DEPARTMENT OF THE INTERIOR

BUREAU OF EDUCATION

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HOW THE WORLD RIDES

A SERIES OF PROJECTS ON VEHICULAR TRANSPORTATION FOR ELEMENTARY SCHOOLS

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WASHINGTON

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CONTENTS

ILLUSTRATIONS

LETTER OF TRANSMITTAL

DEPARTMENT OF THE INTERIOR,
BUREAU OF EDUCATION,
Washington, May 12, 1926.

SIR: The reorganization of the curriculum and the necessary assembling of proper materials of instruction attendant thereto are probably receiving more of the attention of educational leaders at the present moment than any other school problem.

The Bureau of Education is endeavoring to be of assistance to those attempting a solution of this important problem. I have therefore asked Miss Florence C. Fox, assistant specialist in city schools, to prepare from time to time a series of studies based directly upon the child's need and interest as related to present-day civilization.

The last of these studies pertains to the field of transportation and is a carefully assembled series of projects adapted to the level of children in the intermediate grades of the elementary school, entitled "How the World Rides." I think that it constitutes an important contribution to the materials now being collected for curriculum use, and ask that it be printed as a bulletin of the Bureau of Education, Department of the Interior.

Respectfully submitted.

JNO. J. TIGERT, *Commissioner.*

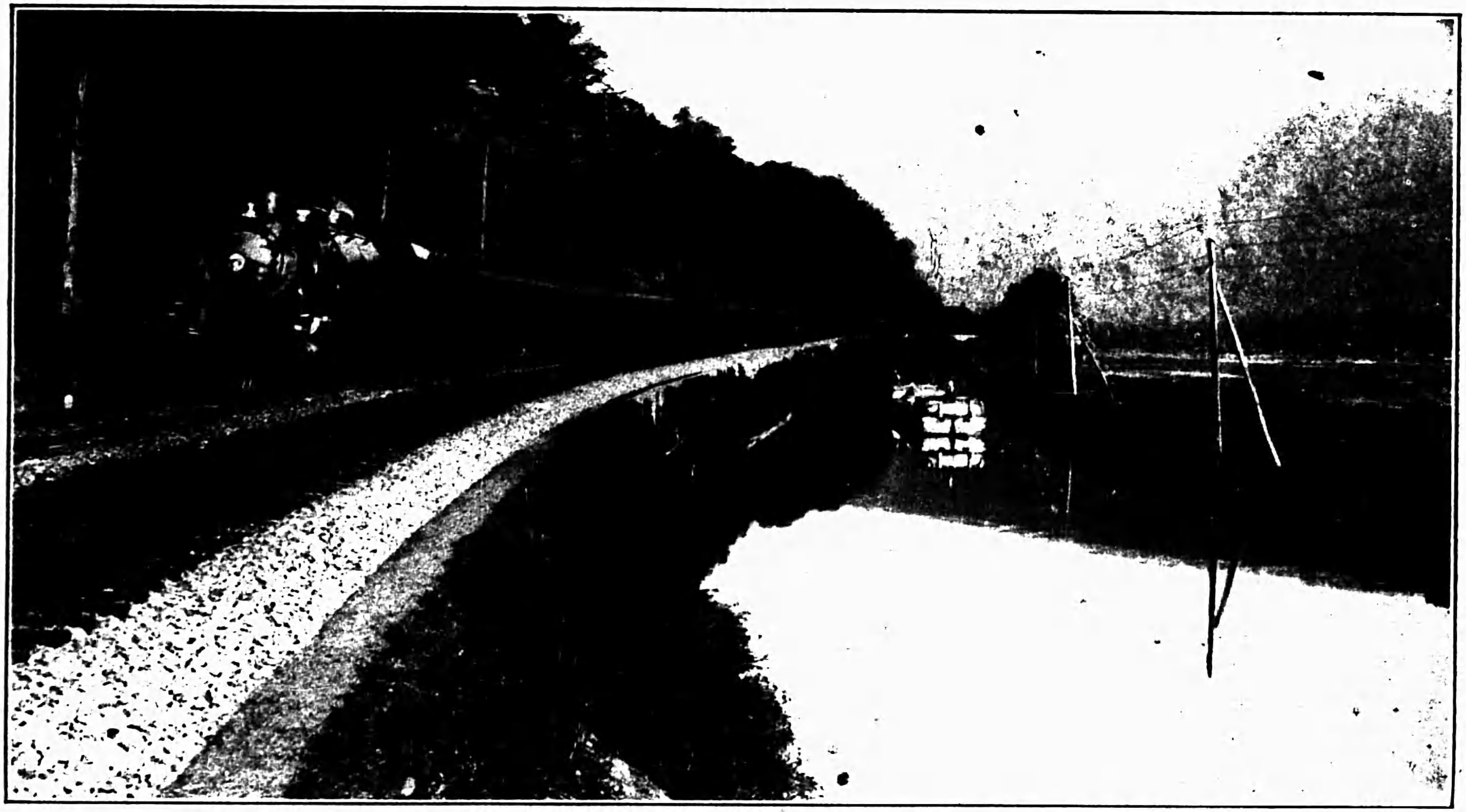
The SECRETARY OF THE INTERIOR.

FOREWORD

No single invention has so influenced the development of man himself, and the changes he has made in his environment, as the making of the wheeled vehicle. It has placed him in close contact with other peoples, with new ideas and with new manners and customs which have altered his point of view and have broadened his conception of the meaning of life itself. Distances have been obliterated; aliens have become neighbors, and strangers friends, when a sympathetic appreciation of the other man's problems has come to us through contact with his daily life.

This will be doubly true with the development of aircraft, now so rapidly nearing that degree of efficiency which will insure its use as a means of transportation for commercial purposes and a mode of travel for business and social convenience. Twenty-eight hours from New York to San Francisco is a short period as compared with five days by train or five weeks by wagon. A letter written in the morning in New York may now be read in Chicago at 7 o'clock in the evening, or in Salt Lake City at 9 the next morning, or in San Francisco the following afternoon at 4.30. A pilot in Michigan may eat his breakfast at Camp Custer, his lunch in Washington, D. C., and return to Michigan in time for dinner the same evening.

Water travel has kept pace with land travel and inland waterways are being developed wherever possible. Trans-Atlantic and trans-Pacific schedules grow shorter each year, and only the minimum time for these journeys is considered by travelers who are selecting routes for voyages on the high seas.



TRANSPORTATION: TO-DAY AND YESTERDAY

HOW THE WORLD RIDES

A SERIES OF PROJECTS ON VEHICULAR TRANSPORTATION FOR ELEMENTARY SCHOOLS

INTRODUCTION

ENRICHED CURRICULA

These great movements in the history of man, affecting as they do his material, intellectual, and civic life, should find some place in the enriched curricula now offered to pupils in our schools who are prepared by endowment and training to accomplish more in the elementary grades than is offered them by the standard courses of study.

Boys and girls show a spontaneous interest in the flight of an airplane, the power of an automobile, or the record speed of a motor boat. These and like data furnish most attractive material upon which to base the fundamental facts which are offered them in the daily program. They offer also a broader outlook, a deeper insight, and a wider perspective of the world in which these children live and in which they must soon assume their share of responsibility.

MODES OF EXPRESSION

A few types of reproduction from a class of fifth-grade pupils in one of the Washington schools are given in this bulletin as suggestive material for other schools who desire to use this subject matter.

Written reproduction.—The transition from oral language to written language forms an important part of the school program in the elementary grades. Back of this written reproduction, however, there must be, on the child's part, a real impetus toward the expression of his ideas in written language. Much of this material will awaken in him a desire to reproduce these ideas in some form or other, of which written language is perhaps the most important in the middle grades.

Informal discussions and conversations.—Discussions with the class and teacher regarding the content of these lessons has been one of the most satisfactory approaches to the development of the projects herein outlined. One or two stenographic reports of these informal conversations are reproduced in connection with the lesson studies as examples of this type of expression. One member of the group in each instance, took charge of the class and conducted the recitation. The plan removed any restraint the pupils might have felt and placed the full responsibility of the exercise in the hands of the leader. He became skillful in controlling the situation and in keeping the class strictly to the point under discussion. There is probably no type of subject presentation which develops the individual pupil and at the same time clarifies the subject matter as this of the socialized recitation.

Posters in colored paper cutting.—Much visualization by the pupils of actual situations precedes the work in any graphic representation, and especially in that of cutting posters from colored papers. The procedure is usually this: The pupil creates a mental image of a given situation, holds it until the details are clearly in mind, and then he is ready to reproduce it.

The choice of colored papers is the next step after the picture has been decided upon, which includes a careful selection of appropriate colors for the different objects in the picture.

Large-sized drawing paper is used for the foundation upon which to mount the objects in the picture. In landscapes blue paper is used for the sky, and green, brown, or gray for the ground, according to the season of the year. The trees are green usually, streets gray, and vehicles any color the pupil may choose. Figures are cut from drawing paper, and, with the exception of face and hands, are covered over with colored paper. Hats, dresses, coats, etc., are cut from appropriate colors and pasted over the figures, with the features of the face marked in with India ink.

All of the objects are cut out free-hand in outline, and when finished are pasted in their appropriate positions on the background and then outlined with India ink.

This is one of the simplest forms of art and one of the first to be used by primitive people in their effort to express thought. A cut outline seems an easier form of technique than an outline drawing, and the colored papers, the pasting, and the assembling of the figures on the background make this form of expression a fascinating mode of reproduction in all grades, and especially in the middle classes of the elementary schools.

Chapter I

ANIMAL SERVICE AND THE EVOLUTION OF THE WHEELED VEHICLE

LESSONS IN SCIENCE AND HISTORY

Animals and Their Service

THE HORSE

1. *Horses of long ago.*—Ages ago one of the first horses in this country was a small animal with four toes on each foot.[1] He was only 16 inches high, we are told. He was swift, alert, and intelligent, and learned how to take care of himself, so that his descendants to-day are seen in our streets and on our farms. In that long ago this little horse had webbed feet for swimming and lived among the rushes that grew along the water courses. Through all these years he has developed and grown to fit into his place in our world. He is much larger now, but eats about the same food and is still a cropper and grazer. His hoofs have become solid, for he now lives on hard ground in the uplands. He is one of the best of our friends, for he carries our burdens and pulls our loads.

2. *The horse and his rider.*—From the earliest records of history man and his horse have been inseparable. Together they have traveled on journeys of migration and conquest. In man's victories and in his defeats, in his games and sports, the horse has been his intelligent friend as well as his obedient servant.

Admirably adapted to this service has the horse become. Length of leg and hardened hoof make him the best of travelers. His broad back furnishes a comfortable seat for the rider. His sensitive mouth makes a bridle rein an easy means of control and guidance. Through years of training his gait has become smooth and flowing, and his speed and endurance have no equal among our burden-bearing animals.

3. *The horse and his driver.*—A deep chest and strong shoulders make the horse an ideal draft animal. His power to pull loads is so remarkable that it has become a unit of force for measuring the power of steam engines and other motors.

A horsepower is a force that will raise a weight of 33,000 pounds 1 foot in one minute. An engine of 100 horsepower can lift 33,000 pounds 100 feet in one minute.

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[1] Found in the Wasatch Lake of the Big Horn Mountains, northern Wyoming.

Much of our success in agriculture, our progress in the development of our country, and our general prosperity we owe to the strength, the intelligence, and the willing service of our friend, the horse.

About one-half of the purebred draft horses in the United States are in the Corn Belt, and most of the other half are found in the hay and pasture, spring wheat, and Great Plains regions.

The number of purebred horses of saddle and carriage breeds in the United States was only about one-ninth of the number of draft horses in 1920. The relatively large number of these saddle and carriage horses are in Kentucky and adjacent States. These areas are famous in song and story for their fine horses, and, despite the

THE INDIAN'S TRAVAIL

decline of horse racing as a sport and the decreased use of horses for riding and driving, horse fanciers in these States retain a large number of purebred saddle and carriage horses.

REFERENCES

Geography.—Where Horses Are Used in the United States, from Yearbook of the Department of Agriculture, 1921. Address the Superintendent of Documents, Washington, D. C. Price, 20 cents per copy.

THE INDIAN'S TRAVAIL

Reading lesson.—The Indians traveled over deer paths through the forest when they moved their village from one location to another.

Their travail was made of two long poles. One end of these poles was tied to the pony's back and the other ends dragged along the ground behind the pony.

All the baggage was carried on these poles. The clothing and the skins for the wigwams were tied up in bundles and fastened to the poles. Then one of the boys rode on the back of the pony and followed along behind the rest of the family.

The mother rode one of the larger ponies and carried her papoose on her back. The father rode ahead of the others on the back of the largest horse, to clear a path and to lead the way through the forest.

When they found a good site for their village they got off their horses and unstrapped their bundles. Then they set their wigwams and built a new village. Before night they were living in their new home just as they had lived in the old village.

THE OX

The ox and his driver.—The ox has great pulling power in his chest and legs. Since the earliest times he has been used for work in agriculture, especially for plowing. The wooden yoke which he wears on his neck and to which the plow is fastened is one of the first bits of harness known in history.

With his split hoof he can easily walk in the soft, plowed ground. A suction of air under his hoof might hinder his progress if he had a solid hoof like the horse. The cleft in the hoof of the ox permits the air to escape when he sets his foot down into the soft, plowed ground and when he lifts it out. For that reason cows and oxen can travel much faster and easier in the moist, fine soil than the horse can.

The ox is guided by the goad which his driver carries, or he obeys his master's voice when directed by certain words which he understands perfectly. The word "Haw!" for instance, means "Turn to the left," and the word "Gee!" means "Turn to the right!" For faithful service and for patient, plodding effort he has no equal among the animals which man uses in his work on the farm.

Geography.—Wherever logging is being done in the United States the ox is still used for draft purposes. He is slow and careful in this work and does it much better than the horse. He is willing to pull a log a few feet at a time and then to stop for a few minutes, which is often necessary when logs are being hauled to the mill. This work wears on the temper of a horse and makes him fractious and unruly. Oxen are used in the lumber camps of California and Oregon and in the Southern States where timber is now being extensively cut and hauled to the mill.

THE PILGRIM'S SLED

Reading lesson.—The Pilgrim made his sled out of a box set on a pair of runners. Then he harnessed a pair of oxen to it and sat down in the bottom of his sleigh to drive.

The sled looked like our stone boats that are used to draw stone over rough ground. In the winter this sled did very well for a sleigh, if there was snow on the ground. But when the ground was bare the sled scraped and bumped over the rough road until one was glad to get out and walk.

A pair of oxen were hitched to this sled. There were no lines or harness. The oxen wore a yoke over their necks which was fastened to the pole of the sled. They were guided by the voice of the driver and by his whip.

PILGRIM'S SLED

These oxen traveled much faster than horses when the road was wet and the soil was muddy. Can you tell why?

Can you see how the Indian's poles which he used for a wagon were turned into sled runners?

THE REINDEER

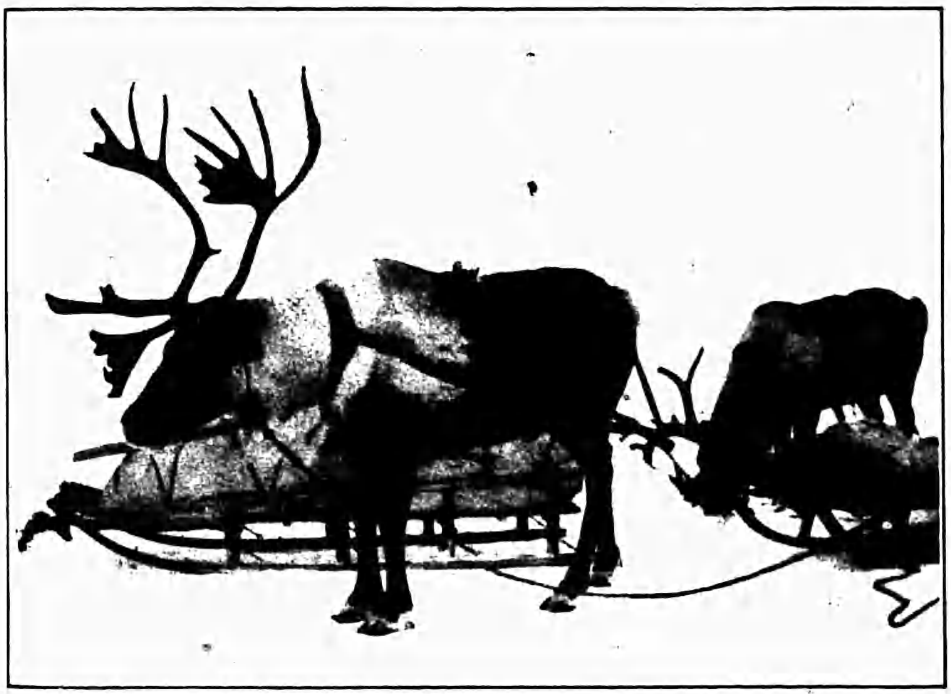
The reindeer and his driver.—Like the horse, the reindeer is one of the best driving animals in the world. He is a cousin to the ox and is like him in many of his characteristics.

In the north, where the reindeer lives, he needs a thicker coat than the ox to keep him warm through the long, cold winter. His feet are broader and flatter than those of oxen, which enables him to travel over the snow and ice with great ease, for his split hoof aids him in running through deep snow.

The Alaskan Eskimos who train the reindeer are expert drivers, and their sleds are built to stand the roughest kind of sledding. Without the reindeer the Eskimo's chief source of food in milk and meat would be cut off, to say nothing of skins used for clothing and shelters and bones and sinews for sled building. He is one of the best animal friends which has been given to man in any part of the world.

Geography.—The United States Government has charge of the reindeer service in Alaska, which is administered by the Bureau of Education of the Department of the Interior.

Herds of reindeer are now found near all the principal native settlements of western Alaska, from the Arctic to the Pacific Ocean.



REINDEER SERVICE IN ALASKA

So rapidly have the herds increased since their introduction in 1892 with a herd of 1,280 that the total number of reindeer in Alaska is now estimated at 350,000, of which about 235,000 are owned by the natives.

THE MULE

The mule is a hybrid animal, having characteristics of both the horse and the ass. He has longer ears than the horse, but otherwise he is very like him. He has unusual power of endurance, is rarely attacked by disease, and is long-lived.

Geography.—The number of mules on farms in the United States has increased 33 per cent during the past decade, while the number of horses has increased only 6 per cent. The mule is found on farms in every State in the Union.

Mules in the Cotton Belt.—About five-sixths of the mature mules in this country are in the Cotton Belt and the corn and winter-wheat regions. There is 1 mule to every 17 acres in the Cotton Belt and to every 18 acres in the Corn Belt. In the eastern Cotton Belt, where negro farmers are most numerous, there are twice as many mules as horses.

Cotton cultivation.—The amount of cotton raised on small-farm areas depends upon the number of pickers available. With 1 mule a man can plow, chop, and hoe from 10 to 20 acres of cotton, from which 5 or 6 bales of cotton are produced. This is ordinarily all that one family can pick. Therefore, one-mule implements are used over the greater portion of the eastern part of the Cotton Belt.

MULE SERVICE

The adaptation of the mule to a warm climate explains his extensive use in the cotton fields of the South. The horse is a more highly organized animal and frets and chafes under the extreme heat which prevails during some parts of the year in this section of the country.

THE SETTLER'S CART

Reading lesson.—Look at the wheels of this cart. They are made from the trunk of a tree. A slice is cut off from a log as one would cut a slice from a loaf of bread. The early settlers in this country used these sections of logs for their tables and chairs and for the wheels of their carts and wagons. They make very good wheels, but they are heavy and they break easily.

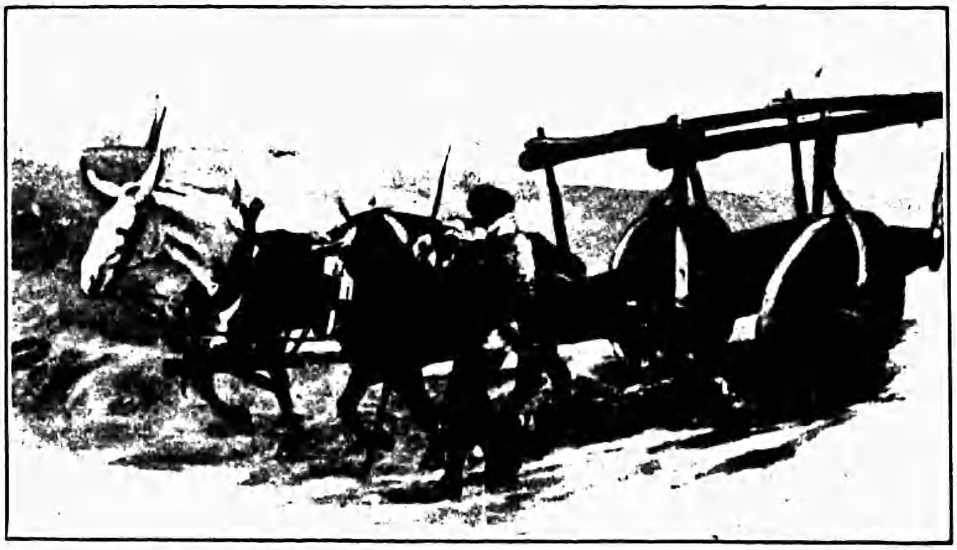
To make these wheels lighter, the Pilgrims cut out three-cornered pieces, and this left the hub in the center, the rim around the edge of the wheel, and the spokes which support the wheel.

Later the wheel was made of three parts, the hub, the spokes, and the rim, first of iron and then of steel.

Now the tires on very heavy trucks and wagons and on automobiles are made of rubber. Sometimes these rubber tires are hollow and are filled with air. Sometimes they are solid, if the wagon is a heavy one.

THE MULE'S COUSIN, THE BURRO

Lesson study.—Travel through mountains is difficult. The roads are narrow and uneven. They often skirt along the edges of a preci-



SETTLER'S CART

pice on the side of a mountain where a misstep would throw a horse and his rider over the cliffs to the rocks below.

A sure-footed beast like the burro is well adapted to this travel. He is not afraid, he is not nervous, and he can climb up and down the mountain side with perfect ease. His tiny feet find a sure foothold in the rocks and gravel which cover his pathway. His back is strong and will carry a heavy burden. He is patient and reliable and will bring his load, whatever it may be, safely to the journey's end.

Geography.—Burro is the Spanish name for donkey. He is used in our Spanish-American States for all kinds of work. He is the animal that hauls and carries for that section of the country. He costs little to buy, and he finds his food among the rocks where another animal would starve; so he is called the poor man's friend.

As a pack animal he has no equal. Upon his small back he can easily carry a load of 360 pounds. Wherever there are mountain paths to climb and journeys to make into rocky canyons and broken foothills, there this little beast will safely carry his load.

DOG TEAMS

The dog and his driver.—Everyone has heard of the famous Eskimo dog Balto and his brave driver. There are many of these brave dogs in the far north that carry men on journeys where other animals can not go.

Like the reindeer, the Eskimo dog is well fitted for this service. He has the thickest coat of fur, the largest feet, and the strongest

BURRO SERVICE

shoulders of any dog in the world. He carries passengers over the frozen plains and across the icy mountains; he brings the mail to far-away settlers; and he carries medicine and food to the sick and hungry. Without the dog team and its service many people in the long, cold, northern winters would suffer and perish.

The Eskimo dog shows his descent from the wolf in his small head, sharp nose, pointed ears, long hair, and bushy tail. Although faithful at his work of drawing sleds over ice and snow in the frozen north he is often very quarrelsome. This may be due to his cruel treatment.

No reins are used to guide him; shouts, shrieks, and volleys of hard words are constantly yelled at him, often helped out by sharp cracks from the whip or blows from a cudgel.

The dogs travel tandem. The harness consists of strong collar, backband, and traces. Sleigh bells are hung from the collars, which are ornamented with beadwork, bright worsted tassels, and fringes.

After the dogs have been over a route once their instincts may be fully trusted. Whenever a traveler in a dog sled is uncertain or bewildered about the course the dogs will guide him to safety.

THE STAGECOACH

Reading lesson.—How would you like to ride in this stagecoach? The people inside look as though they would rather get out and walk.

ESKIMO DOG SERVICE IN ALASKA

In olden times these stagecoaches drove through the country and stopped once or twice a day at the inns along the road.

The roads were so bad in those days that a breakdown often spilled the passengers out in the mud or left them standing by the side of the road for many hours until the coach was repaired.

These coaches usually ran in relays from one point to another of 10 miles' distance. The passengers were transferred from one coach to another at the end of the 10 miles, and the coaches returned to their home town.

The baggage was strapped on to the top of the coach, and the travelers were crowded together inside, unless one was fortunate enough to sit on top with the driver.

It was a weary journey. The jolting and jouncing of the stage-coach, the crowding and jostling of tired and irritable fellow passengers, all made this mode of travel a frightful nightmare only to be endured for the sake of getting somewhere as soon as possible.

To the people who lived on the coach road the passing of the coach was a great sight. When the driver's horn was sounded they knew the coach was coming. Everyone rushed to the windows and the doors to wave a greeting to the coachman and his party.

They thought it was a fine way to travel and that the extreme of speed had been reached in locomotion. They prided themselves upon living in an up-to-date age and talked very much as we do to-day about our automobiles and our flying machines.

STAGECOACH

THE PRAIRIE SCHOONER

Reading lesson (See plate p. 13).—These wagons are called "schooners" because they look like ships, as they roll over the western plains. They are really like houses, for families live in them for weeks at a time during their long journey across the country. They are furnished with stoves, beds, chairs, and tables, much as a house is.

If it is pleasant weather during the journey the people camp at night in the open air. They set their stove up under the trees, cook their supper, roll themselves in their blankets, and sleep near the wagon on the ground.

When it is stormy weather they eat and sleep in their wagon, which is quite comfortable for a house on wheels.

The first white travelers who crossed our country rode in prairie schooners. The roads were rough and almost impassable. There were no bridges in the far West and crossing a ford in a rushing river was very dangerous. Sometimes the team of horses, the wagon, and all the people in it were carried down the river and were never seen again.

The open roadway from coast to coast and the comfortable closed car that speeds along the highway to-day are in great contrast to this early mode of travel in a prairie schooner.

