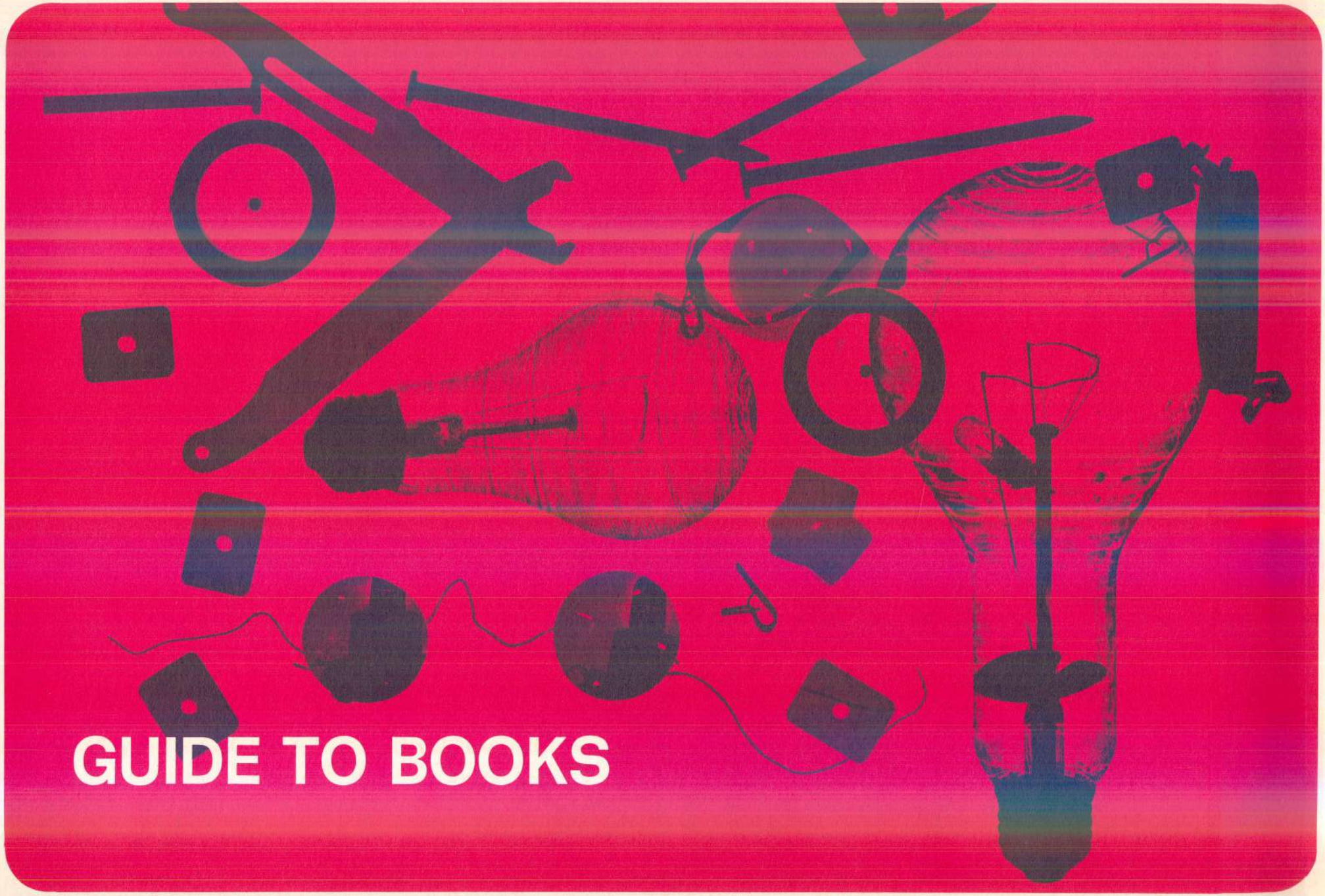
BATTERIES AND BULBS

Book 4



GUIDE TO BOOKS

BATTERIES AND BULBS

Teacher's Guide

Trial Teaching Edition

Book 4

GUIDE TO BOOKS ON ELECTRICAL CIRCUITS AND MAGNETS FOR ELEMENTARY SCHOOLS

Published by the Elementary Science Study of
Educational Services Incorporated
Box 415
Watertown, Massachusetts 02172

The Elementary Science Study, supported by the National Science Foundation, is a project of Educational Services Incorporated, a non-profit corporation sustained by grants from private foundations and from the Federal Government.

Alphabetical Listing of Books by Title*

√Acceptable
√√Recommended

INTRODUCTION

Guide to Books on Electrical Circuits and Magnets for Elementary Schools

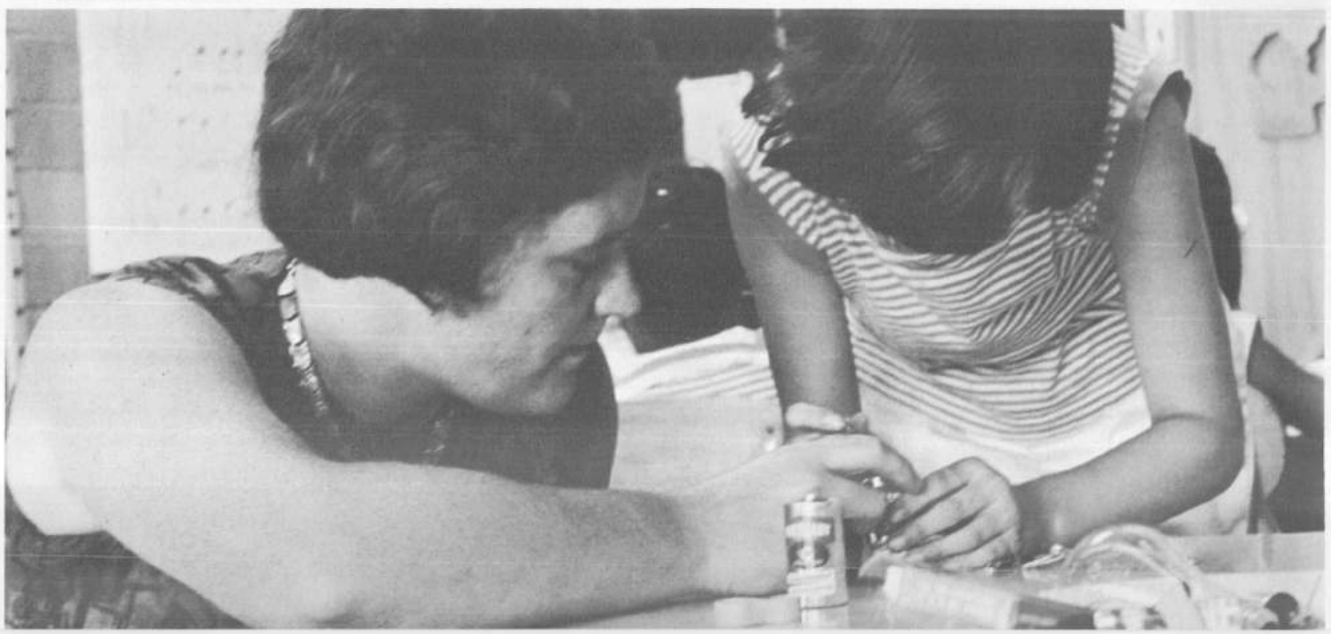
Every year a great many books are published for children to read on the subjects of electricity and magnetism. It would be impossible for the busy teacher or school librarian to read and evaluate them all, and the limitations of a school's budget do not permit indiscriminate buying. Many students and teachers will want, nonetheless, to explore further the background to the Elementary Science Study unit *Batteries and Bulbs* and should be encouraged to do so.

