To
Mr. W. G. Ellis
In sincere appreciation of his interest in my work.

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1/29/32

THE BOYHOOD OF AN INVENTOR

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C. FRANCIS JENKINS

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C. Francis Jenkins

Born in the country, north of Dayton, Ohio, in 1867, of Quaker parents. Spent boyhood on a farm near Richmond, Indiana. Attended country school; a nearby high school; and Earlham College. "Explored" wheatfields and timber regions of northwest, and cattle ranges and mining camps of southwest United States. Came to Washington, D. C., early in 1890, and served as secretary to Sumner I. Kimball, U. S. Life Saving Service. Resigned in 1895 to take up inventing as a profession. Built the prototype of the motion picture projector now in every picture theatre the world over; developed the spiral-wound paraffined all-paper liquid container; and produced the first photographs by radio, and mechanism for viewing distant scenes by radio, i.e., television. Has over four hundred patents, American and foreign; and maintains a private laboratory in Washington. He is a member of the Franklin Institute, the American Association for the Advancement of Science, and founder of the Society of Motion Picture Engineers. Has several times been honored by scientific and other bodies for original research and attainment.

Text Subjects

Broadcast Subjects

Illustrations

Preface

America's supremacy in industrially applied science is often attributed to her patent system. It is the belief of the writer, however, that individual liberty, peace of mind, and freedom from political terrors accounts to a greater extent for the fact that citizens of the United States have made more revolutionary inventions, and in a greater variety of fields, than all the world else combined.

And these great inventions are born of the poor as often as of the well-to-do, and much oftener than of the rich. It is not believed, however, that the real inventors, as distinguished from the "improver of other people's inventions," are ever driven to their efforts by a desire for great wealth, but rather, like other artists, the musician, the painter, the sculptor, the poet, by a love of creative effort. It's a hobby, a plaything outside one's daily employment.

Of course it is also true that but very, very few of those who have hobbies, and still fewer of all those who work, ever make great inventions. Is it then an accident? If not, is it possible to discover how these few differ mentally from those about them?

It is possible that consideration of the subject might lead to conclusions by which inventive talent in youth could be discovered and segregated for cultivation, or even special opportunity for development as musicians and other artists are found and aided, and such a result would be as definitely an addition to our public wealth as is the discovery of a musical prodigy, or a great artist, or more properly a new ore vein or coal body.

On first thought this would seem desirable, but that it would work out successfully is not so certain. The great, revolutionary invention has always been the work of a poor man and meager facilities. Only

its development into an immense industry has been the work of paid workers and a great laboratory.

The great inventor is doubtless born with inventing a natural gift, and, like the born artist, hardly deserves unusual praise for any particular piece of original work. Creation for each of them is too easy. Each clearly pictures the new idea, and, copying what he mentally visualizes, he only labors to put it into a form that others may enjoy. It is recorded of Angelo that, when discovered gazing intently at a rejected scrap of marble, he said he saw an angel in the stone, and immediately set about the release of one of his masterpieces.

This almost uncanny ability to visualize the unfabricated creation permits the worker's mind to run away ahead of his hands, and may account for the recognized tendency of the artist to stop on his all-but-finished painting and to set up a fresh canvas for a new picture; and of the inventor to quit his machine in what seems to the layman an incomplete state. The explanation is that each has a mental picture of the thing completed, and therefore it has no further attraction for him. His interest and his limited funds go for something new, which will be an addition to his store of knowledge, and a further creative delight.

A born gift for inventing seems to disclose itself in childhood as an interest in new things, and accounts for the quick perception of the physical principles involved in each. Thus a store of specialized information is built up much more rapidly in such a mind than in the unobserving. This is probably the explanation of the mechanical cleverness differentiating between persons otherwise equally equipped, and doubtless accounts for the fact that the former quickly and almost intuitively finds the solution to each new problem.

Just how the natural inventor differs mentally from the only destructively inquisitive boy may not be definitely known, perhaps, but an intimate recital of

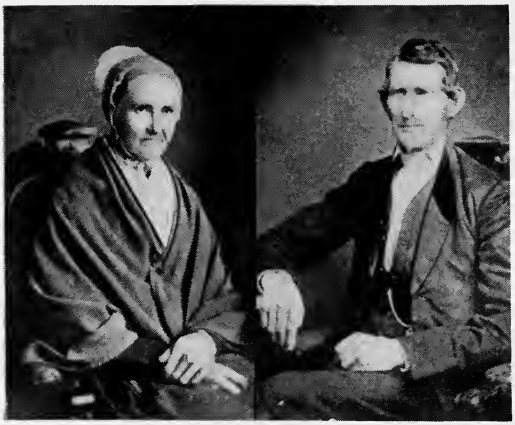
the boyhood activities of an individual case, typical of his class, may be helpful in discovering this special talent. That is, by comparison it may be possible to learn what is the governing psychology, the visible evidence of the truly inventive mind, and this must be the excuse for the following recital of the activities of a boy who later contributed to human advancement in many fields of activity.

The Boyhood of an Inventor

Paternal grandparents

This boy was born in Ohio, on the Stillwater, at his grandfather's home; of Welsh-French paternal ancestry, and William Penn descendants on his mother's side. His father was a farmer and of sturdy Quaker stock; and his mother a member of the Whitewater Friends Meeting of Indiana. They had met at the Friends Boarding School, now Earlham College, during the stirring period of the civil war.

After the wedding the young couple lived at the old Ohio homestead for a time, continuing the farm activities while planing the location of a future home.



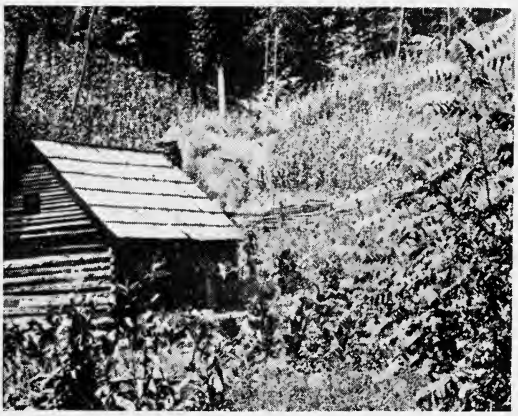
Maternal grandparents

The old, parental homestead was only a few miles from the city, and on the occasion of a visit there the baby boy stood on the rear seat of the buggy, looking out of the back, with the mother holding tight fast to the little dress. A passing newsboy,

Parents in war-time costume

with the fraternity of youth, saluted the youngster; "Ho, ho, red head, red as a brick." So that's our first distinguishing picture of the youngster—he was redheaded.

The boy's father always liked, and had, the finest horses, even from boyhood. It was one of these horses that the young mother drove on a certain occasion from her father-in-law's home in Ohio to her own father's home in Indiana, many of the long, intervening miles being through the thick woods of this, then, great timbered region. This lonely way, which was scarcely more than a blazed trail in those early pioneer days, she traveled alone save only for her redheaded baby boy. Now and then she passed a clearing, where a settler had built his log cabin and enclosed his cultivated patches with a worm fence to keep the deer from eating his meager crops. It was opposite one of these clearings on one such trip that her horse became frightened by the sudden struggle of a colt, which, tied to the fence, and getting tangled in the straps had thrown himself and couldn't get up. The sudden, unexpected movement of the colt in the corner of the worm fence so frightened the horse the mother was driving that the buggy was upset. However, she held to the reins,

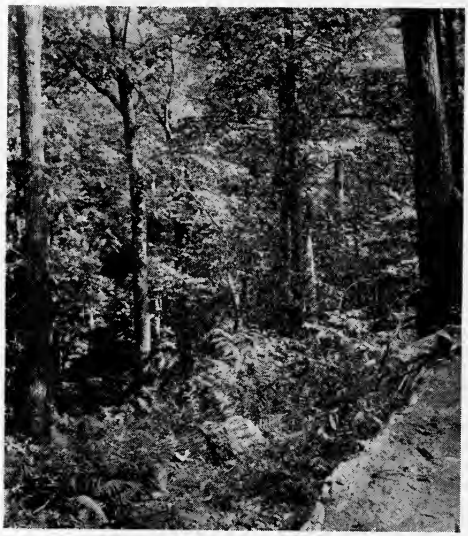


An Indiana pioneer's home

and the horse, hearing her reassuring voice, stood still, though trembling with fright, until the harness could be loosened and the buggy righted by the kindly people who had come quickly from their dinner at the first sound of trouble. With the horse rehitched, the mother with her baby on her lap courageously resumed her journey alone, though the settler offered to go part way with her if she wished. A long, long day's trail, years later flown in twenty minutes by this boy grown tall.

The red-headed boy

The baby's nurse was a negro man, an ex-slave, and his first baby recollection is of a hand on the edge of his wicker carriage, a dark, kindly hand of a lighter shade of palm. Later, when the new family moved from the Ohio homestead and set up a domicile of their own in Indiana near the mother's girlhood home, the baby being then about two years old, this colored man and a girl came along, the man as a field hand and the maid to do housework. A considerable amount of stock was also brought over, including some fine horses.



An Indiana forest

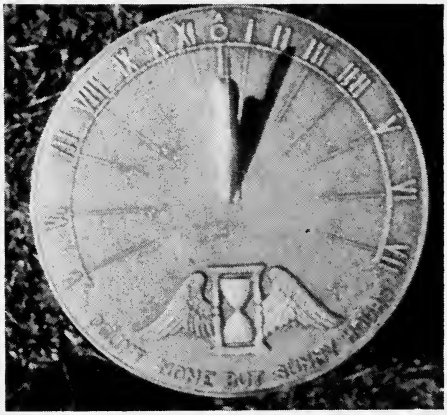
Here they established a home in a log house, and here the fertile fields were cleared, hewn from a virgin forest of the

The largest walnut tree in Indiana

most wonderful and varied collection of industrially valuable timber ever found anywhere. Majestic oaks, elms, beech, maple, ash, hickory, and walnut, walnut that now would almost "bring its weight in gold"; and these great trees in prodigal waste were cut down, piled in great pyramids and burned to get rid of them. Neighbors came long distances to assist in these log-rollings, and in turn to be assisted in their own forest-clearing operations, coming on horseback, often with a girl wife on behind.

It was in the hollow of one of those great walnut trees, standing in the line fence, that "flat foot Black Tom" hid the ham he had stolen out of the smoke house. It was said of him that his feet were so flat that "the hollow of his foot made a dent in the ground," and that by this means the stealing of the ham was traced to him, by men to whom tracking was almost an instinctive gift.

The boy well remembers that old smoke house where the meat hung for curing, for later, when he was big enough, he put wood in the fire pot in the middle of the floor. He would



The sun-dial used to tell time as early as 500 B. C.

William Cullen Bryant, Quaker poet

open the door, and, holding his breath, rush in to throw the smudge wood on the fire, opening his eyes inside the house only just wide enough and often enough to insure accuracy, and then dash out again.

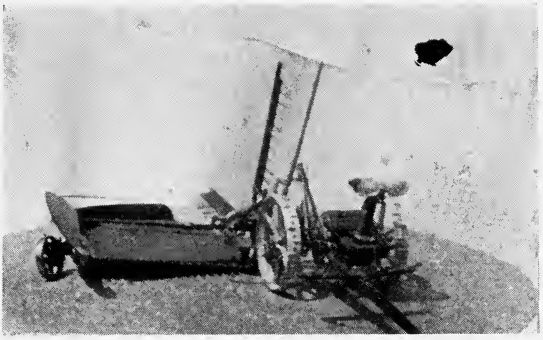
It was alongside the smoke house that the lye vat was located, a hopper-like affair in which the wood ashes were put, and upon which water was poured to make lye for the soap needed by the housewife; perhaps the boy's first lesson in chemistry. It certainly would loosen the dirt, would that old soft soap, but how it did sting when it touched scratches in one's hands.

The woods teemed with game, many specimens of which are gone forever. Wild pigeons, for which the government now offers $1,000 for a single pair, then abounded in such numbers that they often broke down the great branches of the trees in which they roosted. The boy also remembers many occasions when he ran out of the house at the noise of an awesome honking, to watch the wild geese flying over, darkening the sky with their numbers.

Tallow candles for light

All crops grew abundantly in this virgin loam, and the farm prospered, in time coming to be a renowned show place, always well equipped and well stocked with cattle, sheep, hogs, big draft animals, and fine driving horses.

It is evident that

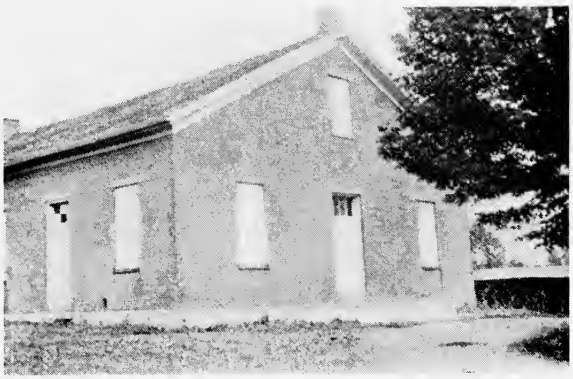


A "self-rake" reaper

the father was proud of his young son, for when he drove the four big horses, hitched two abreast, to the heavy wheat reaper, riding the near wheel horse and driving the leader with a single "gee-haw jerk line", he took the little fellow with him, riding astride the off horse. He was so wee that he had to reach away forward to hold to the hames, which stretch drew back the sleeves of his calico dress, exposing his little arms to the blistering heat of a merciless sun. But the burn disappeared under the application of poultices of wet baking soda which his mother applied, a "first-aid" lesson.

This farm was near the mother's girlhood home, and so it was at grandfather's that his mother left him while she went to a nearby country church, on the occasion when he stole away, in his little dress and sunbonnet, over the fences and across the fields to the meeting house, before the open door of which he stood calling "Ma, oh, Ma." Of course, she knew her baby's voice, and came at once to prevent further disturbance, and sat in the carriage with him until meeting was out.

This meeting house was one of the depots of the underground railway of slavery days when those



New Garden Quaker meeting house

who did not believe in human bondage assisted runaway slaves northward to Canada and freedom. Among men notable in this work in this section was Levi Coffin of hallowed fame.

A Wilson sewing machine of 1848

In the boy's memory this old church is associated in some unaccountable way with his earliest recollection of his mother's first sewing machine, although just why is not clear, for the machine was a gift from the boy's father to his mother not very long after they moved to Indiana. But the boy dearly loved to turn the wheel of that sewing machine and puzzle out the behavior of the needle and thread.

The boy's home was a happy one, and he never heard a cross word pass between father and mother. But home is the place of familiar things, the everyday things with which one grows up, while interest for the youthful mind lies afield, with the unfamiliar things. As grandfather's place had the many strange and homely devices which were associated with the pioneer settler's conquest of a new land, it is little wonder that many of the boy's childhood recollections are associated with the old "gran'-ther" homestead, and its many simple but effective tools,

Wheat cut with sickle from earliest times

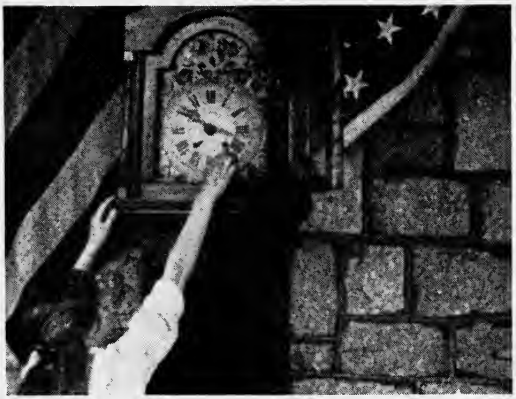
Threshing wheat with a flail

applications of the lever, the screw, the wedge, and the hammer.

So it was from grandfather the boy learned the tricks those early pioneers had practiced in setting up a home in the wilderness. It was grandfather whom he watched drilling holes in great boulders, which must be cracked into smaller pieces when they were to be moved. And it was grandfather who let the little fellow in dress and sunbonnet pour water from a gourd onto the soft wooden plugs driven into the holes, water which was poured on with timid expectancy until the swelling plug split the great rock with a resounding report.

In this way the boy learned that capillary attraction is the greatest force in nature, the force which carries sap to the top of the tallest tree; the force which enables the tender shoot of the pea vine to split the hardest earth crust; and which swelled the soft wooden plugs until the big rock was rent assunder.

Perhaps these tricks had been taught the grandfather by the boy's great-grandfather, for in one of the back fields stood the original log cabin this pioneer settler had built in the wilderness, at



Grandfather clocks were invented in 1867

A "Cape-Cod" lantern, a tallow candle in a perforated tin case

first many, many miles from the nearest neighbor.

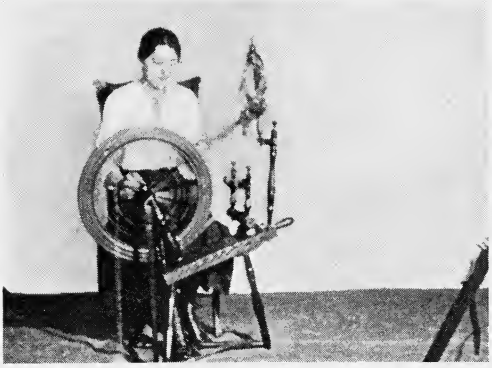
The boy will never forget the occasion when his aunt walked with him across the field to this old log house, nor the elation of discovery when up under the roof were found some pewter spoons, a powder horn, a dip-wick candle lantern, and a great old clock made wholly of wood, including the toothed wheels of the gear train.

Surely this was a veritable treasure-house of interest, and this same boy more than once in later years has pictured to himself the setting in that humble home, musing on a typical fireside scene of that long ago, as he himself sits by a modern electric light on the library table.

Remembering so distinctly the old log cabin, it doesn't take such a vivid imagination to picture the young mother tracing out the alaphabet with a sharp stick in the fine wood ashes on the hearth, as her little chick with an elbow on her knee, watched with sparkling eyes the changing tracery of each letter and figure as he learned his A B Cs.

A flax carder

And how this "chick" grew to manhood, measuring his wits and his brawn against opposing elements as he widened his influence in the surrounding forest, noting the additional settlers, with gre-



Priscilla at the spinning wheel

garious instinct satisfied, ultimately to take a bride of his own, set up a home, a school, a church, and a graveyard, and that this girl bride was the boy's grandmother.

Recalling with quickening pulse, these wonderful times were so near, that the boy, as he stood in the attic years agone, could stretch out his hand and touch the evidence all about him; the old spinning wheel, the flax break, the wool carder, the swinging beam loom, the cheese hoops, the flail, the sickle, He could almost hear the noise of them, as he puzzled out their use, standing there under the rafters, and in imagination peopling the place with living forms.