FROM NEW YORK TO ALBANY IN 1703

The old Post Road from New York to Albany was the first State road developed in this country. Along this route a procession of travelers passed in the early days, which marked the development of vehicular travel in this country. The earliest New Yorker rode horseback over this route when it was but a bridle path widened from

COVERED WAGON

the old Indian trail which led up State along the Hudson River. The madam rode behind her husband on a pillion, a sort of padded cushion, from which was suspended a stirrup platform. On this she braced her feet, while she clung to her husband's coat with both hands. This was a very common mode of travel in the early days, especially in hilly and mountainous countries. It is said that Thomas Jefferson brought his wife home to Monticello in this fashion.

Chairs and then gigs followed the pillion mode of travel; and later the chaise, which was a light vehicle on two wheels, was seen here and there, as the bridle paths were gradually widened into wagon roads.

In 1786 "modern transportation" appeared. John Kenny and Isaac Van Dyke obtained from the legislature the exclusive right to "erect, set up, and carry on and drive stage wagons between New

York and Albany on the east side of the river for a period of 10 years, forbidding all opposition under penalty of 200 pounds."

LITERATURE, MUSIC, AND ART

THE HORSE

Stories.—Phaeton—Greek myth. Gulliver's travels—Jonathan Swift. The story of the enchanted horse—Greek myth. Black Beauty—Sewell. Pegasus—Greek myth. The string of carts—Russian fable.

Poems.—How They Brought the Good News from Ghent to Aix—Robert Browning. Paul Revere's Ride; The Village Blacksmith; The Bell of Atri—Henry W. Longfellow. Windy Nights—Robert Louis Stevenson. Young Lochinvar—Sir Walter Scott. The Charge of the Light Brigade—Alfred Tennyson. The Rhyme of the Duchess May—Elizabeth Barrett Browning. John Gilpin—William Cowper. Sheridan's Ride—Thomas Buchanan Read. Barbara Frietchie—John G. Whittier. The Arab and His Steed—Norton. Kentucky Belle—Constance Fenimore Woolson. My Golden Spurs Now Bring to Me—James Russell Lowell. Thanksgiving—Lydia Maria Childs. The One-Hoss Shay—Oliver Wendell Holmes. The Peddler's Caravan—William B. Rands. The Boy Lives on our Farm—James Whitcomb Riley.

Songs.—A Song of Wheels; The Morning Ride—Music Education Series, Book 3. The Cossack Rider; Marching with the Horse—Music Education Series, Book 4. Sleigh Bells; Windy Nights—Progressive Music Series, Book 1. A Song of the Steppes; Horse and Cock; Sleigh Song; Hoof Beats—Progressive Music Series, Book 2. In the Sleigh—Progressive Music Series, Book 3.

Pictures.—The University Prints: Arab horse, men at a ford (Fromentin); Horse fair (Rosa Bonheur); Automedon and the horses of Achilles (Regnault); The kicking horse (Wouwermann); At the watering trough (Dagnan-Bouveret); The market cart (Gainsborough); Philip IV on horseback (Silva); Horses of Marly (Couston); Horses of the sun (Lorrain); The old gray hunter (Potter); Hotel stable (Wouwermann); Cavalry skirmish on a bridge (Wouwermann).

Art for schools: The horse fair (Rosa Bonheur); A scanty meal (Herring); Showing the bay mare (Landseer); A dash for timber (Remington); The horses of Achilles (Regnault); Prince Carlos (Valesquez); The flight of night (Hunt); Surrender of Cornwallis (Trumbull); Arabs on the march (Schreyer); Aurora (Reni); Spring (Douglas).

Perry Picture Lessons: Barbara Freitchie; Shetland pony; Race of Roman chariots (Chica); Three members of a temperance society (Herring); Village blacksmith (Herring); Glimpses in an English homestead (Herring); Society of friends (Herring); Shoeing the horse (Landseer); Three of a kind (Schmid); American mustangs (Rosa Bonheur); Texas steers and cow boys; Washington at Trenton (Faed).

Brown's Famous Pictures: End of the journey (Entraignes); Horses in pasture (Chialiva); Race of Roman chariots (Chica); Ready for battle (Schreyer); An imperial courier (Schreyer); A. Kabyl (Schreyer). At the watering trough (Dagnan Bouveret).

READING LESSONS

THE HORSE

Silent reading, Grades III, IV, V, VI.—*Third readers.*—The enchanted horse—Bolenius, 3. The bell of Atri; Alexander and his horse; Nahum Prince—Carroll and Brooks, 3. A dumb witness; Saddle to rags; Nahum Prince—Child World, 3. The bell of Atri; The last nail—Merrill, 3. A story of Washington's boyhood—Riverside, 3. Bonny George Campbell—Field, 3. How the horses of the sun ran away; Axel, from stories of life in other lands (Bayard Taylor)—Young and Field, 3. Ways of traveling; The wooden horse—Winston, 3. Lindu and the northern light—New Education, 3. Grumble and Cherry, from Black Beauty—Beacon, 3. The seven foals—Andrew Lang, Part V, 3.

Fourth readers.—Black Beauty's breaking in—Haliburton, 4. The bell of Atri; Thanksgiving (Lydia Maria Child)—New Education, 4. My early home, from Black Beauty; Return to the farm (J. T. Trowbridge)—Standard Classic, 4. A brave boy's adventure; Sigurd, the youthful warrior; How Roosevelt overcame his handicap; The one-hoss shay (Oliver Wendell Holmes)—Elson, 4. Raschmen; Vermont, sugar making—Around the World, 4. The nail; The little post boy; The village backsmith (Longfellow)—Riverside, 4. Silverfooted Thetis—Gordon, 4. Old Major, the faithful horse; Traveling in the old days; The pony express rider—Child Library, 4. The champion of

France; The little Duke's escape—Child World, 4. The little post boy; Thanksgiving day—Wheeler, 4. Mrs. Peterkin wishes to go to drive—Gordon, 4. George Washington, the skillful horseman; The village blacksmith (H. W. Longfellow)—Horace Mann, 4. Paul Revere's ride (Longfellow); The leap of Roushan Beg (Longfellow); The charge of the light brigade (Tennyson); John Gilpin (Cowper); How they brought the good news from Ghent to Aix (Browning)—Elson Grammar, 4.

Fifth readers. The horse, history of development; Breeds of horses; Gamurru—Farm Life, 5. Kentucky Bell (Constance Fennimore Woolson); Douglas and Marmion (Sir Walter Scott); Lochinvar's ride (Sir Walter Scott)—Sprague, 5. The talking saddle (Joel Chandler Harris)—Riverside Literature, 5. The Chimera (Nathaniel Hawthorne); The bell of Atri; The Arab and his steed—Reading Literature, 5. Betty's ride; A strange ride; Hie away! (Sir Walter Scott); The diverting history of John Gilpin (William Cowper); Handy Andy goes for the mail; The circus day parade (James Whitcomb Riley); Capturing the wild horse (Bayard Taylor)—Bobbs Merrill, 5. The horse fair; How Buffalo Bill got his name (Zane Gray)—Progressive Road to Silent Reading, 5. The wooden horse of Troy; The enchanted horse; Fire, from Black Beauty; The rescue; The horse trade, a story of Lincoln—Columbia, 5. The prairie fire (Alice Cary); Joan, a war horse—Barnes New, 5. How Mr. Pickwick undertook to drive; Tom Faggus and his strawberry mare—Merrill, 5.

Sixth readers.—Sail Ho!; Kenneth buys his outfit (Zane Gray)—Modern readings, 6. Black Beauty's training; Lochinvar (Sir Walter Scott); Stories from the travels of Baron Munchausen; The diverting history of John Gilpin (William Cowper)—Kendall 6. Pasha, the son of Selim (Sewell Ford); A race with the Indians; Roadways (John Masefield)—Bobbs Merrill, 6. The bell of Atri (Longfellow); The Arab and his steed (Norton); The village blacksmith (Longfellow)—Reading Literature, 5–6. The horse's cousin, chapter 19—Swiss Family Robinson, 6. Phaeton; Story of the enchanted horse (Arabian Nights); John Gilpin (William Cowper); The one-hoss shay (Oliver Wendell Holmes); Young Lochinvar (Sir Walter Scott); The bell of Atri (H. W. Longfellow)—Riverside Literature, 6. The wooden horse; Midget, the return horse; The bell of Atri (H. W. Longfellow); Paul Revere's ride (H. W. Longfellow)—Riverside, 6. An American stage coach journey (Charles Dickens); How they traveled on the old National road; The horse trade; Moses sells the colt (Oliver Goldsmith); The genuine Mexican plug; Mr. Windle's ride (Charles Dickens); Horace Greeley's ride (Artemus Ward)—Literature and Living, 6.

Seventh reader.—The stage coach (Thomas Hughes); The steeple chase (Ouida); Mr. Pickwick and his friends begin a journey (Charles Dickens); The buffalo hunt (Francis Parkman)—Reading Literature, 7. How they brought the good news from Ghent to Aix (Robert Browning)—Kendall, 7. The charge of the light brigade (Alfred Tennyson)—Barnes, 7. Paul Revere's Ride (Henry W. Longfellow); The legend of sleepy hollow (Washington Irving)—Wheeler, 7. The deacon's masterpiece—Riverside, 7. Vision of Sir Launfal, part first (Oliver Wendell Holmes)—Riverside Literature, 7. Paul Revere's ride (Henry Wadsworth Longfellow); A buffalo hunt (Joaquin Miller)—Wheeler's Literary, 7.

Eighth readers. Trails over the glass mountains (Zane Gray); The pageant; The white man's errand—Child Library, 8.

LITERATURE, MUSIC, AND ART

THE OX

Stories.—The ox who won the forfeit (fable); The dog in the manger (fable).

Poem.—The wagon train—Joaquin Miller.

Pictures.—Perry Picture Co.: Repose (Rosa Bonheur); Oxen going to work (Troyon); Return to the farm (Troyon); Plowing (Rosa Bonheur); Texas steers and cowboys.

Brown's Famous Pictures: Return to the farm (Troyon); Oxen going to work (Troyon).

Art for schools: Oxen going to labor (Troyon); The horses of Achilles (Regnault); Return to the farm (Troyon).

READING LESSONS

THE OX

Silent Reading, Grades III, IV, V, VI.—The sandy road; The straw ox—Silent Reading Hour, 3. The wagon train—Aldine, 3. The sandy road—Winston, 3. The ox that won a wager; The sandy road—Horace Mann, 3. Cuba, drawing water—Around the World, 4. Our rural divinity—Farm Life, 5. Ox-team days on the Oregon trail; The wagon train (Joaquin Miller)—Field, 5. Driving the oxen—Riverside, 5.

THE REINDEER

Silent Reading, Grades III, IV, V, VI.—In Lapland—Carrol and Brooks, 3. The kitten that wanted to be a Christmas present—Beacon, 3. A legend of the Northland—Bolenius, 3. 'Twas the night before Christmas—Young and Field, 4. Sampo, the little Lapp—Gordon, 4. A visit from St. Nicholas—Horace Mann, 4. The night before Christmas—New Education, 4.

LITERATURE, MUSIC, AND ART

THE BURRO

Stories.—Story of a donkey (Sigur); The man, the boy, and the donkey (fable); Donkey John (Morley); Journeys with a donkey—Robert Louis Stevenson.

Poem.—The cow and the ass—Jane Taylor.

Pictures.—*Perry Picture Co.:* The donkey in the stable (Rosa Bonheur); Meditation (Rosa Bonheur); A humble servant (Rosa Bonheur).

READING LESSONS

THE BURRO

Silent reading, Grades III, IV, V, VI.—The peddler's pack; Jack and his companions—Aldine, 3. Pedro and the saddle bags—Merrill, 3. The peddler's pack; Jack and his companions—Silent Reading Hour, 3. The barber of Bagdad—Child World, 3. Donkey John—Study readers, 4. Porto Rico, on the way to market; The Southern States, farming—Around the World, 4. The ass and the students—Magee, 6.

LITERATURE, MUSIC, AND ART

THE DOG

Stories.—The black-eyed puppy (Pyle); Beautiful Joe (Sanders); Under the lilacs (Abbott); Stories of brave dogs (Carter); Dog of Flanders (Ramee); Moufflu (Ramee); The story of Peter Punk from Mrs. Tubbs (Lofting); Eskimo stories (Smith); My dogs in the Northland (Young); Young Alaskans in the far north (Hough); The young Alaskans on the trail (Hough); Connie Morgan of Alaska (Hendry); The dog and his shadow (fable); The Eskimo twins (Perkins); Bob, son of battle (Olliphant); The dog in the manger (fable); The wolf and the house dog (fable); The hare and the hound (fable); Lad, a dog (Terhune).

Poem.—Let dogs delight (Watts); Llewellyn and his dog (Spencer)—Golden Staircase. Roger and I (J. T. Trowbridge); Riley's Armazinda; The toy penny-dog; The little dog-woggle—Bryant's Poetry and Song. Elegy on the death of a mad dog (Goldsmith)—Putnam's Famous Poems. Little Gustava; The gingham dog and the calico cat (Field)—Thaxter's stories and poems for Children.

Songs. Progressive music series—Fido and his master; Music Education Series: My dog (Book I); Hare and hounds (Book 3). Swersy—Doggie's bone; My old dog.

Pictures.—Brown's Famous Pictures: St. Bernard's dogs (Dieker); The wounded hound (Ansdell); Waiting for breakfast (Schmitzberger); The shepherd's dog (Troyon); My dog (Landseer); Saved (Landseer).

Perry Picture Co.: Miss Bowles (Reynolds); King Charles's Spaniels (Landseer); Well-bred setters (Landseer); Wasp (Rosa Bonheur).

Mumford Pictures: Irish setter dog; Pointer dog.

READING LESSONS

THE DOG

Silent reading, Grades III, IV, V, VI.—Moufflu: The old man who made the trees blossom—Merrill, 3. Joe Black—Gordon, 3. Peter and Paul, from the Dutch twins—Bolenius, 3. The dog and wolf; The selfish dog in the manger—New Education, 3. The blind man and the talking dog; Rover and his friends—Winston Companion, 3. The puppies who lived on the roof; War-baby and Tar-baby—Silent Reading Hour, 3. Boots and his crew; Three years without wages—Fox, 3. Three companions (Dinah Mulock Craig); Stories of dogs—Cyr, 3. The dog in the manger—Educational, 3. The dog and the horse—Elson, 3. Battle of the beasts—Aldine, 3. The three dogs—Andrew

Lang, part V, 3. The bat and the pup; Benjy in Beastland Sirrah, the shepherd dog—Child Library, 3. Abraham Lincoln and his dog—Winston Companion, 3. Zelona's dog Togo, from children of the cliffs; Axelma's dogs, from children of the snow Fox's Indian Primer, 3. When old Jack died (James Whitcomb Riley); Blackfriar's Bobby—Haliburton, 4. A dog of Flanders—Elson, 4. Moufflu—Standard Classic, 4. Dogs of war; Lemonade Sandy—Study Readers, 4. Patricia's busy day—Riverside, 4. Gissing at the dog hotel; An Eskimo dog—Field, 4. Jock, a dog of the Bushveld—Horace Mann, 4. Moufflu—Wheeler's Literary, 4. Taking care of Skip; Casper, the snow king; The monk of St. Bernard—Child Library, 4. Alaska, dogs packing over the Dyea trail—Around the World, 4. Kettu, from Sikku, the cowherd—Gordon, 4. The shepherd's dog, from sheep raising—New Education, 4. The saving of bones; Love's sacrifice—Sprague, 5. Ishmael—Bobbs Merrill, 5. Jock's school days; Pierrot, dog of Belgium—Study Readers, 5. A dog of Flanders; For love of a man (Jack London)—Wheeler's Literary, 5. The search for Tom, from Kingsley's Water Babies—Progressive Road to Silent Reading, 5. The wire-haired fox terrier; Boy life on the prairie (Hamlin Garland)—Modern Readings, 5. A tribute to the dog—Merrill, 5. Traveling in the Arctic regions; A yellow dog (Booth Tarkington)—Modern Readings, 6. An elegy on the death of a mad dog (Oliver Goldsmith)—Riverside, 6. Reaching the north pole (Peary)—Kendall, 6. The romance of the Soo—Barnes, 6. Skipper (Norman Duncan); Billy, the dog that made good (Ernest Seton Thompson)—Bobbs Merrill, 6. The children's friend; Cap, the red-cross dog (Georgine Faulkner)—Progressive Road, 6. A visit to dogland (Lewis Carroll)—Magee, 6. The law of club and fang (Jack London)—Literature and Living, 6.

Chapter II

THE RAILROAD TRAIN

Part I. Steam-Motive Force

LESSONS IN SCIENCE

CYLINDER AND PISTON

Plan of study.—1. *Squirt gun:* Let the class experiment with a squirt gun. Draw back the piston to fill the cylinder with water and push it out to expel the water. See that the class realizes something of the force with which the water escapes from the cylinder.

2. *Air pump:* Experiment with an air pump in the same way until the children can distinguish between the force of air and water in a cylinder.

3. *Water pump:* Construct a water pump by cutting a hole in the side of a wooden cylinder, one end of which is set in a basin of water. Insert a spout in the hole. Place a piston in the upper end of the cylinder and draw up the water from the basin into the cylinder. Watch the water as it is expelled through the spout. Note the force of the water as it runs out. What affects the force? Let pupils work the pump and increase or decrease the force at will, so they may be able to state clearly how it is regulated.

4. *Popgun:* Use a popgun to illustrate the principle of force. Measure the distance covered by the ball as it is thrown from the gun. State in general terms the relation between the force which expels the ball and the distance it flies through the air.

THE USE OF STEAM

Compare this principle of the squirt gun, the air pump, the water pump, and the popgun in the use of the piston and cylinder with the use of steam as a motive power. If possible, bring a burner to school and let the class watch a teakettle boil. Fill the kettle full of water and place a loose lid over the top and a plug in the spout. If the steam gathers sufficiently to lift the lid, the class will see how steam was first considered as a motive power.

THE STEAM ENGINE

Parts and their use.—The cylinder and piston are the motor power in a steam engine, and steam is the force which pushes the piston back and forth in the cylinder. The piston rod is attached to the connecting rod, which is joined at the outer end to the flywheel.

PISTON AND CYLINDER ACTION IN A STEAM ENGINE

1. Steam enters the cylinder at S–1, the intake valve at the right end of the cylinder, and pushes the piston forward toward the left end, while E–1, the exhaust valve at the left end, opens and lets out the steam. Valves S–2 and E–2 closed.

2. Steam enters the cylinder at S–2, the intake valve at the left end of the cylinder, and pushes the piston back toward the right end of the cylinder, while E–2, the exhaust valve at the right end, opens and lets out the steam. Valves S–1 and E–1 closed.

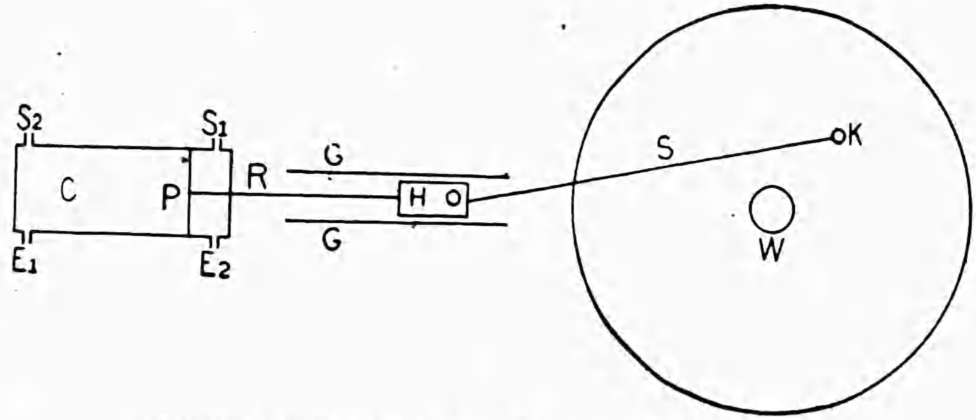


FIG. 1.—CYLINDER AND PISTON IN A STEAM ENGINE

Key: C, cylinder. P, piston. S–2 and S–1, intake valves. E–1 and E–2, escape valves. R, piston rod. G G, guides. H, crosshead. S, connecting rod. K, crank. W, flywheel.

3. This movement of the piston back and forth in the cylinder is carried outside of the cylinder by means of the piston rod, R, to the crosshead, H, which slides between two guides, G G, which carries the motion of the connecting rod, S, which sets the flywheel W in motion.

APPLICATION OF STEAM TO RAILROAD TRANSPORTATION

Reading lesson.—The first railway train made its first trip about 90 years ago. It went much slower than our trains do now, and was not so long nor heavy as trains are to-day.

There were no baggage cars and only three small coaches. These look like stagecoaches and were built in the same way. The baggage was carried on the top of the coach, and there were three seats inside for the passengers.

The engine looks very strange to us, but it has all the parts which are necessary to run an engine. These parts have been improved year by year ever since this first engine was built, until now the big moguls on the fast express trains seem to be the last word in engine building. Doubtless 90 years from now our engines will seem as strange as the first railway train seems to us.

The engineer was also the fireman. Long sticks of wood were the fuel, and they were carried in a wagon which was hitched to the engine. The rails were made of wood with strips of iron nailed over the top. Sometimes these strips of iron became loose and would curl up and strike through the floor of the car, hurting passengers and sometimes killing them. These rails were called "snake heads," and people were so afraid of them that solid iron and steel rails were made to take the place of them.

LESSONS IN HISTORY

ONE OF THE FIRST RAILROADS

Before the steam engine was used to draw a train of cars on a track a team of horses was attached to the coach and was driven between the rails.

THE FIRST RAILWAY TRAIN

Peter Parley, in his "First Book of History," describes this new way of travel.

But the most curious thing at Baltimore is the railroad. I must tell you that there is a great trade between Baltimore and the States west of the Allegheny Mountains. The western people buy a great many goods at Baltimore and send in return a great deal of western produce. There is, therefore, a vast deal of traveling back and forth, and hundreds of teams are constantly occupied in transporting goods and produce to and from market.

Now, in order to carry on all this business more easily, the people are building what is called a railroad. This consists of iron bars laid along the ground and made fast, so that carriages with small wheels may run along upon them with facility. In this way, one horse will be able to draw as much as 10 horses on a common road. A part of this railroad is already done, and if you choose to take a ride upon it, you can do so. You will mount a car something like a stage, and then you will be drawn along by two horses at the rate of 12 miles an hour.

A RAILROAD NOTICE PUBLISHED BY ONE OF THE FIRST RAILROADS IN 1830

The following notice, which appeared in a Baltimore newspaper in 1830, was the first timetable for passenger railway trains published in this country:

Railroad Notice

A sufficient number of cars being now provided for the accommodation of passengers, notice is hereby given that the following arrangements for the arrival and departure of carriages have been adopted, and will take effect on and after Monday morning next, the fifth instant, viz:

A brigade of cars will leave the depot on Pratt Street at 6 and 10 o'clock a. m. and at 3 and 4 o'clock p. m., and will leave the depot at Ellicott's Mills at 6 and 8½ o'clock a. m., and at 12½ and 6 o'clock p. m.

Way passengers will provide themselves with tickets at the office of the company in Baltimore, or at the Relay House, near Elk Ridge Landing.

The evening way car for Ellicott's Mills will continue to leave the depot, Pratt Street, at 6 o'clock p. m., as usual.

N. B.—Positive orders have been issued to the drivers to receive no passengers into any of the cars without tickets.

P. S.—Parties desiring to engage a car for the day can be accommodated after July 5th.

It will be seen that the word train was not used, but instead the schedule spoke of a "brigade of cars."

TRIAL TRIP OF THE STOURBRIDGE LION

The first steam engine which was used on a railroad in this country was built by Mr. Horatio Allen, in England. He named it "The Stourbridge Lion," and to him belongs the distinction of having run in 1829 the first locomotive that was ever used in the United States. In 1880 he wrote the following account of his trip:

When the time came, and the steam was of the right pressure, and all was ready, I took my position on the platform of the locomotive alone, and with my hand on the throttle-valve handle said: "If there is any danger in this ride it is not necessary that the life and limbs of more than one should be subjected to that danger." The locomotive, having no train behind it, answered at once to the movement of the hand; soon the straight line was run over, the curve was reached and passed before there was time to think as to its not being passed safely, and soon I was out of sight in the 3 miles' ride alone in the woods of Pennsylvania. I had never run a locomotive or any other engine before; I have never run one since.

The road was 16 miles long. It extended from the head of the Delaware and Hudson Canal at Honesdale, Pa., to the coal mines belonging to the Hudson Canal Co. at Carbondale.

Peter Cooper built an engine in 1830 and made a trial trip with it in August of that year. The story of a famous race is told in connection with this trip. The people of Maryland believed that horses were a better means of locomotion than steam power. To prove this they brought out a gray roadster and drove him in a breakneck race against Peter Cooper and his engine. The horse lost, much to Peter Cooper's delight, and the race became as renowned at the time as the famous ride of John Gilpin.

A PRESENT-DAY EXPRESS TRAIN

Reading lesson.—This is a present-day express train which runs from New York to Chicago. It is like a well-furnished house. There is a drawing room and a library, where the traveler can read a magazine or write a letter. (See frontispiece.)

There is a bedroom where he can sleep and a bathroom for his morning bath. The barber waits in the barber shop to shave him and dress his hair. In the diner he is served with the choicest foods that can be found in the markets.

And while he is reading, writing, sleeping, bathing, dressing, and eating he is being carried across the country a mile for every minute. He leaves New York at 2 o'clock in the afternoon and eats his breakfast at 9 o'clock the next morning in Chicago.

LESSONS IN GEOGRAPHY

THE EXPRESS TRAIN

Map study.—Taking a journey on a present-day express train. Pupils collect railroad maps and bring them to school. Imaginary trips are planned and routes selected. Reports on journeys with points of interest described should be part of this study, which should be instituted as far as possible by the pupils with the teacher as an interested participator.

N. B.—There is no form of school exercise so fascinating to children as this if properly conducted.

THE FREIGHT TRAIN

Pupils visit a freight depot and watch the loading and unloading of freight. Ask to examine some of the freight bills on file in the freight office. Find the time schedule and cost schedule for some of the freight transportation in the pupils' home town. Encourage them to prepare problems on costs with profits for certain lines of produce which are sent out from the home office.

Part II. Electromotive Force

LESSONS IN SCIENCE

Plan of study.—1. *Magnets.*—Let the children experiment with magnets, picking up steel needles, tacks, iron filings, etc. Let them magnetize a needle by rubbing it over the ends of the magnet, so that the needle has the same attraction for steel and iron that the magnet has.

2. *Compass.*—Let the children use a compass with the magnet. They will find that one end of the magnet attracts one end of the compass needle and repels the other end.

