A COMPARATIVE STUDY OF SEVEN HIGH SCHOOL PHYSICS TEXT BOOKS

By

Lawrence A. Barrett, B. S.

Kansas State Teachers College

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Lawrence A. Barrett

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College of

Education

By

G. Thomas Hopkins

May 15 1929

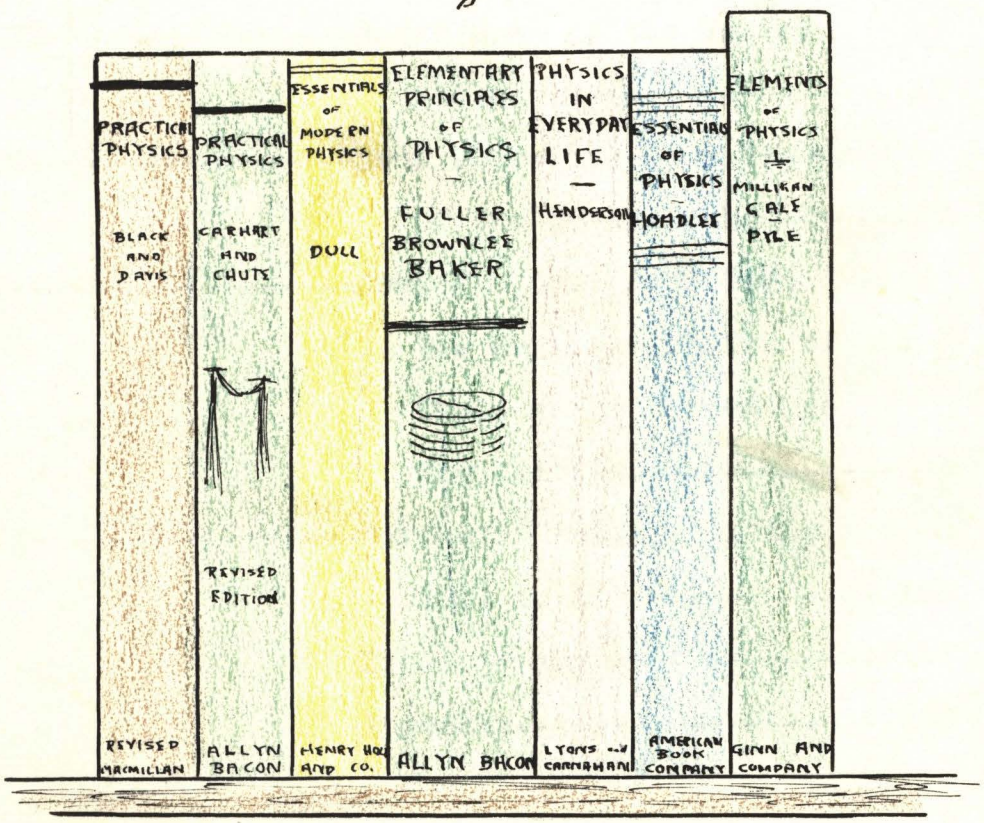
FOREWORD AND ACKNOWLEDGMENT OF APPRECIATION

May we not take this opportunity of expressing our thanks to Mr. Ted Downing, Colorado representative of Allyn and Bacon for aid in securing information needed in this study. We also wish to thank the various publishing companies concerned for their help and courteous attention in giving us data. And then, too, we find it impossible to procede with a discussion of the problem of physics texts without extending our especial thanks to Dr. R. A. Davis, Dr. L. T. Hopkins, and Dr. H. M. Barrett of the Education faculty of the University of Colorado for their help and constructive criticisms.

Lawrence A. Barrett

Introducing

The Seven Books To Be Compared



A COMPARATIVE STUDY OF SEVEN HIGH SCHOOL PHYSICS TEXT BOOKS

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LIST OF CHARTS

A COMPARATIVE STUDY OF SEVEN HIGH SCHOOL PHYSICS TEXT BOOKS

C H A P T E R O N E

INTRODUCTION.

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A COMPARATIVE STUDY OF SEVEN HIGH SCHOOL PHYSICS TEXT BOOKS

CHAPTER ONE

INTRODUCTION

Almost any book one picks up in the field of education whether it is discussing high school administration or primary methods; rural school pedagogy or college teaching will make use of the term individual differences. It seems that Nature abhors duplicates, hence she makes none. Whether one considers the physical or mental side of children matters little since deviations above and below the average or mean will be found in either case.

But individual differences are not at all confined to the field of education nor yet to the psychological testing field. Criminologists use individual differences in finger prints in hunting down law breakers, botanists find no two leaves are identical, and though a person watch the heavens for days he shall never be able to see two fleecy cloud masses that are exactly the same.

All through the plant and animal world dissimilarity is found so it is not at all surprising that a study such as this one of prosaic things like physics texts will also reveal wide differences in them.

The purposes of this study are five in number:

1. To make some objective comparisons between the leading texts on the market.
2. To discover what books are most widely used in the state

of Colorado as well as throughout the United States.

3. To get the personal opinions of teachers as to the merits of the books they are using at present.

4. To make a comparison of each book with the mean and median of the group with regards to the percentage of the book devoted to each division of physics.

5. To attempt if possible to find why some books are so widely used while others are not in vogue.

With these aims, the first step in the process was to secure a list of those books most widely used. To that end, questionnaires were sent to the science teachers in each of the one-hundred- sixty-nine schools given on the state accredited list. In addition, letters were sent to the forty-eight state departments of education to ascertain what state adopted texts in physics are in use. From the replies from these two sources a list of seven books was made. The next work was the analysis of the texts.

The seven books were analyzed in the following ways:

1. Comparison of the number of pages
2. Comparison of the number of chapters
3. Comparison of the area of the pages
4. Comparison of the number of lines per page
5. Comparison of the average number of words per page
6. Comparison of the total number of pictures
7. Comparison of the total area of line drawings

8. Comparison of the total area of half tone cuts which are referred to in the reading matter.
9. Comparison of the total area of half tone cuts which are not referred to in the reading matter.
10. Comparison of the percentage of the total area of the books devoted to drawings of all kinds.
11. Comparison of areas used by biographical pictures.
12. Comparison of the total number of biographical pictures.
13. Comparison of the total number of problems and questions
14. Comparison of the number of mathematical questions.
15. Comparison of the number of non-mathematical questions.
16. Comparison of total number of pages devoted to each of the five divisions of physics.
17. Comparison of percentage of total area devoted to the five divisions of physics.
18. Comparison of the percentage of total problems included which require mathematics.
19. Comparison of the cost of the books.
20. Comparison of the publication dates.
21. Comparison of appendices.
22. Comparison of prefaces (including acknowledgments)
23. Comparison of chapter summaries.
24. Comparison of number of pages devoted to radio.
25. Comparison of the sequence of topics.
26. Comparison of number of full page illustrations
27. Comparison of percentage composition of each book with mean and median distribution as to the five divisions.

In addition, a chart is included to show the books used in each of the towns in Colorado reporting and a like chart shows the state adopted books in those states having them throughout the United States. A graph also shows the books most commonly used in the state of Colorado as well as the personal ratings of the books by the one-hundred-twenty science teachers reporting.

Every effort is made throughout the book to make the comparisons purely objective, since every physics teacher will admit that there is some good and a little bad in every one of these seven books. This study it is hoped will present the data about each of the books in such fashion that a principal or superintendent in search of a text book to suit a particular need can learn something of the strong points of each of the texts which interest him without going through what he knows is "press agent" material submitted by different publishers. Some books are better suited to some classes than to others. For instance, a text with a relatively small number of mathematical problems and a large amount of illustrations will probably be better for a girls' class than one with but few drawings and much mathematical material. Similarly a book with a large amount of radio will appeal to a boys' class while one with larger numbers of applications of heat and light in the form of non-mathematical questions is better for the average predominantly feminine group.

A study was made at the University of Chicago

in the summer of 1925 of fifteen texts, but the method of attack was quite different from this study. A group of science teachers was used. Each member was asked to rate each of the texts according to his judgment on a point basis. Such a study was noteworthy but it does have the objection that such work is somewhat subjective, since some of the answers were based on personal opinion. It is true that by taking a composite score of the group a great deal of the personal equation is eliminated. It is hoped, however, that this study will serve to supplement the Chicago study. The Chicago study gave FULLER, BROWNLEE, and BAKER first place with DULL and HENDERSON in second and third places respectively. MILLIKAN and GALE, the book that is so widely used in Colorado, took but seventh place. It must be admitted though that this particular study did not use the revised edition of MILLIKAN and GALE which is admittedly better than its predecessor. The Chicago study used the older edition of both BLACK and DAVIS and CARHART and CHUTE also. This study includes the newer edition on all three books.

Physics books differ from some other types of texts in that a ten-year-old physics book is considered hopelessly out of date whereas an algebra or a geometry of rather ancient vintage may still be used with no particular disadvantage. Such a condition makes necessary frequent revisions and the addition of new material from time to time in science books.

C H A P T E R T W O

THE TEXT BOOKS USED IN THE COLORADO SCHOOLS

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CHAPTER TWO

THE TEXTBOOKS USED IN THE COLORADO SCHOOLS

The State Department at Denver furnished a list of the accredited high schools in Colorado of which there are one-hundred-sixty-nine listed. A letter was sent to the science teachers in each of the schools asking the name of the book they used. A copy of the letter sent out will be found in the appendix of this study.

MILLIKAN and GALE took an early lead in the returns. The final report shows that seventy-six of the one-hundred-twenty schools reporting use this book. It nearest competitor is FULLER, BROWNLEE, and BAKER used in twenty-four schools. CARHART AND CHUTE is used in nine schools; five report that they are using BLACK and DAVIS, while only one school uses HOADLEY. DULL and HENDERSON are not taught in any of the Colorado schools reporting. Five schools either use two books or are not teaching physics.

Not nearly all of the Colorado schools have taken up the use of the revised edition of MILLIKAN and GALE it is noted in the returns. This book, formerly called "Practical Physics" first appeared in 1906. It was revised in 1927 at which time it appeared under the name of "Elements of Physics." About forty percent of the schools in the state reporting MILLIKAN and GALE still cling to the former edition. In point of the num-

ber of schools using it, FULLER, BROWNLEE, and BAKER comes second. It appeared in 1925 and there has been no revised edition of it to date. (1929)

Many of the schools in the state teach physics but every other year alternating the subject with chemistry or biology. The study includes these schools, however, since they use the books indicated when the subject is being taught.

A list of the schools in alphabetical order arranged under the text booksthey report using will follow:

List of schools using BLACK and DAVIS' "Practical Physics"

1. Fort Collins high school
2. Gypsum (Eagle County) high school
3. LaPorte high school (Cache La Poudre school)
4. Saguache County high school at Saguache
5. Weldona high school

List of Schools using CARHART and CHUTE'S "Practical Physics"

1. Akron (Washington County) high school
2. Elizabeth Union high school
3. Erie high school

4. Estes Park high school
5. Fowler high school
6. Fort Morgan high school
7. Hotchkiss high school
8. Longmont high school
9. Sterling high school (In connection with another book)
10. Walsenburg - St. Mary's school

Schools using DULL'S "Essentials of Modern Physics"

None reporting

List of schools using FULLER, BROWNLEE, and BAKER'S "Elementary Principles of Physics"

1. Canon City - Mt. Scholastica Academy
2. Cheraw high school
3. Dolores high school
4. Grand Junction high school
5. Greeley college high school
6. Grover high school
7. Hugo high school
8. Holyoke high school
9. Johnstown consolidated high school
10. Kersey high school
11. Lafayette high school

12. La Jara Consolidated school

13. Las Animas (Bent County) high school

14. Louisville high school

15. Loveland high school

16. Meeker high school

17. Montrose County high school at Montrose

18. Pagosa Springs high school

19. Paonia high school

20. Platteville high school

21. Steamboat Springs high school

22. Sterling high school (In connection with another book)

23. Westcliffe (Custer County) high school

24. Yuma Union high school

25. Wray (Yuma County) high school

List of schools using HENDERSON'S "Physics in Everyday Life"

None reporting

Schools using HOADLEY'S "Essentials of Physics"

1. Eagle high school

The List of Schools using MILLIKAN and GALE'S Physics

(The schools starred use the old edition called "Practical Physics". The others use the newer edition called "Elements of Physics.")

1. Aguilar high school
2. Alamose high school
3. Arvada high school
4. Aspen high school
5. Boone high school
6. Boulder prep school
7. *Brighton high school
8. Brush Union high school
9. *Buena Vista high school
10. *Burlington high school
11. *Byers high school
12. Canon City high school
13. Castle Rock (Douglas County) high school
14. Cedaredge high school
15. *Center Consolidated School
16. *Central City (Gilpin County) high school
17. *Colorado Springs high school
18. *Colorado Springs - Cheyenne Mountain school
19. Cortez high school
20. *Cripple Creek high school
21. *Crowley high school
22. Durango high school

23. Denver - Cathedral high school

24. Denver - West high school

25. Denver - Manual Training high school

26. Denver - East high school

27.*Denver - St. Joseph's school

28. Denver - North high school

29. Denver - Colorado Woman's College high school

30. Denver - Regis high school

31.*Denver - Loretto Heights high school

32. Eaton high school

33. Eads high school

34. Eckert high school

35.*Florence high school

36. Fort Lupton high school

37.*Fruitvale high school

38. Glenwood Springs (Garfield County) high school

39. Gill high school

40. Golden high school

41. Granada high school

42.*Grand Valley Union high school

43.*Greeley high school

44. Gunnison County high school at Gunnison

45.*Hartman high school

46.*Hooper high school

47.*Hudson high school

48. Julesburg high school

49.*Kiowa high school

50.*Kremmling high school

51. Leadville high school

52.*Limon Union high school

53. Littleton high school

54.*Manassa high school

55. Mancos high school

56. Manitou high school

57. Manzanola high school

58. Milliken high school

59. Monte Vista (Rio Grande County) high school

60.*Oak Creek high school

61.*Palisades high school

62. Pueblo--Central high school

63. Pueblo--St. Patrick's school

64.*Rifle Union high school

65. Rocky Ford high school

66. Salida high school

67.*Silverton high school

68. Springfield high school

69. Stratton high school

70. Telluride high school

71.*Timnath high school

72. Trinidad high school

73.*Trinidad - Holy Trinity school

74.*Victor high school

75. Wheatridge high school

76. Windsor high school

(Thirty of these schools or roughly 40% of them still

use the old edition called "Practical Physics."

The following schools report that physics is not taught:

1. Breckenridge high
2. Denver - St. Mary's Academy
3. Mt. Morrison - Bear Creek school
4. Silt high school

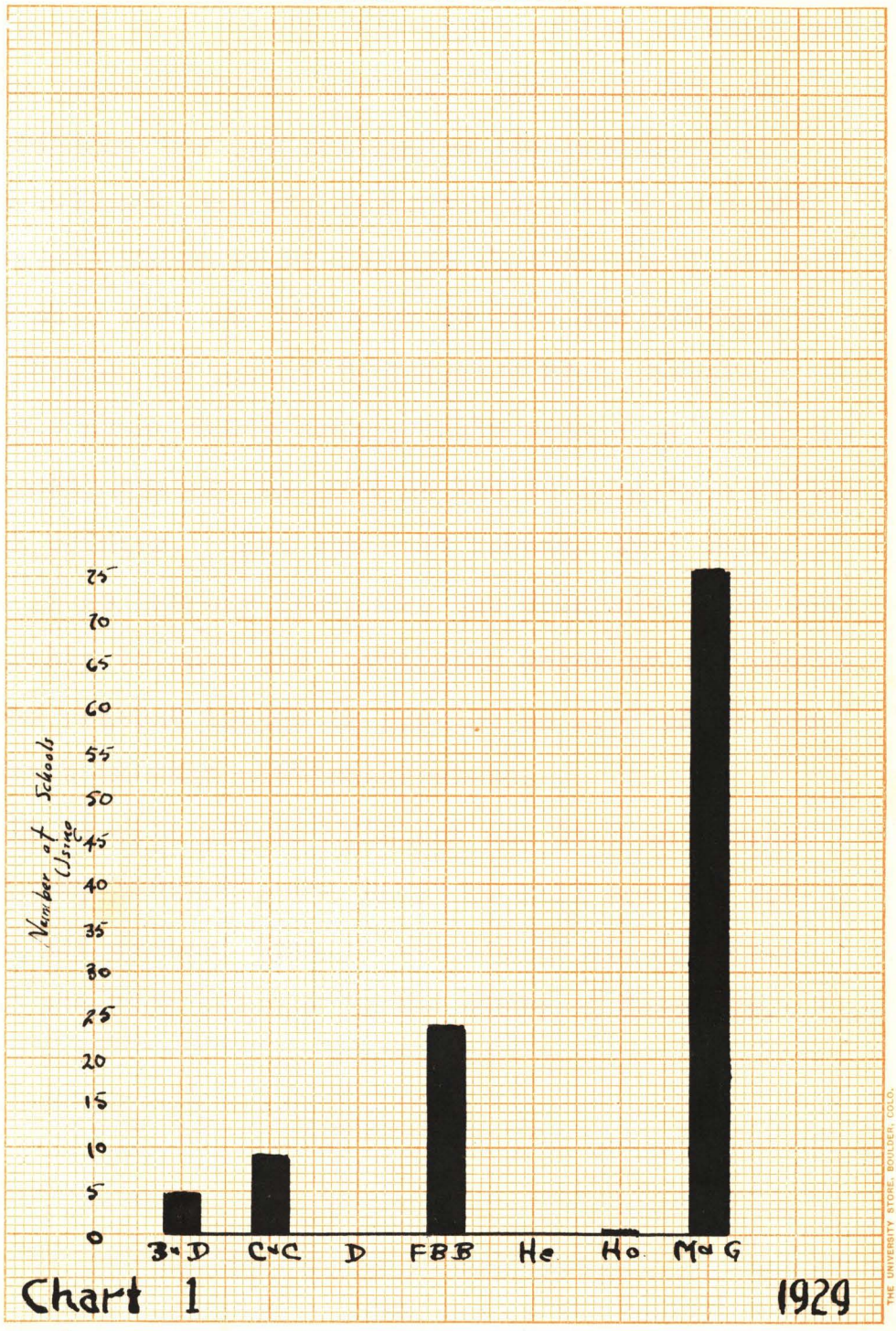
A resume of the data shows that the distribution of the texts according to authors used in Colorado is as follows:

Name of Author	Schools Using	% of Total
Millikan and Gale	76	66%
Fuller, Brownlee, & Baker	24	21%
Carhart and Chute	9	8%
Black and Davis	5	4%
Hoadley	1	1%
	115	100%

Table I

Distribution of Texts by Books in Colorado Schools

A histogram showing this distribution will be found in Chart 1. Chart 2 is a map showing by the accompa-



Distribution of Text Books In 115 Colorado High Schools

nying legend the location of the principal cities in Colorado together with the text they are using at present.

Since practically two-thirds of the schools in Colorado at present (1929) are using the MILLIKAN and GALE text (either the old edition or its revision) it would seem evident that any group wishing to make a new course of study which would include physics would do well to inspect this text if they wish to find the subject matter of physics as taught in Colorado high schools. Whether their aims, their order, their method of presentation, and their content be good or bad is largely a matter of personal opinion. But the fact remains that this book since it so largely dominates the Colorado field will serve admirably to show the curriculum maker or the administrator the present trends in physics as applied to secondary schools in this particular state.

If he will add to MILLIKAN and GALE an inspection of FULLER, BROWNLEE, and BAKER he will see the subject matter and content that is studied in eighty-seven per cent of the high schools in the state of Colorado.

— Legend —

● Millikan + Gale
□ Carhart + Chute
○ Fuller, Brownlee, Baker
+ Black + Davis
★ Hoadley

Chart 2

Distribution of Books In Colorado Schools

1929

C H A P T E R T H R E E

BOOKS USED IN THE UNITED STATES

XXXXX
XXX
X

CHAPTER THREE

BOOKS USED IN THE UNITED STATES

As a second part of this study, letters were sent to the state departments of education in each of the forty-eight states asking for information on state adopted physics books. It was found that the great majority of them, thirty to be exact, do not prescribe a book but allow each district to select its own.

Kentucky has adopted the HOADLEY book, "Essentials of Physics" for its state text although the state department advises that the term "state adoption" merely means that smaller schools are required to use the text stated whereas the larger high schools are free to deviate and select another book if they feel so inclined.

Kansas and South Carolina have adopted BLACK and DAVIS' book "Practical Physics" for use in their high schools. Not nearly all the schools in these states are using the revised edition, however, since the revision was made quite recently.

Alabama and Louisiana have for their state adopted text in physics CARHART AND CHUTE'S "Practical Physics." Not all the high schools in these states are using the revised edition as yet.

Five States: Florida, Mississippi, Oklahoma, Oregon, and Virginia have adopted MILLIKAN AND GALE'S "Elements of Physics" for their state book. Only about half of

the schools included are using the 1927 revision of this book although many others expect to change to it at the close of this term. (1929)

The thirty states having no preference as to the physics books used are as follows: Arizona, Arkansas, Colorado, Connecticut, Georgia, Idaho, Illinois, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Dakota, Ohio, Pennsylvania, Rhode Island, South Dakota, Vermont, Washington, Wisconsin, and West Virginia. Some of these states advise that they do prescribe the books to be used in the lower grades but allow the high schools to make their own lists of books.

California, Delaware, Indiana, North Carolina, Tennessee, Texas, Utah, and Wyoming have a preferred list from which the high schools pick out the book they wish to use. Incidentally, it might be noted that California allows almost absolute freedom in physics texts since their preferred list includes practically every book of any standing whatsoever among physics teachers. Wyoming is revising their preferred list and did not submit the new list in time to have it included in this study. The list of the other states' books will follow:

State	The Books on Preferred List										
	1	2	3	4	5	6	7	8	9	10	11
California *	x	x	x	x	x	x	x	x	x	x	x
Delaware	x		x				x				
Indiana			x	x	x		x				
N. Carolina @	x	x		x		x	x		x		x
Tennessee	x	x			x	x	x				
Texas				x	x		x				
Utah		x					x				

LEGEND

1--Black and Davis

2--Carhart and Chute

3--Fuller, Brownlee, and Baker

4--Dull

5--Henderson

6--Hoadley

7--Millikan and Gale

8--Sears (Essentials of Physics)

9--Tower, Smith, Turton, and Cope

10--Sears (Physics for Secondary Schools)

11--Higgins

- -

*In addition to these books, California also lists special books in electricity, radio, heat, and mechanics as well as a group of laboratory manuals.

@Also include some household physics books.

In selecting the books to be used in this study it was decided to include only those appearing in the preferred list of texts three or more times. This eliminates all but seven of the books since such texts as SEARS; TOWER, SMITH, TURTON, AND COPE; and HIGGINS are apparently not generally accepted as yet. Some of the books found in state preferred lists are technical or household physics rather than general physics. These, of course, have not been included in this study since they obviously are not such that they lend themselves to objective comparisons with other physics books.

The following lists will show the books used as state adopted texts in the various states as well as the group of states which exercise no control over the choice of secondary school science texts.

List of States having BLACK AND DAVIS for the State Adopted Physics Text Book in 1929

1. Kansas
2. South Carolina

List of States having CARHART AND CHUTE for the State Adopted Physics Text Book in 1929

1. Alabama
2. Louisiana

List of States having HOADLEY for the State Adopted Physics text book in 1929

1. Kentucky

List of States having MILLIKAN AND GALE for the State Adopted Physics text book in 1929

1. Florida
2. Mississippi
3. Oklahoma
4. Oregon
5. Virginia

List of States having no state adopted text but using a "preference list" of two or more books

1. California
2. Delaware
3. Indiana
4. North Carolina
5. Tennessee
6. Texas
7. Utah
8. Wyoming

List of States that allow each school to select its own physics text book in 1929

1. Arizona
2. Arkansas
3. Colorado

4. Connecticut

5. Georgia

6. Idaho

7. Illinois

8. Iowa

9. Maine

10. Maryland

11. Massachusetts

12. Michigan

13. Minnesota

14. Missouri

15. Montana

16. Nebraska

17. Nevada

18. New Hampshire

19. New Jersey

20. New Mexico

21. New York

22. North Dakota

23. Ohio

24. Pennsylvania

25. Rhode Island

26. South Dakota

27. Vermont

28. Washington

29. Wisconsin

30. West Virginia

A distribution of texts according to states will follow:

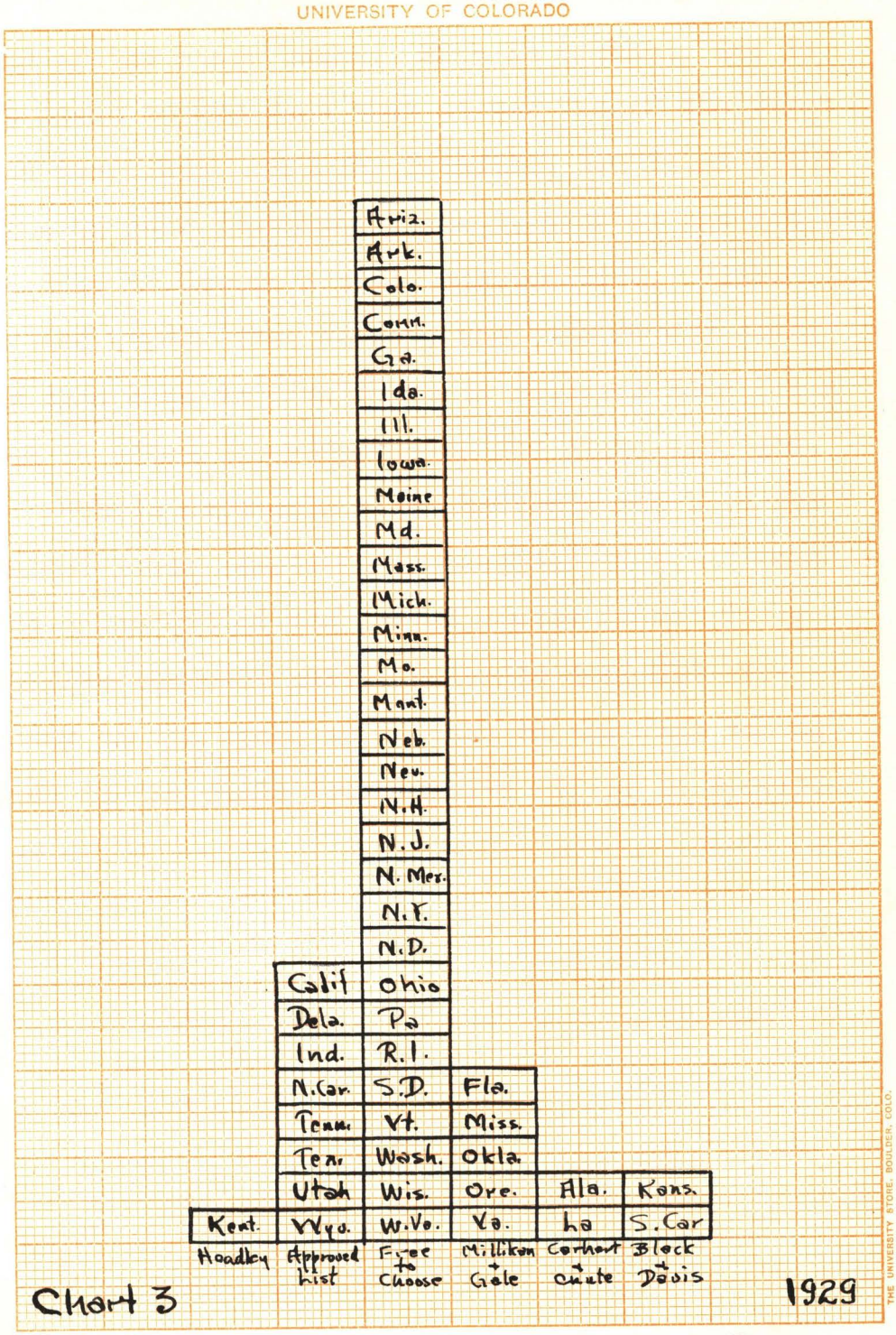
Text Used	No. of States	%
Hoadley	1	2%
Millikan and Gale	5	10%
Carhart and Chute	2	4%
Black and Davis	2	4%
Have Approved List	8	17%
Allow Schools to Select Book	30	63%
	48	100%

Table II

Distribution of Physics Texts by States

A histogram of this distribution is found in Chart 3. A map of the United States which is found in Chart 4 shows that for the most part the northern states are more liberal in allowing their individual schools to select their own books. Georgia and Arkansas are the only southern states which allow perfect freedom of choice whereas practically all of the north central and north eastern states have no state adopted book.

Sixty-three percent of the state departments do not prescribe a physics book or any sort, while seventeen percent or nearly half of the remaining number allow the individual schools to select a book from a list which gives



Distribution of Physics Text Books
According To States

at least a certain amount of freedom. It is interesting to note that more states have adopted MILLIKAN AND GALE than any of the other books. This is probably due in part at least to the fact that it was one of the first texts in the field. FULLER, BROWNLEE, AND BAKER altho appearing in some preferred lists apparently has not as yet had time to become a state adopted book. Since most of the states that do have adoption do not change oftener than once in five years it requires time for a new book to enter the competition for state adoption.

While arguments might be presented both for and against state adoption, in practice it would seem that the e ucators of the United States do not favor the plan for the most part. Colorado does not prescribe any of the books to be used in the high school according to the state department's office in Denver.