Even at this late day it is a study of more than passing interest to note how completely self-reliant were those early settlers of this great wilderness. Each went in alone, master of all circumstances, and lived completely and abundantly, not by leeching off others, but by adeptly turning to his own use and maintenance the abundant bounty of a generous earth, his for the taking.

Each member of these early settlements had the wealth of all the great forest about him, a wealth far beyond his needs. And so he required little money. He took his grist on horseback to the mill, got it ground

The old water-wheel grist mill

into flour, the miller taking his toll of the grist. The neighbors among themselves traded provisions, or swapped horses, or a horse for a cow, a pig for a sheep. Money was almost useless.

The cradle was used for centuries for harvesting wheat

As the settlement became more populous stores were set up and the farmer's wives exchanged butter and eggs for calico and ginghams. Money was still but little needed.

As population increased still more, work became more largely specialized, each man devoting himself to a greater and greater extent to some particular division of the needs of the community. For that reason the use of money as a medium of exchange became a convenience, ultimately a necessity.

As this specialization became more and more marked, the specialist himself became more dependent upon others for food, clothing and shelter, until without knowing it he had become a helpless unit of that community activity we call civilization. How many of us could find food to sustain life if suddenly deprived of our neighborhood groceryman?

He was both blacksmith and wheelwright

The crane and food-pot of long ago

But to look from the helpless dependence on group-activity of the man of today, to the completely self-sustaining citizen of that early yesterday, leads only to an admiring contemplation of the grit of the sturdy pioneer. With his new bride, a yoke of oxen, a rifle, an ax, a skillet, and a Bible he trekked away into that virgin forest for days, finally to establish himself on the bank of some welcoming stream. Here he set up an altar and here he raised a brood; fed them, clothed them, and reared them, in the fear of God, the love of nature, and a kinship with the wild life about them; instilling in them a love of liberty and of fellowman which can be attained in no other way to the same degree.

One may muse for hours upon the scene; the family sitting about the great fireplace in the hand-made straight-backed hickory chairs, as "gramma" in her white cap and apron stirs the savory mixture in the big iron pot hanging on the crane; and ever and anon lifts the lid of the skillet, standing three-legged in the coals on the hearth, to note the state of the baking corn-pone, being care-

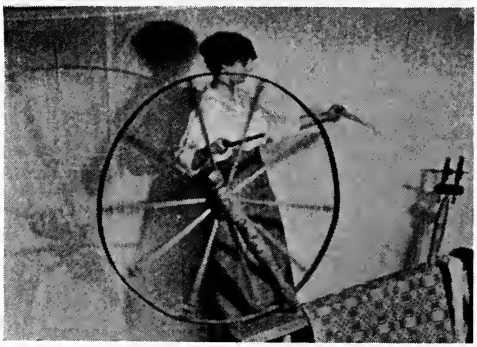
The old "living room" at Mt. Vernon, Washington's Home

ful not to drop the coals off the lid, coals put there to make the tasty brown top crust.

Gathering maple-sap for sugar and syrup

Then there was the delicious maple syrup and maple sugar. But delicious as it was, the most fun was in the gathering of the sap. Grandfather would go about through the woods boring holes with an augur in the trunk of the beautiful maple trees, drive therein a spile made of an elderberry stalk, and set a gourd or a crock to catch the dripping sap, returning next day with bobsled and sapyoke to gather the sweet fluid and boil it down to the right consistency.

It is unimportant whether the grandfather was a gifted handyman and an originator, or only a copyist, or perhaps something of both, but among the many things the grandfather made the boy found much to add to his mental store, and of value in after years, as he studied the weighted-log-lever press with which the grandmother made cheeses; the sturdy cradle in which, with a foot on the rocker, she put the babies to sleep while knitting socks, and the spinning wheel, and the loom used in the making of the family raiment, and the beautiful



Spinning thread for table linen

The old quill pens

table napery of linen; and how grandfather raised the woodhouse by the simple expedient of driving wedges thereunder at many points around the foundation.

Grandfather did all the writing for the family; and it was an occasion of moment when he reached up on the high mantle and took down the inkwell and the goose-quill pens, proceeding with dignified unhaste to set pen to paper, as did the signers of the Declaration of Independence when they, with quill in hand, sat down in turn before that great paper.

Then there were the wonderful stories, listened to with bated breath, of hunting exploits, and trade with the Indians. It was on his grandfather's knee the little fellow heard the story of the visit of the "braves" during an Indian uprising.

It seems that word had been passed by courier that the Indians were on the warpath. Thereupon, the settlers, leaving their homes, hastened with their families to the stockade which had been built at a trading post some ten miles away. But the great-grandfather refused to go, and putting his trust in the God of his Quaker ancestors, he went about his accustomed tasks, the

The advance guard of civilization

Years later the boy was to meet a Quaker President of the United States

good wife in her plain apparel and white cap doing her housework as usual.

One afternoon flitting forms were observed behind trees some distance from the cabin, a confirmation of the rumor that the Indians were near. That evening the door was roughly thrust open from without, and a moment later, in stalked two half naked savages in ominous paint and feathers. One was a familiar face but the other a stranger. They found the pioneer reading the Bible aloud in front of the great fireplace, while the wife knit. Glancing quickly about the room one of the redmen tapped the settler on the shoulder and pointed to the empty gun rack, the two forked tree branches nailed above the door. Thereupon the man left his place at the fire and leading his forbidding visitors some distance from the cabin stooped down and drew the rifle from a hollow log. After ascertaining that the gun was not loaded the Indians withdrew and joined their comrades for a pow-wow, the settler returning to his cabin. No hostile act followed, and no further visit was made by the warriors, though many weeks later the gun was returned to its rest above the door.

In war paint and feathers

Buckskin suit and flintlock gun of the pioneer

And always at the conclusion of this story the fascinated listener on the narrator's knee would insist on again examining this identical firearm, a gun which had passed from father to son, a long-barreled, muzzle-loading flint-lock rifle, with silver-mounted walnut stock, having a little door in one side for the linen patches in which the leaden bullet lay as, in loading, it was pushed home, against the charge of powder, with the long, slender hickory ramrod, a type of weapon made famous in many a story of Daniel Boone's skill therewith. And then the powder horn must be examined with its wonderful nozzle which would measure the powder charge; and the buckskin bag in which the round bullets were carried.

Few of those who visit museums where such rifles are historically preserved ever get the quickened pulse such magic recollections excite under the thinning locks crowning the head of that boy of yesteryear.

Nor is this the only tale which a sight of this quaint old weapon recalls, for there was the story of two deer killed at a single shot, accidentally placed. And again of the time the hunter awoke with a presentiment of fear as he lay stretched

Indiana Deer

out in the warm sun on a log in the woods, awakening just in time to roll off and avoid the sharp claws of a wildcat springing at him from a tree branch overhead.

Wildcat or "bobcat"

It is more than probable that many such stories were revived in the grandfather's mind by the visit of an Indian to the new home across the road from the old pioneer cabin, long years after the Indians had gone from that region. At any rate the boy got from this visitor his first right mental picture of an Indian in war trappings, with bows and arrows, tomahawk and peacepipe. During the evening the Indian chanted songs, weird music indeed, though its purport had to be interpreted for the benefit of those present, the interpreter explaining that he sang of battle and of conquest.

It was quite appropriate, therefore, that grandfather should whittle the splints used to bind the little fellow's broken arm when he fell over the great log sill in the wood house. It couldn't have been a very big or very long forearm, judging from an inspection of these splints today, splints little more than an inch wide and four inches long. Perhaps he cried as he sat on grandfather's knee

"Now I lay me down to sleep"

A young physician

while the kindly old country doctor pulled the bone into place, the little patient watching the operation with a sort of terrified fascination. Maybe, after all, he didn't cry, for his dear mother went aside to pray that it might not hurt her little son, prayed to the God who answered prayers.

Doubtless the little chap with the broken arm was for a time the pampered ruler of the household, with everyone waiting on him. Even dear grandmother in her white cap and apron lead the way down the cool, stone steps into the spring house. where the cookies were kept. Oh, but that was a wonderful place, that underground treasure house with its cold walls and rough paved floor between the stone flags of which the icy water flowed from the welling spring in the corner. On the stones of the floor of this magic place sat earthenware crocks of milk covered with thick, rich cream. And on other stones crocks full of rolls of golden butter marked with "dimples" made with a notched and wetted stick. But the great attraction was under the glazed lid of the crock on the stone shelf where the delicious cookies were kept, cookies sweetened with maple sugar, shining with a film of butter, and sprinkled over with the most delicious

Fairies in the candle flame

A barnyard dinner

spices. Shucks, the city boy with his boughten cakes has never had anything to compare with it.

But "gramma's" home did not hold the only tasty attraction for the boy. His own mother would sit of an evening by the great fireplace, while the snow swirled in eddies outside, and with her little sons on low stools on either side of her, as she scraped apples which in turn the youngsters licked off the end of her knife. Or the luscious whole apples baked on the hearth, turned a bit every few minutes to brown on every side, but which when done must be handled carefully for they are hot and will burn little fingers. And perhaps to be followed by a feast of popcorn which joyously danced in the popper shaken over a great bed of live coals in the fireplace.

And then there were the evenings with the hickory nuts, when with a sadiron upside down on the knees, and a hammer, the nuts were cracked and thrown in the basin, to be freed of their delicious kernels with darning needles.

"Home is where the heart is"

The gathering of the nuts was also an occasion of merriment, for to go nutting was looked forward to with delight. So, immediately after

"A sower went forth to sow"

the first frost, with buckets and baskets in hand, the great shell bark hickory trees were visited and the nuts searched for in the dried grass. When these were all picked up, the boys would shoulder a log, and running swiftly would bump the end of the log against the tree trunk, at the same time jumping safely out from under the rebounding log. At the impact a shiver would travel up the tree and along the branches to the farthest tip of the longest limb, and down would come the nuts, the girls running up to the body of the tree to avoid the nutty shower.

The entrance to the woodshed was the favorite place to hull the walnuts, mashing them with a club and then picking the nuts out of the green hulls. Of course the fingers were stained, but who cares, it will come off when it wears off.

Above the space between the kitchen porch and the woodshed a great grapevine trellis stood, and on a box the boy could easily gather and eat all the grapes he wanted, delicious blue-ripe Concords, and Brightons and Niagaras.

"Making hay while the sun shines"

Hollyhocks

Nor will the boy ever forget the old-fashioned garden at grandma's with its vari-colored hollyhocks and stately sunflowers, and the pebble-bordered flowerbeds each side of the gravel walk up to the great front porch of that welcome-fashioned home; flowerbeds of marigolds, mignonette, lavender and zinnias, with a tracery of maidenhair fern at the back. What sweet odors greeted the visiting crinoline maiden of that long ago as she tripped up to the great front door, and with dainty fingers in long black knitted silk mits lifted the heavy brass knocker.

Invention was this boy's natural gift, doubtless, for at an early age he showed a keen appreciation of the right use of tools, and while still in dresses he sawed a hole in the barnyard fence because the gate had been fastened to keep him out. Dropping the saw he crawled through the hole, knocking off his bonnet in doing so, to visit with the horses and cows and other barnyard folks, fearless of the danger of being trampled. The abandoned saw and sunbonnet told the story of the youngster's victory over obstacles, and the trail by which he was located.

There were artists in those days
(a wood engraving)

On another occasion he was found working the handle of the big, old wooden pump,

The old wooden pump

just about all he could do, and when a small stream ran out of the great spout, he let go of the handle and hurriedly looked up the spout, before the trickling stream should stop, to try to discover where the water came from.

That inquisitive streak in the youngster was the cause of embarrassment on the occasion of a visit to the father's boyhood home, in Ohio, for being curious to know what the mechanical contraption was, in sight, but just out of reach on a stringer running across the open front of the woodshed, he got the sawbuck and on this unsteady coign could, by standing on tiptoe, just touch the object of his curiosity. But alas, in this insecure position, with hands caught over the sill, the sawbuck turned over leaving him hanging in midair. Fortunately he had a grandmother within earshot, and she, hearing a lusty appeal, came running and helped him down from his perilous position, with no harm done.

What little things lead to indelible impressions on the child brain, when more important things are forgotten! The father with his little son had driven over in a buggy to the old homestead in Ohio. One day was spent at a nearby city. They

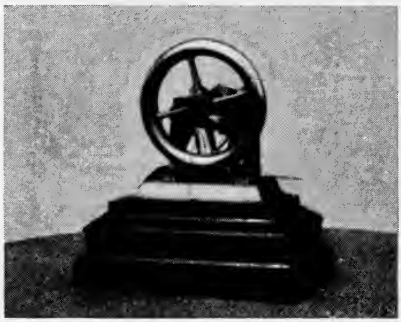
Coal oil lamps came with the discovery of natural oil by Col. Drake in 1859

returned after nightfall by a different road, a road which intersected the morning road near the relative's home. Returning, the horse jogged along leisurely until near the intersection when he quickened his pace. This was remarked, but how did the horse, strange to this territory, know he approached the road leading to feed, and rest and shelter? The boy never forgot the incident, and all through life watched with interest for evidence of this gift in other animals.

Steel needles first made in 1575

And again, next morning he was genuinely surprised to discover that a glass marble, given him by his host, would bounce astonishingly on the granite steps of the house, though it was many a year later when he learned that glass is just about the most perfectly elastic substance known. It is doubtless in this very way that the mind accumulates its most lasting information, i.e., by discovering unexpected phenomena, for the boy was thinking on the subject all the way back home.

The boy's home was about ten miles from the city and thither he went with his parents, and in his first short pants, to meet some friends coming on the train.

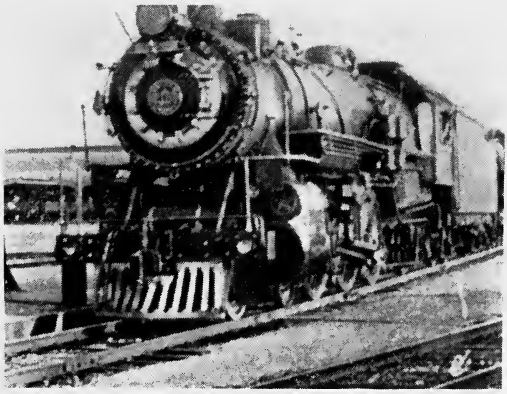


Mrs. Howe invents first sewing machine in 1846

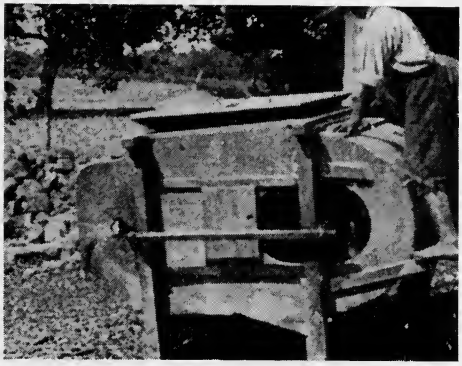
An early B. & O. Railway locomotive

The puffing locomotive was ponderous and inspiring, and the hissing steam, music to the youngster's ears. It wasn't strange, therefore, that he should find more attraction up front than in watching the folks descending from the cars. When he was missed there was considerable excitement, but the mother, knowing her boy as only mothers do, sought and found him by the great black monster, the rods and wheels of which were being reverently surveyed by a worshiper whose red head scarcely reached above the cylinders.

As has been explained, the grandfather's place was a storehouse of interest to an inquisitive, small boy. On a certain expedition of discovery, an old, thick gold watch, of the "turnip" type was found. The boy was immediately seized with a burning desire to see the inside of it, of course. Looking about for something with which to open the watch a hatchet was the first thing found. It proved to be an entirely effective tool. Grown-ups don't seem to appreciate how quickly a boy can open a big gold watch with a hatchet, and how all the shiny wheels then readily come tumbling out. But



The Capital Limited's crack locomotive



Fan-mill for cleaning grain

a painful reckoning followed, as it was patiently explained to the young Columbus that the watch was not worth much as a timepiece after such heroic treatment. Not only was he properly punished therefor, but he had to tell grandfather he was sorry, and pay him the twenty-three cents in the little iron bank.

There was a "fan-mill" on the barn floor, a machine having vibrating screens, a hopper above, and a plurality of wooden paddles, very much resembling the propeller of an old stern-wheel Mississippi steamboat. These wooden fan paddles were given a relatively rapid rotation, by a crank and multiplying gears, to blow the chaff out of the wheat. Of course, the boys learned that by giving the mill a start it would run alone so long that straight wheat-straws could be run through between the teeth of the gears, coming out mashed flat and crinkled in a most interesting fashion. There was no guard over the gears, and so on a certain memorable occasion little fingers went too close to the gears and were caught between, leaving a mutilation which was carried through life.

"Ask for it"

The brothers

As a playmate the boys had a collie dog, a knowing animal that played hide-and-seek with them, though it is probable the dog followed the scent rather than his reasoning in finding them, a trail which sometimes led up a ladder into the haymow.

In the evening the boy would go with the dog to bring the cows, though as a matter of fact the boy only went as far as the barnyard gate-post, upon which he sat and waited for the dog to go into the pasture and single out the milk cows and bring them up, for the collie knew which of the cattle were wanted, and which were to be left in the field.

Then there was the time when the excited mother dog led the boys to her retreat and proudly showed them her little family, looking first at the puppies and then into the faces of the boys, as she wagged her tail in welcome, a puppy family as much thereafter belonging to the boys as to the collie. The boy will never forget the sensation of a little wet nose exploring under his chin as he held an armful of these wiggly little creatures, and vainly tried to keep his chin so high the puppy could not reach.

Another of the boyhood recollections is Frank, his father's

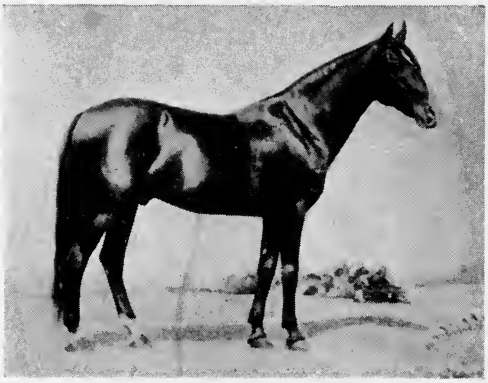
Just a basket of puppies

A "Gee-haw" jerkline team

favorite lead horse, a horse locally rather widely renowned for his intelligence, and always driven with a "jerk" line even in ten-horse teams. Old Frank came to make quite a name for himself. He would work closer in difficult places than any other horse thereabouts. In hauling out of the woods a wagon heavily loaded with logs he often passed so near trees that his bridle would touch, and yet would keep pulling his utmost under the direction of a driver in whom he had confidence.

But the feat which doubtless got him the greatest publicity was pumping water. He would take the pump handle in his teeth and work it up and down to pump water for himself when the drinking trough was empty.

