in. long, bent as shown, to stride over both limbs of the new magnets. When thus bent and forged to shape, both poles being filed perfectly flat and level, this horseshoe is to be wound, as shown, with about 4lb. No. 18 double cotton-covered copper wire. If the two free ends of the winding wire be coupled to the terminals

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 56 of 132

of a 4v. accumulator, this electro-magnet will be found capable of lifting about 1 cwt. Care must be taken when using this, *always to connect* the same terminals to the *same* wire ends: otherwise the polarity will be reversed.

With such a magnet, powerful magnetism can be easily imparted by stroking the steel bars or horseshoes precisely as indicated in our former section. Whether a permanent king magnet or a temporary electro-magnet be employed, the operator will remember that by striking the steel of the new magnet, or "tapping" it several times while it is under the influence of the magnetiser so as to make it ring, will greatly facilitate the acquirement of magnetism—probably in virtue of the fact that the vibration thus set up permits the constituent molecules of the steel to take up the polar position which constitutes magnetism.

30. Continuous-current Dynamo.—Another mode of imparting magnetism is by means of a continuous-current dynamo. While a dynamo is running the two pole-pieces become powerfully magnetised. Hence, if by means of a compass-needle the polarity of these be noted, so as to recognise which is north and which south, it is easy to magnetise our new magnets by placing the pole that we desire to make south against the north pole of the dynamo, and that which we wish

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 57 of 132

to make north against the south pole of the dynamo, using the same precautions of clanking the new magnet against the dynamo-pole several times, so as to bring about the vibratory motion just mentioned,

31. Wire Helix.—There is yet another manner of imparting magnetism to the steel horseshoes, and that is of making a helix of several hundred

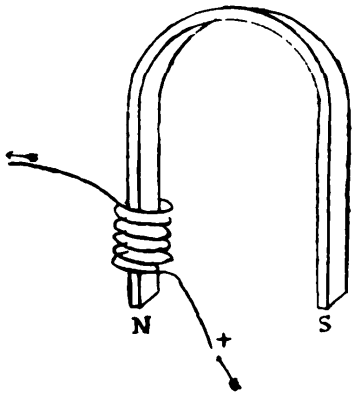


FIG. 18.—Magnetising by a wire helix and battery.

turns of No. 18 cotton-covered wire, as shown in Fig. 18, of such an internal diameter that it can be passed from end to end of the same around the bend. If now a current of electricity (of not less than 6 ampères) be passed through a helix of about two hundred turns, and this latter be drawn over the horseshoe several times from end to end, the horseshoe will become powerfully magnetised.

The operator will bear in mind that *that* end of

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 58 of 132

the magnet will become *north* which is *under* the wire or wires carrying the positive current, the north pole being found to the *left hand* of this entering current. Our Fig. No. 18 illustrates by the arrows the direction of the current and the polarity of the resulting magnet. As before, while this operation is going on, it will be advisable to tap the steel horseshoe repeatedly, and if the circuit between the battery and the helix of wire be frequently broken, the result will be even more satisfactory. This latter method, though perfectly satisfactory when magnetising small magnets, is not so well adapted in the case of large ones, as very heavy currents are then required. We therefore give the preference either to the separate electro-magnet system figured at 17, or else to the dynamo method, which, if the dynamo is one giving at least 1 kilo-watt, will be found eminently satisfactory.

32. Temper.—Before closing this portion of our subject, we might mention the best *temper* is that usually imparted to the steel required for files and other cutting tools for cast iron, and should in no case be deeper than *pale straw.*

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 59 of 132

CHAPTER IV

THE ARMATURE SCREEN AND ITS FUNCTION

Advantage of shield—Effect of shield when in line with pole-pieces—At right angles—Inclined to pole-pieces—Influence on current—"Timing" by use of shield—Retardation and advance of spark—Control of shield—Principle of "timing"—"High tension"—"Sparking" by tappet-rod and cam—Modified shields and armatures.

33. Advantage of Shield.—We can now pass to the consideration of magnetos in which a screen or shield can be inserted between the pole-pieces of the field-magnet proper and the armature, and this, whether the armature itself be made to partake of a rotary or an oscillatory motion, or whether it be held immovable while the screen or the shield be caused to move. One of the chief advantages in the employment of the screen is the power that it gives us of altering the position of the "field of force," and of thus "timing" the occurrence of the spark.

34. Effect of Shield in Line with Pole-pieces.—Before describing the different modes in which the screen can be utilised, it will be well for the

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 60 of 132

reader to glance at the annexed illustration, so as to form a clear idea of the manner in which it acts. For instance, at Fig. 19 we have a sectional illustration of the pole-pieces of one of our magnets, A A, in which at B B we have the two segments of circles which constitute the shield or screen proper. These, as we have already described

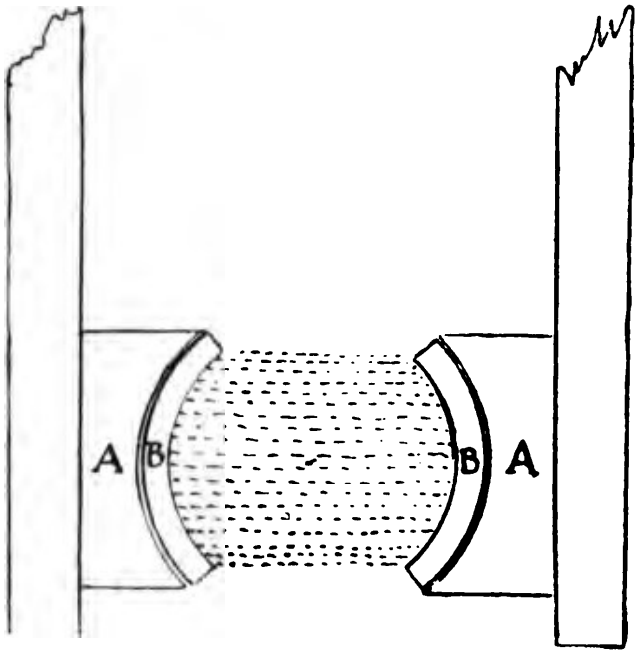


FIG. 19.—Section of pole-pieces with shield in line with them, showing lines of force.

and figured at our illustration, Fig. 9, are carried by the discs at the end, and if shifted move simultaneously. They are made to run so closely to the pole-pieces themselves that, when they are placed as shown in our illustration, they practically

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 61 of 132

become magnetically part and parcel of the field-magnets themselves, and consequently send their lines of force across the tunnel, impinging upon anything (armature, etc.) which may be rotating or oscillating therein. Hence, while in this position, they do not act as a shield at all, but

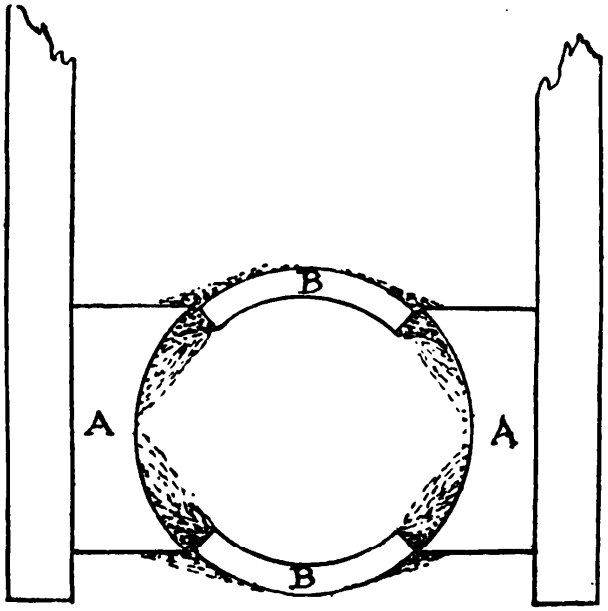


FIG. 20, in which the shield BB is in such a position as to complete the magnetic circuit, and thus prevent the lines from traversing the tunnel.

simply bring the pole-pieces into close proximity to the iron of the armature.

35. Effect of Shield at 90° to Pole-pieces.—Let us now imagine an extreme case, as shown at Fig. 20, in which the shield is placed at right angles to its former position. The result of this

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 62 of 132

position is, that the lines of force emanating from the poles of the magnet, finding themselves almost in contact at the extremities of their gaps with the terminations of the shield or screen, find a ready passage to complete their magnetic circuit through the said screen (which is of soft iron, and, therefore, affords a free passage for the completion of the circuit). Consequently, nearly all the lines of force which otherwise would traverse the tunnel from pole-piece to pole-piece are now concentrated on the screen while the aperture or tunnel is left void of any such lines.

In our illustration, to avoid confusion, we have in this latter case shown the tunnel as being absolutely free from lines of force. As a matter of fact, some few do traverse the space, but, owing to the fact that their magnetic attractions and repulsions act with forces which are inversely as the square of the distance, it follows that, as the shield now finds itself very much closer to the most active portions of the magnets (and also to the armature, which runs in the tunnel), the said shield absorbs practically all the lines of force, very few straying as far as the armature. This fact can be experimentally proved by any one possessing a magneto in which there is a movable shield, by first placing the said shield in a line with the pole-pieces and then attempting to rotate

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 63 of 132

the armature by hand; proceeding afterwards to make the same attempt after the shield has been placed at right angles to the first position. In the first instance, he will encounter very considerable opposition in causing the armature to rotate; in the second case, he will find practically no

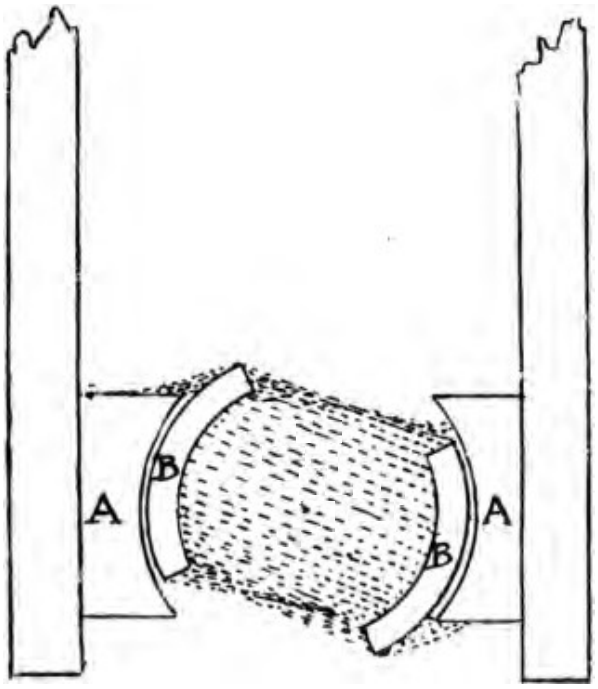


FIG. 21.—**Displacement of lines of force, consequent upon shifting the shield BB through a small angle.**

difficulty in rotating the armature with a very small exertion of force.

36. Effect of Shield inclined to Pole-pieces.—We may now pass to consider the effect of shifting the shield through a few degrees of arc, as illustrated in Fig. 21. Here, again, the shield

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 64 of 132

becomes powerfully magnetised, under the influence of the pole-pieces, with the result that the lines of force traverse the tunnel, producing a field which is somewhat distorted, as shown in Fig. 21, so that an armature rotating in this field will have the *time* at which the current attains its maximum intensity somewhat delayed with regard to the direction of rotation, if the armature be rotating *clockwise*, or advanced if it be rotated *counter-clockwise*.

37. Influence on Current.—In this illustration, as before, we have only depicted the main lines of force, leaving out, to avoid confusion, the stray lines which, to some small extent, also traverse the tunnel. We may now consider the case of using a fixed armature and a rotary shield, simply for the purpose of setting up the current, without the intention of altering or controlling by means of the shield the instant of greatest electrical intensity. In this case, the armature will stand with respect to the magnet and pole-pieces as shown at Fig. 22, A, the shield being indicated by the segments at B B. It will be remembered that, in order to generate current, the conductors C C, with which the armature is wound, must be cutting lines of force, either by rotating across them, or by the lines themselves being suddenly caused to impinge upon them, or to be cut off *from them*.

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 65 of 132

Now, we will suppose the two segments, B B, of the shield to be revolving round the fixed armature. While they are in the position shown in the illustration, *they* are sending all their lines of force *across* the conductors of the armature; but when, during the process of rotation, these two segments find themselves bridging across the

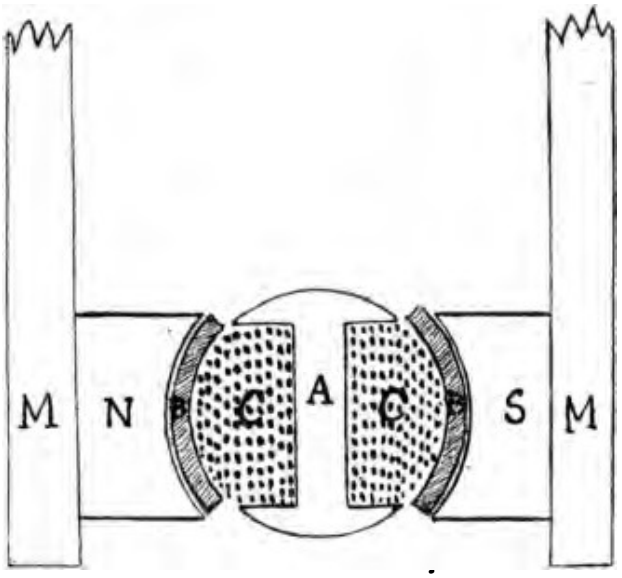


FIG. 22.—Showing shield increasing the action of pole pieces. A, The armature; B B, Segments of the shield; C C, Sections of the conductors; M M, Portions of the magnet; N S, Pole-pieces.

gaps between the pole-pieces, as in Fig. 20, no lines, or practically no lines, impinge upon the conductors, so that no current is generated. The reader will readily perceive that, in order to set up these waves of current, it is by no means

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 66 of 132

essential that either the shield in the one case, or the armature in the other, should perform *complete* revolutions. To secure the end in view, it is quite sufficient that the shield, or armature, should be able to oscillate through an arc of about 90° from side to side. In either case, the E.M.F. and quantity of the current will, *ceteris paribus*, be dependent on the speed of rotation or oscillation.

38.—"Timing" by use of shield.—As one of the most useful properties of the screen or shield is the power it gives us of controlling the time at which the spark shall occur (which should be coincident with the instant at which the greatest number of lines of force are passing through the conductors on the armature), we shall first devote our attention to the consideration of a magneto in which the shield has been placed, or is capable of being placed, in any desired set position with reference to pole-pieces, and has an armature working within it, either by being rotated or oscillated.

Let us suppose the screen or shield to have been set in the position shown in Fig. 19, in which the lines of force are projected straight across the tunnel. It is evident that the point in its rotation at which the conductors wound in its channels (see C C, Fig. 22) will cut the

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 67 of 132

greatest number of these lines of force will be when the said conductors are facing the two segments of the shield (as shown in Fig. 22), and consequently this will be the position at which the electricity set up will be at its highest intensity; hence, the time at which the spark should be taken at the sparking-plug, either by making or breaking circuit therewith.

39. Retardation and Advance of Spark.— We will now presume that the motion imparted to the armature be *clockwise*. As the armature continues its rotation its conductors cut fewer lines, gliding between them until the position of the conductor is at right angles to that shown, when little or no current is set up. Should the motion be continued, again an increasing number of lines is cut, *but in the opposite direction*, so that the current again rises in quantity and in tension, until another maximum is reached, when the conductors are again facing the screen. But, supposing that for any reason it be desired to retard or advance the time of the production of the spark at the firing-plug, without altering the existing arrangements at the contact-breaker, it is evident that this can easily be done by altering the position of the shield, since, by taking the shield through a small angle of arc, in the same direction that the armature is rotated, the field

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 68 of 132

will be proportionately distorted in that direction; consequently, the period at which the armature will reach the intensest point of field will be correspondingly delayed, and the spark retarded to the same degree. An examination of Fig. 23 will render this matter perfectly evident. In like manner, if the shield be moved a few degrees of arc in the opposite direction—that is, opposite

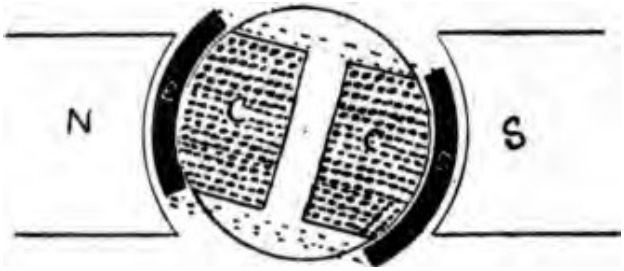


FIG. 23.—Spark delayed, by shifting the shield slightly in the direction of rotation of armature.

to the direction of rotation—the production of the spark will be advanced.

40. Control of Shield.—It will be understood that this power of retardation and advance by means of altering the position of the shield is, in this instance, entirely under the control of the driver, as the exact position of the shield is set or altered by means of a controlling lever on the quadrant. Sometimes the armature does not perform an entire revolution, but only oscillates under the influence of a cam on the two-to-one gear. Lastly, the armature may be held perfectly

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 69 of 132

motionless in the position shown at our Fig. 22, while the shield itself is made to oscillate by means of a lever, as shown in our Fig. 24 and

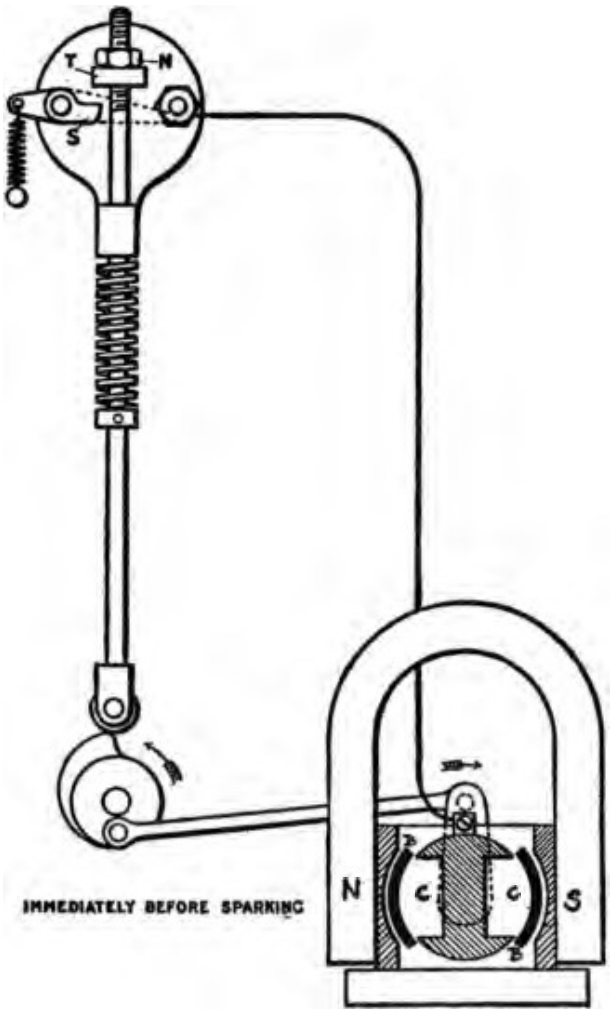


FIG. 24.

Fig. 25, in the former of which the shield is shown in the position it occupies just before sparking, while in the latter the shield has

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 70 of 132

shifted through a small angle through the tappet-rod sliding off the cam, and, at the same time, breaking contact between earth and the sparking-

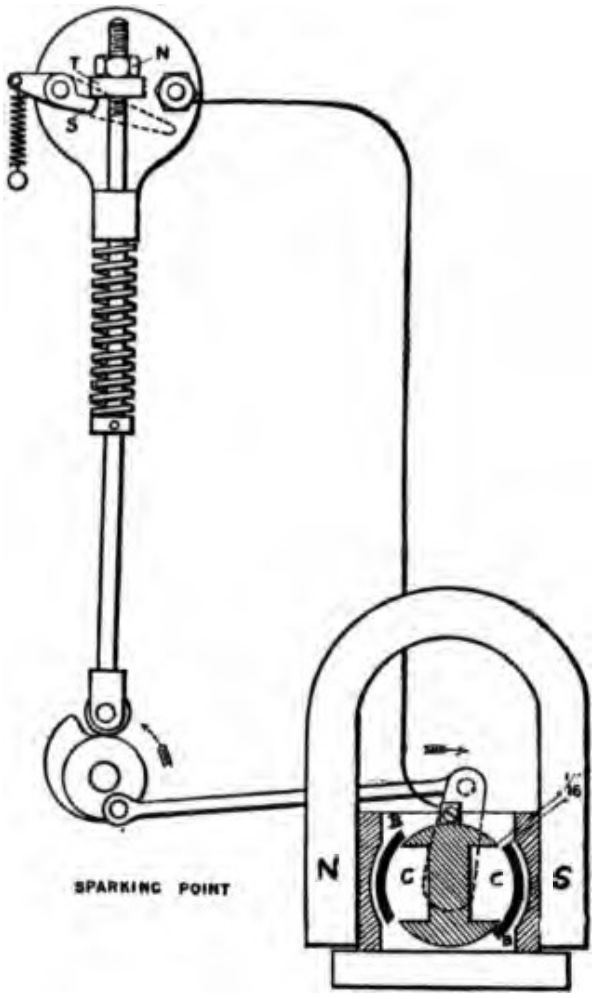


FIG. 25.

plug, thus allowing the spark to flow across the points or other contacts of the firing-plug.

41. Principle of "timing."—We should recommend the reader to study carefully these

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 71 of 132

last two illustrations, as not only is the manner in which the shield affects the magnetic field well illustrated, but also the mode in which the actual timing of the spark at the firing-plug is made to coincide with the point of maximum intensity of the said field. Of course, numerous modifications in the contact-making or breaking device are to be met with; but if the reader once grasps the principle of action of these arrangements, he will have no difficulty in understanding the alterations introduced by the different makers. There is one point, however, which must be borne in mind—and that is, that while on the one hand some makers prefer that the circuit should be complete between the magneto and the frame until the spark is required, so that when the circuit is broken the spark is produced—this method being known as the "closed circuit" system; on the other hand, some give the preference to leaving the circuit interrupted (or open) until the spark is required, when, contact being made, the spark is produced.