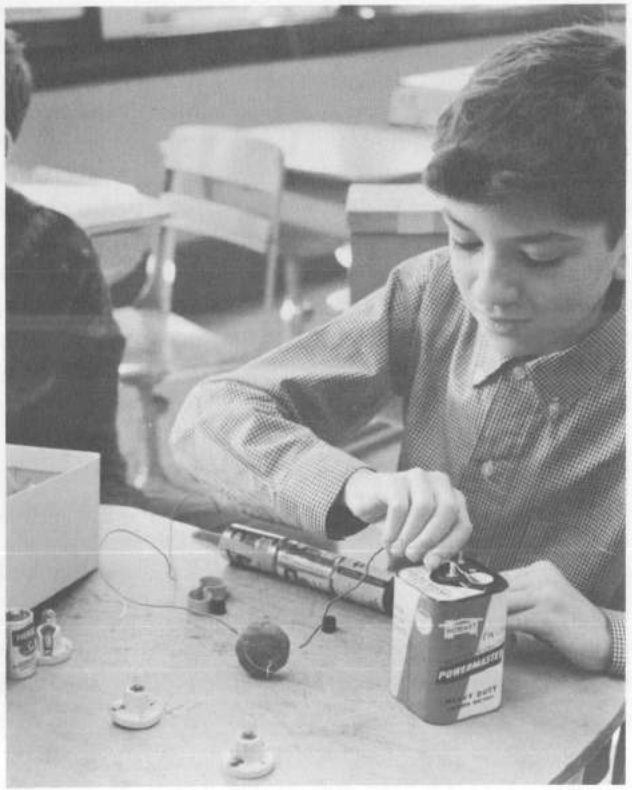
To help provide you with some guidelines for choice in so complex a field we have prepared the following critical bibliography. It does not attempt to be exhaustive, and it cannot, obviously, include many worthwhile books brought out very recently, but a fair representation of the books discussed can be found in many school and public libraries and in bookstores at this time. What is more important is that our criteria for appraising a book are indicated in the description of that book, and we hope that these will help you evaluate other books in this field as well.

The first list is alphabetical by title and tells you the author and the page on which we have discussed the book. We have also indicated by checkmarks our estimate of the suitability of each book as further reading, particularly for children studying this unit.

The three subsequent lists divide the books by subject matter under the headings *Survey Books, Experimental Books,* and *Historical or Biographical Books* and offer a brief description of each book and our reasons for our assessment of it.

We hope you will let us know if you have found this book list useful and will suggest ways in which you feel it can be improved. If we have omitted a book you think we should include, please let us know its title and the reasons for your recommendation.





Survey Books

√√*All About Electricity,* Ira Freeman, New York, Random House, 1957.
141 pp. $1.95 intermediate-advanced

This offers a general coverage of electricity and electrical technology. The book is exceptionally well written, has clear and helpful pictures, and is technically and historically accurate. The later sections on technology may be too advanced for a student with little background or for a younger student, but the first half is an excellent introduction to the subject. It contains a particularly clear development of the water analogy for current electricity—"a battery does not make electricity any more than a pump produces water." A word of caution: the story of Franklin and his kite is so well told that children should be warned never to attempt to repeat Franklin's lucky escape from electrocution.

All About Radio and Television, Jack Gould, New York, Random House, 1958.
144 pp. $1.95 intermediate

This primer is designed to prove that radio and television are simple to understand. Unfortunately, they aren't. In an attempt to simplify wave theory for a youthful audience, the author has produced explanations and analogies which do not really explain. Under a drawing of an electromagnet showing the lines of force, he writes, "You can see that this big force of magnetism looks like our old friend—the waves of water in the pond. In fact, it is really a wave of energy." But in fact the lines of force look not at all like the ripples in the pond. Other metaphors create a completely false impression in the reader's mind: "See what's happened to the first wave made by the electricity. It has been pushed away from the coil by the second wave." Although the book manages to convey an appreciation for the television industry and the difficulties it has overcome and recounts, as well, some interesting stories of the uses of radio, its overall effect is to make the student think he understands what he really does not.

√*The Boys' Book of Magnetism,* Raymond F. Yates, New York, Harper, 1959.
161 pp. $3.50 intermediate

This book is divided into two parts, the first dealing with magnets and the second with electricity and electromagnets. The section on electromagnets is the most valuable, since it suggests some basic experiments. Five chapters are devoted to an exhaustive (and exhausting) list of toys, games, and tricks that can be made with magnets. With a little prodding, a child might have thought of them himself. Writing in typical popular science style, the author's metaphorical exuberance occasionally leads him into heedless misstatements. (Magnetism does not flow across the earth in "never ending streams.") The photographic illustrations are helpful. But the time is past when magnets were for boys only.

√*Electricity,* Bertha M. Parker, Evanston, Illinois, Harper and Row, 1963.
36 pp. $.60 intermediate

This is a general nontechnical introduction to electricity and its uses. Although the first half of the book, which deals with basic concepts such as charge, current, and conductors, is good, the second half tries to cover too much ground. When confronted with a complicated phenomenon such as radio waves, the author introduces the term without even attempting to explain it. One of the purposes of writing science books for children should be to clarify the sloppy and incorrect notions that flourish in newspapers and "grown-up talk." The writing is clear, except in the few places where an inquisitive child is not going to be satisfied with glossing over such problems as the distinction between a glowing and a burning filament. Illustrations are sometimes so undetailed as to be worthless in illustrating specific points mentioned in the text.

√√*Electricity,* Walter Shepherd, New York, John Day, 1964.
49 pp. $1.98 intermediate-advanced

This is a quick introduction to a number of topics in electricity. Definitions are accurate and still not too imposing for a child; explanations of electrical equipment are always to the point. Among the book's outstanding features are an unusually clear development of the water analogy in explaining the terms "volt" and "ampere," and a striking definition of the "short circuit." Well designed and attractively illustrated, the book covers many aspects of electricity in a clear and unhurried style. It would be most useful to a child who had some experience with *Batteries and Bulbs,* though readers without previous background will find it thoroughly engrossing.

√*Electricity and How We Use It,* Tillie Pine and Joseph Levine, New York, McGraw-Hill, 1962.
49 pp. $2.75 primary

This is an elementary introduction to electricity and some electrical devices. The book contains several poor or misleading "explanations," such as the statement that "the cover (insulation) keeps the electricity moving through the copper. It does not let the electricity come out. . . ." The illustrations are not always clear; the diagram of how a flashlight works is hopelessly confusing. A young reader might learn a good deal from this book, however, despite carelessness in the writing.