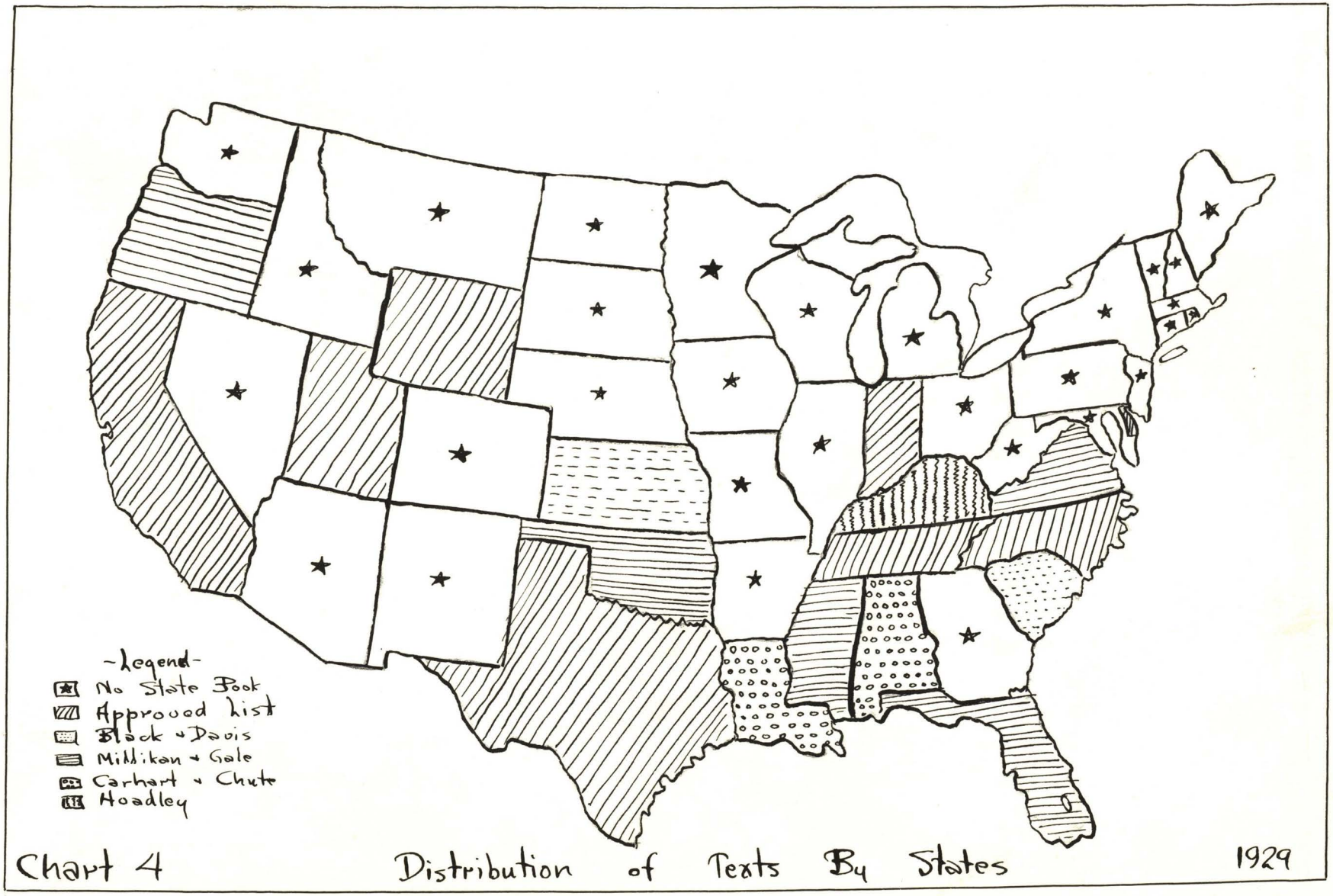


Chart 4 Distribution of Texts By States 1929

C H A P T E R F O U R

SOME OBJECTIVE COMPARISONS OF THE SEVEN BOOKS.

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XXXXX
XXX
X

CHAPTER FOUR

SOME OBJECTIVE COMPARISONS OF THE SEVEN BOOKS

In making objective comparisons of these seven text books perhaps the first thing of interest is their difference in size. FULLER, BROWNLEE, AND BAKER with its 853 pages is easily the largest modern physics book on the market for use in secondary schools. On the opposite end of the scale so far as size is concerned is MILLIKAN AND GALE with 482 pages. The mean of the group is 566.3 pages with the median book having 510 pages.

Quite closely akin to the study of the number of pages to be found in a book is the number of chapters. Here again FULLER, BROWNLEE, AND BAKER leads with a total of thirty-eight while HOADLEY has but eleven chapters. In this connection it might be noted that Colorado's favorite book, MILLIKAN AND GALE, is the median book with twentyone chapters. The mean of the group is 21.4. It is apparent that there is a considerable range in the distribution.

It is contended by the friends of FULLER, BROWNLEE, AND BAKER that their book is more teachable than the average since it contains approximately the same number of chapters as the ordinary school year has weeks which obviously makes it possible for the teacher to cover about a chapter a week. They feel that this would be an advantage and would serve as a check upon the rate of progress needed to cover the text in the year's time.

A table showing the comparison of the number of pages exclusive of indices and appendices follows:

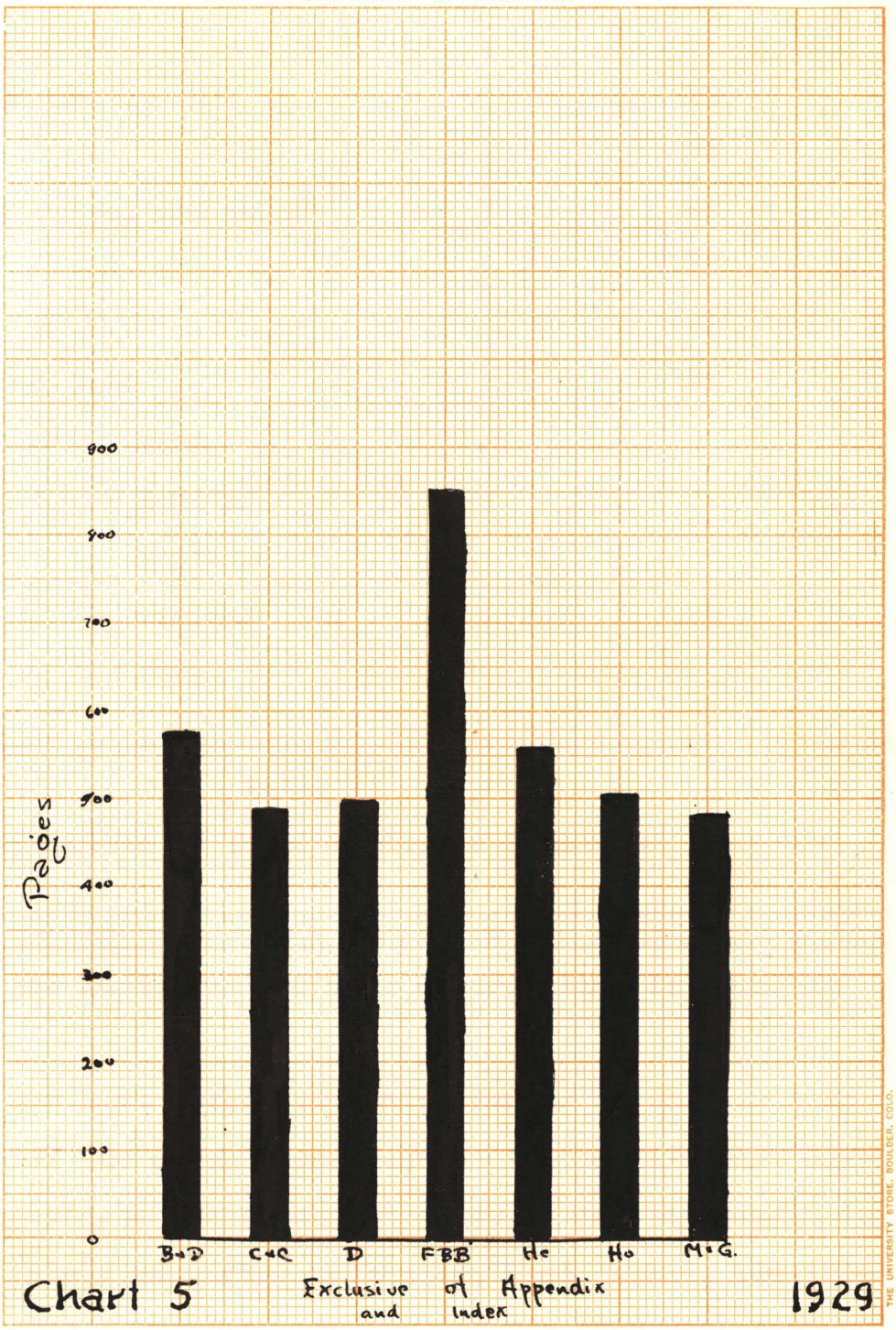
Book	No. of Pages
Black and Davis	572
Carhart and Chute	490
Dull	497
Fuller, Brownlee, and Baker	853
Henderson	560
Hoadley	510
Millikan and Gale	482
Mean	566.3
Median	510
Maximum	853
Minimum	482
Range	371

Table III

Comparison of Total Number of Pages

A histogram of this distribution is found in Chart 5.

A table showing the distribution of the total number of chapters in the seven books follows:



Comparison of Total Number of Pages.

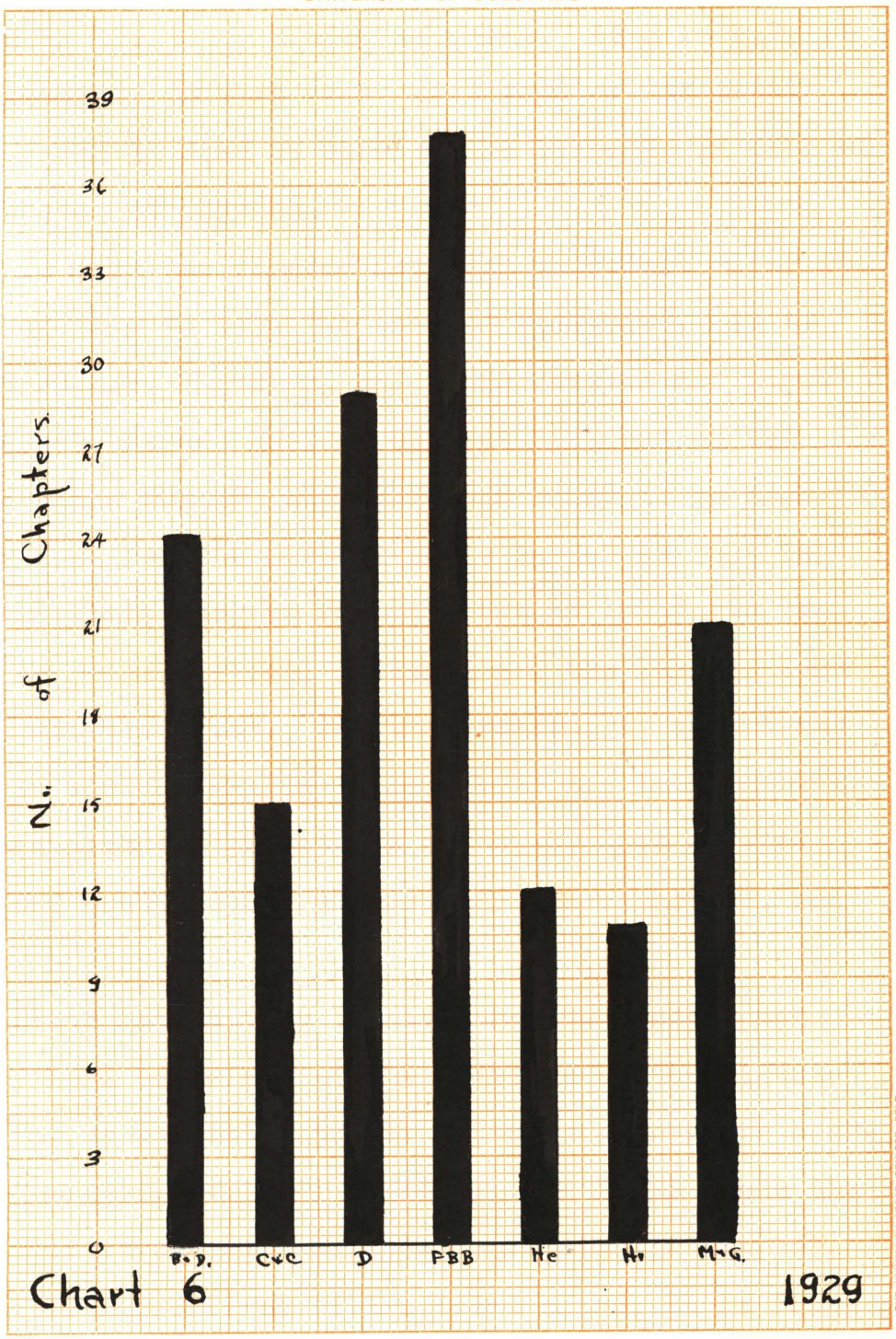
Book	No. of chapters
Black and Davis	24
Carhart and Chute	15
Dull	29
Fuller, Brownlee, and Baker	38
Henderson	12
Hoadley	11
Millikan and Gale	21
Mean	21.4
Median	21
Maximum	38
Minimum	11
Range	27

Table IV

Comparison of Total Number of Chapters

The histogram for this distribution is found in Chart 6.

The next method of comparison is to see how many pages each of the seven books devotes to the different divisions of physics. This subject as it is usually taught is broken up into five parts: mechanics, heat, sound, electricity including magnetism, and light. For this next part of the study, therefore, it is first necessary to find the total number of pages that each of the books gives over to



Comparison of Total Number of Chapters.

each of the five subdivisions. Such a method, however, does not always give the true state of affairs due to the difference in the total number of pages. As a result, it is also necessary to find what percentage of the total number of pages is used by each of the branches in each of the five phases of physics.

To make the reasons for such procedure clear it isnnecessary only to take the case of Mechanics. It is found that FULLER, BROWNLEE, and BAKER devotes 283 pages to the subject whereas HOADLEY has but 182, but on the other hand since FULLER, BROWNLEE, and BAKER is so much larger the base for the percentage is larger so that it is found that this book is devoting but 33.1% of its total space to gears, levers, pulleys, and the like as compared to HOADLEY'S 35.8%. For that reason, it is thought advisable to include graphs to show both the total number of pages and also the percentage of total pages devoted to mechanics, heat, sound, electricity and magnetism, and light.

It is interesting to note that Colorado's two most widely used books are at the extremes of the distribution so far as the total number of pages devoted to mechanics is concerned. FULLER, BROWNLEE, and BAKER leads the field with 283 pages while MILLIKAN and GALE has but 145. Turning to the percentages of the total space, it is found that MILLIKAN and GALE is still lowest with 30.1% of the total space of the revised edition devoted to mechanics.

FULLER, BROWNLEE and BAKER uses 33.1% of the total space on the first branch of the subject.

The general consensus of opinion, it is evident from the texts themselves seems to be that mechanics should occupy about one-third of the year's work in physics. This suggests another problem that might be worked out at a later date, namely, "What fraction of the entire year's work is devoted to teaching mechanics in the high schools of the state?" In this connection, the term work would for the most part be taken to mean the amount of time given to the subject. An attempt was made in connection with this study to gather some data on that problem but the data were not considered reliable due to factors which will be mentioned later.

The following table will show the number of pages devoted to mechanics in each of the seven books:

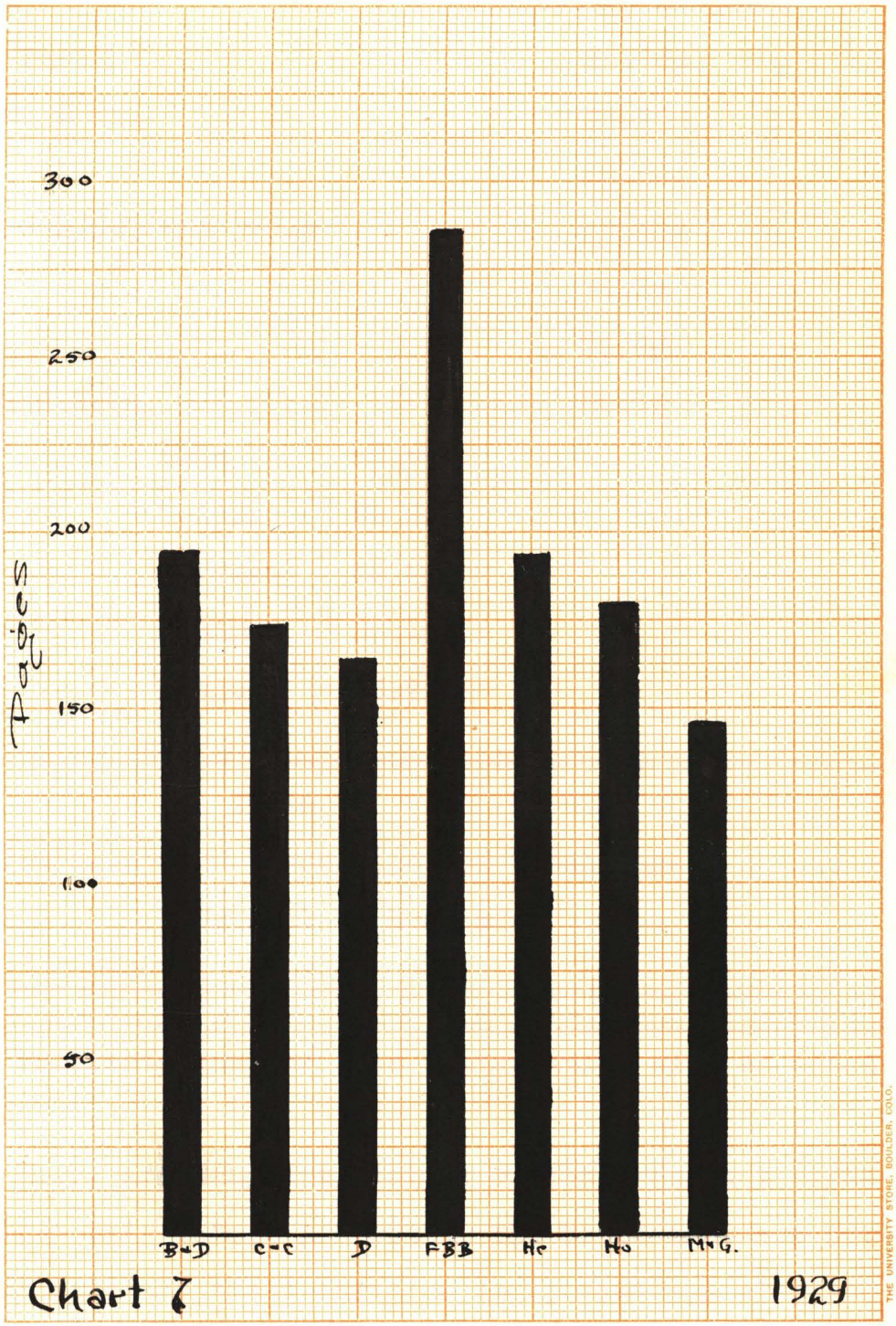
Book	No. of Pages
Black and Davis	193
Carhart and Chute	175
Dull	168
Fuller, Brownlee, and Baker	283
Henderson	192
Hoadley	182
Millikan and Gale	145
Mean	191.1
Median	182
Maximum	283
Minimum	145
Range	138

Table V

Comparison of Number of Pages Devoted to Mechanics

The histogram that accompaniestthis distribution is to be found in Chart 7.

The following table will show the comparisons of the percentages of the total number of pages devoted to mechanics in each of the seven books examined:



Comparison of Number of Pages Devoted To MECHANICS

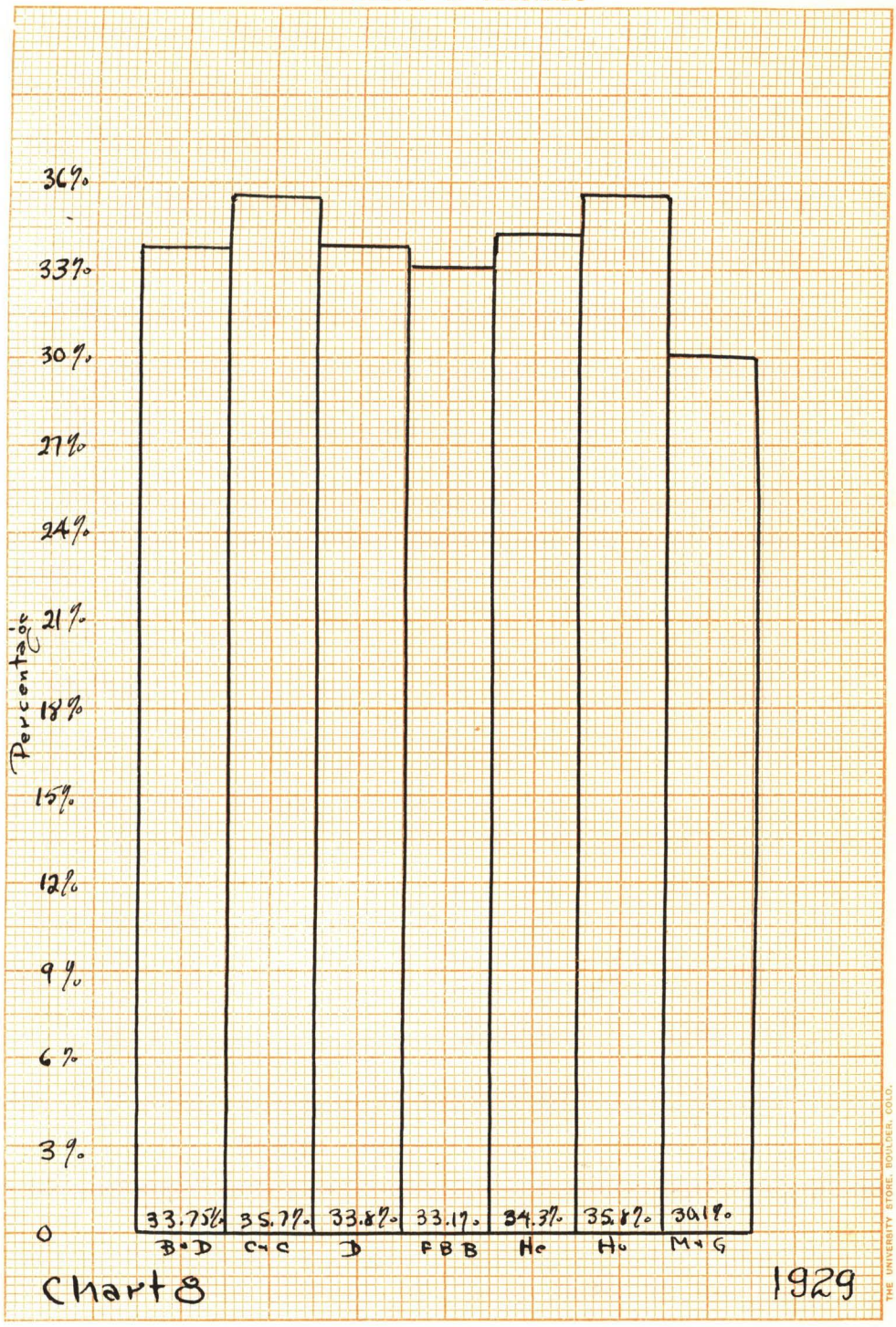
Book	Percentage of Total
Black and Davis	33.75%
Carhart and Chute	35.70%
Dull	33.80%
Fuller, Brownlee, and Baker	33.10%
Henderson	34.3%
Hoadley	35.8%
Millikan and Gale	30.1%
Mean	33.79%
Median	33.85%
Maximum	35.8%
Minimum	30.1%
Range	5.7%

Table VI

Comparison of Percentages of Total Pages Devoted to Mechanics

The histogram for this distribution will be found in Chart 8.

There are many interesting conjectures that might be drawn from this data. Apparently the books that are popular in Colorado are those having a low percentage of space devoted to mechanics. HOADLEY, HENDERSON, and CARHART AND CHUTE all of which are high in this percentage are not



Comparison of Percentage of Pages Devoted To Mechanics

very widely used in the state at the present time. (1929)

Turning to the subject of heat which is usually the second branch of physics to be studied, it is found that FULLER, BROWNLEE, and BAKER once more are in the lead so far as the total number of pages is concerned with CARHART and CHUTE in the lowest position on the page basis. Strangely enough it is found that the relative positions of the two is exactly the same on the percentage basis. The following table will show the number of pages devoted to heat in each of the seven books:

Book	Pages
Black and Davis	87
Carhart and Chute	56
Dull	86
Fuller, Brownlee, and Baker	154
Henderson	71
Hoadley	63
Millikan and Gale	83

Mean	85.7	Maximum	154
Median	83	Minimum	56

Range 98

Table VII

Comparison of Total Number of Pages Devoted to Heat

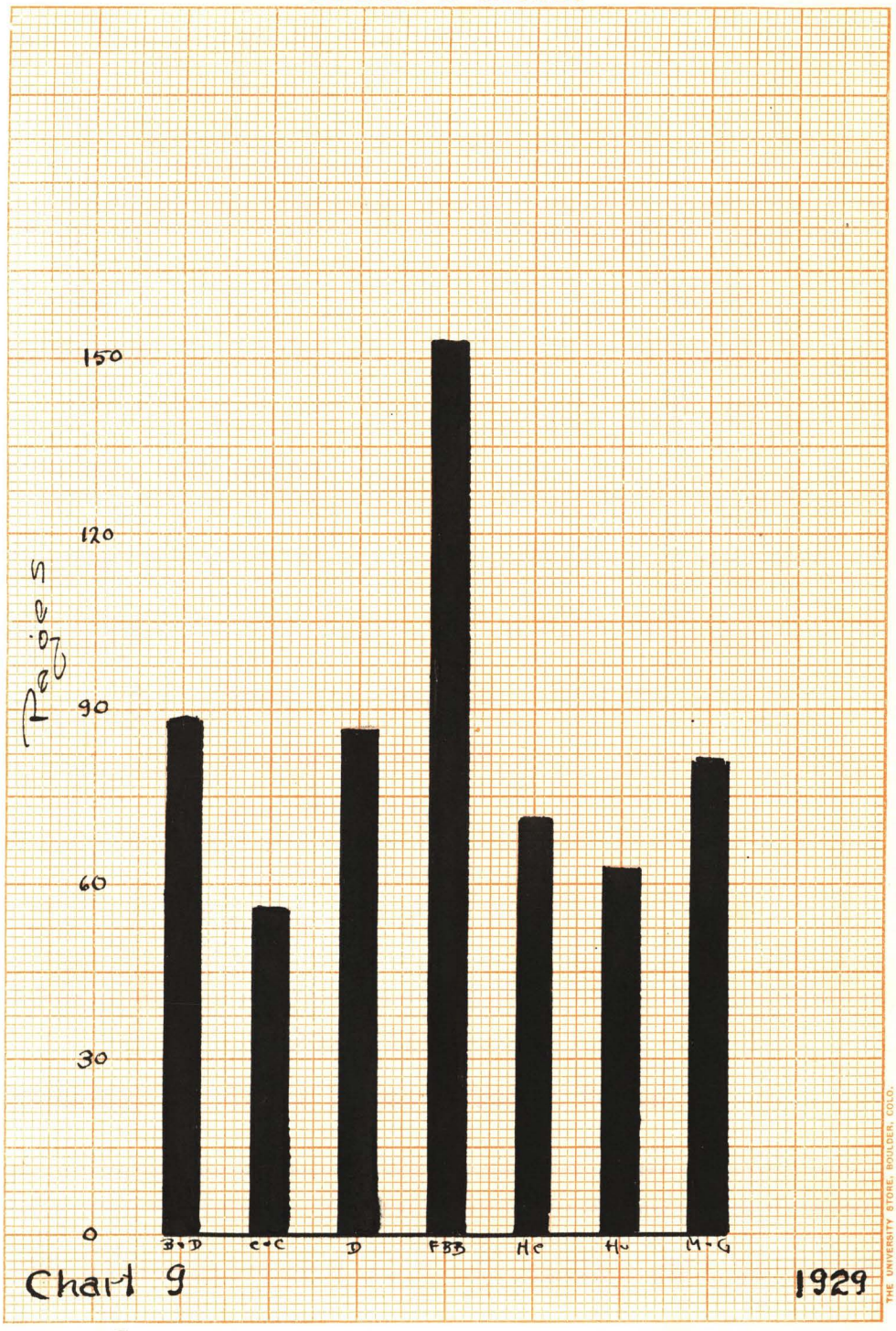


Chart 9 1929

Comparison of Number of Pages Given To HEAT

The histogram for this distribution is found in Chart 9.