On more than one occasion the attention of visiting neighbors was called to the horse's pumping "stunt," and more or less frequently a new pump handle had to be provided as the horse's teeth wore the handle in two.



Black Beauty

The father had always loved horses from early manhood, and so came to be a locally noted

Arm load of "kitnas"

horseman. Colts just grew up under his hand already trained to willing obedience. They never needed to be "broke." Horses understood him and did what he wished. Strange horses, even vicious fighters, when he acquired them, soon came to love and follow him about. For many years he stood ready to buy bad horses at bargain prices. These horses he worked in teams of from two to twenty, and later would drive each of them, single, through the nearby village with the driving reins lying across the horse's back, and guided only by spoken direction. On occasions he sold the horse back to the original owner, though the horse sometimes thereafter again became master.

And old Frank was of great assistance in the "breaking" of these bad horses, for with Frank in the lead of a six-horse team and the bad horse at the off wheel, he had little chance to misbehave, and very soon learned to do as he was told, and willingly. There was one such horse, however, which gave unusual trouble. This one would lay down and refuse to get up. It was then the boy's duty to smother the horse to make him get on his feet again. So gripping the horse's muzzle to shut off his air, (for a horse can breath only

The boy in Sunday clothes

Did you ever ride in an old buggy

through his nose) he would soon begin to struggle to shake off the boy's grip, but failing in this would suddenly come to his feet with a lunge, and it behooved the boy to be on his guard to avoid being struck by the horse's hoofs, for a horse gets up fore quarters first, (a cow gets up front part last). Incidentally, how many city folks know that a cow has no upper front teeth, though a horse has.

Some of those early Indiana winters were winters of big snows. It was on the occasion of one of these deep snows that the boy caught a rabbit without weapons. His parents had bought him a pair of rubber boots, and a pair of real gloves, with fingers. (He had theretofore had only mittens made by mother.) Of course, with such an outfit he must get out in the snow. As he floundered about joyously in the big drifts he came upon a rabbit imprisoned where he had stopped when the snow began to fall. About all the boy had to do was reach down and pick him up, but he was proud of his feat just the same. Holding the rabbit by the hind legs the boy cracked him in the back of the neck with the edge of his hand, the approved

Snowtime

Cottontail rabbit

method of putting rabbits out of commission, and then proceeded to the house to show mother, and to watch her dress and cook him.

But as the boy grew his range widened, and presently he was the proud possessor of a pony, doubtless selected by his father for its quiet and gentle disposition. The pony must have made slow progress forward, most of his motion being up and down, if the description that grandfather made was true when he said that the pony "could gallop all day under the shade of an oak."

But ownership meant responsibility and expense, and expense meant money and money meant work. So pawpaws were gathered in the thicket and sent to the city. No wage was ever so eagerly anticipated, or realization more appreciated, than when the father, returning, gave the boy a "shinplaster," a twenty-five cent piece of paper money received from the sale of the fruit.

Oh, the memory of a ripe pawpaw, that smooth-skinned, yellow, delicious, hunk of messiness, next to the bean-shaped seeds of which the most lusciousness could be found. Because of the very few hours interval between

Aircastles

Mr. Scott invents first machine for recording speech 1866

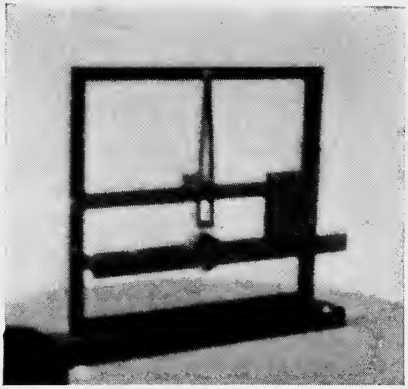
maturity and decay, few city dwellers ever get a taste of this superior relative of the banana.

One of the boy's first inventions was a bean huller. He built it in the attic of the old log house, his early home, used later as a tool house when the new house was built. Proudly he led his father up into the loft to see this wonderful machine, which, turned with a crank, was supposed to break the bean hulls open as the "beater" passed the mouth of the hopper. What was the boy's disappointment when his father, perhaps with just a suggestion of contempt, remarked, after watching it perform, "Why, I could thrust a whole handfull of beans through untouched between the revolutions of the beater." Thereupon the bean huller lost all interest for one small boy, and he probably made it over into a sled or a wagon.

But not all his early inventions lacked appreciation. Making a jack to raise the wagon wheels. in order that the axles might be greased, he hit upon a very effective design, apparently, for neighbors seeing it persuaded him to make jacks for them.

If neighbors liked these jacks so should others,

An old Daguerreotype

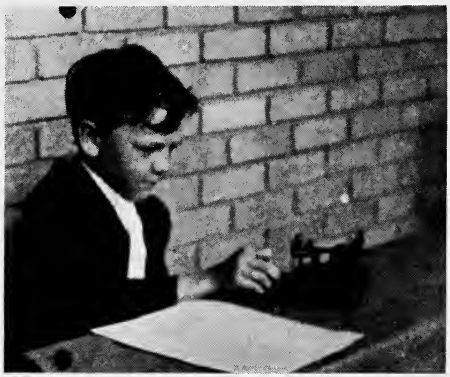


First telegraph Professor Morse 1837

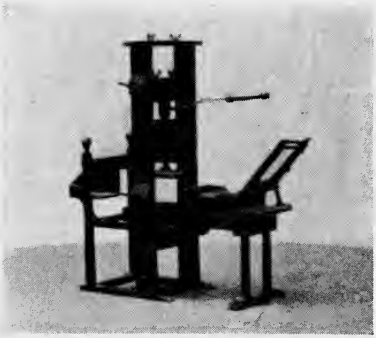
he reasoned, and with visions of wealth in building wagon jacks, the boy and his brother, pooling their capital, made up five jacks and drove to the city to sell them. Three of them had been painted a bright red, and these were quickly sold. The other two, though in every way as good and as serviceable would not sell. So the boys learned a basic truth, i.e., buyers mostly judge value by looks alone, which was one of the first of the young merchandiser's lessons, applied profitably in after years.

Somewhat later he invented a machine for making slat-and-wire fencing in place on the posts in the field. It consisted of a short, flat stick, notched in the middle on opposite edges, with which the wire was twisted between the slats. It was very effective, and made a good fence. These devices he also made for the neighbor-farmers. A little later a manufacturing concern in a nearby city marketed an improved form of this same fence machine, which meantime had lost interest for the boy, because it was no longer an unsolved problem.

But added years brought greater responsibilities and more need for money. The city



A young train dispatcher



Ben. Franklin printing press of 1732

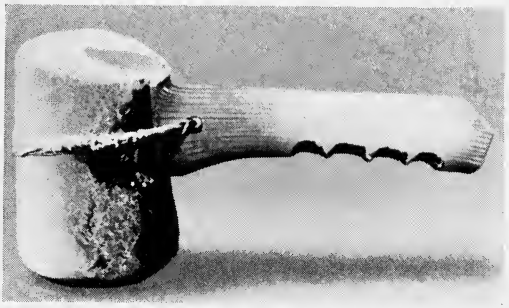
boy, similarly confronted, sells papers; the country boy traps fur-bearing animals, perhaps muskrats, for their skins. And the country boy has the best of it too, for there is the hunter's instinct gratified, the adventure of setting the traps just under the water about the banks of the pond, and subsequent visits of inspection and reward. And then the gathering of suitable forked switches upon which to stretch the turned skins to dry.

But the skin season passes, and the snows are gone and the time soon comes for bare feet, raggedy straw hat, calico shirt, and pants with one gallus, the greatest combination of convenience ever invented, for by the time the boy reached the creek on the run, every piece had been removed and into the swimming hole he goes, without stopping, ahead of his fellows if possible.

Round the clock the weeks speed until again school time comes with its three-mile walk each way daily in all kinds of weather, and the more or less frequent encounters with the bully who pulled the little girl's hair and knocked the crutches from under the cripple. Of course a red-headed boy couldn't see that without mixing in, never stopping to think of the beating sure to follow from tackling too big a job.

Old swimmin' hole

But school had its attractions for the future inventor as well,

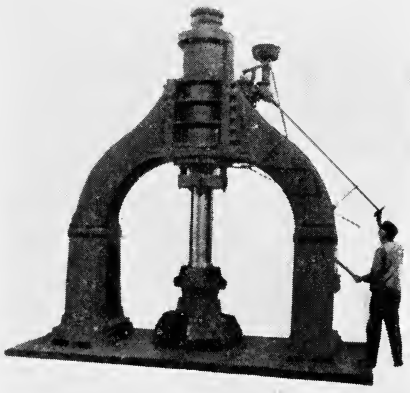


The oldest known hammer

for in a glass case over in the corner was the air pump and the electric machine, and the sparking tubes, and all other up-to-the-minute scientific apparatus, very complete, no doubt, for the time, though perhaps beyond most of the district school teachers, who probably knew little more about scientific apparatus than the pupils did. And it was a great day for the red-headed boy when the school trustees decided the little-used apparatus might just as well be given to him as "he seemed to be the only one liking it."

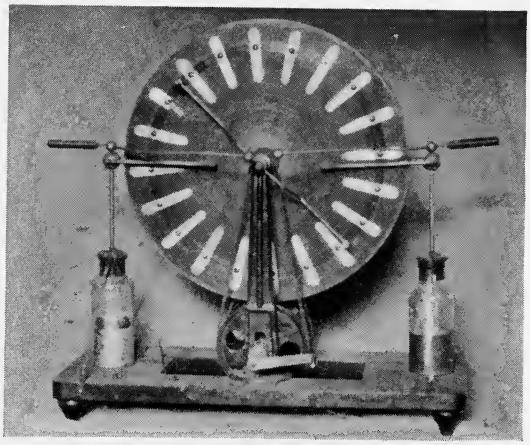
Perhaps the boy's mother came to doubt the wisdom of accepting such a gift, for while sulphuric acid on zinc would make hydrogen gas, and hydrogen gas would make paper bags rise high in the air, sulphuric acid spilled on clothes and carpets made holes, results which the mother saw to it ended the boy's immediate interest in chemistry. Thereafter the electric devices must suffice. So neighbors, visiting the boy's home, eagerly consented to "join hands" and take the shock of a discharging Lyden jar, or watch the scintillating sparks in a vacuum tube.

Incidentally, it might be recorded that the forms of entertainment which obtained in evening gatherings of country young people consisted more of



This hammer strikes a 3-ton blow

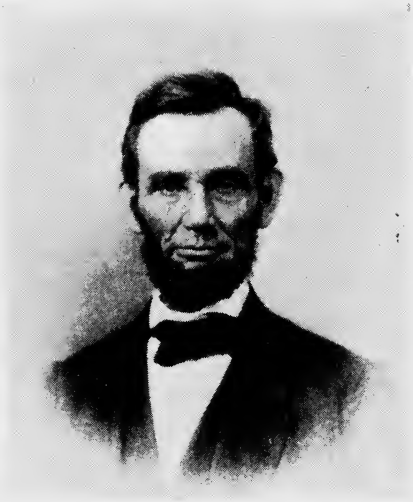
feats of mental skill, cleverness and quickness of perception than of dancing, the latter being reserved for the less frequent "worldly" occasions, graced with the stately "Virginia reel," the beautifully gliding waltz, and the like.



Early static machine

Charades and other guessing contests were common, as well as displays of unusual natural phenomena. It was at such delightful gatherings that the boy learned that one cannot blow a card away from the end of a spool by blowing through the hole; that a bent pin can easily be straightened if thrown on the bare floor and rolled under the shoe; that one cannot touch the two hands together (if one hand touches the elbow); that an egg laid on the floor cannot be crushed with a bushel basket (if put in the corner of the room). That a brim-full glass of water, with a card covering the top, may be held inverted without the water falling out; that a boy can be comfortably seated on the floor, but with legs crossed in such a way that he can't possibly get up; that a horse's head is as long as a barrel is deep; that a child two

The sewing bee



Lincoln, the rail-splitter

years old is just half as tall as he will be when full grown.

And perhaps such mental exercises largely account for the cleverness, self-reliance and self-sufficiency of the country boy and girl, so many of whom have risen to places of great responsibility in industry, and of power in government; why a rail-splitter becomes President of the United States, for example.

The older young men had their sources of amusement as well; jumping, running, wrestling, pitching horseshoes, etc. Life wasn't all just hard work; and they were quick to grasp the comedy of a situation.

On a certain occasion one of the young men employed on the farm rode an ox to an evening gathering at the school house, a sort of lyceum, perhaps. After the session adjourned, the young man mounted his steed for home. But as he chatted with his friends before setting off, some mischievous chap slipped up, gave the steer's tail a twist which sent him down the road at a furious pace. As the young man

Oxen "treading out the corn"

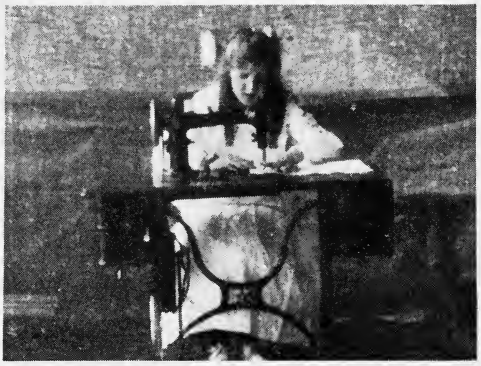
A President pitches horseshoes

rode bareback and guided the run-away ox only by "gee-haw" command, he had a precarious seat, to the great amusement of his friends; though, it's only fair to say that he stayed aboard until the steer reached home.

The boy has heard his father recount an amusing story of his ex-slave nurse. It appears that he liked to tease a ram that ran with the flock. He would get down on hands and knees and bleat defiantly at the ram, which soon so enraged him that he'd come tearing at the man. Just as the ram doubled up his knees and launched his weight, the man would duck his head and the ram would harmlessly shoot entirely over him. But once, as the man ducked his head, a stubble jabbed him in the nose, and he didn't go low enough, with the result that the ram hit the colored man in the head a resounding crack, however, without serious harm, but to the hilarious amusement of the spectators.

A blooded ram

Such was the order of the play of the grown-ups of that formative settlement period, in which feats of strength in friendly contest most often predominated and in which surprises sometimes developed,



Making her own clothes

as for example, when it was demonstrated to the doubtful that the strongest of the strong could not lift his own weight off the ground if the weight must be lifted by pulling on a rope passing over a pulley with the other end of the rope fastened to the weight.

For the social gatherings of the women folk there were the quilting parties, when from miles around, they gathered for a day of visiting and quilting, with fingers incessantly busy; stopping only for a dinner of good things, which rarely failed to include delicious pumpkin pie.

Applebutter making was also an occasion for visiting when the neighbor's wives came over, and peeled and pared apples, and cooked them, with constant stirring with the long-handled wooden stirrer, in the great copper kettle hanging over the out-of-doors fire.

But winter in Indiana means snow and sleds, and while that flat country had few hills, a short coasting place could most always be found. Then came the glorious afternoon when he took the two little sweethearts coasting on a red bobsled. Down the slope toward the road the sled flew, but when only half way down a heavy wagon was seen crossing the path.

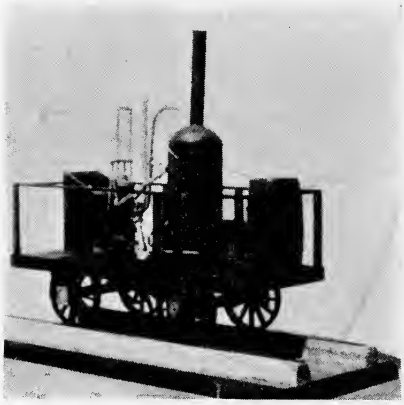
Applebutter time

There was no way to go around the wagon, and he couldn't stop, so shouting over his shoulder to the two little pig-tail passengers "I guess I'll have to dump you," the young engineer gave one of the guide ropes a hard pull, passengers, pilot and sled all rolling over and over in the snow in perfect safety, and the driver of the heavy wagon continuing on his unconcerned way all unconscious of the averted catastrophe.

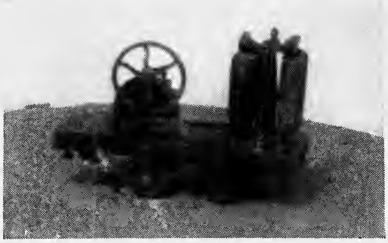
David Copperfield and his mother

Perhaps the boy came by his talent through heredity, for while the father was not inventively gifted, the father's brother was, and during a visit to the homestead, the uncle made for the little fellow a windmill which was nailed to the ridge-pole of the woodhouse. It was held head into the wind with a feather, and a remark by some elder person that "like Job's turkey, it had but one feather in its tail" stuck in the boy's memory.

It was this uncle that brought the boy a little steam engine which he had made when himself a youngster. There was, however, no steam generator. So the boy immediately set about making one. This he did by fitting the ends of a joint of stove pipe with two wooden discs. Filling this makeshift steam boiler with water he set it upright in a pile of ashes (to prevent burning out the lower wooden disc) and connected the top to his steam engine. Around this improvised boiler he



Peter Cooper locomotive used by B. & O. Railway in 1829



First trolley car, invented in 1846

built a fire. After an expectant wait steam began to flow and presently the engine was turning over, going faster and faster to the young boiler-maker's increasing delight, until the head of the boiler blew out with a report that brought everybody from the dinner table.

The country boy is surrounded by a wealth of raw material from which he may fashion, if he is clever, more toys than can be found in the toy shop of any city. He can cut from a green willow switch a short section, and by beating on it with his knife handle, the bark can be slipped off, the woody part cut away to suit, and a whistle completed when the bark sheath is again in place.

He goes to the elder patch and cuts a stalk to length, punches out the pith, fits a ramrod and he has a popgun. And for wads he chews paper into pellets, which go off with a startling crack, and for as long as his "tummy" will stand the pressure.

Of course, this boy like every other country boy had his "bean shooter," a forked stick with a rubber band on each prong, and a leather patch between for pebbles. With this, such accuracy of aim was attained by the brothers that shooting at green apples was limited to just skinning them. But this, too, became such a common result that even it lost its attraction.

Or, like the stripling David did so

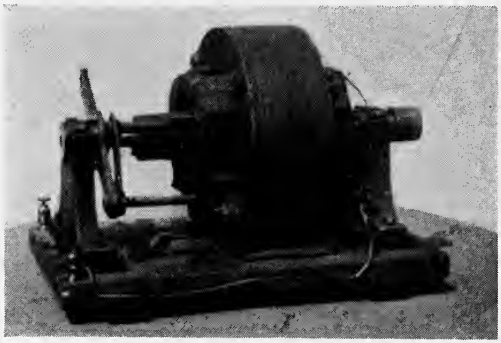
Modern electric locomotive

long ago, he makes himself a slingshot of a diamond shaped piece of leather and a string, with which pebbles can be hurled to incredible distances, and which he can do safely only in the country.