42. "High Tension."—We shall revert to the different modes of causing the spark to occur at the desired intervals when we consider those forms of magnetos in which the current from the armature winding is not taken directly to the sparking-plug, but is intensified either by means

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 72 of 132

of being passed through an independent sparking coil, or by enveloping the primary winding on the channel of the armature with a well-insulated winding of secondary wire, by which means the tension of the resulting current is very greatly increased. Such magnetos are known as "high tension."

43. "Sparking" by tappet-rod and cam.— In many excellent machines, such as the Bassée-Michel, the Peugeot, etc., no shield at all is employed, the regulation of the sparking being effected entirely by the tappet-rod and cam. In some instances which have come under our notice, in which no shield is employed, the desired alteration in the position of the field is effected by carrying the field-magnets a few degrees of arc to the right or left of the axis of motion of its armature.

44. Modifications of Shield and Armature.— Still, in the hands of a skilled workman, who knows how to set and adjust the shield, the presence of the shield gives him considerable latitude in the range of timing the spark. It would be hardly necessary here for us to dilate on the modifications in the construction of the armature and shield, when the motion of one of the two is dispensed with, since we have shown, in our first articles, that the shield should be made so as to be capable of rotation round the

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 73 of 132

spindle of the armature when such motion is required; while, on the other hand, when it is desired to arrange the machine so that the armature should rotate or oscillate, it can do so freely on the extremities of the tube carrying the caps of the shield as bearings, these latter being themselves held immovable in any desired position by



FIG. 26.—Mode of imparting oscillatory motion to shield

means of a set-screw or otherwise. In order to show how an oscillatory motion may be imparted to the shield or to the armature by the aid of a rod swivelled on the face of an eccentric on the shaft, we illustrate at Fig. 26 an old form of Simms-Bosch low-tension magneto, in which the shield alone can be made to oscillate under the impulses of the adjustable or telescopic rod actuated by the eccentric on the shaft.

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 74 of 132

CHAPTER V

HIGH TENSION MAGNETOS

Induced currents—Intensity and volume of induced currents—Back currents—Condenser: its materials and construction—Position of condenser—Simms-Bosch high tension magneto—Eisemann high tension magneto—Gianoli high tension system.

45. Induced Currents.—In the machines we have hitherto been considering, the current, whether set up by the motion of the armature or of the shield, and whether alternating or continuous, is conveyed by means of the live wire passing through the insulating spindle of the armature *directly* to the plug. In those we are about to study, the current is not utilised in this manner at all, but is made to set up a second current of very much higher tension in another piece of apparatus, which secondary current is the one utilised for the production of the spark. We here propose to show how this is done. We will suppose the reader to have sufficient acquaintance with the production of currents by induction to know that if we send an interrupted current

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 75 of 132

along a wire (whether bent into the form of a helix or in one straight length, is immaterial to the results), another current will be set up in the opposite direction along a second wire lying parallel to the first or primary wire at every time the alterations or interruptions in the first or primary wire take place. Let us suppose that we have 150 inches of, say, No. 16 cotton-covered copper wire, coiled into a helix round a 1 inch core; and either over it, or alongside it, another separate and distinct helix consisting of the same amount and gauge of similar wire. On making and breaking contact with any source of electricity and the first helix, it will be found that a precisely similar current will be set up in the second helix.

46. Intensity and Volume of Induced Currents.—Furthermore, if the number of turns of wire on the second helix be doubled, so that rather more than 300 inches of wire be employed, the tension of the current set up in the secondary coil will be approximately double that employed in the primary coil; in other words, the tension of the current set up in the secondary coil is directly proportional to the ratio existing between the number of turns on the primary and secondary coils. Another point which must be noted is that the volume of current (in ampères) set up in the

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 76 of 132

secondary coil, will vary in like proportion; that is to say, as the number of turns in the secondary coil *increases*, so the volume of current *decreases*. Therefore, if a primary coil of one hundred turns is fed with a current of one ampère, at one volt pressure, and over it be wound one thousand turns of secondary wire, we shall find that we can get a current of one-tenth of an ampère at 10 volts pressure from the extremities of the secondary, when the primary current is interrupted in the primary; and as the section of the wire required to carry one-tenth of an ampère is one-tenth of that required to carry one ampère, we may use a very much finer wire for the secondary than was required for the primary. Hence, it is customary to use a comparatively coarse wire for the primary and a much finer wire for the secondary, with a view to economise space, and also to keep the secondary wire in the most intense portion of the magnetic field.

47. Back Currents.—Before proceeding further with the details of making up these "high tension" magnetos, we must point out some other peculiarities connected with the behaviour of wires along which interrupted currents are being sent. It is found that if such a wire be bent into the form of a helix of many convolutions, each spiral will react on its neighbour, so that in a

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 77 of 132

coil of one hundred turns there will be during the passage of one flow one hundred oppositions in the helix—one for each turn—and these oppositions (which take the form of a back electromotive force, of equal intensity to that of the current sent) would greatly interfere with the induction effect set up on a secondary coil, unless some means were found of taking up this "back" current. In like manner, at the moment the primary current is interrupted, and the primary wire falls back into its neutral condition, a second current, in the same direction as the primary current, now traverses the helix; but this, thanks to its being in the same direction as the primary current, so far from annulling its effects, strengthens them.

48. Condenser: its Materials and Construction.—It is, therefore, essential in using primary and secondary windings, whether on the same armature or in a separate coil, to have some means of picking up or storing this back electromotive force, and turning it to good account, instead of allowing it to interfere with the desired inductive effect on the secondary. For this purpose an arrangement called a "condenser" is essential, and the following details of its construction, which apply equally whether intended for use in high tension magnetos or in coils (actuated by batteries),

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 78 of 132

will be of service. About 51 sheets of good, but rather thin, paper, absolutely free from pin-holes, metallic spots, or other blemishes which might allow the passage of electricity, are now prepared, and cut into oblong squares of exactly equal size (this dependent on the size of the machine into which they are to fit). A convenient size for coils is 5 in. long by $2\frac{1}{2}$ in. in width; 50 sheets of tinfoil, say 2 in. wide by 5 in. long, are also cut. A sufficient quantity of paraffin wax is now melted in a perfectly clean, flat tin dish over a gentle burner or a spirit lamp, and the sheets of paper one by one are immersed into this melted paraffin, drawn out against the edge of the dish to drain off all superfluity of melted wax, and hung up on a stretched line to drain and harden. Care should be taken to drain off as completely as possible any superfluity of wax by drawing the papers along the edge of the dish, as it is essential that the papers be perfectly evenly coated, and free from any blobs or patches of congealed wax. When the required number of sheets has been thus prepared, a piece of soft flat board (planed on its upper surface) is chosen, and one of the sheets of paper laid flat upon it. Eight pins are placed, two at each corner, at about three-quarters of an inch apart, as shown at Fig. 27, so as to prevent the sheets of paper moving during the

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 79 of 132

succeeding operations. A sheet of tinfoil is now taken and laid over the sheet of paper, leaving a quarter-inch margin all round, except at what we shall call the *lower* edge, where the tinfoil will project over about a quarter of an inch.

Another sheet of paper is now laid upon this,

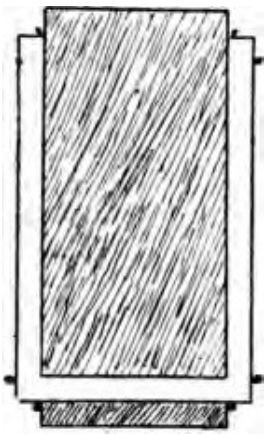


FIG. 27.—Building a Condenser.

and over this another sheet of tinfoil, with this difference: that the tinfoil must overlap the paper at the *upper* or opposite edge of the $2\frac{1}{2}$ in. side, instead of at the lower edge. Again, another sheet of paper is placed over the second tinfoil, followed by a third tinfoil sheet, again overlapping at the bottom or lower edge, and therefore in contact with the tinfoil below. In like manner the remaining sheets of paraffined paper and of tinfoil are placed one over the other, with the

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 80 of 132

alternate tinfoils overlapping at opposite ends of the paper sheets, as above described, until the whole tally of papers and tinfoils have been laid on, terminating, as we begun, with a sheet of paraffined paper. As each sheet is laid on, the papers should be firmly pressed together, which, owing to the plasticity of the paraffin wax, will cause them to adhere. When this has been neatly done, the operator will prepare two squares of rather stout cardboard of the same size as the paper sheets (in the example given 5 in. by $2\frac{1}{2}$ in.), soak these in melted paraffin wax, and, when set and hardened, will, by passing the blade of a thin knife under the prepared sheets, lift them bodily without disturbing their arrangement, and place them on one cardboard, cover them with the other, and bind them together tightly with a wrapping of rather wide tape laid on spirally, and stitched down one end, remembering to leave protruding beyond the cardboards the free ends of the tinfoils which project beyond the paper. A piece of No. 20 copper wire, about 7 in. long, drawn perfectly straight, is placed at its middle across one of these projecting ends, the tinfoils rolled tightly round it, and stitched down to it by means of a piece of black thread. The projecting ends of the wire are then bent over the tinfoil roll thus produced, and twisted

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 81 of 132

tightly together for after-connection, where required. The other extremity of the tinfoils are served in precisely similar manner, with the result that we have an arrangement of 25 sheets of tinfoil connected in parallel one with the other, separated by 25 sheets of paper from other 25 sheets of tinfoil, likewise in parallel among themselves, each set being furnished with its own separate connection. This arrangement constitutes a "condenser," or

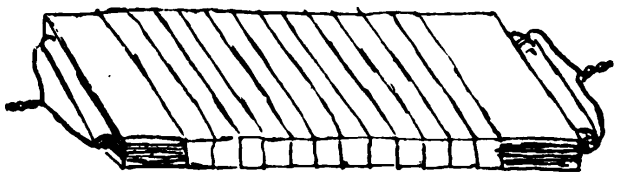


FIG. 28.—Condenser completed.

"capacity," so that if a charge of any given nature be communicated to the tinfoils of one set, a charge of opposite nature is acquired by the tinfoils of the opposite set, and this charge cannot be dissipated except through some path left open between the two connections. We give (Fig. 28) an illustration of a finished condenser of this type.

49. Position of Condenser.—Whatever be the system adopted for setting up the high tension current in the secondary winding, whether it be

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 82 of 132

an independent coil or whether it take the form of coils of fine wire insulated from, but superimposed on, the primary, the position of this condenser will always be the same, namely—its two terminals, *i.e.* the two twisted wires which are individually in contact with the two sets of protruding sheets of tinfoil, must be electrically in contact with the two ends of the primary circuit at which the "break" or "make" of contact takes place, to enable the "extra" or "self-induced" current to pass into and charge the two opposite sets of coatings of the condenser.

50. Simms-Bosch High tension Magneto.—These precautions being premised, we will pass on to the consideration of a typical form of magneto, in which the secondary winding is on the same armature as the primary. The one which we select for the purpose of illustrating the principle is the one known as the "Simms-Bosch high tension" magneto, illustrated in sectional elevation at Fig. 29. In this we have a set of three powerful steel magnets, with pole-pieces as usual. The armature itself is stationary, having two windings, one consisting of a few turns of coarse wire, and the other of many turns of well-insulated fine wire, thus simulating the iron core, the primary winding, and the secondary ditto of an ordinary induction-coil. Those who are interested in the

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 83 of 132

construction of the ordinary induction-coil as adapted for ignition purposes will do well to refer to the author's little book, "Ignition Devices for Gas and Petrol Engines." Over this is a rotating soft iron sleeve, having two slots, as illustrated at Fig. 9, that is, fitted between the pole-pieces and the armature. At one end of this latter is mounted a piece of mechanism, consisting of a contact-breaker or

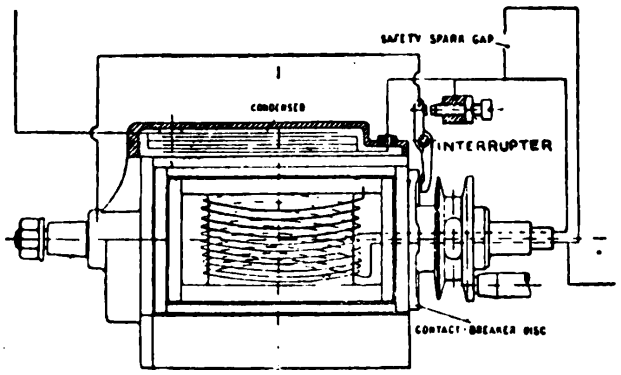


FIG. 29.

interrupter, of which we have recently described the construction, the object of which is to suddenly break the primary circuit when the current induced therein by the partial rotation of the soft iron sleeve has reached the point of maximum strength. The condenser is fixed in a small case in a recess just over the armature, and is connected to the primary or coarse wire circuit of the said armature by means of two wires as shown. The sudden

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 84 of 132

interruption of the primary current by the contact-breaker or interrupter brings about a high tension current in the secondary winding; one end of each winding is connected as usual with the metal-work of the machine, and the other ends are carried through suitable insulators to metal rings, whence the current is collected by carbon brushes pressing against them, and transmitted to the sparking-plug by an insulated cable in the usual manner.

51. Eisemann High tension Magneto.—Another form, perhaps familiar to the reader, is known as the "Eisemann," in which the secondary or high tension winding is entirely separate from the primary. Our Fig. 30 gives a typical illustration of this form of high tension magneto. In this we have the ordinary magneto with an ordinary H-armature, wound with coarse wire, rotating between the pole-pieces in the usual manner, no sleeve being used. The current produced in the armature is conveyed directly to the primary windings of an ordinary induction-coil, as shown at the bottom right-hand corner of our illustration, being connected in its path thereto to the condenser and to a contact-breaker or interrupter worked by a cam, the condenser being, as usual, placed in shunt with the interrupter. It will be seen, from the illustration,

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 85 of 132

that the primary or armature current is entirely independent from the secondary or coil current, and the occurrence of the sparks is regulated so as to take place at the point of maximum effect by the adjustment of the relative positions of the cam actuating the interrupter and the arrival of the armature in the field of maximum

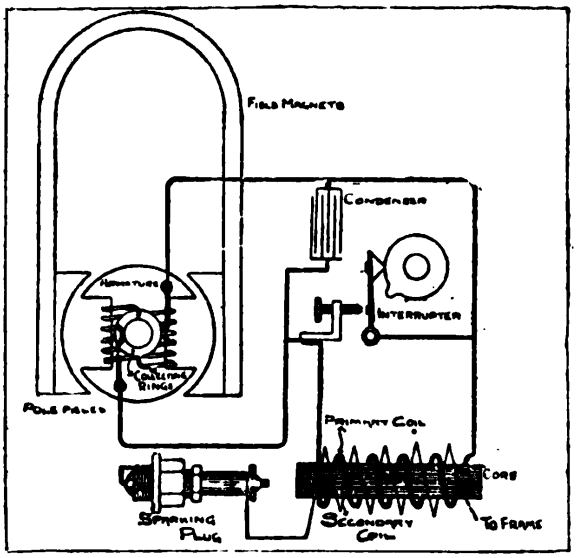


FIG. 30.—The Eisemann Magneto, with its separate coil. (No shield.)

intensity. It is, therefore, the negative wire proceeding from the core alone which is earthed or taken to the frame, and *not*, as in the former instance, the one proceeding from the armature.

52. Gianoli High tension Magneto.—In order to render the comprehension of this subject as clear as possible, and to facilitate the operator's

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 86 of 132

work in case he has to deal with magnetos of peculiar patterns, we now proceed to describe an ingenious system of construction, in which the regulation of the time at which the spark is produced is controlled automatically by means of a magnetic device that comes into play only at the instant when the current reaches the point of maximum intensity, thus closing (or breaking)

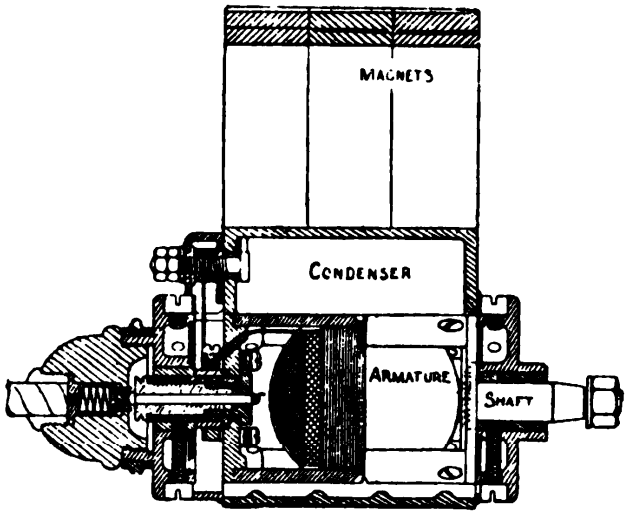


FIG. 31.—Sectional view of Gianoli High tension Magneto.

the circuit at the most favourable moment. This system is known as the " Gianoli High Tension." In this we have an ordinary magneto with soft iron sleeve and a double-wound rotating armature, along with its relative condenser. At. Fig. 31, we give a somewhat shortened sectional elevation of the Gianoli magneto. The main point of difference lies, as we have already said, in the

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 87 of 132

manner in which the high tension current produced by the sudden interruption in the primary circuit is set up invariably when the armature finds itself in the most favourable position, and this is brought about, not by means of a mechanical make-and-break device, such as a cam and

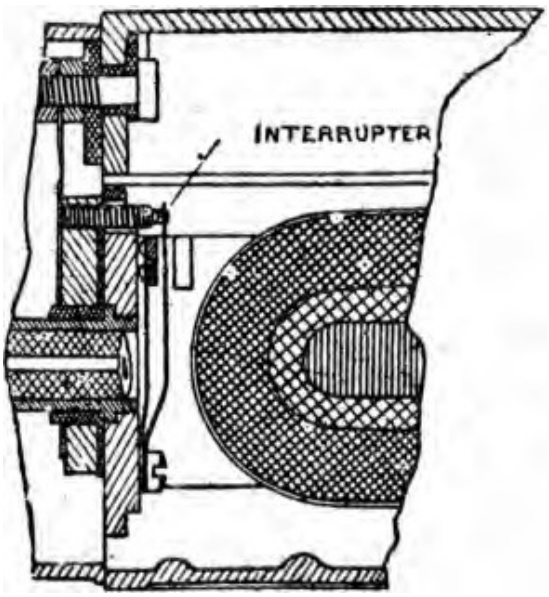


FIG. 32.—Front and sectional view of Gianoli Armature, showing automatic electro-magnetic make and break.

rocker, but by an electro-magnetic vibrator or interrupter, which we show in section on the portion of the armature illustrated at Fig. 32. To the extreme left, held by a screw shown towards the bottom of the figure, is a thin plate of soft iron, held in position by a double spring, both these being secured by the screw shown at

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 88 of 132

the end of the spring. On the end of the armature cheeks are polar extensions, and the soft iron plate on the end of the spring is normally so adjusted as to be two or three millimetres away from the polar extensions. On one of the springs is a platinum contact, which abuts and presses against another platinum contact at the end of an adjustable screw. When together these contacts close the primary circuit; but, as soon as the polar extensions of the armature come opposite the soft iron plate, this plate is strongly attracted, and, striking against the platinum contact, breaks the circuit. The armature core, by the process of induction between the poles of the magnets and the circulating of the induced current, also becomes a magnet, and it is by virtue of this that it attracts the soft iron plate and causes the interruption. The attraction of the soft iron plate is rapid at all speeds, thus producing a succession of sparks at each period or phase of the armature's rotation. This enables the starting to be easily accomplished. Another important advantage gained is that, no matter how fast the armature be driven, it is impossible for an excess of current to be generated. The vibrator acts, in fact, as a perfect electro-magnetic governor, and always breaks the circuit at the same voltage irrespective of the speed. The soft iron sleeve, by means of

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 89 of 132

which ignition can be advanced or retarded, is made to fit so closely to the pole-pieces as to be

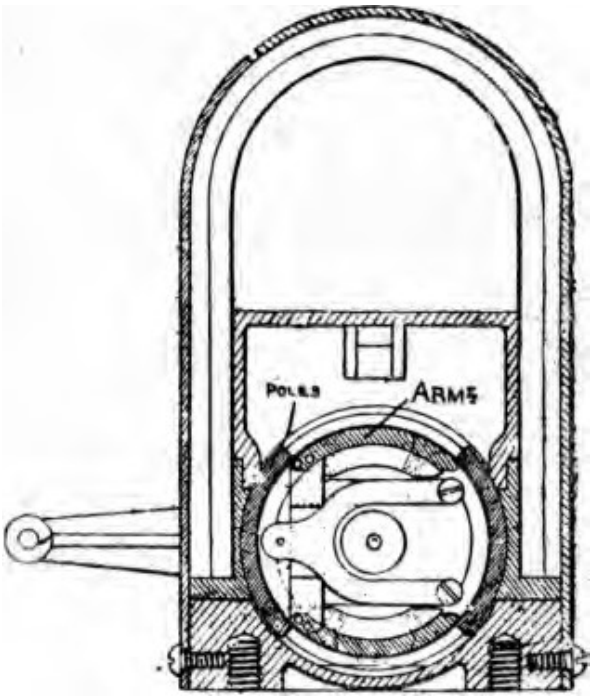


FIG. 33.—**Front view of Armature, movable extension of pole-pieces, and electro-magnetic contact breaker of the Gianoli High tension Magneto.**

practically in contact with them. These, along with the armature and interrupter, are shown in our Fig. 33.

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 90 of 132

CHAPTER VI

A FEW PRACTICAL HINTS

To insure correct timing—Adjustments of lever—Adjustments of tappet rod or cam—Ignition by alternating currents—"High" and "low" tension compared.