The tabulation of the percentage of each of the books devoted to heat follows:

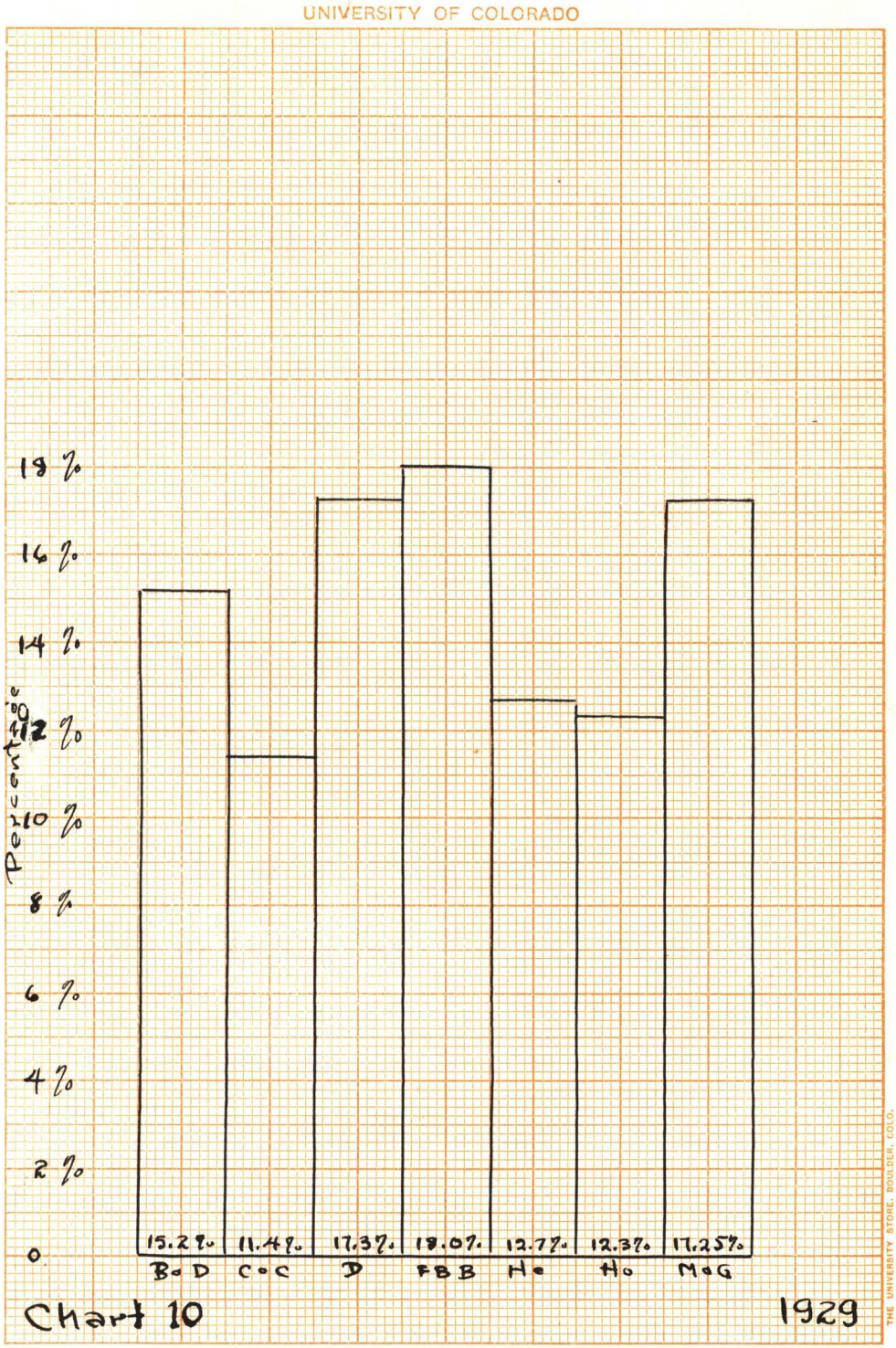
Book	Percentage of Total
Black and Davis	15.2%
Carhart and Chute	11.4%
Dull	17.3%
Fuller, Brownlee, and Baker	18.0%
Henderson	12.7%
Hoadley	12.3%
Millikan and Gale	17.25%
Mean	14.88%
Median	15.25%
Maximum	18.0%
Minimum	11.4%
Range	6.6%

Table VIII

Percentage of Total Pages Devoted to Heat

The histogram for this distribution will be found in Chart 10.

In the field of sound, it is found that HENDERSON and FULLER, BROWNLEE, and BAKER each has 59 pages, the



Comparison of Percentage of Pages Devoted To Heat.

greatest number, while BLACK AND DAVIS and DULL have 36 each, the least number. HENDERSON has by far the largest percentage of the total space devoted to sound while BLACK AND DAVIS gives over less percentage of space to this branch than any of the books studied.

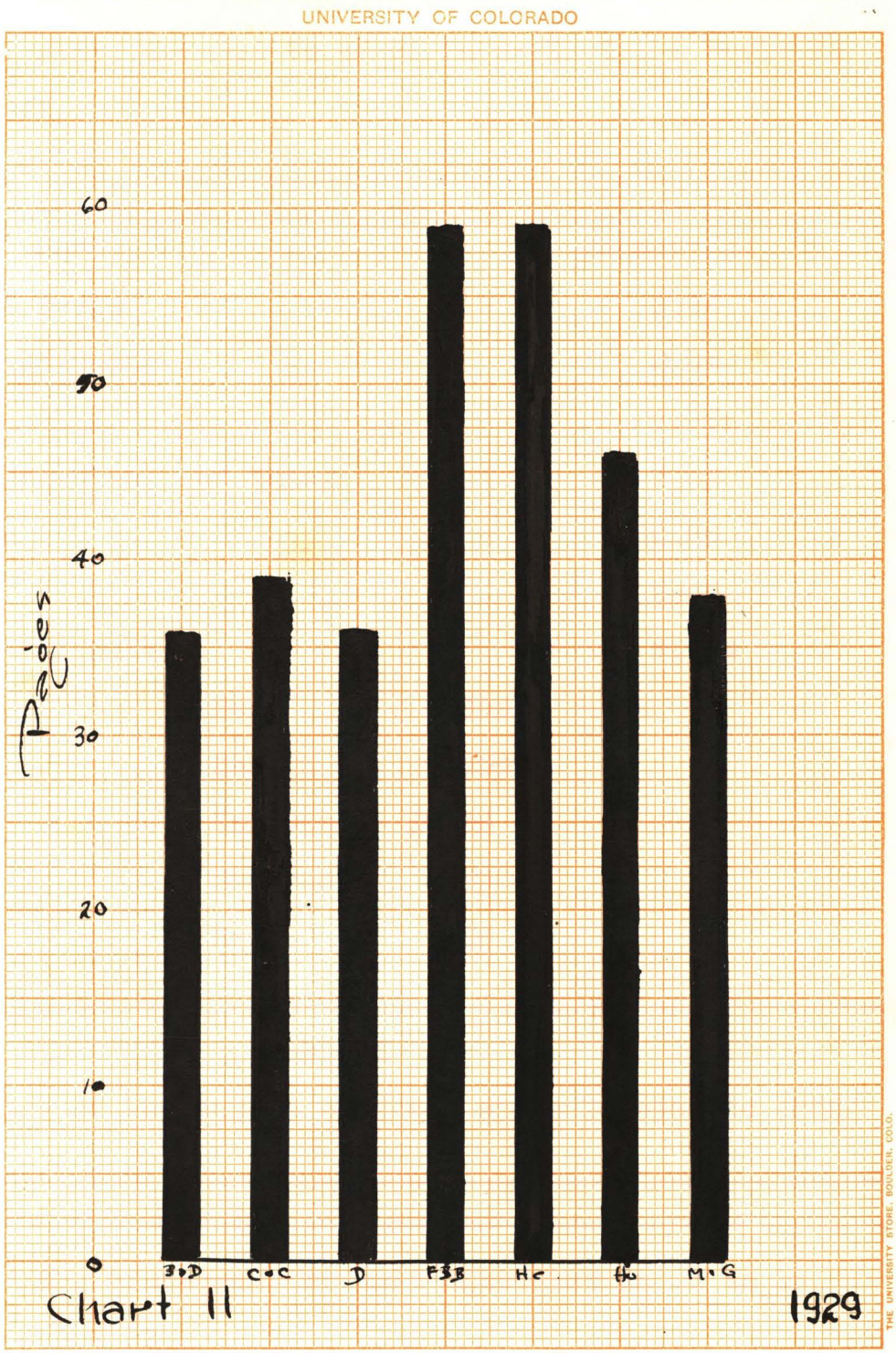
The table showing the relative amount of space devoted to sound in each of the books follows:

Book	Pages
Black and Davis	36
Carhart and Chute	39
Dull	36
Fuller, Brownlee, and Baker	59
Henderson	59
Headley	46
Millikan and Gale	38
Mean	44.7
Median	39
Maximum	59
Minimum	36
Range	23

Table IX

Comparison of Number of Pages Devoted to Sound

The histogram for this distribution will be



Comparison of Number of Pages Devoted To Sound

found in Chart 11.

The table showing the percentages of the total number of pages devoted to sound in each of the books is as follows:

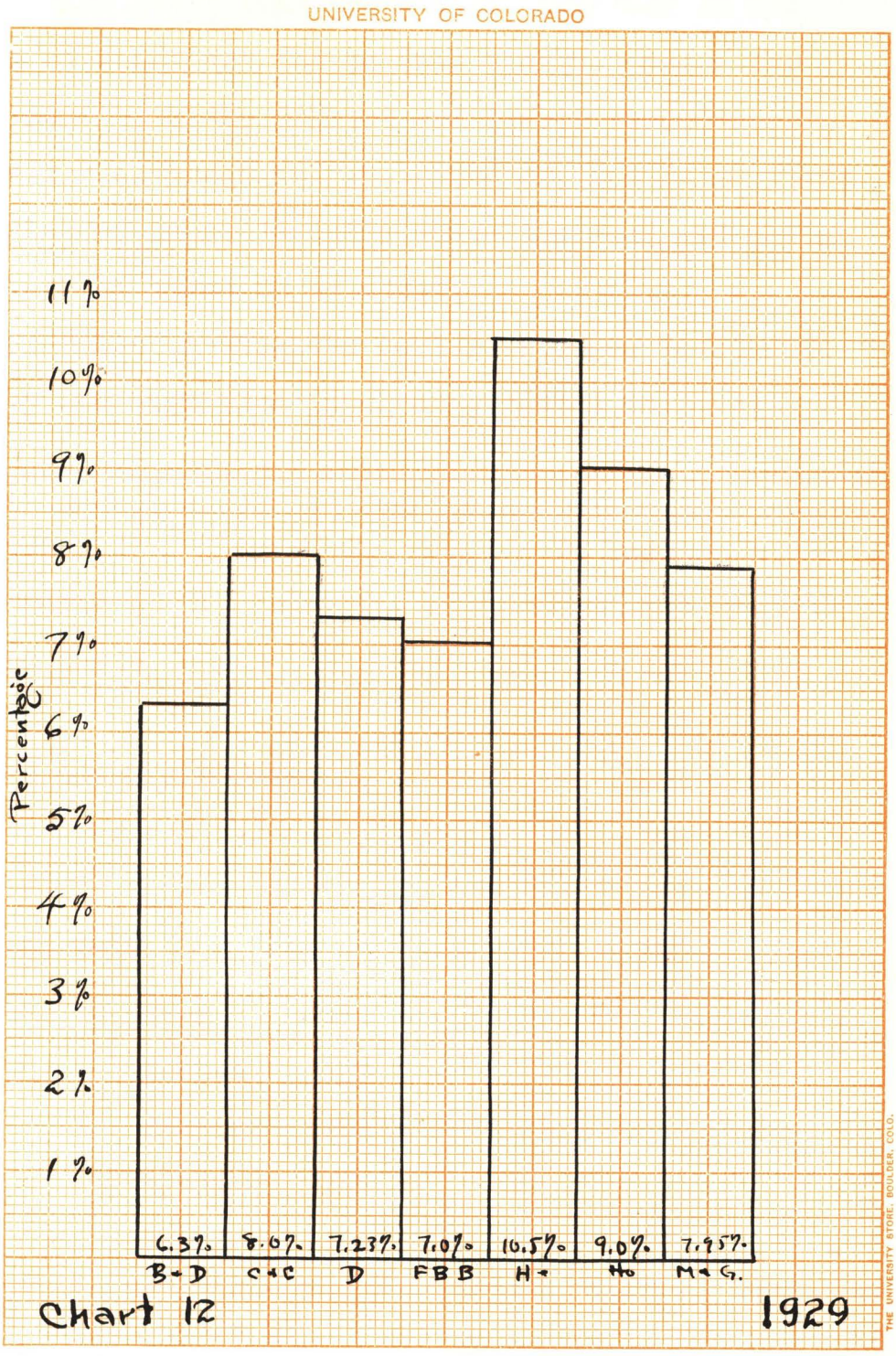
Book	Percentage
Black and Davis	6.3%
Carhart and Chute	8.0%
Dull	7.23%
Fuller, Brownlee, and Baker	7.0%
Henderson	10.5%
Hoadley	9.0%
Millikan and Gale	7.95%
Mean	7.98%
Median	7.95%
Maximum	10.5%
Minimum	6.3%
Range	4.2%

Table X

Comparison of Percentage of Total Space Devoted to Sound

The histogram for this distribution is to be found in Chart 12.

Turning to electricity and magnetism, FULLER, BROWNLEE, and BAKER again leads with 252 pages while DULL



Comparison of Percentage of Pages Devoted To Sound

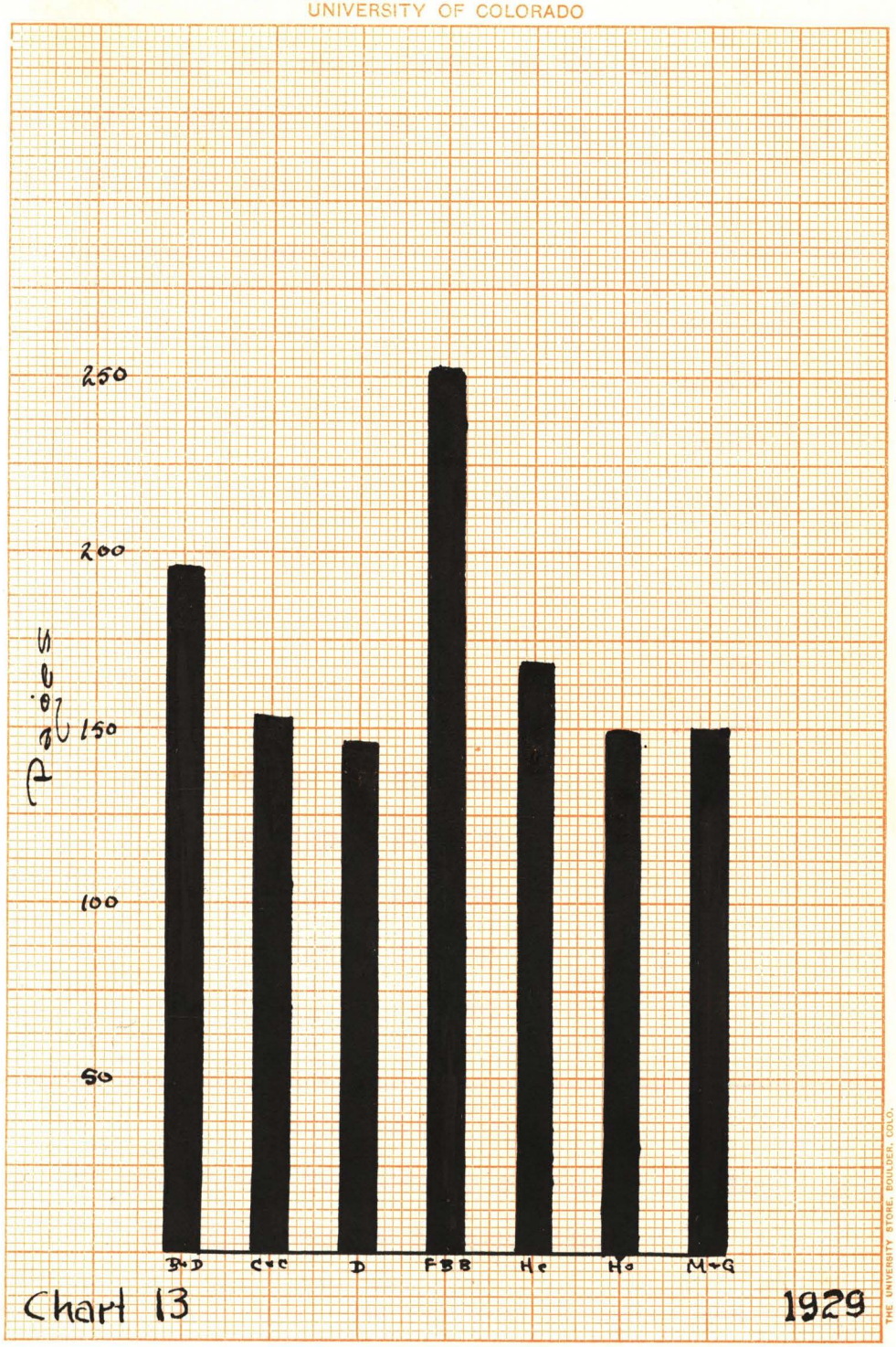
with 143 is the lowest in rank so far as total pages is concerned. The books rank quite close together on the percentage of space devoted to this branch. BLACK AND DAVIS and DULL have the highest and lowest percentages respectively. Although FULLER, BROWNLEE, and BAKER leads in the number of pages it falls below the mean and median in percentage of space it is noted.

The table showing the number of pages devoted to electricity and magnetism (including radio) follows:

Book	Pages
Black and Davis	189
Carhart and Chute	153
Dull	143
Fuller, Brownlee, and Baker	252
Henderson	168
Hoadley	148
Millikan and Gale	150
Mean	172
Median	153
Maximum	252
Minimum	143
Range	109

Table XI

Comparison of Number of Pages Devoted to Electricity and Magnetism



Comparison of Number of Pages Devoted To Electricity & Magnetism.

The histogram for this distribution will be found in Chart 13.

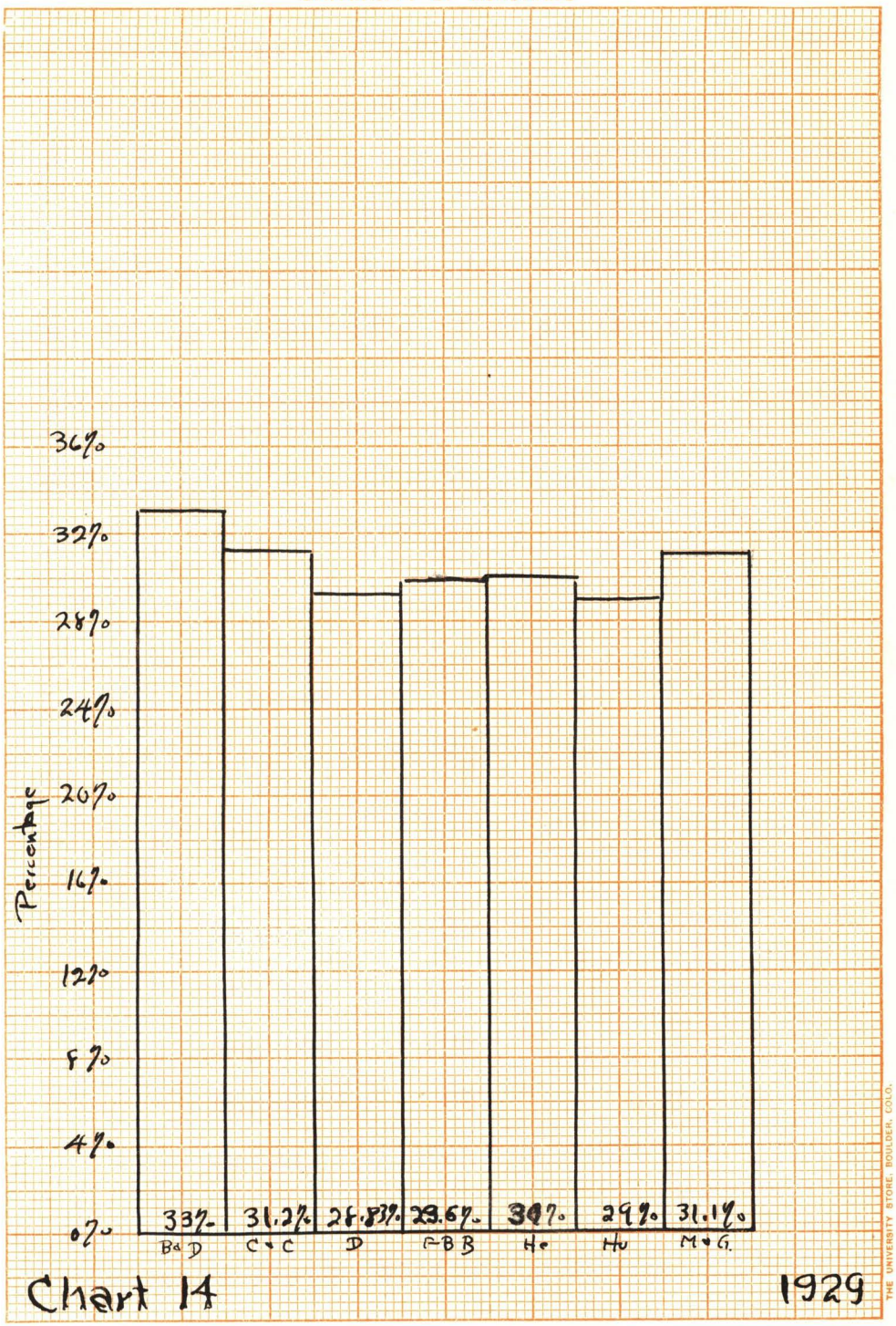
Comparing the seven books on the basis of the percentage this number of pages is of the entire number it is found that the data runs as follows:

Book	Percentage
Black and Davis	33.0%
Carhart and Chute	31.2%
Dull	28.83%
Fuller, Brownlee, and Baker	29.6%
Henderson	30.0%
Hoadley	29.0%
Millikan and Gale	31.1%
Mean	30.39%
Median	30.10%
Maximum	33.00%
Minimum	28.83%
Range	4.17%

Table XII

Comparison of the Percentage of Pages Devoted To Electricity & Magnetism

The histogram for this table will be found in Chart 14.



Comparison of Percentage of Pages Devoted To Electricity and Magnetism.

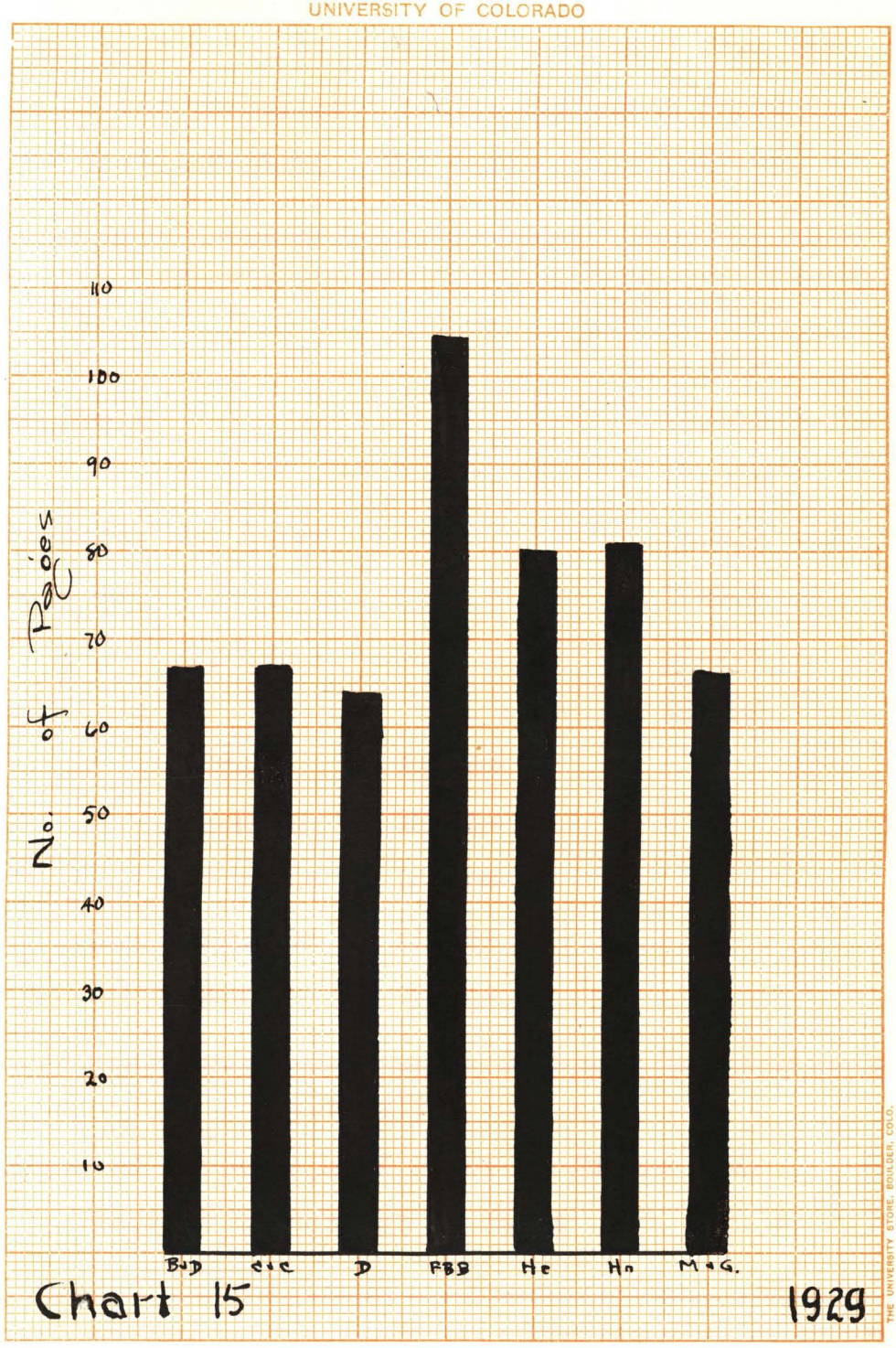
Turning to the field of light, it is found that with the exception of FULLER, BROWNLEE, and BAKER with 105 pages, the other six books cluster closely around the median of 67 pages while DULL with 64 is lowest in point of pages. HOADLEY has a greater percentage devoted to light than any of the others while BLACK AND DAVIS has least.

The table showing the number of pages devoted to light in each of the seven books is as follows:

Book	Pages
Black and Davis	67
Carhart and Chute	67
Dull	64
Fuller, Brownlee, and Baker	105
Henderson	70
Hoadley	71
Millikan and Gale	66
Mean	73
Median	67
Maximum	105
Minimum	64
Range	41

Table XIII

Comparison of Number of Pages Devoted to Light



Comparison of Number of Pages Devoted To Light.

The histogram for this distribution is found in Chart 15.

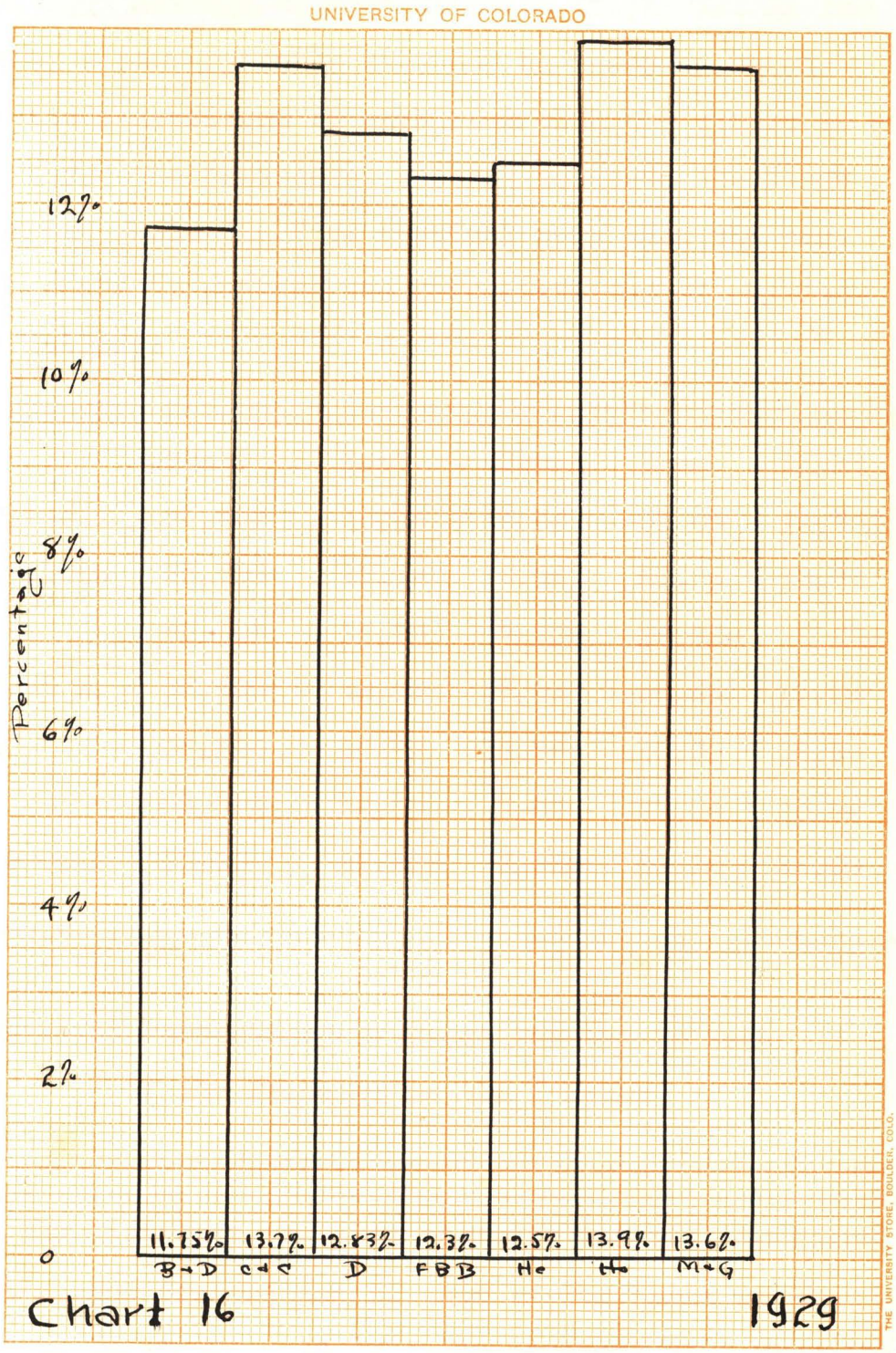
The next table will give in tabulated form the comparisons of the percentages of the different books devoted to the field of light. The table is as follows:

Book	Percentage
Black and Davis	11.75%
Carhart and Chute	13.70%
Dull	12.83%
Fuller, Brownlee, and Baker	12.30%
Henderson	12.50%
Hoadley	13.90%
Millikan and Gale	13.60%
Mean	12.96%
Median	12.85%
Maximum	13.90%
Minimum	11.75%
Range	2.15%

Table XIV

Comparison of Percentage of Pages in Entire Book Devoted to Subject of Light

The histogram for this distribution will be found in Chart 16.