First electric motor, Prof. Henry, 1831

Later he rives out a hickory bow, and with a broken piece of window glass scrapes it to a beautiful smoothness, and he has bow and arrow. If he wants more formidable ammunition, he cuts some notches about the end of the shaft, wraps a bit of writing paper about it and pours in lead for a tip of more striking power. If he seeks greater accuracy of flight he may bind feathers to the other end of the shaft.

In addition to all these activities he probably spends a whole day in the blazing sun building a mud dam across the burbling creek just where the ripples end. The stream is thus restricted to a narrow overflow, and here he sets a water wheel whittled from pine sticks. Or he floats a ship through a canal, scooped out of the gravel floor of the creek and along the foot of the mud bank. The graduate engineer has nothing on the youngster, though the boy's level may only be a shingle with two pins set in the ends and across the tops of which he sights as the shingle floats on a pan of water.



First induction motor, Prof. Thompson, 1888

If the creek is too far away, he prob-

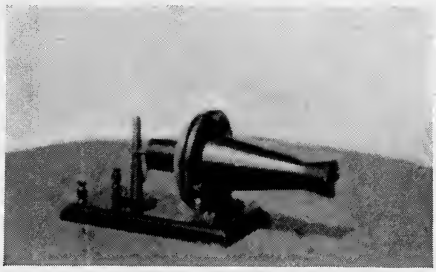
The tea party

ably builds a railway instead, the car of which he pushes ahead of him with all his might and main until, considerable momentum having been attained, jumps on, joining his brother and sister, to ride only a few feet, and then repeat.

If there's a hill available, he builds him a bobsled for winter sport and a long-geared wagon for summer. The country boy knew long before the automobile engineer did that for safe speed a long wheel base is necessary. Even the city boy knocked the front wheels loose from the boughten wagon and lengthened it with a board years before the first modern racing car was built.

It was on the farm this boy learned the rudiments of weather-cloud, and goosebone lore, learned to know which is the north side of trees, the woodman's natural compass; that the great dipper would tell him the time of night; and that mullen leaves rubbed on would neutralize poison ivy and give immediate relief; learned to make box traps, and deadfalls, with "figure-four" trip-triggers; and to line bee trees

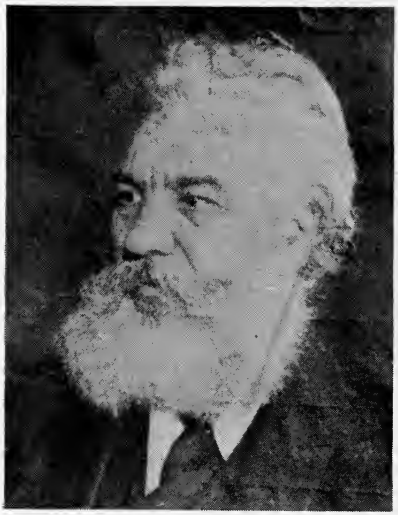
"Just make-believe tea"



Early Bell telephone, 1876

for honey by watching the successive flight of the bees from a saucer of sweetened water; learned to know the foot tracks of all the wood folks, to bait traps for coons with crawfish, and to note that a possum carries her young on her back, while the little fellows hold on with claws and tail.

In due time the boy traded for a gun, the first breach-loader he had ever seen, the cartridges being loaded by hand at home. With this he and his brother became quite expert, even setting up in the empty fireplace of the living room a heavy oak board to hold a bit of white paper for a target. Of course, when the father discovered this he said it must be stopped. But boys can't see danger and begged to continue just a little longer. Then the father, interested, must try his skill. But fumbling with the gun it goes off prematurely, frightening everyone, and this, it can be well understood, stopped parlor shooting right there.



Dr. A. Graham Bell

It was a similar experience when the brothers were discovered spinning string tops in the kitchen. The father would stop the hazardous sport, but before doing so must first try his hand. Winding the string on the top with deliberation for a very superior shot, he makes the cast only to have the string fail to let go of the peg, with the result that the top is jerked back through

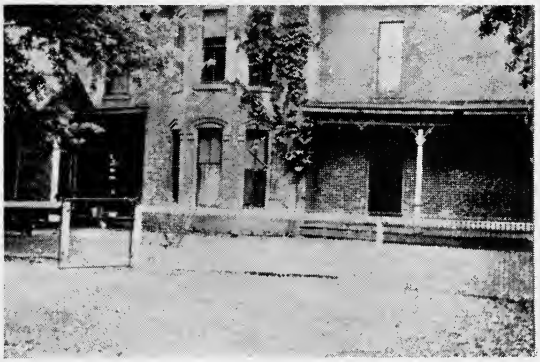
The farmer's friend, the iron mule

a window. And that ended for all time the spinning of tops in the house.

Very naturally being adept with tools, the farm tool repairs were left for the boy to do. So one day finishing a singletree, and getting red paint on his hands just at dinner time, the mischievous rascal went into the house holding his crimson hand in the other. But the evident distress of the mother, as she jumped up from the table to dress his hurt, so shamed him that he quickly undeceived her; though he should have had his ears boxed for his joke.

When the new brick house was built, to replace the old two-story log house, the log house was thereafter used as a tool house and work shop. Working in this old building the boy ultimately noticed the peculiar locking of the logs at the corners, a system of notching, invented by some pioneer, by which the weight of additional logs and of the roof locked the logs firmly together. The higher the house, and the heavier the roof-load the more firmly the building withstood the force of storms which tended to tear it apart. It was a real engineering feat, though its inventor remains unknown and unsung.

It must have been about the time the boy broke his arm



The boyhood home

Joke on Uncle Charles

for the second time that he suggested the perpetual motion machine solution. On the farm a treadmill was used to drive the fodder-cutter. A big, heavy horse simply walked up the incline of the treadmill to produce the power, he didn't pull anything, why wouldn't the weight of a cart load of gravel do as well? It had wheels instead of legs, so the platform could move under just as easily. The reasoning so impressed the neighbors that a cart was loaded, and tied in the mill, tied to prevent its running out at the bottom. Of course, it didn't work. But it was many years later before the boy learned about "the resultant of forces," and was able to predict with accuracy the result of similar experiments.

Joe Jefferson as Rip Van Winkle

But there was no one about when the boy broke his arm this second time. He was looking in the oats mow for baby rats, and feels yet the bare-skinned pink little bodies, so soft and pulsing as they snuggled in the cracks between his fingers, with tiny wet noses, their eyes not yet open. With two or three such miniature specimens in his hand, he accidentally stepped on the unsupported end of a rail of the floor of the oats loft and went

First white child born within the Arctic Circle

through to the ground below. A pitchfork following after stuck into the bone of the thigh so deeply that the mother, who came running when she heard him crying, had to put her foot on his leg to pull the fork out. Then one of the hired men was sent on horseback for the country doctor, who came in his one-horse shay. When he arrived the boy's attention was about equally divided between watching the doctor set the arm, and studying the hand-full of fascinating little red rats, which he refused to part with through it all.

Because of the boy's gift of mechanical intuition, it early fell to his lot to keep all the farm machinery in order. As has already been noted his father was progressive and was the first in the neighborhood to get the newest farm implements. So the boy's oversight took in a wide range of tools, for the well-equipped farm has a great variety of machines, for clearing ground, for preparing the soil for seeding, for the planting, cultivation and harvesting of crops, and the threshing and storing of grain. His "power factors" were horses and steam, and his playthings riding-plows and cultivators, mowers, harvesters, self-binders, threshing machines, traction engines, farm sawmills, feed cutters, windmills, hay-riggers, etc.

An old one-horse shay

Threshing wheat by power

The boy's father bought the first self-binder in that part of the country. When it was received the boy directed its setting up, and one Saturday wistfully watched his father drive it into the grain field. Everyone about the place was very proud and more or less excited. All went well except that sheaves would often be kicked off with the knot so insecurely tied that the sheaf would come open. So the first day's work was somewhat disappointing. The following morning, although it was the Sabbath, saw the boy studying the intricacies of the knotting mechanism. This he could do with less difficulty than a grown-up, for he was so small that he could get inside the machine. Meeting time came on but he had not yet found the trouble. After much coaxing, the young investigator was left with his new-found problem, while the family drove away in the carriage to church service. Before they returned he had discovered the knotter trouble and corrected it, and on the morrow the work was done with perfectly tied sheaves, much to the satisfaction of everybody.

Modern plowing

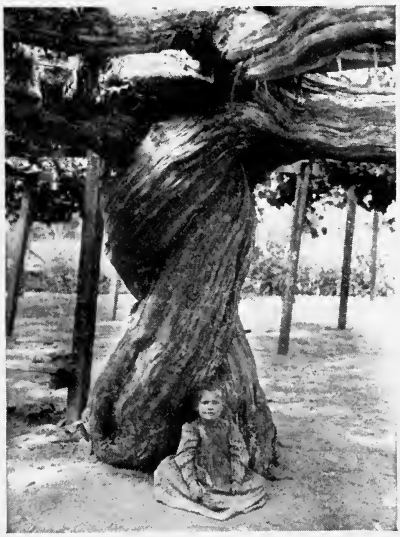
Self-binder for harvesting wheat

Of course he was lauded for his attainment, though perhaps undeservedly, for the born inventor is entitled to little praise for what he does. Like the great painter and the great sculptor, his is a natural gift, and accomplishments are for him too easy to deserve unusual mention.

The boy's ability to quickly locate trouble in machinery amounted to an almost uncanny intuition. His father took him into the meadow one day to discover why the mower had stopped. The farmhand reported he could see nothing wrong but "it wouldn't go." The boy quickly located the trouble, a hot bearing. He poured water from the drinking jug onto the bearing until it cooled off; then, flooding it with oil, it was ready to go again.

Perhaps the boy showed contempt because no one else saw the cause of the trouble, for the father reproved him, saying: "That is thy gift, and to thee it is no great credit," a remark never forgotten.

It was after the visit of Barnum's Circus to the nearby town that the boy started in to teach his colt to stand on a tub as he had seen the ponies do in the show. The schooling was progressing well, when suddenly the boards laid across the tub spread and



Largest grapevine known

Drives her own horseless carriage

let the colt through. So the boy's circus activities ended there, for the colt would not try any more.

In due course, to cultivate a taste for thrift in the boys, the father gave each of them a sheep, the increase of which was to be their very own. In time the beginning of a substantial flock resulted. One day, hearing that a pedal-propelled vehicle had come to the city some ten miles away, the boy went to see the new thing. Then, hastening home, he sold his sheep to get the money to pay for his first bicycle. Thereupon ponies and such like were second rate attractions, for this high-wheeled vehicle crowded everything else aside for weeks.

As the novelty of the first bicycle wore off, the boy's ambition to travel grew until on a certain eventful day his father and mother reluctantly carried him to the railroad station, buying a ticket for the Pacific Coast. Getting safely through the great city at the foot of Lake Michigan, he found himself aboard one of the "tourists pullman" coaches, fitted with cane upholstered seats. It was the first sleeping car he had ever seen, and the work of the porter was a source of interest, as was the effort of an immigrant family to carry three through on two tickets. The father and

Bicycle of 1885

Freighting in the desert

mother would shut up the 16-year old boy in the smothering upper berth until the conductor had passed through the car punching the tickets, then they would let him out until night, when all three would sleep in that same section.

The limitless expanse of the great barren plains was a revelation to the boy raised in the hardwood timber region, plains over which roamed immense herds of bison only a few years before when the boy's uncle crossed in the early operation of the Union Pacific railway, a moving mass so great that the train had to be stopped until it passed. The evidence of the subsequent great slaughter was the skeletons scattered over a territory as wide as the boy could see.

But with Pike's Peak passed, the train began its long ascent of the Sierra NevadaMountains, going by the switchback and the long

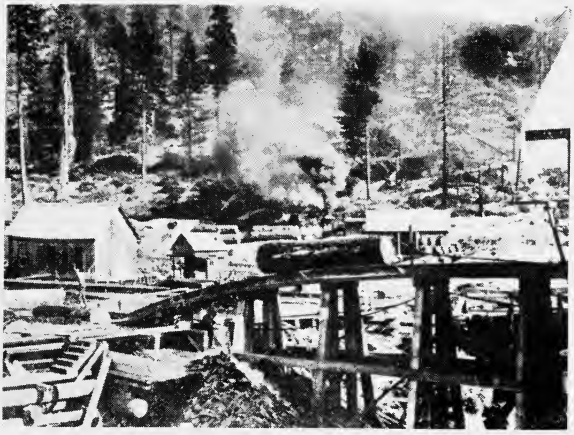
Crossing the plains in an auto—1910

Logging in the snow

snow sheds, every foot of which, it can well be imagined, held the young engineer's interest. Landing on the coast, work was quickly found. In fact his entire sojourn in a mining, lumbering and ranching west was made easy by his knack of doing mechanical things, a west where most of the activities were in charge of young men, college graduates often, many of whom had not yet attained manhood.

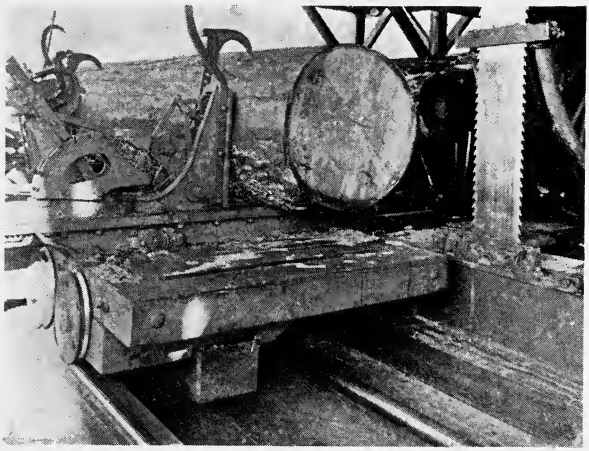
The boy is not apt soon to forget his first employment at one of the great sawmills. He was sent out into the mill pond to ride the logs up to the foot of the inclined runway where the chain picked up the log and carried it to the saws. Watching the other men riding the logs about as they poled them up to the carrier, jumping from one to another all over the pond as they made their selections, the thing looked easy. The logs were round as dollars, and when the boy tried it the log simply rolled over and dumped him into the water. He stuck it out, however, and attained some proficiency, though he went under many times, and worked all day in wet clothes.

Riding logs in mill pond



The runway to the saws

The railroad naturally attracted him, as it has many other youngstersbefore and since. It was not long before the boy was second in charge of a wreck train. One day orders were delivered to him to go to "the junction" and clear a wreck. Arriving, he found that a freight train on one track had run halfway through a freight on the cross road. Clearing the tracks in a hurry to permit the movement of eastbound perishable freight was the immediate job. So, pulling the wreckage apart with locomotives as far as this was possible, he ordered oil poured on the tangled snarl of smashed-up wooden cars and set it afire. With the woodwork burned away the remaining wreckage was easily pulled apart and the tracks cleared and trains running in three hours, a feat for which the boy was complimented by the superintendent a few days later, though half expecting censure for destroying company propererty.



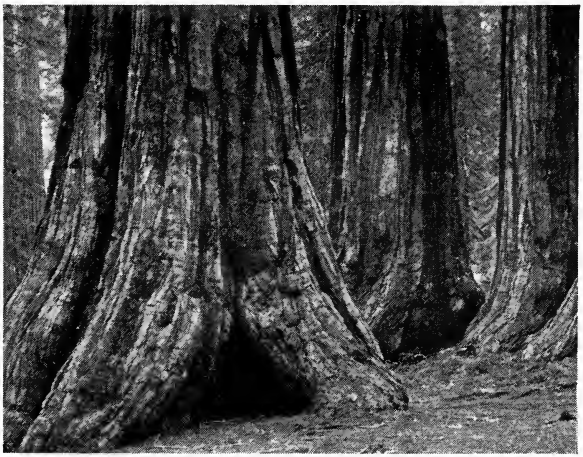
Double-bitted lumber saw

There were

In Yosemite Park

many unfamiliar things to interest the boy, mountains and great rivers, big trees, new beasts and birds and wild flowers. Then there was the freshet on the melting of the snow in the mountains. How the great Columbia would sweep through the gorges, an irresistible flood, humped up in midstream. Perhaps the awe-inspiring sight of so much rushing water impressed him as it did another Eastern tenderfoot, who remarked: "Boy, I'd like to see the old ocean now; I'll bet she's aboomin."

Among the boy's first purchases was a rifle and a pony, and with these he roamed the forests on the mountain sides. The pony became his chum, following close up, and frequently nuzzling at pockets for the apple, sugar or other tidbit with which he was rewarded.



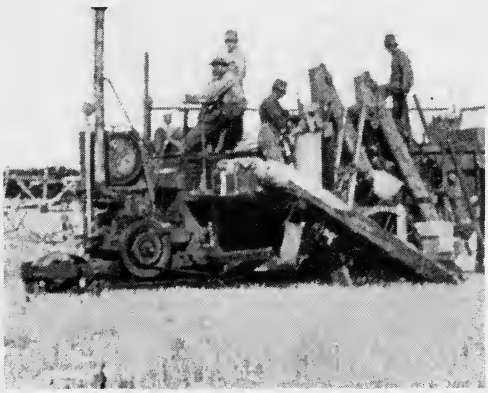
The oldest living thing; Redwood trees of California

One day as the boy pushed through underbrush, alert and all on edge for the startling whir

Yosemite Falls

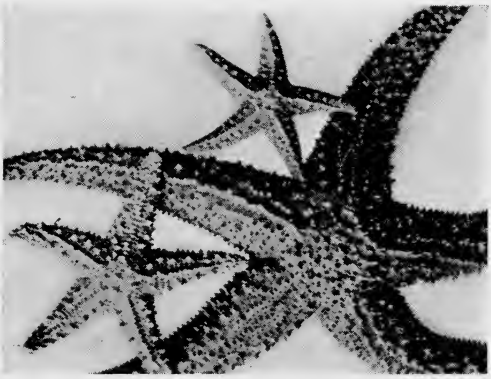
of the upwinging grouse, the pony took hold of the boy's coat shoulder. This so startled him that he whirled and unthinkingly slapped the pony. That was a regrettable act, for never thereafter would the pony follow so closely, with the previous intimate comradeship.