53. To Insure Correct Timing.—Having thus described the principal variations which may occur in the magneto proper, we pass to consider what the operator (called upon to adjust or repair such machines) often finds somewhat puzzling. We refer to the setting of the movable portion, be it shield or armature, so as to insure correct timing. We will then close the subject by a comparison between the merits and demerits of the two rival systems—viz. "high tension" and "low tension." When the armature rotates and does not simply oscillate, the timing is not such an essential part of the setting as in the case in which either the shield or the armature performs an oscillation only; we will therefore begin by supposing that the armature is a fixture, the shield only oscillating. Now, the best position

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 91 of 132

for the armature to spark will be when the fixed armature has its conductors facing the pole-pieces, or, what amounts to the same thing, when the screen or shield has its two cheeks opposite to the two cheeks of the pole-pieces. Then all the lines of force are, as already seen, concentrating themselves upon the conductors round the armature. But, in order to affect the armature, *motion of the shield* must take place. If the motion be

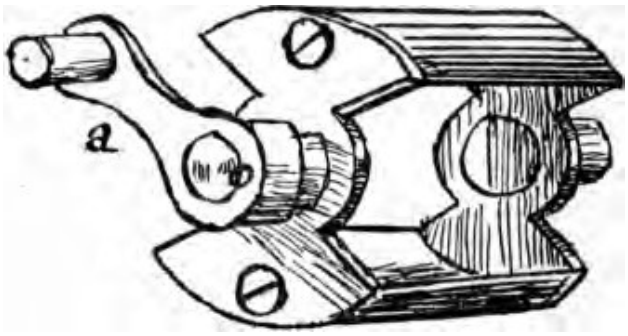


FIG. 34.

from the poles *towards* the gaps, the current is set up in one direction, and if, on the contrary, the shield be brought from a position of lying between the horns of the pole-pieces towards that of lying facing the pole-pieces, the current produced is in the opposite direction. It is really indifferent which of these two motions is given to the shield or to the armature: it is usual, however, that the lever or arm which imparts the movement to the shield (or armature) should,

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 92 of 132

under the impulse of the cam, give the movement in the direction of the hands of a clock. The amount of motion to be given varies but little with the different machines; it never exceeds 90° of arc, and is generally rather less than this, but is seldom less than 60°. Now the portion that may possibly get out of order is the little lever (see Fig. 34, a), which is rigidly attached to the oscillating shield.

54. Adjustments of Lever.—Dependent upon the manner in which it is connected to the shield, this lever may have shifted slightly in position, or got bent, so that it may receive and communicate its impulse to the said shield *too early* or *too late* to produce the best effect. The first step, therefore, towards remedying this defect is to ascertain (either by actual inspection or by trial) *when* the conductors face the pole-pieces, and whether the motion of the shield when it oscillates be such as to expose the armature to the flux of the greatest magnetic intensity. If it is convenient to take off the zinc cover from over the armature tunnel, this point can easily be ascertained by inspection only; and a mark, easily visible from the outside, should be made, indicating the position in which the conductors on the one hand, and the shield on the other, face the pole-pieces. Now, these should coincide with

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 93 of 132

the instant of best spark production. If they do not, the arm or lever that conveys the oscillating motion must be so fixed or straightened that they do thus coincide the one with the other. Of course, if there is considerable wear in the bearings, these latter should be rebushed; but the fault, if any, will generally be found to lie in the direction of a shifting or distortion of the lever itself. Sometimes it is not easy or convenient to take the magneto to pieces. A very fair idea may be got of the relative positions of the two moving portions by noticing where the greatest resistance is found on attempting to make the lever (usually actuated by the cam) to perform its motion. It will be noticed that at the beginning of its stroke little or no resistance is felt, this resistance increasing to a maximum, and then rather suddenly falling off. Now, if the portions (screen and armature) are in their proper relative position with reference to the lever, this point of greatest resistance should be about mid-way along the stroke, and any deviation from this position would be suspicious, and would demand immediate attention.

55. Adjustments of Tappet Rod or Cam.— It may require that the tappet rod be lengthened; this can be done either by unscrewing for a turn or two the nuts above, or by inserting a cheese-

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 94 of 132

headed screw at the bottom of the tappet rod where it rests against the cam, and then filing it to the right length and carefully smoothing it so that it shall slide freely over the cam. If the cam itself be seriously worn, the ear thereof may be thickened by the addition of a piece of metal, or, better still, removed and replaced by a new one. In all cases when these adjustments have been made to facilitate future operations or repairs, it will be well, once having found the correct relative positions of the parts, to make distinct file-marks to indicate the correct position of the different portions.

56. Ignition by Alternating Currents.— It may aid the comprehension of this portion of our subject if we give here a brief description of the magneto and its timing-gear sent out by one of the most famous French makers. The magneto in question is furnished with an armature I, made of soft iron, the channel of which is wound in the usual manner with insulated copper wire. No shield or screen is employed. This armature *rotates* between the poles of the magnet U, which are fitted with pole-pieces; the variations in magnetic flux thus obtained give rise to a succession of alternating currents that are utilised for igniting the gaseous mixture. In fact, if contact be suddenly broken between any two conductors

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 95 of 132

traversed by the current, a "break" spark results, and the mixture is ignited. This sudden rupture of continuity is obtained by means of a system of levers, actuated by the engine itself. In motors

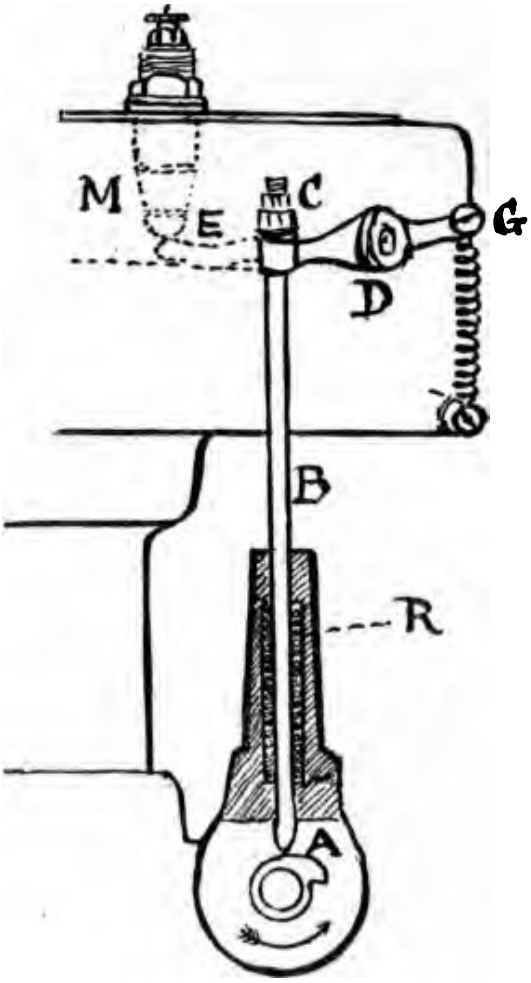


FIG. 35.

of from 18 H.P. to 24 H.P. (see Fig. 35), a cam, A, is keyed or otherwise rigidly fastened to the shaft in the admission, acting upon a tappet rod, B,

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 96 of 132

running in a vertical guide. This tappet terminates above in two regulating nuts, and is kept in contact with the cam A by the spring R. A little two-branched lever, G, is fitted on a crank at D, the axis of the crank itself passing into the interior of the combustion chamber through a suitably plugged aperture in its side. In the interior of the combustion chamber an extension of the lever at E comes into contact with the sparking-plug M, which is made of nickel and of the type shown in our Figs. 15 and 16—*q.v.* On the exterior of the chamber one branch of the lever is kept in position by the counter spring G, while the other end receives the pressure of the push C. As the rod B rests against the circular portion of the cam A, the push C keeps the pieces E and M apart. When this rod is raised by the cam, the nutted end thereof releases the little lever G, and, consequently, the piece E is brought into contact with the sparker M. The current set up by the magneto is led by an insulated cable to the said igniter M, which is likewise insulated. While in this position the circuit is complete through the body of the car or "earth," since the parts E and M are in contact; but, as the cam continues its rotation, on arriving at the depression, it frees the tappet rod B, which suddenly falls to its lowest position under the influence of

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 97 of 132

the spring R; the push, therefore, withdraws the little lever G, producing thereby an interruption in the circuit, and consequently a spark at the igniter.

57. "High" and "Low" Tension Compared.—In conclusion, we may glance at some of the advantages and disadvantages in the high tension and low tension systems. Although makers of late have rather favoured the high tension system under the impression that the high tension current set up by such magnetos is more efficient in producing the ignition of the gaseous mixture, yet, after a considerable experience with many of these appliances, we have come to the conclusion that the difference, if any, is rather in favour of the low tension—for this reason, that ignition is more readily effected by a spark of considerable volume, technically known as a "fat spark," than by one in which the tension is high, but in which quantity is wanting. It is difficult, if not practically impossible, in the confined space admissible in the magneto, to unite quantity and high tension in one and the same instrument, since this would necessitate, on the secondary winding, a large quantity of coarse wire. The flash produced by the low tension magneto is very hot, and this is a great point in its favour. Added to this, we have the advantage that, just in

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 98 of 132

consequence of the, comparatively speaking, low tension of the current employed, the tendency to leakage is not nearly so great, and therefore the probability of breakdowns through defective insulation is minimised. As the voltage in a low-tension magneto rarely exceeds a few hundred volts, while that in one of the high tension class may amount to 25,000 or more, it will be evident that this point is one of very considerable importance in the selection of a machine. Another good point is the facility with which the timing can be regulated if an oscillating shield be employed in conjunction with a low tension armature. The only drawback is the fact that the low tension magneto, as it does not produce a "jump spark," must be fitted with a suitable ignition plug, one similar to those shown in our Figs. 15 and 16, and partaking of similar characteristics, which are those of breaking and making the contact in the interior of the combustion-chamber, effecting this with certainty, and at the desired instant.

THE END

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 99 of 132

INDEX

[*The numbers refer to paragraphs.*]

ADJUSTMENTS to cam, 55
„ „ lever, 54
„ „ tappet rod, 55
Advance of spark, 39
Advantage of shield, 33
Alternating currents, 56
Armature, clearance, 15
„ connecting, 18
„ contact with machine, 17
„ fitting to spindle, 18
„ materials, 16
„ Siemens', 5
„ winding, 17, 19
„ with or without shield, 16, 44

BACK currents, 47
Bearings, 20
„ insulated, 21
Binding armature, 19
Break spark, 56
Breaker, contact, 23, 26
Breaking contact, 24
Breguet's igniter, 4
Brushes, 7
Bushing spindle, 18

CAM, 55
Capacity, 48
Circuit, closed and open, 22, 41
Clearance between armature and poles, 15
Clockwise, 36, 39
„ counter-, 36
Coil, induction, 50
Commutator, 5, 7
Compound magnets, 4, 13
Condenser, 48, 49
Contact, 17
„ breaker, 23, 24, 26
„ making, 25, 26
„ of platinum, 52
„ stud, 21
Continuous-current dynamo, 30
Control of shield, 40
„ „ timing, 38
Correct timing, 53
Currents, alternating, 56
„ back, 47
„ induced, 45, 46
„ influenced by shield, 37
Cutting lines of force, 6

DISCOVERY, Faraday's, 2
Dressing armature, 19
Dynamo, continuous current, 30

EISEMANN high tension magneto, 51
Electro-magnet, 29
Electro-magnetic interrupter, 52

FARADAY'S discovery, 2
Fat spark, 15
Field of force, 5, 8, 34, 35, 36, 37
Field magnets, 27
Fitting magnets, 14
„ spindle, 18
Flexible wire, 23
Force, magnetic, 15, 35
Front bearing, 21

GIANOLI high tension system, 52

H-GIRDER, 5
Hardening magnets, 14, 27
Helix, 31
High tension, 23, 57
High tension magnetos, 42, 50, 51, 52, 57

IGNITER, 4
Ignition by alternating currents, 56
Importance of ignition, 1
Induced currents, 45, 46
Induction coil, 50
„ spark, 23
Influence of shield, 37
Insulation of front bearing, 21

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 100 of 132

Intensity of currents, 46, 57
Interrupter, 50
JUMP spark, 57
KING magnet, 27
LEVER of shield, 54
Lines of force, 5, 6, 8, 34, 35, 36, 37
Low tension, 57
„ „ magneto, 15
Lubrication, 20
MAGNET, compound, 4, 5, 11, 12, 13
Magnet, electro, 29
„ field, 27
„ fitting, 14
„ form, 14
„ material, 11
„ permanent, 28
„ size, 12
Magnetic force, 15
Magnetisation, 14, 27, 28, 29, 30, 31, 32, 33
Magneto, high tension, 42, 50, 51, 52
„ low tension, 15
„ medical, 3
„ parts, 10
„ theory, 9
Making contact, 25
Manganese, 11
Materials of condenser, 48
Method of cutting lines of force, 6
Mica, 19
Mode of insuring correct timing, 53
Modifications of armature and shield, 44
OPEN circuit, 22, 41
PARAFFIN-waxed paper, 48
Parts of magneto, 10
Pattern of bearings, 20
Permanent magnet, 27, 28
Platinum contact, 52
Plug, 26, 51
Polarity, 14, 28, 29, 30, 31
Pole-pieces, 13, 15
Position of condenser, 49
Primary, 45
Principle of timing, 41
REGULATION of shield, 40
Requirements of ignition, 1,
Retardation of spark, 36, 39
SECONDARY, 45
Shield of armature, 6, 15, 16, 33, 34, 35, 36, 37, 38
Shield, its advantage, 33
„ „ control, 40
„ „ effect in line, 34
„ „ „ at 90°, 35
„ „ „ inclined, 36
„ „ influence on current, 37
Short-circuiting, 19
Solenoid, 27
Spark, advanced, retarded, 39
„ break, 57
„ fat, 57
„ inductive, 23
„ jump, 57
Sparking, position, 38, 39, 40
„ by tappet rod, cam, 43
Spindle of armature, 17, 18
TAPPET ROD and cam, 26, 43, 55
Temper, 32
Tension, high, 42
Theory of magneto, 9
Timing, 10, 38, 41, 52, 53
Tinfoil for condenser, 48
Tungsten, 11
Tunnel, 15, 16
VARNISH, 19
Vibrator, 52
Volume of current, 46, 57
WINDING of armature, 17, 19
Wire of armature, 19
Wire helix, 31

PRINTED BY WILLIAM CLOWES AND SONS, LIMITED, LONDON AND BECCLES.

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 101 of 132

CROSBY LOCKWOOD & SON'S

LIST OF WORKS

ON

CIVIL, MECHANICAL, MARINE AND ELECTRICAL ENGINEERING.

A Complete Catalogue of NEW and STANDARD WORKS on MINING and COLLIERY WORKING; ARCHITECTURE and BUILDING; The INDUSTRIAL ARTS, TRADES and MANUFACTURES; CHEMISTRY and CHEMICAL MANUFACTURES; AGRICULTURE, FARMING, GARDENING, AUCTIONEERING, LAND AGENCY, &c. Post Free on Application.

LONDON:
7, STATIONERS' HALL COURT, LUDGATE HILL, E.C.,
AND
12la, Victoria Street, Westminster, S.W.
1909.

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 102 of 132

LIST OF WORKS

ON

CIVIL, MECHANICAL, ELECTRICAL AND MARINE ENGINEERING.

ACETYLENE, LIGHTING BY. Generators, Burners, and Electric Furances. By WILLIAM E. GIBBS, M.E. With 66 Illustrations. Crown 8vo, cloth **7/6**

AËRIAL NAVIGATION. A Practical Handbook on the Construction of Dirigible Balloons, Aërostats, Aëroplanes, and Aëromotors. By FREDERICK WALKER, C.E., Associate Member of the Aëronautic Institute. With 104 Illustrations. Large Crown 8vo, cloth . . . *Net* **7/6**

AËRIAL OR WIRE-ROPE TRAMWAYS. Their Construction and Management. By A. J. WALLIS-TAYLER, A.M.Inst.C.E. With 81 Illustrations. Crown 8vo, cloth **7/6**

AIR GAS LIGHTING SYSTEMS. See PETROL AIR GAS.

ALTERNATING CURRENTS, THE PRINCIPLES OF. For Students of Electrical Engineering. By E. T. LARNER, A.I.E.E., of the Engineering Department, G.P.O., London. 144 pages, with 69 Illustrations. Crown 8vo, cloth. [*Just published.* *Net* **3/6**

COMPARISON OF CONTINUOUS AND ALTERNATING CURRENTS—SIMPLE HARMONIC MOTION—VECTORIAL REPRESENTATION—ALTERNATING CURRENT THEORY—CIRCUITS IN SERIES—CIRCUITS IN PARALLEL—ALTERNATING CURRENT POWER.

ARMATURE WINDINGS OF DIRECT CURRENT DYNAMOS. Extension and Application of a General Winding Rule. By E. ARNOLD, Engineer, Assistant Professor in Electro-Technics and Machine Design at the Riga Polytechnic School. Translated from the original German by FRANCIS B. DE GRESS, M.E., Chief of Testing Department, Crocker-Wheeler Company. Medium 8vo, 120 pp., with over 140 Illustrations *Net* **12/0**

BEAMS. EXPERIMENTS ON THEIR FLEXURE. Resulting in the Discovery of New Laws of Failure by Buckling. By ALBERT E. GUY. Medium 8vo, cloth . . . . . *Net* **9/0**

BLAST FURNACE CALCULATIONS AND TABLES FOR FURNACE MANAGERS AND ENGINEERS. Containing Rules and Formulæ for Finding the Dimensions and Output Capacity of any Furnace, as well as the regular Outfit of Stoves, Heating Surface, Volume of Air, Tuyere Area, &c., per ton of Iron per day of 24 hours. By JOHN L. STEVENSON. F'cap. 8vo, leather . . . . . *Net* **5/0**

BOILER AND FACTORY CHIMNEYS. Their Draught-Power and Stability. With a chapter on "Lightning Conductors." By ROBERT WILSON, A.I.C.E., Author of "A Treatise on Steam Boilers," &c. Crown 8vo, cloth **3/6**

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 104 of 132

BOILER CONSTRUCTION. A Practical Handbook for Engineers, Boiler-Makers, and Steam Users. Containing a large Collection of Rules and Data relating to Recent Practice in the Design, Construction, and Working of all Kinds of Stationary, Locomotive, and Marine Steam-Boilers. By WALTER S. HUTTON, Civil and Mechanical Engineer. With upwards of 500 Illustrations. Fourth Edition, carefully Revised, and Enlarged. Medium 8vo, over 680 pages, cloth, strongly bound **18/0**

HEAT, RADIATION, AND CONDUCTION—NON-CONDUCTING MATERIALS AND COVERINGS FOR STEAM-BOILERS—COMPOSITION, CALORIFIC-POWER AND EVAPORATIVE-POWER OF FUELS—COMBUSTION, FIRING STEAM-BOILERS, PRODUCTS OF COMBUSTION, ETC., CHIMNEYS FOR STEAM-BOILERS—STEAM BLAST—FORCED DRAUGHT—FEED-WATER—EFFECT OF HEAT ON WATER—EXPANSION OF WATER BY HEAT—WEIGHT OF WATER AT DIFFERENT TEMPERATURES—CONVECTION—CIRCULATION—EVAPORATION—PROPERTIES OF SATURATED STEAM—EVAPORATIVE POWER OF BOILERS—PRIMING, ETC.—WATER-HEATING SURFACES OF STEAM-BOILERS—TRANSMISSION OF HEAT—SMOKE TUBES—EVAPORATIVE POWER AND EFFICIENCY OF BOILERS—WATER-CAPACITY AND STEAM-CAPACITY OF BOILERS—FIRE-GRATES, FIRE BRIDGES, AND FIRE-BARS—POWER OF BOILERS—CYLINDRICAL SHELLS AND FURNACE-TUBES OF BOILERS, ETC.—TESTS OF MATERIALS—STRENGTH AND WEIGHT OF BOILER-PLATES—EFFECT OF TEMPERATURE ON METALS—RIVET HOLES—RIVETS—RIVETED JOINTS OF STEAM-BOILERS—CAULKING ENDS OF CYLINDRICAL SHELLS—STAYS FOR BOILERS, ETC.—STEAM GENERATORS—DESCRIPTION AND PROPORTIONS OF CORNISH, LANCASHIRE, AND OTHER TYPES OF STATIONARY BOILERS—BOILER-SETTING—MULTI-TUBULAR, LOCOMOTIVE, PORTABLE, MARINE, VERTICAL, AND WATER-TUBE BOILERS—SUPER-HEATERS—COST OF STEAM PRODUCTION—FURNACES FOR REFUSE-FUELS—DESTRUCTORS, ETC.—SAFETY-VALVES—STEAM PIPES—STOP-VALVES AND OTHER MOUNTINGS FOR BOILERS—FEED-PUMPS—STEAM PUMPS—FEED-WATER CONSUMPTION—INJECTORS—INCRUSTATION AND CORROSION—FEED-WATER HEATERS—EVAPORATORS—TESTING BOILERS—EVAPORATIVE PERFORMANCES OF STEAM BOILERS: STEAM-BOILER EXPLOSIONS, ETC.