Comparison of Percentage of Pages Devoted To C hight C

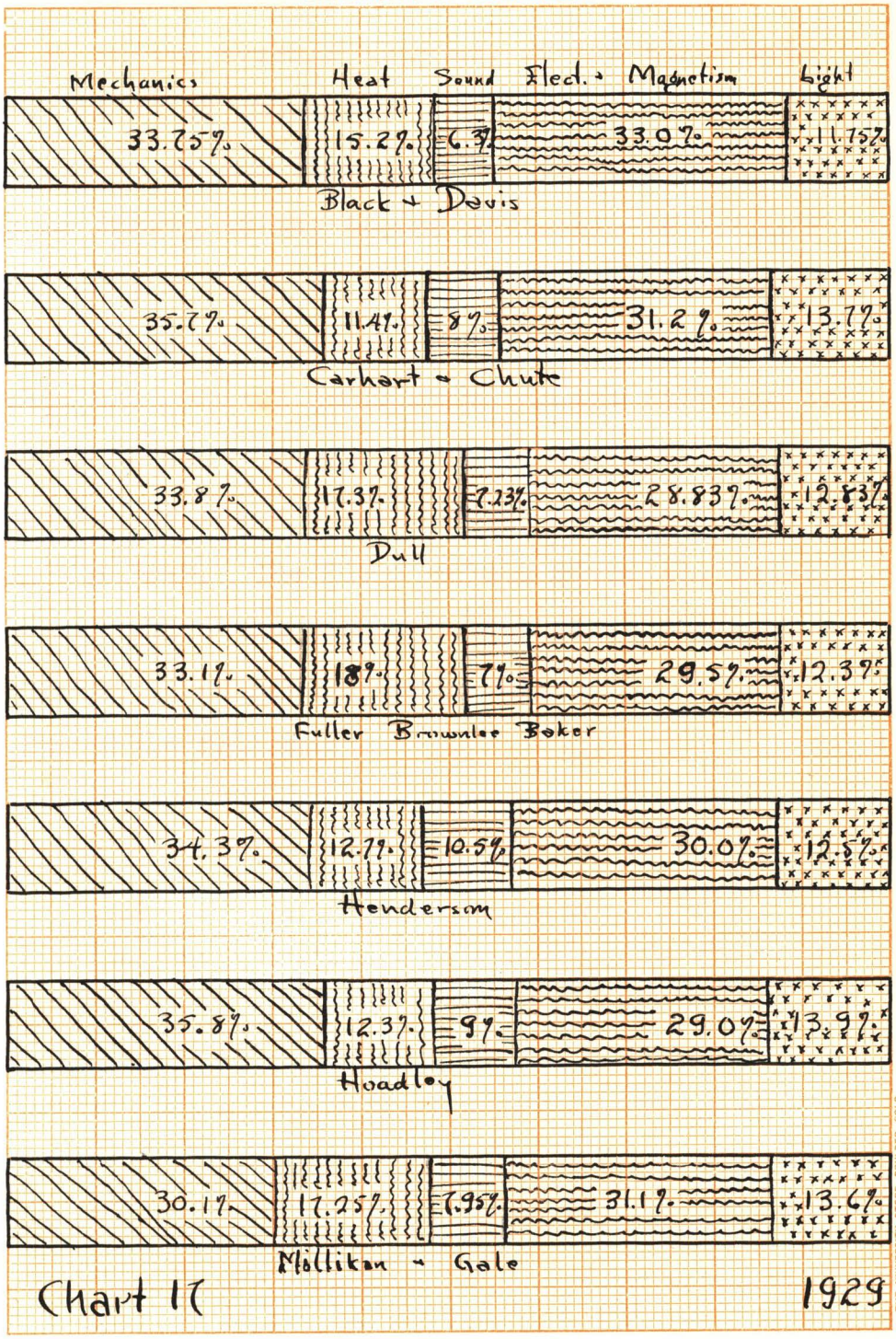
In order to give the reader a sort of a resume of the percentages devoted to each division of physics in the seven books, a summary table will now be included which will show the comparisons of each book with the others in a composite way. The horizontal columns indicate the seven books reviewed while the five vertical rows show the percentage of space in each of the five divisions of physics. The table follows:

Book	Mech.	Heat	Sound	Elec.	Light
Black & Davis	33.75%	15.2%	6.3%	33.0%	11.75%
Carhart & Chute	35.70%	11.4%	8.0%	31.2%	13.7%
Dull	33.80%	17.3%	7.33%	28.83%	12.83%
Fuller, B. & B.	33.10%	18.0%	7.0%	29.6%	12.3%
Henderson	34.30%	12.7%	10.5%	30.0%	12.5%
Hoadley	35.80%	12.3%	9.0%	29.0%	13.9%
Millikan & Gale	30.10%	17.25%	7.95%	31.1%	13.6%

Table XV

Composite Percentages of Space Devoted to Each Of the Branches in the 7 Books

The histogram for this distribution will be found in Chart 17. The composition of each of the books on the 100% basis is indicated. It is quite apparent that from the standpoint of size alone, electricity and magnetism and mechanics are the most important of the five divisions. Using



Composite of Percentage Distribution Of The Seven Books.

the same criteria of size alone, it would seem that sound is the least important of the subjects since less space is devoted to it on the average than any of the other subjects in the field of physics.

Because of the fact that the preface of a book is usually so short, it was deemed advisable to compare the prefaces on the basis of the number of lines rather than on the area or page basis. BLACK AND DAVIS has the longest while CARHART AND CHUTE contains the shortest of the prefaces studied. The following table lists the number of lines in the seven books devoted to this matter of introducing the text. The first column gives the total number of lines while the second column gives the number of lines devoted to acknowledgments only.

The table follows:

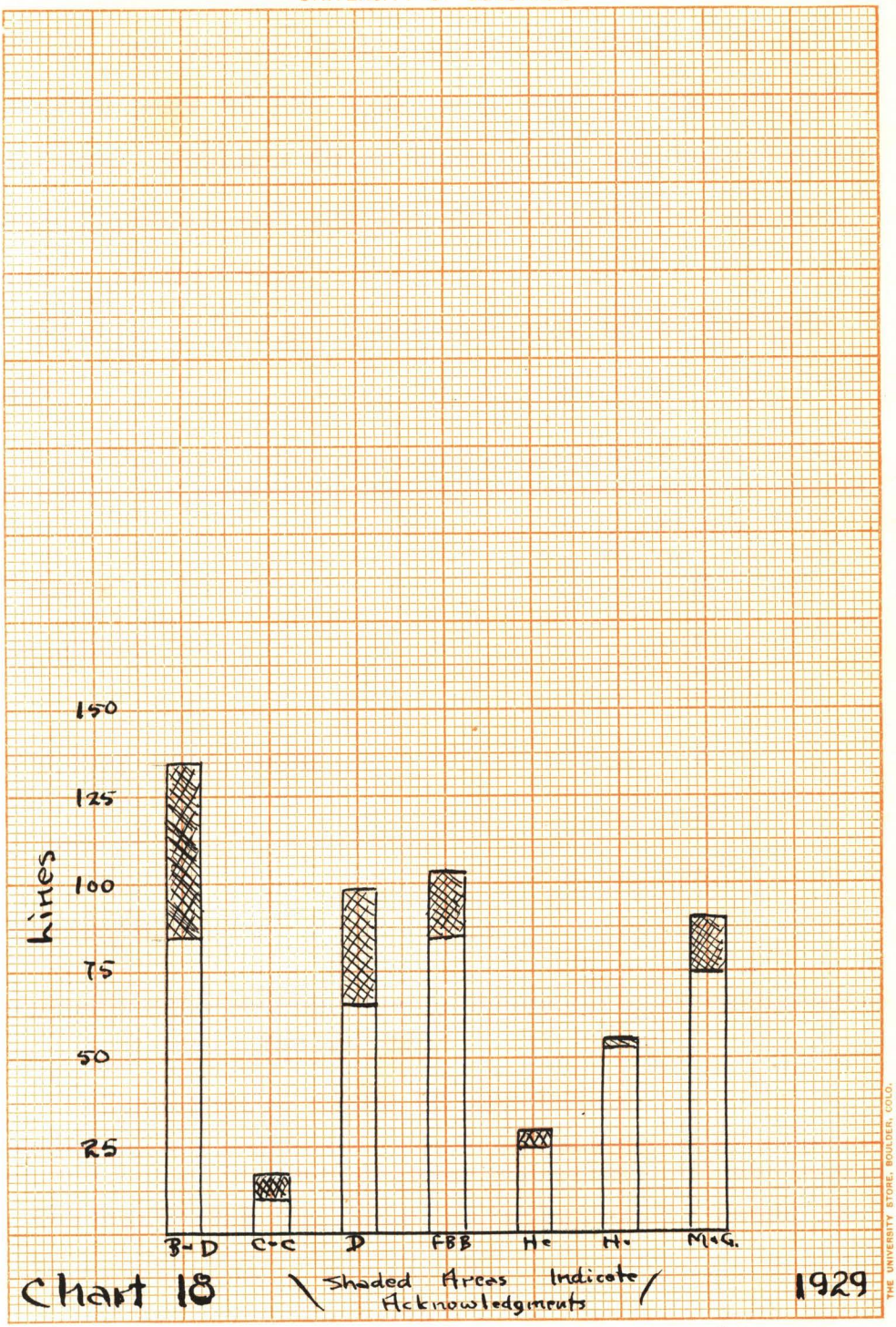
Book	Total Lines	Acknowledgments
Black and Davis	134	50
Carhart and Chute	17	7
Dull	97	32
Fuller, Brownlee, and Baker	104	20
Henderson	30	5
Hoadley	56	3
Milliken and Gale	91	16
Mean	75.57 lines	
Median	91 "	
Maximum	134 "	
Minimum	17 "	
Range	117 "	

Table XVI

Comparison of Number of Lines in the Prefaces

The histogram for this distribution is found in Chart 18.

In comparing the books as to appendices it is found that two of them, BLACK AND DAVIS and HENDERSON contain none at all. MILLIKAN AND GALE devotes 18 pages to an appendix which contains supplementary questions and problems placed in order according to chapters to correspond to the book itself. No tables are included. DULL has a list of formulas and some common tables used in science



Comparison of Number of lines Devoted To The Preface.

work. CARHART AND CHUTE devotes its appendix to some brief principles of geometry and to some tables. FULLER, BROWNLEE, AND BAKER has tables in its appendix while HOADLEY gives over that part of his book to a list of answers for the mathematical problems found throughout the book together with some formulas and concise definitions for some of the commoner physics terms.

The table of the comparative sizes of appendices will follow:

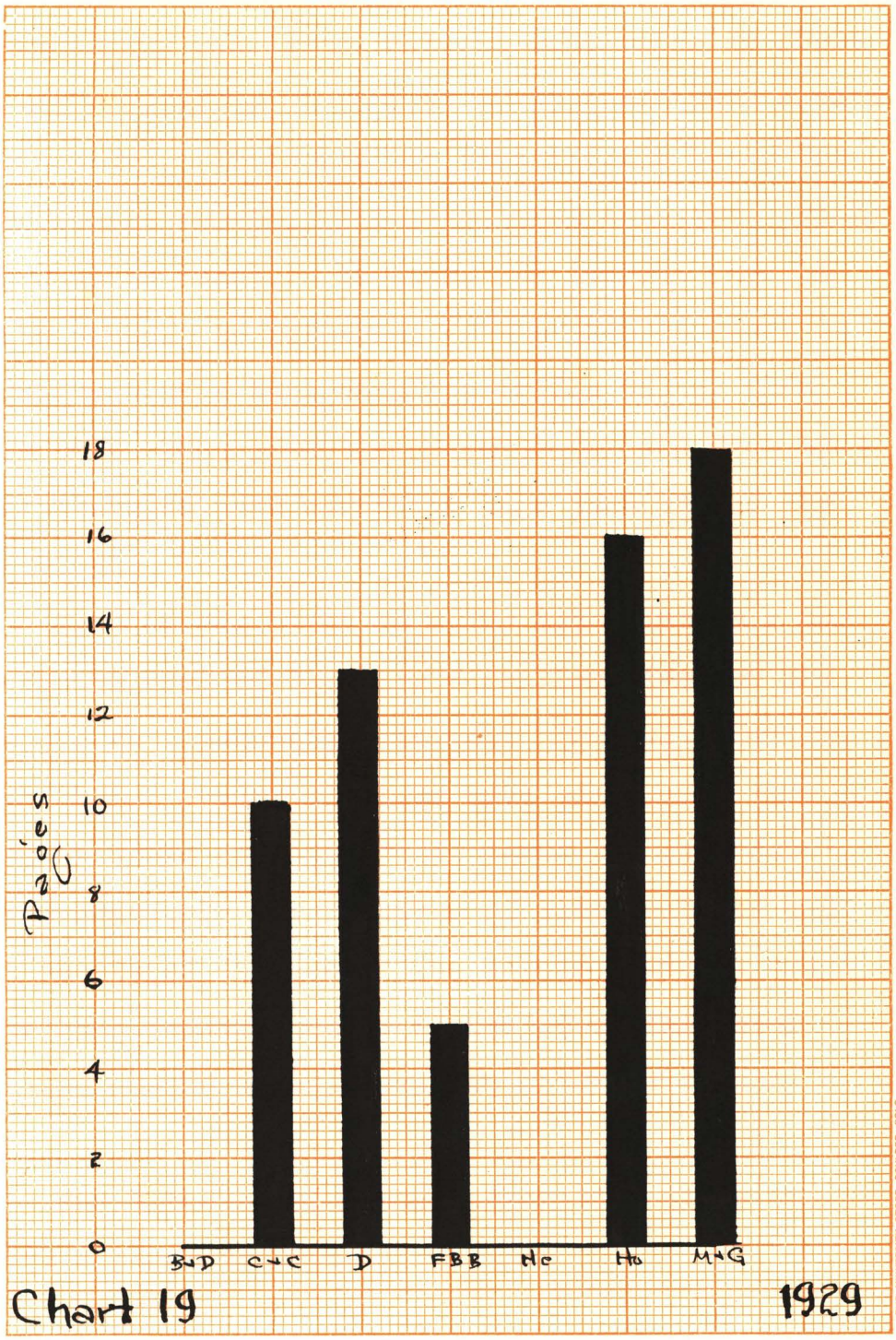
Book	Pages
Black and Davis	0
Carhart and Chute	10
Dull	13
Fuller, Brownlee, and Baker	5
Henderson	0
Hoadley	16
Millikan and Gale	18

Table XVII

Comparative Sizes of Appendices

The histogram for this distribution is found in Chart 19.

The next objective study is on the lengths and widths of the pages used. In this work, only the space actually used in printing and not the full pages including



Comparison of Pages Devoted To An Appendix.

the margins has been recorded. The metric system is used here but the measurements may be converted to the English system by recalling that one centimeter is about the same as two-fifths of an inch or that one inch equals 2.54 centimeters. It is noticed that all the books are quite similar in length, width, and area of pages. MILLIKAN AND GALE is found to be using the largest page of any of the group. By referring to the frontispiece, it is noticed that this book stands a trifle taller than the other six. This probably accounts for the fact that this book averages more words per page than any of the others studied.

Each of the books is using ten-point as a basic type though most of them use a smaller size for the problems and supplementary material. FULLER, BROWNLEE, AND BAKER though having the same area of page as some of the other books averages fewer words per page due to the comparatively large number of illustrations and sketches scattered throughout the volume. One of the strong talking points used by advocates of this book is the large amount of illustrative material it contains.

The table showing the comparative sizes and areas of the pages follows:

Book	Width	Length	Area
Black and Davis	10 cm.	15 cm.	150 sq. cm.
Carhart and Chute	9.5	14.5	137½ "
Dull	9.5	15	142½ "
Fuller, Brownlee, & Baker	9.5	14.5	137½ "
Henderson	10	15	150 "
Hoadley	9.5	14.5	137½ "
Millikan and Gale	10	15.5	155 "

(All measurements given in metric system i. e. centimeters)

Table XVIII

Comparison of Lengths, Widths, and Areas of Pages

The diagram to accompany this table will be found in Chart 20.

The next table will show the comparative number of lines per page in each of the books. It must be remembered that lines are counted on pages where there are no illustrations and where the printer has used the same sized type (10-point) throughout. Here again MILLIKAN AND GALE leads its nearest rival by one line per page and some of them by as much as four lines per page.

The table follows:

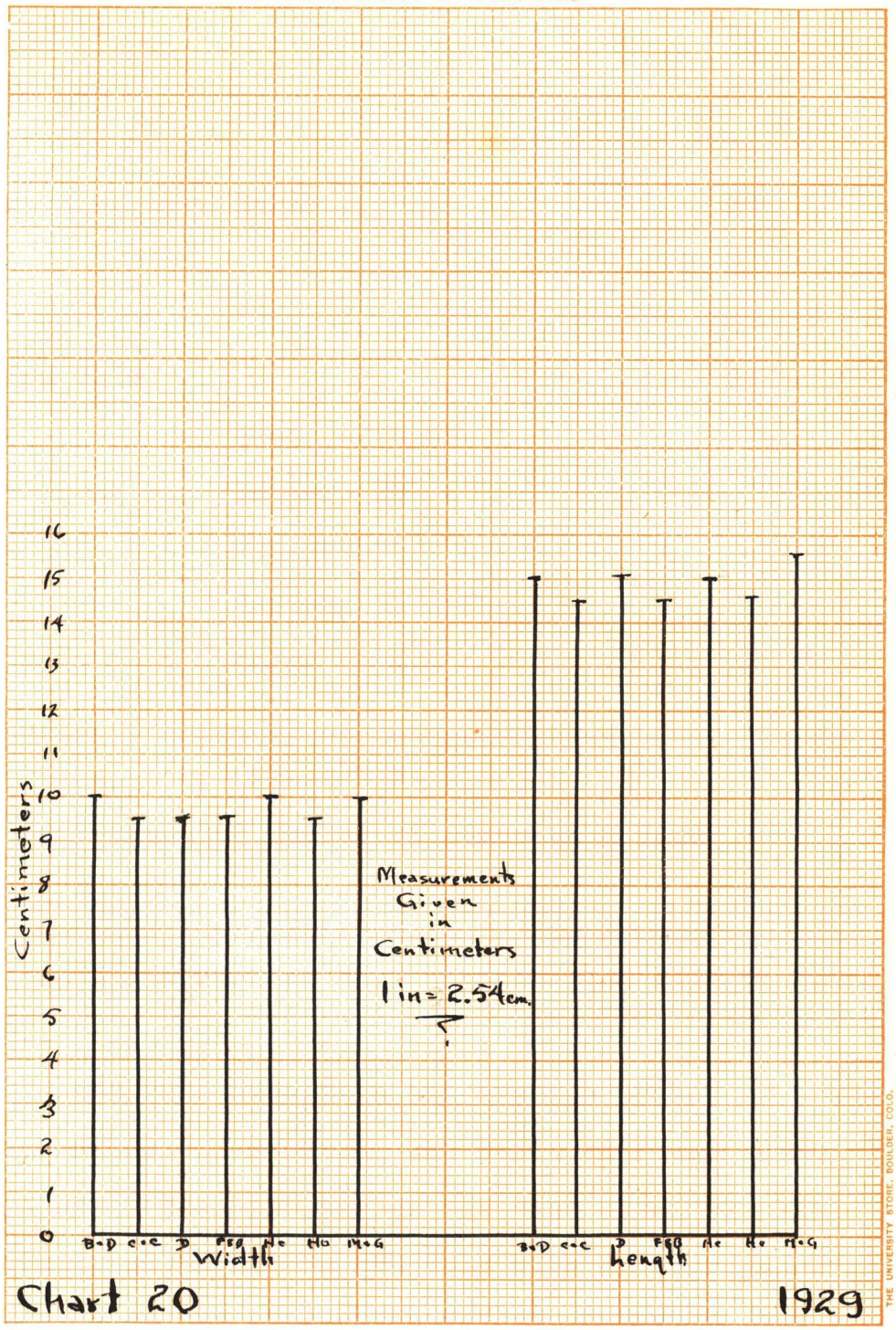


Chart 20 1929

Comparison Of Lengths and Widths Of Printed Matter On The Pages.

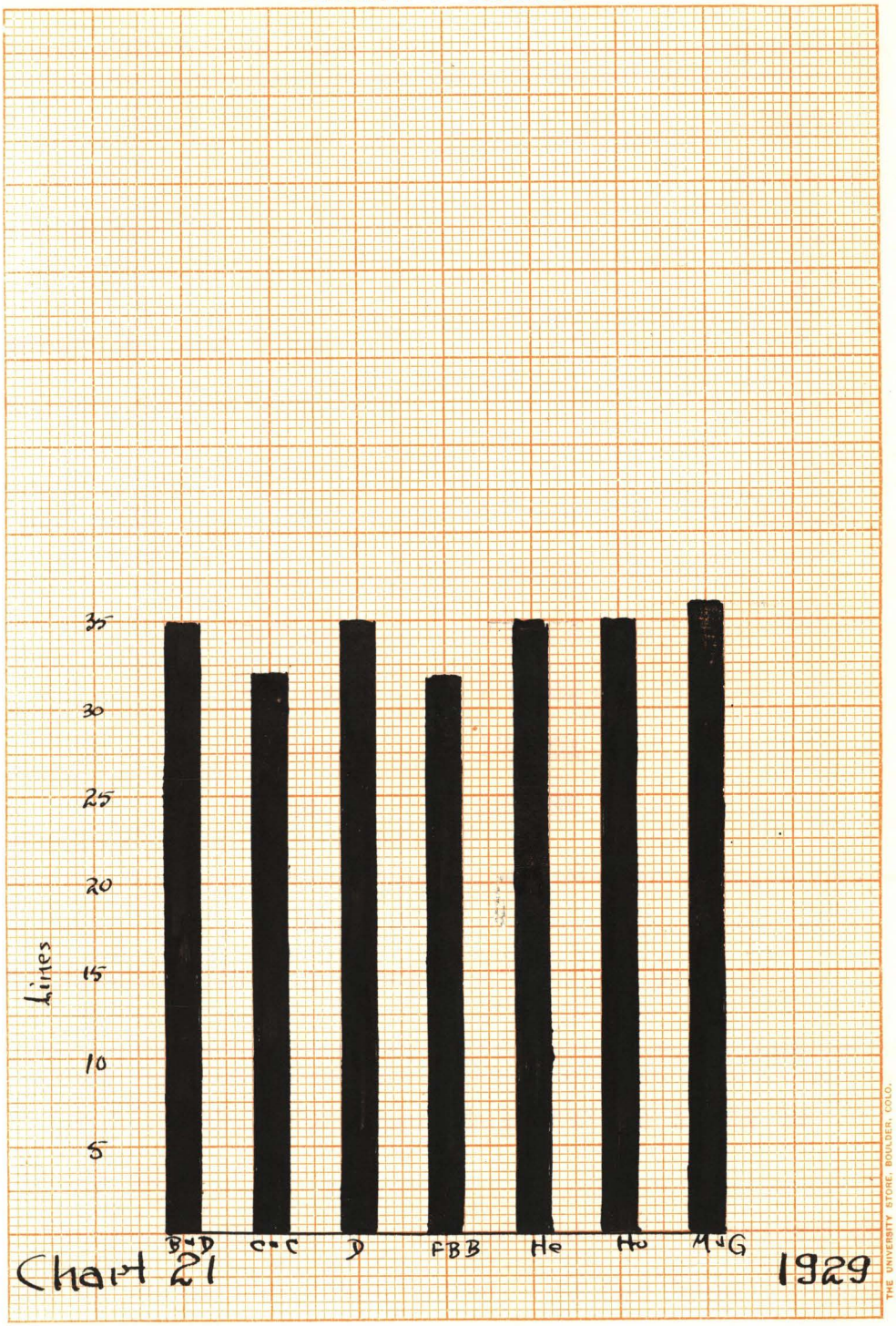
Book	Lines
Black and Davis	35
Carhart and Chute	32
Dull	35
Fuller, Brownlee, and Baker	32
Henderson	35
Hoadley	35
Millikan and Gale	36
Mean	34.28
Median	35
Maximum	36
Minimum	32
Range	4

Table XIX

Comparison of Number of Lines on a Page

The histogram for this distribution will be found in Chart 21.

In order to ascertain the average number of words per page the method of counting the words on every tenth page was resorted to. An average was then obtained. As has been mentioned, MILLIKAN AND GALE with an average of 306.89 words he ds the list while FULLER, BROWNLEE, AND BAKER is lowest in word count with an average of 175.01 words.



Comparison of Number of lines On A Page

The table showing the comparison of the average number of words per page follows:

Book	Words
Black and Davis	298.61
Carhart and Chute	289.41
Dull	235.75
Fuller, Brownlee, and Baker	175.01
Henderson	294.73
Hoadley	268.67
Millikan and Gale	306.89
Mean	267.01
Median	289.41
Maximum	306.89
Minimum	175.01
Range	131.88

Table XX

Comparison of Average Number of Words Per Page

The histogram for this distribution is to be found in Chart 22.

The next part of the comparison will consider the publication dates of the seven texts. As has been pointed out previously, as a general rule, the more recent the text the better since it is more apt to contain the newer

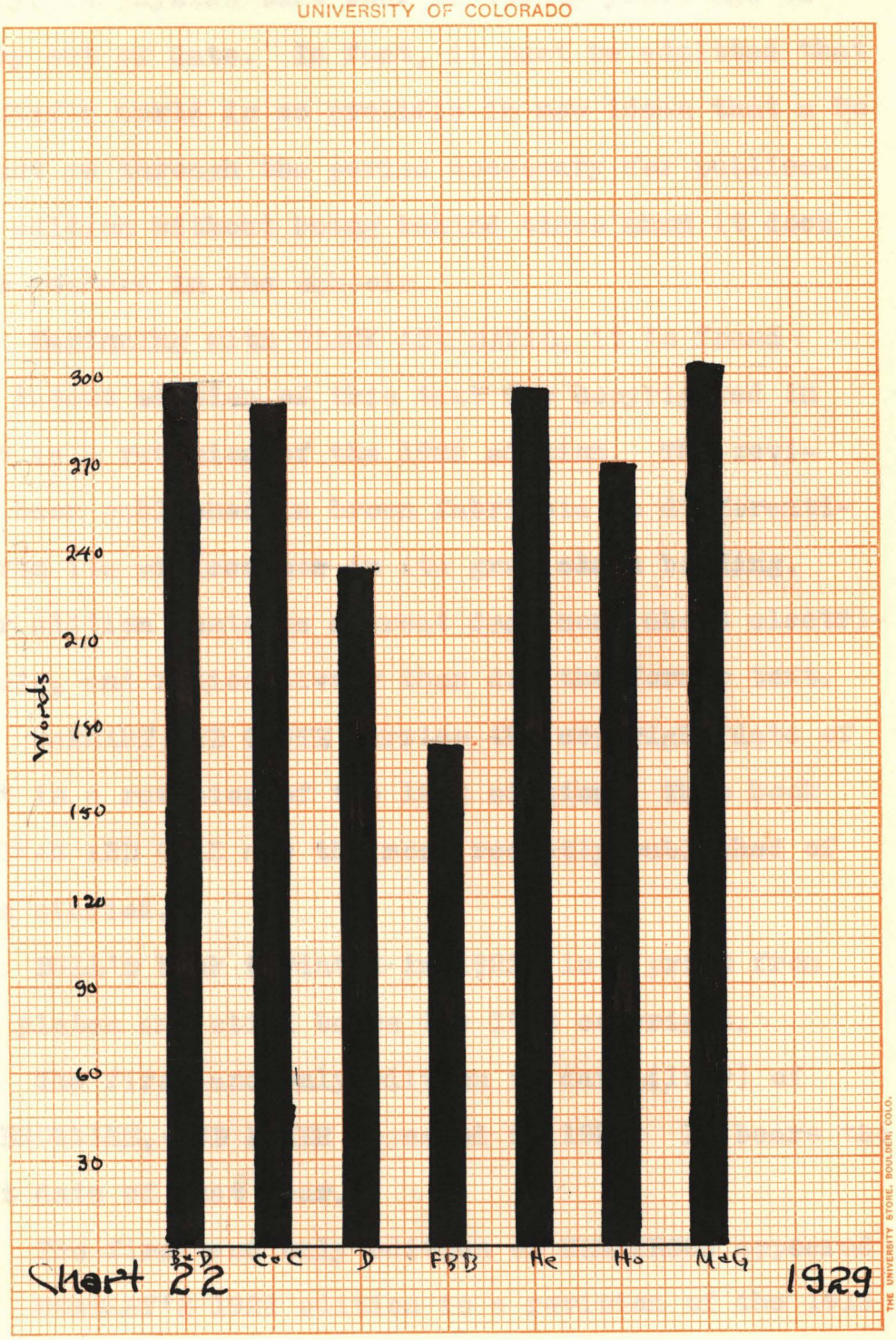


Chart 22 1929

Comparison Of Average Number Of Words On 11 C Page C

discoveries and inventions which are being brought out almost daily. A physics text book of twenty years ago is hopelessly out of date. In fact, it must be admitted that the scientific world is so prolific in new ideas that a bo book cannot go through the period necessary for publication and edition without being behind times when it does reach the readers in the schools.