√√*Electricity and Magnetism,* Verne N. Rockcastle, Ithaca, New York, New York State College of Agriculture (Cornell Rural School Leaflet, vol. 50, no. 3), 1957.
32 pp. $.20 advanced-teacher

An excellent source-book of questions and experiments for the teacher who would like to do some work with electricity, this leaflet might also serve as a guide for the older child who would like to try the suggested experiments himself. The writing is warm, clear, and always in the spirit of scientific investigation. In thirty-two pages the author manages to ask a number of significant questions about electricity in a manner which makes the reader, whether teacher or student, want to find the answer for himself. A reader going through the leaflet for "content" would be sorely disappointed, for the content is not a set of facts, and one must have materials in front of him and be willing to try at least some of the experiments for the questions to make sense. With these qualifications, this is a fine (and inexpensive) little book to have around the classroom.

√*Electricity: How It Works,* Percy Dunsheath, New York, Thomas Y. Crowell, 1960.
248 pp. $3.95 advanced-teacher

This survey is organized around a series of topics and proceeds in each case from a discussion of scientific principles to some technological applications; for example, one chapter is devoted to the nature of direct electrical current and some devices which make use of it. The explanations of electrical machines are clear, and unusual applications of electrical principles are brought in as examples. Yet the detail and dryness of the writing put this book beyond the level of appreciation of all but the highly motivated student at the junior high school level, or of the inquiring teacher. This is one of the few surveys of electricity that actually lives up to the title, but it is not for the beginner and it is not an easy book.

√*Electricity in Your Life,* Eugene David, Englewood Cliffs, N.J., Prentice-Hall, 1963.
72 pp. $3.50 primary-intermediate

Written in an informal, story-telling style and illustrated with offbeat drawings by Aliki, this book is intended as a child's primer in electricity. The explanations of such crucial terms as circuit, motor, and electrical force are cursory, while relatively sophisticated devices like commutators and transformers are given extensive description. In places the text reads like a glossary of technical terms. Historical developments in man's knowledge of electricity are run together and the contributions of important figures such as Franklin and Gilbert misinterpreted. The projects suggested at the back of the book, such as making your own "conductor tester," seem interesting and feasible, however. Though of little scientific value, this book might be a pleasant introduction to the topic.

√*Electromagnetic Waves,* Robert Irving, New York, Knopf, 1960.
145 pp. $3.00 advanced

This is a valiant attempt to cover an extremely complicated and difficult subject. Several types of electromagnetic waves (infrared, radio, etc.) are discussed separately and in relation to each other. An army of technical terms, many of them used inconsistently, may frighten all but the most determined readers, but the writing is usually straightforward and interesting. In attempting to cover a great deal of material, the author has frequently resorted to capsule explanations which are inadequate; a reader who knew nothing of the work of Einstein and Planck or of the operation of a photomultiplier would be baffled by Irving's descriptions. Several technical errors, including an incorrect interpretation of Oersted's experiment, weaken the generally careful argument of the book. It is, however, the only book for children we have seen which deals exclusively with electromagnetic waves.

Electronics for Young People, Jeanne Bendick, New York, McGraw-Hill (Whittlesey House), 1960.
190 pp. $3.50 intermediate-advanced

Although the book is generally well written, it contains so much factual information (much of which is unrelated to the material under discussion), that it is difficult to get through. The explanations of the television camera and radio transmission are hard to understand. Several technical errors (such as a wrong

definition of the alpha particle) and a number of incorrect drawings limit the book's usefulness for the reader with no background in electronics. There are, nevertheless, several chapters, notably the one on electron tubes, which an advanced student might find interesting.

√*Everyday Machines and How They Work,* Herman Schneider, New York, McGraw-Hill, 1950.
192 pp. $2.95 intermediate

The section on electrical machines is brief (twenty pages) but it is written with clarity and occasional flashes of humor. The explanations of incandescent light, fluorescent light, toasters, irons, electric ovens, and other gadgets are not detailed, but they are correct as far as they go. Some of the material, particularly the discussion of temperature controls on electric irons, is not often encountered. Structural unity is achieved by the author's division of electrical devices into three basic types: those that produce heat, light, or motion. Some children will find machines an exciting subject; certainly this is a handy reference.

√*The First Book of Electricity,* Beryl and Samuel Epstein, New York, Franklin Watts, 1953.
69 pp. $2.50 intermediate

The book begins with a fine introduction stating that electricity is a very complicated phenomenon that even scientists don't completely understand, but that nevertheless there is much we can learn about it by observing what it does. It then proceeds to discuss some simple electrical devices, such as the toaster, and how they work. The book is unfortunately marred by several misleading statements, such as "electricity is made by rushing electrons" and an incorrect illustration of electromagnetic induction. In one or two places the book is outdated—batteries no longer have bare zinc outer coatings. Unusually fine pictures in the experiment sections are the book's best feature.

√*The Golden Adventure Book of Magnetism,* Francis L. Behnke, New York, Golden Press, 1962.
95 pp. $3.00 advanced

One of the book's major faults is its unevenness of difficulty in both subject matter and treatment. In the space of ninety-five pages we find a definition of the word physicist (FI-zi-sist) and a discussion of the principles of magnetohydrodynamics. Topics are introduced with apparent disregard for logical order; some seem thrown in to give the book an up-to-date appearance. ("The magnetometer is a bomb-like apparatus with parts about the size of a cigarette.") The suggested experiments are presented in confusing language and diagrams, and in many cases the required materials would be impossible for a child to obtain. Pyrite, lodestone, and "keepers" are listed as necessary tools at the beginning of the book, but the reader is given no hint about where to obtain them. Yet the essential facts of what magnets do, how they act on themselves and other objects, and their relation to electricity are quite thoroughly and simply covered. In a field which has been the target of so many poor books, this is by no means the worst.

Here's How It Works, Duane Bradley and Eugene Lord, Philadelphia, Lippincott, 1962.
157 pp. $3.95 intermediate

This book does not explain how things work. It does little more than describe a series of exercises and demonstrations and the results one should expect to obtain. In many places both the text and the instructions are hard to follow. Illustrations are sparse and not helpful, and there is extensive use of unexplained terminology.

The How and Why Wonder Book of Electricity, Jerome Notkin and Sidney Gulkin, New York, Grossett and Dunlap, 1960.
48 pp. $1.00 intermediate

The first half of the book, written in the form of dialogue, is a general introduction to electricity, while the second half indicates a series of activities to be performed by the student. There are technical errors: the steam-driven turbine generator (illustrated at the beginning of the book) which the student is supposed to construct cannot work. There are numerous confusing and misleading statements: atomic energy does not directly "make the generator move." The explanations of why a dry cell is so named are contradictory. Terms are often employed which are not defined in context. The suggested activities do not seem original or likely to stimulate original thinking on the part of the student.

√*The How and Why Wonder Book of Magnets and Magnetism,* Martin L. Keen, New York, Grosset and Dunlap, 1963.
48 pp. $1.00 intermediate

This is an uneven survey of what magnets do. Some explanations, particularly that of the telephone, are unusually succinct, but in later pages, as in the description of how to make an electric motor, the author's attempt to "simplify" leads him into a mass of almost incomprehensible verbiage. The suggested "experiments" are simply demonstrations, the equipment is difficult to construct in several cases, and then the reader is told what he "discovered." In addition, there is an inexcusable number of typographical errors and mistakes in labelling diagrams for a book of this size. Outright factual errors are very few, however (though in the statement that poles of a magnet occupy exactly 1/12 of its length the author invents a wild one!), making the book an acceptable, if unsatisfactory, addition to the literature on magnets for children.