"There has long been room for a modern handbook on steam boilers; there is not that room now, because Mr. Hutton has filled it. It is a thoroughly practical book for those who are occupied in the construction, design, selection, or use of boilers."—*Engineer.*

BOILERMAKER'S ASSISTANT. In Drawing, Templating, and Calculating Boiler Work, &c. By J. COURTNEY, Practical Boilermaker. Edited by D. K. CLARK, C.E. Eighth Edition. Crown 8vo, cloth . **2/0**

BOILERMAKER'S READY RECKONER. With Examples of Practical Geometry and Templating for the Use of Platers, Smiths, and Riveters. By John COURTNEY. Edited by D. K. CLARK, M.Inst.C.E. Crown 8vo, cloth **4/0**

BOILERMAKER'S READY RECKONER & ASSISTANT, being the two previous mentioned volumes bound together in one volume. With Examples of Practical Geometry and Templating, for the Use of Platers, Smiths, and Riveters. By JOHN COURTNEY. Edited by D. K. CLARK, M.Inst.C.E. Fifth Edition, 480 pp., with 140 Illustrations. Crown 8vo, half bound **7/0**

"No workman or apprentice should be without this book."—*Iron Trade Circular.*

BOILER MAKING AND PLATING. A Practical Handbook for Workshop Operations, including an Appendix of Tables. By JOSEPH G. HORNER, A.M.I.M.E. Second Edition. Thoroughly revised and enlarged. 380 pp., with 351 Illustrations. Crown 8vo, cloth.
[*Just published.* *Net* **9/0**

BOILERS (STEAM). Their Construction and Management. By R. ARMSTRONG, C.E. Illustrated. Crown 8vo, cloth . . . **1/6**

BOILERS. Their Strength, Construction, and Economical Working. By R. WILSON, C.E. Fifth Edition. 12mo, cloth . . . **6/0**

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 105 of 132

BRIDGE CONSTRUCTION IN CAST AND WROUGHT IRON. A Complete and Practical Treatise on, including Iron Foundations. In Three Parts.—Theoretical, Practical, and Descriptive. By WILLIAM HUMBER. A.M.Inst.C.E., and M.Inst.M.E. Third Edition, revised and much improved, with 115 Double Plates (20 of which now first appear in this edition), and numerous Additions to the Text. In 2 vols., imp. 4to, half-bound in morocco . . . . . **£6 16s. 6d.**

"In addition to elevations, plans, and sections, large scale details are given, which very much enhance the instructive work of these illustrations."—*Civil Engineer and Architect's Journal.*

BRIDGES AND VIADUCTS, IRON AND STEEL. A Practical Treatise upon their Construction. For the use of Engineers, Draughtsmen, and Students. By FRANCIS CAMPIN, C.E. Crown 8vo, cloth **3/6**

BRIDGES (IRON) OF MODERATE SPAN: Their Construction and Erection. By H. W. PENDRED. With 40 illustrations. Crown 8vo, cloth **2/0**

BRIDGES, OBLIQUE. A Practical and Theoretical Essay. With 13 large Plates. By the late GEORGE WATSON BUCK, M.Inst.C.E. Fourth Edition, revised by his Son, J. H. WATSON BUCK, M.Inst.C.E.; and with the addition of Description to Diagrams for Facilitating the Construction of Oblique Bridges, by W. H. BARLOW, M.Inst.C.E. Royal 8vo, cloth **12/0**

"As a guide to the engineer and architect, on a confessedly difficult subject, Mr. Buck's work is unsurpassed."—*Building News.*

BRIDGES, TUBULAR AND OTHER IRON GIRDER. Describing the Britannia and Conway Tubular Bridges. With a Sketch of Iron Bridges, &c. By G. D. DEMPSEY, C.E. Crown 8vo, cloth . **2/0**

CALCULATOR (NUMBER, WEIGHT, AND FRACTIONAL). Containing upwards of 250,000 Separate Calculations, showing at a Glance the Value at 422 Different Rates, ranging from $\frac{1}{128}$th of a Penny to 20s. each, or per cwt., and £20 per ton, of any number of articles consecutively, from 1 to 470. Any number of cwts., qrs., and lbs., from 1 cwt. to 470 cwts. Any number of tons, cwts., qrs., and lbs., from 1 to 1,000 tons. By WILLIAM CHADWICK, Public Accountant. Fourth Edition, Revised and Improved. 8vo, strongly bound **18/0**

CALCULATOR (WEIGHT). Being a Series of Tables upon a New and Comprehensive Plan, exhibiting at one Reference the exact Value of any Weight from 1 lb. to 15 tons, at 300 Progressive Rates, from 1*d.* to 168*s.* per cwt., and containing 186,000 Direct Answers, which, with their Combinations, consisting of a single addition (mostly to be performed at sight), will afford an aggregate of 10,266,000 Answers; the whole being calculated and designed to ensure correctness and promote despatch. By HENRY HARBEN, Accountant. Sixth Edition, carefully Corrected. Royal 8vo, strongly half-bound . . . . . **£1 5s.**

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 106 of 132

CHAIN CABLES AND CHAINS. Comprising Sizes and Curves of Links, Studs, etc., Iron for Cables and Chains, Chain Cable and Chain Making, Forming and Welding Links, Strength of Cables and Chains, Certificates for Cables, Marking Cables, Prices of Chain Cables and Chains, Historical Notes, Acts of Parliament, Statutory Tests, Charges for Testing, List of Manufacturers of Cables, etc., etc. By THOMAS W. TRAILL, F.E.R.N., M.Inst.C.E., Engineer-Surveyor-in-Chief, Board of Trade, Inspector of Chain Cable and Anchor Proving Establishments, and General Superintendent, Lloyd's Committee on Proving Establishments. With numerous Tables, Illustrations, and Lithographic Drawings. Folio, cloth **£2 2s.**

CIVIL ENGINEERING. By HENRY LAW, M.Inst.C.E. Including a Treatise on Hydraulic Engineering by G. R. BURNELL, M.Inst.C.E. Seventh Edition, revised, with Large Additions on Recent Practice by D. KINNEAR CLARK, M.Inst.C.E. Crown 8vo, cloth **6/6**

CONDUCTORS FOR ELECTRICAL DISTRIBUTION. Their Materials and Manufacture, The Calculation of Circuits, Pole-Line Construction, Underground Working, and other Uses. By F. A. C. PERRINE, A.M., D.Sc.; formerly Professor of Electrical Engineering, Leland Stanford, Jr., University; M.Amer.I.E.E. Medium 8vo, 300 pp., fully illustrated, including Folding Plates and Diagrams . . . . . *Net* **20/0**

CONTINUOUS RAILWAY BRAKES. A Practical Treatise on the several Systems in Use in the United Kingdom, their Construction and Performance. By M. REYNOLDS. 8vo, cloth **9/0**

CRANES, the Construction of, and other Machinery for Raising Heavy Bodies for the Erection of Buildings, &c. By J. GLYNN, F.R.S. Crown 8vo, cloth **1/6**

CURVES, TABLES OF TANGENTIAL ANGLES AND MULTIPLES. For Setting-out Curves from 5 to 200 Radius. By A. BEAZELEY, M.Inst.C.E. 7th Edition, Revised. With an Appendix on the use of the Tables for Measuring up Curves. Printed on 50 Cards, and sold in a cloth box, waistcoat-pocket size **3/6**

"Each table is printed on a small card, which, placed on the theodolite, leaves the hands free to manipulate the instrument—no small advantage as regards the rapidity of work."—*Engineer*.

DRAINAGE OF LANDS, TOWNS AND BUILDINGS. By G. D. DEMPSEY, C.E. Revised, with large Additions on Recent Practice in Drainage Engineering by D. KINNEAR CLARK, M.Inst.C.E. Fourth Edition. Crown 8vo, cloth **4/6**

DYNAMIC ELECTRICITY AND MAGNETISM, ELEMENTS OF. A Handbook for Students and Electrical Engineers. By PHILIP ATKINSON, A.M., Ph.D. Crown 8vo, cloth, 417 pp., with 120 Illustrations **10/6**

***DYNAMO* BUILDING. HOW TO MAKE A DYNAMO.** *A Practical Treatise for Amateurs.* By ALFRED CROFTS. Crown 8vo, *cloth* **2/0**

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 107 of 132

DYNAMO ELECTRIC MACHINERY. By SAMUEL SHELDON, A.M., Ph.D., Professor of Physics and Electrical Engineering at the Polytechnic Institute of Brooklyn, etc., assisted by HOBART MASON, B.S., E.E.

In two volumes (sold separately).

Vol. I.—DIRECT CURRENT MACHINES. Sixth Edition, Revised. 202 Illustrations . . . . . *Net* **12/0**

Vol. II.—ALTERNATING CURRENT MACHINES. Fifth Edition. With 184 Illustrations . . . . . *Net* **12/0**

DYNAMO MANAGEMENT. A Handybook of Theory and Practice for the Use of Mechanics, Engineers, Students, and others in Charge of Dynamos. By G. W. LUMMIS-PATERSON, Electrical Engineer. Fourth Edition, Revised and Enlarged. 300 pp., with 117 illustrations. Crown 8vo, cloth . . . . . [*Just published. Net* **4/6**

ELECTRICAL UNITS—MAGNETIC PRINCIPLES—THEORY OF THE DYNAMO—ARMATURES—ARMATURES IN PRACTICE—FIELD MAGNETS—FIELD MAGNETS IN PRACTICE—REGULATION DYNAMOS — COUPLING DYNAMOS — INSTALLATION, RUNNING AND MAINTENANCE OF DYNAMOS—FAULTS IN DYNAMOS—FAULTS IN ARMATURES—MOTORS.

"The book may be confidently recommended."—*Engineer.*

DYNAMO, MOTOR AND SWITCHBOARD CIRCUITS FOR ELECTRICAL ENGINEERS. A Practical Book dealing with the subject of Direct, Alternating and Polyphase Currents. By WILLIAM R. BOWKER, Consulting Electrical and Street Railway Engineer, Professor of Physics in the University of Southern California, Los Angeles. Second Edition, revised and greatly enlarged. 180 pages, with 130 illustrations. Medium 8vo, cloth. . . . . [*Just published. Net* **7/6**

DYNAMO AND MOTOR CIRCUITS—STARTING AND STOPPING OF SAME—METHODS OF CHANGING DIRECTION OF ROTATION—SYNCHRONISM—PARALLELING OF ALTERNATORS, ETC.—POLYPHASE CIRCUITS—POLYPHASE TRANSMISSION OF POWER—DIPHASE AND TRIPHASE CIRCUITS, ETC.—BOOSTERS—EQUALISERS—REVERSIBLE BOOSTERS—STORAGE BATTERIES—END-CELL SWITCHES, ETC.—ELECTRIC TRACTION MOTORS — SERIES — PARALLEL CONTROLLERS — CAR WIRING DIAGRAMS — MOTOR VEHICLE CIRCUITS — CANAL HAULAGE ROTARY CONVERTERS — SWITCHBOARD CIRCUITS, ETC.

DYNAMOS (ALTERNATING AND DIRECT CURRENT). A Text-book on their Construction for Students, Engineer-Constructors and Electricians-in-Charge. By TYSON SEWELL, A.M.I.E.E., Lecturer and Demonstrator in Electrical Engineering at the Polytechnic, Regent Street, London, author of "The Elements of Electrical Engineering." 328 p., with over 230 Illustrations. Large crown 8vo, cloth . . . . *Net* **7/6**

FUNDAMENTAL PRINCIPLES OF DIRECT CURRENTS—THE MAGNETIC FIELD—THE PRODUCTION OF AN ELECTRO-MOTIVE FORCE—FUNDAMENTAL PRINCIPLES OF ALTERNATING CURRENTS—THE ALTERNATING MAGNETIC FIELD—THE CAPACITY OF THE CIRCUIT—BIPOLAR DYNAMO CONSTRUCTION—THEORY OF BIPOLAR MACHINES—BIPOLAR DYNAMO DESIGN — MULTIPOLAR DYNAMO CONSTRUCTION — MULTIPOLAR DYNAMO DESIGN—SINGLE PHASE ALTERNATORS—CONSTRUCTION OF ALTERNATORS—POLYPHASE ALTERNATORS — EXCITING, COMPOUNDING AND SYNCHRONISING OF ALTERNATORS.

EARTHWORK DIAGRAMS. Giving graphically the Cubic Contents for different Heights of Banks and Cuttings, either 66 ft. or 100 ft. Chains. By R. A. ERSKINE-MURRAY, A.M.Inst.C.E., and Y. D. KIRTON, A.M.Can.Soc.C.E. On a sheet in a roll.

5/0 *Net*, or mounted on card, *Net* **7/6**

These Diagrams or Scales have been designed with the intention of reducing the labour connected with the computation of earthwork quantities, and especially those of railways and roads. It has been found in the Authors' *practice that* they are much quicker, and at the same time as accurate and *much more* complete than most of the tables heretofore published.

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 108 of 132

EARTHWORK MANUAL. By ALEX. J. GRAHAM, C.E. With numerous Diagrams. Second Edition. 18mo, cloth **2/6**

EARTHWORK TABLES. Showing the Contents in Cubic Yards of Embankments, Cuttings, &c., of Heights or Depths up to an average of 80 feet. By JOSEPH BROADBENT, C.E., and FRANCIS CAMPIN, C.E. Crown 8vo, cloth **5/0**

EARTHWORK TABLES, HANDY GENERAL. Giving the Contents in Cubic Yards of Centre and Slopes of Cuttings and Embankments from 3 inches to 80 feet in Depth or Height, for use with either 66 feet Chain or 100 feet Chain. By J. H. WATSON BUCK, M.Inst.C.E. On a Sheet mounted in cloth case **3/6**

ELECTRIC LIGHT. Its Production and Use. By J. W. URQUHART. Crown 8vo, cloth **7/6**

ELECTRIC LIGHT FITTING. A Handbook for Working Electrical Engineers. By J. W. URQUHART. Crown 8vo, cloth . . **5/0**

ELECTRIC LIGHT FOR COUNTRY HOUSES. A Practical Handbook, including Particulars of the Cost of Plant, and Working. By J. H. KNIGHT. Crown 8vo, wrapper **1/0**

ELECTRIC LIGHTING. By ALAN A. CAMPBELL SWINTON, M.Inst.C.E., M.I.E.E. Crown 8vo, cloth **1/6**

ELECTRIC LIGHTING AND HEATING POCKET BOOK. Comprising useful Formulæ, Tables, Data, and Particulars of Apparatus and Appliances for the use of Central Stations, Engineers, Contractors, and Engineers-in-Charge. By SYDNEY F. WALKER, R.N., M.I.E.E., M.I.M.E., A.M.Inst.C.E., Etc. F'cap 8vo, 448 pp., 270 Diagrams, and 240 Tables. *Net* **7/6**

DEFINITIONS—DIFFERENT UNITS EMPLOYED—LAWS OF ELECTRIC CIRCUITS—DIFFERENCES BETWEEN WORKING OF CONTINUOUS AND ALTERNATING CURRENTS—LAWS OF ELECTRO MAGNETIC AND ELECTRO-STATIC INDUCTION—ELECTRICITY GENERATORS—ACCUMULATORS—SWITCHBOARDS—SWITCHES, CIRCUIT-BREAKERS, ETC.—CABLES—METHODS OF INSULATION—SIZES AND INSULATION OF CABLES MADE BY LEADING MAKERS—CONDUITS—LEADING WIRES AND OTHER ACCESSORIES—MEASURING INSTRUMENTS OF ALL KINDS AND APPARATUS FOR TESTING LAMPS AND ACCESSORIES—APPARATUS FOR HEATING BY ELECTRICITY.

ELECTRIC SHIP-LIGHTING. A Handbook on the Practical Fitting and Running of Ships' Electrical Plant. By J. W. URQUHART. Crown 8vo, cloth **7/6**

ELECTRIC-WIRING, DIAGRAMS & SWITCH-BOARDS. By NEWTON HARRISON, E.E., Instructor of Electrical Engineering in the Newark Technical School. Crown 8vo, cloth . . . . *Net* **5/0**

THE BEGINNING OF WIRING—CALCULATING THE SIZE OF WIRE—A SIMPLE ELECTRIC LIGHT CIRCUIT CALCULATED—ESTIMATING THE MAINS, FEEDERS, AND BRANCHES—USING THE BRIDGE FOR TESTING—THE INSULATION RESISTANCE—WIRING FOR MOTORS—WIRING WITH CLEATS, MOULDING AND CONDUIT—LAYING-OUT A CONDUIT SYSTEM—POWER REQUIRED FOR LAMPS—LIGHTING OF A ROOM—SWITCHBOARDS AND THEIR PURPOSE—SWITCHBOARDS DESIGNED FOR SHUNT AND *COMPOUND-WOUND* DYNAMOS—PANEL SWITCHBOARDS, STREET RAILWAY SWITCH-*BOARDS, LIGHTNING* ARRESTERS—THE GROUND DETECTOR—LOCATING GROUNDS—*ALTERNATING* CURRENT CIRCUITS—THE POWER FACTOR IN CIRCUITS—CALCULATION *OF SIZES OF* WIRE FOR SINGLE, TWO AND THREE-PHASE CIRCUITS.

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 109 of 132

ELECTRICAL AND MAGNETIC CALCULATIONS. For the Use of Electrical Engineers and Artisans, Teachers, Students, and all others interested in the Theory and Application of Electricity and Magnetism. By A. A. ATKINSON, M.S., Professor of Physics and Electricity in Ohio University, Athens, Ohio. Crown 8vo, cloth . . . . *Net* **9/0**

ELECTRICAL DICTIONARY. A Popular Encyclopædia of Words and Terms Used in the Practice of Electrical Engineering. By T. O'CONOR SLOANE, A.M., E.M., Ph.D., Author of "Arithmetic of Electricity," "Electricity Simplified," "Electric Toy Making," etc. Fourth Edition, with Appendix. 690 pages and nearly 400 Illustrations. Large Crown 8vo, cloth *Net* **7/6**

"The work has many attractive features in it, and is, beyond doubt, a well put together and useful publication. The amount of ground covered may be gathered from the fact that in the index about 5,000 references will be found."—*Electrical Review.*

ELECTRICAL ENGINEERING. A First-Year's Course for Students. By TYSON SEWELL, A.I.E.E., Lecturer and Demonstrator in Electrical Engineering at the Polytechnic, Regent Street, London. Fourth Edition, Revised, with additions. Large Crown 8vo, cloth. 466 pp., with 277 Illustrations . . . . . *Net* **5/0**

OHM'S LAW—UNITS EMPLOYED IN ELECTRICAL ENGINEERING—SERIES AND PARALLEL CIRCUITS—CURRENT DENSITY AND POTENTIAL DROP IN THE CIRCUIT—THE HEATING EFFECT OF THE ELECTRIC CURRENT—THE MAGNETIC EFFECT OF AN ELECTRIC CURRENT—THE MAGNETISATION OF IRON—ELECTRO-CHEMISTRY—PRIMARY BATTERIES—ACCUMULATORS—INDICATING INSTRUMENTS—AMMETERS, VOLTMETERS, OHMMETERS—ELECTRICITY SUPPLY METERS—MEASURING INSTRUMENTS, AND THE MEASUREMENT OF ELECTRICAL RESISTANCE—MEASUREMENT OF POTENTIAL DIFFERENCE, CAPACITY, CURRENT STRENGTH, AND PERMEABILITY—ARC LAMPS—INCANDESCENT LAMPS—MANUFACTURE AND INSTALLATION—PHOTOMETRY—THE CONTINUOUS CURRENT DYNAMO—DIRECT CURRENT MOTORS—ALTERNATING CURRENTS—TRANSFORMERS, ALTERNATORS, SYNCHRONOUS MOTORS—POLYPHASE WORKING—APPENDIX I., THE THREE-WIRE SYSTEM—APPENDIX II., QUESTIONS AND ANSWERS.

"Distinctly one of the best books for those commencing the study of electrical engineering. Everything is explained in simple language which even a beginner cannot fail to understand."—*The Engineer.*

ELECTRICAL ENGINEERING (ELEMENTARY). In Theory and Practice. A Class Book for Junior and Senior Students and Working Electricians. By J. H. ALEXANDER. With nearly 200 Illustrations. Crown 8vo, cloth . . . . . *Net* **3/6**

FUNDAMENTAL PRINCIPLES—ELECTRICAL CURRENTS—SOLENOID COILS, GALVANOMETERS—VOLT-METERS—MEASURING INSTRUMENTS—ALTERNATING CURRENTS—DYNAMO ELECTRIC MACHINES—CONTINUOUS CURRENT DYNAMOS—INDUCTION, STATIC TRANSFORMERS, CONVERTERS—MOTORS—PRIMARY AND STORAGE CELLS—ARC LAMPS—INCANDESCENT LAMPS—SWITCHES, FUSES, ETC.—CONDUCTORS AND CABLES—ELECTRICAL ENERGY METERS—SPECIFICATIONS—GENERATION AND TRANSMISSION OF ELECTRICAL ENERGY—GENERATING STATIONS.

ELECTRICAL ENGINEERING. See ALTERNATING CURRENTS.

ELECTRICAL TRANSMISSION OF ENERGY. A Manual for the Design of Electrical Circuits. By ARTHUR VAUGHAN ABBOTT, C.E., Member American Institute of Electrical Engineers, Member American Institute of Mining Engineers, Member American Society of Civil Engineers, Member American Society of Mechanical Engineers, etc. Fourth Edition, entirely Re-Written and Enlarged, with numerous Tables, 16 Plates, and nearly 400 other Illustrations. Royal 8vo, 700 pages. Strongly bound in cloth . . . . . *Net* **30/0**

INTRODUCTION—THE PROPERTIES OF WIRE—THE CONSTRUCTION OF AERIAL CIRCUITS—GENERAL LINE WORK—ELECTRIC RAILWAY CIRCUITS—PROTECTION—THE CONSTRUCTION OF UNDERGROUND CIRCUITS—CONDUITS—CABLES AND CONDUIT CONDUCTORS—SPECIAL RAILWAY CIRCUIT—THE INTERURBAN TRANSMISSION LINE—THE THIRD RAIL—THE URBAN CONDUIT—ELECTRICAL INSTRUMENTS—METHODS OF ELECTRICAL MEASUREMENT—CONTINUOUS-CURRENT CONDUCTORS—THE HEATING OF CONDUCTORS—CONDUCTORS FOR ALTERNATING CURRENTS—SERIES DISTRIBUTION—PARALLEL DISTRIBUTION—MISCELLANEOUS METHODS—POLYPHASE TRANSMISSION—THE COST OF PRODUCTION AND DISTRIBUTION.

NOTE.—This Volume forms an indispensable Work for Electrical Engineers, Railway and Tramway Managers and Directors, and all interested in Electric Traction.

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 110 of 132

ELECTRICITY AS APPLIED TO MINING. By ARNOLD LUPTON, M.Inst C.E., M.I.Mech.E., M.I.E.E., late Professor of Coal Mining at the Yorkshire College, Victoria University, Mining Engineer and Colliery Manager; G. D. ASPINALL PARR, M.I.E.E., A.M.I.Mech.E., Associate of the Central Technical College, City and Guilds of London, Head of the Electrical Engineering Department, Yorkshire College, Victoria University; and HERBERT PERKIN, M.I.M.E., Certificated Colliery Manager, Assistant Lecturer in the Mining Department of the Yorkshire College, Victoria University. Second Edition, Revised and Enlarged. Medium 8vo, cloth, 300 pp., with about 170 Illustrations . . . . . *Net* **12/0**

INTRODUCTORY—DYNAMIC ELECTRICITY—DRIVING OF THE DYNAMO—THE STEAM TURBINE—DISTRIBUTION OF ELECTRICAL ENERGY—STARTING AND STOPPING ELECTRICAL GENERATORS AND MOTORS—ELECTRIC CABLES—CENTRAL ELECTRICAL PLANTS—ELECTRICITY APPLIED TO PUMPING AND HAULING—ELECTRICITY APPLIED TO COAL CUTTING—TYPICAL ELECTRIC PLANTS RECENTLY ERECTED—ELECTRIC LIGHTING BY ARC AND GLOW LAMPS—MISCELLANEOUS APPLICATIONS OF ELECTRICITY—ELECTRICITY AS COMPARED WITH OTHER MODES OF TRANSMITTING POWER—DANGERS OF ELECTRICITY.