Beginning with BLACK AND DAVIS, it is found that the latest edition of this text was copyrighted in 1926. It is a revision of the 1922 edition. The revision has been published in brown fabrikoid to differentiate it from its predecessor in its gray cloth binding. The newer edition contains a great deal more about electricity, radio, and radioactivity than did the former text.

CARHART AND CHUTE carries the copyright date of 1927. It is a revision of the 1920 edition. This book and MILLIKAN AND GALE are the most recently published of the books studied.

DULL'S book (printed in 1923) is a print from the 1922 plates and still bears the 1922 copyright.

The first and only edition to date (1929) of FULLER, BROWNLEE, AND BAKER appeared in 1925. It bears the copyright date of that year.

The first and only edition of HENDERSON appeared in 1921. HOADLEY'S 1921 edition is a revision of the 1913 text in which the author has brought the material up to date and much electrical material has been added.

MILLIKAN AND GALE'S "Practical Physics" which appeared in 1922 has been revised and now appears under a new title, "Elements of Physics" The new edition has larger type, more illustrations, and more pages on electricity than its predecessor.

A table showing the most recent edition of each of the seven books follows:

Book	Date
Black and Davis	1926
Carhart and Chute	1927
Dull	1923
Fuller, Brownlee, and Baker	1925
Henderson	1921
Hoadley	1921
Millikan and Gale	1927

Table XXI

Comparison of Most Recent Editions of the Books

The histogram for this distribution is to be found in Chart 23.

MILLIKAN AND GALE has more than twice as many of the full-page illustrations as has its nearest competitor. HENDERSON has limited his book to four full-page pictures as compared with MILLIKAN AND GALE'S ninety-nine. Although

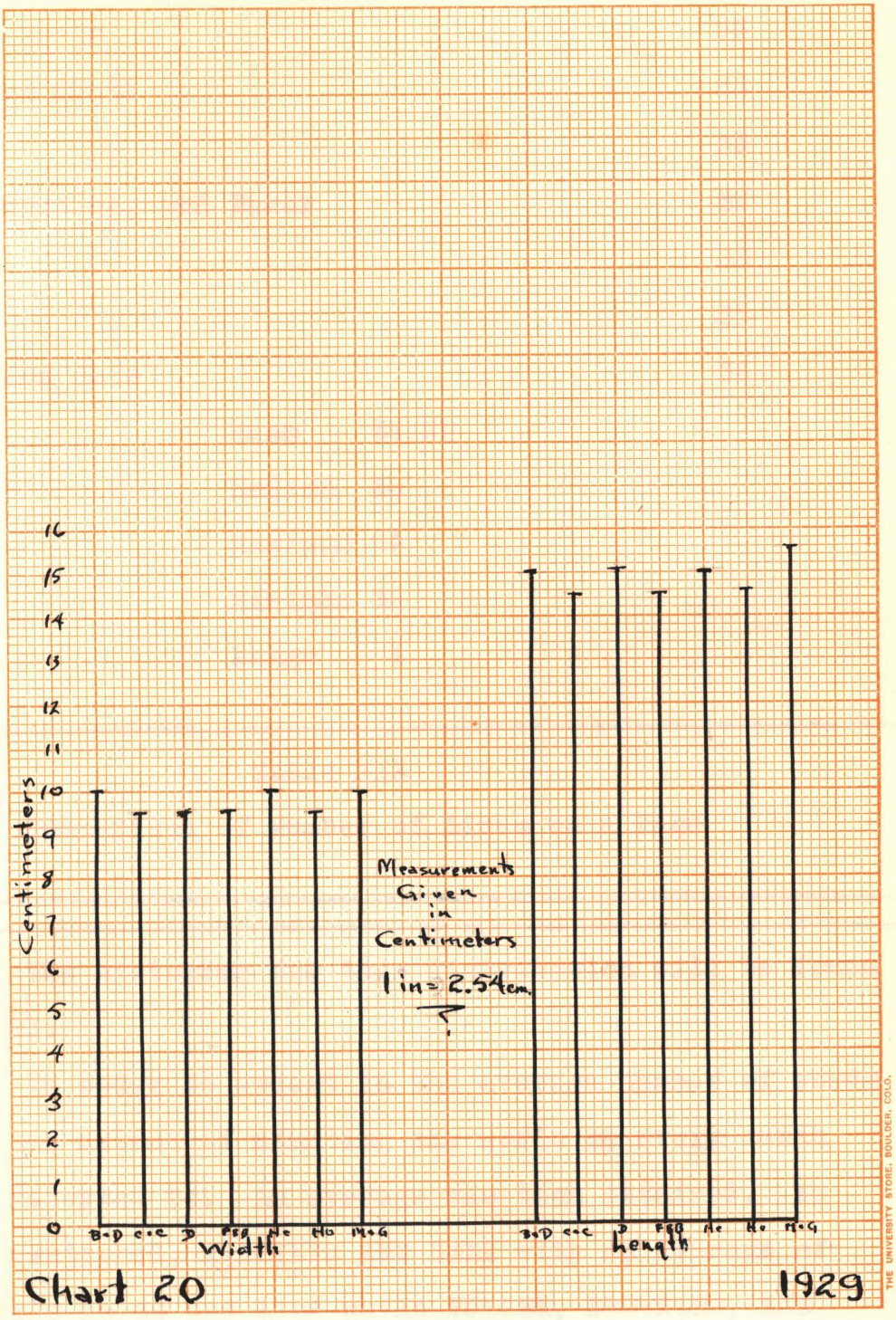


Chart 20

1929

Comparison Of Lengths and Widths Of Printed Matter On The Pages.

FULLER, BROWNLEE, AND BAKER has more illustrative material than any of the books in thisestudy it is found that this book has but twenty-eight pictures which cover an entire page.

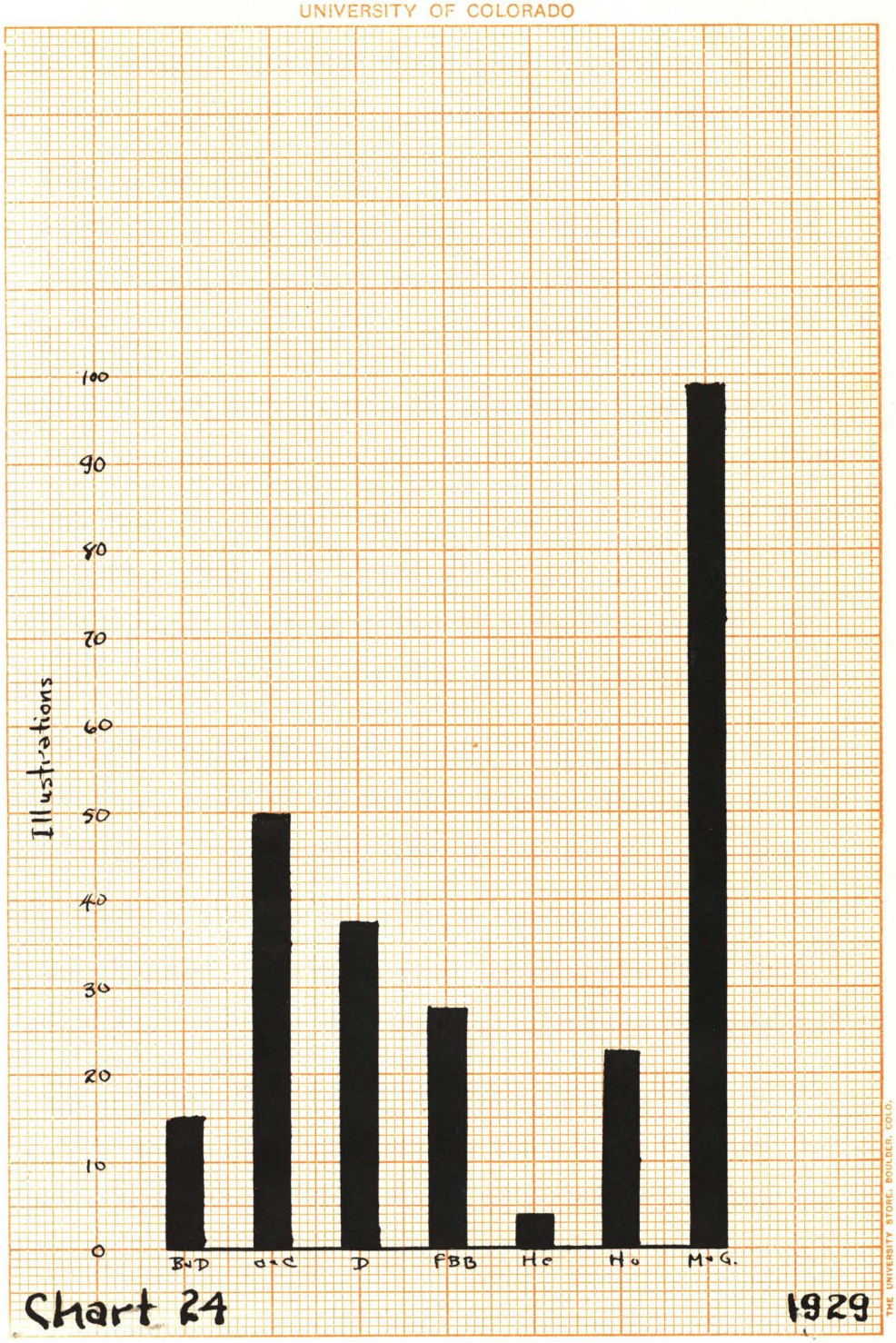
The table showing the comparison between the seven books in regard to full-page illustrations follows:

Book	Full page illustrations
Black and Davis	15
Carhart and Chute	50
Dull	38
Fuller, Brownlee, and Baker	28
Henderson	4
Hoadley	23
Millikan and Gale	99
Mean	36.5
Median	28
Maximum	99
Minimum	4
Range	95

Table XXII

Comparison of number of full-page illustrations

The histogram for this distribution is to be found in Chart 24.



Comparison of Number of Full-Page Illustrations

The next comparison is the percentages of the total area of the printed material devoted to illustrative material. It is necessary for this purpose to go through each of the books and get the measurements of every picture, find the total area, and then calculate the percentage this amount is of the total area or "floor space" of the book. Next, it was necessary to separate the kinds of illustrations into line drawings and half-tones. The next step was to find what part of the half tone cuts were referred to in the context of the book. The rest of them are classed as not referred to. A separation of the biographical pictures from the other kinds was also made.

It is found that CARHART AND CHUTE with 32.1% of the possible space devoted to illustrations leads the other books while BLACK AND DAVIS is lowest in the actual percentage of illustrative material used. It is true, of course, that FULLER, BROWNELL, AND BAKER leads all the books in the actual number of square centimeters of illustrative material used. It is found by measurement that this book contains over 32,000 square centimeters of pictures and line drawings but since it has much more total area due to its size, the percentage of space devoted to pictures falls low enough that both CARHART AND CHUTE as well as MILLIKAN AND GALE are able to surpass it in percentage.

The following table will show two things at the same time. The histograms will show the total area devoted

to printing in each of the books. In addition, the shaded areas of each of the bars indicates the total amount of illustrative material. It is noticed that FULLER, BROWNLEE, AND BAKER has the largest and CARHART AND CHUTE the smallest total area of the seven books studied. It is also evident that FULLER, BROWNLEE, AND BAKER has the greatest amount of picture material while HOADLEY is lowest in this respect.

The table showing this comparison follows:

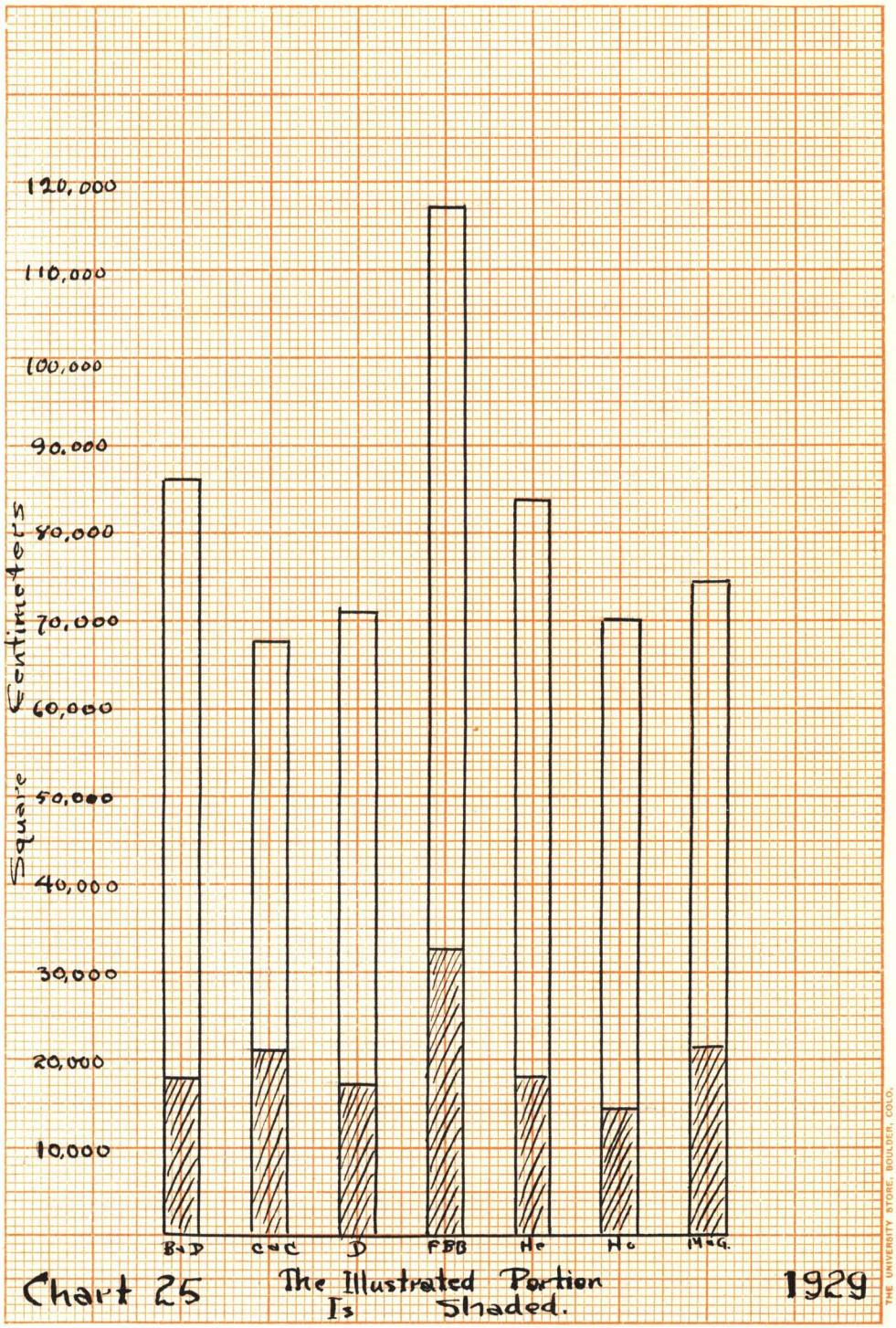
Book	Total area	Picture area
Black and Davis	85,800 sq.cm.	18,083 sq.cm.
Carhart and Chute	67,500 "	21,634 "
Dull	71,100 "	17,543 "
Fuller, Brownlee, & Baker	117,200 "	32,527 "
Henderson	84,000 "	17,924 "
Hoadley	70,400 "	14,897 "
Millikan and Gale	74,600 "	21,159 "

Table XXIII

Table of Total Areas and of Areas of Illustrations in the 7 Books

The histogram for this distribution is found in Chart 25.

In order to show another comparison of this same



Comparison of Total Areas or "Floor Space" And of Illustrated Areas

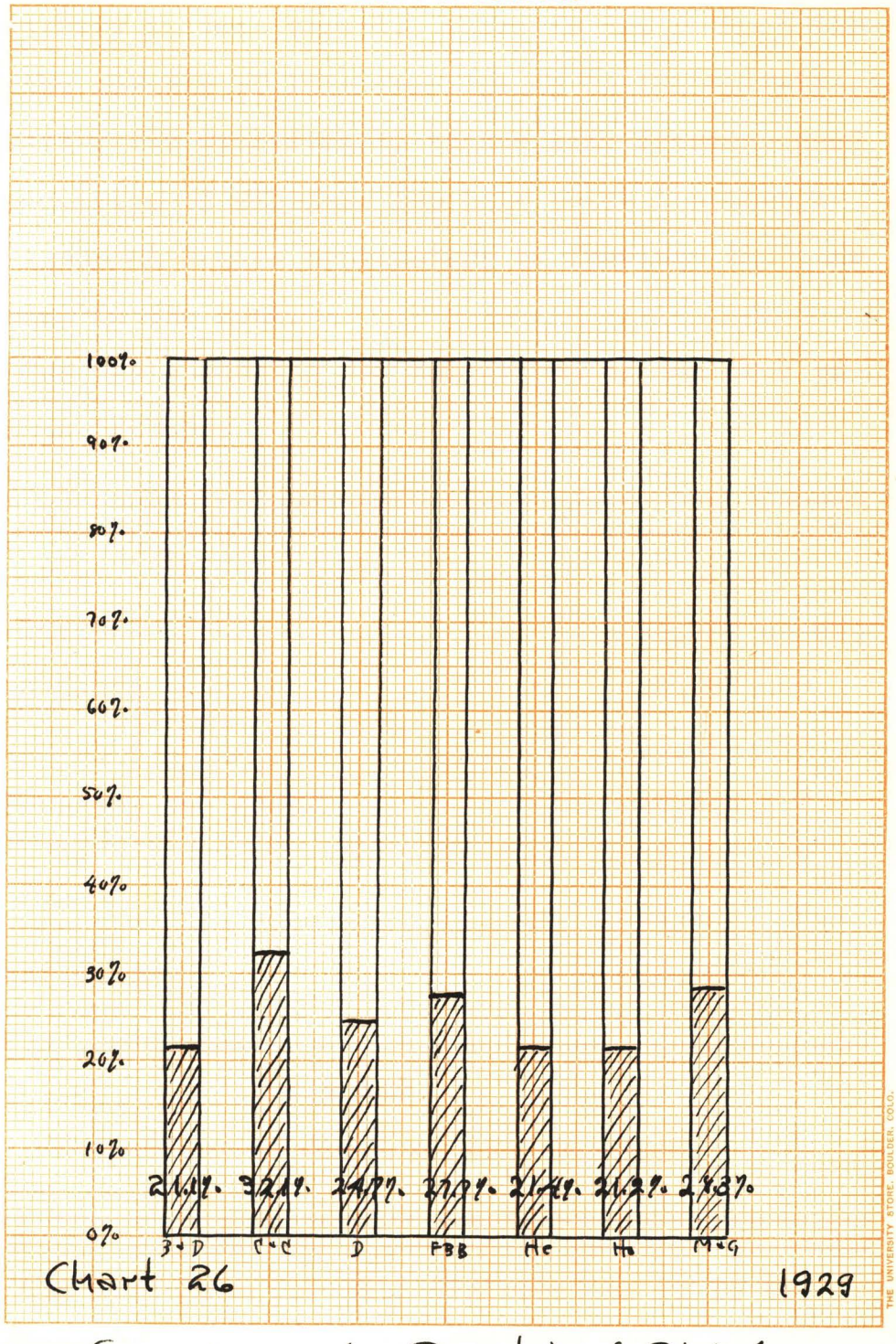
data, the next table will show the percentage of the whole each of the above amounts is when the whole area is called 100%. In this way it is possible to have a method of comparison in which the size of the book does not effect the results as much as in the case where one merely reads the total number of square centimeters devoted to pictures.

Book	% of illustrations
Black and Davis	21.1%
Carhart and Chute	32.1
Dull	24.7
Fuller, Brownlee, and Baker	27.7
Henderson	21.4
Hoadley	21.2
Millikan and Gale	28.3
Mean	25.2%
Median	24.7%
Maximum	32.1%
Minimum	21.1%
Range	11.0%

Table XXIV

Comparison of Total Percentage of Space Devoted to Illustrations

The histogram for this distribution is to be found in Chart 26.



Comparison of Percentage of Total Area Devoted To Illustrations.

Turning next to the subject of line drawings, it is found that BLACK AND DAVIS and DULL are highest and lowest respectively in this regard. There is not so much variation in the amounts of line drawings as in the half-tones. All the books refer specifically to the line drawings used with the exception of MILLIKAN AND GALE which includes over three thousand square centimeters of drawings that are not mentioned in the book.

The table showing the comparison of the area of line drawings follows:

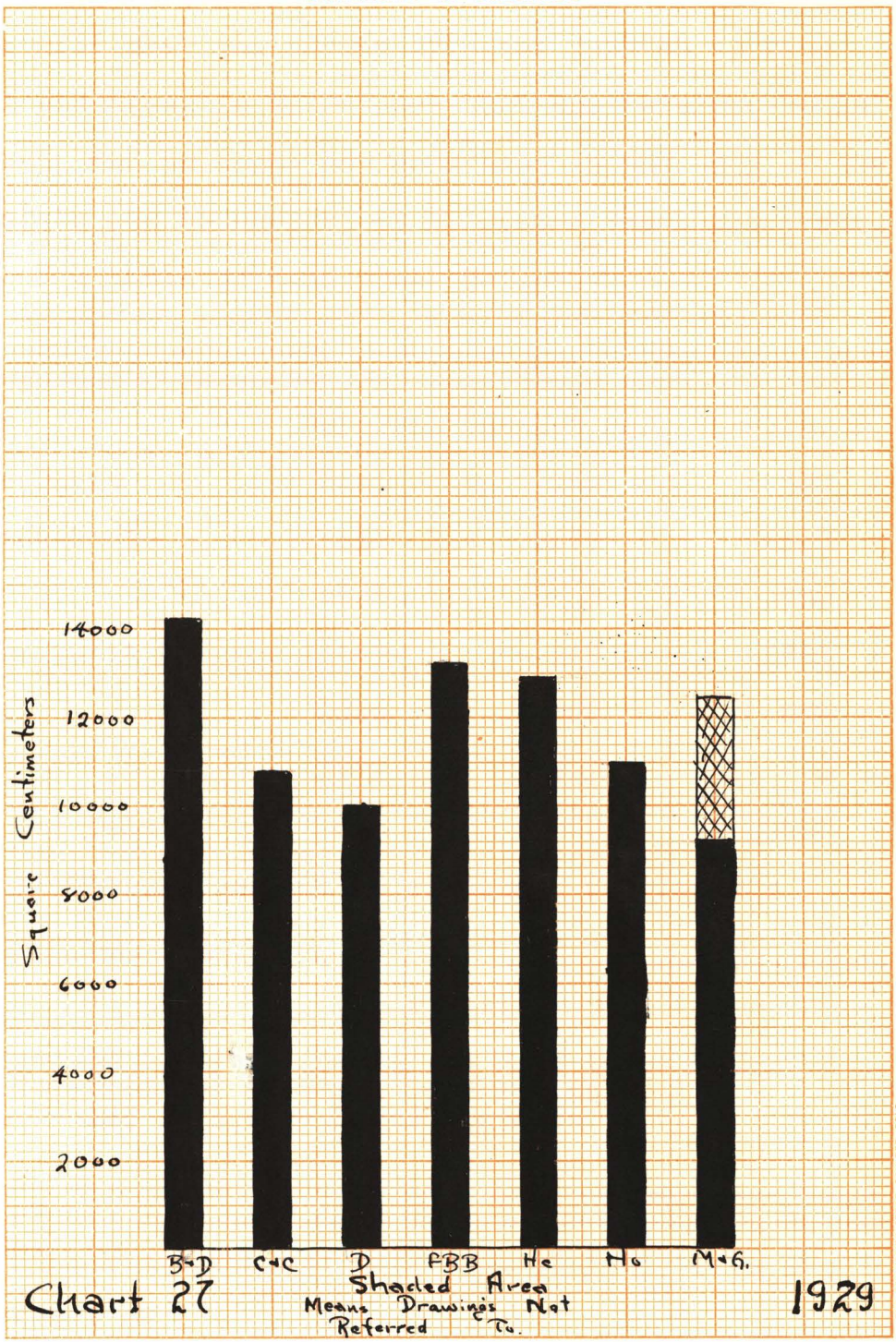
Book	Area
Black and Davis	14,207 sq.cm.
Carhart and Chute	10,877 "
Dull	10,002 "
Fuller, Brownlee, and Baker	13,194 "
Henderson	12,091 "
Hoadley	11,021 "
Millikan and Gale	12,439 "

Table XXV

Comparison of Areas of Line Drawings

The histogram for this distribution is to be found in Chart 27.

It is found that the amount of area devoted to



Comparison of Areas of Line Drawings.

half-tones varies a great deal being the greatest in FULLER, BROWNLEE, AND BAKER and least in HOADLEY. The following table will show the amount of space devoted to biographical pictures, to half-tones that are referred to in the context, and to those not mentioned in the body of the text. Totals can be arrived at by adding the three parts.

The table of half-tones follows:

Book	Referred to	Not ref. to	Bio. P.
Black and Davis	3144	150	582
Carhart and Chute	2468	5679	2610
Dull	5956	0	1585
Fuller, Brownlee & Baker	15649	889	2795
Henderson	4468	300	255
Hoadley	1923	1953	0
Millikan and Gale	315	7800	3830

All Measurements Given in Square Centimeters

Table XXVI

Comparison of Areas devoted to Half-Tones Not Referred To, Of those referred to, And of Biographical Pictures

The histogram for this distribution is to be found in Chart 28.

Turning to biographical pictures themselves, it is found that HOADLEY has not even a one. MILLIKAN AND

GALE, with 36, have more pictures of scientists than any other book studied. It is found that the tendency is to include a brief sketch of the life of the person with the portrait though HENDERSON is an exception. He gives but small pictures, but no biographical material. MILLIKAN AND GALE has eight and DULL ten cases in which they have included nothing besides the scientist's picture and his name.

The table showing the relative number of biographical pictures in the seven books studied follows:

Book	Pictures
Black and Davis	14
Carhart and Chute	24
Dull	24
Fuller, Brownlee, and Baker	20
Henderson	17
Hoadley	0
Millikan and Gale	36

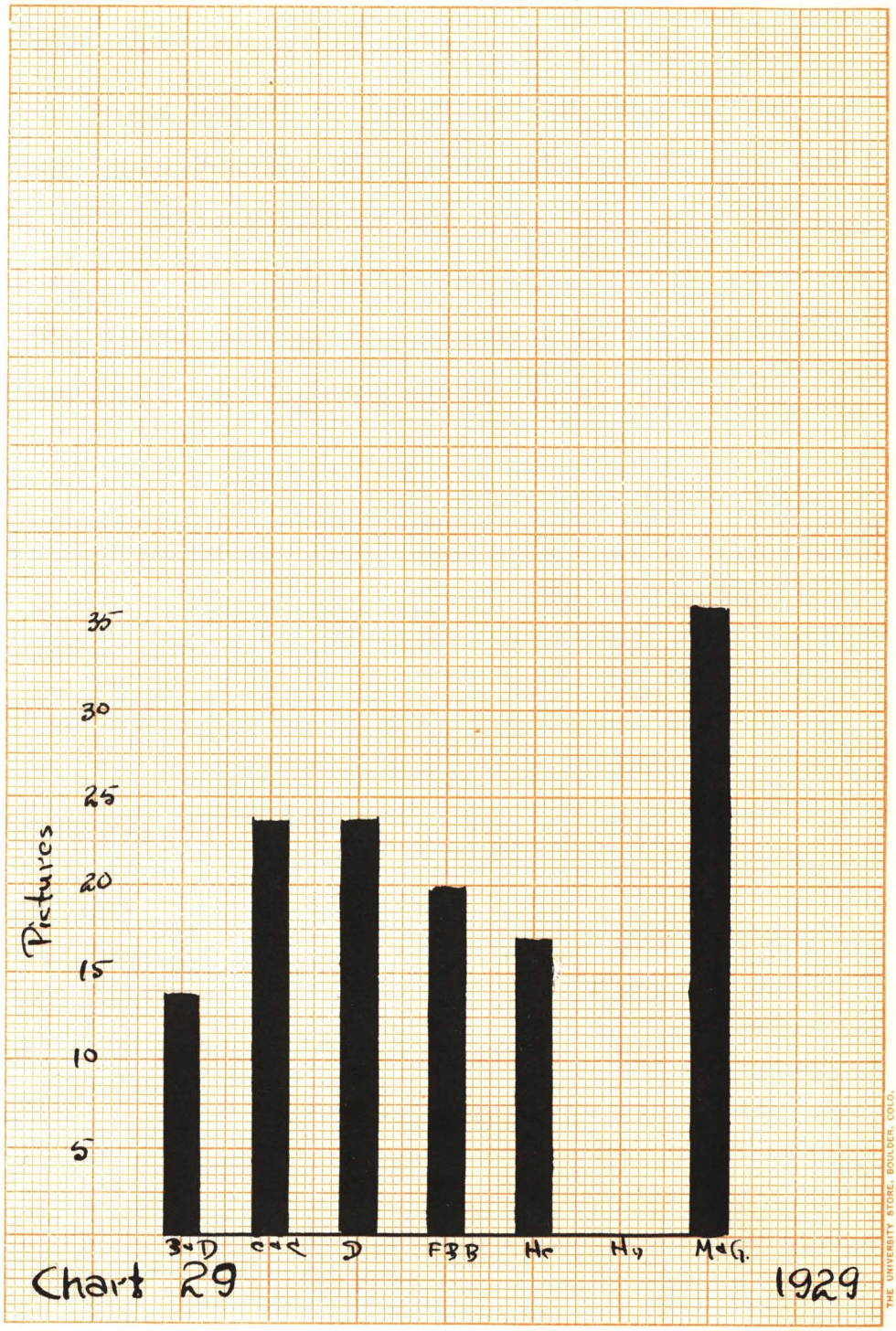
Mean 19.28 Maximum 36

Median 20 Minimum 0

Range 36

Table XXVII

Comparison of Number of Biographical Pictures



Comparison of Number Of Biographical Pictures.