√*Junior Science Book of Electricity,* Rocco V. Feravolo, Champaign, Illinois, Garrard Press, 1960.
61 pp. $2.50 primary-intermediate

This is an introduction to electricity and some of its simple uses, particularly valuable for the sections dealing with conductors and insulators. There are incorrect explanations of the "'short-circuit" and a misleading discussion of the long and short clicks on a telegraph set. Although the writing is good, the book lacks any spark of humor or enjoyment.

√*Junior Science Book of Magnets,* Rocco V. Feravolo, Champaign, Illinois, Garrard Press, 1960.
64 pp. $1.98 primary

There are several errors here common to many books for children on magnets, including the statement that magnets attract only iron and that these objects are attracted only to the ends of the magnet. Other important points are glossed over, such as the fact that a metal object attracted to the end of a magnet acts like a magnet. Although no activities are suggested, this is a pretty sound reference book, straightforwardly written. Especially welcome is the generally overlooked statement that, "Nobody knows exactly why a magnet attracts things."

√*Lightning,* Jeanne Bendick, Chicago, Rand McNally, 1961.
61 pp. $2.95 intermediate-advanced

It would be difficult to discuss lightning in as much detail as this author does without introducing some electron theory, but the explanations of such concepts as "voltage" and "amperage" here are unnecessarily complicated and not directly related to the text. The book's strong points are its constant focus on the young reader, illustrations that really illustrate, and entertaining writing style. Occasionally the author's flair for metaphor carries her too far; statements like, "It is the attraction between proton and electrons which keeps you from flying apart," seem more frightening than explanatory. Incidental bits of information, such as the observation that there is always a thunderstorm someplace on earth, contribute to making this a highly acceptable survey.

√*Lightning and Thunder,* Herbert S. Zim, New York, William Morrow, 1952.
63 pp. $2.75 intermediate

This is an undistinguished introduction to these interesting phenomena of weather, written in a flat and often disjointed style. Illustrations are adequate, if unexciting, except for one illustration of an experiment being performed with household current which is extremely dangerous. Its main weakness stems from inadequate explanations of the electrical theory behind all that noise and light. Although apparently addressing himself to a second or third grade reader, the author seems to feel it necessary to go into explanations of "watts" and "ohms" and to introduce mathematical calculations where none are called for. In the end, the book is intellectually frustrating, for it has raised many extraneous questions, while the main question ("Why is there lightning?") has been lost somewhere along the way.

√√*Magnet,* E. G. Valens and Berenice Abbott, Cleveland, World Publishing Co., 1964.
58 pp. $3.00 advanced

This book is for the reader with at least some familiarity with the topic. Although it begins with the most elementary facts about magnetism, rules are never merely stated, and the reader must deduce most of the rules himself from the excellent experiments described. This is in no sense an "all about magnetism" book, but an illustration of some of the important properties of magnets, presented through a set of original (and beautifully photographed) experiments. Its exciting style of writing and excellent design make this a gem for the more advanced student who is interested in how magnets work.

√√*Magnets,* Bertha M. Parker, Evanston, Illinois, Harper and Row, 1963.
36 pp. $.60 intermediate

This is the most comprehensive introduction to magnets and their properties that we have seen. The writing is lucid and accurate, as are the illustrations. The book does an especially fine job of suggesting open-ended experiments and activities (it poses questions without spelling out answers) which work and which can be easily performed. A minor objection is the fact that pictures usually do not appear on the same page as the corresponding text, although the reader is referred to the appropriate page.

√*Magnets,* Edward Victor, Chicago, Follet Publishing Co., 1962.
32 pp. $1.00 primary

This is a general introduction to magnets on the primary level. It is written in simple, declarative sentences. It does not particularly try to encourage children to explore for themselves, although a few activities are listed at the end. The text is generally accurate and the illustrations are clear, but the book lacks either charm or a sense of purpose.

√*Magnets and How to Use Them,* Tillie Pine and Joseph Levine, New York, McGraw-Hill, 1958.
46 pp. $2.75 primary

This book makes no attempt to cover more than the fundamentals, and, compared with many other primary books on magnetism, the writing is quite imaginative. In places the tone becomes artificial, as in the statement that we must call bar magnets by that name because that is what everyone else calls them. There are also a number of unnecessary misstatements (dry cells do not really "make" electricity) and there are more plausible ideas about the origin of the word magnet than that of the shepherd boy Magnes. But the

writing is generally easy and should be enjoyed by the early grades.

√√*Mickey's Magnet,* Franklyn Branley and Eleanor Vaughan, New York, Thomas Y. Crowell, 1956.
48 pp. $2.50 primary

This is a charming little book suitable for the beginning reader. Although the book is not intended to be a source of information on magnets, the description of what Mickey did with his magnet is scientifically correct and serves as a very pleasant introduction for the earliest grades. The book contains many attractive illustrations and a simple, easy-to-read text.

More Power to You, Herman and Nina Schneider, New York, William R. Scott, 1953.
128 pp. $3.00 intermediate

Poorly-chosen terminology and examples continually obscure the author's points. There are errors, confusions, and omissions: we are told, for example, that electricity makes heat and motion, but light is not mentioned. In the instructions for making an electromagnet, the child is told to wind a coil of wire around a pencil and then be sure to remove the pencil —a completely unnecessary precaution, since the pencil lead has no effect. The illustrations represent experiments which cannot work. For example, a child might wait forever for the homemade generator shown on page 69 to light a bulb.

Picture Book of Electricity, Jerome Meyer, New York, Lothrop, Lee, and Shepard, 1953.
39 pp. $1.95 intermediate

This book is not well written and it contains many errors: for example, "a comb charged with static electricity is a magnet." Technical terms are commonly introduced before the need for them is established, and often without definition. The ratio of pictures to text is small for a picture book, and the book tries to cover too much material.

Picture Book of Radio and Television, Jerome Meyer, New York, Lothrop, Lee, and Shepard, 1951.
40 pp. $1.95 intermediate

This book has very few pictures, and they are not helpful. The explanations of the complex technology of radio and television are inadequate. Surprising statements are not backed up with theory or example. In describing the Leyden jar, for example, Meyer says: "If there is a great deal of electricity in this jar, the sparks will be very strong, but they will not vibrate or jump back and forth so rapidly. If the amount of electricity in the jar is little, the sparks will be weak, but they will jump very quickly to and fro." He also tells us that the Leyden jar (which was made in about 1650) was made by coating a jar with tin foil of "the kind used to wrap up candy and chewing gum." There are many confusing generalities and explanations.

√√*Push and Pull: The Story of Energy,* Paul Blackwood, New York, McGraw-Hill, 1959.
190 pp. $3.00 intermediate-advanced

In an unusually clear and informal style, this book offers an excellent survey of energy, approaching it through its various manifestations. The suggested experiments are open-ended with just enough directions given to set the student off on the right track. There are almost no errors of fact or definition, though additional illustrations would have made the author's meaning more apparent in several places. His foreword, a general discussion of energy, is unique in its concise and engaging completeness.