"The book is a good attempt to meet a growing want, and is well worthy of a place in the mining engineer's library."—*The Electrician.*

ELECTRICITY IN FACTORIES: ITS COST AND CONVENIENCE. A Handbook for Power Producers and Power Users. By A. P. HASLAM, M.I.E.E. About 300 pp., fully illustrated. Demy 8vo. *[In the Press.*

ELECTRICITY. A STUDENT'S TEXT-BOOK. By H. M. NOAD, F.R.S. 650 pp., with 470 Illustrations. Crown 8vo . . **9/0**

ELECTRICITY, POWER TRANSMITTED BY, AND APPLIED BY THE ELECTRIC MOTOR, including Electric Railway Construction. By PHILIP ATKINSON, A.M., Ph.D., author of "Elements of Static Electricity." Fourth Edition, Enlarged, Crown 8vo, cloth, 224 pp., with over 90 Illustrations . . . . . *Net* **9/0**

ELECTRO-PLATING AND ELECTRO-REFINING OF METALS. Being a new edition of Alexander Watt's "Electro-Deposition." Revised and Largely Re-written by ARNOLD PHILIP, Assoc. R.S.M., B.Sc., A.I.E.E., F.I.C., Principal Assistant to the Admiralty Chemist, formerly Chief Chemist to the Engineering Departments of the India Office, and sometime Assistant Professor of Electrical Engineering and Applied Physics at the Heriot-Watt College, Edinburgh. 700 pp., with numerous Illustrations, Large Crown 8vo, cloth . . . . . *Net* **12/6**

ENGINE-DRIVING LIFE. Stirring Adventures and Incidents in the Lives of Locomotive Engine-Drivers. By MICHAEL REYNOLDS. Third Edition. Crown 8vo, cloth **1/6**

ENGINEERING DRAWING. A WORKMAN'S MANUAL. By JOHN MAXTON, Instructor in Engineering Drawing, Royal Naval College, Greenwich. Eighth Edition. 300 Plates and Diagrams. Crown 8vo, cloth **3/6**

"A copy of it should be kept for reference in every drawing office."—*Engineering.*

ENGINEERING ESTIMATES, COSTS, AND ACCOUNTS. A Guide to Commercial Engineering. With numerous examples of Estimates and Costs of Millwright Work, Miscellaneous Productions, Steam Engines and Steam Boilers; and a Section on the Preparation of Costs Accounts. By A GENERAL MANAGER. Second Edition. 8vo, cloth **12/0**

"The information is given in a plain, straightforward manner, and bears throughout evidence of the intimate practical acquaintance of the author with every phase of commercial engineering."—*Mechanical World.*

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 111 of 132

ENGINEERING PROGRESS (1863-6). By WM. HUMBER, A.M.Inst.C.E. Complete in Four Vols. Containing 148 Double Plates, with Portraits and Copious Descriptive Letterpress. Impl. 4to, half-morocco. Price, complete, **£12 12s.**; or each Volume sold separately at **£3 3s.** per Volume. *Descriptive List of Contents on application.*

ENGINEER'S AND MILLWRIGHT'S ASSISTANT. A Collection of Useful Tables, Rules, and Data. By WILLIAM TEMPLETON. Eighth Edition, with Additions. 18mo, cloth **2/6**

"A deservedly popular work. It should be in the 'drawer' of every mechanic. —*English Mechanic.*

ENGINEER'S HANDBOOK. A Practical Treatise on Modern Engines and Boilers, Marine, Locomotive, and Stationary. And containing a large collection of Rules and Practical Data relating to Recent Practice in Designing and Constructing all kinds of Engines, Boilers, and other Engineering work. The whole constituting a comprehensive Key to the Board of Trade and other Examinations for Certificates of Competency in Modern Mechanical Engineering. By WALTER S. HUTTON, Civil and Mechanical Engineer, Author of "The Works' Manager's Handbook for Engineers," &c. With upwards of 420 Illustrations. Sixth Edition, Revised and Enlarged. Medium 8vo, nearly 560 pp., strongly bound **18/0**

"A mass of information set down in simple language, and in such a form that it can be easily referred to at any time. The matter is uniformly good and well chosen, and is greatly elucidated by the illustrations. The book will find its way on to most engineers' shelves, where it will rank as one of the most useful books of reference."—*Practical Engineer.*

"Full of useful information, and should be found on the office shelf of all practical engineers.' —*English Mechanic.*

ENGINEER'S, MECHANIC'S, ARCHITECT'S, BUILDER'S, ETC. TABLES AND MEMORANDA. Selected and Arranged by FRANCIS SMITH. Seventh Edition, Revised, including ELECTRICAL TABLES, FORMULÆ, and MEMORANDA. Waistcoat-pocket size, limp leather **1/6**

"The best example we have ever seen of 270 pages of useful matter packed into the dimensions of a card-case."—*Building News.*

ENGINEER'S YEAR-BOOK FOR 1909. Comprising Formulæ, Rules, Tables, Data and Memoranda in Civil, Mechanical, Electrical, Marine and Mine Engineering. By H. R. KEMPE, M.Inst.C.E., Electrician to the Post Office, Formerly Principal Staff Engineer, Engineer-in-Chief's Office, General Post Office, London, Author of "A Handbook of Electrical Testing," "The Electrical Engineer's Pocket-Book," &c. With 1,000 Illustrations, specially Engraved for the work. Crown 8vo, 950 pp., leather . . . . . [*Just Published.* **8/0**

"Kempe's Year-Book really requires no commendation. Its sphere of usefulness is widely known, and it is used by engineers the world over."—*The Engineer.*

"The volume is distinctly in advance of most similar publications in this country."—*Engineering.*

ENGINEMAN'S POCKET COMPANION, and Practical Educator for Enginemen, Boiler Attendants, and Mechanics. By MICHAEL REYNOLDS. With 45 Illustrations and numerous Diagrams. Fifth Edition. *Royal 18mo,* strongly bound for pocket wear **3/6**

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 112 of 132

EXCAVATION (EARTH AND ROCK). A Practical Treatise, by CHARLES PRELINI, C.E. 365 pp., with Tables, many Diagrams and Engravings. Royal 8vo, cloth . . . . . *Net* **16/0**

FACTORY ACCOUNTS: their PRINCIPLES & PRACTICE. A Handbook for Accountants and Manufacturers. By E. GARCKE and J. M. FELLS. Crown 8vo, cloth **7/6**

FIRES, FIRE-ENGINES, AND FIRE BRIGADES. With a History of Fire-Engines, their Construction, Use, and Management. Hints on Fire-Brigades, &c. By C. F. T. YOUNG, C.E. 8vo, cloth, **£1 4s.**

FOUNDATIONS AND CONCRETE WORKS. With Practical Remarks on Footings, Planking, Sand and Concrete, Béton, Pile-driving, Caissons, and Cofferdams. By E. DOBSON. Crown 8vo . . . **1/6**

FUEL, ITS COMBUSTION AND ECONOMY. Consisting of an Abridgment of "A Treatise on the Combustion of Coal and the Prevention of Smoke." By C. W. WILLIAMS, A.Inst.C.E. With extensive Additions by D. KINNEAR CLARK, M.Inst.C.E. Fourth Edition. Crown 8vo, cloth **3/6**

FUELS: SOLID, LIQUID, AND GASEOUS. Their Analysis and Valuation. For the use of Chemists and Engineers. By H. J. PHILLIPS, F.C.S., formerly Analytical and Consulting Chemist to the Great Eastern Railway. Fourth Edition. Crown 8vo, cloth **2/0**

GAS AND OIL ENGINE MANAGEMENT. A Practical Guide for Users and Attendants, being Notes on Selection, Construction, and Management. By M. POWIS BALE, M.Inst.C.E., M.I.Mech.E. Author of "Woodworking Machinery," &c. Second Edition, with an additional Chapter on Gas Producers. Crown 8vo, cloth . . . . . *Net* **3/6**

SELECTING AND FIXING A GAS ENGINE—PRINCIPLES OF WORKING, ETC.—FAILURES AND DEFECTS—VALVES, IGNITION, PISTON RINGS, ETC.—OIL ENGINES—GAS PRODUCERS—RULES, TABLES, ETC.

GAS ENGINEER'S POCKET-BOOK. Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution, and Use of Coal Gas and the Construction of Gas Works. By H. O'CONNOR, A.M.Inst. C.E. Third Edition, Revised. Crown 8vo, leather . . *Net* **10/6**

"The book contains a vast amount of information."—*Gas World.*

GAS-ENGINE HANDBOOK. A Manual of Useful Information for the Designer and the Engineer. By E. W. ROBERTS, M.E. With Forty Full-page Engravings. Small Fcap. 8vo, leather . . *Net* **3/6**

GAS ENGINES. With Appendix describing a Recent Engine with Tube Igniter. By T. M. GOODEVE, M.A. Crown 8vo, cloth . **2/6**

GAS ENGINES. See INTERNAL COMBUSTION ENGINES.

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 113 of 132

GAS-ENGINES AND PRODUCER-GAS PLANTS. A Treatise setting forth the Principles of Gas Engines and Producer Design, the Selection and Installation of an Engine, the Care of Gas Engines and Producer-Gas Plants, with a Chapter on Volatile Hydrocarbon and Oil Engines. By R. E. MATHOT, M.E. Translated from the French. With a Preface by DUGALD CLERK, M.Inst.C.E., F.C.S. Medium 8vo, cloth, 310 pages, with about 150 Illustrations . . . . . *Net* **12/0**

MOTIVE POWER AND COST OF INSTALLATION—SELECTION OF AN ENGINE—INSTALLATION OF AN ENGINE—FOUNDATION AND EXHAUST—WATER CIRCULATION—LUBRICATION—CONDITIONS OF PERFECT OPERATION—HOW TO START AN ENGINE—PRECAUTIONS—PERTURBATIONS IN THE OPERATION OF ENGINES—PRODUCER-GAS ENGINES—PRODUCER-GAS—PRESSURE GAS-PRODUCERS—SUCTION GAS-PRODUCERS—OIL AND VOLATILE HYDROCARBON ENGINES—THE SELECTION OF AN ENGINE.

GAS LIGHTING. See ACETYLENE.

GAS LIGHTING FOR COUNTRY HOUSES. See PETROL AIR GAS.

GAS MANUFACTURE, CHEMISTRY OF. A Practical Manual for the Use of Gas Engineers, Gas Managers and Students. By HAROLD M. ROYLE, F.C.S., Chief Chemical Assistant at the Becton Gas Works. Demy 8vo, cloth. 340 pages, with numerous Illustrations and Coloured Plate . . . . . *Net* **12/6**

PREPARATION OF STANDARD SOLUTIONS—ANALYSIS OF COALS—DESCRIPTION OF VARIOUS TYPES OF FURNACES—PRODUCTS OF CARBONISATION AT VARIOUS TEMPERATURES—ANALYSIS OF CRUDE GAS—ANALYSIS OF LIME—ANALYSIS OF AMMONIACAL LIQUOR—ANALYTICAL VALUATION OF OXIDE OF IRON—ESTIMATION OF NAPTHALIN—ANALYSIS OF FIRE-BRICKS AND FIRE-CLAY—ART OF PHOTOMETRY—CARBURETTED WATER GAS—APPENDIX CONTAINING STATUTORY AND OFFICIAL REGULATIONS FOR TESTING GAS, VALUABLE EXCERPTS FROM VARIOUS IMPORTANT PAPERS ON GAS CHEMISTRY, USEFUL TABLES, MEMORANDA, ETC.

"It should prove a useful book of instruction and reference both to students in the technical colleges and to practical engineers and managers in their daily duties."—*Scotsman.*

GAS WORKS. Their Construction and arrangement, and the Manufacture and Distribution of Coal Gas. By S. HUGHES, C.E. Ninth Edition. Revised, with Notices of Recent Improvements by HENRY O'CONNOR, A.M.Inst.C.E. Crown 8vo, cloth **6/0**

GEOMETRY. For the Architect, Engineer, and Mechanic. By E. W. TARN, M.A., Architect. 8vo, cloth **9/0**

GEOMETRY FOR TECHNICAL STUDENTS. By E. H. SPRAGUE, A.M.Inst.C.E. Crown 8vo, cloth . . . . . *Net* **1/0**

GEOMETRY OF COMPASSES. By OLIVER BYRNE. Coloured Plates. Crown 8vo, cloth **3/6**

HEAT, EXPANSION OF STRUCTURES BY. By JOHN KEILY, C.E. Crown 8vo, cloth **3/6**

HOISTING MACHINERY. Including the Elements of Crane Construction and Descriptions of the Various Types of Cranes in Use. By JOSEPH HORNER, A.M.I.M.E. Crown 8vo, cloth, with 215 Illustrations, including Folding Plates . . . . . *Net* **7/6**

HYDRAULIC MANUAL. Consisting of Working Tables and Explanatory Text. Intended as a Guide in Hydraulic Calculations and Field Operations. By LOWIS D'A. JACKSON. Fourth Edition, Enlarged. Large crown 8vo, cloth **18/0**

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 114 of 132

HYDRAULIC POWER ENGINEERING. A Practical Manual on the Concentration and Transmission of Power by Hydraulic Machinery. By G. CROYDON MARKS, A.M.Inst.C.E. Second Edition, Enlarged, with about 240 Illustrations. 8vo, cloth . . . . . *Net* **10/6**

SUMMARY OF CONTENTS:—PRINCIPLES OF HYDRAULICS—THE FLOW OF WATER—HYDRAULIC PRESSURES—MATERIAL—TEST LOAD—PACKING FOR SLIDING SURFACES—PIPE JOINTS—CONTROLLING VALVES—PLATFORM LIFTS—WORKSHOP AND FOUNDRY CRANES—WAREHOUSE AND DOCK CRANES—HYDRAULIC ACCUMULATORS—PRESSES FOR BALING AND OTHER PURPOSES—SHEET METAL WORKING AND FORGING MACHINERY—HYDRAULIC RIVETERS—HAND AND POWER PUMPS—STEAM PUMPS—TURBINES—IMPULSE TURBINES—REACTION TURBINES—DESIGN OF TURBINES IN DETAIL—WATER WHEELS—HYDRAULIC ENGINES—RECENT ACHIEVEMENTS—PRESSURE OF WATER—ACTION OF PUMPS, &c.

"Can be unhesitatingly recommended as a useful and up-to-date manual on hydraulic transmission and utilisation of power."—*Mechanical World.*

HYDRAULIC TABLES, CO-EFFICIENTS, & FORMULÆ. For Finding the Discharge of Water from Orifices, Notches, Weirs, Pipes, and Rivers. With New Formulæ, Tables, and General Information on Rain-fall, Catchment-Basins, Drainage, Sewerage, Water Supply for Towns and Mill Power. By JOHN NEVILLE, C.E., M.R.I.A. Third Edition, revised, with additions. Numerous Illustrations. Crown 8vo, cloth . . . **14/0**

INTERNAL COMBUSTION ENGINES. Their Theory, Construction, and Operation. By ROLLA C. CARPENTER, M.M.E., LL.D., and H. DIEDERICHS, M.E., Professors of Experimental Engineering, Sibley College, Cornell University. 610 pages, with 373 Illustrations. Medium 8vo, cloth . . . . . [*Just published.* *Net* **21/0**

INTRODUCTION, DEFINITIONS AND CLASSIFICATIONS, INDICATED AND BRAKE HORSE-POWER—THERMODYNAMICS OF THE GAS ENGINE—THEORETICAL COMPARISON OF VARIOUS TYPES OF INTERNAL COMBUSTION ENGINES—THE VARIOUS EVENTS OF THE CONSTANT VOLUME AND CONSTANT-PRESSURE CYCLE AS MODIFIED BY PRACTICAL CONDITIONS—THE TEMPERATURE ENTROPY DIAGRAM APPLIED TO THE GAS ENGINE—COMBUSTION—GAS ENGINE FUELS, THE SOLID FUELS, GAS PRODUCERS—THE GAS-ENGINE FUELS, LIQUID FUELS, CARBURETERS AND VAPORISERS—GAS ENGINE FUELS, THE GAS FUELS, THE FUEL MIXTURE EXPLOSIBILITY, PRESSURE, AND TEMPERATURE—THE HISTORY OF THE GAS ENGINE—MODERN TYPES OF INTERNAL COMBUSTION ENGINES—GAS ENGINE AUXILIARIES, IGNITION, MUFFLERS, AND STARTING APPARATUS—REGULATION OF INTERNAL COMBUSTION ENGINES—THE ESTIMATION OF POWER OF GAS ENGINES—METHODS OF TESTING INTERNAL COMBUSTION ENGINES—THE PERFORMANCE OF GAS ENGINES AND GAS PRODUCERS—COST OF INSTALLATION AND OF OPERATION.

IRON AND METAL TRADES' COMPANION. For Expeditiously Ascertaining the Value of any Goods bought or sold by Weight, from 1s. per cwt. to 112s. per cwt., and from one farthing per pound to one shilling per pound. By THOMAS DOWNIE. Strongly bound in leather, 396 pp. **9/0**

IRON AND STEEL. A Work for the Forge, Foundry, Factory, and Office. Containing ready, useful, and trustworthy Information for Iron-masters and their Stock-takers; Managers of Bar, Rail, Plate, and Sheet Rolling Mills; Iron and Metal Founders; Iron Ship and Bridge Builders; Mechanical, Mining, and Consulting Engineers; Architects, Contractors, Builders, &c. By CHARLES HOARE, Author of "The Slide Rule," &c. Ninth Edition. 32mo, leather **6/0**

IRON AND STEEL CONSTRUCTIONAL WORK, as applied to Public, Private, and Domestic Buildings. By FRANCIS CAMPIN, C.E. Crown 8vo, cloth **3/6**

IRON & STEEL GIRDERS. A Graphic Table for facilitating the Computation of the Weights of Wrought Iron and Steel Girders, &c., for Parliamentary and other Estimates. By J. H. WATSON BUCK, M.Inst.C.E. *On a Sheet.* **2/6**

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 115 of 132

IRON-PLATE WEIGHT TABLES. For Iron Shipbuilders, Engineers, and Iron Merchants. Containing the Calculated Weights of upwards of 150,000 different sizes of Iron Plates from 1 foot by 6 in. by ¼ in. to 10 feet by 5 feet by 1 in. Worked out on the Basis of 40 lbs. to the square foot of Iron of 1 inch in thickness. By H. BURLINSON and W H SIMPSON. 4to, half-bound . . . . . **£1 5s.**

IRRIGATION (PIONEER). A Manual of Information for Farmers in the Colonies. By E. O. MAWSON, M.Inst.C.E., Executive Engineer, Public Works Department, Bombay. With Chapters on Light Railways by E. R. CALTHROP, M.Inst.C.E., M.I.M.E. With Plates and Diagrams. Demy 8vo, cloth . . . . . *Net* **10/6**

VALUE OF IRRIGATION, AND SOURCES OF WATER SUPPLY—DAMS AND WEIRS—CANALS—UNDERGROUND WATER—METHODS OF IRRIGATION—SEWAGE IRRIGATION—IMPERIAL AUTOMATIC SLUICE GATES—THE CULTIVATION OF IRRIGATED CROPS, VEGETABLES, AND FRUIT TREES—LIGHT RAILWAYS FOR HEAVY TRAFFIC—USEFUL MEMORANDA AND DATA.

LATHE PRACTICE. A Complete and Practical Work on the Modern American Lathe. By OSCAR E. PERRIGO, M.E., Author of "Modern Machine Shop Construction, Equipment, and Management," etc. Medium 8vo, 424 pp., 315 illustrations. Cloth . . . *Net* **12/0**

HISTORY OF THE LATHE UP TO THE INTRODUCTION OF SCREW THREADS—ITS DEVELOPMENT SINCE THE INTRODUCTION OF SCREW THREADS—CLASSIFICATION OF LATHES—LATHE DESIGN: THE BED AND ITS SUPPORTS—THE HEAD-STOCK CASTING, THE SPINDLE, AND SPINDLE-CONE—THE SPINDLE BEARINGS, THE BACK GEARS, AND THE TRIPLE-GEAR MECHANISM—THE TAIL STOCK, THE CARRIAGE, THE APRON, ETC.—TURNING RESTS, SUPPORTING RESTS, SHAFT STRAIGHTENERS, ETC.—LATHE ATTACHMENTS—RAPID CHANGE GEAR MECHANISM—LATHE TOOLS, HIGH-SPEED STEEL, SPEEDS AND FEEDS, POWER FOR CUTTING TOOLS, ETC.—TESTING A LATHE—LATHE WORK—ENGINE LATHES—HEAVY LATHES—HIGH-SPEED LATHES—SPECIAL LATHES—REGULAR TURRET LATHES—SPECIAL TURRET LATHES—ELECTRICALLY-DRIVEN LATHES.

LATHE-WORK. A Practical Treatise on the Tools, Appliances, and Processes employed in the Art of Turning. By PAUL N. HASLUCK. Eighth Edition. Crown 8vo, cloth **5/0**

"We can safely recommend the work to young engineers. To the amateur it will simply be invaluable."—*Engineer.*

LAW FOR ENGINEERS AND MANUFACTURERS. See EVERY MAN'S OWN LAWYER. A Handybook of the Principles of Law and Equity. By a Barrister. Forty-sixth (1909) Edition, Revised and Enlarged, including Abstracts of the Legislation of 1907-8 of especial interest to Engineering Firms and Manufacturers, such as the Workmen's Compensation Act, 1906; the Prevention of Corruption Act, 1906; the Trades Disputes Act, 1906; the Census of Production Act, 1906; the New Companies Act, 1907; the Limited Partnerships Act, 1907; the Patents and Designs Act, 1907; and many other recent Acts. Large crown 8vo, cloth, 838 pages.