3. *Frictional electricity.*—Let the children experiment with a glass plate supported on books with tissue-paper dolls underneath, the glass rubbed with silk. Experiment with a comb rubbed with silk, and bits of paper, with sealing wax rubbed with silk and pith balls. All these experiments will give the pupils some idea of frictional electricity and some experience with its behavior.

4. *Electric battery.*—Let the children make a simple electrical battery by this formula. Take a tumbler partially filled with water and add a tablespoonful of sulphuric acid. Then insert a strip of zinc and a strip of copper, so placed that they do not touch under the water. Connect the upper ends of the plates with wires. As soon as the connection is made a chemical action takes place which produces electricity.

The wires are called poles, the wire connected with the copper plate being the positive (+) pole, and that attached to the zinc plate the negative (−) pole.

5. *Dry battery.*—Let the children make a dry battery. This is made on the same plan as the wet battery, by mixing the liquid with starch and glue. It can be used to better advantage than the wet battery because it is more convenient to carry about and is less expensive.

6. *Electric bell.*—Let the children examine an electric bell. Let them set up an electric bell, using the dry battery they have made for the current of electricity. For this lesson, see the Course in Nature Study and Science in the University Elementary School, by Bertha M. Parker, University of Chicago Press.

7. *Electric motor.*—Let the children examine a small electric motor. After they are familiar with the principles involved let them take a motor and attach it to a sewing machine, using it in place of hand or foot power to sew long seams and simple stitching of other kinds.

DEFINITIONS

Electric motor—a device for driving machinery by the power of an electric current.

Electric dynamos—machines for generating electricity by some mechanical power which develops electromotive force in the machine.

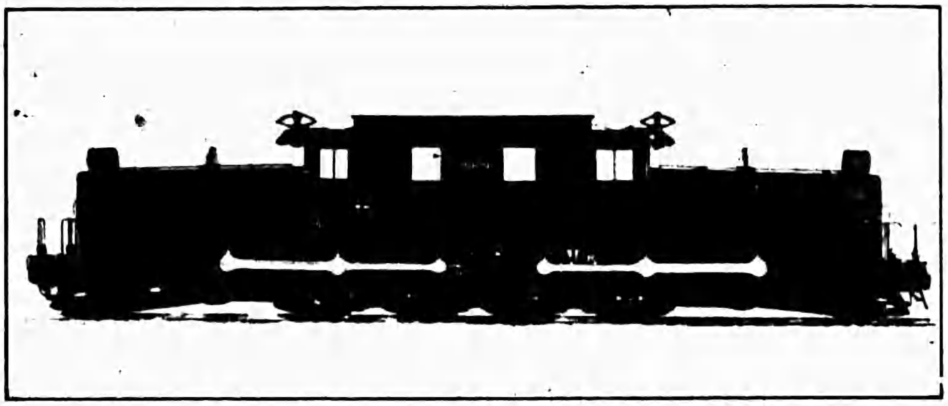
Electromotive force—a phrase commonly abbreviated into the three letters *e. m. f.*, is the force that tends to cause a flow of electricity.

Electric battery—a device for generating electricity by chemical action.

Frictional electricity—the name applied to all electricity produced by friction.

APPLICATION OF ELECTRICITY TO RAILROAD TRANSPORTATION

Electric street railways.—The electric street railway represents the application of electromotive force to transportation. Electric



ELECTRIC LOCOMOTIVE

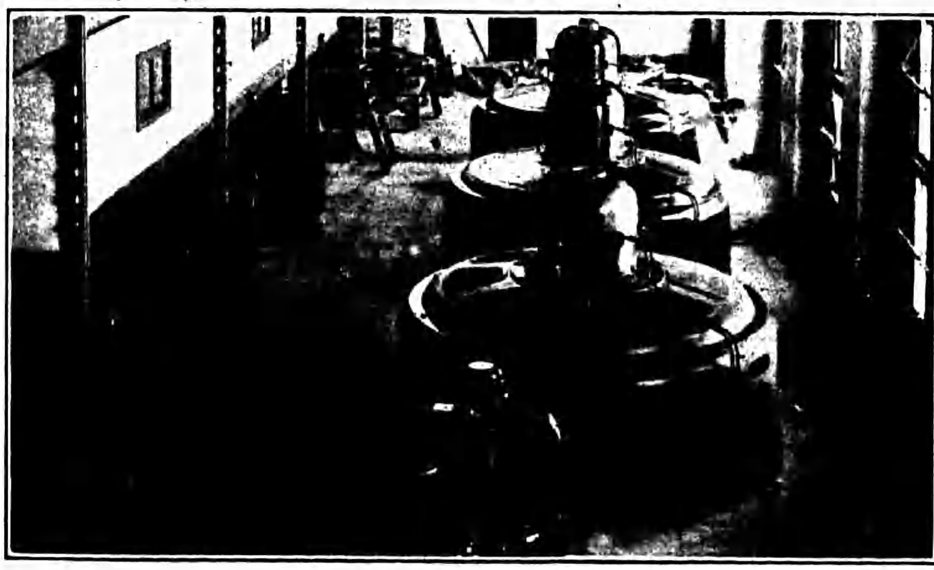
motors are installed in each car, and when an electric current is turned on the car moves at the will of the motorman. The current of electricity is sent through wires to the cars from dynamos stationed at some distance from the tracks over which the cars are running.

A TURBINE: OUTSIDE VIEW

A TURBINE: INSIDE VIEW

Sometimes steam power is used to run the dynamos, and sometimes they are built near a water power. The electricity is conveyed to any point desired by means of overhead wires. The current passes from the wires down the trolley pole conductor to and through the motors in the car and returns to the central station by way of the rails. The motors which are attached to the trucks of the car are controlled by a switch which is operated by the motorman.

Electric locomotives.—Electric locomotives are being used on many lines of railroads in place of steam locomotives. Great turbines (see p. 24), run by steam or water power, and connected with dynamos where electricity is generated. The current of electricity from these dynamos is carried to overhead wires running parallel to the tracks and through the wires to the trolleys attached to the locomotive. Some systems of railroads in the West have installed electric locomotives to pull their trains over the mountain passes in Montana and Idaho. In New York City no steam engine is permitted to enter, and for that reason electric locomotives pull all



DYNAMOS

trains into and out of the city. The average electric locomotive weighs from 110 to 125 tons and has from 8 to 12 motors, each developing from 300 to 325 horsepower.

LITERATURE, MUSIC, AND ART

THE RAILROAD

Stories.—Buffalo Bill and the overland train—Sabin. The railroad book—Smith. Story of steam—McCabe.

Poems.—Bryant's Library of Poetry and Song. The song of steam—Cutter. Railroad rhyme—Saxe. Eugene Field's Poems. The shut-in train; Conductor Bradley—Whittier.

Songs.—Progressive music series: The train (Book II); Choo-choo-choo (Manual).

Congdon Music Readers: Train a-coming (Book III); The train (Book I).

Music Education Series: The train (Book I); From a railway train (Book II); A song of wheels (Book III).

Pictures.—Art for schools: The train—here it comes (Birney).

READING LESSONS

THE RAILROAD

Silent reading, Grades III, IV, V, VI.—The first locomotive—Carroll and Brooks, 3. The boy who studied the teakettle; The kettle and the engines—Merrill, 3. From a railway train—Gordon, 4. Boston subway; California, Incline railway, Mount Lowe; New England, Mount Washington railway; White Mountains, Jacob's Ladder—Around the World, 4. James Watt, the story of steam; George Stevenson, the engineer—Standard Classic, 4. Kate Shelly, the girl who saved the train—Field, 5. Conductor Bradley (Whittier)—Elson, 6. The story of the railroad; The train—Kendall, 6. The runaway freight—Bobbs Merrill, 6. The song of steam—Wheeler, 6. Saving the Seaside Special—Natural Method, 6. The first railroad across the continent; Fireman Gannet; The home express (John G. Saxe); Engineer Maitland; On the train; Railroad service; Rushing freight to New York; Beating time and space; Commerce; The song of steam—Literature and Living, 6

Chapter III

THE AUTOMOBILE

LESSONS IN SCIENCE

THE GASOLINE ENGINE

Parts and their uses.—There are three essentials which make a gasoline engine run.

First, it is necessary to have a mixture of gasoline and air in the engine cylinders.

Second, the mixture must be compressed.

Third, there must be a spark to set fire to the compressed mixture at the right time.

PISTON AND CYLINDER ACTION IN A GASOLINE ENGINE

1. *Downward suction stroke.*—The mixture is sucked into the cylinder by forcing the piston down. This is called the suction stroke.

2. *Upward compression stroke.*—The upward stroke of the piston compresses the mixture in one end of the cylinder. This is called the compression stroke.

3. *Downward power stroke.*—An electric spark sets fire to the compressed mixture in the end of the cylinder and the pressure from this combustion drives the piston down. This is called the power stroke.

4. *Upward exhaust stroke.*—The next upward movement of the piston pushes the useless gases out of the cylinder. This is called the exhaust stroke.

THE PISTON

A trunk piston is used in a gasoline engine. It is longer than its diameter. The trunk piston is hollow and has one closed end. The closed end is toward the combustion space in the cylinder. It is against the closed end of the piston that the force of the explosion acts.

Driving power.—The piston is the driving power. It is attached to a crank shaft which turns the wheel of the automobile and the propeller of the airplane.

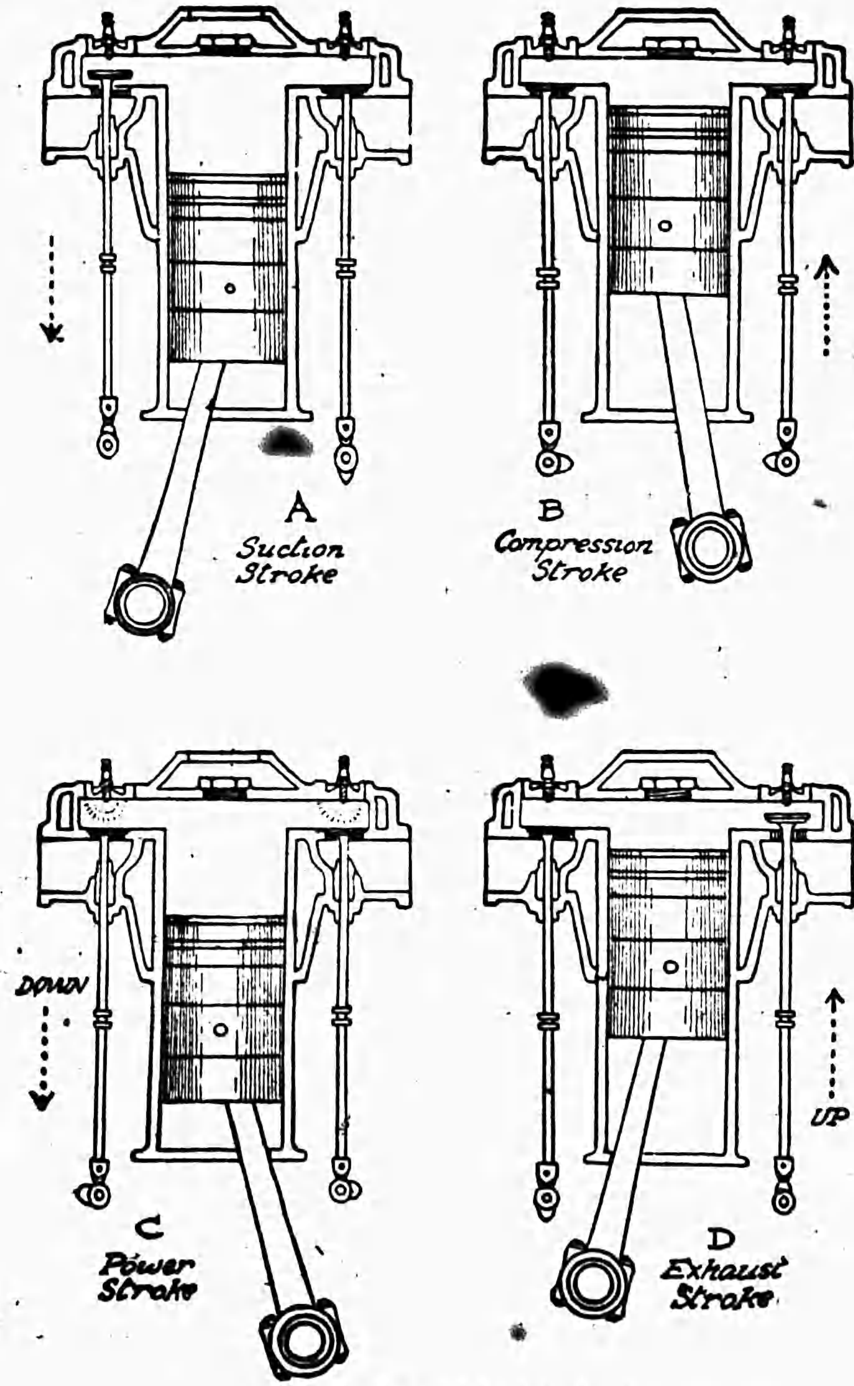


FIG. 2.—THE GASOLINE ENGINE

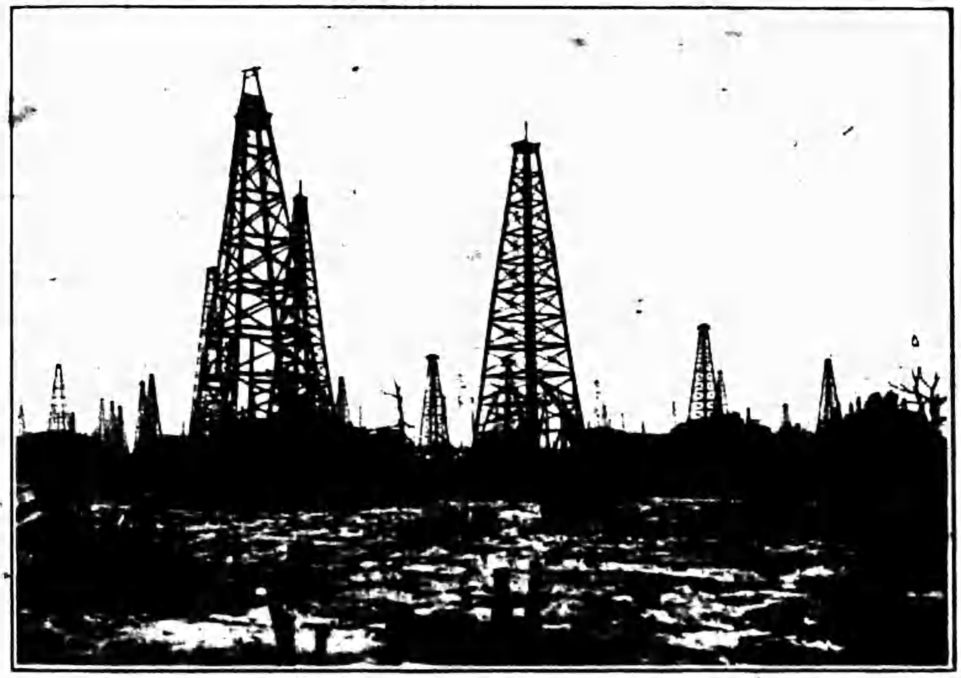
Key: E, exhaust valve. Sp, electric spark. I, intake valve. C, cylinder. P, piston. R, piston rod. W, flywheel. 1, downward suction stroke. 2, upward compression stroke. 3, downward power stroke. 4, upward exhaust stroke.

OIL FIELDS

Study lessons—Where gasoline is found.—Gasoline is distilled from petroleum, which is the crude oil that is found under the ground in the sand or in reservoirs in the rocks. Wells are bored into these storage places filled with oil, and pumps bring it up to the surface in the same way that wells are bored and water brought up.

The use of gasoline.—Petroleum contains many substances that must be distilled from it before they can be used. Gasoline is one of the most valuable of these products on account of its use in the gasoline engine. Its price has risen in the past 10 years from 10 cents to as high as 45 cents per gallon, and its consumption has increased in that time from 7,000,000 to 50,000,000 barrels.

Oil wells.—The cause of oil formation has never been determined. It is only found in sedimentary rock; that is, rock of sandstone, shale, or limestone, which has been formed from sediment laid down under water. The oil wells vary in depth from 300 to 4,500 feet.



AN OIL FIELD

The machinery consists of a derrick, shaped like a pyramid, about 20 feet across at the base and from 70 to 75 feet high. A steam engine is used for operating the machinery and a windlass for raising and lowering the drill. As fast as the hole is drilled it is cased with a steel tube. Sometimes the oil is confined in the earth under pressure, and when the reservoir is opened it flows a steady stream which may rise many feet into the air. Such a well is called a gusher.

How gasoline is obtained.—When petroleum comes from the well it is carried through pipes into large iron tanks from which it is transferred into stills which hold about 600 barrels of petroleum. Sometimes this crude oil is thin like water, but oftener it is thick and heavy like molasses.

Fractional distillation.—As the petroleum in the still is slowly heated, several different substances, one by one, are separated from it, each depending largely upon the degree of heat used. This process is called fractional distillation, because it gradually separates the different products of petroleum into its several portions or fractions. Each product in turn rises as vapor and passes through a tube into a condenser which is usually a series of iron pipes surrounded by cold water. When the first product, which is naphtha, has risen and all of it has entered the condenser, then that tube is closed and the next tube opens for the next product, which is benzine. As the heat increases, gasoline rises and is condensed in the usual manner. The amount of gasoline averages about 40 barrels to 600 barrels of petroleum. Kerosene and many other products are produced in the same way. From the remaining material a heavy, lubricating oil is obtained, followed by paraffin wax and vaseline, leaving a porous mass of carbon in the still. It is stated that there are over 200 different products which can be secured from the refining of petroleum.

Transportation of petroleum.—Pipe lines are generally used to carry petroleum from the oil fields to the refineries. Some of the main pipe lines are 500 miles long. They extend over mountains, through valleys, and across the plains, forming a network of pipes which measure, all told, 80,000 miles in length. Pumps are stationed every 30 miles along these lines where an upgrade flow makes it necessary, and storage tanks receive the oil from one station and the pump forces it on to the next. Pipe lines have been built from the Appalachian oil regions to Jersey City, Philadelphia, Baltimore, Chicago, and Cleveland; from Kansas eastward; from Oklahoma to the Gulf of Mexico; and from the California oil fields to the Pacific coast. Tank steamers are also used for the transportation of petroleum by water, and tank cars are used on the railroads. Many of these tank cars may be seen standing on the tracks at wayside stations waiting to be shipped to their destination.

Geography.—Russia and the United States produce about nine-tenths of the world's supply of petroleum. Ordinarily Russia's output is one-fourth that of the United States. Oklahoma leads in State production with a yearly flow of 96,000,000 barrels, followed by California with 87,000,000. The output varies from year to year, and a State that leads one year may drop to second place the next. The oldest and most noted field in the United States is in the Appalachian Mountains from southwestern New York through western Pennsylvania into West Virginia, Kentucky, and Tennessee. Another field of great prominence extends from Southeastern Kansas to eastern Oklahoma, the oil here lying in the Cherokee shales and sandstones.

PARTS OF AN AUTOMOBILE

Construction of an automobile in the sixth grade.[1]—Pupils visit an automobile show, if possible, where they will find demonstrations of how an automobile is run and the use of the different parts.

The class will have no difficulty in constructing a model out of meccano. Certain parts of the mechanism will furnish problems of absorbing interest to pupils in elementary grades.

List of problems in automobile construction.—Universal joint (can be completely demonstrated by meccano construction), chain drive, transmission gears, cam shaft, which operates the intake and exhaust valves, link chain, speedometer, carburetor, which can be made reasonably clear by means of dissected models.

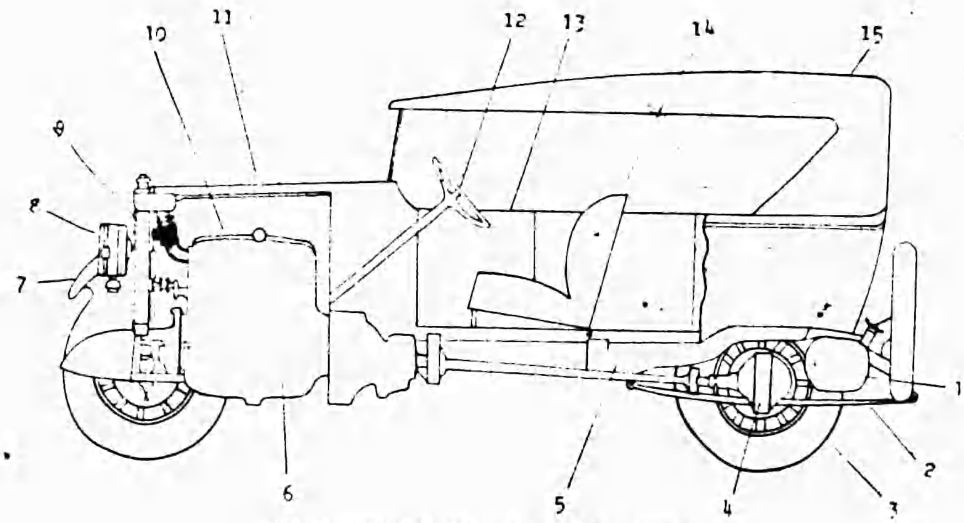


FIG. 3.—PARTS OF AN AUTOMOBILE

Key: 1, gasoline tank. 2, flat springs composed of many thin steel leaves. 3, balloon tire. 4, differential. 5, frame. 6, engine. 7, mud guard. 8, headlight. 9, radiator. 10, engine cover. 11, hood. 12, steering wheel. 13, door. 14, driver's seat. 15, top.

No study will prove of more practical value to boys and girls in these grades or of greater interest than the discussion of the construction and operation of the automobile.

MOTOR TIRES

Lesson study—Rubber tires.—Motor tires made of rubber lessen the shock of motor vehicles and make them more comfortable for riding. They also lessen the wear on chasses and do less damage to the roadway. Solid rubber tires were first used and are still used to some extent, but the pneumatic tire is in almost universal demand for cars of every description.

[1] See Francis W. Parker School Yearbook, The Course in Science, Vol. V, July, 1918. Price, 40 cents. Published annually by the faculty of the Francis W. Parker School, Chicago.

Pneumatic tires.—A pneumatic tire consists of two parts, the inner tube, which holds the air, and the casing or outer tire, which incloses the tube and bears the friction of the roadway. Strong cotton cords form the foundation of the outer tube. Rubber which has been mixed with sulphur and other substances is pressed into the fabric, which is cut into suitable strips. In building the tire these strips are placed one above the other until the proper thickness is reached. The rubber coating holds them together. After the tire is constructed it is "vulcanized," by heat and all the parts become a single unit, strong and durable.

The inner tube is made of a strip of vulcanized rubber with the walls and ends vulcanized together to make an airtight circular tube. When the tube is inclosed in the casing it is pumped full of air with a pressure sufficient to bear the weight of the vehicle and load. The proper size of the tire and its air pressure depend upon the load to be carried. As a rule where the average load requires a tire 4 inches in diameter the air pressure is about 70 pounds. The new balloon tires are larger than the old tires and therefore require less air pressure.

IMPACT OF MOTOR TIRES

A comparative study has been made to determine the force of the impact of motor tires and the power which solid tires and pneumatic tires possess to withstand vibration and shock.

Experiment.—A motor truck was driven over a sharp incline at 15 to 18 miles an hour, which caused it to spring into the air and to strike the ground at a vertical drop of from 2 to 3 feet.

Record taken by a slow-moving camera.—A record was taken by a camera at 160 per second, instead of 16, and was then projected on the screen at one-tenth of the normal speed. This recorded photographically the comparative road impact and chassis shock of motor trucks shod with pneumatic or solid tires. The timing and registering devices were attached to the camera and operated simultaneously.

What the registering devices showed.—The solid-tired truck, although 60 pounds lighter than the pneumatic truck, struck the ground with a force of 14,336 pounds, as compared with the impact of 4,624 pounds for the heavier, pneumatic-tired vehicle. In other words, the pneumatic truck hit the ground less than one-third as hard as the solid-tired truck, greatly lessening the strain on the chassis.

The photographic record.—The pneumatic tires absorbed the shock of vertical drop and the truck left the ground only slightly, whereas the truck with the solid tires bounded high into the air after the impact.

Conclusions.—The lighter impact is undoubtedly due to the extra cushioning of the pneumatic tires. A 7½-ton pneumatic truck would do less damage to roads than a 5-ton solid-tire truck operating at the same speed and under the same rough road conditions.

HIGHWAY TRAFFIC

TIRES

Reproduction in written language (grade 5).

Once some boys in the country stretched tacks across the road. Soon an automobile came by and rode on the tacks. Of course, the result was a blow-out. The driver did not have any more tires, so he had to wait for another car to sell him a tire or else walk 15 miles to a store where tires are bought. The man discovered who put tacks on the road and put them in the hands of a policeman. The boys soon found out that they would be put in the house of detention if they did it once more. Of course, they never did it any more.

THE CATERPILLAR DRIVE

How they travel.—Trucks that are propelled on the principle of the caterpillar drive travel on two endless belts one on each side of the machine. These belts are kept in motion by cogged driving wheels, so that the tractor moves forward with the revolution of the belts. The trucks are made on the automobile principle with bodies designed for various kinds of work.

Where used.—The caterpillar tractor is popular with many farmers because of its great hauling power and because it can pass over ground where tractors of the ordinary type can not be used.

In Alaska the caterpillar tractor is used to haul freight. Nothing stops it. Snow, ice, mud, sand, swamp, or marsh are all alike to the driver of the tractor. The broad, flat, endless tread makes it possible to drive over any one of these obstacles. Each tractor can carry 15 tons of freight and is used to transport food to the workers on the railroad in Alaska and to draw ore from the mines for shipment.

The caterpillar tractor has proven very successful in road-building operations. In gravel pits it draws out the trucks after they have been loaded with gravel; it grinds out the shoulders when concrete roads are widened; it scarifies the surface of the gravel roads when grading is done.

LESSONS IN HISTORY

THE AMERICAN AUTOMOBILE

A young farmer who liked to work with tools made one of our first automobiles. When he was a boy he used all his spare time making wheels that could be turned by wind or by water. As he grew older he began to study steam engines and finally made an engine out of the odds and ends that he found in a junk pile. Then he left the farm and went to the city, where he worked and studied until he became a skilled mechanic.