On another excursion the pony and boy went camping with a small party to the beach, the boy's first sight of the ocean. It was some miles from the nearest settlement, and the great stretch of beach was practically virgin territory. The only trail to the nearest post office was five or six miles around, though scarcely two miles away over a great sand dune. When it was the boy's turn to go for the mail, he led his pony up the side of this great sand pile, perhaps 200 or 300 feet high, and then, mounting, rode along its top until progress was interrupted by a chasm. Across this chasm a great tree had fallen a long time before, as shown by the flatness on top of the log, worn by the feet of many a bear going over it. Throwing the rein on the ground, the boy started across the log, leaving the pony to await his return. Halfway over, a sound from behind made the boy



This harvester does the work of 600 men with cradles

turn, to discover the pony trying to follow, tossing her head to free the dragging rein. In sympathy and pride the boy returned, picked up the tripping rein, and both safely crossed this natural log bridge together, later returning the same way, and this time the boy rode across.



Star fish

The next day the boy, afoot, crossed another of these great sand dunes, which extended out into the ocean and formed a cove of quiet water inside. Here the boy came down upon a most wonderful marine garden, blooming with multi-colored star fish, sea urchins, and other sea growth just under the surface of the smooth blue-green water. Removing his jacket he filled it with these wonders to take back to camp. He then labored in the hot sun to get this precious find over the top of the hill of oozy sand, buoyed up by the thought of the delight and pride of his mother, in the home back east, when she opened the box he would send her. The journey ended, he spread out his treasures in the sun to dry. Great was his disappointment next morning to find that in the night wild hogs had come down out of the hills and eaten his whole catch.

Deer horns

Then there was the hunting trip back into the foot-hills, where in the dust of the paths deer tracks appeared, in size and figure not greatly dissimilar from the hoof

Cub bear

tracks of the sheep in the paths on the farm back home.

The party, scattering soon after noon, left the boy alone in this wilderness of burned-over terrain, and being only an amateur "big-game" hunter, he early turned his steps toward the descending sun so as to reach the coast before the dark should come down. On his way in he heard the barking of dogs ahead of him. Following the sound of their baying he came out into a glade, in the middle of which he saw a burned-off stump, perhaps twenty feet tall, on the top of which perched a young black bear languidly watching the dogs harmlessly yelping below. It was an easy shot, but as there was no way to get the meat into camp, and having no heart for killing just for the sake of killing, the boy continued his journey, to the evident disgust of the dogs, for their noise soon ceased, with a few parting remarks to the bear that next time they treed him he wouldn't get off so easily.

Next morning the tide was unusually low, so, rolling up his trousers, the boy took an ax and cutting into the soft sandstone cliffs below mid-tide, as he had been instructed, he

A papoose carrier

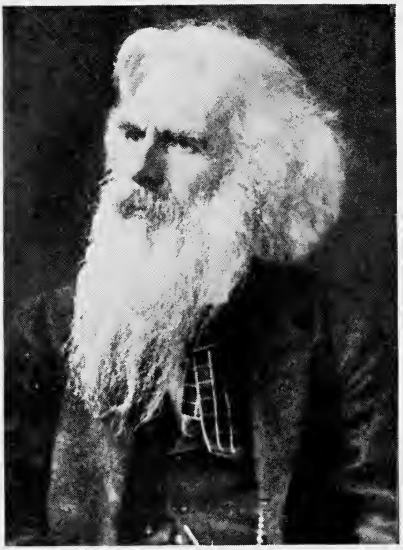
split slabs off the soft stone to find the native rock oysters, long slim, bivalves, the big end inside their selfmade stone cells. Pinching off the long, thin, black outer neck, the pink body of the oyster was swallowed whole, making a dainty morsel indeed.

Black bear

This camping trip was most enjoyable and all too soon ended. It took two days to make the return journey home, the night being spent beside a crystal-clear mountain stream. Sometime in the night the uneasiness of the horses waked everybody, only to discover a big, black bear, some distance down the trail, sitting on his haunches inspecting the visitors to his territory. Presently, satisfied, he went away, but that big fellow sitting in the road, and the shape of his tracks in the soft earth, examined next morning when the journey was resumed, will never be forgotten.

Wyoming red sage

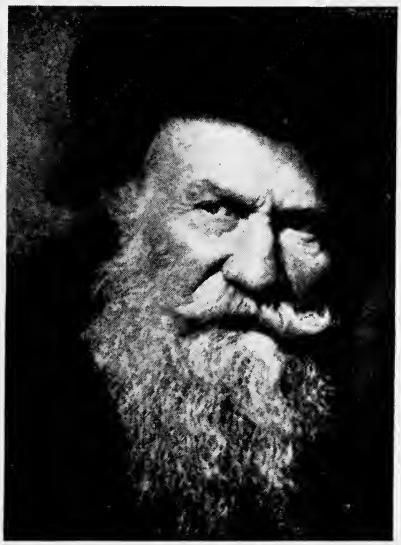
Boys being social animals, and this boy being no exception, he, of course, had a chum and a girl. The chum being similarly attached, the four of them set out on an



Edward Muybridge—first to study animal motion analytically

evening's adventure soon after his return from the coast. Borrowing the work car of a Chinese section gang, after the white boss had refused to let them have the car but had accommodatingly told them he was going into town for two hours, the trip was begun down that crazy right of way with a rickety old pump-car from which the the brakes had been lost. Why the kids were not killed on that wild unchecked ride down the long grade may not be known. However, ultimately the car stopped at the end of a trestle over a ravine through which a winding road led. Reacting from the excitement, shooting irons were brought forth in bravado, and after much persuasion the boy's girl, with averted face and a hand over an ear, fired the gun without aim into the ravine. However, as the boy passed down the ravine the next day, he found a wild boar shot dead by a bullet squarely in its forehead.

After a year's stay in our great Northwest, the boy returned home for a visit, only to find that his stories of the wonders he had seen were not believed, stories of high mountains, of great gashes in the earth, of wondrous waterfalls, of tall



They had whiskers in those days

trees, of rivers full of fish from bank to bank when the ocean waves went back from the river's mouth.

A Buffalo Bill gun

In all his travels he made it a rule to visit his folks at least once a year, and it is a great commentary on the security of this peaceful Quaker settlement to say that on each of the boy's return trips home he never found the door locked, and could quietly enter and lie down on the sofa without wakening anyone.

But the attraction of the great out-of-doors soon proved too strong, and again he turned his face outward, this time going to the great Southwest. He proudly took along two bright blue pistols, with regulation holster and belt. He wore them just one day. Noting the shooting skill of some of the bad men of that region, he went back to the bunk house, took off his artillery, threw it into his trunk, and there it stayed. His judgment was wise, for the bad men shot up each other, while the unarmed man lived longer.

Visiting the Sierra Nevada mines, the boy found plenty of work for his aptitude in mechanisms, repairing hoisting machinery, mine locomotives, deep well pumps, air compressions, and what not.

An Arizona mining scene

One of his first jobs was the repair of a hoister. He was sent up the side of the mountain with orders to hoist with air until he could get up steam. But as the boiler leaked badly it

Colorado gold mines

was hard to keep fire to make steam ahead of his needs. Presently a messenger from the boss ordered the boy to stop using air, and stop at once. As the boss sitting in his office below could see the engine exhaust, there was only one thing to do, and that was to fill the boiler with air between bells and hoist with an air-steam exhaust. And he got away with it, too.

He soon was a favorite with Bob, the watchman at the railhead of a spur of the Santa Fe railroad. This was doubtless lucky for the boy on the evening he borrowed a locomotive during the watchman's absence. Clattering over the switch frogs, and out onto the prairie ten miles or so, he took his ranch-girl friend for a ride, only to return later to find the watchman sitting on a cross-tie waiting for the young thief. He was a fearless watchman, was Bob, but the boy was only a boy, and Bob was Bob, so there were no regrettable consequences.

The young engineer

Easy-going, good-natured Bob, when he came off his watch, usually slept until one or two o'clock in the afternoon. The remainder of the day was spent gambling. It was on one of these

occasions, sitting in a two-bit game with the Chinese cook and a tin-horn gambler who had lost an eye in some ruction, that Bob asserted himself. After playing along quietly for a time, everyone in the saloon was startled when a gun came down, whack, on the table; to be followed by roars of laughter when Bob was heard to say: "They's cheatin' goin' on 'round this table; I ain't goin' to name no names, but ef it ain't stopped somebody is goin' to lose his other eye."

A plain's horse

It was down in this barren country where the heat is blistering by day, but where one sleeps under blankets at night, that the boy found a bath scarcer than gold nuggets. The mill superintendent said he thought he had seen a tub somewhere about the "diggins," but with water hauled ten miles and costing six bits a barrel,he didn't think it had ever been set up. So, borrowing horses, the boy and a friend rode across country to where, they were told, a lake could be found. They found it, but the entire margin was thickly lined with knife-sharp, dried flags over which they would have to swim to get into clean water, so the attempt

Arizona cactus

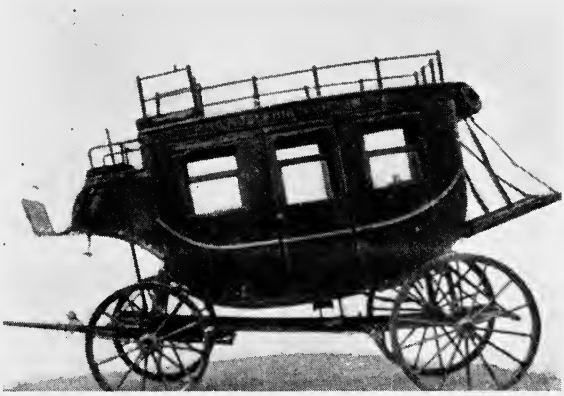
Mexican mines

was abandoned. Perhaps their decision was hastened by the mean looks of great hairy spiders and immense centipedes on guard about the margin of the lake.

By the by, it was also down in this torrid region during a brief engagement with a cow outfit, that the boy learned to cook eggs and fresh meat on a hot stone, by laying a piece of paper on the stone and breaking the eggs thereon before the paper caught fire.

He also noticed that a bit of hair stuck to a cold branding iron was not burned off when the iron was put into the fire, until the iron was red hot. Practically applied, this means, for example, that a surgeon's or dentist's instruments cannot be sterilized by holding them momentarily in an alcohol flame.

There was a stage route between the camp and town, the stage coach of the old, pioneer type, like the first public conveyance between Philadelphia and Pittsburgh. The body hung in two great leather straps running fore-and-aft, and the coach was drawn by four horses. For some reason or other the regular driver wished to get off for a few



Old pioneer stagecoach

Do you remember when we cranked the phone?

days and asked the boy to "take her out." So the boy mounted the box and, working over the grade, came down onto the flat, where the little "road runner" joined him, a lizzard-eating bird which alternately ran and flew along ahead of the horses for miles every trip. All went well for a week, when one day, coming in, the horses got frightened and ran away. Down the mountain road they came, dragging the lumbering coach after them with the wheels ineffectively locked. The boy was able to keep the coach upright until it hit the sharp turn over the railroad in the edge of town. Here it went over. The boy was thrown clear, but had to crawl along with a broken leg until help arrived.

This was the year the Apaches got off the reservation and began a soiree of massacre, reports of which came in with the ranchers, when they brought their wives and children into camp for protection, while the men organized posses to hunt down the Indians. After the first excitement not much was heard of the raid, though camp life was enlivened by the arrival of a cavalry troop.

Sam Bryan, an early telephone president; a personal friend

So after a time, nothing much happening, the boy and his bunkie, a young assayer, set out one morning to locate for an old miner, for record, an ore prospect near the foot of Cook's Peak. Running lines from government monuments, the work was about finished when sud-

Mexican corn grinders

denly shooting began, with puffs of smoke rising from boulders on the side of the Peak, followed by mean little messengers singing a spiteful, high-pitched song as they sped past the boy's ears. Everyone dropped tools and instruments and sought shelter, including the two Mexican helpers, who, however, were shot before shelter was reached. Those little lead pellets left blue spots on the stones uncomfortably near, but fortunately without harm for the white "hombres" until one found the fleshy part of the boy's leg, but luckily not breaking the bone. After minutes which seemed hours, safe haven was found behind a great rock, and there the boys waited until nightfall. Then, stealing out from their shelter, they caught their hobbled ponies and loped back to camp in safety to tell their story and join a quickly organized scouting party.

But that was not to be the last encounter. A few evenings later the boy's bunkie, the young assayer, went just around the hill from camp, only a few hundred yards away, to get some ore samples. Shortly after a shot was faintly heard in that direction. A hasty investigation, and the boy came back mourning a murdered chum, shot in the back by a sneaking varmint.

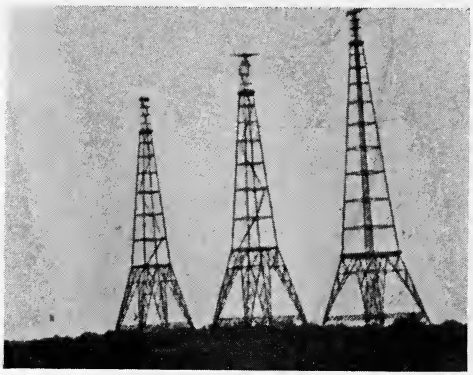
Drab days followed, but work, that great restorer, brought renewed interest, and softened depressing recollections. For

First prize for artistic photographs

A prophecy of a wireless telephone

there was heavy machinery to move across the border into Mexico. Many delightfully difficult problems were encountered. The most stubborn one was the loosening of the big belt pulley. To the great shafts in the mill, these pulleys were keyed; with keys which would not move, though arches were used and a heavy shaft dropped thereon endwise, arches of the best steel the blacksmith had. So the pulley-mounted shafts were loaded on the cars as they were, though overhanging the sides. When these were later taken from the cars and loaded on wagons, with twenty yoke of oxen hitched thereto, the journey to the new mines was begun. The wagons went creaking along uninterruptedly until Bitter Water Gulch was reached. Here it was found that the big wooden pulleys on the shaft would not pass between the canyon walls. So the wagon was drawn from under and the pulleys were burned off the shaft, later to be rebuilt by the carpenters when on location.

On one of his annual visits back home the boy took a civil service examination in a nearby city, and some months later, being then in Mexico again, he received a delayed telegram which notified him of his appointment to a clerkship in Washington,D.C. Thereupon, after giving to his bunkie his guns and belt as a rosary, he turned his face toward the city which became



Arlington talks to Paris by radio 1918

The United States Capitol

in time his permanent residence.

His notification of appointment had instructed him to report to the appointment clerk, and, being accustomed to go to work soon after sun-up, he sought the Department building about seven a. m., only to find it a cold, forbidding mass of granite with equally uninviting watchmen sitting in lonely state at all the doors. The young adventurer was turned back and told that the building wasn't open until nine o'clock.

But when he did get in, what a wealth of new impressions and strange experiences followed his introduction to "official life" in Washington. One of these first impressions was that no one seemed to work very hard at anything, and that the principal topic of discussion was annual and sick leave, the clerks getting thirty days of each, and as much more as he or she could get by planning vacation to begin on Tuesday after a Monday holiday, or to end as advanta-

Capitol from the air; plane flying southeast

geously on a Friday.

Then there were the dear old ladies who brewed tea midway between nine o'clock and noon, and again between one o'clock and four p.m. Many of them acted as if they wished they might go to work at twelve, get an hour for lunch, and quit work at one o'clock.

Washington Monument from the air—looking like a tack standing on its head

Each clerk in those pre-Spanish war years had issued to him, for his own private use, stationery, pens, pencils, and accessories, soap, towels, hair brush and comb, shoe-shining brush and polish, and what not, petty graft, since wisely discontinued. But these perquisites were picayune compared to what the secretaries, assistants, chiefs of bureaus, and their like secured while public conscience as to official graft continued so elastic that Congressmen sent household furniture across the continent at public expense, a custom which prevailed until the postal clerks grumbled at handling, as a piece of first class mail, a piano which was being sent from Washington to a distant city under the Congressman's franking privilege.

Sumner I. Kimball—founder of the U. S. Life Saving Service

The boy soon found his place as secretary to that gifted man of humanitarian vision, Sumner I. Kimball,

The lone patrolman

organizer of the Life Saving Service. The work was very interesting, and as the annual reports were dictated to the boy to be typewritten, he learned the thrilling stories of heroic battles with the sea to save human life; of lonely patrols in blizzard weather; of sailors lashed to the rigging and drenched with freezing spray, or snatched overboard by the angry sea; and which often later laid the dead body on the beach, gently and tenderly, as though in atonement for her ungovernable fury of the day before.

Perhaps for the boy one of the most interesting mechanical features of the city was the Seventh Street cable car line, and its powerhouse, with cable passed around the easing-pulley which gentled the savage jerking of a green gripman. Once the boy stayed up all night to watch the men put in a new cable, pulled from the powerhouse to the end of the line, around the pulley and back again, with twenty big horses. But in due course the cable road passed out, to be followed by the electric underground trolley, though there were plenty of methods tried before the present system was finally adopted.

And doubtless such things interested him far more than the Davie Burns Cottage,

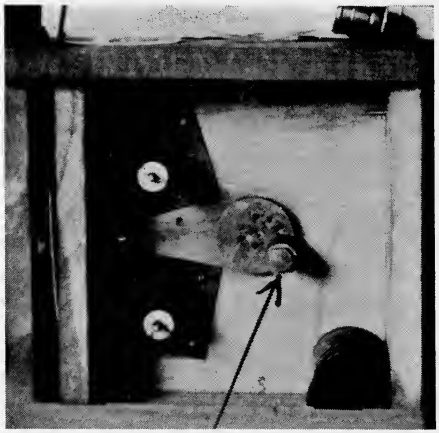
Coast Guard surfboat

Hamilton-Burr flintlock dueling pistol

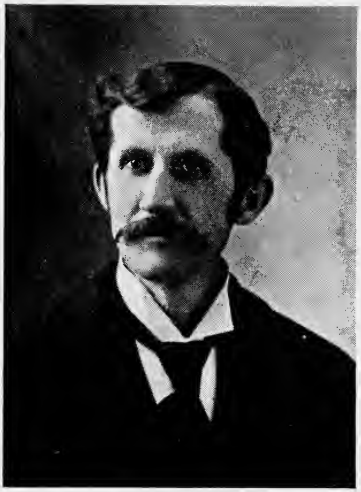
one of the very early houses in Washington; or the Chamberlain restaurant where so many of the legislators of that day habitually ate; or the house on H Street with no front entrance; or the little stone house which was George Washington's war-headquarters; or the proximity of the Hamilton-Burr dueling grounds, of which he had read, and such like historical attractions.

In common with vivacious youngsters, military pomp and circumstance had its attraction, and next we find him enlisted in the District National Guard; however, more as a recreation than any realization of possible war activity. But a single encampment was enough for this boy, and a furlough for the balance of his enlistment was granted.