[*Just published.* *Net* **6/8**

"No Englishman ought to be without this book."—*Engineer.*

"Ought to be in every business establishment and all libraries."—*Sheffield Post.*

"It is a complete code of English Law written in plain language, which all can understand. . . . Should be in the hands of every business man, and all who wish to abolish lawyers' bills."—*Weekly Times.*

"A useful and concise epitome of the law, compiled with considerable care."—*Law Magazine.*

LEVELLING, PRINCIPLES AND PRACTICE OF. Showing its Application to Purposes of Railway and Civil Engineering in the Construction of Roads; with Mr. TELFORD'S Rules for the same. By FREDERICK W. SIMMS, M.Inst.C.E. Ninth Edition, with LAW'S Practical Examples for Setting-out Railway Curves, and TRAUTWINE'S Field Practice of Laying-out Circular Curves. With 7 Plates and numerous Woodcuts. 8vo **8/6**

"The publishers have rendered a substantial service to the profession, especially to the younger members, by bringing out the present edition of Mr. Simms's useful work."—*Engineering.*

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 116 of 132

LOCOMOTIVE ENGINE. The Autobiography of an old Locomotive Engine. By ROBERT WEATHERBURN, M.I.M.E. With Illustrations and Portraits of GEORGE and ROBERT STEPHENSON. Crown 8vo, cloth. *Net* **2/6**

LOCOMOTIVE ENGINE DEVELOPMENT. A Popular Treatise on the Gradual Improvements made in Railway Engines between 1803 and 1903. By CLEMENT C. STRETTON, C.E. Sixth Edition, Revised and Enlarged. Crown 8vo, cloth . . . . . *Net* **4/6**

LOCOMOTIVE ENGINE DRIVING. A Practical Manual for Engineers in Charge of Locomotive Engines. By MICHAEL REYNOLDS, M.S.E. Twelfth Edition. Crown 8vo, cloth, **3/6**; cloth boards **4/6**

LOCOMOTIVE ENGINES. A Rudimentary Treatise on. By G. D. DEMPSEY, C.E. With large Additions treating of the Modern Locomotive, by D. K. CLARK, M.Inst.C.E. With Illustrations. Crown 8vo, cloth **3/0**

LOCOMOTIVE (MODEL) ENGINEER, Fireman and Engine Boy. Comprising a Historical Notice of the Pioneer Locomotive Engine and their Inventors. By MICHAEL REYNOLDS. Crown 8vo, cloth, **3/6** cloth boards **4/6**

LOCOMOTIVES, THE APPLICATION OF HIGHLY SUPERHEATED STEAM TO. See STEAM.

MACHINERY, DETAILS OF. Comprising Instructions for the Execution of various Works in Iron in the Fitting Shop, Foundry, and Boiler Yard. By FRANCIS CAMPIN, C.E. Crown 8vo, cloth . . **3/0**

MACHINE SHOP TOOLS. A Practical Treatise describing in every detail the Construction, Operation and Manipulation of both Hand and Machine Tools; being a work of Practical Instruction in all Classes of Modern Machine Shop Practice, including Chapters on Filing, Fitting and Scraping Surfaces; on Drills, Reamers, Taps and Dies; the Lathe and its Tools; Planers, Shapers and their Tools; Milling Machines and Cutters; Gear Cutters and Gear Cutting; Drilling Machines and Drill Work; Grinding Machines and their Work; Hardening and Tempering, Gearing, Belting, and Transmission Machinery; Useful Data and Tables. By W. H. VAN DERVOORT, M.E. Illustrated by 673 Engravings. Medium 8vo. *Net* **21/0**

MAGNETOS FOR AUTOMOBILISTS: How made and How used. A handybook on their Construction and Management. By S. R. BOTTONE. Crown 8vo, cloth . . . . . *Net* **2/0**

MARINE ENGINEERING. An Elementary Manual for Young Marine Engineers and Apprentices. By J. S. BREWER. Crown 8vo, cloth. **1/6**

MARINE ENGINEER'S GUIDE to Board of Trade Examinations for Certificates of Competency. Containing all Latest Questions to Date, with Simple, Clear, and Correct Solutions; 302 Elementary Questions with Illustrated Answers, and Verbal Questions and Answers; complete Set of Drawings with Statements completed. By A. C. WANNAN, C.E., Consulting Engineer, and E. W. I. WANNAN, M.I.M.E., Certificated First Class *Marine Engineer*. With numerous Engravings. Fourth Edition, Enlarged. *500 pages.* Large crown 8vo, cloth . . . . . Net **10/6**

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 117 of 132

MARINE ENGINEER'S POCKET-BOOK. Containing latest Board of Trade Rules and Data for Marine Engineers. By A. C. WANNAN. Fourth Edition, Revised, Enlarged, and Brought up to Date. Square 18mo, with thumb Index, leather **5/0**

MARINE ENGINES AND BOILERS. Their Design and Construction. A Handbook for the Use of Students, Engineers, and Naval Constructors. Based on the Work "Berechnung und Konstruktion der Schiffsmaschinen und Kessel," by Dr. G. BAUER, Engineer-in-Chief of the Vulcan Shipbuilding Yard, Stettin. Translated from the Second German Edition by E. M. DONKIN, and S. BRYAN DONKIN, A.M.I.C.E. Edited by LESLIE S. ROBERTSON, Secretary to the Engineering Standards Committee, M.I.C.E., M.I.M.E., M.I.N.A., &c. With numerous Illustrations and Tables. Medium 8vo, cloth . . . . . *Net* **25/-**

SUMMARY OF CONTENTS:—PART I.—MAIN ENGINES—DETERMINATION OF CYLINDER DIMENSIONS—THE UTILISATION OF STEAM IN THE ENGINE—STROKE OF PISTON—NUMBER OF REVOLUTIONS—TURNING MOMENT—BALANCING OF THE MOVING PARTS—ARRANGEMENT OF MAIN ENGINES—DETAILS OF MAIN ENGINES—THE CYLINDER—VALVES—VARIOUS KINDS OF VALVE GEAR—PISTON RODS—PISTONS—CONNECTING ROD AND CROSSHEAD—VALVE GEAR RODS—BED PLATES—ENGINE COLUMNS—REVERSING AND TURNING GEAR. PART II.—PUMPS—AIR, CIRCULATING FEED, AND AUXILIARY PUMPS. PART III.—SHAFTING, RESISTANCE OF SHIPS, PROPELLERS—THRUST SHAFT AND THRUST BLOCK—TUNNEL SHAFTS AND PLUMMER BLOCKS—SHAFT COUPLINGS—STERN TUBE—THE SCREW PROPELLER—CONSTRUCTION OF THE SCREW. PART IV.—PIPES AND CONNECTIONS—GENERAL REMARKS, FLANGES, VALVES, &C.—UNDER WATER FITTINGS—MAIN STEAM, AUXILIARY STEAM, AND EXHAUST PIPING—FEED WATER, BILGE, BALLAST AND CIRCULATING PIPES. PART V.—STEAM BOILERS—FIRING AND THE GENERATION OF STEAM—CYLINDRICAL BOILERS.—LOCOMOTIVE BOILERS—WATER-TUBE BOILERS—SMALL TUBE WATER-TUBE BOILERS—SMOKE BOX—FUNNEL AND BOILER LAGGING—FORCED DRAUGHT—BOILER FITTINGS AND MOUNTINGS. PART VI.—MEASURING INSTRUMENTS. PART VII.—VARIOUS DETAILS—BOLTS, NUTS, SCREW THREADS, &c.—PLATFORMS, GRATINGS, LADDERS—FOUNDATIONS—SEATINGS—LUBRICATION—VENTILATION OF ENGINE ROOMS—RULES FOR SPARE GEAR. PART VIII.—ADDITIONAL TABLES.

"An excellent specimen of the best class of German technical handbooks; it is clear and systematic in arrangement; perfectly sound on theoretical matters; and very complete, detailed, and distinct in descriptions of construction and directions for calculations, with fully-detailed numerical and graphical examples."—*Engineer.*

"The book covers very completely the whole range of subjects embraced by the title. Dr. Bauer has produced a volume which forms a most useful and important addition to our practical text-books on marine engineering, and he has been most fortunate in securing translators and editor who have been able to place his views before English readers in such an eminently satisfactory form."—*Engineering*

". . . All who wish to know the principles on which this principal branch of science is based should be in possession of a copy of this work. There is nothing but solid matter in it."—*Marine Engineer.*

"The book is one of the best we have ever seen on the subject. It will be welcomed both by the designer and the student of marine engineering, and no marine engineer who wishes to be up-to-date can afford to be without it."—*Steamship.*

MARINE ENGINES AND STEAM VESSELS. By R. MURRAY, C.E. Eighth Edition, thoroughly Revised, with Additions by the Author and by GEORGE CARLISLE, C.E. Crown 8vo, cloth . . **4/6**

MASONRY DAMS FROM INCEPTION TO COMPLETION. Including numerous Formulæ, Forms of Specification and Tender, Pocket Diagram of Forces, &c. For the use of Civil and Mining Engineers. By C. F. COURTNEY, M.Inst.C.E. 8vo, cloth **9/0**

MASTING, MAST-MAKING, AND RIGGING OF SHIPS. Also Tables of Spars, Rigging, Blocks; Chain, Wire, and Hemp Ropes, &c., relative to every class of vessels. By R. KIPPING. Crown 8vo, cloth **2/0**

MATERIALS AND CONSTRUCTION. A Theoretical and Practical Treatise on the Strains, Designing, and Erection of Works of Construction. By F. CAMPIN. Crown 8vo, cloth **3/0**

MATERIALS, A TREATISE ON THE STRENGTH OF. By P. BARLOW, F.R.S., P. W. BARLOW, F.R.S., and W. H. BARLOW, F.R.S. Edited by WM. HUMBER, A.M.Inst.C.E. 8vo, cloth **18/0**

"*The standard treatise on that particular subject.*"—**Engineer.**

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 118 of 132

MATHEMATICAL TABLES. For Trigonometrical, Astronomical, and Nautical Calculations; to which is prefixed a Treatise on Logarithms, by H. LAW, C.E. With Tables for Navigation and Nautical Astronomy. By Prof. J. R. YOUNG. Crown 8vo, cloth . . . **4/0**

MEASURES: BRITISH AND AMERICAN CUSTOMARY AND METRIC LEGAL MEASURES. For Commercial and Technical Purposes, forming the Measure Section of Part I. of "The Mechanical Engineer's Reference Book." By NELSON FOLEY, M.I.N.A. Folio, cloth.
[*Just Ready.*

MEASURES: LEGAL STANDARDS—LINEAL—SQUARE—CUBIC AND CAPACITY—WEIGHT—COMPOUND UNITS—VELOCITY AND SPEED—MEASURES OF GRAVITY—MASS—FORCE—WORK—POWER—ELECTRICAL—HEAT—MOMENTS—ENERGY—MOMENTUM—CENTRIFUGAL FORCE—ANGLES—EQUIVALENTS: CUSTOMARY MEASURES TO METRIC, AND *vice versa*—LINEAL—SQUARE—CUBIC AND CAPACITY—WEIGHTS.

MECHANICAL ENGINEERING. Comprising Metallurgy, Moulding, Casting, Forging, Tools, Workshop Machinery, Mechanical Manipulation, Manufacture of the Steam Engine, &c. By FRANCIS CAMPIN, C.E. Third Edition. Crown 8vo, cloth **2/6**

MECHANICAL ENGINEERING TERMS. (Lockwood's Dictionary). Embracing terms current in the Drawing Office, Pattern Shop, Foundry, Fitting, Turning, Smiths', and Boiler Shops, &c. Comprising upwards of 6,000 Definitions. Edited by J. G. HORNER, A.M.I.M.E. Third Edition, Revised, with Additions. Crown 8vo, cloth . . . *Net* **7/6**

MECHANICAL ENGINEER'S COMPANION. Areas, Circumferences, Decimal Equivalents, in inches and feet, millimetres, squares, cubes, roots, &c.; Strength of Bolts, Weight of Iron, &c.; Weights, Measures, and other Data. Also Practical Rules for Engine Proportions. By R. EDWARDS, M.Inst.C.E. Fcap. 8vo, cloth **3/6**

MECHANICAL ENGINEER'S POCKET-BOOK. Comprising Tables, Formulæ, Rules, and Data: A Handy Book of Reference for Daily Use in Engineering Practice. By D. KINNEAR CLARK, M.Inst.C.E., Sixth Edition, thoroughly Revised and Enlarged. By H. H. P. POWLES, A.M.Inst.C.E., M.I.M.E. Small 8vo, 700 pp., Leather . . *Net* **6/0**

MATHEMATICAL TABLES—MEASUREMENT OF SURFACES AND SOLIDS—ENGLISH WEIGHTS AND MEASURES—FRENCH METRIC WEIGHTS AND MEASURES—FOREIGN WEIGHTS AND MEASURES—MONEYS—SPECIFIC GRAVITY, WEIGHT, AND VOLUME—MANUFACTURED METALS—STEEL PIPES—BOLTS AND NUTS—SUNDRY ARTICLES IN WROUGHT AND CAST IRON, COPPER, BRASS, LEAD, TIN, ZINC—STRENGTH OF MATERIALS—STRENGTH OF TIMBER—STRENGTH OF CAST IRON—STRENGTH OF WROUGHT IRON—STRENGTH OF STEEL—TENSILE STRENGTH OF COPPER, LEAD, &c.—RESISTANCE OF STONES AND OTHER BUILDING MATERIALS—RIVETED JOINTS IN BOILER PLATES—BOILER SHELLS—WIRE ROPES AND HEMP ROPES—CHAINS AND CHAIN CABLES—FRAMING—HARDNESS OF METALS, ALLOYS, AND STONES—LABOUR OF ANIMALS—MECHANICAL PRINCIPLES—GRAVITY AND FALL OF BODIES—ACCELERATING AND RETARDING FORCES—MILL GEARING, SHAFTING, &c.—TRANSMISSION OF MOTIVE POWER—HEAT—COMBUSTION: FUELS—WARMING, VENTILATION, COOKING STOVES—STEAM—STEAM ENGINES AND BOILERS—RAILWAYS—TRAMWAYS—STEAM SHIPS—PUMPING STEAM ENGINES AND PUMPS—COAL GAS—GAS ENGINES, &c.—AIR IN MOTION—COMPRESSED AIR—HOT AIR ENGINES—WATER POWER—SPEED OF CUTTING TOOLS—COLOURS—ELECTRICAL ENGINEERING.

"It would be found difficult to compress more matter within a similar compass, or produce a book of 700 pages which should be more compact or convenient for pocket reference. . . . Will be appreciated by mechanical engineers of all classes."—*Practical Engineer.*

MECHANICAL ENGINEER'S REFERENCE BOOK. For Machine and Boiler Construction. By NELSON FOLEY, M.I.N.A. New Edition, Revised throughout and much Enlarged. To be issued in parts.
[*In Preparation.*

The Measure Section of Part I.—**BRITISH AND AMERICAN CUSTOMARY AND METRIC LEGAL MEASURES**—now ready.
See under MEASURES.

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 119 of 132

MECHANICAL HANDLING OF MATERIAL. A Treatise on the Handling of Material such as Coal, Ore, Timber, &c., by Automatic or Semi-Automatic Machinery, together with the Various Accessories used in the Manipulation of such Plant, and Dealing fully with the Handling, Storing, and Warehousing of Grain. By G. F. ZIMMER, A.M.Inst.C.E. 528 pages Royal 8vo, cloth, with 550 Illustrations (including Folding Plates) specially prepared for the Work . . . *Net* **25/0**

"It is an essentially practical work written by a practical man, who is not only thoroughly acquainted with his subject theoretically, but who also has the knowledge that can only be obtained by actual experience in working and planning installations for the mechanical handling of raw material."—*The Times.*

MECHANICS. Being a concise Exposition of the General Principles of Mechanical Science and their Applications. By C. TOMLINSON, F.R.S. Crown 8vo, cloth **1/6**

MECHANICS: CONDENSED. A Selection of Formulæ, Rules, Tables, and Data for the Use of Engineering Students, &c. By W. G. C. HUGHES, A.M.I.C.E. Crown 8vo, cloth **2/6**

MECHANICS OF AIR MACHINERY. By Dr. J. WIESBACH and PROF. G. HERRMANN. Authorized Translation with an Appendix on American Practice by A. TROWBRIDGE, Ph.B., Adjunct Professor of Mechanical Engineering, Columbia University. Royal 8vo, cloth . . *Net* **18/0**

MECHANICS' WORKSHOP COMPANION. Comprising a great variety of the most useful Rules and Formulæ in Mechanical Science, with numerous Tables of Practical Data and Calculated Results for Facilitating Mechanical Operations. By WILLIAM TEMPLETON, Author of "The Engineer's Practical Assistant," &c., &c. Eighteenth Edition, Revised, Modernised, and considerably Enlarged by W. S. HUTTON, C.E., Author of "The Works' Manager's Handbook," &c. Fcap. 8vo, nearly 500 pp., with 8 Plates and upwards of 250 Diagrams, leather **6/0**

"This well-known and largely-used book contains information, brought up to date, of the sort so useful to the foreman and draughtsman. So much fresh information has been introduced as to constitute it practically a new book."—*Mechanical World.*

MECHANISM AND MACHINE TOOLS. By T. BAKER, C.E. With Remarks on Tools and Machinery by J. NASMYTH, C.E. Crown 8vo, cloth **2/6**

MENSURATION AND MEASURING. With the Mensuration and Levelling of Land for the purposes of Modern Engineering. By T. BAKER, C.E. New Edition by E. NUGENT, C.E. Crown 8vo, cloth **1/6**

METAL-TURNING. A Practical Handbook for Engineers, Technical Students, and Amateurs. By JOSEPH HORNER, A.M.I.Mech.E. Author of "Pattern Making," &c. Large Crown 8vo, cloth, with 488 Illustrations . . . . . *Net* **9/0**

SUMMARY OF CONTENTS:—INTRODUCTION—RELATIONS OF TURNERY AND MACHINE SHOP—SEC. I. THE LATHE, ITS WORK, AND TOOLS—FORMS AND FUNCTIONS OF TOOLS—REMARKS ON TURNING IN GENERAL.—SEC. II. TURNING BETWEEN CENTRES—CENTRING AND DRIVING—USE OF STEADIES—EXAMPLES OF TURNING INVOLVING LINING-OUT FOR CENTRES—MANDREL WORK.—SEC. III. WORK SUPPORTED AT ONE END—FACE PLATE TURNING—ANGLE PLATE TURNING—INDEPENDENT JAW CHUCKS—CONCENTRIC, UNIVERSAL, TOGGLE, AND APPLIED CHUCKS.—SEC. IV. INTERNAL WORK—DRILLING, BORING, AND ALLIED OPERATIONS.—SEC. V. SCREW CUTTINGS AND TURRET WORK.—SEC. VI. MISCELLANEOUS—SPECIAL WORK—MEASUREMENT, GRINDING—TOOL HOLDERS—SPEED AND FEEDS, TOOL STEELS—STEEL MAKERS' INSTRUCTIONS.

METRIC TABLES. In which the British Standard Measures and Weights are compared with those of the Metric System at present in Use on the Continent. By C. H. DOWLING, C.E. 8vo, cloth . . . **10/6**

MILLING MACHINES; their Design, Construction, and Working. A Handbook for Practical Men and Engineering Students. By JOSEPH HORNER, A.M.I.Mech.E., Author of "Pattern Making," &c. With 269 Illustrations. Medium 8vo, cloth . . . . . *Net* **12/6**

LEADING ELEMENTS OF MILLING MACHINE DESIGN AND CONSTRUCTION—PLAIN AND UNIVERSAL MACHINES—ATTACHMENTS AND BRACINGS—VERTICAL SPINDLES MACHINES—*PLANO*-MILLERS OR SLABBING MACHINES—SPECIAL MACHINES—CUTTERS—*MILLING OPERATIONS*—INDEXING, SPIRAL WORK, AND WORM, SPUR, AND BEVEL GEARS, *ETC.*—*SPUR AND* BEVEL GEARS—FEEDS AND SPEEDS.

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 120 of 132

MOTOR CAR CATECHISM. Containing about 320 Questions and Answers Explaining the Construction and Working of a Modern Motor Car. For the Use of Owners, Drivers, and Students. By JOHN HENRY KNIGHT. Second edition, revised and enlarged, with an additional chapter on Motor Cycles. Crown 8vo, with Illustrations. [*Just Published. Net* **1/6**

THE PETROL ENGINE—TRANSMISSION AND THE CHASSIS—TYRES—DUTIES OF A CAR DRIVER—MOTOR CYCLES—LAWS AND REGULATIONS.

MOTOR CAR ENGINEERING. Practical Lectures on the Motor Car. By ROBERT W. A. BREWER, A.M.Inst.C.E., M.I.M.E., M.I.A.E. With numerous Illustrations. Demy 8vo . . . . [*In the Press.*

MOTOR CARS FOR COMMON ROADS. By A. J. WALLIS-TAYLER, A.M.Inst.C.E. 212 pp., with 76 Illustrations. Crown 8vo, cloth **4/6**

MOTOR VEHICLES FOR BUSINESS PURPOSES. A Practical Handbook for those interested in the Transport of Passengers and Goods. By A. J. WALLIS-TAYLER, A.M.Inst.C.E. With 134 Illustrations. Demy 8vo, cloth . . . . . *Net* **9/0**

NAVAL ARCHITECT'S AND SHIPBUILDER'S POCKET BOOK. Of Formulæ, Rules, and Tables, and Marine Engineer's and Surveyor's Handy Book of Reference. By CLEMENT MACKROW, M.I.N.A. Ninth Edition, Fcap., leather . . . . . *Net* **12/6**

SIGNS AND SYMBOLS, DECIMAL FRACTIONS—TRIGONOMETRY—PRACTICAL GEOMETRY—MENSURATION—CENTRES AND MOMENTS OF FIGURES—MOMENTS OF INERTIA AND RADII GYRATION—ALGEBRAICAL EXPRESSIONS FOR SIMPSON'S RULES—MECHANICAL PRINCIPLES—CENTRE OF GRAVITY—LAWS OF MOTION—DISPLACEMENT, CENTRE OF BUOYANCY—CENTRE OF GRAVITY OF SHIP'S HULL—STABILITY CURVES AND METACENTRES—SEA AND SHALLOW-WATER WAVES—ROLLING OF SHIPS—PROPULSION AND RESISTANCE OF VESSELS—SPEED TRIALS—SAILING, CENTRE OF EFFORT—DISTANCES DOWN RIVERS, COAST LINES—STEERING AND RUDDERS OF VESSELS—LAUNCHING CALCULATIONS AND VELOCITIES—WEIGHT OF MATERIAL AND GEAR—GUN PARTICULARS AND WEIGHT—STANDARD GAUGES—RIVETED JOINTS AND RIVETING—STRENGTH AND TESTS OF MATERIALS—BINDING AND SHEARING STRESSES—STRENGTH OF SHAFTING, PILLARS, WHEELS, &c.—HYDRAULIC DATA, &c.—CONIC SECTIONS, CATENARIAN CURVES—MECHANICAL POWERS, WORK—BOARD OF TRADE REGULATIONS FOR BOILERS AND ENGINES—BOARD OF TRADE REGULATIONS FOR SHIPS—LLOYD'S RULES FOR BOILERS—LLOYD'S WEIGHT OF CHAINS—LLOYD'S SCANTLINGS FOR SHIPS—DATA OF ENGINES AND VESSELS—SHIPS' FITTINGS AND TESTS—SEASONING PRESERVING TIMBER—MEASUREMENT OF TIMBER—ALLOYS, PAINTS, VARNISHES—DATA FOR STOWAGE—ADMIRALTY TRANSPORT REGULATIONS—RULES FOR HORSE-POWER, SCREW PROPELLERS, &c.—PERCENTAGES FOR BUTT STRAPS—PARTICULARS OF YACHTS—MASTING AND RIGGING—DISTANCES OF FOREIGN PORTS—TONNAGE TABLES—VOCABULARY OF FRENCH AND ENGLISH TERMS—ENGLISH WEIGHTS AND MEASURES—FOREIGN WEIGHTS AND MEASURES—DECIMAL EQUIVALENTS—USEFUL NUMBERS—CIRCULAR MEASURES—AREAS OF AND CIRCUMFERENCES OF CIRCLES—AREAS OF SEGMENTS OF CIRCLES—TABLES OF SQUARES AND CUBES AND ROOTS OF NUMBERS—TABLES OF LOGARITHMS OF NUMBERS—TABLES OF HYPERBOLIC LOGARITHMS—TABLES OF NATURAL SINES, TANGENTS—TABLES OF LOGARITHMIC SINES, TANGENTS, &c.