One evening he read of a new vehicle in France called a horseless carriage. He began at once to plan to make an automobile. As he worked on the engine for his horseless carriage he saw that a steam engine was too heavy for a carriage, and he was struck with a great idea, "Why not use gasoline for fuel?"

He went at once into a light and power company as a shop worker at a very low wage, that he might learn about the use of electricity as a motive power. He built a house for himself and

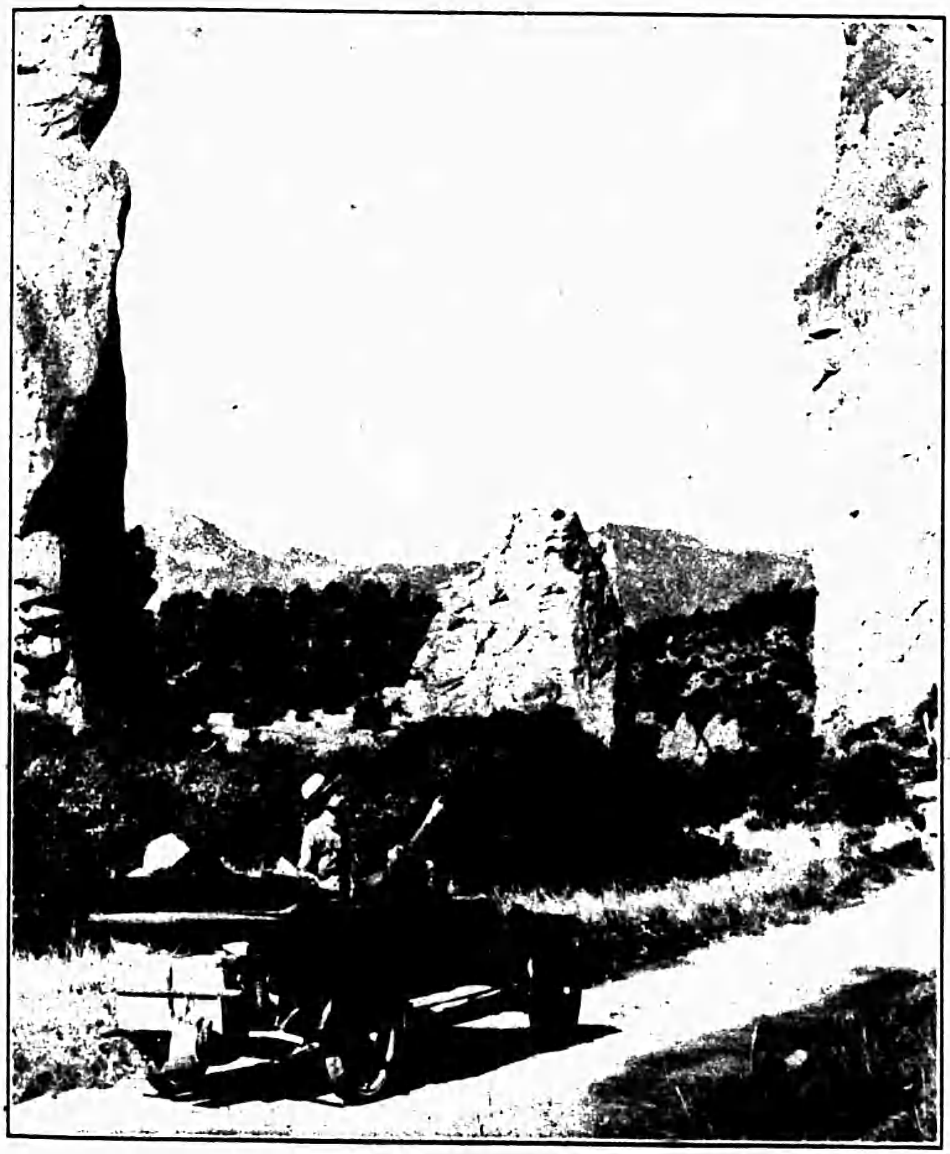
ONE OF THE FIRST AUTOMOBILE INVENTIONS

wife with a large shed at the back where he worked after factory hours. Everyone called him crazy, but at last his horseless carriage was finished.

It was a crude affair, a platform set on four bicycle wheels supporting a one-cylinder engine. On his first ride in this horseless carriage the young mechanic found he couldn't turn his machine around. He got out and lifted the wheels around, so the machine faced in the opposite direction. He worked eight more years developing this first machine, and finally it became one of our popular American automobiles.

THE WAR TANKS

Tanks are heavy armored cars propelled by the caterpillar drive, and were used during the war to break through enemy defenses, to enfilade his trenches, or to cover attacks upon them. They have a powerful engine and in construction are like an enormous automobile covered with a bullet-proof casing for the protection of the crew.



TOURING CAR

How they travel.—They are propelled on the caterpillar principle and possess considerable power of traveling over rough ground, both in crossing trenches, craters, and other cavities, and in climbing over obstacles. They can tear their way through entanglements, can uproot trees, and can throw down the walls of ordinary dwellings.

How used.—They were first used on September 15, 1916, by the British in their operations on the Somme, and were the decisive factor in General Byng's brilliant advance toward Cambrai. By the use of several hundred tanks the wire entanglements and outposts along a front of 32 miles were demolished without military preparation and an advance of 5 or 6 miles covered—one of the greatest victories on the western front, bringing Cambrai and its railroads under the fire of the British guns.

How combated.—The Germans were prepared for the attack by the tanks, and several of them were put out of action by small-caliber shells fired by guns especially manufactured for the purpose. A Dutch spy, Madam Mata-Hari, had secured sufficient information regarding the preparation of the tanks in England to enable the German Government to make an antitank gun which has made the tank much less effective than was at first anticipated.

THE FIRST ARMY CONVOY RUN

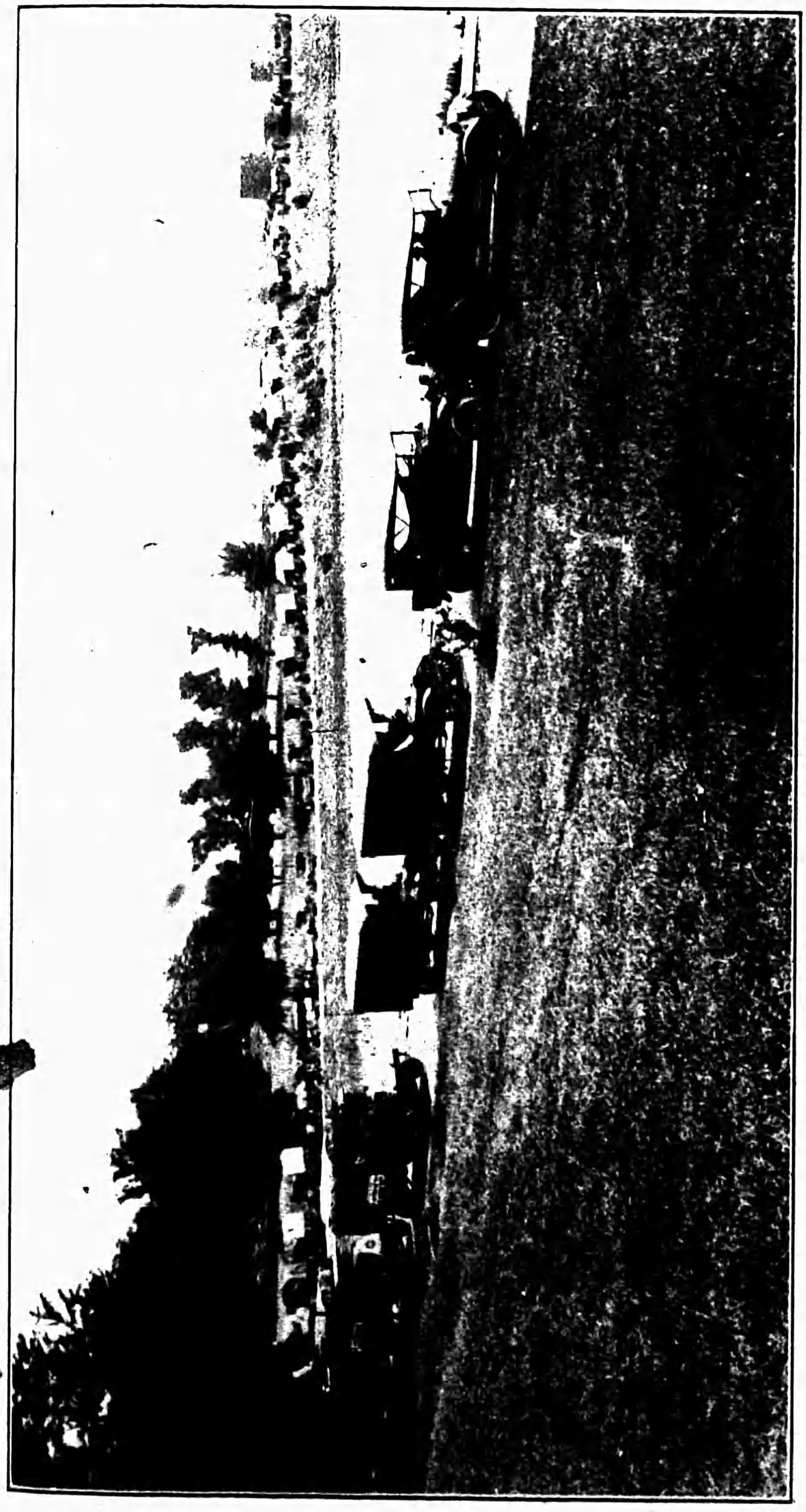
Reading lesson.—During the war the highways were used by the United States Government for motor trains to carry supplies to the Army camps situated in different parts of the country. Some of this freight went direct to the training camps, but most of it was carried to the docks in New York and shipped across the water to our boys in France.

The run from Chicago to New York by motor truck over the Lincoln Highway helped to keep our soldiers supplied with food and clothing and with war materials from the western part of our country. After the war a run was made from Washington to San Francisco to demonstrate the possibility of running motor trains from coast to coast over the Lincoln Highway. A Zero Milestone was erected on the ellipse in Washington just in the rear of the White House as the starting point of the run.

There were 72 vehicles in the convoy, 65 of which were motor trucks of all the types used by the Government during the war. There were 260 men and 35 officers in the company.

They covered the distance of 3,310 miles from Washington to San Francisco in 62 days, arriving only 4 days behind the schedule laid out in Washington before the start. Every vehicle arrived at the end of the journey under its own power except one, which was lost in the Allegheny Mountains during the first days of the journey.

The lessons which were learned about our highways were many. That the roads and bridges will not do for heavy traffic is quite evident, for the Army train broke and repaired 100 bridges on the outbound trip. It also demonstrated that we must build our roads wider, deeper, and more solid, and that our bridges must be strong enough to carry 20 tons. It showed that the interstate road is no better for through transportation than its weakest mile.



FIRST ARMY CONVOY RUN ACROSS THE UNITED STATES

LESSONS IN GEOGRAPHY

WHERE AUTOMOBILES ARE FOUND ON FARMS IN THE UNITED STATES

Map study.—The number of automobiles on farms in the United States.

Pupils reproduce this map after a study of the map on corn production from the Department of Agriculture bulletin, 1920, A Graphic Summary of American Agriculture. The map is made from an outline map of the United States by filling in the States with a crayon or pencil stroke from right to left, back and forth across the paper, heavy and light, as this map indicates.

Geography.—In January, 1920, there were 2,000,000 automobiles on the farms of the United States. Two-fifths of these were

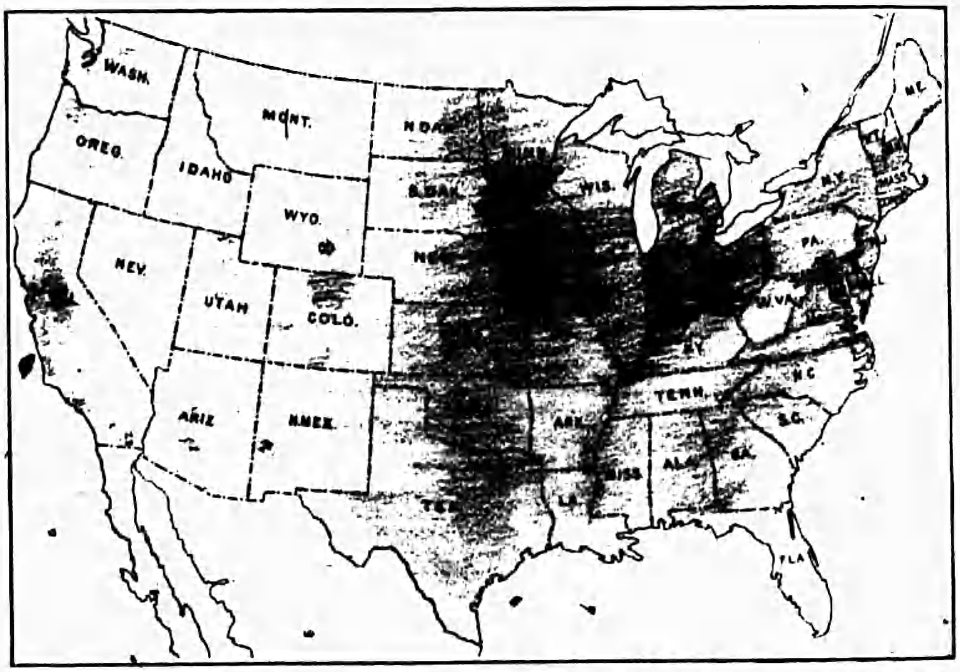


FIG. 4.—MAP STUDY: WHERE AUTOMOBILES ARE FOUND ON FARMS IN THE UNITED STATES

in the Corn Belt. One-half of the farms in the eastern part of the Corn Belt had automobiles, and three-fourths of the farms in the western part. Five States lead in corn production—Iowa, Illinois, Nebraska, Missouri, and Texas—but the Corn Belt, proper, includes a strip of land extending from southwestern Ohio to southeastern South Dakota, and thence southward along the Missouri River. One-third of the farms in New York had automobiles, and one-fourth of those in New England. Southward the number drops to one-seventh in the Carolinas and Georgia, and to one-twentieth in Mississippi.

MOTOR-TRUCK ROUTES

Regular routes for motor trucks are being established for distances of upward of 25 miles as fast as cars can be turned out. On good roads these trucks make two trips per day over a distance of 25 miles. Light trucks make even better time.

Transportation of wheat by team versus truck.—The advantage of the truck to rural districts is well set forth in the following statement made by a farmer who has used one for a long time:

I live 25 miles from the railroad, and it used to take me two days with four horses to get 70 bushels of wheat to the elevator and get back home again, and the horses could only stand two trips a week and keep it up. So you readily see I know how to appreciate two trips in one day and all my meals at home.

This was done over the dirt roads of Nebraska, and thousands of others are doing as well.

Arithmetic.—Suggestive problems by the teacher or by the pupils may grow out of this study.

1. How many trips a week did the farmer make with his four-horse loads? How many trips a week did the farmer make with his truck loads of wheat? Suppose he sells his wheat at $1.30 a bushel. What will the horse-drawn loads bring him at the end of a week? What will the truck loads bring him at the end of the week? What does he gain by using a truck?

2. If wagon haulage of wheat, per ton per mile, costs twice as much as haulage by motor truck, how much does the farmer gain in one day by using his motor truck? In one week?[2]

LESSONS IN CIVICS

Motor Trucks

TANK-TRUCK MILK DELIVERY

Use of fluid milk.—It is estimated that about 45 per cent of the total milk production in the United States is used as milk (unchanged) for household purposes. This milk is highly perishable and must be served to the city consumer daily in a fresh and sweet condition if it is to be used at all. This means not only cleanliness in production but speed and maintenance of low temperature throughout the journey from the farm to the consumer's door.

Difficulties in milk transportation.—The greatest difficulties in long-distance milk transportation lie in the spoilage due to overheating and churning in transit, caused by hot weather and the long-continued jolting over the road. It has been found that the use of insulated tanks mounted on trucks has to some extent eliminated these difficulties.

Tank trucks.—Porcelain or glass-lined tanks on auto trucks are successfully used for long and short hauls to milk plants and condensaries. These tanks are in reality hugh thermos bottles that

[2] Department of Agriculture Yearbook, 1921.

protect the milk from spoilage by heat. Experiments show that on trips on hot days the rise in temperature is less than 1° per hour. Churning of the milk in transit is prevented by filling the tank to capacity.

THE SCHOOL BUS

The law of cause and effect has been exemplified in the use of the school bus in our rural school communities. Better roads have led to better transportation facilities, which in turn have led to better schoolhouses and to superior advantages for pupils in the schools.

The school bus stands for economy in school expenditures. It means better attendance, because the children can be carried to school in any weather, and long distances cease to be a hindrance to

DAIRY TRUCK

regularity and punctuality at school. It has been estimated by Dr. A. C. Ellis that every day in school is worth $9 to the pupil, and the money value alone of persistence in attendance is important.[3]

There are countless other benefits which accrue to the child from his uninterrupted participation in school activities, now made possible by the service of the school bus.

The same is true of economy in the use of equipment. One gymnasium will serve for many classes of children. One physics room, one library, or one auditorium can be used quite as well for a large number of pupils as for a smaller number. All these advantages can be secured by the consolidation of several school districts.

[3] United States Bu. of Educ. Bul., 1917, No. 22, The Money Value of Education.

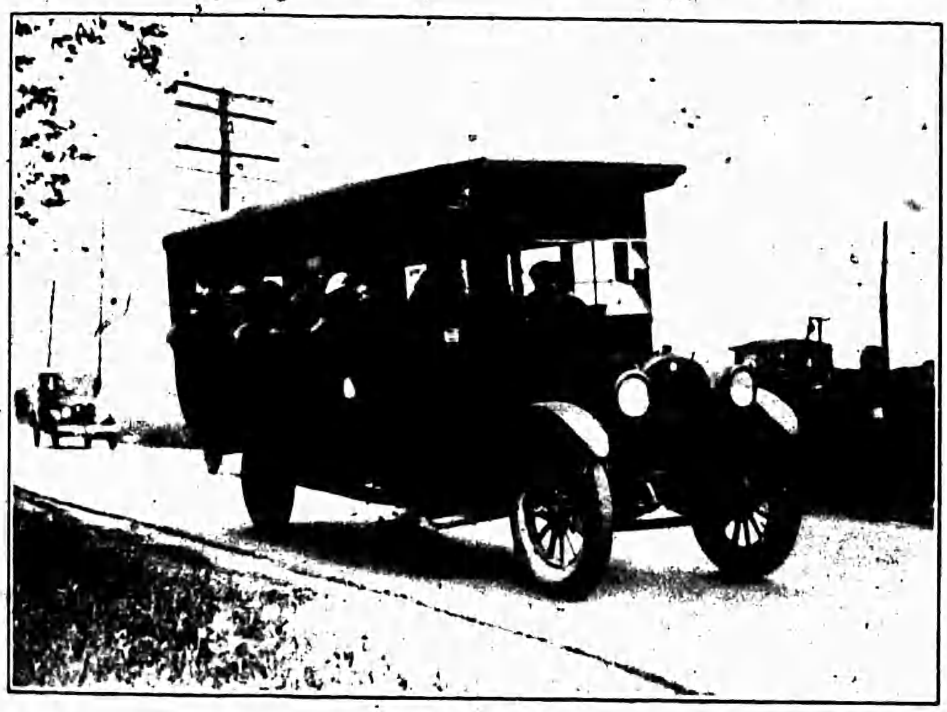
School funds can be pooled, and poorer districts can benefit from an equalization of receipts and expenditures. Without the school bus the consolidated school would be impracticable and well-nigh impossible of realization.

HIGHWAY SAFETY

JAY WALKING

Reproduction in written language (grade 5):

If I should be crossing a busy street I should look to right and left before I cross. Jay walking is how you cross the street. You aren't supposed to cross



SCHOOL BUS

in the middle of the streets, because you are liable to get run over. It is very dangerous to cross tracks, because you are apt to catch your foot in one of the slats. It is also dangerous to cross the State roads, because they are mostly always crowded with trucks, autos, and street cars. The proper way to board a car is to wait until it stops before you get on, so as to avoid danger that might happen to you. The proper way to alight from a car is to wait until the car stops, and when you are getting off a car look for some careless people that might not stop when the car does. The reason you should not play in the street is that an automobile might come along unexpected. If you don't watch the driver's hand, you will surely get run over, because he will turn a corner when you don't know it. You should always watch the policeman's hand, and don't go across the street when the police tells the autos to go across.

Reproduction in paper-cutting colored posters.

LICENSE LAWS

Discussion by a class of fifth-grade children (pupil as leader):

(Stenographic report)

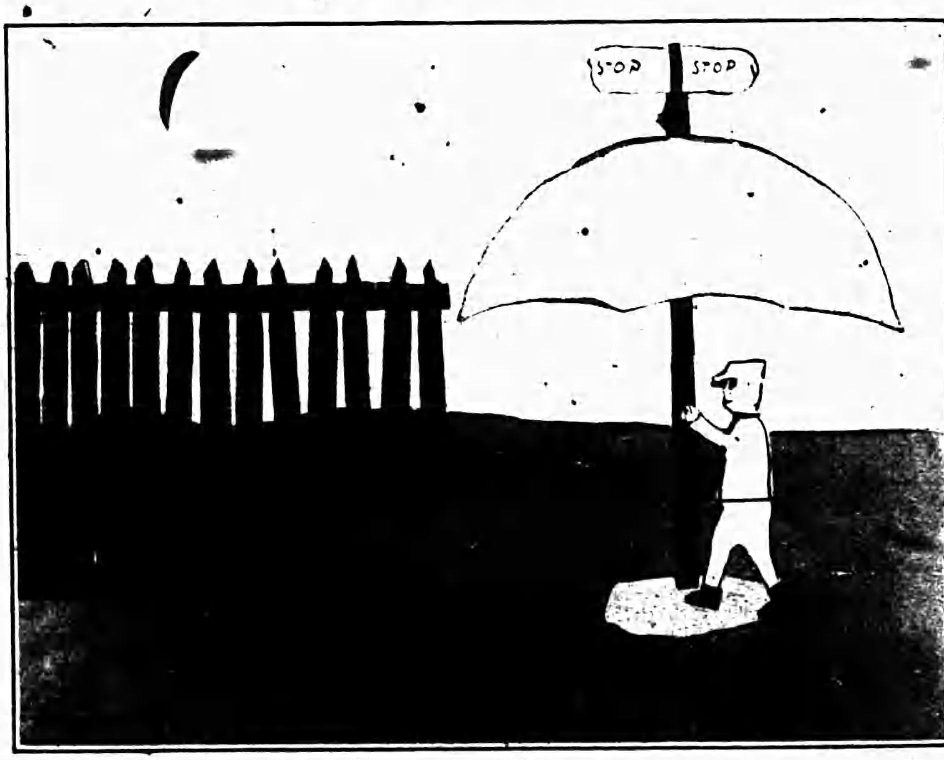
Lois. Sometimes the policeman gets you because you haven't a license to come into a city.

Earl. I don't think a man can run under another man's permit.

Bowie. If the man is with him he can run a car.

Horace. I was on a motor cycle with a man who was driving with another man's permit.

Margaret. You can not. My uncle bought a car, and he had a Philadelphia license on it. He had to get a new license to run that car.



PAPER CUTTING POSTER: OBEY STREET SIGNALS

Horace. When a man gets a brand-new car, does he have to go right down and get his permit? I asked a man that the other evening, and he said that if he didn't know how to drive he had to learn before he could get his permit, and a policeman had to go with him.

Bowie. A policeman doesn't go with him when he learns, but they will have a man there to teach the man how to drive, and then when he is all right and answers the questions he is allowed to have a permit.

TRAFFIC LAWS

Discussion by a fifth-grade class of children (pupil as leader):

(Stenographic report)

Lois. What regulations have we in this town for automobiles?

Clinton. If you started out to name them all, you wouldn't get half through.

Teacher. Name one, Clinton.

Clinton. I know they have to be about 4 inches from the curb and have to be 15 feet from the corner and 12 feet from a water plug.

Teacher. I want each one to get up and tell one regulation.

Clinton. You are supposed to keep 4 inches from the curb when parking.

Edwin. You are supposed to stop 25 feet from car stops.

Carrie. In turning around the corner you are supposed to put your hand out. Sometimes people don't put their hand out on the right side of the car.

Pupil. When there is a car in front of automobiles, the driver has to put his hand like this to show that he is going to stop.

Clara. On busy streets you are only supposed to park 15 minutes.

John. You musn't get in front of street cars. When a street car stops you have to stop.

Edmund. On Fifteenth and New York Avenue there is no left-hand turn. You only turn to the right.

Edwin. When the fire engines come you have to stop.

Teacher. What do you do?

Edwin. Drive down to the curb.

Pupil. You must always give the ambulances right of way.

Pupil. Eighteen miles an hour is the speed limit in town.

Teacher. How many in the country?

Pupil. Sometimes you are allowed to go 15 and sometimes 18.

Margaret. It is 25 and 30 in the country.

Clinton. Not in Alexandria. They only let you go 12 miles an hour.

PENALTIES FOR SPEEDING

Discussion by a fifth-grade class of children (pupil as leader):

(Stenographic report)

Pupil (as leader). Who enforces these automobile laws?

Pupil. Congress does.

Pupil. Congress doesn't do it all. Sometimes the police will get in back of some of these drivers who are not watching where they are going, and he will take them to Congress.

Bowie. Congress makes the laws, but the policemen are the ones who are supposed to enforce them. They are supposed to arrest a man when he is drunk when driving. And if you haven't a driver's license you will be arrested and have to go to the police court. If they are out on the roads, like the State roads, why they make them go to the nearest town where there is a policeman or they fine them right out there on the road.

Pupil. I know a man who was 50 miles from a city, and the cop fined him $15 right there.

Clara. The policeman is not sure. If a man is drunk, there isn't so much fine for being drunk.

Teacher. Have any of you been in an automobile when the traffic cop stopped you?

Albert. I have never been in one, but I know how it is. The policeman will take your name and address, and you will have to come to court at a certain time.

Margaret. My uncle and some people were going to Germantown, and we were speeding about 45 or 60 miles, and a cop saw us on a motor cycle. He said we had to stop. We pulled up on the road. The cop asked my uncle his name and said "Now you come to the police station," and we had to turn all the way back and go back to the police station.

Teacher. Did you go?

Margaret. No; we walked the rest of the way. We were almost up to Germantown. He came for us later.

Teacher. How much did it cost him?

Margaret. Twenty dollars.