The histogram for this distribution is to be found in Chart 29.

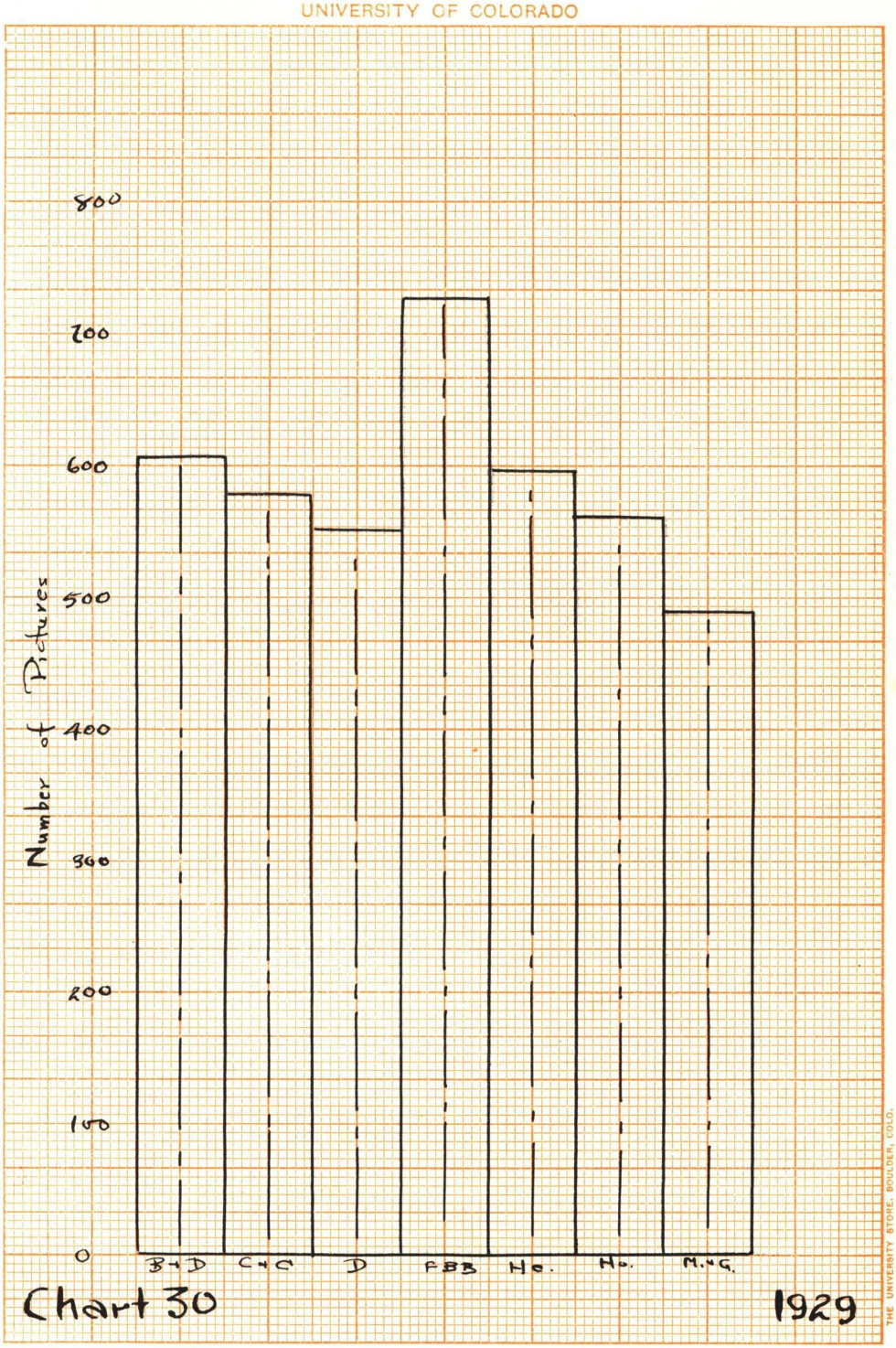
The last of the comparisons on pictures will indicate the total number of "figures" in each of the books. Here again FULLER, BROWNLEE, AND BAKER leads the others with 728 while MILLIKAN AND GALE with only 493 figures is lowest in this respect.

The table showing the comparisons of the total number of drawings and figures exclusive of biographical cuts follows:

Book	No. of figures
Black and Davis	604
Carhart and Chute	577
Dull	546
Fuller, Brownlee, and Baker	728
Henderson	599
Headley	556
Millikan and Gale	493
Mean 586.1	Maximum 728
Median 577	Minimum 493
Range 235	

Table XXVIII

Comparison of Total Number of Figures
And Drawings Exclusive of The
Biographical Pictures



Comparison of Number of Figures and Drawings Exclusive of Biographical Pictures

The histogram for this distribution will be found in Chart 30.

It is found in comparing the retail prices of the seven books that there is but little variation. It is interesting to note that while FULLER, BROWNLEE, AND BAKER has 853 pages as compared to CARHART AND CHUTE'S 490, both retail at the same price. These two, selling at $1.80, are the highest, while HENDERSON and HOADLEY retailing at $1.60 are lowest in price. In each case, the wholesale price is twenty per cent less than the price quoted here.

The table follows:

Book	Cost
Black and Davis	$1.68
Carhart and Chute	1.80
Dull	1.72
Fuller, Brownlee, and Baker	1.80
Henderson	1.60
Hoadley	1.60
Milliken and Gale	1.64
Mean $1.69	Maximum 1.80
Median 1.68	Minimum 1.60
Range .20	

Table XXIX

Comparison of Retail Costs of Texts

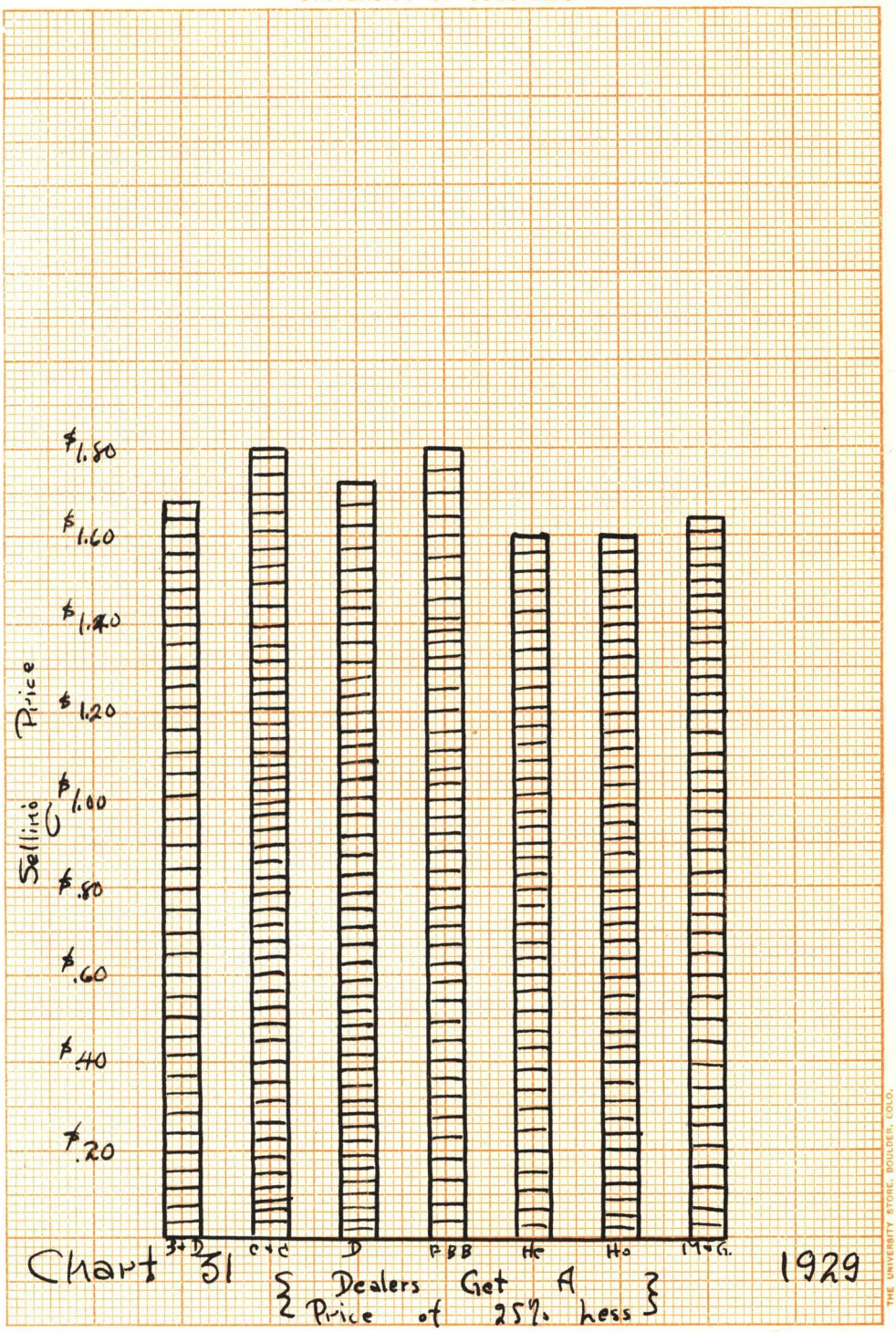


Chart 31 1929

{ Dealers Get A Price of 25% less }

Comparison of Selling Price Of The Books.

The histogram for this distribution will be found in Chart 31.

As a next part of this study, the nature of the questions and problems asked will be examined. It is found that some contain mathematics, usually arithmetic, but occasionally including a little algebra or geometry. A class of girls might prefer a book with less mathematics while a class of boys might actually like a book with a great deal of mathematics. For example, it is found that fifty-five per cent of all the questions and problems in BLACK AND DAVIS will require some sort of mathematics while only twenty per cent of the quentions and problems in FULLER, BROWNLEE, AND BAKER are mathematical. It is noted that FULLER, BROWNLEE, AND BAKER has well over one-thousand-three-hundred questions that can be answered without so much as an arithmetical computation, while BLACK AND DAVIS includes over five-hundred requiring such computations.

The table showing the comparison of the number of mathematical problems and questions follows:

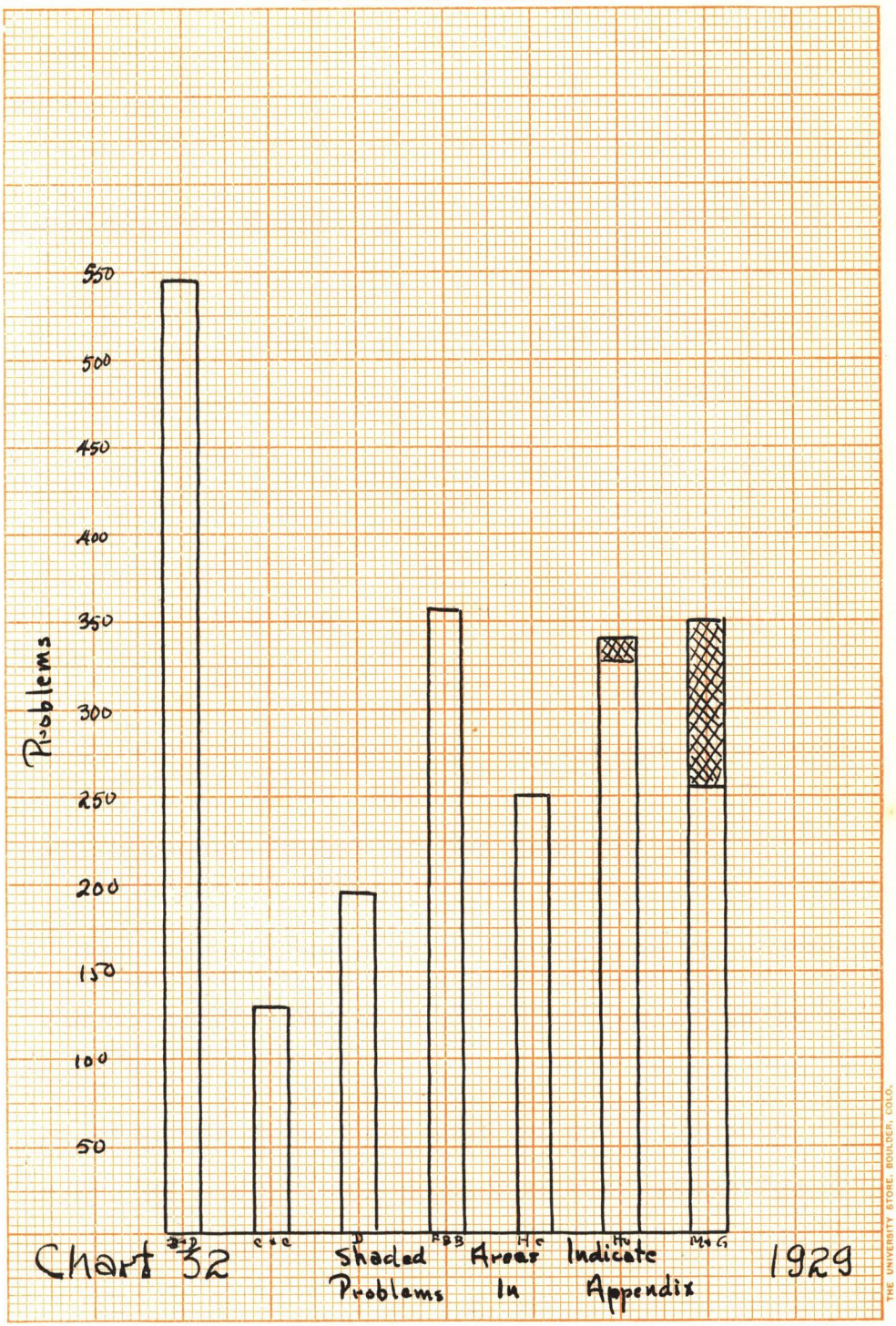
Book	Number
Black and Davis	546
Carhart and Chute	128
Dull	192
Fuller, Brownlee, and Baker	360
Henderson	251
Hoadley	340
Millikan and Gale	351
Mean	309.7
Median	340
Maximum	546
Minimum	128
Range	418

Table XXX

Comparison of Number of Mathematical Problems

The histogram for this distribution is to be found in Chart 32.

There is a wide range of non-mathematical problems varying from 1367 in FULLER, BROWNLEE, AND BAKER to 202 in CARHART AND CHUTE. The complete table showing the number found in each of the seven books follows:



Comparison of Number of Mathematical Problems and Questions.

Book	Number of Non Math. Probs.
Black and Davis	467
Carhart and Chute	202
Dull	281
Fuller, Brownlee, and Baker	1367
Henderson	375
Hoadley	352
Millikan and Gale	469
Mean	501.85
Median	375
Maximum	1367
Minimum	202
Range	1165

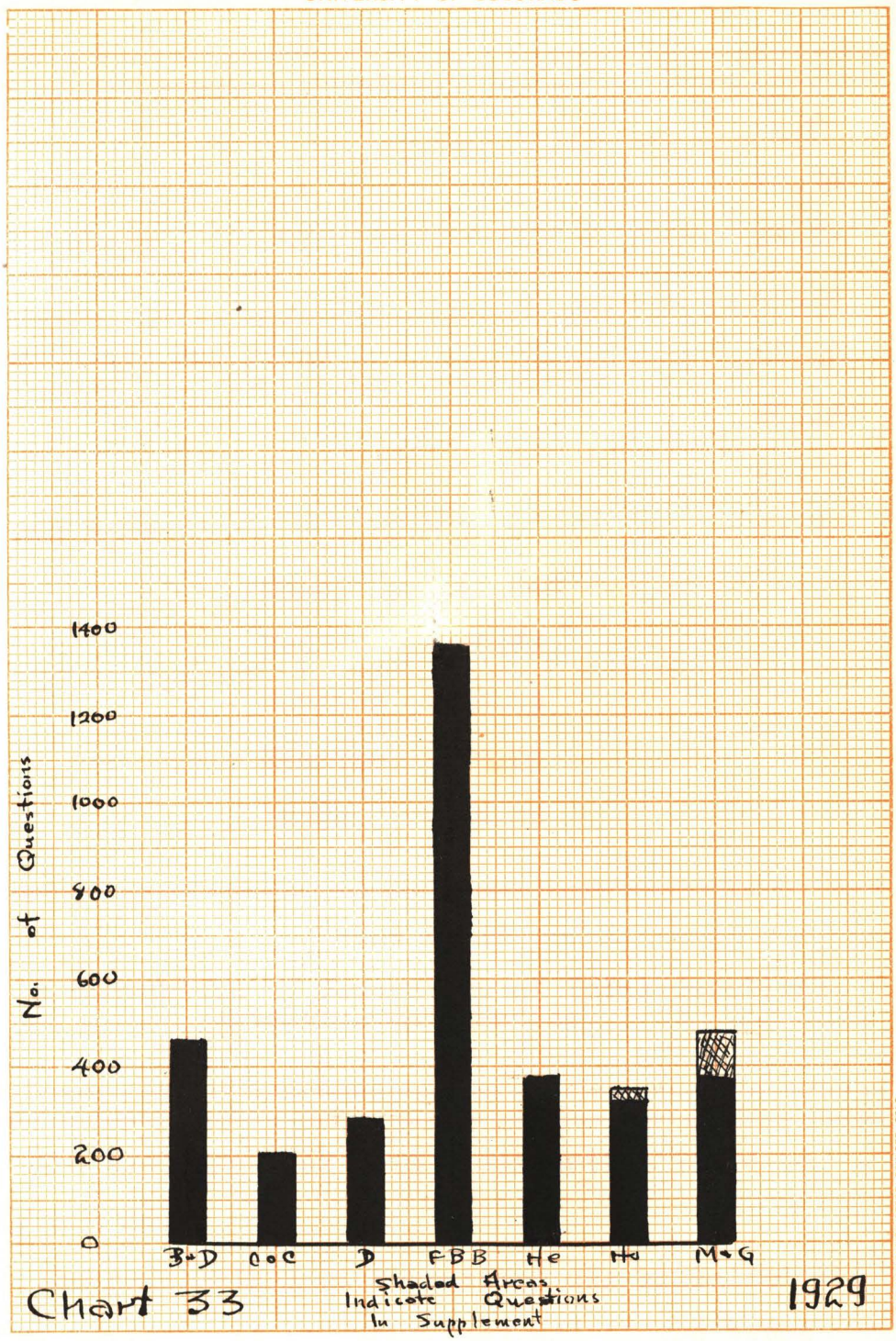
Table XXXI

Comparison of Number of Non Mathematical Questions and Problems

The histogram for this distribution is to be found in Chart 33.

In order to show this data in still another way, the next method of comparison will show the percentage of the total number of questions asked which involve mathematics.

As has been mentioned, BLACK AND DAVIS has the highest and FULLER, BROWNLEE, AND BAKER the lowest so far



Comparison of Number of Non-Mathematical Questions and Problems. ~

as percentage is concerned.

The complete table will follow:

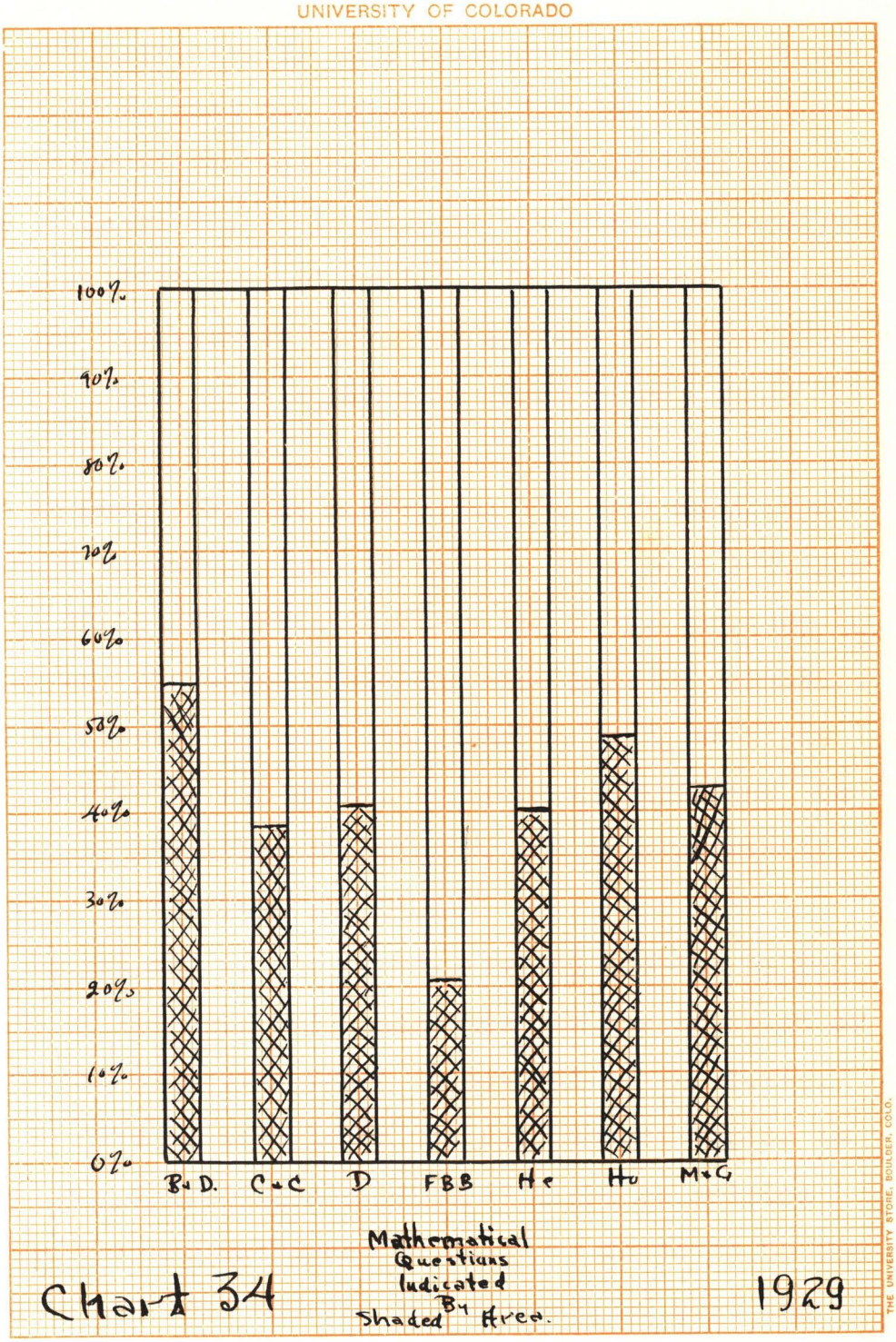
Table	%
Black and Davis	55.0%
Carhart and Chute	38.5%
Dull	40.7%
Fuller, Brownlee, and Baker	20.8%
Henderson	40.1%
Hoadley	48.7%
Millikan and Gale	42.7%
Mean	40.93%
Median	40.7%
Maximum	55.0%
Minimum	20.8%
Range	34.2%

Table XXXII

A Comparison of Percentage of Total Questions Involving Mathematics

The histogram for this distribution is to be found in Chart 34.

The next method of comparison may be called the sequence of topics. It is found that all of the books studied begin with the division called mechanics. Five of them follow this with heat while sound comes in second



Comparison of Percentage of Total Questions Involving Mathematics

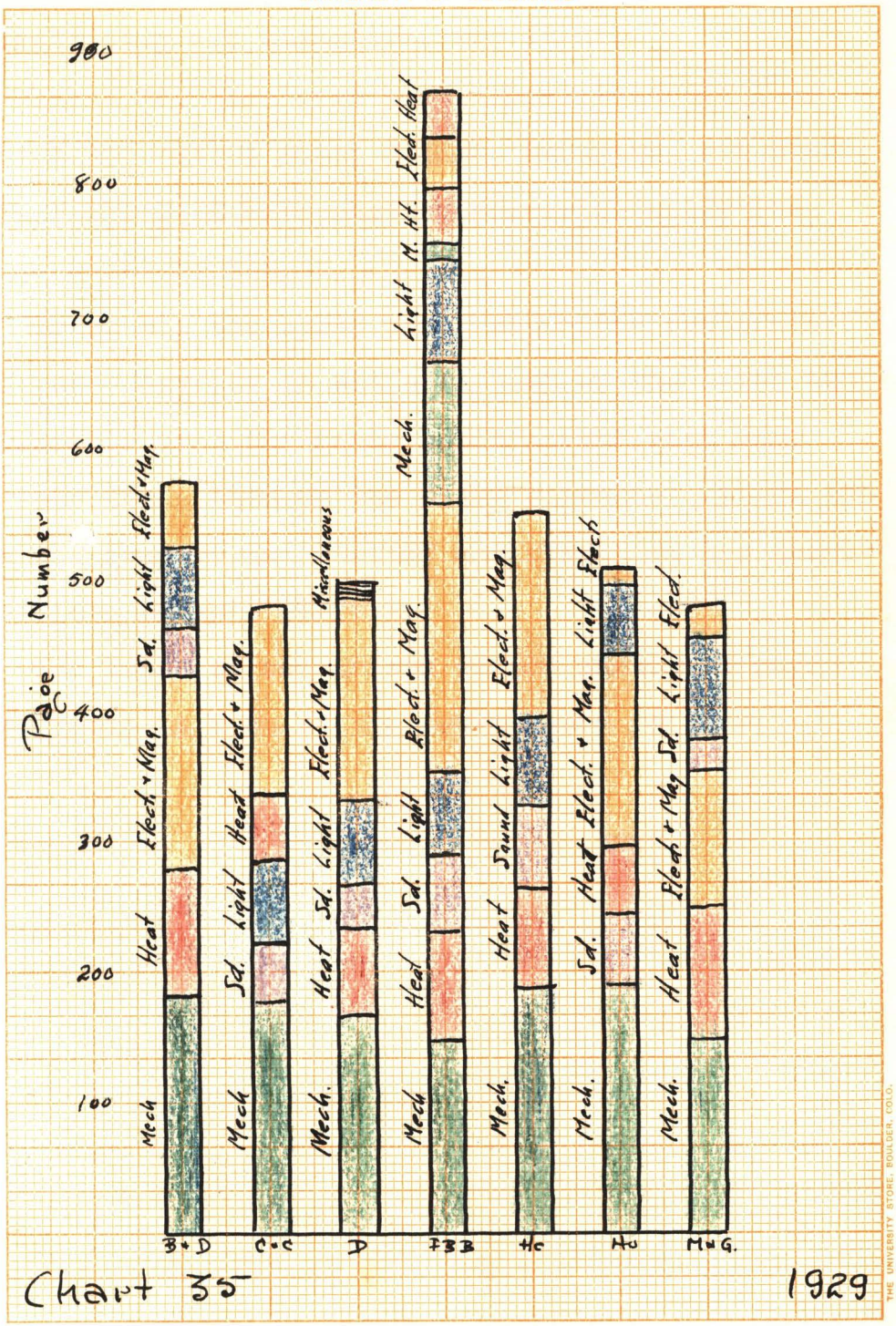
place in the order of topics in CARHART AND CHUTE and in HOADLEY.

The criticism by some teachers of FULLER, BROWNLEE, AND BAKER is that the topics are divided rather than being presented in the logical order, as they term it. Referring to Chart 35, it is easy to see what the teachers mean by the splitting up of topics. It is noticed in this book that the division of mechanics appears in three different places. Heat also appears in three places while light comes in two places.

In Chart 35, the numbers on the left hand side refer to page numbers. Thus it is seen that page 300, for example, in BLACK AND DAVIS falls in the division given to electricity and magnetism while the same page in CARHART AND CHUTE is devoted to heat, to light in DULL, to light in FULLER, BROWNLEE, AND BAKER, to sound in HENDERSON, to electricity and magnetism in HOADLEY, and to electricity and magnetism in MILLIKAN AND GALE.

Almost all of the books have the section on radio at the back of the book which accounts for the division of electricity and magnetism found in several of the texts.

To give an example of the divisionsof topics as used in FULLER, BROWNLEE, AND BAKER it might be pointed out that the chapter on "Specific Heat" is found to be the last thing in the book whereas the elements of heat are found early in the book. The study of heat engines is taken up in still another place.



Comparison of Sequence of Five Divisions

Chart 35 illustrates graphically the order of sequence of the five divisions of physics: mechanics, heat, sound, electricity and magnetism, and light.

Chart 36, the lower part, shows that the four books: BLACK AND DAVIS; DULL; FULLER, BROWNLEE, AND BAKER; and MILLIKAN AND GALE have chapter summaries while the other three books do not.