√√*Rusty Rings a Bell,* Franklyn Branley and Eleanor Vaughan, New York, Thomas Y. Crowell, 1957.
32 pp. $2.50 primary

This book for the early reader or pre-reader deals with the most elementary aspects of circuit theory. The story concerns Rusty's experiences with an electric buzzer. It serves as an introduction to free exploration, though in this respect it is not quite so nice as *Mickey's Magnet* by the same authors, simply because the plot is more conventional. The scientific content of these thirty-two pages is not large, but what there is, is presented in an original manner.

√√*The Story of Electricity,* Mae and Ira Freeman, New York, Random House, 1961.
79 pp. $1.95 intermediate

The Freemans' writing is simple and interesting, the type and illustrations large enough for a younger reader, though the content of the book is solid enough to hold an older one. Topics follow each other in logical order, and technical terms are used sparingly. The book's one important lapse is the description of Ben Franklin's kite experiment; like many other accounts, this one does not mention the grave danger of imitating Franklin's miraculous escape from electrocution. This book is an impressive introduction to electricity and some of its uses, from rubbed amber to the electron tube.

Television and How It Works, Eugene David, Englewood Cliffs, New Jersey, Prentice-Hall, 1962.
72 pp. $2.95 intermediate

This is a story book, not a science book. A child who wants to know how television works will not find the information here. He will find an informal account of how a show is produced inside a television studio, enlivened by some charming but irrelevant illustrations. (To illustrate the blurred image called a "ghost" with a white-sheeted figure saying, "Boo!" is not very illuminating.) The chapters devoted to how a television picture is transmitted and received are inadequate, and the technical terms are not sufficiently defined.

√*Television Works Like This,* Jeanne and Robert Bendick, New York, McGraw-Hill (Whittlesey House), 1959.
64 pp. $2.75 intermediate

Although the book has few glaring errors, it lacks freshness of writing or originality of approach. It is a good, comprehensive coverage of how television programs are produced and broadcast for a child who wants to know *all* about television, although the scientific basis of television is only summarized briefly. The less dedicated reader will find little here to engage his curiosity or his attention.

√*The True Book of Magnets and Electricity,* Illa Podendorf, Chicago, Children's Press, 1961.
47 pp. $2.00 primary

As a general introduction to magnetism, this book is distinguished by its bright and imaginative pictures, although more detail would be desirable in some cases. The text is clear and generally accurate, but it suffers from a mistaken attempt to cover all of magnetism and electricity in forty-five pages of large print. Consequently, the book becomes a series of factual statements, with many technical terms—"magnetic field" and "keeper"—mentioned but never explained. An adequate, but superficial introduction to the topic.

Understanding Science, William Crouse, New York, McGraw-Hill (Whittlesey House), 1963.
224 pp. $3.95 advanced

For an advanced book (the language is fairly adult), this gives superficial explanations. The word "voltage" is introduced with no further clarification than the statement that, "It takes higher voltages to go longer distances"—a statement which may be true, but only in a specific context. The author has tried to cram too much theory and technology into too short a space. In fourteen pages he discusses and "explains" magnets, generators, motors, resistance, electric lights, solar batteries, and fuel cells. There is, however, a good chapter on the early history of electrical science.

What is a Magnet?, Gabriel Reuban and Gloria Archer, Chicago, Benefic Press, 1961.
48 pp. $1.80 primary

In attempting a comprehensive coverage of the uses and the causes of magnetism for very young readers, the authors have produced a little book which combines the most elementary facts (a magnet attracts things made of iron) with advanced theory (what happens to the molecules of iron when they are brought near a magnet). The various theories of the causes of magnetism are not effectively explained; at this level such explanations must be oversimplified and would better have been omitted. The illustrations in the second half of the book are often misleading, as in the case of a drawing showing molecules as little bars with one black end and one red end lining up.

What is Electricity?, John B. Syrocki, Chicago, Benefic Press, 1960.
48 pp. $1.80 primary-intermediate

In trying to simplify extremely difficult material (electrochemistry, for example), this book does not succeed in making it comprehensive. While it attempts to give a general coverage of electricity and electrical technology, the difficulty of the topics varies greatly from page to page. The illustrations are not helpful. In the case of the illustration of the difference between parallel and series circuits with circuits connected to wall plugs, a potentially dangerous experiment is suggested. There are misleading statements, as in the claim that current in a short circuit "always flows across the short path."

Wonder Worker: The Story of Electricity, Walter Buehr, New York, William Morrow, 1961.
96 pp. $3.00 intermediate

The well-written passages in this book do not compensate for its errors. In a chapter titled "What is Electricity?," the following explanation of a magnet is given: "One end, or pole, containing positive magnetism, is marked by a [plus] sign, the other has negative magnetism, marked by a [minus] sign." It is impossible to tell what is meant by such a statement as, "Static electricity sends out feeble waves from transmitters."

The Wonderful World of Energy, Lancelot Hogben, Garden City, New York, Doubleday and Company, 1957.
69 pp. $2.95 intermediate-advanced

This book, although designed for young readers, requires a substantial knowledge of physics. The definition of power on the third page would be confusing to anyone who did not already know how physicists use the word: "By power [engineers] mean so much work done in so much time." This is a large, glossy book with two or three colorful and detailed illustrations on each page, but the pictures of experiments are meaningful only to those with great scientific sophistication. The many generalizations, too, are likely to be misleading. The picture of Cockcroft and Walton splitting an atomic nucleus shows, literally, a man in a box. Most of the subjects discussed (Avogadro's number, atomic fission, radio-isotopes, and others) are much too esoteric to be covered satisfactorily in a paragraph or two. This is an attractive but frustrating book.

√*Your Telephone and How It Works,* Herman and Nina Schneider, New York, McGraw-Hill (Whittlesey House), 1962. New Edition, 1965.
96 pp. $2.75 intermediate

This gives a reasonably comprehensive explanation of the theory and development of the telephone from Bell's first model to the policeman's travelling phone. The descriptions of the modern transmitter and receiver are correct and not too detailed for a reader without much experience in electricity. Both the writing and the illustrations are good but undistinguished.

Experimental Books

√*Experiments with Electricity,* Nelson Beeler and Franklyn Branley, New York, Thomas Y. Crowell, 1949.
145 pp. $2.95 intermediate-advanced

The title of this book is a misnomer. The book consists mainly of a series of directions for making various gadgets and performing simple tricks. The "experiments" are simple to perform, however. They work, and the directions are generally clear. The illustrations are particularly helpful. All the required materials are inexpensive; if they are not readily available the authors tell how to obtain them. Obviously the authors have performed the "experiments" themselves and are familiar with the problems a child is likely to encounter. The book is an excellent source of post-*Batteries and Bulbs* activities for the student who likes to tinker.

The First Book of Science Experiments, Rose Wyler, New York, Franklin Watts, 1952.
66 pp. $2.50 intermediate

This book contains eleven pages dealing with electricity and magnetism. Although the book begins with a fine discussion of what an experiment is and why one does an experiment, the section on electricity and magnetism is not helpful. The few "experiments" are really demonstrations; no attempt is made to give any sort of systematic view of the subject or even to touch the high points. Accuracy is sacrificed to an informal style: "Electrical wire has some kind of covering or coating on it to keep the electricity from jumping out." There is a very nice description of the work of Galvani and Volta, but this is presented as exposition and adds nothing to the experimental content. It should be noted, however, that the section on electricity and magnetism is the least effective portion of the book, and that some of the other sections, particularly that on plant growth, are considerably better.