But the gay life of the capital with its attractions, its charming femininity and handsome manhood, its private and its official functions, resplendent with gold-braided officers and bemedaled ambassadors was not the only force shaping the activities of the youngster. Shorthand was all very well for a daily vocation, shorthand which had been learned while sitting on a plow-beam back home; and dancing and good friends were all right for the night-time, but as an avocation, a hobby, photography was taken up, and developed along a new line, motion pictures, but which, because it had not yet been chris-



First Jenkins motion-picture camera



I. D. Boyce, photographer, who developed the first motion picture negatives

tened, he called "devices for recording and reproducing motion."

But the mechanical, optical and photographic problems did not yield readily. Each step required new mechanism and new material. A considerable length of light-sensitive film was adjudged to be the best surface upon which to photograph, but no such required length of film was to be had. So the tissue-like film made at that time for kodak cameras was bought in local shops, slit into strips in the dark, and spliced into considerable lengths.

Cameras for exposing this strip evenly and in rapid succession were made, as well as devices for developing this long length, and others for printing a positive therefrom for lantern projection.

It was fascinating work, although the results were strange and awesome to the athletic friends who had willingly enough tumbled, jumped, or otherwise performed in front of the strange camera without clearly understanding until days later what the resultant pictures were to look like. The most accomodating athlete, and the most frequently photographed, was Arthur J. McElhone, son of a pioneer shorthand reporter of Congress.

It is a strange fact that no one ever seemed to comprehend from an oral description what "motion pictures" were,

Arthur J. McElhone, first motion picture "star"

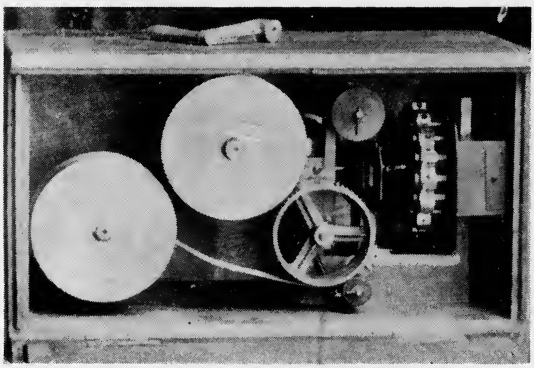
First motion picture projector, 1893—Jenkins; the beginning of a $500,000,000 industry

or had a right mental concept of them until seen for the first time, perhaps because nothing had ever gone before by which these animated pictures could be compared.

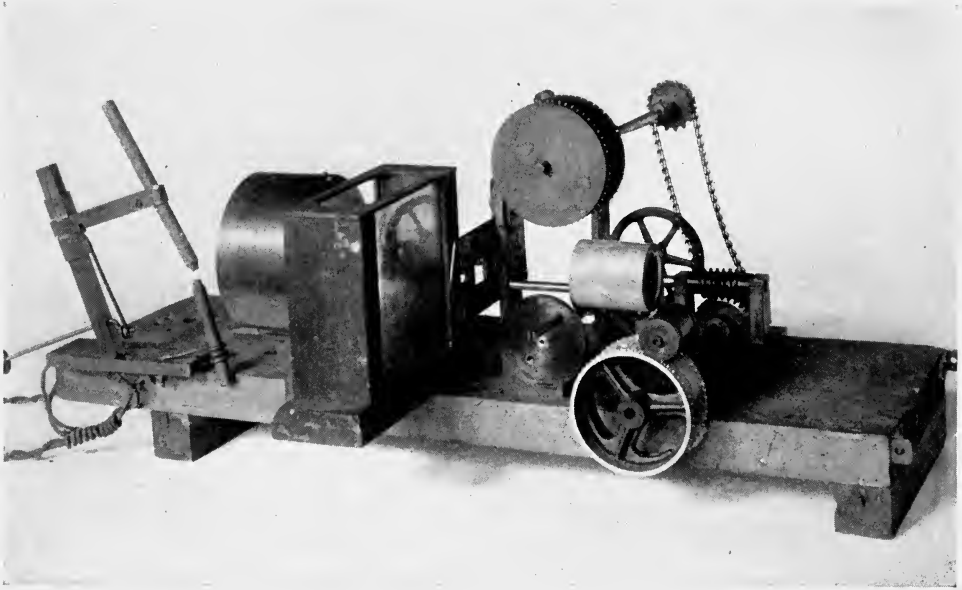
In the projector an oil lantern was his first source of illumination, but in 1893, after three years of work with the new idea, a friend, Dwight G. Washburn, fitted an arc lamp to the machine, and the first motion pictures projected by electric light appeared on a large canvas. Accounts of these and subsequent exhibitions appeared first in the *Richmond Telegram*, June 6, 1894, and again in the *Photographic Times*, July 7, 1894.

Incidentally it may be recorded that pictures of a little girl dancing, illuminated by similar electric lamps, were made in Mr. Washburn's place in 1893, the first motion pictures ever made by artificial illumination.

As the plaything developed it attracted to itself more and more attention, as better and better screen pictures were attained, until in the summer and fall of 1894 demonstrations were rather regularly made;principally, however, to gratify pride in accomplishment rather than with any thought of financial gain, for no admission fee to these exhibitions was ever



Early Chronoteine camera



This machine is the prototype of the motion picture projector in universal use the world over, the result of experimentation begun by Mr. Jenkins in 1890; the machine finished and publicly exhibited in 1893 and 1894. Later shown before the Franklin Institute, and thereafter in the U. S. National Museum. When it has completed its service in the Jenkins Laboratory office, the Franklin Institute Museum will be the final depository.

The accompanying cuts show the Elliott Cresson Gold Medal awarded by the Franklin Institute, of Philadelphia, for a machine exhibited before the Institute in 1895 by Mr. C. Francis Jenkins.

Later, in making a second award, that of the John Scott Medal, "in recognition of the value of this invention," the Institute Committee said: "Eighteen years ago the applicant exhibited a commercial motion picture projecting machine which he termed the 'Phantoscope.' This was recognized by the Institute and subsequently proved to be the first successful form of projecting machine for the production of life-size motion pictures from a narrow strip of film containing successive phases of motion."

Mr. Jenkins early motion picture apparatus, film slitters, perforators, cameras, developers, printers, projectors, etc., on exhibit in U. S. National Museum since 1895.

First long film was of a little dancing girl

charged.

At first the makers of roll negative for hand cameras declined to furnish the much-desired long lengths of film. Finally yeilding to persistent urging, they advised that if a whole table of film was ordered (22 inches wide by 100 feet long), and cash accompanied the order, the film would be furnished in hundred-foot lengths. But "the father of motion pictures" didn't have that much money. Finally a compromise was effected, and a supply of the precious long strips of celluloid ribbon was available.

The same year, 1894, we find him not only giving exhibitions with his Phantoscope picture machine, but, representing the League of American Wheelmen, making a lone bicycle trip from Washington to his old home at Richmond, Indiana.

The route was up the towpath of the C. & O. Canal to its intersection with the Old National Road, which was then followed through Wheeling and Columbus.

The mules pulling the canalboats were not yet accustomed to bicycles, and, getting out of control of the driver, ran down the embankment into the field, permitting the boat to

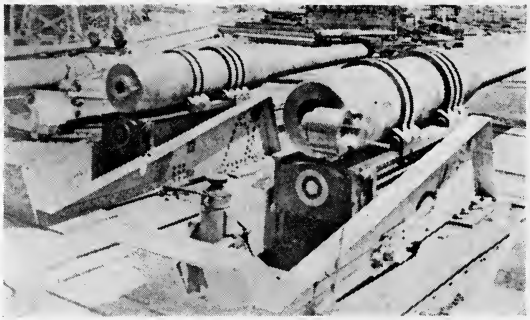
Old C. & O. Canal

drift. When the cyclist had passed, the mules got back again on the towpath and tightened up on the towline. The boy had forgotten that it lay hidden in the tall weeds, and ignominiously the cycle and its rider were swept into the canal. This mishap was the cause of great glee on the part of the boatmen, between whom and the cyclists there was no love at all. But the boy fished his cycle out of the canal with a tree branch and went on his way.

Children chained to top of canal boat to prevent their falling off

Another incident of this cycle trip seems worthy of repeating, for it disclosed to the boy a new point of view. He stopped in a mountaineer's cabin to get out of the rain. There was a ladder in one corner of the cabin reaching up to an opening in the space under the roof. At different elevations on the rungs of this ladder sat the mother and two grown daughters, in silent, barefooted contentment. When the shower passed the mountaineer went out to fetch a watermelon; the cyclist meantime, trying to encourage friendly address, tells them how far he has already come. At this the mother exclaimed:

A Virginia mountaineer's cabin

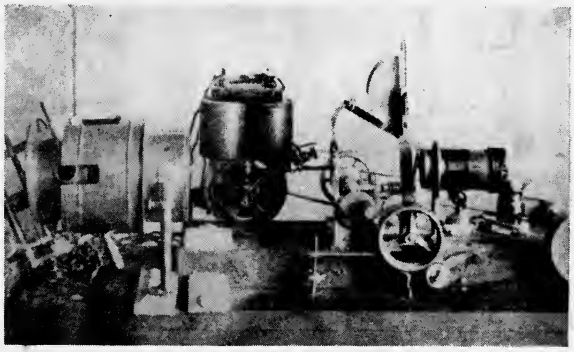


"Peacemaker" of 1894

"What, from—Washington, D. C.? Gee, I'd think you all'ed feel awful lonesome livin' so fur away." The center of the world for them was that log cabin on the mountainside.

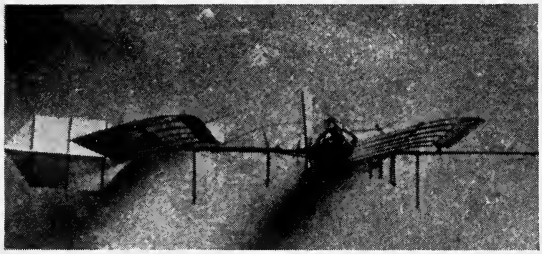
After his return to Washington, the first official use of the Phantoscope camera was made in an attempt to photograph the flight of a projectile, on the occasion of an armor test at the Indian Head Naval Proving Grounds, the pass for transportation on the tug from the Washington Navy Yard being signed by Admiral Sampson, later of Spanish War fame. The camera was duly set, and the camera motor started from the protection of a bombproof. But the concussion of the very first discharge of that great gun, "The Peacemaker," split the camera into kindling. The tug brought back a wiser boy than it took down the Potomac River that morning.

In the winter of 1894 the young inventor was introduced to the junior member of a real estate firm in Washington, a man possessed of that great lubricant for inventions, money, and in March (1895) a contract was signed to "finance and promote the invention of the party of the first part."



Atlanta Exposition motion picture projector

Three machines, refined copies of that old 1894 projector, were



Langley model power plane

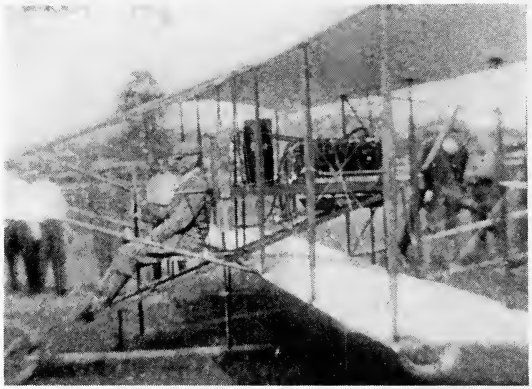
made and taken to the Atlanta Cotton States Exposition, where a special building was erected, being, therefore, the first motion picture theatre.

But attendance could not be secured because it was found impossible to get a mental image of the new pictures into the heads of the Midway visitors. They would listen to the "barker," smile incredulously, and pass on. The plan was then adopted of throwing the doors open and inviting the weary sightseers to enter and rest. Whatever they expected to see, it is certain they were quieted, if indeed they were not startled, by the exhibition. However, on suggestion, nearly everyone left twenty-five cents at the box office as they passed out, certainly a fine showing of the American's love of fair play.

Then came the fire, started in the negro plantation concession where an open gasoline torch and a thatched roof kindled a blaze which swept southeast and left nothing but charred remains of the concessions beyond, among which was that first motion picture theatre.

First man-carrying airplane—Wright Bros. Fort Myer, 1908

One of the three projecting machines was saved, for it had been left in a trunk at the hotel down town. This machine was taken to New York City by the promoter without the knowledge of the inventor, and exhibited before T. A. Edison's repre-

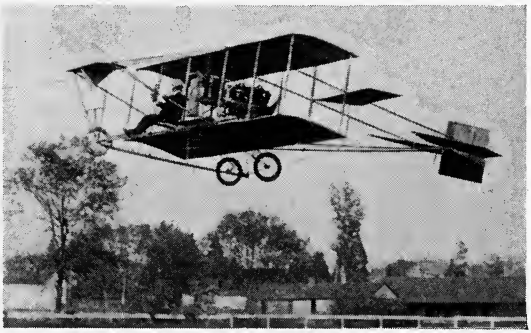


Early Curtis Airplane, Arthur McCurdy, pilot, 1908

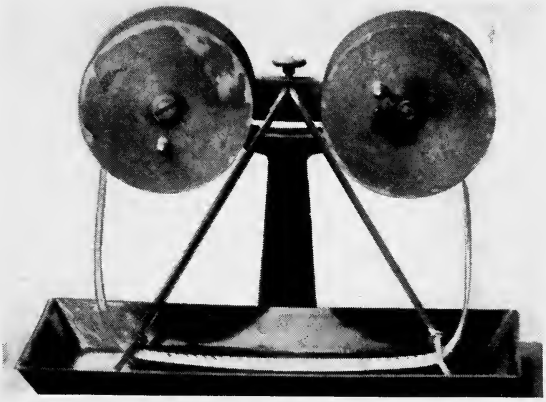
sentatives in a vacant room in the Postal Telegraph Building, on lower Broadway; whereupon an arrangement was consummated whereby the machine was to be made and marketed by the Edison Manufacturing Company, as the Edison Vitascope.

Meantime the inventor had gone back to his stenographic work. But this could not last long. Inventing was now too fixed a habit, in the grip of which he was helpless. So he handed in his resignation, explaining to his good friend and chief, Mr. Kimball, that he had determined that inventing should keep him or break him of the habit. And for seven long, grueling years thereafter it wasn't certain which it would be.

Soon after resigning his position in the Treasury Department, the young man brought his picture invention to the attention of the Franklin Institute, of Philadelphia, giving a demonstration of such realism that a motion was made to have it come before the Committee on Science and the Arts, although a member in seconding the motion said that, while he thought the abbreviated skirts of the dancing girls shown on the screen might not add to the dignity of the Institute, he did, however, heartily second the motion. He also remarked that while on his



Curtis plane in the air

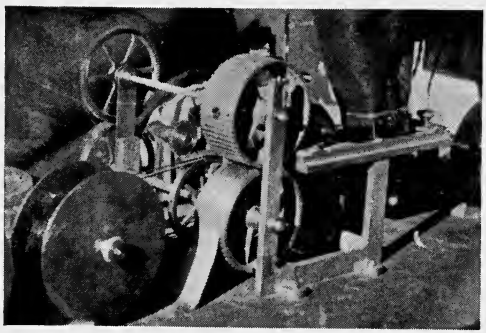


Early developing tray

feet he should like to ask the inventor if he could suggest any plan by which the device could be made commercially profitable. The inventor had to say he did not, though machines of which this one is the prototype are now in every theatre the world over, and became the foundation of one of the largest of all industries. The idea of a special theatre for pictures had not yet been born.

It was the 5 cent theatre which later released the golden flood; for just as the central exchange made the telephone widely useful, so it was the establishment of the film exchange to serve many theatres in turn with series of picture films, that made their wide use possible, and motion picture a synonym for easy money fortunes.

But to return to the Institute proceedings. After due investigation, the Committee recommended that the Elliott Cresson gold medal be awarded in recognition of the invention of this wonderful machine. When this recommendation was published in the *Institute Journal*, a protest was filed by interested parties, resulting in another period of deliberation and consideration of evidence. But in the end the protest was dismissed and the award made, establishing the fact of sole inventorship of



First motor printer

1331 CONNECTICUT AVENUE,
WASHINGTON, D.C.

April 24 1896

W. C. Francis Jenkins
My dear Sir

I must thank you for the opportunity you have afforded me of seeing your Phantascope in operation.

The simple and ingenious mechanism by which you have secured an intermittent motion of the photographic films has enabled you to employ a continuous light of great intensity suitable for projection purposes; and I must congratulate you upon your success in throwing upon the screen life-sized moving photographs with such remarkable fidelity to nature.

Wishing you every success I am, my dear Sir,
Yours truly
Alexander Graham Bell

Camera built for Maryland Agricultural College

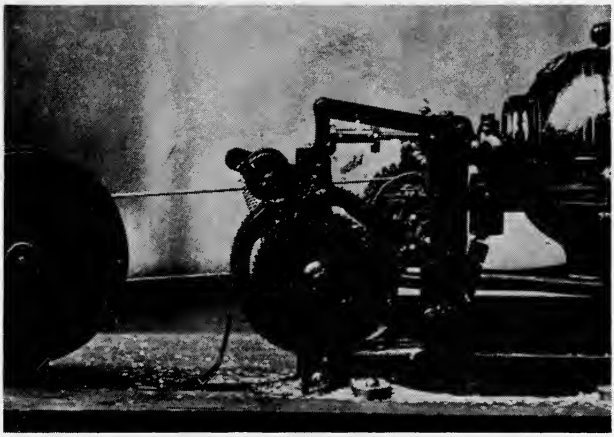
the type of projector which has come into universal use the world over.

Eighteen years later a second medal was awarded for further work in which the judgment of the previous committee award was affirmed.

A mutual friend introduced the young inventor to that great man, Dr. A. Graham Bell, of telephone fame, who immediately asked if a demonstration could not be made at his house on Connecticut Avenue. This suggestion was carried out a few nights later, at which time he inquired as to the feasibility of using the new machine for teaching the deaf to read lip motion. A test film was made of a repetition of the Lord's Prayer, to the reproduction of which Mrs. Bell was invited without her knowing what to expect. The success of the experiment was considered proved when Mrs. Bell began reading the message of the moving lips in the pictures. At Dr.Bell's request, the film was deposited for safe keeping in the Volta Laboratory, Washington.

Oh, those wonderful growing days, when a motion picture of Niagara Falls was intensely fascinating; the waves breaking on the Atlantic City beach awe inspiring; and the Black Diamond Express terrifying as it dashed across the screen toward the audience.