Chart 36, the upper part, shows the comparative number of pages devoted to radio in each of the seven books. It is noticeable that the newer books devote much more space to this topic than do the older editions. BLACK AND DAVIS has the longest and HOADLEY and HENDERSON the shortest discussions on this subject.

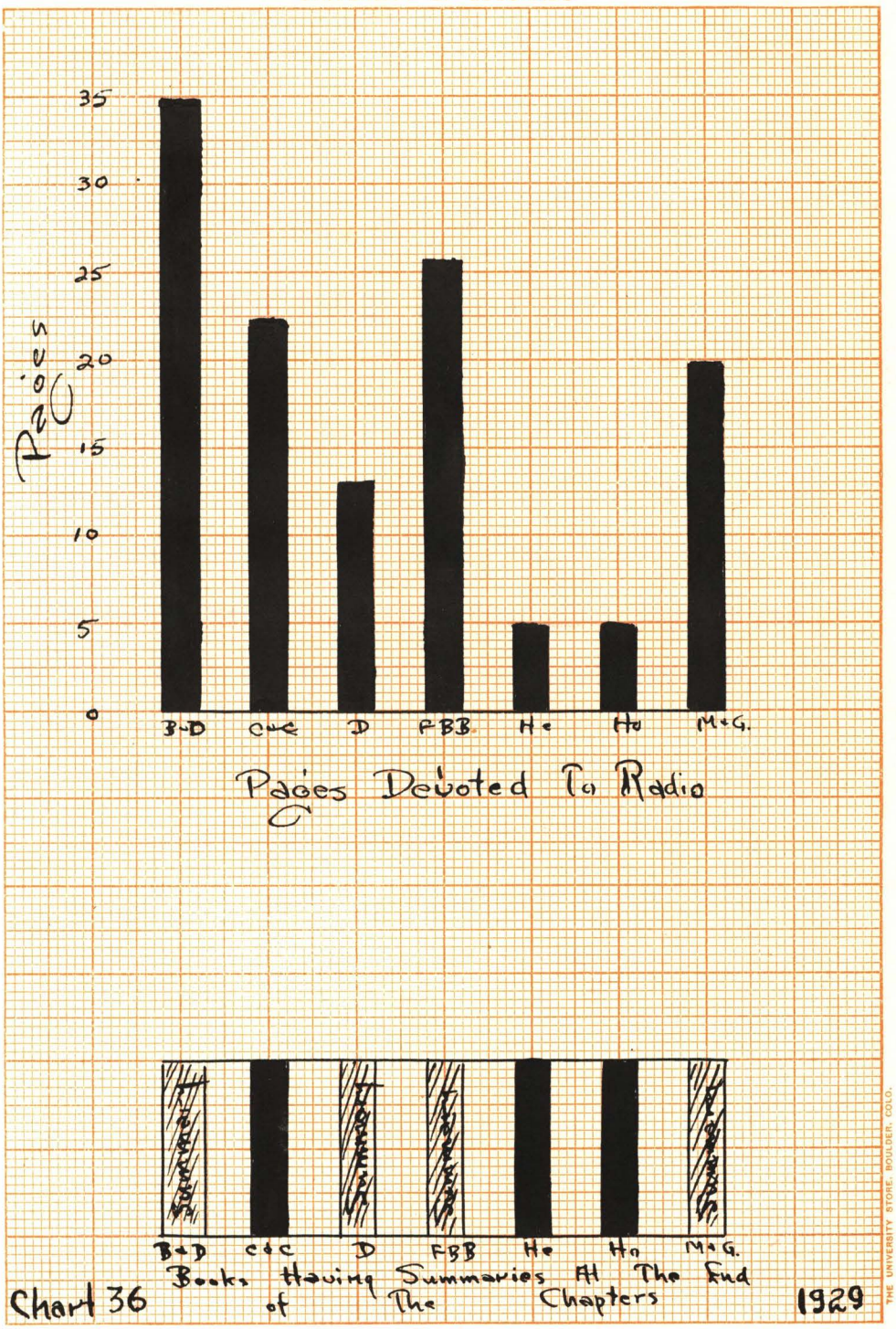
The table of comparison of the number of pages devoted to radio in each of the seven books follows:

Book	Pages
Black and Davis	35
Carhart and Chute	22
Dull	13
Fuller, Brownlee, and Baker	26
Henderson	5
Hoadley	5
Millikan and Gale	20
Mean	18
Median	20
Maximum	35
Minimum	5
Range	30

Table XXXIII

Comparison of Number of Pages Devoted To Radio

The histogram for this distribution is to be found in Chart 36.



Comparison of Pages Devoted To Radio And Of Chapter Summaries.

CHAPTER FIVE

COMPARISONS OF EACH TEXT WITH THE MEAN AND MEDIAN OF THE GROUP AS TO PERCENTAGE COMPOSITION

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XXX
X

CHAPTER FIVE

COMPARISON OF EACH TEXT WITH THE MEAN AND MEDIAN OF THE GROUP AS TO PERCENTAGE COMPOSITION

The purpose of this chapter is to compare each of the books with the mean and median of the group on the basis of the percentage of space devoted to each of the five divisions of the subject of physics.

Obviously seven charts are required in order to present this data.

Taking the books in alphabetical order, the first book to be so studied is BLACK AND DAVIS. It is found that this book is near the mean and median book in mechanics, between them in heat, considerably lower in sound, above them in electricity and magnetism, and a bit lower than the mean and median in light.

The table showing how BLACK AND DAVIS compares with the mean and median of the seven books as to percentage composition follows:

Book	Mechanics
Mean	33.79%
BLACK AND DAVIS	33.75%
Median	33.85%
	Heat
Mean	14.88%
BLACK AND DAVIS	15.20%
Median	15.25%
	Sound
Mean	7.98%
BLACK AND DAVIS	6.30%
Median	7.95%
	Electricity and Magnetism
Mean	30.39%
BLACK AND DAVIS	33.00%
Median	30.10%
	Light
Mean	12.96%
BLACK AND DAVIS	11.75%
Median	12.85%

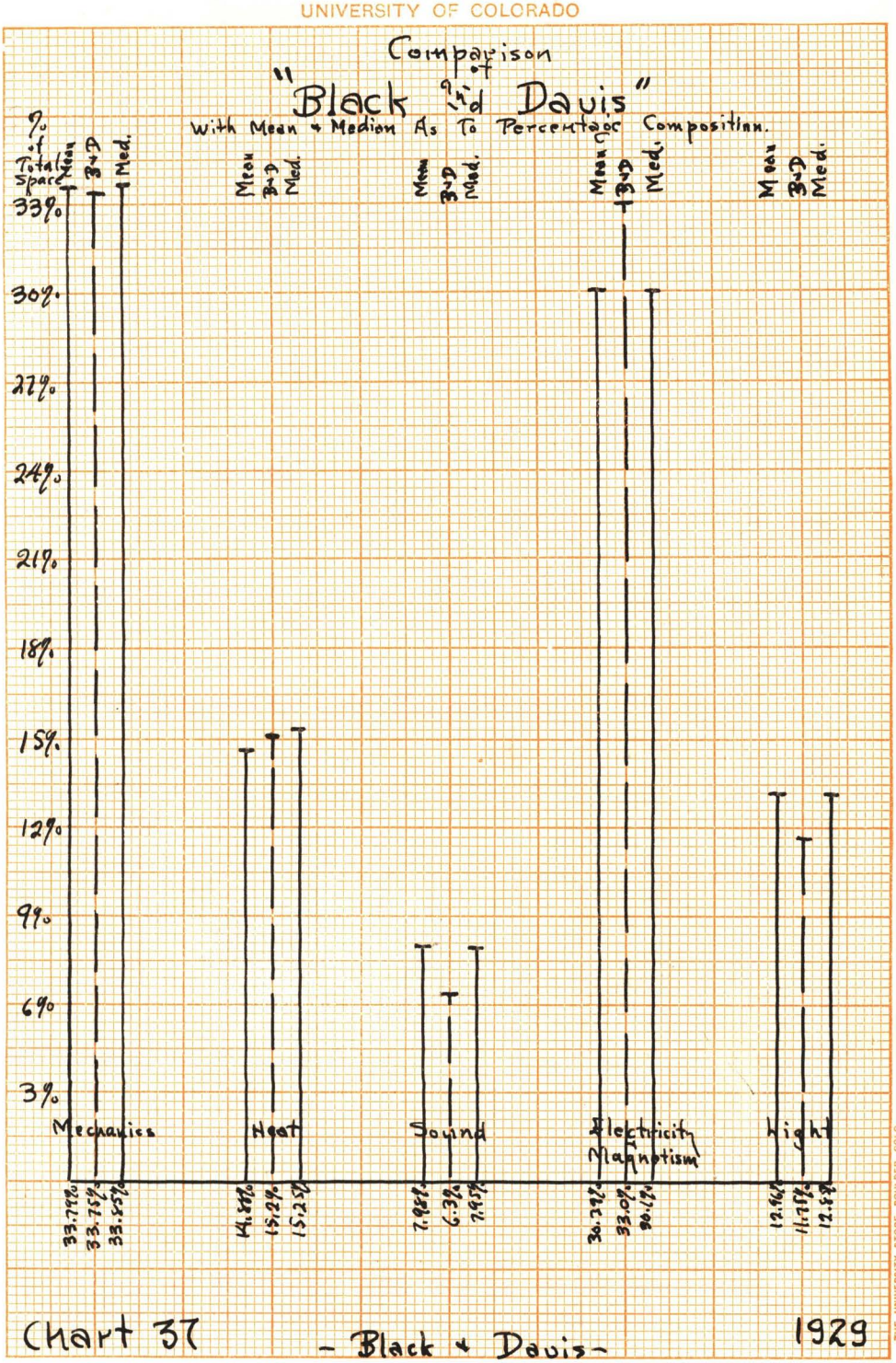
Table XXXIV

Comparison of BLACK AND DAVIS with mean and median as to percentage composition

The histograms for this distribution are to be found in Chart 37.

Turning next to CARHART AND CHUTE, it is found that this book exceeds the mean and median in mechanics, is considerably lower than either of them in heat, is about equal to them in sound, and is a bit above the mean and the median in both electricity and magnetism and in light.

The table itself follows:



Comparison of Percentage Distribution of Branches With Mean & Median of Group.

Mechanics	
Mean	33.79%
CARHART AND CHUTE	35.70%
Median	33.85%
Heat	
Mean	14.68%
CARHART AND CHUTE	11.40%
Median	15.25%
Sound	
Mean	7.98%
CARHART AND CHUTE	8.00%
Median	7.95%
Electricity and Magnetism	
Mean	30.39%
CARHART AND CHUTE	31.2%
Median	30.1%
Light	
Mean	12.96%
CARHART AND CHUTE	13.70%
Median	12.85%

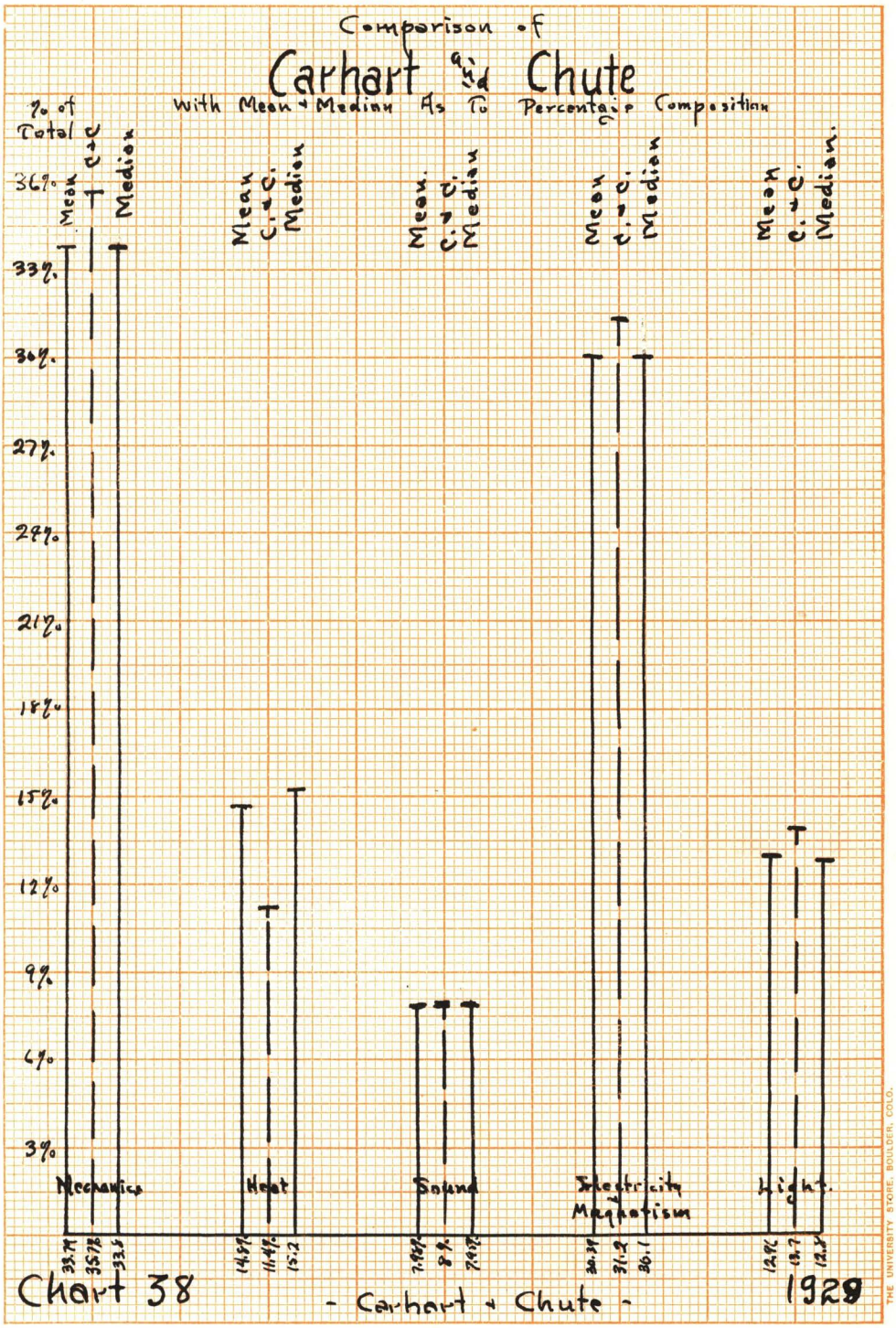
Table XXXV

Comparison of CARHART AND CHUTE With Mean and Median as to Percentage Composition

The histograms for this distribution are to be found in Chart 38.

DULL'S book is very close to the mean and median in mechanics and light, above them in heat, and below in both sound and in electricity and magnetism.

The table for DULL'S book follows:



Comparison of Percentage Distribution of Branches With Mean + Median of Group.

Mechanics	
Mean	33.79%
DULL	33.80%
Median	33.85%
Heat	
Mean	14.88%
DULL	17.30%
Median	15.25%
Sound	
Mean	7.98%
DULL	7.23%
Median	7.95%
Electricity and Magnetism	
Mean	30.39%
DULL	28.83%
Median	30.10%
Light	
Mean	12.96%
DULL	12.83%
Median	12.85%

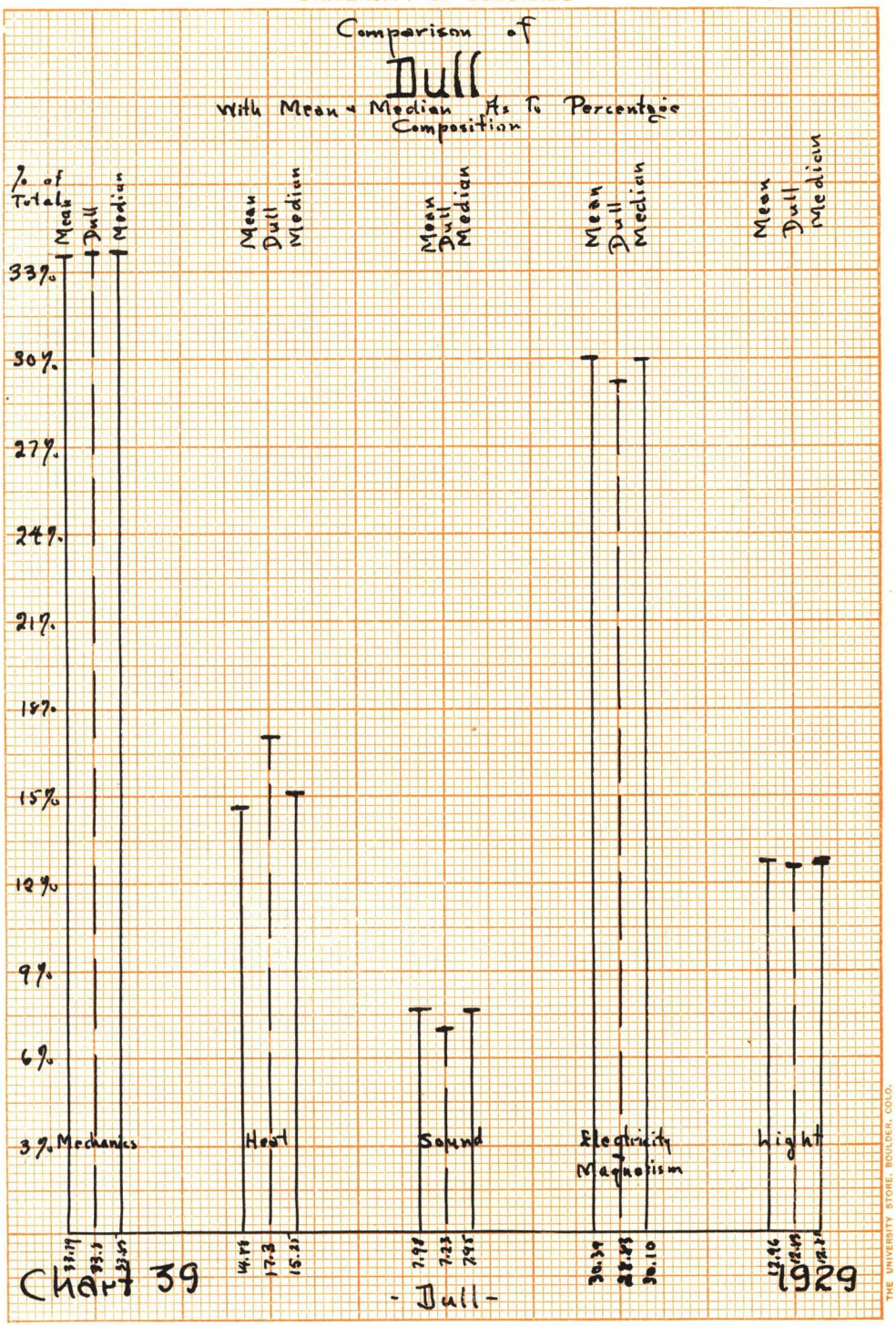
Table XXXVI

Comparison of DULL With Mean and Median
As To Percentage Composition

The histograms for this distribution will be found in Chart 39.

FULLER, BROWNLEE, AND BAKER is far above the mean and median in heat, and just below the two in the other four fields of physics.

The table showing the relationship between FULLER, BROWNLEE, AND BAKER and the mean and median of the group as to percentage composition follows:



Comparison of Percentage Distribution of Branches With Mean and Median of Group.

Mechanics	
Mean	33.79%
FULLER, BROWNLEE, AND BAKER	35.10%
Median	33.85%
Heat	
Mean	14.88%
FULLER, BROWNLEE, AND BAKER	18.00%
Median	15.25%
Sound	
Mean	7.98%
FULLER, BROWNLEE, AND BAKER	7.00%
Median	7.95%
Electricity and Magnetism	
Mean	30.39%
FULLER, BROWNLEE, AND BAKER	29.6%
Median	30.10%
Light	
Mean	12.96%
FULLER, BROWNLEE, AND BAKER	12.30%
Median	12.85%

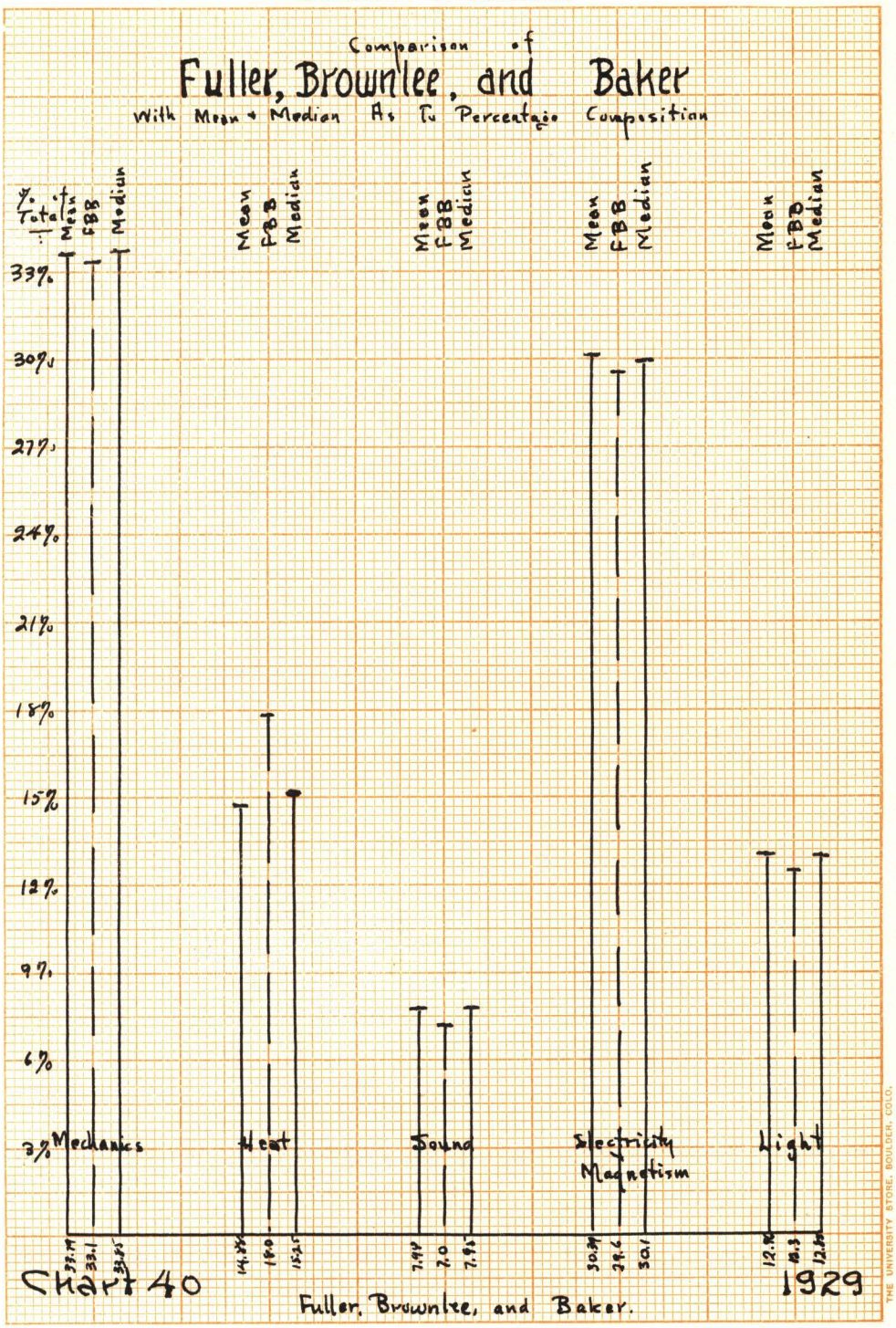
Table XXXVII

Comparison of FULLER, BROWNLEE, AND BAKER With Mean and Median as to Percentage Composition

The histograms for this distribution are to be found in Chart 40.

HENDERSON is near the mean and median in the fields of mechanics, electricity and magnetism, and light, above them in sound and below the two in regards to heat.

The comparison of HENDERSON with the mean and median of the group as to percentage composition is as follows:



Comparison of Percentage Distribution of Branches With Mean and Median of Group.

Mechanics	
Mean	33.79%
HENDERSON	34.30%
Median	33.85%
Heat	
Mean	14.38%
HENDERSON	12.70%
Median	15.25%
Sound	
Mean	7.98%
HENDERSON	10.50%
Median	7.95%
Electricity and Magnetism	
Mean	30.39%
HENDERSON	30.0%
Median	30.10%
Light	
Mean	12.96%
HENDERSON	12.5%
Median	12.85%

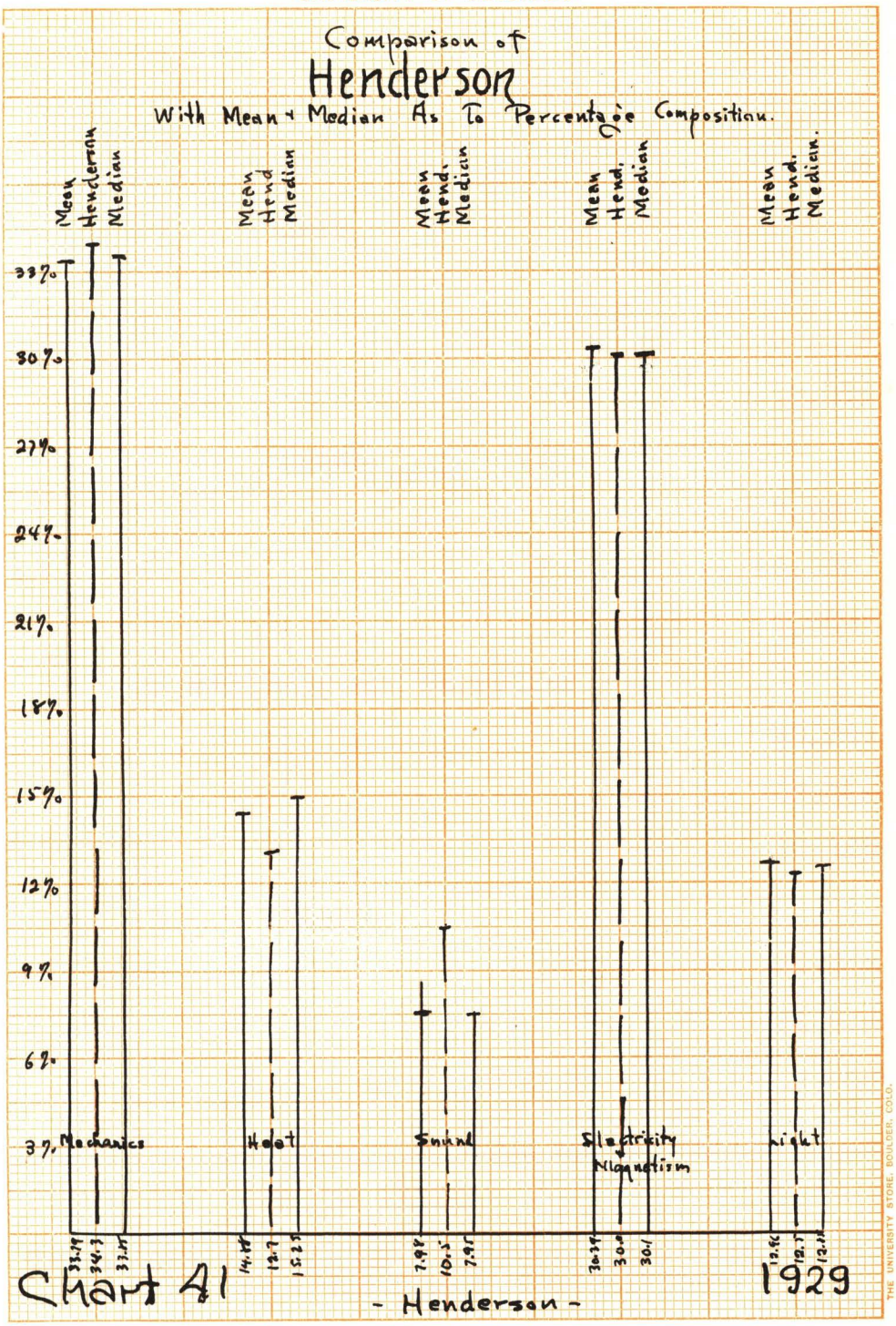
Table XXXVIII

Comparison of HENDERSON With Mean and Median
As to Percentage Composition

The histograms for this distribution are to be found in Chart 41.

ROADLEY is above the mean and median in regards to mechanics, sound, and light and below the two in heat and in electricity and magnetism.

The table showing the comparison of the percentage composition of ROADLEY with the mean and median percentage composition follows:



Comparison of Percentage Distribution of Branches
With Mean & Median of the Group.