√√*Fun with Scientific Experiments,* Mae and Ira Freeman, New York, Random House, 1960.
58 pp. $1.95 intermediate-advanced

The experiments in this book are not designed to teach fundamental principles. Instead, each has been selected because it illustrates a particular point about the way science works, and each is interesting in its own right. A wealth of excellent photographs give the experiments authenticity and entice the reader to try for himself. Since the authors explain at each step what is being shown, this might be called a book of experiences rather than an experiment book. Only a fraction of the experiments deal with electricity and magnetism. All the experiences presented are worthwhile, however, if only because they are touched with the excitement of real science.

√*More Experiments in Science,* Nelson Beeler and Franklyn Branley, New York, Thomas Y. Crowell Company, 1950.
176 pp. $3.50 intermediate

The section on electricity is brief (twenty-two pages) but on the whole well done. Particularly worthwhile is the chapter on static electricity, which presents a few activities other than those found in every science book for children. Although the particle theory of electrical phenomena is better left unstated, the authors' attempt at a simple "explanation" is better than most. By far the worst fault in this otherwise well-written book is the habit of introducing technical terms — such as "magnetic field," "volt," and "transformer" — either without adequate background, or with no definition at all.

√√*More Research Ideas for Young Scientists,* George Barr, New York, McGraw-Hill, 1961.
159 pp. $3.00 intermediate

Another good book by the author of *Research Ideas for Young Scientists* (see below). The experiments are generally unstructured enough to allow the child some room for discovery, though even here too many answers are given. Making a lemon battery and a simple galvanometer are two of the more interesting experiments described. The section devoted to electricity (pp. 47-63) is accurate and informative.

√*One Hundred and One Science Experiments,* Illa Podendorf, New York, Grossett and Dunlap, 1960.
157 pp. $3.95 intermediate

The book begins with a very nice introduction stating what an experiment is—an attempt to answer a specific question—and how one goes about doing an experiment. Each experiment in the book is designed to answer the specific question posed at the head of each page. But after stating the question and directing the layout of the experiment, and often even going so far as to ask the student to make a prediction, almost every experiment ends with, "You are right if . . . ," or "You are sure to have discovered that. . . ." In thirty pages of experiments with electricity and magnetism, there is almost no room for a child to ask questions for himself. This is a colorful book, with illustrations which are large, imaginative, and detailed enough to be of real value. The section dealing with magnets is considerably better than that on electricity.

√√*Research Ideas for Young Scientists,* George Barr, New York, McGraw-Hill, 1958.
142 pp. $3.00 intermediate

This is a project book, rather than the standard experiment book. The activities suggested here are not merely tricks to do with electricity. The directions are usually easy to follow, including the formulation of the problem, the design of the experiment, and further ideas to pursue. It should be noted that only a small part of the book deals with electricity. Most of the projects can be done in the home with no special equipment. Although the problems are not arranged in any particular order and there is a tendency to ask

too many rhetorical questions, the book does give a feeling of what it is like to do scientific research, even on the elementary level.

√*Science Experiences (Elementary School),* Bertha M. Parker, Evanston, Illinois, Row, Peterson and Co., 1961. (reprinted by Harper, 1963)
272 pp. $4.95 intermediate-advanced

The thirty-two pages which deal with electricity and magnetism contain activities which are fairly standard and not especially imaginative. Many of the suggested activities are fun, but they do not add up to any coherent picture of how electricity and magnetism work. The book may have some value as a teacher's resource book (as stated in the introduction), but it would seem to be severely limited in this respect by its unevenness. This is a strange mixture of toys, stunts, and good experiments.

Science Experiments with Ten-Cent Store Equipment, Carleton J. Lynde, Princeton, N. J., Van Nostrand, 1950.
262 pp. $4.00 intermediate-advanced

This is an unoriginal collection of rainy-day activities. The "experiments" are unimaginative, no reason is given for doing any of them, no questions are asked, and there is no logical transition from one to the next. In addition, the book contains extensive suggestions for activities which utilize household electricity. In a book written for children, such activities must be considered extremely dangerous. Explanations for all the experiments are given at the end of the book, but they are much too complicated to be of use to an elementary school student.

√√*700 Science Experiments for Everyone,* UNESCO, Garden City, New York, Doubleday and Co., 1958.
252 pp. $4.00 advanced-teacher

The title of the book is rather a misnomer, since many of the "experiments" are simply things to build, but the book does ask a lot of questions designed to stimulate the reader's thinking. The book is notable for the thoroughness with which it covers many topics in thrity-five crammed pages on electricity and magnetism. It will be most useful, however, as a resource book for teachers. Although much of the material is suitable for students, the small print, exhaustive coverage, and terse language may discourage them. Teachers will find in it the most extensive list of activities with electricity and magnetism we have seen. But the suggested experiments using household current must be considered extremely dangerous unless performed by a knowledgeable adult or under careful supervision.

Simple Science Experiments for the Elementary Grades, Harold Visner and Adelaide Hechtlinger, Palisade, New Jersey, Franklin Publishing Co., 1960.
232 pp. $4.80 intermediate

The twenty-two pages which deal with either electricity or magnetism are scattered throughout this book and consequently have no logical unity. Although the book is written for children, the lack of organization would seem to limit its usefulness. The authors imply, moreover, that certain activities are suitable only for certain grades. It should be noted that the introduction definitely states that the book is not intended to be used as a supplement to class work. The instructions for the activities suggested are incomplete; those dealing with electricity usually do not mention what size dry cell or light bulb to use—a factor which is often critical to the success of the experiment. Experiments are included which will not work, such as those which use Christmas-tree light bulbs to be lit by dry cells, and explanations are often incorrect. The illustrations lack necessary detail.

The True Book of Science Experiments, Illa Podendorf, Chicago, Children's Press, 1954.
47 pp. $2.00 primary

Some experiments that "Alice" and "John" did are described with the author's explanation of their results. There is no incentive for a child to try them for himself. The explanations are simple enough for very young readers to follow, but they are often confusing and only half true. For example, the reason that a boat filled with clay does not tip over is not because gravity pulls hardest at the bottom. The fact that a dart stays in the dartboard because of air pressure means nothing out of context. (Does your arm stay up because of air pressure?) The experiments themselves are of the ordinary, this-will-illustrate-the-principle-of type. On almost every page, the author makes categorical statements which raise the question, "Why?" No answers are found here.

Historical or Biographical Books

√*Alessandro Volta and the Electric Battery,* Bern Dibner, New York, Franklin Watts, 1964.
135 pp. $2.95 advanced

This book is an impressive history of the period in which electricity was first fully explored, rather than a personal biography of Volta, written by an historian of science. Specific inventions, such as the electrophorus or the battery itself, are usually only sketchily described, but the excerpts from historical documents which run through the text and the old engravings used as illustrations are excellent. For a reader of junior high school age or older, this book might serve as an introduction to the field of history of science, and it is certainly a fine reference, but not one a child is likely to pick up and read for pleasure.