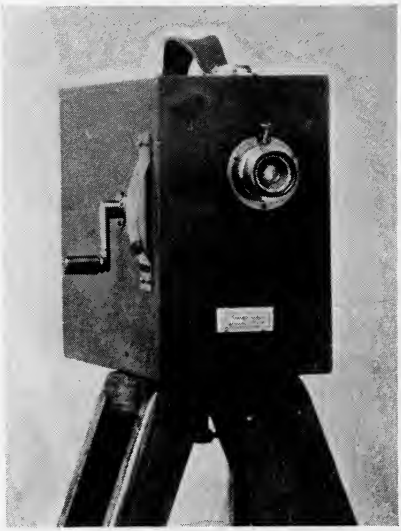
Niagara Falls, from first motion picture film



An early film-perforator

It was gratifying as showing an appreciation of work well done that the Kodak Company ordered of the young inventor a film perforator built to meet the slowly increasing demand for long-length perforated film.

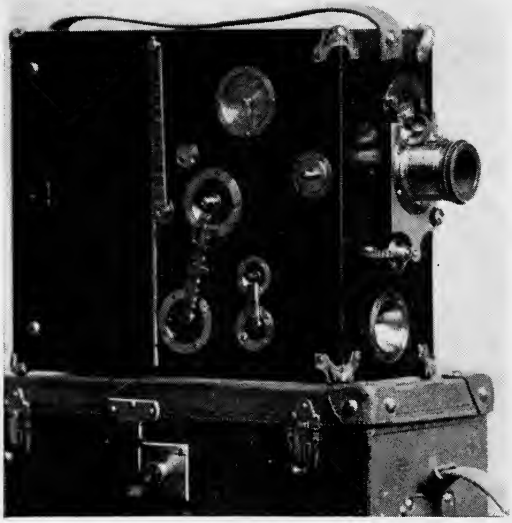
The machine was built, delivered, and personally set up. But Mr. Eastman probably never knew that his lunch invitation was a blessing to the breakfastless inventor. His poverty was discovered, however, when the request was made that the check in payment for the machine be cashed so that return railroad fare could be bought.



First motion picture camera to go into the Klondike

It wasn't so very long after this that John Carbutt, a dryplate maker, of Wayne Junction, Pa., decided to begin the manufacture of strip film for motion pictures. This occasioned a visit to the Washington inventor, where an order for certain necessary machines was placed, and which in time were delivered.

It was likewise in the Washington inventor's little place that the motion

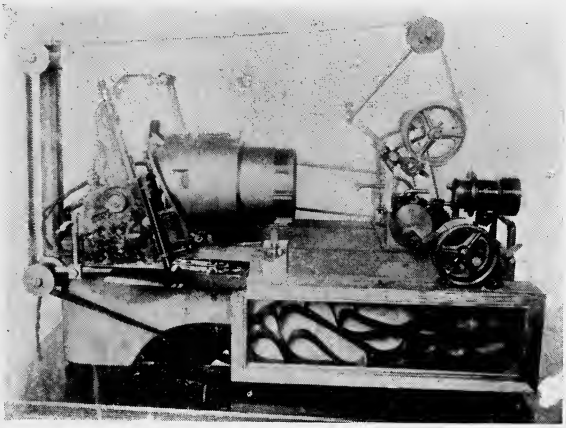


Motion picture camera made for Mr. Holmes

picture camera was made which first went into the Klondike, purchased and taken there by Herbert Miles.

In response to a cablegram a trip was made to New York, and here the motion picture inventor met the lecturer, E. Burton Holmes, and his cameraman, Oscar B. DePue. Plans were discussed for the construction of a special motion picture camera, a camera which ultimately went several times around the world.

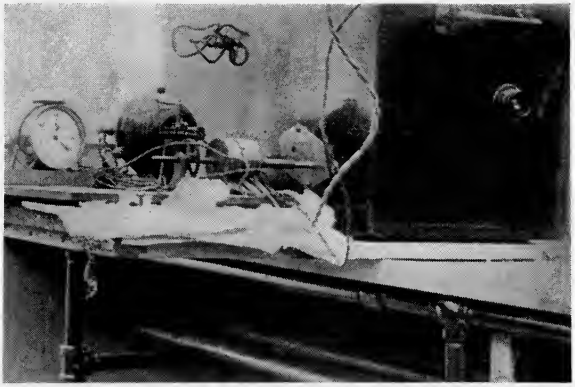
But perhaps the most comedy came from the entrance of "Pop" Lubin, a spectacle man of Philadelphia, who came to the then Washington mecca of picture apparatus and recklessly bought the whole outfit. Because it was Sunday, and no assistance readily available, his man, left on guard, slept on the studio floor Sunday night. Lubin's rise from this humble equipment to a multi-millionaire establishment, and his subsequent loss of the whole accumulation, is a story in itself, not, however, to be



Early commercial projector

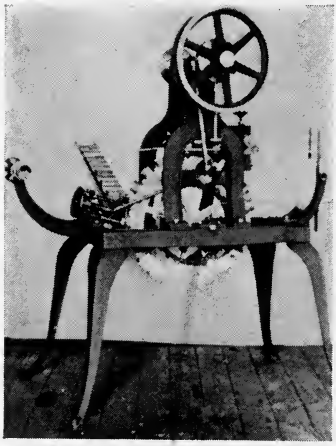
told here.

It was about this time that his efforts were directed toward proving the worth of the new instrument as an aid in education and in scientific study. From the appropriation which Gifford Pinchot secured from Congress to establish the U. S. Forestry Service, Mr. Pinchot set aside a sum for film, to be used by the young man in photographing growing plants.



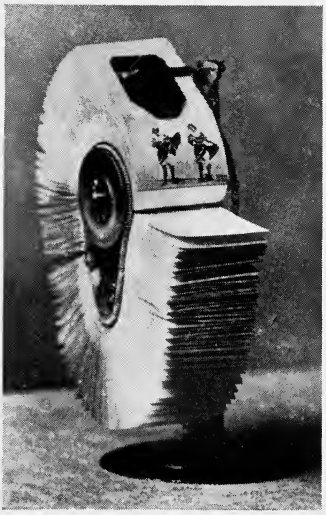
Clock-controlled camera for studying plant growth

The camera was set on a bench in a greenhouse of the Agricultural Department, with its lens looking at a box of earth in which tomato seed had been planted. A motor was attached to the camera in such a fashion that the film was exposed and moved forward at regular time intervals controlled by a clock. The plan was to show on a picture screen in a few minutes the plant growth which had taken weeks to produce, so that the plant could be seen pushing up through the soil, putting out leaves and buds, which flowering later produced fruit. The work went on nicely until one sad day a driving rain, coming through the greenhouse roof, got into the camera and so cemented the convolutions of the roll of exposed film that it could not be unrolled for development. This ignominiously ended the boy's first purely scientific labors in motion picture use.



Automatic paper-box capper

But, as always, a residue of experience remained, even a



Motion pictures on cards

physical bit of the experiment, perhaps, enough to indicate a usefulness in educational work. To no one did this feature appeal more strongly than to Major W. B. Powell, at the time Superintendent of District of Columbia Schools, but best remembered for his voyage of discovery down the Grand Canon of the Colorado, the first white man to explore its length. On February 11, 1899, Major Powell wrote thus: "I see a wide field for the use of your Phantoscope in the teaching of science to the children of the schools of the country," a vision which was not put into tangible form for many years, although the time was to come when a machine of this inventor's construction became a part of the equipment of every high school in the city of Washington, and as well many clubs and churches. Nor was the Board's action less effective because of the friendly activity of Professor Magee, that odd scientist who spent his annual vacations in the impressive silence of the desert, by a waterhole in the shade of a great rock, alone for the whole of a thirty-day sojourn each year.

In August, 1899, the motion picture camera was again called into use for scientific purposes, this time to record a dramatic ceremony, i. e., the snake dance of the Hopi Indians, of Tusayan, Arizona.

Perhaps the story can be no

Card motion picture toy

better told here than it was told in a letter, written by Mr. Jenkins on the train returning, addressed to a friend back home.

"Dear Miss Grace:—

"The great ceremony is over, and I am on my way back to table meals and bath tubs.

"But it was a great show, and a solemn ceremony in spite of the weird incantations and painted actors. They seemed very much in earnest, these old Hopi priests, and one could but respect their faith and devotion.

"I received my notice to come out here so late that there remained only just time to reach the scene early enough to get the whole performance, that is, that part which the uninitiated are permitted to witness.

"Arriving at Canyon Diabolo, a train stop on the Santa Fe Railway, I get off with my photographic traps. It wasn't a very exciting place; there was only the box-like station, the trading post store, and a corral.

"I make my errand known to the owner of the trading post; hire a pair of mules, and a light wagon into which I put my junk. The storekeeper directs me on my way thus: 'Keep a little east of north, and before sundown you should reach the middle trading post, where they will give you a fresh pair of mules. You will find a trail most of the way.'

"With these instructions, and the mesa a hundred miles away, I set out across the sandy waste, with the hot sun getting hotter as the day advances. But I reach the middle trading post just about sundown, as the trader said I would. After a brief rest and supper, a fresh pair of mules are hooked up for me, and I start out again with the ominous import of the trader's directions disturbing me: 'There is no trail from here on,' he says, 'all sand; but if you bear a little east of north you should be in sight of the mesa by morning.'

"I go on; the moon comes out and looks down on lonesome me in a desert of sand, headed 'a little east of north.' For a moment I am stricken with terror, knowing that to get lost in this waste of sand meant a lingering death. But, getting a grip on my courage again, I relieve my fright by beating the mules into a gallop for a mile.

"However, the friendly stars smile and beckon me on, the course being laid between the north star and the great dipper. All night I push ahead, and as the gray dawn begins to faintly show in the eastern sky, I unhitch the mules and let them feed out of the wagon, while I roll up in a blanket, wriggle down into the sand, and sleep. When I awake, the sun is just showing, and I look ahead to see the welcoming mesa, 'a little east of north.'

"And what a relief to discover that my navigation has been 100 per cent correct. I had dreamed that I was finding my way by compass, and that the compass had been acting in a most erratic fashion, pointing this way and then that as though it was itself lost; so that finally I had decided to set it by the pole star, as one might set a clock by sundial.

"But it was only a dream, and in my satisfaction at finding everything all right I was tempted to lie down again in that cozy nest in the sand, out of which I had hustled when the rising sun had peeped at me across the plain.

"There is a feeling of unequaled peace and contentment steals over one in the death-like quiet of the desert. No city noise or other clamor of civilization disturbs the great quiet. I can almost hear my pulse; not a sound except an occasional squeak from the harness as the mules stand eating oats out of the feed box of the wagon.

"Nor is there an interruption to the view as far as the eye can see across that great sandy waste, except the welcoming sight of the mesa ahead. It reminds me of the purpose of my errand. I must get going now without delay.

The Pueblo of Walpi

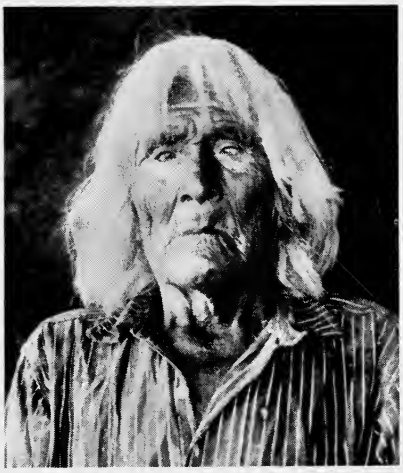
"Hitching the mules again I am soon at the foot of this great rock, a rock perhaps three miles long and a mile wide at the widest place, and sticking up out of the sand to a height about equal that of the Washington Monument.

"The first I meet here are two comely Hopi Indian maidens who have come down to the spring to fill their baskets with water, and which they will carry, on their heads, to the top of the mesa. Yes, baskets, 'pitched' inside, I guess, as was the cradle of rushes in which Pharaoh's daughter found baby Moses floating on the river when she came down for a swim in the sacred Nile.

Hopi Indian blanket loom

"I sent word by these young ladies for two Indian boys to come and carry my luggage up. And presently here they came, running down the tortuous path, a path so steep that it shortened my breath in the climb. But soon we reach the top, and the village of Walpi; and presently I find quarters with a young married couple and their baby boy.

"Then I go about getting 'the lay of the land.' The people are moving here and there with quickened step,



The old town-crier, Walpi's daily newspaper

for there is the feel of expectancy in the air, much like circus day back home.

"I meet the old town-crier who has just come down from the housetop, where, in stentorian voice, he had broadcast the news of the day, which included, I find out later, the arrival of a visitor from the town of the 'Great White Father.' He is an interesting man, this old town-crier, obviously quite intelligent, but with a face as wrinkled as an old boot. With stately mien he crosses the plaza, disappears in a doorway, and, for the time, is lost to me.

"But let me tell you something about the place, before I say more about the people. The houses are made of adobe, that is, dried mud blocks, set up on the flat top of the mesa; and are one, two and three stories high, the roof of the house below being the door yard of the next house above, all set back from the precipitous edge to leave a plaza in front of them; and this plaza is where the snake dance is to take place.

"Each house of this composite dwelling is a separate apartment, owned separately, the upper stories reached by wooden ladders set up outside. The woman of the household owns all real estate, passed down from mother to daughter in each generation. About all the

Hopi Indian apartment house

men folks seem to own is the jewelry they wear, and maybe the burros which clutter up the place.

"But this being a gala day, every native is dressed in extra gaudy colors. The Hopi maidens are wearing their hair in whorls of shimmering blackness above each cheek. Others wear their hair in two ropes hanging over their shoulders, the hallmark of the married women. The youngsters are the only ones not dressed in finery, but as they are dressed in nothing else, perhaps they have the best of it after all.

A Hopi maiden's hair dress

"The day passes quickly while I learn much from these rather good-looking, and delightfully friendly people of Tusayan. I get the old cobbler to measure my foot for a pair of moccasins; and the jeweler to make me a bracelet out of silver dollars. Beads he makes of dimes, burnished into hemispheres in the palm of his hand, and the edges of pairs of them welded to make spheres, as he squats before his tiny charcoal fire, intensified by blowing through the hollow bone of an eagle's wing. A young man shows me the Hopi's only weapon, the boomerang; how it will return to the thrower, and how they kill jack rabbits with it. I join the kachina chase, and am permitted to capture the prize by the purposeful clumsiness of my betters.

A Hopi matron's hair dress

"A kisi, or bower of cottonwood branches, is set up on the plaza, near the houses.

His wealth in silver jewelry and buttons

The sun goes down, and a feeling of intensified expectancy fills the air. Visitors and natives gather on the house tops, and line the plaza space next the house walls. The big show begins just as the sun disappears below the sandy horizon.

"I had set up my camera in a favorable location suggested by one of my newly made friends, and am all ready to 'shoot the show.'

"Presently a devout old priest, with grave tread, enters the kisi with a bag of snakes, just come from participation in the mysterious rites in the kiva below.

"Almost immediately the antelope priests make their grand entry; in scanty attire, with painted bodies, and with clanking tortoise shells tied to their knees. Four times around the plaza they march, chanting as they go, to finish up in a line on each side of the kisi, where, still chanting, they mark time with their moccasined feet. These antelope priests range in stature from full grown men down to very small children.

"Now a hush falls on the spectators, the moment of the big event has arrived. And here they come, the snake priests, in single file, stately procession, their white-striped

Corn grinding and baking

bodies undulating in unison and in time with their weird chanting. Four times around they go, in dignified progress, finally to line up facing the antelope priests, their steps marking time to the beat of the members of the junior lodge they face.

Basket weaving

"Suddenly the snake priests break up into groups of three, and one of them, the 'carrier,' steps forward to receive his first snake from the priest in the kisi. Grasping the wriggling reptile by neck and body he places it between his teeth, shuts his eyes, and, guided by an attendant, he begins the circuit of the plaza, the other attendant following close behind.

"Of course the snake resents this rough treatment, and coils and uncoils himself about the carrier's neck and arms, the while the attendant, with feather-tipped stick, wards off a too intimate contact with the snake's fangs.

Hopi snake dancers

"The fourth time around, the carrier drops the snake, which immediately coils himself and defiantly holds his head erect ready to strike. But that is exactly what the gatherer does not permit. Tormenting the snake with his feather-tipped stick, he soon uncoils, when down swoops a hand that snatches him from the ground by a grip around the neck. The snake is then taken over to the antelope priest line, to be held by one of them until wanted again.

Hopi priest in daily garb

"Other three-member groups follow the first, in corresponding order and procedure, but I notice that the poisonous rattlers are always handed to a full-grown antelope priest, while the harmless bullsnakes are given to the younger ones to hold.

"One little chap received a big snake, more than twice the length of himself. He had grasped his prize too low when it was handed to him, and the snake swinging its head about finally hits the little fellow a bump on the nose. He drops the snake and crying turns to his mother who is seated only a few steps away. The mother coos and pets and praises him until he again has courage enough to go stand in the line and receive the snake from the gatherer, who had instantly recaptured it when the snake had dropped to the ground.

"I shall not soon forget that courageous youngster as he stood the second time in the line, sniffling to be sure, but holding onto that snake with a two-fisted grip that fairly choked the life out of it.

Snake dancers and visitors

"The incident brought to my mind, as I cranked away at my camera, a scene of my own early childhood, when another mother, following a similar panic in her own little boy, had likewise soothed and petted him, and finally persuaded him to go back and stand in line again with his Sunday School class and say his scripture verse. How very like we are, after all, no matter what our dress, our color, or degree of culture.

"But my attention is brought back with a snap to the scene before me by a change in the pitch of the chant. An old priest is sprinkling meal on the plaza floor. He draws sacred figures therein with a stick, steps back, and all the snakes are thrown down onto the meal picture, a squirming mass.

"Then, at a signal, the priests dash at the writhing snakes, grab as many as they can, and race down the mesa trails, out onto the sandy plain, to release these messengers carrying prayers 'to those above' for rain on the meager crops of the worshipers.

"Returning, all participants repair to the ledge behind the pueblo where the women hand them bowls of a powerful emetic. I can't describe it to you, for I went right away from there.

"Then out onto the plaza women and girls bear trays of food, and all join in a gorgeous feast, which lasts until near midnight.

"I find myself getting hungry, and I ask my hostess to grind, in her corn mill, for my supper drink, some coffee beans I brought with me. The mill is a sloping stone set in the floor, on which she pours the coffee beans, and rubs them with another stone until the grinding is completed.

"She gathers up the pulverized product with a brush of coarse grass with which just a little while before I had seen her sweep the dirt floor, and with which earlier she had brushed her hair.

"In spite of this I liked the coffee she made,—I had to like it, as I did the corn bread she baked on the stone stove-top,—for I hadn't come there to starve.

"With my midnight supper over, I hung my coat on the 'blanket pole' spanning the room, and lay down to sleep on the wide dirt ledge running around the room, a few inches higher than the floor.

"Next morning, after a breakfast, which is practically a duplicate of my supper of the night before, I prepare for my departure. I pay my bill, and as I am about to leave am presented with a saddle-blanket of native weave and dye.

"My hunter of the day before presents me the boomerang with which he killed the rabbit. He assists another to carry my traps down the trail and load them into the wagon; and I start my return journey.