"In these days of advanced knowledge a work like this is of the greatest value. It contains a vast amount of information. We unhesitatingly say that it is the most valuable compilation for its specific purpose that has ever been printed. No naval architect, engineer, surveyor, seaman, wood or iron shipbuilder, can afford to be without this work."—*Nautical Magazine.*

NAVAL ARCHITECTURE. An Exposition of the Elementary Principles. By J. PEAKE. Crown 8vo, cloth **3/6**

NAVIGATION AND NAUTICAL ASTRONOMY, In Theory and Practice. By Prof. J. R. YOUNG. Crown 8vo, cloth . . . **2/6**

"A very complete, thorough, and useful manual for the young navigator."—*Observatory.*

NAVIGATION, PRACTICAL. Consisting of the Sailor's Sea Book, by J. GREENWOOD and W. H. ROSSER; together with Mathematical and Nautical Tables for the Working of the Problems, by H. LAW, C.E., and Prof. J. R. YOUNG **7/0**

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 121 of 132

PATTERN MAKING. Embracing the Main Types of Engineering Construction, and including Gearing, Engine Work, Sheaves and Pulleys, Pipes and Columns, Screws, Machine Parts, Pumps and Cocks, the Moulding of Patterns in Loam and Greensand, Weight of Castings, &c. By J. G. HORNER, A.M.I.M.E. Third Edition, Enlarged. With 486 Illustrations. Crown 8vo, cloth . . . . . *Net* **7/6**

"A well-written technical guide, evidently written by a man who understands and has practised what he has written about."—*Builder.*

PATTERN MAKING. A Practical Work on the Art of Making Patterns for Engineering and Foundry Work, including (among other matter) Materials and Tools, Wood Patterns, Metal Patterns, Pattern Shop Mathematics, Cost, Care, &c., of Patterns. By F. W. BARROWS. Fully Illustrated by Engravings made from Special Drawings by the Author. Crown 8vo, cloth. *Net* **6/0**

PATTERN MAKERS AND PATTERN MAKING—MATERIALS AND TOOLS—EXAMPLES OF PATTERN WORK—METAL PATTERNS—PATTERN SHOP MATHEMATICS—COST, CARE, AND INVENTORY OF PATTERNS—MARKING AND RECORD OF PATTERNS—PATTERN ACCOUNTS.

PETROL AIR GAS. A Practical Hand-book on the Installation and Working of Air Gas Lighting Systems for Country Houses. By HENRY O'CONNOR, F.R.S.E., A.M.Inst.C.E., &c., Author of "The Gas Engineer's Pocket-Book." Crown 8vo . . [*In the Press. Price about* **1/6** *Net.*

PIONEER ENGINEERING. A Treatise on the Engineering Operations connected with the Settlement of Waste Lands in New Countries. By E. DOBSON, M.Inst.C.E. Second Edition. Crown 8vo, cloth **4/6**

PNEUMATICS, Including Acoustics and the Phenomena of Wind Currents, for the use of Beginners. By CHARLES TOMLINSON, F.R.S. Crown 8vo, cloth **1/6**

PUMPS AND PUMPING. A Handbook for Pump Users. Being Notes on Selection, Construction, and Management. By M. POWIS BALE, M.Inst.C.E., M.I.Mech.E. Fifth Edition. Crown 8vo, cloth . **3/6**

"The matter is set forth as concisely as possible. In fact, condensation rather than diffuseness has been the author's aim throughout; yet he does not seem to have omitted anything likely to be of use."—*Journal of Gas Lighting.*

PUNCHES, DIES, AND TOOLS FOR MANUFACTURING IN PRESSES. By JOSEPH V. WOODWORTH. Medium 8vo, cloth. 482 pages with 700 Illustrations . . . . . *Net* **16/0**

SIMPLE BENDING AND FORMING DIES, THEIR CONSTRUCTION, USE AND OPERATION—INTRICATE COMBINATION, BENDING AND FORMING DIES, FOR ACCURATE AND RAPID PRODUCTION—AUTOMATIC FORMING, BENDING AND TWISTING DIES AND PUNCHES, FOR DIFFICULT AND NOVEL SHAPING—CUT, CARRY, AND FOLLOW DIES, TOGETHER WITH TOOL COMBINATIONS FOR PROGRESSIVE SHEET METAL WORKING—NOTCHING PERFORATING AND PIERCING PUNCHES, DIES AND TOOLS—COMPOSITE, SECTIONAL, COMPOUND AND ARMATURE DISK AND SEGMENT PUNCHES AND DIES—PROCESSES AND TOOLS FOR MAKING RIFLE CARTRIDGES, CARTRIDGE CASES OF QUICK-FIRING GUNS, AND NICKEL BULLET JACKETS—THE MANUFACTURE AND USE OF DIES FOR DRAWING WIRE AND BAR STEEL—PENS, PINS, AND NEEDLES, THEIR EVOLUTION AND MANUFACTURE—PUNCHES, DIES, AND PROCESSES FOR MAKING HYDRAULIC PACKING LEATHERS, TOGETHER WITH TOOLS FOR PAINT AND CHEMICAL TABLETS—DRAWING, RE-DRAWING, REDUCING, FLANGING, FORMING, REVERSING, AND CUPPING PROCESSES, PUNCHES AND DIES FOR CIRCULAR AND RECTANGULAR AND SHEET-METAL ARTICLES—BEADING, WIRING, CURLING AND SEAMING PUNCHES AND DIES FOR CLOSING AND ASSEMBLING OF METAL PARTS—JEWELLERY DIE-MAKING, EYE GLASS, LENS AND MEDAL DIES, AND CONSTRUCTION OF SPOON AND FORK-MAKING TOOLS—DESIGN, CONSTRUCTION AND USE OF SUB-PRESSES AND SUB-PRESS DIES FOR WATCH AND CLOCK WORK AND ACCURATE PIERCING AND PUNCHING—DROP FORGING AND DIE SINKING, TOGETHER WITH MAKING OF DROP DIES, STEAM-HAMMER DIES, NUMBER-PLATE TOOLS AND DIES FOR BOLT MACHINES—METHODS, DESIGNS, WAYS, KINKS, FORMULAS AND TOOLS FOR SPECIAL WORK, TOGETHER WITH MISCELLANEOUS INFORMATION OF VALUE TO TOOL AND DIE MAKERS AND SHEET-METAL GOODS MANUFACTURERS—SPECIAL AND NOVEL PROCESSES, PRESSES AND FEEDS FOR WORKING SHEET METAL IN DIES.

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 122 of 132

RECLAMATION OF LAND FROM TIDAL WATERS. A Handbook for Engineers, Landed Proprietors, and others interested in Works of Reclamation. By A. BEAZELEY, M.Inst.C.E. 8vo, cloth. *Net* **10/6**

"The work contains a great deal of practical and useful information which cannot fail to be of service to engineers entrusted with the enclosure of salt marshes, and to land-owners intending to reclaim land from the sea."—*The Engineer.*

REFRIGERATING AND ICE-MAKING MACHINERY. A Descriptive Treatise for the Use of Persons Employing Refrigerating and Ice-Making Installations, and others. By A. J. WALLIS-TAYLER, A.M.Inst.C.E. Third Edition, Enlarged. Crown 8vo, cloth . . **7/6**

"May be recommended as a useful description of the machinery, the processes, and of the facts, figures, and tabulated physics of refrigerating."—*Engineer.*

REFRIGERATION AND ICE-MAKING POCKET BOOK. By A. J. WALLIS-TAYLER, A.M.Inst.C.E. Author of "Refrigerating and Ice-making Machinery," &c. Fourth Edition. Crown 8vo, cloth. *Net* **3/6**

REFRIGERATION, COLD STORAGE, & ICE-MAKING: A Practical Treatise on the Art and Science of Refrigeration. By A. J. WALLIS-TAYLER, A.M.Inst.C.E., Author of "Refrigerating and Ice-Making Machinery." 600 pp., with 360 Illustrations. Medium 8vo, cloth. *Net* **15/0**

"The author has to be congratulated on the completion and production of such an important work and it cannot fail to have a large body of readers, for it leaves out nothing that would in any way be of value to those interested in the subject."—*Steamship.*

RIVER BARS. The Causes of their Formation, and their Treatment by "Induced Tidal Scour"; with a Description of the Successful Reduction by this Method of the Bar at Dublin. By I. J. MANN, Assist. Eng. to the Dublin Port and Docks Board. Royal 8vo, cloth . . **7/6**

"We recommend all interested in harbour works—and, indeed, those concerned in the improvement of rivers generally—to read Mr. Mann's interesting work."—*Engineer.*

ROADS AND STREETS. By H. LAW, C.E., and D. K. CLARK, C.E. Revised, with Additional Chapters by A. J. WALLIS-TAYLER, A.M.Inst.C.E. Seventh Edition. Crown 8vo, cloth **6/0**

"A book which every borough surveyor and engineer must possess, and which will be of considerable service to architects, builders, and property owners generally."—*Building News.*

ROOFS OF WOOD AND IRON. Deduced chiefly from the Works of Robison, Tredgold, and Humber. By E. W. TARN, M.A., Architect. Fifth Edition. Crown 8vo, cloth **1/6**

SAFE RAILWAY WORKING. A Treatise on Railway Accidents, their Cause and Prevention; with a Description of Modern Appliances and Systems. By CLEMENT E. STRETTON, C.E. Third Edition, Enlarged. Crown 8vo, cloth **3/6**

***SAFE USE* OF STEAM.** Containing Rules for Unprofessional Steam Users. By an ENGINEER. Eighth Edition. Sewed . **6d.**

"*If steam-users would but learn this little book by heart, boiler explosions would become sensations by their rarity.*"—*English Mechanic.*

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 123 of 132

SAILMAKING. By SAMUEL B. SADLER, Practical Sailmaker, late in the employment of Messrs. Ratsey and Lapthorne, of Cowes and Gosport. Second Edition. Revised and Enlarged. Plates. 4to, cloth *Net* **12/6**

SAILOR'S SEA BOOK. A Rudimentary Treatise on Navigation. By JAMES GREENWOOD, B.A. With numerous Woodcuts and Coloured Plates. New and Enlarged Edition. By W. H. ROSSER. Crown 8vo, cloth **2/6**

SAILS AND SAIL-MAKING. With Draughting, and the Centre of Effort of the Sails. Weights and Sizes of Ropes; Masting, Rigging, and Sails of Steam Vessels, etc. By R. KIPPING, N.A. Crown 8vo, cloth **2/6**

SCREW-THREADS, and Methods of Producing Them. With numerous Tables and complete Directions for using Screw-Cutting Lathes. By PAUL N. HASLUCK, Author of "Lathe-Work," etc. Sixth Edition. Waistcoat-pocket size **1/6**

"Full of useful information, hints and practical criticism. Taps, dies, and screwing tools generally are illustrated and their action described."—*Mechanical World.*

SEA TERMS, PHRASES, AND WORDS; Technical Dictionary (French-English, English-French), used in the English and French Languages. For the Use of Seamen, Engineers, Pilots, Shipbuilders, Shipowners, and Shipbrokers. Compiled by W. PIRRIE, late of the African Steamship Company. F'cap. 8vo, cloth **5/0**

SHIPBUILDING INDUSTRY OF GERMANY. Compiled and Edited by G. LEHMANN-FELSKOWSKI. With Coloured Prints, Art Supplements, and numerous Illustrations throughout the text. Super-royal 4to, cloth . . . . . *Net* **10/6**

SHIPS AND BOATS. By W. BLAND. With numerous Illustrations and Models. Tenth Edition. Crown 8vo, cloth . . **1/6**

SHIPS FOR OCEAN AND RIVER SERVICE. Principles of the Construction of. By H. A. SOMMERFELDT. Crown 8vo . . **1/6**
ATLAS OF ENGRAVINGS to illustrate the above. Twelve large folding Plates. Royal 4to, cloth **7/6**

SMITHY AND FORGE. Including the Farrier's Art and Coach Smithing. By W. J. E. CRANE. Crown 8vo, cloth . . **2/6**

STATICS, GRAPHIC AND ANALYTIC. In their Practical Application to the Treatment of Stresses in Roofs, Solid Girders, Lattice, Bowstring, and Suspension Bridges, Braced Iron Arches and Piers, and other Frameworks. By R. HUDSON GRAHAM, C.E. Containing Diagrams and Plates to Scale. With numerous Examples, many taken from existing Structures. Specially arranged for Class-work in Colleges and Universities. Second Edition, Revised and Enlarged. 8vo, cloth **18/0**

"*Mr. Graham's book will find a place wherever graphic and analytic statics are used or studied.*"—*Engineer.*

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 124 of 132

STATIONARY ENGINE DRIVING. A Practical Manual for Engineers in Charge of Stationary Engines. By MICHAEL REYNOLDS M.S.E. Eighth Edition. Crown 8vo, cloth, **3/6**; cloth boards . **4/6**

"The author is thoroughly acquainted with his subjects, and has produced a manual which is an exceedingly useful one for the class for whom it is specially intended."—*Engineering.*

STATIONARY ENGINES. A Practical Handbook of their Care and Management for Men-in-charge. By C. HURST. Crown 8vo. *Net* **1/0**

STEAM: THE APPLICATION OF HIGHLY SUPER-HEATED STEAM TO LOCOMOTIVES. Being a reprint from a Series of Articles appearing in the *Engineer*. By ROBERT GARBE. Privy Councillor, Prussian State Railways. Translated from the German. Edited by LESLIE S. ROBERTSON, Secretary of the Engineering Standards Committee, M.Inst.C.E., M.I.Mech.E., M.Inst.N.A., etc. Medium 8vo, cloth

[*Just Published.* **7/6**

STEAM AND THE STEAM ENGINE. Stationary and Portable. Being an Extension of the Treatise on the Steam Engine of Mr. J. SEWELL. By D. K. CLARK, C.E. Fourth Edition. Crown 8vo, cloth **3/6**

"Every essential part of the subject is treated of competently, and in a popular style."—*Iron.*

STEAM AND MACHINERY MANAGEMENT. A Guide to the Arrangement and Economical Management of Machinery, with Hints on Construction and Selection. By M. POWIS BALE, M.Inst.M.E. Crown 8vo, cloth **2/6**

"Gives the results of wide experience."—*Lloyd's Newspaper.*

STEAM ENGINE. A Practical Handbook compiled with especial Reference to Small and Medium-sized Engines. For the Use of Engine Makers, Mechanical Draughtsmen, Engineering Students, and users of Steam Power. By HERMAN HAEDER, C.E. Translated from the German with additions and alterations, by H. H. P. POWLES, A.M.I.C.E., M.I.M.E. Third Edition, Revised. With nearly 1,100 Illustrations. Crown 8vo, cloth . . . . . *Net* **7/6**

"This is an excellent book, and should be in the hands of all who are interested in the construction and design of medium-sized stationary engines. . . . A careful study of its contents and the arrangement of the sections leads to the conclusion that there is probably no other book like it in this country. The volume aims at showing the results of practical experience, and it certainly may claim a complete achievement of this idea."—*Nature.*

STEAM ENGINE. A Treatise on the Mathematical Theory of, with Rules and Examples for Practical Men. By T. BAKER, C.E. Crown 8vo, cloth **1/6**

"Teems with scientific information with reference to the steam-engine."—*Design and Work.*

STEAM ENGINE. For the Use of Beginners. By Dr. LARDNER. Crown 8vo, cloth **1/6**

STEAM ENGINE. A Text-Book on the Steam Engine, with a Supplement on GAS ENGINES and PART II. on HEAT ENGINES. By T. M. GOODEVE, M.A., Barrister-at-Law, Professor of Mechanics at the Royal College of Science, London; Author of "The Principles of Mechanics," "The Elements of Mechanism," etc. Fourteenth Edition. Crown 8vo, cloth . **6/0**

"*Professor Goodeve has given us a treatise on the steam engine, which will bear comparison with anything written by Huxley or Maxwell, and we can award it no higher praise.*"—*Engineer.*

"*Mr. Goodeve's text-book is a work of which every young engineer should possess himself.*"—*Mining Journal.*

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 125 of 132

STEAM ENGINE (PORTABLE). A Practical Manual on its Construction and Management. For the use of Owners and Users of Steam Engines generally. By WILLIAM DYSON WANSBROUGH. Crown 8vo, cloth **3/6**

"This is a work of value to those who use steam machinery. . . . Should be read by every one who has a steam engine, on a farm or elsewhere."—*Mark Lane Express.*

STEAM ENGINEERING IN THEORY AND PRACTICE. By GARDNER D. HISCOX, M.E. With Chapters on Electrical Engineering. By NEWTON HARRISON, E.E., Author of "Electric Wiring, Diagrams, and Switchboards." 450 Pages. Over 400 Detailed Engravings. *Net* **12/6**

HISTORICAL—STEAM AND ITS PROPERTIES—APPLIANCES FOR THE GENERATION OF STEAM—TYPES OF BOILERS—CHIMNEY AND ITS WORK—HEAT ECONOMY OF THE FEED WATER—STEAM PUMPS AND THEIR WORK—INCRUSTATION AND ITS WORK—STEAM ABOVE ATMOSPHERIC PRESSURE—FLOW OF STEAM FROM NOZZLES—SUPER-HEATED STEAM AND ITS WORK—ADIABATIC EXPANSION OF STEAM—INDICATOR AND ITS WORK—STEAM ENGINE PROPORTIONS—SLIDE VALVE ENGINES AND VALVE MOTION—CORLISS ENGINE AND ITS VALVE GEAR—COMPOUND ENGINE AND ITS THEORY—TRIPLE AND MULTIPLE EXPANSION ENGINE—STEAM TURBINE—REFRIGERATION—ELEVATORS AND THEIR MANAGEMENT—COST OF POWER—STEAM ENGINE TROUBLES—ELECTRIC POWER AND ELECTRIC PLANTS.

STONE BLASTING AND QUARRYING. For Building and other Purposes. With Remarks on the Blowing up of Bridges. By Gen. Sir J. BURGOYNE, K.C.B. Crown 8vo, cloth **1/6**

STONE-WORKING MACHINERY. A Manual dealing with the Rapid and Economical Conversion of Stone. With Hints on the Arrangement and Management of Stone Works. By M. POWIS BALE, M.Inst.C.E. Crown 8vo, cloth **9/0**

"Should be in the hands of every mason or student of stonework."—*Colliery Guardian.*

STRAINS, HANDY BOOK FOR THE CALCULATION OF. In Girders and Similar Structures and their Strength. Consisting of Formulæ and Corresponding Diagrams, with numerous details for Practical Application, &c. By WILLIAM HUMBER, A. M.Inst.C.E., &c. Sixth Edition. Crown 8vo, with nearly 100 Woodcuts and 3 Plates, cloth . . . **7/6**

"We heartily commend this really *handy* book to our engineer and architect readers."—*English Mechanic.*

STRAINS ON STRUCTURES OF IRONWORK. With Practical Remarks on Iron Construction. By F. W. SHEILDS, M.Inst.C.E. 8vo, cloth **5/0**

SUBMARINE TELEGRAPHS. Their History, Construction, and Working. Founded in part on WÜNSCHENDORFF'S "Traité de Télégraphie Sous-Marine," and Compiled from Authoritative and Exclusive Sources. By CHARLES BRIGHT, F.R.S.E., A.M.Inst.C.E., M.I.Mech.E. M.I.E.E. Super royal 8vo, nearly 800 pages, fully Illustrated, including a large number of Maps and Folding Plates, strongly bound in cloth

Net £3 3s.

"Mr. Bright's interestingly written and admirably illustrated book will meet with a welcome reception from cable men."—*Electrician.*

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 126 of 132

SUPERHEATED STEAM, THE APPLICATION OF, TO LOCOMOTIVES. See STEAM.