√√*Benjamin Franklin,* Clara Ingram Judson, Chicago, Follet Publishing Co., 1957.
204 pp. $3.50 intermediate

This book creates a balanced, complex portrait of Franklin and the age he lived in with a minimum of fabricated conversation or psychological speculation. Although Franklin's public and political life are always in the foreground, we are constantly aware of his family, his private interests, and his scientific investigations in the background. Unlike most biographies for children, this one shows clearly that Franklin was a controversial figure in his own time, that he was not simply a "great man," but a versatile and difficult human being. The author's style is refreshingly colorful without being sentimental, and even an older reader will find this book informative.

√*Benjamin Franklin, Man of Science,* Irmengarde Eberle, New York, Franklin Watts, 1961.
145 pp. $2.95 intermediate

Franklin's accomplishments in many different fields are described here, but without any real attempt to extract from his many activities a picture of the man himself. Some of his work with electricity is discussed, but its place in the history of electrical science is not clear. The writing is a little too bland, the explanation of Franklin's political role a little too shallow, but never actually inaccurate. All in all, this is the typical reverent biography of a great figure. Better biographies of Franklin are available for the same age group.

√*The Bright Design,* Katherine B. Shippen, New York, Viking Press, 1949.
207 pp. $4.00 advanced

The book is uneven, both in the quality and in the accuracy of the writing. The sections on atomic structure and relativity are especially weak, even to the point of errors in the simplest arithmetical chronology. Toward the beginning of the book the author states that positively charged objects attract each other and so do negatively charged objects! In addition, the author is careless in the use of the words "fact" and "prove" in their scientific sense. She does, however, a nice job of presenting scientists as human beings with all the normal worries and problems, although she occasionally goes overboard in her description of the young, naïve scientist. Scientific motivation and purpose are well suggested. For every fault, there is a section where the writing is magnificent. This book ought to be read, if for no other reason than the fact that it is the only children's book we have encountered which attempts to give a more or less comprehensive history of electrical science and its related fields.

√√*Edison Experiments You Can Do,* Marjorie Van de Water (for the Edison Foundation), New York, Harper, 1960.
129 pp. $2.95 advanced

A short biography of Edison is followed by a series of unique activities and experiments based on the original Edison notebooks. The experiments do not illustrate many of the fundamentals of electricity; they are impressive, simplified versions of experiments conducted by Edison himself. The writing is generally good, though a reader may bog down in the description of the quadruplex telegraph in the last chapter. One of the outstanding features of the book is the abundant use of photographs and facsimile reproductions. The introduction differentiates clearly between real experiments and those which are contained in any book (which do not "launch forth into uncharted seas"). The editors and authors are also careful to distinguish between Edison's contributions and those of others, and between the way Edison did things and the way they are done today. This is an exciting combination of history and science.

√√*Electrical Genius: Nikola Tesla,* Arthur J. Beckhard, New York, Messner, 1959.
192 pp. $3.25 advanced

A colorful biography of one of America's forgotten scientists, this book reads like a novel, complete with several passages which border on the melodramatic, and can be enjoyed by a person with no scientific background. Tesla is most certainly not typical of the average scientist, and the book should not be read as if he were—he was a vain, superstitious, and flamboyant genius. The author clearly does not understand the precise nature of Tesla's work. At one point, moreover, he seems to think that the theory of relativity implies that all truth is relative. Also, the book gives an unobjective view of Tesla's contemporaries (Edison is made the symbol of conservative reaction, Steinmetz not even mentioned)—but this is fascinating reading all the same.

√√*The Electrical Genius of Liberty Hall: Charles Proteus Steinmetz,* Floyd Miller, New York, McGraw-Hill, 1962.
126 pp. $3.00 advanced

Although this book sheds little light on Steinmetz's "electrical genius," it is proof that biography for children does not have to be childish. The author does not spare Steinmetz's early chagrin at his hunched back, his insensitivity to the demands of his non-genius neighbors; neither does he slight the great scientist's service to his community or his tender affection for his adopted family. But what Steinmetz did in his laboratory at General Electric remains quite mysterious. Several pages of photographs—including a shot of Edison and Steinmetz conferring together—add a further touch of reality to a highly readable book.

Electricity: A Book to Begin On, Leslie Waller, New York, Holt, Rinehart, and Winston, 1961.
45 pp. $2.50 primary

This is an introduction to electricity and the history of electrical science in terms of the great experimenters. It is written in language a second grader can understand. After finishing this book one would believe that Volta "made electricity" by putting a piece of brass next to a piece of iron, and Faraday "made electricity" by moving a piece of iron back and forth. There is a list of the names of scientists who contributed to the development of electrical theory, complete with an illustration of each holding an electron in his hand, but without any explanation of their work. Despite some charming illustrations, the text is too superficial to be useful.

√*Famous Physicists,* A. L. Mann and A. C. Vivian, New York, John Day, 1963.
159 pp. $3.25 advanced

The book presents in chonological order nine brief biographies of important physicists, from Archimedes to Faraday. Several experiments illustrating the man's work are placed at the end of each biography. Although the plan is an excellent one, the biographies are often just a collection of anecdotes and the experiments require materials too difficult to obtain for most readers to try them at home. One of the book's advantages is the fact that it includes some description of the lives and achievements of Von Guericke, Franklin, Galvani, Volta, and Faraday in one place, although the authors seldom attempt to show how each man's separate discoveries are related. An older child who is willing to go through most of the experiments might find this an intriguing approach to scientific history.

√*The Genie and the Word,* Walter Buehr, New York, Putnam, 1959.
88 pp. $2.90 intermediate

As a history of communications technology, this book traces the development of methods of communication from the origins of speech through the telegraph and telephone to the modern communications satellite. The book begins with an excellent approach, which views the rise of modern communications through the simultaneous advances in knowledge and need. There are several egregious errors, including the definition of the ionosphere as a radioactive layer in the earth's atmosphere and the implication that steam locomotives were invented in the 1850's (it was long before that time). Historical chronology is often confusingly jumbled, particularly in the first chapter, and some terms are used without definition. Despite a few grammatical lapses and disconnected paragraphs, the book is interestingly written.

√*The Incandescent Light,* Floyd A. Lewis, New York, Shorewood, 1961.
128 pp. $2.95 advanced-teacher

A "review" of the history and development of incandescent light, this book assumes considerable technical knowledge on the part of the reader. Probably only a high school student or a teacher would be able to enjoy reading it from cover to cover. However, the book provides an excellent picture of how Edison worked and detailed information about the development of the light bulb which cannot be found elsewhere. The extensive use of the original drawings and diagrams from the Edison notebooks give the book historical significance. It might be a useful book to have in the school library for answering specific questions about bulbs.

√*James Clerk Maxwell and Electromagnetism,* Charles Paul May, New York, Franklin Watts, 1962.
152 pp. $2.95 advanced

Maxwell's early work is clearly explained, but the later sections of the book demand a knowledge of physics and chemistry to understand his theory of electromagnetism. Biographical details are included, but Maxwell's life is described in so superficial a manner that it does not hold the reader's interest. A junior high school student would probably understand most of the science in this book, but would emerge with little sense of what kind of man Maxwell was.