John. I was on a motor cycle once with my uncle and a policeman watched us come up and told us that we were speeding.

Edwin. On bridges—I won't say that is everywhere—but most bridges the speed limit is 8 miles an hour.

Pupil. They only allow a certain amount of tons to go on a bridge.

Pupil. On a rainy day or at night, if you are going to stop, you should have a little back light—a red parking light.

Edwin. When near a railroad track and you hear a train crossing you have to stop.

Lois. What do you do when it gets dark?

Pupils. Put on your lights.

Pupil. I think you have to put your lights on half an hour after sunset.

Clinton. They are only allowed dim lights in the city.

Pupil. I was going to Chapel Point, and when we came back it was night, but we had to have dim lights. Another machine came by and the lights were real bright.

Lois. I have seen lots of bright lights. They almost blind you.

Pupil. When you are parking you have to put on your parking light.

Pupil. All the people don't have a little parking light.

Teacher. And if you haven't a parking light?

Pupil. You put on dim lights.

John. You can't pass a car on a hill in Maryland.

John. In Maryland they won't let you go fast on crossing railroad tracks.

Edwin. In Virginia when the car comes along the motorman has to stop and get out and look up and down the track.

Pupil. John said that you couldn't pass a car on a hill, but you can do it.

John. Not in Maryland.

Pupil. Yes you can. We have done it.

Chapter IV

THE AIRPLANE

LESSONS IN HISTORY

THE FLYING MACHINE

When Darius Green tried to fly from the old barn door he was laughed at and called a fool both before and after his attempt. Perhaps the Wright brothers feared the world's ridicule, and for that reason kept their invention a secret. So they experimented alone along the barren sands on the coast of North Carolina until in 1903 their machine had flown 852 feet. Four years more they worked, perfecting their device and securing their patents. In 1908 they attracted the attention of the world with an airship that gave great promise.

It was the use of airplanes in the war that caused the wonderful development of aircraft in this country and in Europe. In 1918 a speed of 150 miles an hour was accomplished with machines that carried 4 men, 3 guns, and 3,000 pounds of ammunition and bombs.

The Barling bomber is the giant of heavier-than-air machines. Says the Geographic Magazine:

> This airplane could pick up 8 tons of coal at Scranton, Pa., and deliver it in 6 hours to a cellar in Chicago, if the Chicago house were on a very wide street. The tip-to-tip measurement of the plane is 120 feet, about twice the width of the average building lot. It is as high as a two-story house and 65 feet long.

LESSONS IN SCIENCE

WHAT MAKES AN AIRPLANE FLY

Factors which assist an airplane in its flight.—Rise, thrust, and lift.—An airplane must be kept in motion if it stays in the air. It must be given the power to lift itself off the ground. It must have power also to thrust itself forward through the air. The force which lifts the airplane is called the "lift." The force which thrusts it forward is called the "thrust."

Factors which offer resistance.—Resistance; gravity and drift.—When the airplane rises in the air two forces are resisting its flight. One of these is gravity, the force which pulls the airplane toward the ground. The other is called "drift," and is known also as "head resistance," because it hinders the forward movement of the plane.

Parts of the airplane and their use.—Certain parts of the air-plane are designed especially to furnish the necessary power required to keep the plane in motion and to overcome the resistance of gravity and drift.

The propeller.—It is the aerial screw or propeller which produces the thrust through the air. The propeller is made of two long blades of wood attached to the front of the engine in the nose of the plane. When the engine sets these blades in motion they whirl round and round like the arms of a windmill. Faster and faster they turn until their motion clears a path through the air, so to speak, and the head resistance is overcome. As the plane rises and

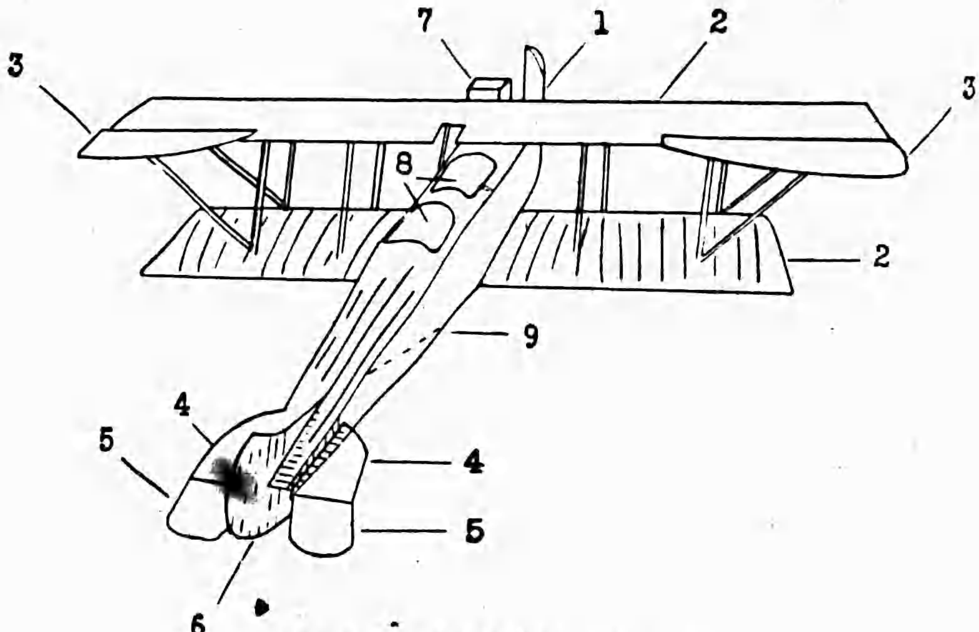


FIG 5.—REAR VIEW OF AIRPLANE

Key: 1. Propeller. 2. Wings. 3. Ailerons. 4. Stabilizers. 5. Elevators. 6. Rudder. 7. Engine. 8. Cockpits. 9. Fusilage.

the speed of the thrust increases, the force of gravity is no longer felt.

Lifting effect of the wings.—This rapid movement forward through the air also gives a lifting effect to the wings.

The air as it passes the rapidly turning propeller becomes compressed. It strikes the edge of the wing and divides, one part passing under the wing and one part above it.

As the compressed air strikes the bottom of the wing it pushes up against its under surface. Then it is deflected downward, giving the wing its supporting effect.

Over the upper surface of the wing the opposite effect is taking place. Here the air is deflected upward and only a slight pressure is felt above the wing.

The result is that if the pressure below the wing is greater than above it will cause the wing to have a lifting effect.

The engine.—The gasoline engine is usually in the forward part of the car. The Liberty engine is most commonly used in planes that are built especially for long flights. It has 400-horsepower and is equipped with a self-starter. When the machine is heavily loaded it burns 30 gallons of high-test gasoline each hour—one gallon every 2 minutes.

The cockpits.—These are the seats provided for the pilot and passenger. They are sunk into the body of the plane, so that only the head and shoulders of the occupant are above the surface of the the body.

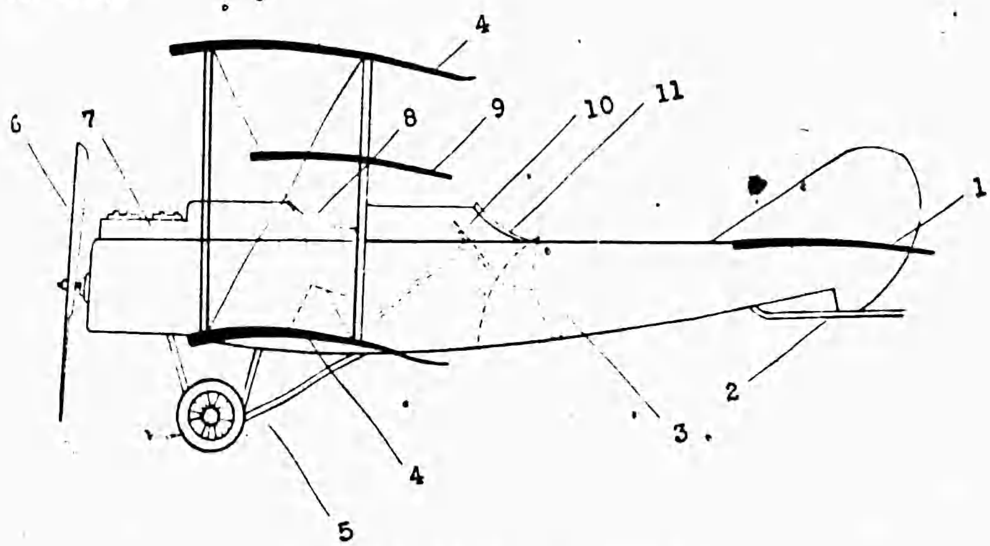


FIG. 6.—SIDE VIEW OF AIRPLANE

Key: 1. Elevator. 2. Land skid. 3. Fusilage. 4. Supporting plane. 5. Chassis. 6. Propeller. 7. Engine. 8. Passenger's seat. 9. Ailerons. 10. Control. 11. Aviator's seat.

The switch board is immediately in front of the pilot, in his cockpit, where he has easy access to levers and controls. Two sets of controls are provided in large planes designed for war use. One is for the pilot, and the other for the observer. In case one is hurt, the other is not left helpless in the air.

Rudder.—The rudder is at the tail end of the plane and is used to control the direction or turning. It is hinged and is controlled from the cockpit.

Stabilizers.—These are two small stationary wings made of wood on either side of the tail, which buoy up the rear of the machine when flying, as it has a tendency to drop tail down when the wings in front are at a sharp angle to the wind.

Elevators.—Two small rudders called elevators are hinged to the back ends of the stabilizers. They are controlled by wires from the cockpit. Elevator up, causes the machine to ascend, and down, to descend.

Ailerons.—Two small extensions are added to the back of the upper wings near the ends. They act as balances when the machine tilts sidewise.

Aerofoil is the lower wing surface. The covering for the wings is usually strong linen; cotton was tried, but was found too weak for severe stress of air pressure. The woodwork is of spruce and the metal parts of steel.

Body. The fusilage is the body part, separate from the wings. It holds the power plant, the passengers, and the cargo.

Chassis. The landing gear is called the chassis. It is the steel framework and wheels on which the airplane moves over the ground when it lands and when it takes off.

ALTITUDE RECORDS FOR AIRPLANES

Low flying did not long appeal to daring aviators. But the intense cold of the higher altitudes made high flights sometimes very dangerous. Clothing that was thick enough to afford warmth was too heavy. Finally, electrically heated clothing was devised. Even then a pilot's eyes were in danger of frostbite, and more than one suffered from this malady.

Some very startling feats in high flying have been accomplished. During the war it was often necessary to mount into the upper air to avoid the attacks of enemy planes. In 1910 the record for high flying jumped from 1,478 feet to 3,445 feet. Late in the same year a Breliot monoplane ascended 10,499 feet into an intensely cold temperature. By 1912 an altitude of 19,032 feet was reached. In 1920 Major Schroeder, an American aviator, reached 36,020 feet, or nearly 7 miles above the earth.

A French aviator in 1924 made the record of 39,506 feet, which has not been exceeded.

SPEED RECORDS FOR AIRPLANES

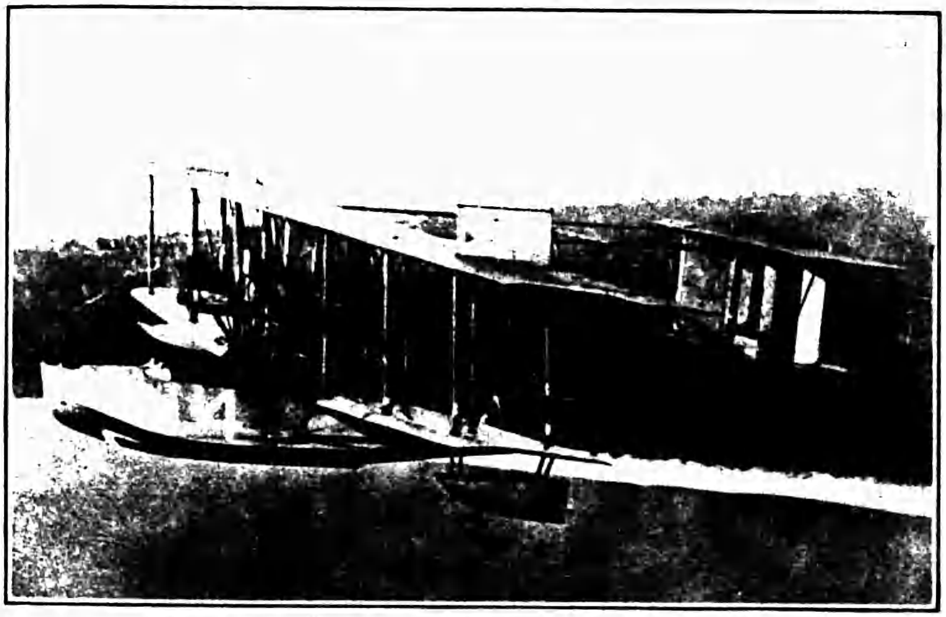
Before the war, in 1909, Glenn Curtiss flew 47.04 miles per hour and won the Bennett trophy for the greatest speed yet made by an airplane.

On November 10, 1918, the day after the signing of the Armistice, a De Haviland airplane flew from Dayton, Ohio, to Washington, D. C., at the rate of 1⅞ miles a minute. This was the greatest speed ever recorded to that time. Up to date, June, 1925, the speed for airplanes has reached 278.48 miles per hour. This record was made in France on December 11, 1924, by a French pilot named Bownett.

SEAPLANES

One of the great dangers in flying over the water in an airplane was the possibility of drowning. If the plane dropped into the water it sank, and both the pilot and the plane went to the bottom before help could reach them.

A Frenchman in 1910 designed a flying machine on which he placed floats instead of wheels as landing devices. The floats were large enough to support the machine on the water. This new landing gear at once broadened the use of the airplane. The Navy Department was able to use it with safety. Flights across the Atlantic were possible when a forced landing on the water could be made without injury to the plane or the pilot.



THE SEAPLANE THAT CROSSED THE ATLANTIC

An American, Glenn Curtiss, perfected this landing device by building an airplane on a boat body. This form has since been generally adopted. This seaplane can not only alight on the water, but can be propelled through the water at a good speed and can rise from it into the air with perfect ease. Ships are now constructed with a flat top on which a seaplane can land and take off wherever the ship may be located.

LESSONS IN GEOGRAPHY

Plan of study.—The subject of transportation is rich in materials for lessons in geography. Map study, both tracing and making, should be the basis of this work.

Tracing routes on a blackboard map.—The pupils use the blackboard maps with boundaries and water systems outlined in white for tracing with chalk the different routes of transportation. They go to the board, and with chalk in hand they talk and sketch, describing in detail the interesting features of a journey. They locate prominent cities, cross important waterways, and note historic points of interest.

Making maps.—Each pupil in the class will enjoy making the maps which record the routes of these historic journeys. Any outline paper map will do for this exercise.

The children sketch in the lines of travel, first with pencil and then with ink. They locate the cities along the route by pasting small black disks, which have been cut with a punch from black *passe partout*

AIR MAIL SERVICE

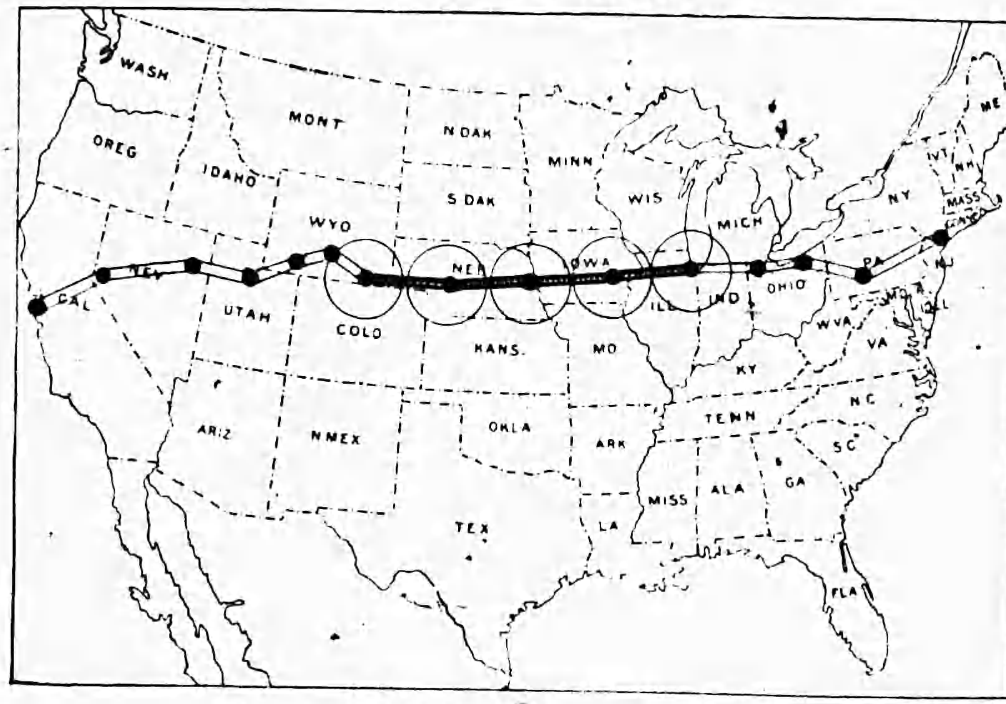


FIG. 7.—LESSONS IN GEOGRAPHY. MAP STUDY

paper, in their appropriate positions. They letter the top of the map with gummed letters, which may be obtained in sets of 10 at any paper store in one of our larger cities.

AIR-MAIL SERVICE

Map study—Route of the air mail.—Pupils trace the route of the air-mail pilot from New York to San Francisco on this map and describe the night flight and the landing fields for the day and night portions of the trip. The line of flight is marked with two parallel lines extending from coast to coast. The dots on the map represent the cities at which the airplane stops, where special landing fields have been provided for the exchange of mail and of planes. There are eight main air stations on this route—New York, Cleveland, Chicago, Omaha, Cheyenne, Salt Lake City, Reno, and San Francisco—as well as many lesser stops and emergency fields arranged at intervals of 25 miles along the entire route.

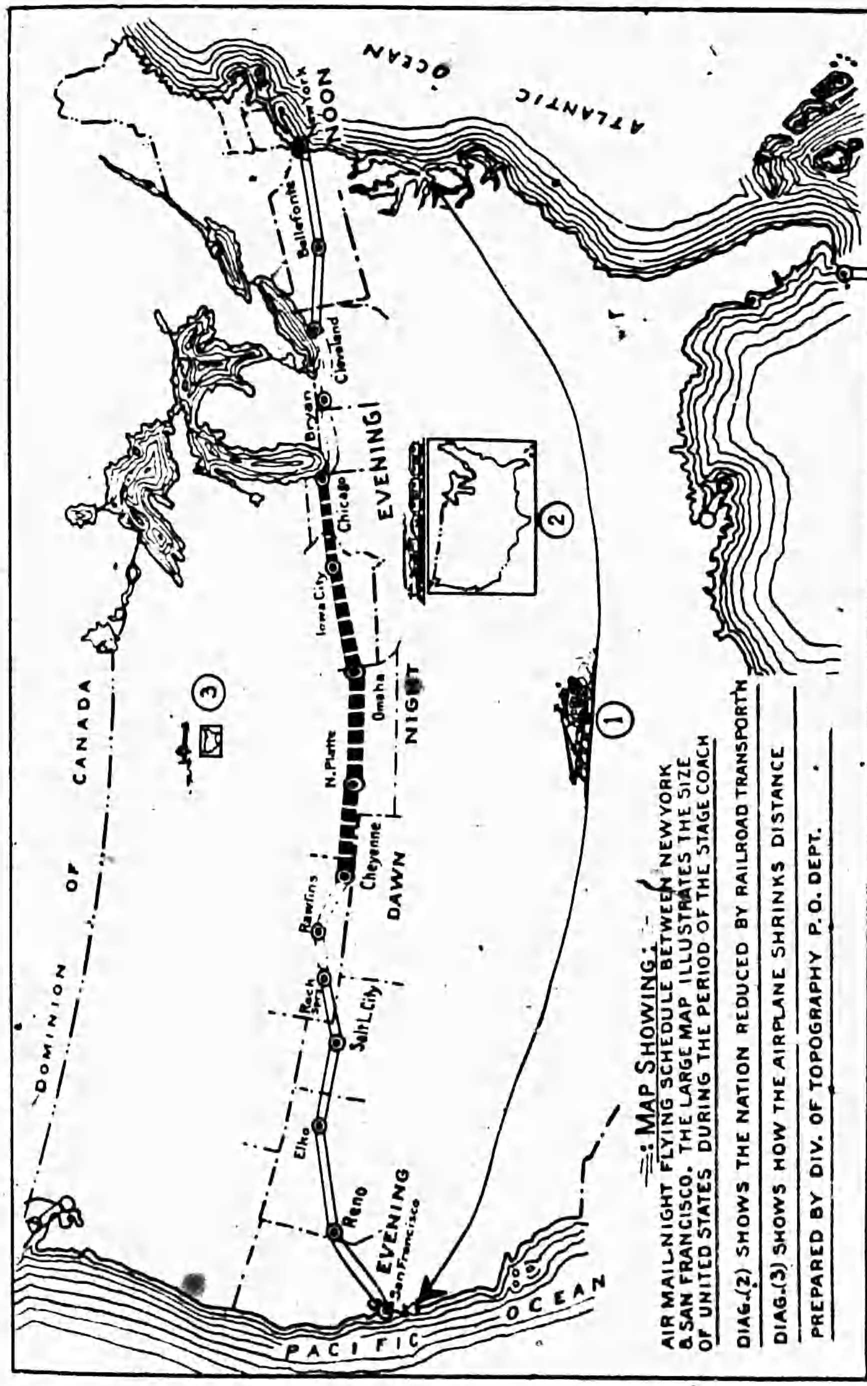
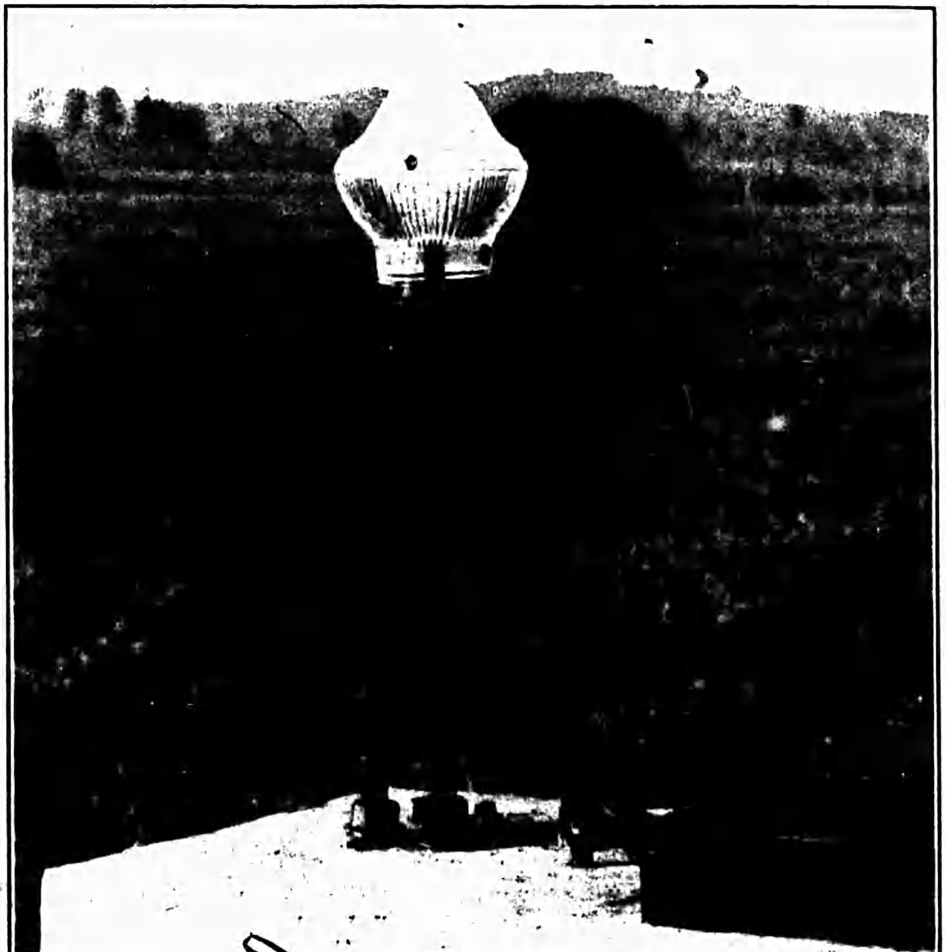


FIG. 8.—AIR MAIL NIGHT FLYING: MAP STUDY

The night flight.—The night flight over this route depends upon the time of leaving at New York on the western trip or at San Francisco for the eastern trip. The darker portion of the route on this map indicates the night flight, when the mail plane leaves New York at 11 in the morning, eastern time, and arriving in Chicago at 7 in the evening, central time, begins the night flying to Cheyenne, arriving there at 4.30 in the morning, mountain time.

The landing fields.—The entire field is surrounded with lights spaced about 200 feet apart. (See fig. 7.) A 50-foot mill tower supports the great beacon steadily swinging around the skies. This light can be seen for a distance of 50 miles. The hangars on the field and the airplane shop stand out in daylight perspective, lighted on every side by gooseneck floodlights, such as are used on billboards.