Mechanics	
Mean	33.79%
HOADLEY	35.80%
Median	33.85%
Heat	
Mean	14.88%
HOADLEY	12.30%
Median	15.25%
Sound	
Mean	7.98%
HOADLEY	9.00%
Median	7.95%
Electricity and Magnetism	
Mean	30.39%
HOADLEY	29.00%
Median	30.10%
Light	
Mean	12.96%
HOADLEY	13.90%
Median	12.85%

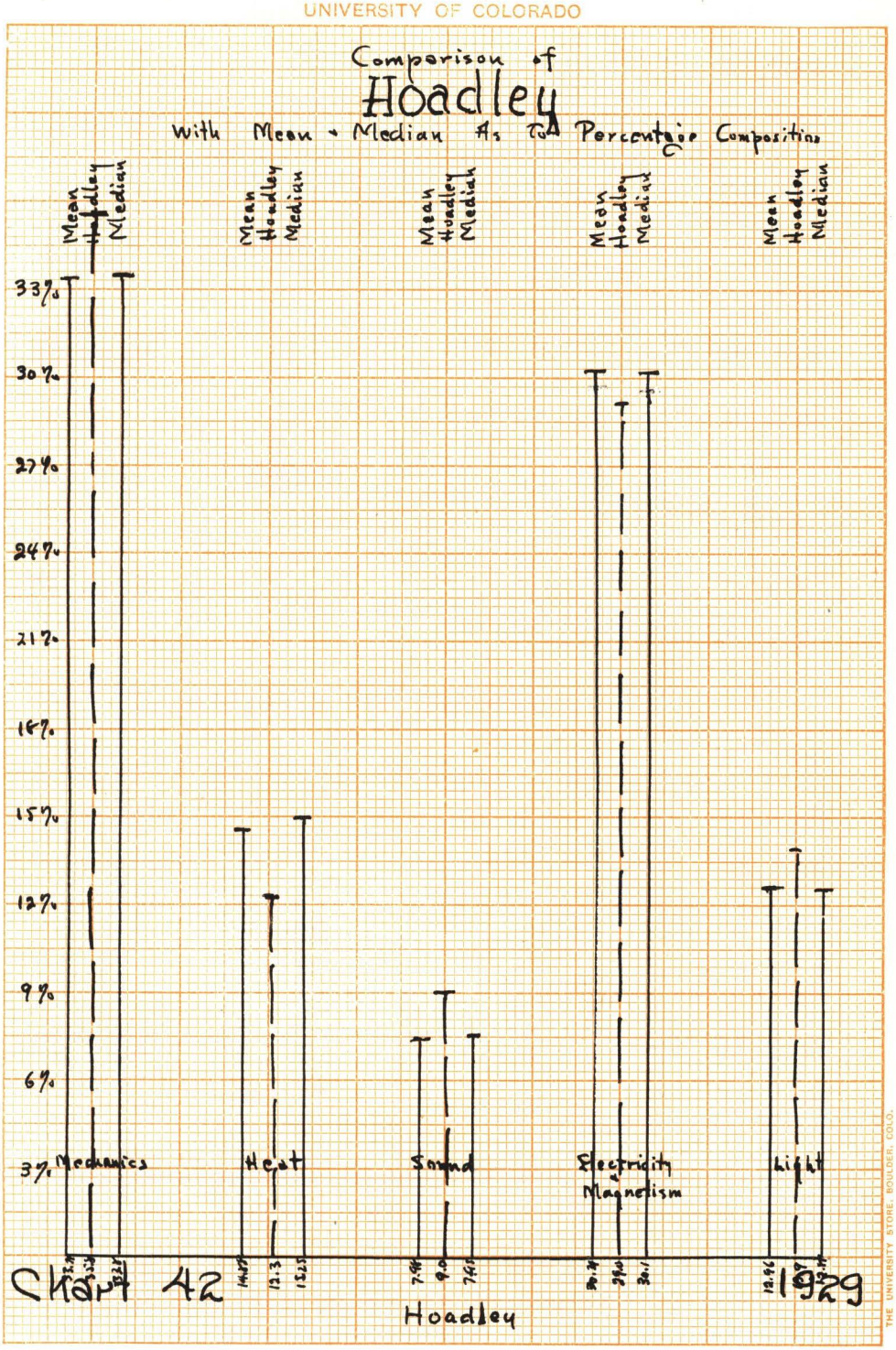
Table XXXIX

Comparison of HOADLEY With Mean and Median
As to Percentage Composition

The histogram for this distribution is to be found in Chart 42.

MILLIKAN AND GALE are close to the mean and median in sound and in electricity and magnetism, below them in mechanics and above them in heat and in light.

The table showing the comparison of the percentage composition of MILLIKAN AND GALE with the mean and median percentage composition follows:



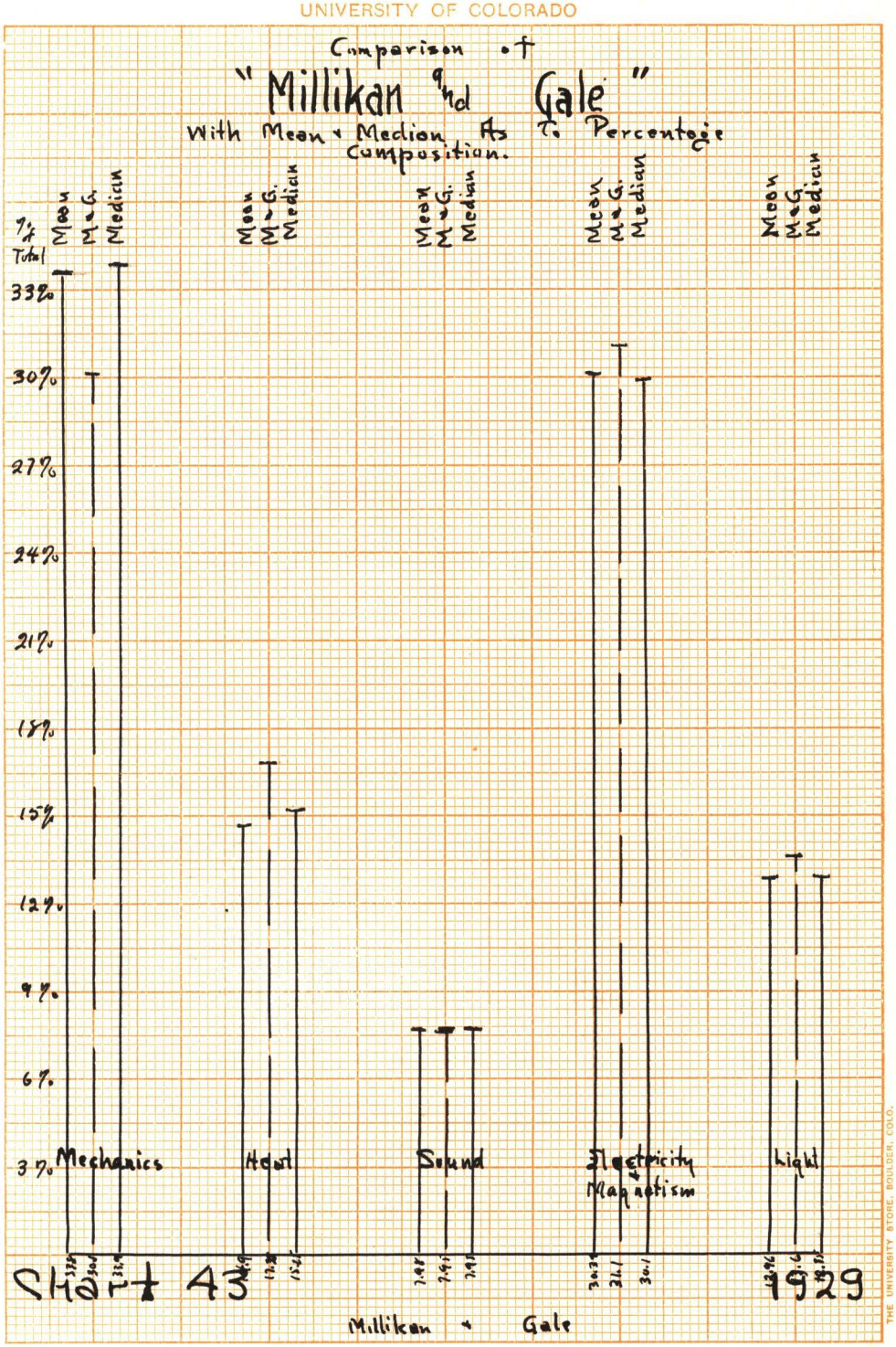
Comparison of Percentage Distribution of Branches
With Mean + Median of the Group.

Mechanics	
Mean	33.79%
MILLIKAN AND GALE	30.10%
Median	33.85%
Heat	
Mean	14.88%
MILLIKAN AND GALE	17.25%
Median	15.25%
Sound	
Mean	7.98%
MILLIKAN AND GALE	7.95%
Median	7.95%
Electricity and Magnetism	
Mean	30.39%
MILLIKAN AND GALE	31.10%
Median	30.10%
Light	
Mean	12.96%
MILLIKAN AND GALE	13.60%
Median	12.85%

Table XL

Comparison of MILLIKAN AND GALE With Mean and Median as to Percentage Composition

The histograms for this table are in Chart 43.



Comparison of Percentage Distribution of Branches With Mean and Median of the Group.

CHAPTER SIX

TEACHERS' RATINGS OF THE TEXT BOOKS

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X

CHAPTER SIX

TEACHERS' RATINGS OF THE TEXT BOOKS

While it is true that teachers' opinions are not the last word in reliability yet it is interesting to see how those in Colorado rate the books which they are using. Obviously, the greatest number of opinions are on MILLIKAN AND GALE since it is the most widely used text in the state of Colorado.

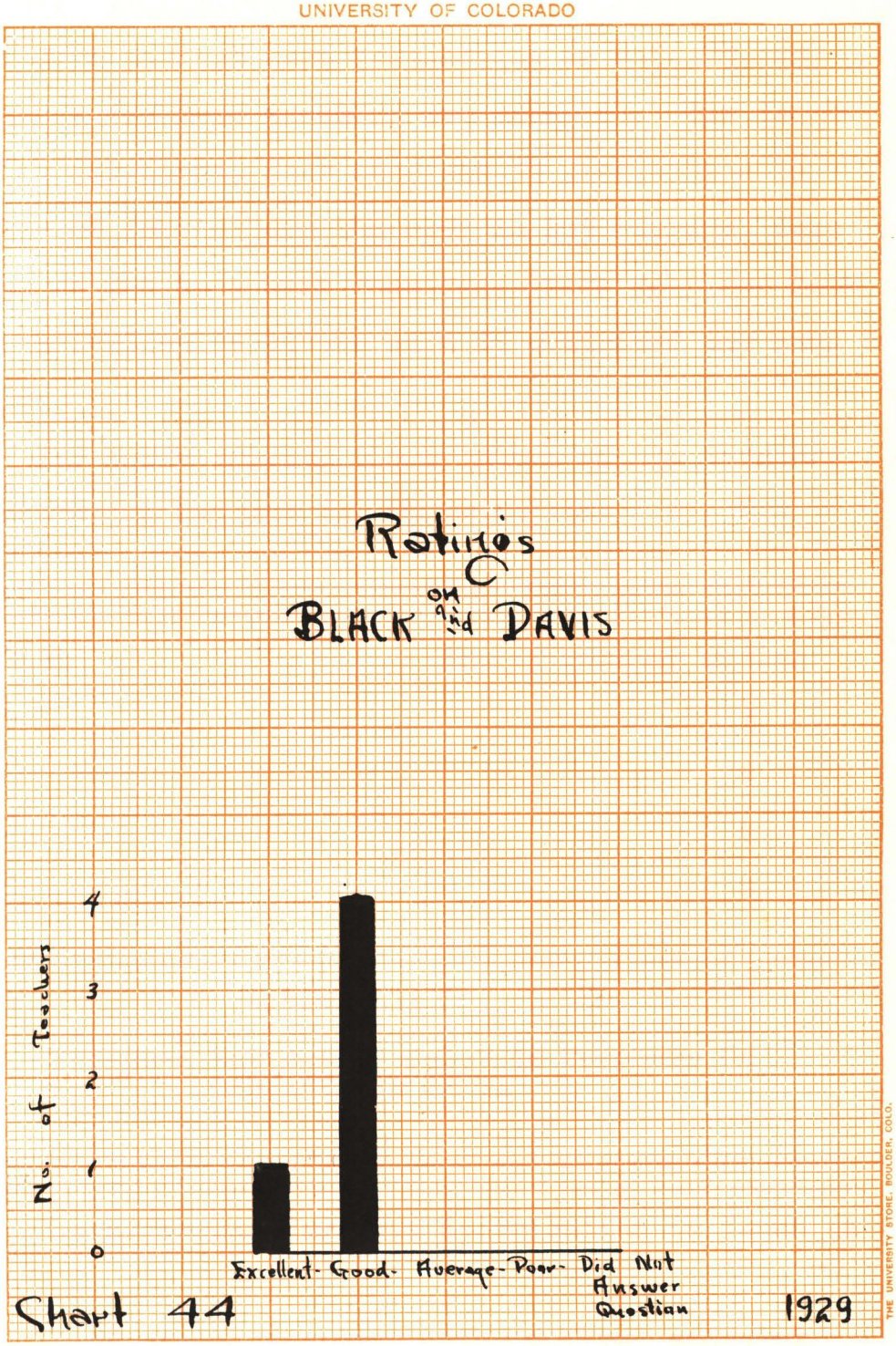
Turning first to BLACK AND DAVIS, one teacher reports that he considers the book "Excellent" while four marked it "Good". No replies indicated an opinion of "Average" or "Poor". The objections expressed to this book were: Poor arrangement in some places, poor diagrams in some sections, some important parts omitted, and a lack of explanatory pictures.

The table showing the personal ratings of the Colorado teachers using BLACK AND DAVIS follows:

Ratings	No. giving each rating
Excellent	1
Good	4
Average	0
Poor	0

Table XLI

Personal Ratings of Colorado Teachers on Black & Davis



Personal Ratings On BLACK + DAVIS
Rated By 5 Colorado Teachers.

The histogram for this distribution is found in Chart 44.

More ratings were forthcoming on CARHART AND CHUTE since a few more teachers are using it. One teacher rates it excellent, four consider it good, while in the opinion of four others the book is but average. Some complaints of the book were received. Some said the book is too technical while others said it contained too much mathematics.

The table showing the opinions of the teachers in Colorado using CARHART AND CHUTE follows:

Rating	No. of Persons Rating
Excellent	1
Good	4
Average	4
Poor	0

Table XLII

Personal Ratings of Colorado Teachers On CARHART AND CHUTE

The histogram for this distribution is found in Chart 45.

Eight of the teachers using FULLER, BROWNLEE, AND BAKER rate it as excellent, eight more call it good, while five consider it only average. Four of the teachers

UNIVERSITY OF COLORADO

Ratings on Carhart and Chute

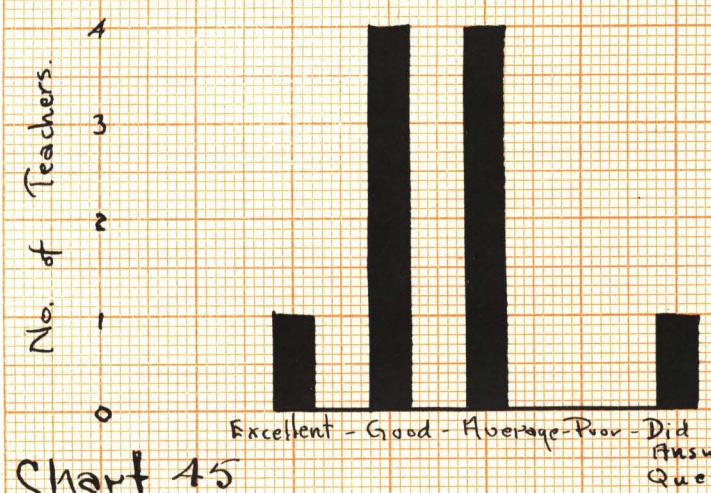


Chart 45

1929

THE UNIVERSITY STORE, BOULDER, COLO.

Personal Ratings On Carhart & Chute
Rated by 10 Colorado Teachers

did not state their personal opinions of the book when they returned their questionnaires. One of the chief objections offered by several of the teachers is to the order or sequency of subjects while the next most common complaint seems to be that there is too much material to be covered in one year. Another teacher says too much time is spent on detailed material especially on light. Still another teacher claims the book talks over students' heads and takes too much for granted.

The table showing the Colorado teachers' opinions on FULLER, BROWNLEE, AND BAKER follows:

Ratings	No. of Persons Rating
Excellent	8
Good	8
Average	5
Poor	0
Did not answer question as to opinion	4

Table XLIII

Personal Ratings of Colorado Teachers On FULLER, BROWNLEE, AND BAKER

The histogram for this distribution is found in Chart 46.

Eighteen teachers ranked MILLIKAN AND GALE as excellent, twenty-eight place it in the "good" column,

Ratings on Fuller, Brownlee, Baker

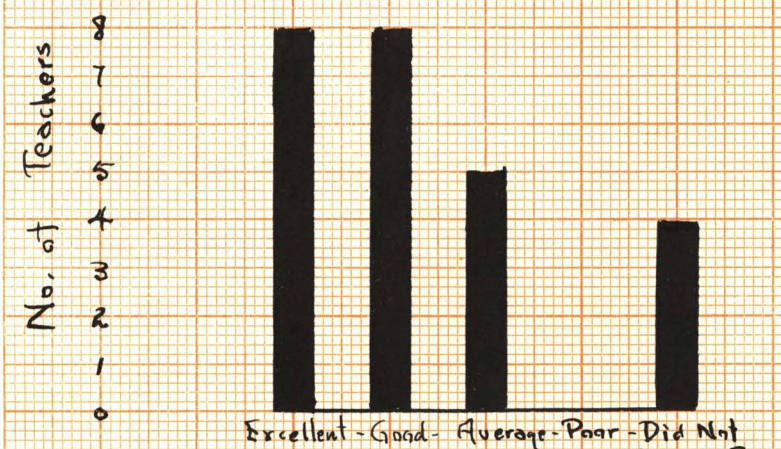


Chart 46

1929

Personal Ratings On Fuller, Brownlee, Baker.
Rated By 25 Colorado Teachers.

fifteen consider it average, and one calls it poor. Fourteen teachers did not state their personal opinions of the text they are using.

The table showing the ratings of the seventy-six teachers in Colorado using MILLIKAN AND GALE follows:

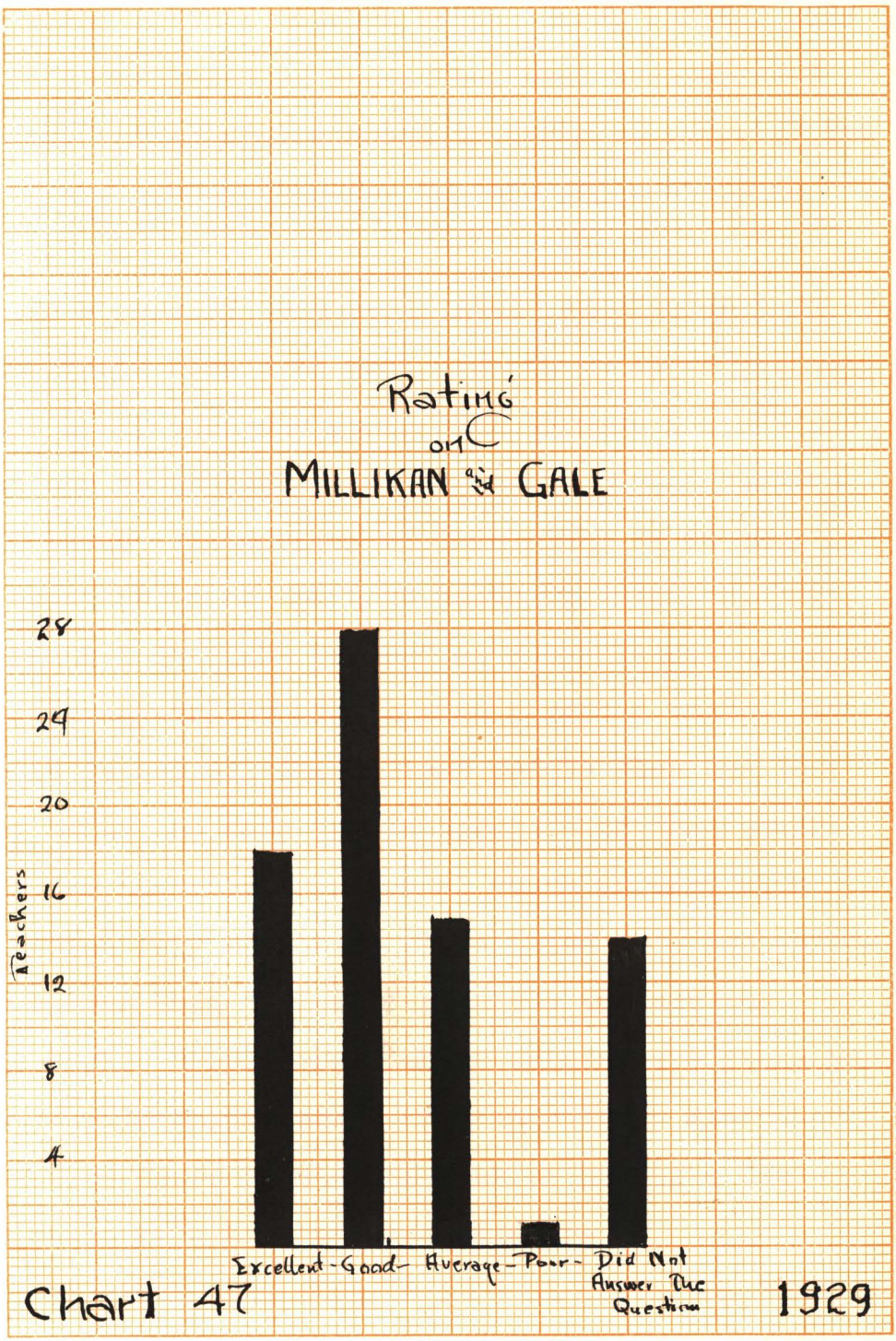
Ratings	No. of Persons Rating
Excellent	18
Good	28
Average	15
Poor	1
Did not answer the question as to opinion	14

Table XLIV

Personal Ratings of Colorado Teachers on MILLIKAN AND GALE

The histogram for this distribution is to be found in Chart 47.

A great many teachers complained that MILLIKAN AND GALE is too technical, too difficult, and hard to understand. One or two teachers say there are not enough problems, but more of them state that those which are included are too difficult unless one has superior children to teach. The complaint is made that the book is too dry. One teacher favors the introduction of "sensational material" while many deplore the lack of practical connections



Personal Ratings of 76 Colorado Science Teachers on Millikan & Gale.

to life.

Some complaint is made in regard to the sequence of topics while another teacher urges larger chapter summaries. Some complaint is made, too, that the topic of light is hard enough as presented to serve as material for a college class rather than for juniors and seniors in high school.

In a work of this sort little conclusion need be drawn. The facts have been presented in an objective manner in such a way that one could look through the various charts and see somethingsas to the merits of the various books. It is not the purpose of this study to do away with the examination of the text books in question, but it is hoped that it might be used as a supplement or as an aid to the administrator who is examining the books. It is difficult to see all the salient points when one is inspecting texts and many people hesitate to take their ideas from the advertising material which is sent with the examination copy of a text since there is a possibility of its having been "colored" slightly to suit the particular book. Should one wish to construct a standardized test in physics, he could from this study find the usual amount of space devoted to each of the five divisions and could make his test accordingly.

But after all, what is it that makes one text in physics sell well while another having approximately the same composition mathematically, about the same number of illustrations, of problems, and the like will be used

in but very few schools? Evidently the thing that makes the difference is something that cannot be measured objectively for while this study does show that in many and diverse ways each of the books varies from the rest, yet the two most widely used books in Colorado---MILLIKAN AND GALE and FULLER, BROWNLEE, AND BAKER vary from each other in some of the comparisons about as much as any two of the texts could. Yet they are both popular while others falling within their limits are seldom heard of.

It will undoubtedly remain for a further study on physics text books to show what constitutes popularity in such texts.

A COMPARATIVE STUDY OF SEVEN HIGH SCHOOL PHYSICS TEXT BOOKS

THE BIBLIOGRAPHY

BIBLIOGRAPHY

Author	Title	Publisher
Black and Davis	"Practical Physics"	Macmillan
Carhart and Chute	"Practical Physics"	Allyn and Bacon
Dull	"Essentials of Modern Physics"	Henry Holt
Fuller, Brownlee, And Baker	"Elementary Principles of Physics"	Allyn and Bacon
Henderson	"Physics in Everyday Life"	Lyons and Carnahan
Hoadley	"Essentials of Physics"	American Book Co.
Millikan and Gale	"Elements of Physics"	Ginn & Co.

The above books are the seven used in the study. The following list are books which are by no means of little value in text book selection. They are all to be found in the University of Colorado reference or circulation library and hence the publishers' names are omitted.

Franzen and Knight	"Text Book Selection."
Hall-Quest	"Text Book--How To Use And Judge It"
Maxwell	"Selection of Text Books"

Fuller	"Scientific Evaluation of Text Books"
Spaulding	"Measuring Text Books"
Twiss	"Science Teaching"

A COMPARATIVE STUDY OF SEVEN HIGH SCHOOL PHYSICS TEXT BOOKS

THE APPENDIX

THE APPENDIX

In this section are found copies of the form letter and the questionnaire sent to each of the science teachers in the 169 accredited high schools in the state of Colorado. Even though it will probably never reach their ears, the writer wishes to express his thanks to the scores of them who were so kind as to fill in the questionnaires and to return them.

It is scarcely necessary to point out that each questionnaire was stamped and addressed so that the recipient had but to fill in the blanks, sign his name, and return the card.

Thanks is due the forty-eight state departments for their courtesies and favors and for the information which helped make this thesis possible.

No attempt was made to draw any conclusions from the information received as to the number of weeks devoted to each division of physics since some of the teachers fill-filled the spaces in such a way that the total would be 36 weeks while others deducted their review and quiz weeks and thus gave but 33 or 34 weeks as a total.

The number of students taking physics in the state was obtained, but since the numbers correspond roughly to the number of schools using each book, little is gained by showing the total number of students studying each text. Obviously, over three times as many Colorado boys and girls

are using MILLIKAN AND GALE as are using any other book.

There seems to be no uniformity as to the year in which physics is offered, some giving it in the third year while the seniors alone are eligible to take the subject in other systems. But so many teachers omitted filling in that part of the questionnaire that it was not deemed advisable to include the data.

THE QUESTIONNAIRE.

Answered By 120 Colorado Science Teachers

1. The Title of Our Physics Book is_____
   _____
2. The Authors of our Physics are_____
   _____
3. We devote about_____ weeks to heat, _____weeks to mechanics, _____weeks to sound, _____weeks to electricity, and _____weeks to light.
4. Underline YOUR rating of your physics: excellent, good, average, poor.
5. We have_____students in physi this year.
6. Physics is offered in the_____year in our high school.
7. We use_____'s lab. manual.
8. What is your chief objection to your physics book?

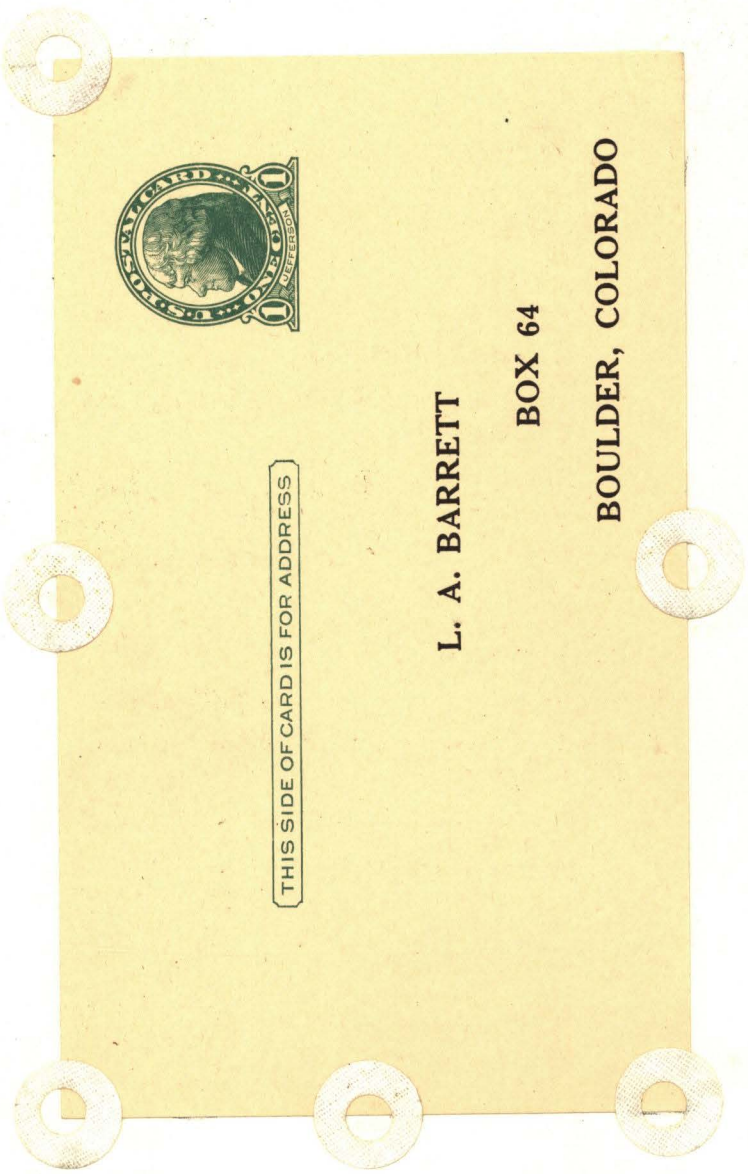
   _____
   _____
   _____

   _____
   Name.

   _____
   School.

THE QUESTIONNAIRE

Showing the Reverse Side



UNIVERSITY OF COLORADO

GRADUATE SCHOOL

LAWRENCE A. BARRETT, B. SC.

Boulder, October 2.

Dear Fellow Science Teacher:

We are trying to gather some data about physics text books used in Colorado for a masters thesis. Would you please fill in the blanks on the enclosed postal card and return it to us today? If physics is never taught or is taught only every other year in your system, won't you please so indicate it and return the card just the same?

Thank you so much for your help,

L. A. BARRETT.

The form letter sent to the science teachers