√*Marconi: Pioneer of Radio,* Douglas Coe, New York, Messner, 1953.
256 pp. $3.50 advanced

This is more a biography of radio than of Marconi himself. There is a great deal of biographical detail about other scientists. Hertzian waves, induction coils, and other sophisticated phenomena are discussed at some length. These difficult passages contrast strangely

with the fictitious dialogue, which is even more stereotyped than that in most children's biographies. But the author's representation of how an idea becomes an experiment, and then an invention is excellent, sparing none of the complexity, the frustration, the sometimes boring repetition that actually occurs. Unnecessary name-dropping of scientists and theories makes this book tough going, but it gives an unusually fine picture of how scientific knowledge is accumulated.

√√*Men of Science and Invention* (American Heritage), New York, Golden Press, 1960.
153 pp. $3.95 advanced

This panorama of American science from the colonial period to the jet age is richly illustrated with contemporary prints and paintings. It includes a brief and interesting introduction on the relation between science and invention, many quotes from literary and scientific sources, and a vast amount of information about some important but little-known American experimenters. Although the technical details of inventions and discoveries are usually not explained, the interlocking contributions of many individuals are skillfully discussed and evaluated. There are frequent, unusual glimpses of the relation between science and government in American history.

√*Michael Faraday: From Errand Boy to Master Physicist,* Harry Sootin, New York, Messner, 1954.
180 pp. $3.25 advanced

This book might well be read in conjunction with May's biography of Faraday, for the two are complementary. Here the personal and the emotional aspects of Faraday's career are dominant, the style is novelistic, and details about experiments are kept in the dim background. The story of Michael Faraday is an engrossing one, and will certainly make the reader feel he "knew" Faraday. As sheer novel, however, the book is both melodramatic and sentimental. The student who can swallow such purple passages as, "His whole being was taut, like a musical instrument whose tightly stretched strings were ready to vibrate to whatever sound came from the man (Sir Humphrey Davy) on the platform," will find this a delight.

√*Michael Faraday and the Electric Dynamo,* Charles Paul May, New York, Franklin Watts, 1961.
144 pp. $2.95 intermediate-advanced

This is a highly acceptable biography of Faraday, written in an intelligent and factual style. The author's attitude toward the man and his work is both scientific and stimulating. However, the difficulty of the technical explanations is likely to obscure the meaning of Faraday's investigations from the younger reader without much background in science. The later chapters, which contain most of the explanations of Faraday's work, are well written and accurate; they are simply beyond the level of most elementary or junior high school readers. For the child with sufficient preparation or interest, this might be exciting reading.

√*Mr. Bell Invents the Telephone,* Katherine B. Shippen, New York, Random House, 1952.
183 pp. $1.95 intermediate

The fact that this book can hold even an adult reader's attention is a tribute to Miss Shippen's ability to use simple language with vigor. Bell's ideas and inventions are not explained, but they are effectively suggested. The book is not for the reader who wants a full account of the early history of the telephone. Bell's difficulties in arriving at a working model are barely hinted at. It is, however, a good portrait (if occasionally, like most children's biographies, a little too pretty) of the life, personality, and contributions of Alexander Graham Bell.

√√*Samuel F. B. Morse: Artist-Inventor,* Jean Lee Latham (Discovery Books Series), Champaign, Illinois, Gerrard, 1961.
80 pp. $2.50 primary

This brief, readable account of Morse's life emphasizes his long and unhappy struggle for success both as artist and inventor, building up to the eventual triumph of the telegraph. It neither examines his character closely nor describes in detail his work on the telegraph, but manages to convey an impression of his life's work in a brief and quite dramatic manner. At least one quarter of the book is devoted to full-page illustrations which manage to enhance a younger reader's interest without disrupting the flow of narrative.

√√*Samuel Morse and the Telegraph,* Wilma Pitchford Hays, New York, Franklin Watts, 1960.
66 pp. $2.65 intermediate

Written in a straightforward narrative style, this book provides an excellent brief history of the telegraph. It emphasizes the practical problems of making a national communication system out of a workshop invention, although the essential facts of Morse's life are woven into the story. Morse's fight to gain public acceptance and support for his invention is thoroughly described, but the pace is swift enough for easy reading.

√*The Telephone,* Henry Brinton, New York, John Day, 1962.
48 pp. $2.50 intermediate

The development of communications is traced briefly from smoke signals through the telephone to the radio link telephone. Although the format is well designed, illustrations are often confusing; they are pretty pictures, but add little to the text. A very vague discussion of the electromagnet follows a highly sophisticated description of the workings of a battery. There is an especially clear explanation of how an automatic ex-

change operates. Perhaps because the author is an Englishman, the writing is sometimes strange. In addition, it is irritating to be told that something was very important to the development of something else, without any explanation of why the two are related.

√√*Thomas Alva Edison* (Lives to Remember Series), Henry Thomas, New York, Putnam, 1958.
128 pp. $2.95 intermediate

This book has the same advantages as Garbedian's biography of Edison, but the writing is simpler and the pace somewhat more swift. It is a neat combination of historical fact and personal insight. One of the book's most impressive features is its solution to the problem of organizing material in a biography for children. Of course, the standard approach is chronological, but this method often fails to come to grips with the most important aspects of the man's career, as well as giving most child's biographies a common tone. Here the author has organized Edison's life into various topics which were of particular concern, such as the electric light, the phonograph, his family. The reader senses the quickness and versatility of Edison's mind without being bored by repetitions.

√√*Thomas Alva Edison: Builder of Civilization,* H. Gordon Garbedian, New York, Messner, 1947.
231 pp. $3.50 advanced

Edison is presented in this detailed biography as a creative and seemingly tireless man whose more than 1,000 patented inventions covered a wide range of fields. Many humorous and personal anecdotes of Edison's life are woven into the narrative. The writing is occasionally stiff or disconnected, but on the whole this is a thoroughly interesting and accurate account of Edison's life and work.

√*Thomas Alva Edison: Miracle Worker,* Mervyn D. Kaufman (Discovery Books Series), Champaign, Illinois, Garrard, 1962.
80 pp. $2.50 primary

The first half of the book is devoted to a few incidents from Edison's boyhood, all designed to demonstrate his curiosity and precociousness. His adult life and work are summed up in a few scenes. Extreme compression produces some disturbing effects: Edison is made a widower and proposes to his second wife on the same page. Still, the book is written in a style simple and interesting enough for a learning reader, who will at least end up with some idea who Edison was.

√*Tom Edison: Boy Inventor,* Sue Guthridge, Indianapolis, Bobbs-Merrill, 1959.
200 pp. $2.25 primary

Sixteen of the seventeen chapters in this book are devoted to Edison's boyhood, while his adult career is compressed into a few pages. The childhood scenes are reconstructed from known incidents and written in a fast moving, easy-to-read style. One major theme—that even as a child Edison was inventive and independent—ties the various incidents together. Questions and lists of vocabulary included at the end indicate that this book might be used as a classroom reader. Read in class or on one's own, it is an interesting story which also contains some facts about the great inventor.

√*Young Thomas Edison,* Sterling North, Boston, Houghton-Mifflin, 1958.
182 pp. $2.60 intermediate

Edison's life was a unique combination of aimless wandering and fierce determination, of inspired tinkering and unexplainable blind spots. This book does not succeed in reconciling the inventor's many contradictions in a coherent portrait, though it does a fine job of recreating his early years as a telegraph operator. Some melodramatic and even sloppy writing ("His well-shaped head was one big question mark.") add unintentional humor. The details of Edison's work are not included, but their general nature and relation to the work of other inventors are well outlined.