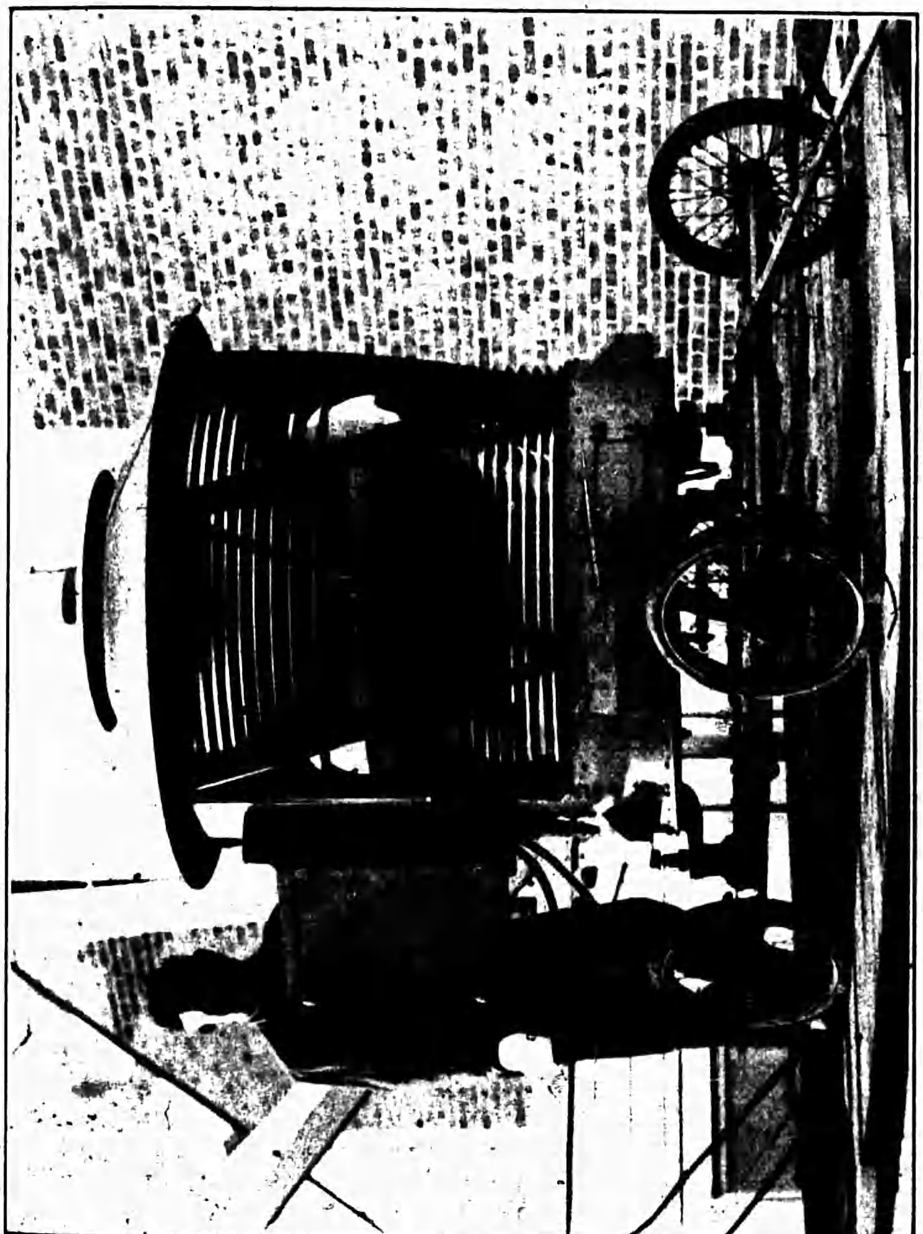


EMERGENCY FIELD BOUNDARY LIGHT: AIRMAIL SERVICE

Any large chimneys or other tall obstacles in the vicinity have warning red lights. In one corner of the field is a large illumined T which turns in the wind. This gives the pilot the wind direction. (See frontispiece.)

When the stagecoach carried the United States mail from coast to coast, the size of the United States in point of time was 500 hours at 6 miles per hour. In 1925 the railroad train carries the mail over this route in 100 hours at 30 miles per hour, and the airplane carries the mail in 30 hours at 100 miles per hour.

The distance across the United States in point of time shrinks from 500 hours, in the old stagecoach days, to 30 hours in the year 1925.

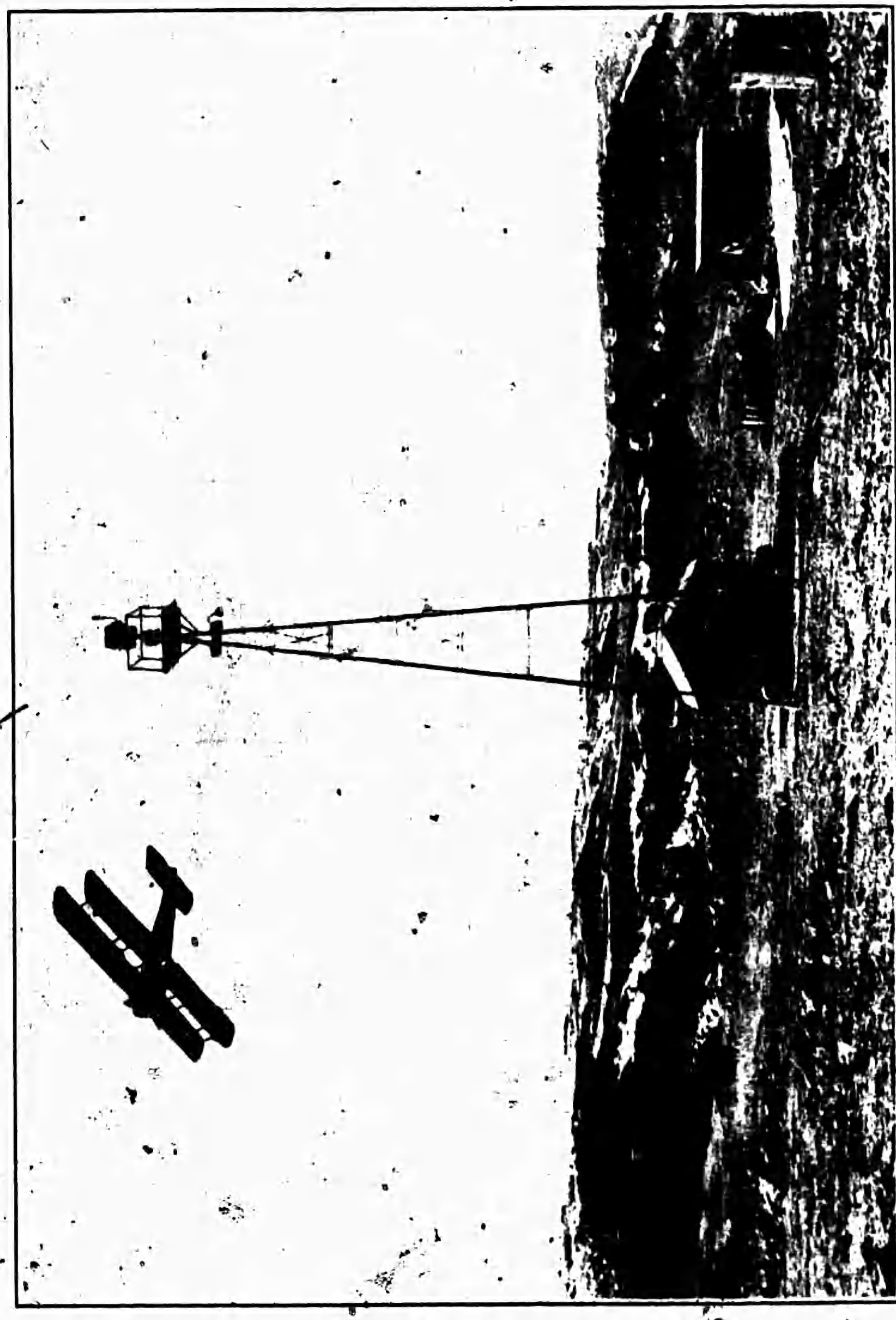


FLOODING THE LANDING FIELD WITH LIGHT

If we include the cross-country trip in an automobile, we have something like 200 hours at 15 miles per hour. Reducing these time distances to a table, we have the following:

30 hours by air at 100 miles per hour.
100 hours by railroad train at 30 miles per hour.
200 hours by automobile at 15 miles per hour.
500 hours by stagecoach at 6 miles per hour.

Arithmetic.—The distance from New York to San Francisco by air is about 3,000 miles. The air pilot flies the entire distance in 28 hours. How many hours per mile does he fly?



AIR MAIL SERVICE: THE HIGHEST BEACON IN THE WORLD

2. If he stops at 14 stations on his flight and spends 15 minutes at each station, how many minutes does he spend on the ground? How many hours? What is the actual time the pilot is in the air?

3. If a mail pilot leaves New York at 11 a. m., eastern time, and arrives at Cleveland, Ohio, at 4.45 p. m., eastern time, how many hours has it taken him to fly from New York to Cleveland?

4. If he spends 15 minutes at Cleveland for lunch and repairs, at what time does he leave Cleveland?

5. He arrives at Chicago at 6.45 p. m., central time. How many hours has it taken him to fly from Cleveland to Chicago?

6. What is the difference in time between eastern time and central time? Would his watch be fast or slow when he reached Chicago? Does he turn his watch back or turn it forward to get the correct time?

7. How much faster per mile does he carry mail than the mail train?

8. If the mail train and the mail plane leave New York at the same time, 11 a. m., when will the mail train reach Chicago and where will the mail plane be at this time? Where will the mail train be when the mail plane reaches San Francisco?

Rates of postage

Between	New York	Cleveland	Chicago	Omaha	Cheyenne	Salt Lake City	Reno	San Francisco
New York		8	8	16	16	24	24	24
Cleveland	8		8	16	16	24	24	24
Chicago	8	8		8	8	16	16	16
Omaha	16	16	8		8	16	16	16
Cheyenne	16	16	8	8		8	8	8
Salt Lake City	24	24	16	16	8		8	8
Reno	24	24	16	16	8	8		8
San Francisco	24	24	16	16	8	8	8	

Arithmetic.—The table for rates of postage by air gives the number of cents per ounce which is charged for air mail between certain cities.

1. If I send a letter by air mail from New York to Chicago weighing 1 ounce or less, what postage must I pay? If my letter weighs 2 ounces, what is the postage? If it weighs 1½ ounces?

2. If I send a letter weighing 2½ ounces from Chicago to Omaha, what postage must I pay?

N. B.—Other problems should be worked out by the teacher.

ROUND-THE-WORLD FLIGHT

Map study.—Tracing the route of the round-the-world flyers on the map of the world, Mercator projection.

Find Seattle, Wash., on the map and begin to trace the journey from this point in a northwestern direction by locating the cities and towns at which stops were made, reading from right to left, as follows:

No. 1. Seattle, Wash. 2. Vancouver, Canada. 3. Prince Rupert, Canada. 4. Sitka, Alaska. 5. Cordova, Alaska. 6. Seward, Alaska. 7. Chignik, Alaska. 8. Dutch Harbor, Alaska. 9. Nazan, Alaska. 10. Chicagoff, Alaska. 11. Shimushu Island, Russia. 12. Bettobu Island, Russia. 13. Aomori, Japan. 14. Yokohama, Japan. 15. Osaka, Japan. 16. Nagasaki, Japan. 17. Shanghai, China. 18. Amoy, China. 19. Hongkong, China.

Beginning at right side of the map with the first city at the right margin, reading from right to left, as follows:

No. 20. Haiphong, China. Tourane, China. 22. Saigon, Cochin China. 23. Bangkok, Siam. 24. Rangoon, India. 25. Akyab, India. 26. Calcutta, India. 27. Allahabad, India. 28. Umballa, India. 29. Karachi, India. 30. Charbar, Persia-India. 31. Bandar, Persia. 32. Bushire, Persia. 33. Bagdad, Mesopotamia. 34. Aleppo, Syria. 35. Constantinople, Turkey. 36. Belgrade, Yugoslavia. 37. Budapest, Hungary. 38. Vienna, Austria. 39. Strassburg, Germany. 40. Paris, France. 41. London, England. 42. Hull, England. 43. Kirkwall, Orkney Islands. 44. Thorshavn, Faroe Islands. 45. Reyjavik, Iceland. 46. Annagsalik, Greenland. 47. Ivigtut, Greenland. 48. Indian

ROUND THE WORLD FLIGHT—1924

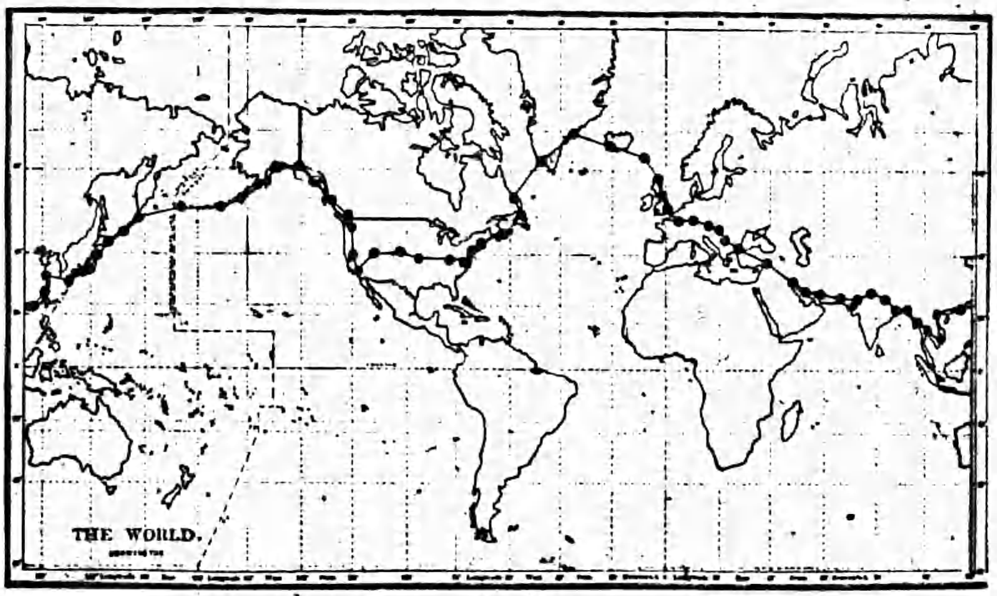


FIG. 9.—LESSONS IN GEOGRAPHY: MAP STUDY

Harbor, Labrador. 49. Hawkes Bay, Labrador. 50. Pictou Harbor, Nova Scotia. 51. Boston, Mass. 52. New York City, N. Y. 53. Washington, D. C. 54. Dayton, Ohio. 55. St. Joseph, Mo. 56. Cheyenne, Wyo. 57. Salt Lake City, Utah. 58. Los Angeles, Calif. 59. Sacramento, Calif. 60. Seattle, Wash.

AIRWAYS AND LANDING FIELDS

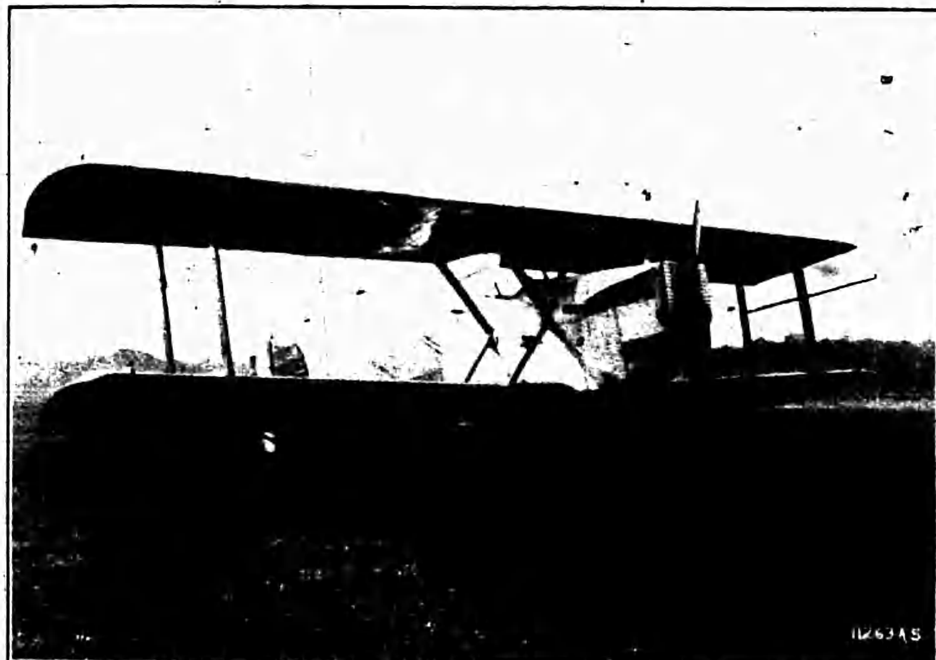
This map represents the landing stations and proposed airways which have been suggested by the Army Air Service of the United States.

The landing fields consist of a plot of ground set apart for the use of airplanes in landing and taking off. Some of these are Government or Army landing fields, some are Navy, some are air mail, and others are municipal or commercial, and all can be used by any type of aircraft.

Map study.—Each pupil makes a map of airways and landing fields in the manner suggested on page 50, using dots for location of cities and drawing lines representing the various airways.

Airways usually follow highways in cross-country flights, and the pupils should trace the great transcontinental highways on their airways map, locating the cities where landing fields may be found.

The Lincoln Highway.—Tracing from right to left the pupils locate the following cities: New York City, Trenton, N. J., Philadelphia, Pa., Gettysburg, Pa., Pittsburgh, Pa., Canton, Ohio, Fort Wayne, Ind., South Bend, Ind., Chicago Heights, Ill., Clinton, Iowa, Omaha, Nebr., Cheyenne, Wyo., Salt Lake City, Utah, Carson City, Nev., San Francisco, Calif.



PLANE READY FOR ROUND THE WORLD FLIGHT

The Lee Highway.—From right to left, New York City, Philadelphia, Pa., Washington, D. C., Bristol, Va., Knoxville, Tenn., Chattanooga, Tenn., Muscle Shoals, Ala., Memphis, Tenn., Little Rock, Ark., Durant, Okla., Clovis, N. Mex., El Paso, N. Mex., Globe, Ariz., Phoenix, Ariz., Yuma, Ariz., San Diego, Calif.

The Dixie Highway.—Eastern route: From north to south, from Sault Ste. Marie, Mich., Detroit, Mich., Toledo, Ohio, Cincinnati, Ohio, Knoxville, Tenn., Asheville, N. C., Augusta, Ga., Savannah, Ga., Jacksonville, Fla., Miami, Fla. Western route: Grand Rapids, Mich., South Bend, Ind., Indianapolis, Ind., Louisville, Ky., Nashville, Tenn., Chattanooga, Tenn., Jacksonville, Fla.

The Old Spanish Trail.—From right to left: Jacksonville, Fla., Mobile, Ala., New Orleans, La., Morgan City, La., Houston, Tex., San Antonio, Tex., El Paso, Tex., Globe, Ariz., Phoenix, Ariz., Yuma, Ariz., San Diego, Calif.

See United States Bulletin, 1923, No. 38, Main Streets of the Nation, for description of highways.

LESSONS IN CIVICS

COMMERCIAL AVIATION

Economic value.—The greatest advantage of travel by airplane lies in the saving of time it represents as compared with the speed of even the fastest train. One hundred miles an hour is made by the ordinary plane, while 50 miles an hour, including stops, is considered express speed on the railway. Add to the advantage of speed the element of cheapness, and the future of the airplane as a commercial carrier is assured. The only limitation of the aerial route is in regard to the quantity of baggage which may be taken. In time, however, powerful freight planes will come into use, and each

AIRWAYS AND LANDING FIELDS

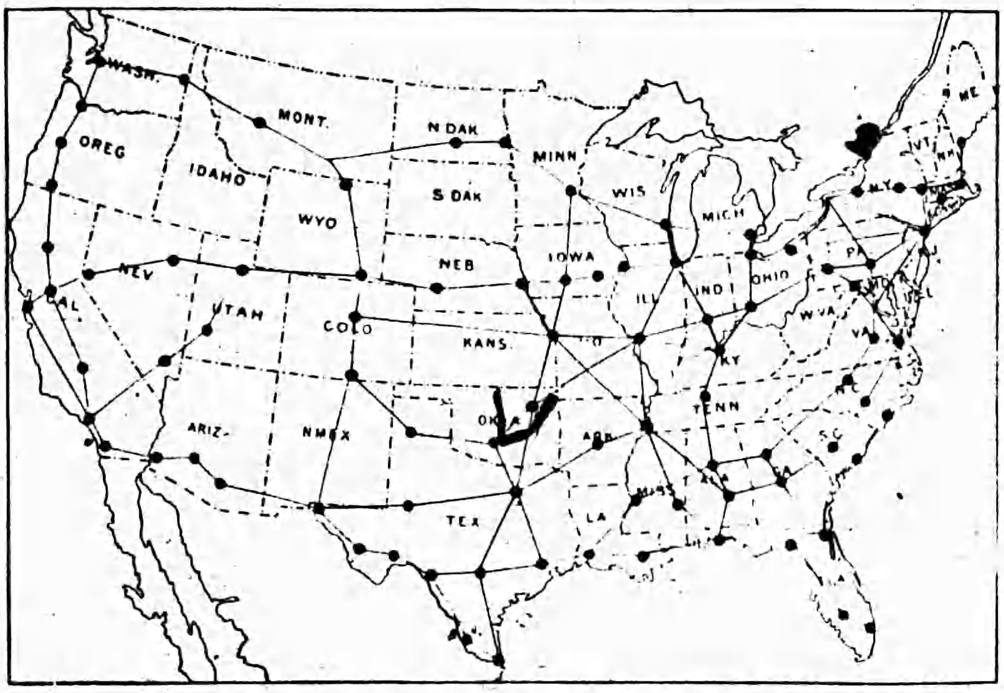


FIG. 10.—LESSONS IN GEOGRAPHY. MAP STUDY

passenger plane may be followed by a baggage plane carrying the heavier luggage.

The Chicago-Detroit commercial air line.—This line of commercial planes has been established between Detroit and Chicago and makes a daily schedule of five hours, round trip, from Detroit to Chicago and return. Each plane carries a thousand pounds of freight each way and makes the round trip in just the time required for a one-way run by the fastest train on the railroad between these two points. This line will soon be extended to St. Paul, Minn., St. Louis, Mo., and Iron Mountain, Mich. Eventually it will connect with all the principal cities of the United States.

A commercial landing field.—A landing field which is almost three-quarters of a mile square is being built for Detroit's commercial aviation activities just outside the city, at Dearborn. It is planned to make this an ideal airport. It will have a distinct bearing on air-mail activities coming in and out of Detroit and will be the basis of all commercial airlines in and out of the city.

Chapter V

THE AIRSHIP

LESSONS IN SCIENCE

THE "SHENANDOAH" AND THE "LOS ANGELES"

The Shenandoah.—An American dirigible was built in America for the United States Navy and was launched at Lakehurst, N. J., in September, 1923. It was never equipped with armament, however, for it was destroyed in a storm during a trip to the Middle West in September, 1925, just two years after it was built. Its cost was $2,000,000, but for scouting purposes it was equal to four modern cruisers costing $40,000,000 each. It was two-thirds the length of the *Leviathan*, see Chapter VI, but weighed 37 tons to the *Leviathan's* 50,000 tons. Its speed was from 60 to 75 miles an hour, and it could float for days in the air, if necessary.

The Los Angeles.—A German dirigible was built for the United States Navy in Germany, as part of the German reparations agreement. It arrived in America on October 15, 1924. It is larger than the *Shenandoah*, and is designed for a commercial airship, without armament. The control car is close against the hull and contains the cabin. This has accommodations for 15 or 20 passengers. It has compartments like the berths in a railway car or a steamer. Two sofas, opposite each other, are made up as berths at night, and provide for four occupants. There is a kitchen, pantry, storage room, and toilets and lavatories for men and women.

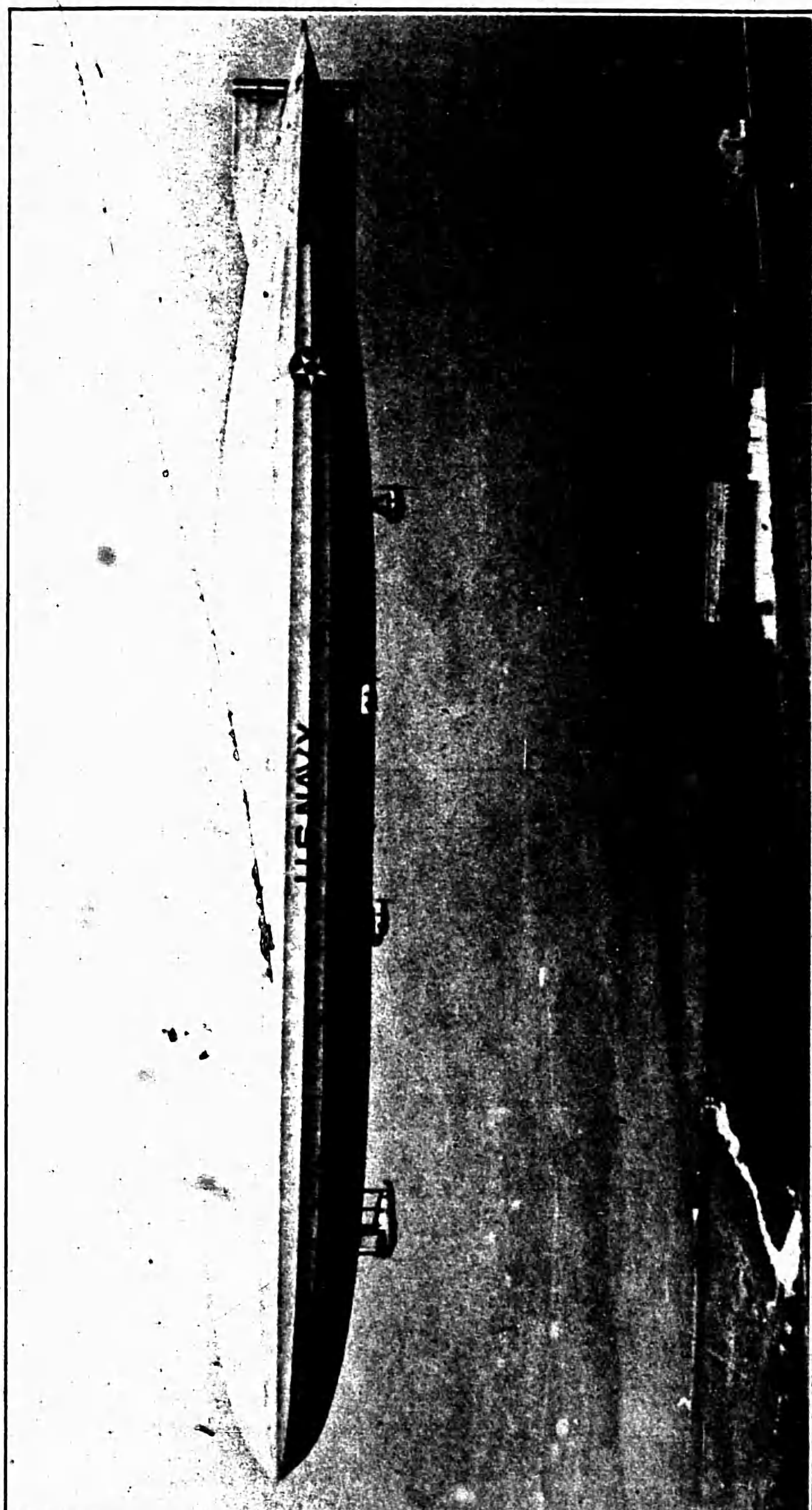
Landings are made at night when the ship is cool and heavy.