SURVEYING AS PRACTISED BY CIVIL ENGINEERS AND SURVEYORS. Including the Setting-out of Works for Construction and Surveys Abroad, with many Examples taken from Actual Practice. A Handbook for use in the Field and the Office, intended also as a Text-book for Students. By JOHN WHITELAW, Jun., A.M.Inst.C.E., Author of "Points and Crossings." With about 260 Illustrations. Second Edition. Demy 8vo, cloth . . . . . *Net* **10/6**

SURVEYING WITH THE CHAIN ONLY—SURVEYING WITH THE AID OF ANGULAR INSTRUMENTS—LEVELLING—ADJUSTMENT OF INSTRUMENTS—RAILWAY (INCLUDING ROAD) SURVEYS AND SETTING OUT—TACHEOMETRY OR STADIA SURVEYING—TUNNEL ALIGNMENT AND SETTING OUT—SURVEYS FOR WATER SUPPLY WORKS—HYDROGRAPHICAL OR MARINE SURVEYING—ASTRONOMICAL OBSERVATIONS USED IN SURVEYING—EXPLANATIONS OF ASTRONOMICAL TERMS—SURVEYS ABROAD IN JUNGLE, DENSE FOREST, AND UNMAPPED OPEN COUNTRY—TRIGONOMETRICAL OR GEODETIC SURVEYS.

"This work is written with admirable lucidity, and will certainly be found of distinct value both to students and to those engaged in actual practice."—*The Builder.*

SURVEYING, LAND AND ENGINEERING. For Students and Practical Use. By T. BAKER, C.E. Twentieth Edition, by F. E. DIXON, A.M.Inst.C.E. With Plates and Diagrams. Crown 8vo, cloth **2/0**

SURVEYING, LAND AND MARINE. In Reference to the Preparation of Plans for Roads and Railways; Canals, Rivers, Towns, Water Supplies; Docks and Harbours. With Description and Use of Surveying Instruments. By W. DAVIS HASKOLL, C.E. Second Edition, Revised with Additions. Large crown 8vo, cloth **9/0**

"This book must prove of great value to the student. We have no hesitation in recommending it, feeling assured that it will more than repay a careful study."—*Mechanical World.*

SURVEYING, PRACTICAL. A Text-book for Students Preparing for Examinations or for Survey Work in the Colonies. By GEORGE W. USILL, A.M.Inst.C.E. Eighth Edition, thoroughly Revised and Enlarged by ALEX. BEAZELEY, M.Inst.C.E. With 4 Lithographic Plates and 360 Illustrations. Large crown 8vo, **7/6** cloth; or, on thin paper, leather, gilt edges, rounded corners, for pocket use **12/6**

ORDINARY SURVEYING—SURVEYING INSTRUMENTS—TRIGONOMETRY REQUIRED IN SURVEYING—CHAIN SURVEYING—THEODOLITE SURVEYING—TRAVERSING—TOWN-SURVEYING—LEVELLING—CONTOURING—SETTING OUT CURVES—OFFICE WORK—LAND QUANTITIES—COLONIAL LICENSING REGULATIONS—HYPSOMETER TABLES—INTRODUCTION TO TABLES OF NATURAL SINES, ETC.—NATURAL SINES AND CO-SINES—NATURAL TANGENTS AND CO-TANGENTS—NATURAL SECANTS AND CO-SECANTS.

"The first book which should be put in the hands of a pupil of civil engineering."—*Architect.*

SURVEYING TRIGONOMETRICAL. An outline of the Method of Conducting a Trigonometrical Survey. For the Formation of Geographical and Topographical Maps and Plans, Military Reconnaissance. Levelling, &c., with Useful Problems, Formulæ, and Tables. By Lieut.-General FROME, R.E. Fourth Edition, Revised and partly Re-written by Major-General Sir CHARLES WARREN, G.C.M.G., R.E. With 19 Plates and 115 Woodcuts, royal 8vo, cloth **16/0**

SURVEYING WITH THE TACHEOMETER. A Practical Manual for the use of Civil and Military Engineers and Surveyors, including two series of Tables specially computed for the Reduction of Readings in Sexagesimal and in Centesimal Degrees. By NEIL KENNEDY, M.Inst.C.E., *With Diagrams* and Plates. Second Edition. Demy 8vo, cloth *Net* **10/6**

"*The work is very* clearly written, and should remove all difficulties in the way of any surveyor *desirous of making use of* this useful and rapid instrument."—*Nature.*

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 127 of 132

SURVEY PRACTICE. For Reference in Surveying, Levelling, and Setting-out; and in Route Surveys of Travellers by Land and Sea. With Tables, Illustrations, and Records. By L. D'A. JACKSON, A.M.Inst.C.E. Second Edition. 8vo, cloth **12/6**

SURVEYOR'S FIELD BOOK FOR ENGINEERS AND MINING SURVEYORS. Consisting of a Series of Tables, with Rules, Explanations of Systems, and use of Theodolite for Traverse Surveying and plotting the work with minute accuracy by means of Straight Edge and Set Square only; Levelling with the Theodolite, Setting-out Curves with and without the Theodolite, Earthwork Tables, &c. By W. DAVIS HASKOLL, C.E. With numerous Woodcuts. Fifth Edition, Enlarged. Crown 8vo, cloth **12/0**

"The book is very handy; the separate tables of sines and tangents to every minute will make it useful for many other purposes, the genuine traverse tables existing all the same."—*Athenæum.*

TECHNICAL TERMS, English-French, French-English: A Pocket Glossary; with Tables suitable for the Architectural, Engineering, Manufacturing, and Nautical Professions. By JOHN JAMES FLETCHER. Fourth Edition, 200 pp. Waistcoat-pocket size, limp leather . . . **1/6**

"The glossary of terms is very complete, and many of the Tables are new and well arranged. We cordially commend the book."—*Mechanical World.*

TECHNICAL TERMS, Eng.-Spanish, Spanish-Eng: A Pocket Glossary of Engineering, Technical, Nautical and Mining Terms. By R. D. MONTEVERDE, B.A. (Madrid).

[*In Preparation. Price about* **2/0** *Net.*

TELEPHONES: THEIR CONSTRUCTION, INSTALLATION, WIRING, OPERATION AND MAINTENANCE. A Practical Reference Book and Guide for Electricians, Wiremen, Engineers, Contractors, Architects, and others interested in Standard Telephone Practice. By W. H. RADCLIFFE and H. C. CUSHING, JR. 180 pages. With 125 Illustrations. Fcap 8vo, cloth . . . . [*Just published. Net* **4/6**

TELEPHONES: FIELD TELEPHONES FOR ARMY USE: INCLUDING AN ELEMENTARY COURSE IN ELECTRICITY AND MAGNETISM. By Lieut. E. J. STEVENS, D.O., R.A., A.M.I.E.E., Instructor in Electricity, Ordnance College, Woolwich. Crown 8vo, cloth. With Illustrations . . . . . [*Just Published. Net* **2/0**

BATTERIES—ELECTRICAL CIRCUITS—MAGNETISM—INDUCTION—MICROPHONES AND RECEIVERS—PORTABLE AND FIELD TELEPHONE SETS—SELF-INDUCTION, INDUCTIVE CAPACITY, ETC.

TELEPHONY. See WIRELESS TELEPHONY and WIRELESS TELEGRAPHY.

TOOLS FOR ENGINEERS AND WOODWORKERS. Including Modern Instruments of Measurement. By JOSEPH HORNER, A.M.Inst.M.E., Author of "Pattern Making," &c. Demy 8vo, with 456 Illustrations . . . . . *Net* **9/0**

SUMMARY OF CONTENTS:—INTRODUCTION—GENERAL SURVEY OF TOOLS—TOOL ANGLES.—SEC. I. CHISEL GROUP—CHISELS AND APPLIED FORMS FOR WOODWORKERS—PLANES—HAND CHISELS AND APPLIED FORMS FOR METAL WORKING—CHISEL-LIKE TOOLS FOR METAL TURNING, PLANING, &c—SHEARING ACTION AND SHEARING TOOLS—SEC. II. EXAMPLES OF SCRAPING TOOLS.—SEC. III. TOOLS—RELATING TO CHISELS AND SCRAPES—SAWS—FILES—MILLING CUTTERS—BORING TOOLS FOR WOOD AND METAL—TAPS AND DIES.—SEC. IV. PERCUSSIVE AND MOULDING TOOLS—PUNCHES, HAMMERS AND CAULKING TOOLS—MOULDING AND MODELLING TOOLS—MISCELLANEOUS TOOLS.—SEC. V. HARDENING, TEMPERING, GRINDING AND SHARPENING.—SEC. VI. TOOLS FOR MEASUREMENT AND TEST—STANDARDS OF MEASUREMENT—SQUARES, SURFACE PLATES, LEVELS, BEVELS, PROTRACTORS, &c.—SURFACE GAUGES OR SCRIBING BLOCKS—COMPASSES AND DIVIDERS—CALIPERS, VERNIER CALIPERS, AND RELATED FORMS—MICROMETER CALIPERS—DEPTH GAUGES AND ROD GAUGES—SNAP CYLINDRICAL AND LIMIT GAUGES—SCREW THREAD, WIRE AND REFERENCE GAUGES—INDICATORS, ETC.

"As an all-round practical work on tools it is more comprehensive than any with which we are acquainted, and we have no doubt it will meet with the large measure of success to which its merits fully entitle it."—*Mechanical World.*

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 128 of 132

TOOTHED GEARING. A Practical Handbook for Offices, and Workshops. By J. HORNER, A.M.I.M.E. Second Edition, with a New Chapter on Recent Practice. With 184 Illustrations. Crown 8vo, cloth **6/0**

TRAMWAYS: THEIR CONSTRUCTION AND WORKING. Embracing a Comprehensive History of the System; with an exhaustive Analysis of the Various Modes of Traction, including Horse Power, Steam Cable Traction, Electric Traction, &c.; a Description of the Varieties of Rolling Stock; and ample Details of Cost and Working Expenses. New Edition, Thoroughly Revised, and Including the Progress recently made in Tramway Construction, &c. By D. KINNEAR CLARK, M.Inst.C.E. With 400 Illustrations. 8vo, 780 pp., buckram **28/0**

TRUSSES OF WOOD AND IRON. Practical Applications of Science in Determining the Stresses, Breaking Weights, Safe Loads, Scantlings, and Details of Construction. With Complete Working Drawings. By W. GRIFFITHS, Surveyor. Oblong 8vo, cloth **4/6**

"This handy little book enters so minutely into every detail connected with the construction of roof trusses that no student need be ignorant of these matters."—*Practical Engineer.*

TUNNELLING. A Practical Treatise. By CHARLES PRELINI, C.E. With additions by CHARLES S. HILL, C.E. With 150 Diagrams and Illustrations. Royal 8vo, cloth . . . . . *Net* **16/0**

TUNNELLING, PRACTICAL. Explaining in detail the Setting-out the Works, Shaft-sinking, and Heading-driving, Ranging the Lines and Levelling underground, Sub-Excavating, Timbering and the Construction of the Brickwork of Tunnels. By F. W. SIMMS, M.Inst.C.E. Fourth Edition, Revised and Further Extended, including the most recent (1895) Examples of Sub-aqueous and other Tunnels, by D. KINNEAR CLARK, M.Inst.C.E. With 34 Folding Plates. Imperial 8vo, cloth . . . . . **£2 2s.**

TUNNEL SHAFTS. A Practical and Theoretical Essay on the construction of large Tunnel Shafts. By J. H. WATSON BUCK, M.Inst.C.E., Resident Engineer, L. and N. W. R. With Folding Plates, 8vo, cloth **12/0**

"Will be regarded by civil engineers as of the utmost value and calculated to save much time and obviate many mistakes."—*Colliery Guardian.*

WAGES TABLES. At 54, 52, 50, and 48 Hours per Week. Showing the Amounts of Wages from One quarter of an hour to Sixty-four hours, in each case at Rates of Wages advancing by One Shilling from 4*s.* to 55*s.* per week. By THOS. GARBUTT, Accountant. Square crown 8vo, half-bound **6/0**

WATER ENGINEERING. A Practical Treatise on the Measurement, Storage, Conveyance, and Utilization of Water for the Supply of Towns, for Mill Power, and for other Purposes. By CHARLES SLAGG, A.M.Inst.C.E. Second Edition. Crown 8vc, cloth **7/6**

WATER, POWER OF. As Applied to Drive Flour Mills and *to give motion* to Turbines and other Hydrostatic Engines. By JOSEPH GLYNN, F.R.S., &c. New Edition. Illustrated. Crown 8vo, cloth **2/0**

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 129 of 132

WATER SUPPLY OF CITIES AND TOWNS. By WILLIAM HUMBER, A.M.Inst. C.E., and M.Inst.M.E., Author of "Cast and Wrought Iron Bridge Construction," &c., &c. Illustrated with 50 Double Plates, 1 Single Plate, Coloured Frontispiece, and upwards of 250 Woodcuts, and containing 400 pp. of Text. Imp. 4to, elegantly and substantially half-bound in morocco . . . . . *Net* **£6 6s.**

LIST OF CONTENTS:—I. HISTORICAL SKETCH OF SOME OF THE MEANS THAT HAVE BEEN ADOPTED FOR THE SUPPLY OF WATER TO CITIES AND TOWNS.—II. WATER AND THE FOREIGN MATTER USUALLY ASSOCIATED WITH IT.—III. RAINFALL AND EVAPORATION.—IV. SPRINGS AND THE WATER-BEARING FORMATIONS OF VARIOUS DISTRICTS.—V. MEASUREMENT AND ESTIMATION OF THE FLOW OF WATER.—VI. ON THE SELECTION OF THE SOURCE OF SUPPLY.—VII. WELLS.—VIII. RESERVOIRS.—IX. THE PURIFICATION OF WATER.—X. PUMPS.—XI. PUMPING MACHINERY.—XII. CONDUITS.—XIII. DISTRIBUTION OF WATER.—XIV. METERS, SERVICE PIPES, AND HOUSE FITTINGS.—XV. THE LAW AND ECONOMY OF WATER-WORKS.—XVI. CONSTANT AND INTERMITTENT SUPPLY.—XVII. DESCRIPTION OF PLATES.—APPENDICES, GIVING TABLES OF RATES OF SUPPLY, VELOCITIES, &c., &c., TOGETHER WITH SPECIFICATIONS OF SEVERAL WORKS ILLUSTRATED, AMONG WHICH WILL BE FOUND: ABERDEEN, BIDEFORD, CANTERBURY, DUNDEE, HALIFAX, LAMBETH, ROTHERHAM, DUBLIN, AND OTHERS.

"The most systematic and valuable work upon water supply hitherto produced in English, or in any other language. Mr. Humber's work is characterised almost throughout by an exhaustiveness much more distinctive of French and German than of English technical treatises."—*Engineer.*

WATER SUPPLY OF TOWNS AND THE CONSTRUCTION OF WATER-WORKS. A Practical Treatise for the Use of Engineers and Students of Engineering. By W. K. BURTON, A. M. Inst.C.E., Consulting Engineer to the Tokyo Water-works. Third Edition, Revised. Edited by ALLAN GREENWELL, F.G.S., A.M.Inst.C.E., with numerous Plates and Illustrations. Super-royal 8vo, buckram **25/0**

I. INTRODUCTORY.—II. DIFFERENT QUALITIES OF WATER.—III. QUANTITY OF WATER TO BE PROVIDED.—IV. ON ASCERTAINING WHETHER A PROPOSED SOURCE OF SUPPLY IS SUFFICIENT.—V. ON ESTIMATING THE STORAGE CAPACITY REQUIRED TO BE PROVIDED.—VI. CLASSIFICATION OF WATER-WORKS.—VII. IMPOUNDING RESERVOIRS.—VIII. EARTHWORK DAMS.—IX. MASONRY DAMS.—X. THE PURIFICATION OF WATER.—XI. SETTLING RESERVOIRS.—XII. SAND FILTRATION.—XIII. PURIFICATION OF WATER BY ACTION OF IRON, SOFTENING OF WATER BY ACTION OF LIME, NATURAL FILTRATION.—XIV. SERVICE OR CLEAN WATER RESERVOIRS—WATER TOWERS—STAND PIPES.—XV. THE CONNECTION OF SETTLING RESERVOIRS, FILTER BEDS AND SERVICE RESERVOIRS.—XVI. PUMPING MACHINERY.—XVII. FLOW OF WATER IN CONDUITS—PIPES AND OPEN CHANNELS.—XVIII. DISTRIBUTION SYSTEMS.—XIX. SPECIAL PROVISIONS FOR THE EXTINCTION OF FIRES.—XX. PIPES FOR WATER-WORKS.—XXI. PREVENTION OF WASTE OF WATER.—XXII. VARIOUS APPLIANCES USED IN CONNECTION WITH WATER-WORKS.

APPENDIX I. By PROF. JOHN MILNE, F.R.S.—CONSIDERATIONS CONCERNING THE PROBABLE EFFECTS OF EARTHQUAKES ON WATER-WORKS, AND THE SPECIAL PRECAUTIONS TO BE TAKEN IN EARTHQUAKE COUNTRIES.

APPENDIX II. By JOHN DE RIJKE, C.E.—ON SAND DUNES AND DUNE SANDS AS A SOURCE OF WATER SUPPLY.

"We congratulate the author upon the practical commonsense shown in the preparation of this work. . . . The plates and diagrams have evidently been prepared with great care, and cannot fail to be of great assistance to the student."—*Builder.*

WATER SUPPLY, RURAL. A Practical Handbook on the Supply of Water and Construction of Water works for small Country Districts. By ALLAN GREENWELL, A.M.Inst.C.E., and W. T. CURRY, A.M.Inst.C.E., F.G.S. With Illustrations. Second Edition, Revised. Crown 8vo, cloth **5/0**

"The volume contains valuable information upon all matters connected with water supply It is full of details on points which are continually before water-works engineers."—*Nature.*

WELLS AND WELL-SINKING. By J. G. SWINDELL, A.R.I.B.A., and G. R. BURNELL, C.E. Revised Edition. Crown 8vo, cloth **2/0**

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 130 of 132

WIRELESS TELEGRAPHY: ITS THEORY AND PRACTICE. A Handbook for the use of Electrical Engineers, Students, and Operators. By JAMES ERSKINE-MURRAY, D.Sc., Fellow of the Royal Society of Edinburgh, Member of the Institution of Electrical Engineers. Demy 8vo, 338 pages, with over 130 Diagrams and Illustrations. *Net* **10/6**

ADAPTATIONS OF THE ELECTRIC CURRENT TO TELEGRAPHY—EARLIER ATTEMPTS AT WIRELESS TELEGRAPHY—APPARATUS USED IN THE PRODUCTION OF HIGH FREQUENCY CURRENTS—DETECTION OF SHORT-LIVED CURRENTS OF HIGH FREQUENCY BY MEANS OF IMPERFECT ELECTRICAL CONTACTS—DETECTION OF OSCILLATORY CURRENTS OF HIGH FREQUENCY BY THEIR EFFECTS ON MAGNETISED IRON—THERMOMETRIC DETECTORS OF OSCILLATORY CURRENTS OF HIGH FREQUENCY—ELECTROLYTIC DETECTORS—THE MARCONI SYSTEM—THE LODGE-MUIRHEAD SYSTEM—THE FESSENDEN SYSTEM—THE HOZIER-BROWN SYSTEM—WIRELESS TELEGRAPHY IN ALASKA—THE DE FOREST SYSTEM—THE POULSEN SYSTEM—THE TELEFUNKEN SYSTEM—DIRECTED SYSTEMS—SOME POINTS IN THE THEORY OF JIGS AND JIGGERS—ON THEORIES OF TRANSMISSION—WORLD-WAVE TELEGRAPHY—ADJUSTMENTS, ELECTRICAL MEASUREMENTS AND FAULT FINDING—ON THE CALCULATION OF A SYNTONIC WIRELESS TELEGRAPH STATION—TABLES AND NOTES.

". . . . A serious and meritorious contribution to the literature on this subject. The Author brings to bear not only great practical knowledge, gained by experience in the operation of wireless telegraph stations, but also a very sound knowledge of the principles and phenomena of physical science. His work is thoroughly scientific in its treatment, shows much originality throughout, and merits the close attention of all students of the subject."—*Engineering.*

WIRELESS TELEPHONY IN THEORY AND PRACTICE. By ERNST RUHMER. Translated from the German by J. ERSKINE-MURRAY, D.Sc., M.I.E.E., &c. Author of "A Handbook of Wireless Telegraphy." With an Appendix on Recent Advances by the Translator, and numerous Illustrations. Demy 8vo, cloth . . . [*Just published.* *Net* **10/6**

"A very full descriptive account of the experimental work which has been carried out on Wireless Telephony is to be found in Professor Ruhmer's book. . . . The volume is profusely illustrated by both photographs and drawings, and should prove a useful reference Work for those directly or indirectly interested in the subject."—*Nature.*

"The explanations and discussions are all clear and simple, and the whole volume is a very readable record of important and interesting work."—*Engineering.*

"The translator is to be congratulated upon the selection of his task, and upon the excellent manner in which he has accomplished it: for this is a book that marks an era in the progress of applied science."—*Times.*

"The book is well written and contains much interesting information on a subject which promises great developments."—*Glasgow Herald.*

WORKSHOP PRACTICE. As applied to Marine, Land, and Locomotive Engines, Floating Docks, Dredging Machines, Bridges, Ship building, &c. By J. G. WINTON. Fourth Edition, Illustrated. Crown 8vo, cloth **3/6**

WORKS' MANAGER'S HANDBOOK. Comprising Modern Rules, Tables, and Data. For Engineers, Millwrights, and Boiler Makers; Tool Makers, Machinists, and Metal Workers; Iron and Brass Founders, &c. By W. S. HUTTON, Civil and Mechanical Engineer, Author of "The Practical Engineer's Handbook." Seventh Edition, carefully Revised, and Enlarged. Medium 8vo, strongly bound **15/0**

STATIONARY AND LOCOMOTIVE STEAM-ENGINES, GAS PRODUCERS, GAS-ENGINES, OIL-ENGINES, ETC.—HYDRAULIC MEMORANDA: PIPES, PUMPS, WATER-POWER, ETC.—MILLWORK: SHAFTING, GEARING, PULLEYS, ETC.—STEAM BOILERS, SAFETY VALVES, FACTORY CHIMNEYS, ETC.—HEAT, WARMING, AND VENTILATION—MELTING, CUTTING, AND FINISHING METALS—ALLOYS AND CASTING—WHEEL-CUTTING, SCREW-CUTTING, ETC.—STRENGTH AND WEIGHT OF MATERIALS—WORKSHOP DATA, ETC.

"The volume is an exceedingly useful one, brimful with engineer's notes, memoranda, and rules, and well worthy of being on every mechanical engineer's bookshelf."—*Mechanical World.*

Abbott v. Miracor, IPR2025-00115
Abbott Ex. 1020, p. 131 of 132