Departures are made well after sunrise, when the gas is superheated and light.

Gas bags.—Inside the great balloon are 20 gas bags filled with helium. Tissue from the intestines of oxen is used for lining the huge gas bags. Stockyards saved this membrane from some 2,000,000 cattle for the gas bags in the Los Angeles.

Helium is a gas without color and is nonexplosive. For that reason it is valuable for inflating the airship. Most accidents to dirigibles have been due to the explosion of hydrogen in the gas bags, which has been used heretofore in German Zeppelins.

Gas deposits containing large quantities of helium have been found in our gas fields, which makes a home supply available for use in



THE "SHENANDOAH"

airships. The United States has almost a monopoly of the production of this gas in large quantities. Manufactured helium costs $1,750 per cubic foot, while natural helium from our gas wells costs about 35 cents per cubic foot. Helium has a lifting power 8 per cent less than hydrogen, which is used in other dirigibles, but it is much safer.

Engines.—The *Shenandoah* had six engines of 300 horsepower, with a speed of from 60 to 75 miles an hour. The engines could drive the craft two days and nights at 60 miles an hour. The *Los Angeles* has five engines of 400 horsepower and a speed of 75 miles an hour with all motors running full.

A TRIP IN THE SHENANDOAH

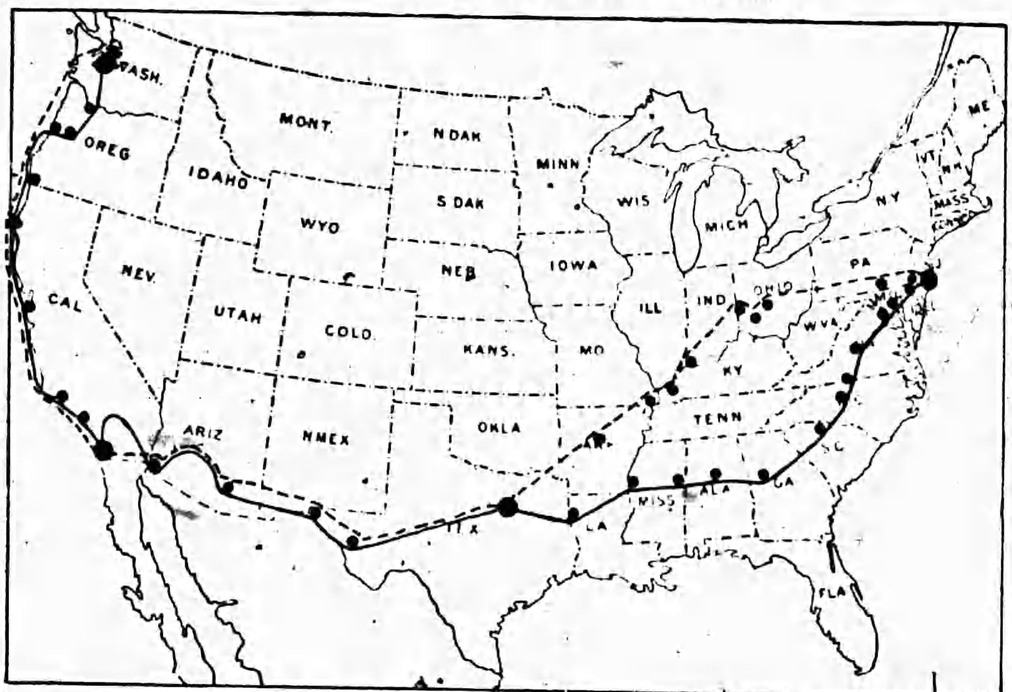


FIG. 11.—LESSONS IN GEOGRAPHY: MAP STUDY

Crew.—On the *Shenandoah's* famous trip,[1] October, 1924, across the United States half the crew of over 30 men watched while the other half slept. Day in and day out the crew were four hours on duty and four hours off. Hot coffee, chocolate bars, and sandwiches were on tap at all hours for the crew. The cook worked 22 hours a day preparing hot coffee, soup, and beans. The crew ate 4,172 sandwiches and 2,300 cakes of chocolate during the voyage.

LESSONS IN GEOGRAPHY

A TRIP IN THE "SHENANDOAH"

The children trace the route of the *Shenandoah* both outward bound and returning, and locate the principal cities over which the great airship passed on her voyage to the Pacific coast.

[1] Geographic Magazine, January, 1925.

Beginning at Lakehurst, N. J., they follow the mountain valleys south and west until they stop at Forth Worth, near Dallas, Tex. Then due west to the naval station at San Diego, Calif., and north over the coast line they come to rest at Camp Lewis, near Tacoma, Wash. On the return trip they follow the same route to Dallas, Tex. Here they take the northeastern course across Arkansas, Kentucky, Indiana, Ohio, and Pennsylvania to the home field at Lakehurst, N. J.

They write to the Navy Department at Washington, D. C., for information regarding this trip and receive as much material as it is possible for the department to send out. Occasionally descriptions of the appearance of the country from an airship are found in current magazines which the pupils are eager to secure and bring to the class.

The time schedule in hours and minutes for the trip they use for lessons in arithmetic in computing distances by time, number of miles covered, number of days and nights en route, length of journey, and speed of ship per hour, per day, and per night—problems in cost of trip by amounts of fuel consumed, of helium gas in use, and of food and wages for the crew.

Schedule of time en route in hours and minutes

	In flight		In air		Moored	
	Hrs.	*min.*	*Hrs.*	*min.*	*Hrs.*	*min.*
From Lakehurst to Fort Worth	36	45	38	05	10	41
From Fort Worth to San Diego	39	14	41	14	128	15
From San Diego to Camp Lewis	47	15	57	55	16	55
From Camp Lewis to San Diego	39	55	47	35	23	25
From San Diego to Fort Worth	36	25	37	22	8	06
From Fort Worth to Lakehurst	[illegible]	27	36	22		
Total	235	01	258	33	187	22

ARITHMETIC

(Based upon the table of schedule of time en route in hours and minutes)

1. How many days and hours were spent in the flight?
2. They were in the air 38 hours. How much time was spent in landing?
3. How long did they stay at Fort Worth?
4. How long did it take them to land at San Diego?
5. How many hours were they moored at the San Diego mast? How many days?
6. How many days were spent on the trip up the Pacific coast from San Diego to Camp Lewis at Tacoma, Wash.?
7. How long did the return trip take in hours and minutes from Camp Lewis to Lakehurst?

TAKING THE AIRSHIP OUT OF THE HANGAR

The children take an imaginary journey in the *Shenandoah*. They arrive at the flying field at Lakehurst, N. J., early in the morning, before the sun has risen. They watch the great doors of the hangar being pushed aside. They see 300 men clinging to ropes, pulling the big ship out of its shed, and towing it over to the tall mooring mast which stands a half mile away in the flying field.

MOORING THE AIRSHIP TO THE MOORING MAST

The children see the men loosen the long ropes which hold the balloon to the ground and watch it as it quietly rises until its nose touches the top of the mast. Then the big round button on the end of its nose slips into the big round cup at the top of the mast and the ship balloon hangs suspended in the air, 150 feet from the ground.

HOW IT LOOKS FROM THE GROUND

The children look up at the "huge silver whale" and count the cars which are fastened to its underside. There are six of these, and from below they look like six big eggs hanging down from the ship. The forward car, under the front of the ship, is larger than the others. This is called the "control car," for here the ship's officers turn the wheels and lift the levers which control the ship and guide it through the air. There are five other cars, two on each side and one near the tail, which are called "power cars." They hold the engines which keep the propellers in motion and help to drive the ship through the air. All the propellers are hanging idle now, but when the ship is ready to start, the engines will begin to hum and the propellers begin to turn faster and faster until the great ship is on its way.

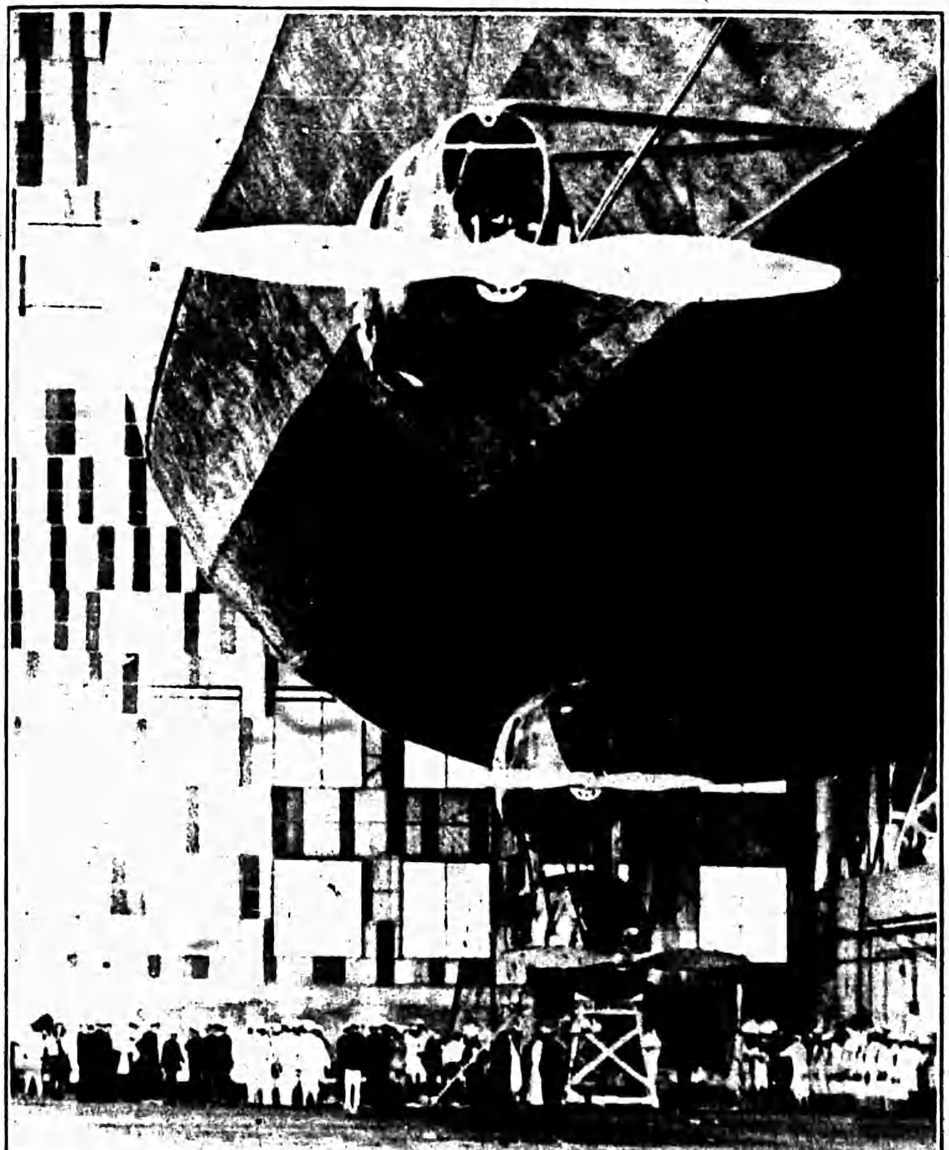
BOARDING THE AIRSHIP

The children get into the elevator at the foot of the mast and ride up to the platform at the top. There, in front of the platform, hangs the great balloon. A door under its nose is open, and an officer is pushing a gangplank over from the door onto the end of the platform.

HOW THE INSIDE LOOKS

The children step across the gangplank and peer into the balloon. They see the metal framework which seems to fill the whole inside of the balloon. Girders and beams and struts and braces stretch in every direction. And over it all the heavy cotton cover is pulled tight around the framework. The balloon is black inside, to soften the rays of sunlight, and outside a silver gray, painted with aluminum, which drives back the rays of the sun.

The children notice a long narrow walk running down the middle of the balloon from its nose to its tail. This is called "the cat's walk" because it is only 9 inches wide and 682 feet long. It is just about the length of three average city blocks. The crew of the ship are nimble footed. They trot up and down this narrow plank, passing and repassing each other, while below them there is nothing



GASOLINE ENGINES ON THE AIRSHIP

but the cotton cover of the balloon between them and a drop sometimes of 3,000 feet.

THE DECK OF THE SHIP

On either side of the cat's walk are the crew's quarters. These are alcoves on small wooden platforms. Some are furnished with berths for the men's sleeping quarters. Others are supplied with tables and benches where rations are served by the mess boy whenever there is time to eat. Food lockers are placed along the walk, where the crew can help themselves to foods already prepared.

SHIP SUPPLIES

The fuel tanks are stationed along the walk at intervals. There are 48 of them, each holding 131 gallons of gasoline to supply the engines with fuel. Cans of oil for the machinery hang within easy reach, and water-ballast bags are placed from one end to the other

DECK OF THE AIRSHIP

to help to balance the long slender form and hold it level, so that neither its nose nor its tail will dip too far toward the ground.

THE GAS BAGS

Over the cat's walk, along the length of the ship, hang the 20 great gas bags filled with helium which buoy up the balloon and keep it floating in the air.

THE CONTROL CAR

The children are led into the balloon and climb down a ladder into the control car. Five or six officers are in their places ready to start the ship on its journey. One officer holds the steering wheel which controls the big upright rudder on the tail of the balloon. He steers the great ship by this rudder much as he would steer a ship at sea. Another officer is at the wheel of the elevators. These are the horizontal rudders on the tail. If the officer lifts the elevators the ship rises. If he lowers them the ship descends. The deck officer has his hands on the levers which control the water ballast. If the ship is too heavily loaded he pulls a lever and lets 550 pounds of water out of one of the water bags to the ground. If the ship begins to nose down he opens a water bag in the forward part of the car. If the tail begins to drop he opens a water bag near the tail. Sometimes he sends the men along the cat's walk to help balance the ship.

THE CONTROL CAR

One man walking the length of the ship when the engines are not running changes her level 3°.

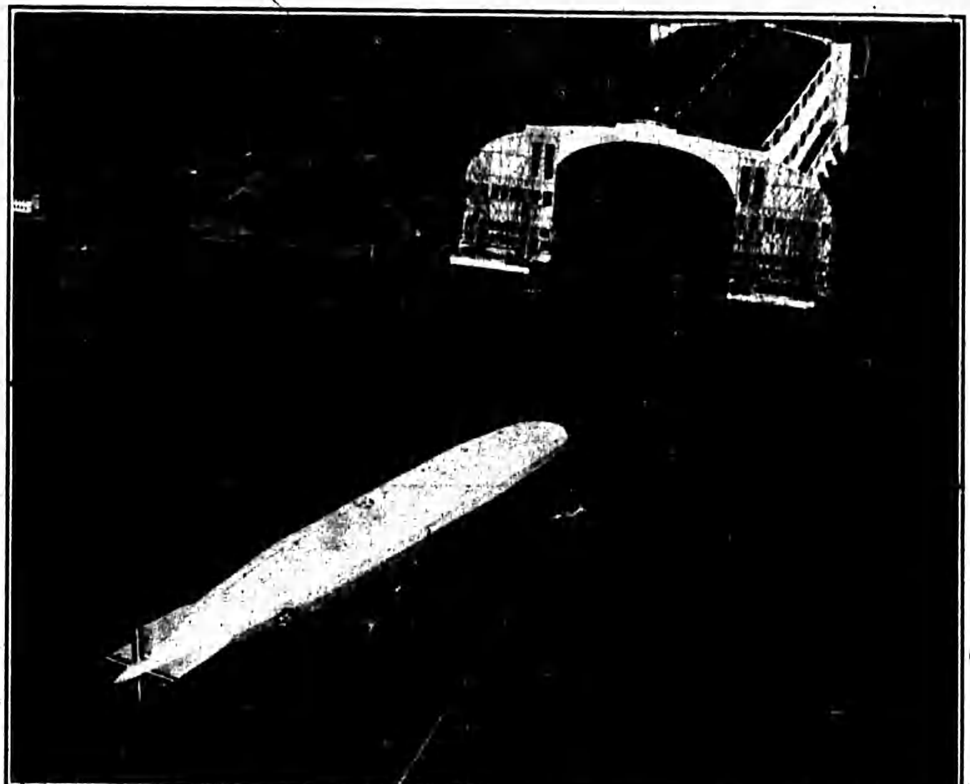
CASTING OFF

Now the officer on watch calls "Speed ahead," and each motor in the five power cars begins to roar and revolve at the rate of 1,200 times a minute. The ship rises, circles over the field, and sails away toward the south on her trip to the Pacific.

THE SOUTHERN ROUTE

She was 1,300 feet above the sea. Her route lay south almost directly over the Shenandoah Valley to Atlanta, Ga., then west to San Diego, Calif. This roundabout way was taken on account of the height of the Rocky Mountains. The lowest point for passing was necessary because the balloon could not rise above the higher ranges in the northern part of the United States. Dragoon Pass, near Tucson, Ariz., was the point of passing. The mountain walls on either side were so close as almost to touch the sides of the ship. But the long ship worked slowly through this narrow defile, and the worst of the Rockies was passed. A little over 14 hours later she safely reached the naval air station mast at San Diego.

After leaving San Diego she sailed up the coast to her landing field in Tacoma, Wash. Here the crew stopped only for a day, and



COMING INTO THE HANGAR

then the *Shenandoah* cast off from the Camp Lewis mast on its return voyage.

READING LESSONS

AVIATION

Silent reading, Grades III, IV, V, VI.—A ride in an airplane—Field, 3. Ways of traveling—Winston Companion, 3. How the little kites learned to fly—Riverside, 3. A flight through the air—Merrill, 3. Hunting wild goats by seaplane—Silent Reading Hour, 3.

The *Zr 3*; How Uncle Sam's magic carpet flew around the world—Modern Readings, 5. The flying machine—Gordon, 5. Quentin Roosevelt, a story of an aviator; A little prayer for the men in the air—Bobbs Merrill, 5.

The first airship across the Atlantic; Postmen of the skies—Literature and Living, 6. Flying machines; Darius Green and his flying machine; the balloon—Progressive Roads, 6.

Chapter VI

INLAND WATERWAYS

LESSONS IN GEOGRAPHY

PRINCIPAL CANALS IN THE UNITED STATES

Map study.—Pupils reproduce this map by tracing navigable rivers and locating principal canals now in use on an outline map of the United States. Cities along these water routes should be designated by small black passe partout paper disks, pasted in their proper location.

The following table should be copied on the blackboard for the pupil's use in tracing freight and passenger canal routes on their outline maps of the United States.

PRINCIPAL CANALS IN THE UNITED STATES[1]

State	Canal	Points connected	Opened	Total length	Canal length	Width	Depth	Cost
				Miles	*Miles*	*Feet*	*Feet*	
Massachusetts	Cape Cod Ship Canal.	Buzzard Bay to Cape Cod Bay.	1915	13.00	7.68	200	25	$13,500,000
New York	Erie	Troy to Tonawanda	1825	340.40	122.40	150	12	134,214,920
Do	Champlain	Troy to Whitehall	1822	62.66	23.53	125	12	21,691,584
New Jersey	Delaware & Raritan.	New Brunswick to Bordentown.	1834	44.00	44.00	80	8	5,113,749
Delaware	Chesapeake & Delaware.	Delaware River to Chesapeake Bay.	1829	20.63	13.63	60	10	5,000,000
Maryland	Chesapeake & Ohio.	Washington, D. C., to Cumberland, Md.	1850	184.50	180.70	68	6	14,000,000
Illinois	Illinois & Michigan.	Chicago to Lasalle	1848	95.00	95.00	60	6	9,429,606
Do	Chicago Drainage.	Chicago to Lockport	1900	38.60	32.35	226	22	55,208,889

[1] See p. 70.

CITIES LOCATED ON INLAND WATERWAYS

(NOTE.—The rivers are not necessarily navigable at these points.)

Map study.—The children locate the cities on each river and place a small black disk at the point located.

Northwest.—On the Columbia and Snake River to Yellowstone Park, from west to east: Start at Portland, Oreg., Lewiston, Idaho, Weiser, Idaho, Idaho Falls, Idaho.

On the Missouri River to the Mississippi River, from west to southeast: Start at Dillon, Mont., Great Falls, Mont., Williston,

N. Dak., Bismarck, N. Dak., Pierre, S. Dak., Omaha, Nebr.; Kansas City, Mo., St. Louis, Mo.

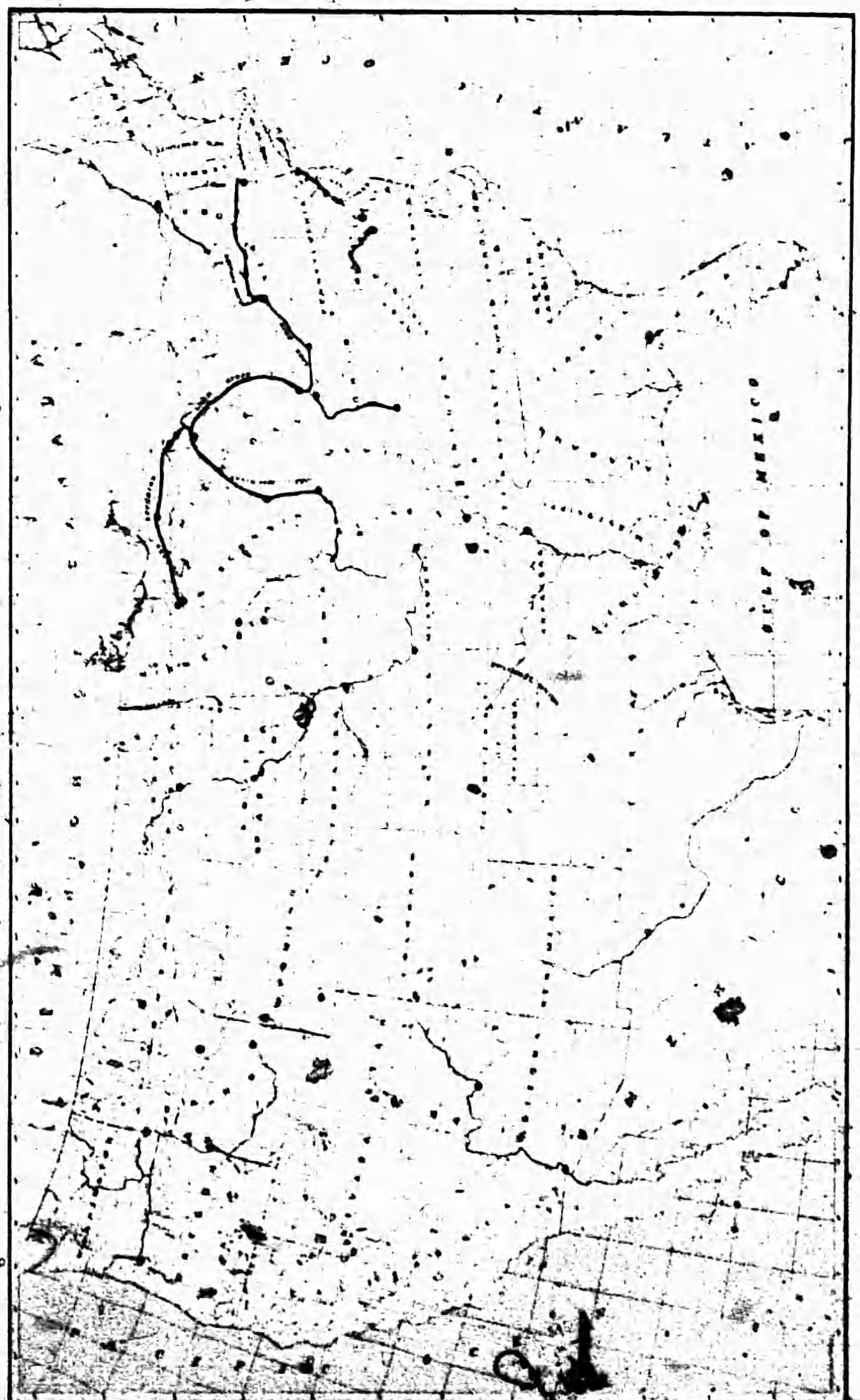


FIG. 12.—INLAND WATERWAYS

Southwest.—On the Colorado River and Green River to source; from south to north: **Start at Yuma, Ariz., Grand Canyon, Ariz., Green River, Wyo.**

Midwest.—On the Mississippi River from source to the Gulf of Mexico, from north to south: Start at St. Paul, Minn., Davenport, Iowa, St. Louis, Mo., Cairo, Ill., Memphis, Tenn., New Orleans, La.

On the Ohio River from Pittsburgh, Pa., to Cairo, Ill.: Start at Pittsburgh, Pa. From east to southwest: Cincinnati, Ohio, Cairo, Ill.

LAKE PORTS ON INLAND WATERWAYS

Midwest.—On Lake Superior, from west to east: Start at Duluth, Minn., or Superior, Wis., Houghton, Mich., Sault Ste. Marie, Mich., on the Soo Canal in St. Mary's River.

On Lake Michigan from south to north: Start at Chicago, Ill., Milwaukee, Wis., Mackinaw, Mich., on Mackinac Island.

On Lake Huron and Lake St. Clair from north to south: Start at Mackinaw, Mich., to Detroit, Mich., on the Detroit River.

On Lake Erie, from west to east: Start at Detroit, Mich., Cleveland, Ohio, Buffalo, N. Y.

CANAL PORTS ON INLAND WATERWAYS

Midwest.—On the Drainage Ship Canal, east to west: Start at Chicago, Ill., through the Drainage Canal to Lockport, Ill., on the Illinois River to La Salle, Ill., Peoria, Ill., St. Louis, Mo., thence to the Gulf of Mexico by way of the Mississippi River.

East.—On the Erie Canal, west to east: Start at Buffalo, N. Y., Tonawanda, N. Y., Rochester, N. Y., Utica, N. Y., Rome, N. Y.; thence to New York City by way of the Hudson River.

On the Champlain Canal, north to south: Start at Whitehall, N. Y., on the Lake Champlain Inlet, south to Troy, N. Y.; thence south by way of the Hudson River to New York City.

On the Delaware and Raritan Canal, N. J., from New Brunswick, N. J., southwest: Start at New Brunswick, N. J., Princeton, N. J., Trenton, N. J., Bordentown, N. J.

On the Chesapeake and Delaware Canal, from Delaware City southwest to Chesapeake Bay.

On the Chesapeake and Ohio, from Washington, D. C., to Cumberland, Md. (It is not now used.)

LESSONS IN SCIENCE AND HISTORY

Boats and Waterways

THE CANOE

The kayak.—The Eskimo kayak is a wonderful example of the adaptation of a people to their environment. Out of a few pieces of driftwood and the skins of a half dozen seals the Eskimo has fashioned one of the most perfect specimens of water craft that has ever been made. After the frame has been tied together with the sinews of some animal it is covered with the skins, which are also sewed in place with bear or walrus sinews. Only one small opening is left in the top of the kayak large enough to admit the boatman to his seat. Around this opening a skin is fastened which is drawn together with a drawstring around the waist of the boatman after he has taken his place in the canoe, and makes his boat as nearly water-tight as a boat can be.

The dugout.—The Indians in the eastern Atlantic States made their canoes out of trunks of trees, using fire and stone hatchets. A binding of wet grass was wrapped around the trunk near the roots

ESKIMO AND HIS KAYAK

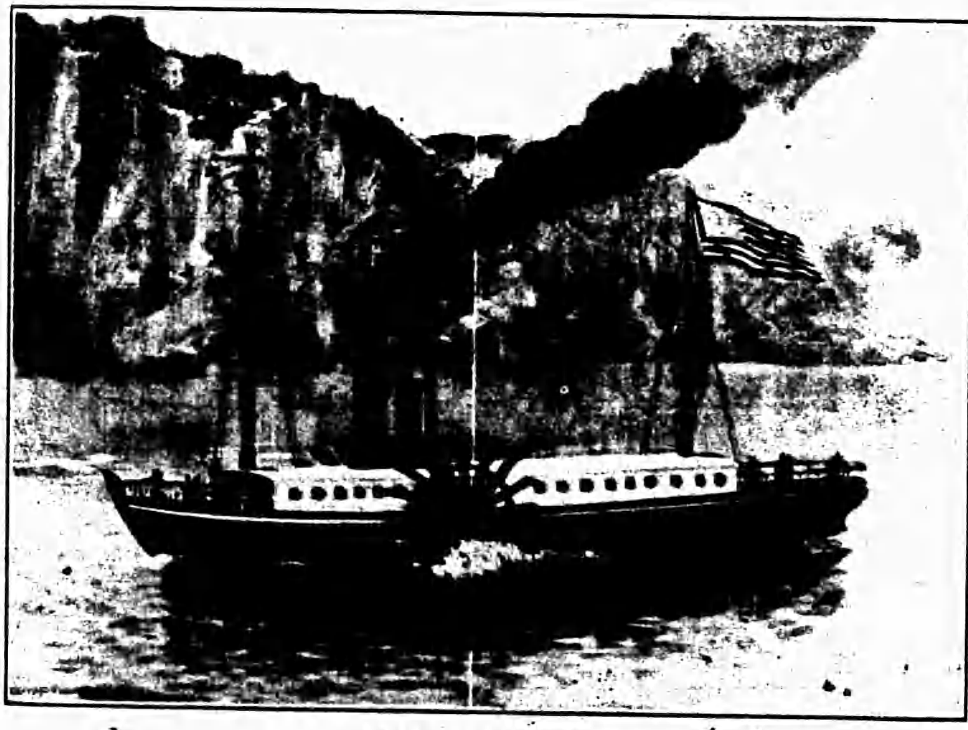
and below this another binding of dry grasses. When the dry grass was set on fire it charred the wood under it and after this had been chipped away, bit by bit, with the hatchet, the tree fell to the ground. Then the other end of the trunk was cut off just below the branches in the same way.

After the bark had been taken off the log a row of little fires was built along the top of the log, and as the wood began to char under the fires it was chipped away with the hatchet. This process was repeated until the heart of the trunk was entirely dug out and only a shell about 1 inch thick remained. In this way a boat sometimes 18 feet long, which would hold from 10 to 12 people, could be made in a few days.

THE FERRY

Scows were used by the Pilgrims and early settlers for ferryboats. They were broad and shallow, and several persons could ride on one of them at a time. A horse and wagon could be driven upon a scow and ferried across a stream. Many of these ferries are still used where streams are sluggish and haste is no object to the passengers.

Washington used many flatboats and scows to carry his army across the Delaware River the night he surprised the Hessians at Trenton. There are several large, steam ferryboats at New York on the Hudson River which carry passengers across from New York to New Jersey. These ferryboats are so large that many automobiles



THE "CLERMONT"

can ride on them on one trip. There is a large upper deck where foot passengers may ride. One of the famous ferries of our country runs across the bay from San Francisco to Oakland in California.

THE "CLERMONT"

Robert Fulton's *Clermont* was the first steamboat in this country to make a successful trip on the water. It was launched on the Hudson River in the spring of 1807 and started off on its journey to Albany in the presence of thousands of astonished spectators.

Through many years of trials and discouragement Fulton worked before the *Clermont* was finally completed and launched with safety. His first small model made a successful trial trip, but the larger boat which he copied from the model sank to the bottom of the river because the engine was too heavy. His problem was to make an engine light enough to float on the water, and when he had solved this difficulty the success of steamboat navigation was assured.

The success of the *Clermont* led to the construction of many river steamboats and to the rapid development of river traffic. The paddle wheel which Fulton invented was used for 30 years, until John Ericsson constructed a screw propeller, which is used almost exclusively on steamboats at the present day.

THE "SAVANNAH"

The first steamship to cross the ocean was the *Savannah*, built and owned by the people of the city of Savannah, Ga. Sailing out from the Savannah River, it made its first trip to England and Russia just 12 years after Fulton had launched the *Clermont* on the Hudson River. This ship used both sails and steam, but after the invention of the screw propeller the construction of steamships was greatly changed. The wooden ship gave place to ships of iron or steel. During the war the use of wooden ships was revived, but when the war emergency had passed the construction of wooden ships was abandoned.

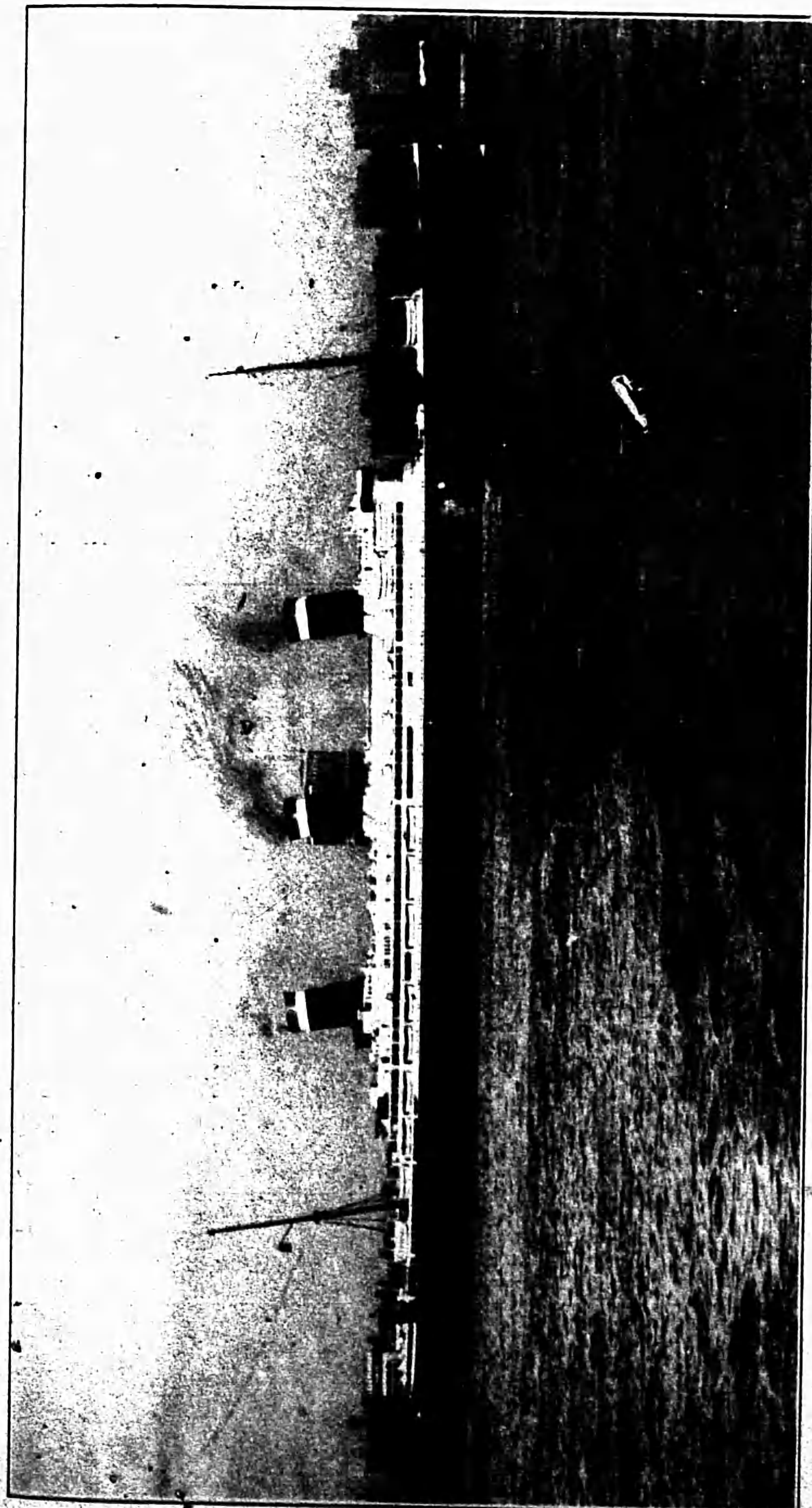
A TWENTIETH CENTURY GREYHOUND

There are hundreds of ocean steamers crossing the oceans which are the marvels of the age. The number of passengers enrolled on their list for a voyage is equal to the population of a small city, and they cross the Atlantic in five days, the same voyage which the Pilgrims made in three months. One has all the comforts and luxuries on an ocean liner which are afforded the guest in a great hotel in a large city. Telephone service from one part of the ship to every other, the daily newspaper with the latest news from shore, received by wireless, theaters, concerts, and every type of entertainment one would find in any city in the world.

The *Lusitania* and her sister ship, the *Mauretania*, marked a new era in ocean transportation. Steel turbines took the place of the old-styled reciprocating engine. Each ship is driven by four propellers and makes an average speed of nearly 30 miles an hour.

The *Leviathan* is the largest of these later steamships. She has a length of 950 feet, a gross tonnage of 57,000 tons, and a displacement of 62,000 tons. The superdreadnaught, *West Virginia*, of the United States Navy, has a displacement of 30,000 tons and a length of 584 feet. The *Leviathan* will accommodate 3,397 passengers, and its crew numbers 1,138.

During the war the *Leviathan* acted as the world's greatest troopship. She carried 94,183 United States troops across the Atlantic in



AN OCEAN LINER—THE "LEVIATHAN"

10 trips, on one trip carrying 11,470 soldiers, breaking the world's troop transportation record.

She was built in Germany and came to this country as the *Vaterland*. When war was declared she was seized by the United States customs officials and turned over to the United States Shipping Board. She was converted into a troop ship to carry United States soldiers over to France. After the armistice she was rebuilt and refurnished for a merchant marine and to-day is called the most famous and most luxurious ship in the world.

Lighting.—Fifteen thousand lamps are required to light the 4,000 rooms of the vessel. The electric current consumed in one evening between the hours of 7 and 11 would supply the ordinary house for seven years.

Dining.—There are many dining rooms on the *Leviathan*; a restaurant, winter garden, tea room, and officers' dining room, the main dining room and the Ritz-Carlton room. For the feeding of 4,500 people on a round trip she requires 80,000 eggs, 600 boxes of apples, 15,000 pounds of butter, 20,000 pounds of jam, 20,000 pounds of cabbage, 6,000 pounds of game, 2,000 quarts of milk, 70,000 pounds of flour, 186,000 pounds of meat, 20,000 pounds of ham, 60,000 pounds of potatoes, 56,000 pounds of fish, 16,000 pounds of sugar, 2,000 pounds of grapes, 14,000 pounds of carrots, 400 crates of oranges, 250,000 cigarettes, 1,600 pounds of tomatoes, 2,240 pounds of tobacco, and 3 tons of tea and coffee.

HOW THE EARLY MARINERS GUIDED THEIR VESSELS

A mariner must know where the port lies that he is trying to reach. He must know his ship's position on the sea and he must know the best courses to be steered, from the beginning of his voyage until the end.

The early mariner was guided by the moon and stars at night and by the sun during the day. In cloudy weather, or when a fog settled down over his ship, he drifted around on the surface of the water until it was clear again.

In the China Sea and the Indian Ocean, where the monsoons blow regularly in one direction, vessels made long journeys out of sight of land by running directly before these prevailing winds. This haphazard method of sailing the high seas was fraught with great danger. When a fleet of merchant vessels was sent to distant ports the trader did not expect more than one or two of them to return.

Many serious accidents occurred to war vessels as well as to merchant marines. Admiral Wheller's squadron in 1624 in leaving the Mediterranean ran on Gibraltar and was lost because he thought he had passed through the straits and was safely out to sea. Many transports and whole squadrons were wrecked in European waters, and exploring vessels on our own coast were frequently lost because the ship's position at sea could not be accurately determined.

THE COMPASS AND HOURGLASS

In early times mariners used the compass as a rough sundial for determining the time. As early as 1400 the mariner's compass was adopted and led to a period of progress in navigation.

Water clocks and sand clocks were used for rough purposes of keeping time on board ships. It is curious to note that the hour and half-hour sand glasses were used in the British Navy until 1839.

MEASURING THE POSITION OF THE SHIP

Latitude.—The distance north and south of the Equator was measured by observations of the sun and the pole star. This was quite accurate enough to fix the observer's position within a 20-mile limit[1]. It was done with instruments called the cross-staff and the astrolabe, which have since been replaced by the sextant and chronometer.

The sextant and the chronometer are largely responsible for the rise of modern navigation. The sextant is an instrument for the measurement of angular distances. The chronometer is a timekeeper that is much more accurate than an ordinary clock. It is so balanced that the motion of the ship does not affect its accuracy.

Longitude.—The distance east or west from Greenwich was much more difficult to determine when a ship was out at sea.

When a mariner lost his bearings, or was sailing 60 to 100 miles outside his course, his ship was in great danger. Most of the accidents at sea happened for this reason, for the measurement of the ship's position east or west from Greenwich was the greatest difficulty which mariners had to face.

This position was usually found by measuring the distance between the moon and selected stars. The moon makes a rapid circuit of the sky once each month. In so doing it passes close to a number of bright stars. To measure the distance between the moon and selected stars and to note the time of measurement was the method used.

The mariner carried a time-table of these measurements made at Greenwich. He compared his time of measurement with the Greenwich time of measurement and found his position in this way. Even by this method he was often several hundred miles out of reckoning, and the study of the longitude problem led to all sorts of experiments and inventions.

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[1] It is suggested that teachers develop these lessons in detail with advanced classes.

Prizes were offered by Spain and England for a discovery of a better method of computing distances from Greenwich. It is said that England established her national observatory in 1675 in order to study this problem.

To-day the time in Greenwich can be sent by radio to any ship which carries an instrument, but in those days there was no way of reaching a vessel at sea from a point on the land.

Using the sun, moon, and stars for reckoning affords the most accurate means of finding positions at sea. Navigators generally prefer to determine position from observations of the sun by measuring the altitude of that body above the sea horizon. But similar observations of the planets and brighter stars in twilight, when the horizon is well defined, afford even better determinations of positions at sea. In such a case the careful navigator, by observing for latitude two stars, one north and one south of the zenith, and for longitude two stars, one east and one west of the zenith, can depend on a good result. Since the moon also may be used when necessary, it is evident that the navigator seldom needs to go along without a good "fix" or determination of position.

MEASURING THE SPEED OF THE VESSEL

The speed of the ship was measured every two hours in this way: Two observers stood on the deck a certain distance apart. Then a float was thrown out from the bow into the water. Each observer sighted the float when it came abeam of his position and noted the time. The speed of the ship was estimated by the length of time it took the float to pass from one observer to the other, compared with the distance between them.

At the present time the rotary or patent log is used to determine the speed of a vessel. It records the revolution of a small screw towed by the ship, and, like the speedometer, registers the speed of the ship and the distance run at any second.

Soundings.—A weight and line for making soundings is an important part of a mariner's equipment. The depth of the water is found in this way. Another method invented during the World War for locating submarines measures depth by sound instead of by the slow and cumbersome method of line and sinker. Sound is sent out by the instrument, strikes the bottom of the ocean, and is reflected back to a specially designed receiver. The depth is calculated from the interval between the sending of the signal and the receipt of its echo.

This instrument can be used while the ship is under way and makes a complete survey of the bottom in one-tenth to one twenty-fifth of the time required by any other method. Twenty-two Government vessels (1925) are equipped with this device. The sonic depth finder, as it is called, was invented by Dr. H. C. Hayes.

NAUTICAL ALMANACS AND CHARTS

The crying need in early times was for better charts and for better knowledge of tides, winds, and currents. The Admiralty in England issued its first official catalogue in 1830.

The United States Navy Department began its marine chart work in 1837. Maury's famous "Wind and Sailing Charts" and "Sailing Directions" were issued from the United States Observatory during the period from 1844 to 1861. This work is now done by the Hydrographic Office.

THE SHIP'S LOG

All records of the ship's movements at sea are kept in an official book called the ship's log. Each day at noon the ship's position is computed. The course and distance from the day before at noon is computed and recorded. The distance to the port toward which the ship is bound is also recorded.

In early times this record was made with chalk on a wooden board called a log board. It was folded like a book, and the ship's position was computed as well as it could be with the crude instruments then in use.

LITERATURE, MUSIC, AND ART

BOATS AND WATERWAYS

Poems.—The Song my Paddle Sings—Pauline Johnson. The Landing of the Pilgrims—Felicia Hemans. The Sailing of the Mayflower; The Wreck of the Hesperus; Hiawatha's Canoe; Hiawatha's Sailing; The Building of the Ship—Henry W. Longfellow. The Gray Swan—Alice Cary. The Ferry of Galloway—Alice Cary. The Captain's Daughter—James T. Fields. A Life on the Ocean Wave—Epes Sargent. Casabianca—Felicia Hemans. A Canadian Boat Song—Thomas Moore. Lord Ullin's Daughter—Thomas Campbell. The Jumblies—Edgar Leer. How's My Boy—Sidney Dobell. The Three Fishers—Charles Kingsley. Rocked in the Cradle of the Deep—Emma Willard. The Pleasure Boat—Richard Henry Dana. Boats Sail on the River—Christina Rosetti.

Stories.—The Bag of Winds—Stories of Ulysses. Scylla and Charybdis—Stories of Ulysses. The Good Ship Argo—Stories of Jason. The Shipwreck—Robinson Crusoe. The Cruise of the Dolphin—Thomas Bailey Aldrich in Stories of a Bad Boy. The Ship Wreck (Charles Dickens) in David Copperfield. Grace Darling—Fifty Famous Stories. The Boy who Liked Boats—Aldine, 3. Washington Crossing the Delaware—Great Americans for Little Americans. Operating a Modern Submarine—Literature and Living, 2. How Phileas Fogg Won his Wager—Jules Verne.

Songs.—Columbus and the Sailors; Sailing; A Boat Song; Where Goes the Sailor—Music Education Series, Book 2. In a Canoe; A Boat of Dreams; The Boat Race; A Boat Song; The Herring Boats—Music Education Series, Book 3. A Fishing Boat—Progressive Music Series, 2. A Sailor's Life—Progressive Music Series, 3. Boating Song—Gaynor.

Pictures.—From Picture Publishing Companies: Ulysses Deriding Polyphemus (Turner). The Ferryman's Daughter (Adan). Changing Pastures (Rosa Bonheur). Lessons in Boat Building (Bacon). Fishing Boats (Ravanne). Boats at Low Tide (Ravanne). Out for a Sail (Waldon). Calling the Ferryman (Knight). Embarkation of the Pilgrims (Weir). The Mayflower in Plymouth Harbor (Hallsall). Return of the Mayflower (Boughton).

REFERENCES

Perry Picture Co., Malden, Mass.
Brown, George P., 38 Lovett Street, Beverly, Mass.
Keystone View Co., Meadville, Pa., drawer 166.

READING LESSONS

BOATS AND WATERWAYS

Silent reading, Grades III, IV, V, VI.—The raft, from Robinson Crusoe; An ocean voyage, Part V—Beacon, 3. Napoleon and the sailor—Carroll and Brooks, 3. Horses of the sea; Where go the boats—Gordon, 3. The horses of the sea; The bag of winds; The first Thanksgiving Day—Merrill, 3. Where go the boats—Riverside, 3. The pirate story—Silent Reading Hour, 3. The boy who liked boats; Where go the boats—Aldine, 3. My bed is a boat; Wynken, Blynken, and Nod; The story of Moses—Young and Field, 3. The sea-gulls of the Great Salt Lake; Why George Washington did not become a sailor; Run away brook—Winston Companion, 3. Hiawatha's Canoe, from children of the forest—Fox's Indian Primer, 3. Little Gwen—Bolenius, 3.

The building of the ship (H. W. Longfellow); The quest; Early settlers; The fishermen; The sunken treasure; The ship builders (J. G. Whittier); Old Ironsides (Oliver Wendell Holmes); From morn till night on a Florida river (Sydney Lanier); The man without a country (Edward Everett Hale)—Elson, 4. Old Ironsides (O. W. Holmes); Hiawatha's sailing (H. W. Longfellow); The landing of the Pilgrims (Felicia Hemans)—Horace Mann, 4. The ship builders (Whittier); Old Ironsides (Holmes)—Elson Grammer, 4. The great admiral; The vikings of old; The northern seas; The shipwreck (Charles Dickens); Christopher Columbus—Haliburton, 4. Robinson Crusoe—New Education, 4. The landing of the Pilgrims; From the Apennines to the Andes; Sweet and low (Tennyson)—Young and Field, 4. San Francisco, Ship building at the Union Iron Works; Irrigating canal; New York, the Erie Canal; The great lakes; Alaska, Indian canoes at Dyea; New England coast, life savers at work—Around the World, 4. The flying Dutchman; The sailor's star; The wreck of the Hesperus (Longfellow)—Riverside, 4. The lighthouse (Longfellow); The landing of the Pilgrims (Hemans); A sailor's song; Children of the Arctic—Carroll and Brooks, 4.

Adrift in an open boat; On board a mackerel schooner; The boyhood of Vandemark—Modern Readings, 5. The discovery of America—Columbia, 5. Last voyage of Sinbad the sailor; Sir William Phips; Two French explorers; Pirate story (Robert Louis Stevenson)—Gordon, 5. Alec Yeaton's son (Thomas Bailey Aldrich); Ballad of the tempest (James T. Field)—Riverside Literature, 5. The story of ships—Study readers, 5. A song of the sea; The shipwreck of Robinson Crusoe; The gray swan (Alice Cary); The Inchcape rock (Robert Southey); Columbus (Joaquin miller); The building of the canoe, Longfellow's Hiawatha—Bobbs Merrill, 5. The first voyage of Columbus; Washington's Journey; Washington crossing the Delaware; Trade routes in the Middle Ages—Progressive Road to Silent Reading, 5. The story of ships; Making a boat; Abe, the boatman; Sweet and low (Tennyson); Sinbad the sailor; The Tempest (James T. Fields)—Wheeler's Literary, 5. Hiawatha's Sailing—Elson, 5. A pioneer ferry; Norse sea rovers in a storm; The song my paddle sings (E. Pauline Johnson)—Field, 5. Old Ironsides (O. W. Holmes); A race at sea—Merrill, 5. Peggoty and I (Charles Dickens)—Gordon, 5. Jason, or the golden fleece—Reading Literature, 5–6.

~~Sail Ho!~~—Modern readings, 6. Roadways (John Masefield); The Sea (Barry Cornwall); A strange shipwreck (Robert Louis Stevenson); What is told by a ship's bell; The discovery of America; A letter from Columbus; Columbus (Joaquin Miller); A play—1492; Magellan's voyage; Henry Hudson's quest—Kendall, 6. The golden fleece (Nathaniel Hawthorne); The wise Odysseus—Bobbs Merrill, 6. A great disaster; Jason; My first voyage; The chestnut kettle—Magee, 6. Jason or the golden fleece; The raft of Odysseus—Reading Literature, 5–6. Commerce; They that go down to the sea in ships (The Bible); The glory of ships (Van Dyke); How Phileas Fogg won his wager; Sea fever (John Masefield); Opearting a modern submarine; Hiawatha's sailing (Longfellow); The romance of the Soo—Literature and Living, 6. Christmas at sea (Robert Louis Stevenson)—Natural Method, 6. Making boats, chapter 22—Swiss Family Robinson, 6. The gray swan (Alice Cary)—Riverside Literature, 6. The landing of Columbus; George Roberts; The shipwreck, from Swiss Family Robinson; The voyage of the Mayflower—Progressive Road, 6.

Columbus (Joaquin Miller); The cruise of the Dolphin (Thomas Bailey Aldrich); Chesuncook (Henry D. Thoreau); The sailing of the Mayflower, from the courtship of Miles Standish (Henry W. Longfellow); The voyage of Columbus (Washington Irving)—

Reading Literature, 7. Going around Cape Horn (Richard H. Dana); Sailing and drifting (Hamilton Wright Mabie); The sailing of the Mayflower (Henry W. Mabie); Roosevelt on his ranch (Herman Hagedorn); On a Florida river (Sidney Lanier); Song of the Chattahoochee (Sidney Lanier)—Kendall, 7. The sea of darkness; Columbus (Joaquin Miller); The landing of the Pilgrims (Felicia Hemans)—Wheeler's Literary, 7. Old Ironsides (Oliver Wendell Holmes); John Maynard (John B. Gough)—Barnes, 7.

Across the ocean came a Pilgrim bark; The song of the Chattahoochee (Sidney Lanier); The man without a country (E. E. Hale)—Wheeler's Literary, 8. The bird-woman guide of the Oregon trail—Child Library, 8.

Pictures.—The University Prints, Newton, Mass. Art for schools, Elson Art Publication Co. Brown's Famous Pictures, 38 Lovett Street, Beverly, Mass. Perry Picture Co., Malden, Mass. Mumford Pictures, Kankakee, Ill. Keystone View Co., Meadville, Pa.