"The great bi-annual show is over, the Hopi snake dance. The whole is an elaborate prayer for rain, and rain it did that night. It poured. A dry sink near the middle trading post was now a lake around which I must detour.

"Eventually I reach the railroad again and board a train bound for the noise and confusion of civilization, but with a feeling that I should like to stay longer in the silence and the solitude of that great desert."

Back in Washington motion picture development was again taken up. The early collection of motion picture films largely consisted of elementary subjects, as has already been pointed out, and because dancing girl subjects were so easily obtained, these were frequently seen.

It was one of these subjects that was being projected in the room of the Capital Bicycle Club, before an audience of ladies and gentlemen, when something went wrong with the machine. The light being on, the picture continued on the screen as a single lantern slide. While the young man was tinkering with the balky machine, he heard a titter in the audience, and looking at the screen, discovered that the film had stopped just as one of the performers,

who was turning a flip-flop, had her nether extremities stuck up in the air in a very immodest fashion. He put the light out in a hurry.

It was about this time that the young man turned author, writing three books on the subject of motion pictures, in quick succession, all of which found a market during the swaddling clothes period of the new art.

Mrs. Grace Love Jenkins

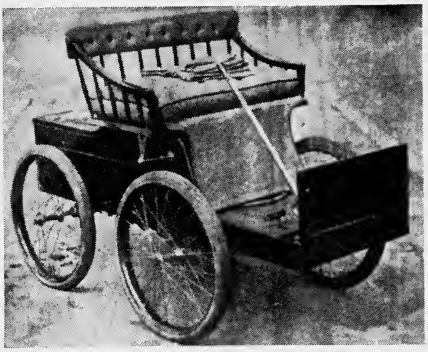
Perhaps the turning point came when he married that wonderful girl, "Miss Grace," who had endeared herself to everyone by her sympathetic understanding and unselfishness, winning the hearts and confidences of all who came in contact with her. It is to her kindly help and business wisdom, rather than to any personal "genius," that this inventor attributes such success as has attended his efforts.

The new home was set up in a very modest little frame house, which was bought on small monthly payments, for the inventor was too poor to rent the house, the rent being $35 a month. Many a time the end of the month approached without the cash in sight, but before the end of the last day the $25.50 payment was always ready. This situation was

A typical inventor's home

repeated so often it came to seem uncanny, and was spoken of with almost reverential breath.

In 1898 Mr. Jenkins built the first horseless carriage seen on the streets of Washington, D. C. It was indeed a queer-looking contraption, without springs, steered with a tiller, but with very fancy upholstery. About the most that can be said of this early horseless carriage is that it had a wheel under each corner, used steam as a source of power, and would actually run. Its top speed might have been eight miles per hour, perhaps, when everything worked fine. At any rate, it rarely had a speed which would prevent the small boy from running rings around it, and with a derisive thumb at his nose.



First auto in Washington, 1898

The steam generator was hardly larger than a large bucket. Nevertheless, the District Government insisted that a steam-boiler license must be obtained before they would officially permit its operation on the streets. The opposing argument was made that other mobile steam boilers were permitted in the city without licenses, namely, locomotives, and that it hardly seemed fair to require one for this little teakettle. But a license was insisted upon, and so a steam-boiler license it had, this first Washington automobile.

Other and better vehicles were built by Mr. Jenkins, "horseless carriages" though they still remained, until finally a large car was constructed, seating twenty passengers, the first sight-seeing bus, doubtless. It was well made and driven by a double compound steam engine. Individual chairs were

This horseless carriage is thought to be the first to have the engine under the hood in front.

First "sight-seeing bus." A steam-driven car with compound engines.

intended for the passengers; but the financial backers refused to put up any more cash, and so the car was sold at auction by the holder of a note for a borrowing made thereon, and the car went to New York City for sight-seeing service in Central Park and Riverside Drive.

This inventor, like other pioneers in horseless carriage development, went broke, but each contributed his bit, and set the goal stake a little farther ahead, until ultimately the automobile came to such a state of perfection that, with the slogan, "The most transportation for the least money," it made one of our citizens the richest man in the world. And with this undertaking was born a new business policy. A policy of high wages and a superior product at the lowest possible price. It was a revolutionary policy, but it worked.

In 1900 Mr. Jenkins was asked to assist in the defense of independent motion picture producers who were being sued by the motion picture trust for alleged patents infringement. Injunctions had been secured against several of them, one of whom, the I. M. P. Company, had sent its director, players and camera man to Cuba to make motion pictures, to avoid the injunction against making pictures in the United States.

Mr. Jenkins, from his experience, knowledge, and skill in the motion picture art, was able immediately to supply a non-infringing camera. This camera was brought before the Court to show that the plaintiffs were not entitled to a broader interpretation of their patents than the patents themselves disclosed. And as the new camera seemed to establish this, the injunctions were dissolved, and in due course the Court rendered its decision, in the following language:

Quoting from C. C. A., 2nd Ckt., March 10, 1902, Fed. 114, page 926, the Court said:

"The photographic reproductions of moving objects, the production from the negatives of a series of pictures, representing the successive stages of

motion, and the presentation of them by an exhibiting apparatus to the eye of the spectator in such rapid sequence as to blend them together and give the effect of a single picture in which the objects are moving, had been accomplished long before Mr. Edison entered the field."

This decision set the infant industry free to grow as its merit as a public entertainer might warrant, ultimately to become the most widely accepted source of group entertainment ever known. To this "dumb" show, speech, music and appropriate sounds were later added, and often in all the gorgeous colors of nature. Many attempts were made to introduce depth, i.e., stereoscopic relief, in the picture, but to date no publicly-acceptable method has been found.

Within a few months, after taking over the responsibility of financing a home, Mr. Jenkins began the consideration of a more sanitary container for the delivery of milk to families. The glass bottle had, by that time, entirely superseded the milk-can and hand-dipper to fill the pitcher or pan left on the doorstep by the housewife the night before. But the glass bottle was often used for such unsanitary purposes as to cause Health Bureau Officials heartily to encourage the trial of the proposed new single-service container. As finally designed the new "bottle" consisted of a spirally wound cylindrical box of paraffined paper, with fixed bottom, and slip-cover top.

Automatic machinery was built to make the boxes as a continuous process, which was recognized as the only way it would be possible to make it if it was to successfully compete with the multi-service glass bottle.

The glass bottles cost five dollars a hundred. A survey in several cities was then made to discover the number of trips a bottle averaged before it was lost or broken. This was found to be ten trips. Obviously, then, the single-trip paper box must sell at five dollars per thousand. And for three years it was done. But the margin of sales price above the total price was so very narrow that it was ultimately decided to double the sales price and confine the use of the box to articles selling for a much higher unit price than milk; for example, ice cream, cottage cheese, oysters, and the like.

This proved the practical field of usefulness for this particular receptacle, and that is why you find these handy boxes at your favorite grocery and drug stores, a box made so well that the housewife saves them for other uses, when emptied, and reluctantly throws them away when too many accumulate about the house.

When to sell a patent, if the invention is such that a sale is best, is often of importance to the inventor. For example, a ball bearing of a new type was designed; a patent secured thereon; and an offer of $750 was received from a manufacturer of ball bearings. The inventor held out for a higher price. Very shortly thereafter the "ball-separator" or "cage" bearing came out. It was better, and the sale of the other ball bearing was now impossible.

In discussing this situation with his patent attorney the inventor was told of a similar case in trolley car development. At first the current collectors ran on top of the trolley. Trouble was often encountered at the cross-overs. The attorney's client had invented an excellent device, and $300,000 was offered for the patent. The attorney urged him

to take it, but the inventor wanted "a million dollars." While he waited, a patent was issued for the now universally-used under-running trolley arm, and the other patent was worthless; the inventor could not sell it at any price. The conclusion seems to be that when the inventor gets a fair price offer he should take it.

The successful completion of an invention rarely means the end of the mental worry. The inventor may make a good sales arrangement, but this does not always mean his troubles are over. Our hero invented a milk-bottle capper. It was really a very good bottle capper. He took the model and the patent to a dairy machinery manufacturer in a distant city. A deal was consummated whereby the inventor was paid $10,000 in cash; to be followed by a royalty of $2.50 on each capper sold. But time passed and no royalties were received, nor could the inventor get any answer to his inquiries. He then turned the contract over to an attorney for action. Later on it was discovered that the attorney was crooked and had surrendered the contract for a cash consideration which he pocketed. The conclusion this time seems to be: Select honest civil attorneys as well as honest patent attorneys. Both are available.

When, in 1908, President Theodore Roosevelt, on the White House yacht, *Mayflower*, went down the Potomac River to Hampton Roads to review the battle fleet, Secretary Newberry of the Navy authorized the young man to take his motion picture camera aboard the Navy tug put at the disposal of photographers, on the usual arrangement that "copies of all photographs made and of all the motion pictures made" should be delivered free of cost to the Navy.

It was a marvelous sight, that great parade of fighting watercraft, and the motion picture contributed to a permanent record of fleet activities.

On the way home the value of motion pictures as

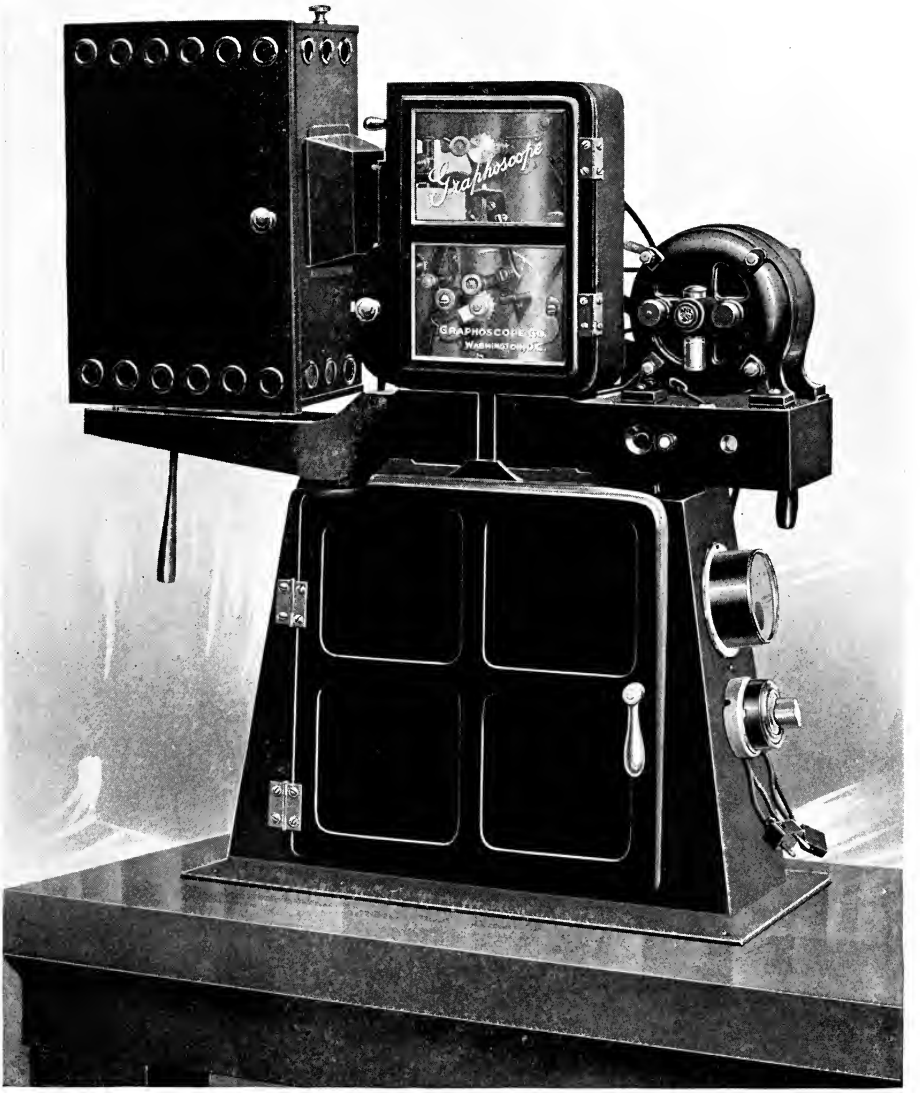
an educational means was discussed among the pressmen, with the result that the inventor determined to take a try at it. So he designed a projector, especially adapted to the new service, fire safety being particularly emphasized. On the test by fire authorities, its fire safety features being demonstrated, this particular machine was approved for use without the usual booth. This advantage greatly enlarged the usefulness of the machine, for similar action was taken in several states and quite a number of cities.

The inventor set up a corporation to exploit the new machine, and in the first year, the year of its introduction, ten times more business was done in the territory covered than by all competitors combined. With this claim proved, buyers for the patents of the little corporation were easily found, a new corporation set up, and a skilled merchandizer put at the head of it.

Mr. Jenkins was then again free to follow new research and invention on his own account.

A new usefulness was proposed for the motion picture camera, namely, undersea pictures. A water-tight chamber to contain the camera and operator with a free air tube leading to the surface. In the end of the chamber a thick glass window was set, through which the camera lens looked, and another such window through which the camera man sighted his aquatic subjects. The vertical air tube provided equalized air pressure from the surface, with a gentle circulation provided by a small blower. The scheme, in one modification or another, has been in

Undersea motion pictures



The Graphoscope; first motion picture projector designed exclusively for educational use.

The penalty of being a pioneer. This road today is a fine motor boulevard.

use ever since.

It is believed to be capable of greatly enlarged usefulness in wrecking operations. For example, through switches controlled by the operator in the under water chamber, grappling hooks, scoops, magnets, and the like, could be handled in almost exactly the same way the crane man now operates in open air circumstances. Salvage operations could then be carried on as a continuous process, the chamber being held to the iron sides of the ship by magnets at the end of extended arms, for example.

But when the physician, in 1910, said that the inventor must immediately take a rest or his life span would end within six months, Mr. Jenkins, accompanied by Mrs. Jenkins, put the wheels of his automobile in the ocean at Atlantic City. Then heading westward, he continued toward the setting sun until the same wheels rolled through the surf running over the white sands of the Pacific coast.

Many days after leaving the Atlantic coast the car drew up beside a concrete post the cross-arm of which read: "1733 miles to San Francisco; 1733 miles to Boston," with arrows pointing west and pointing east. After reading the inscription Mrs. Jenkins exclaimed: "Do you mean to say that we are only halfway across?" But it did not matter, for by that time the trek had become an enjoyable vacation.

Varied experiences were encountered in this first trans-continental automobile crossing of our country. In many places, no roads of any kind, not even trails; past homesteads with a single barbed wire enclosing the ranch, and, sometimes, on a board hanging to the wire where the loose end was wrapped around a post, the forceful admonition: "—— you, shut the gate."

Discoveries new to the tourists were made almost daily. Just before reaching Medicine Bow the car traveled a road at the foot of an oyster-shell mountain. This mountain had once been a dimple in the

ocean floor. But a geological upheaval of long ago had turned this dimple over, leaving it a mole on the face of the plain, three thousand feet above present sea level and a thousand miles from shore.

At the end of another day's driving the car rolled into Salt Lake City, over the last 75 miles of the old Mormon trail. At the banquet given the tourists by the Chamber of Commerce a few nights later, an inscription was read on the bleached forehead of a buffalo skull (in a glass case), as follows:— "Made fifteen miles today. All well. Brigham Young."

Another day the car was stopped beside a similar buffalo skull, with one horn stuck in the sandy gravel of the plain to hold it in place. Upon the flat of the skull was scrawled:— "Water twenty paces," and underneath, an arrow pointing to a pool of that lifegiving treasure often scarcer than gold in that arid territory.

In due time the car, crossing the California-Nevada state line at Lake Tahoe, rolled down the sunny side of the range to Sacramento to spend the last night before reaching San Francisco and the Pacific Ocean. A few days later the trip was continued southward to Los Angeles, where, dipping the wheels in the Pacific, the first transcontinental tourists' tour ended in a glorious uproar.

The car had been initially fitted with knobby tread tires, the first of their kind, and replaced with the same kind as often as required. The knack of vulcanizing tires with knobs had not yet been mastered by the makers, so that they were rather easily detached by souvenir hunters when the car stood unattended on the streets of Pacific coast cities. But this destruction of the tires was accepted philosophically as a part of the penalty of the pioneering game.

Motion pictures and "stills" were made on the trip, a record both entertaining and useful as the study of transcontinental automobile roads became more and more acute.

Returning to Washington, and resuming the study

of motor cars, it seemed obvious to Mr. Jenkins that as automobiles came more and more into use, and particularly as larger engines with more cylinders were built, some self-starter means must be provided. On the larger cars it took a good, husky man to crank the engines; ladies were barred. The first application was a self-starter which Mr. Jenkins had invented a year previously, development of which was interrupted by the Ocean-to-Ocean trip. He tried it out successfully on a four-cylinder car, and then, for demonstration, bought one of the best of the few six-cylinder cars then available and similarly equipped that. It was found, as expected, that Mrs. Jenkins could operate this car as easily as a man could. So a tour of the few six-cylinder car manufacturers was planned, to sell them the idea of the new self-starter, and to license its use by them.

But the demonstration car had only reached Philadelphia when parties were found who wanted to buy the patents outright. The sale was consummated, though a part of the agreement provided for the completion of the tour as originally planned, with a representative of the new owner as a passenger. Incidentally, an additional value was found for the self-starter when the engine was accidentally "killed" on a very bad mud road. To have started the engine without the new starter would have meant getting down in that "muddy mud" to crank the motor. Those involved thanked the new invention for its never-failing aid in a bad situation.

About this time the study of airplane possibilities was begun; of course, from a layman's point of view. Applications for patents were filed on various "improvements." Many of the patents were issued before the inventor had ever been up in an airplane. Later, the result of a study of the flying machine from closer contact, kindred knowledge in other arts, and subsequent experiences as a pilot, disclosed that many of these patented ideas are foolish and impractical. The trouble lay, of course, in the fact

that the conclusions were drawn from the limited knowledge of the man on the ground, in ignorance of the entirely new phenomena involved in an airplane in flight, and hardly to be guessed by an engineer, the lever fulcrum of whose reasoning rested on the ground, or at least something more substantial than a baby's breath. Just as an illustration: how many of us knew in 1912, and how few know now, that 75 to 80 per cent of the lift of an airplane comes from the air which passes over the top of the wings?

The beginning of war in Europe, which later came to be designated as "the World War," started the study of our preparedness in case we should be drawn into the conflict in defense of our own security.

The use of motion picture cameras aboard airplanes was one of the subjects involved, and Mr. Jenkins was called on for such assistance as he might be able to render.

But as his standard motion picture camera must be modified to best adapt it to work from the unstable base of an airplane, the inventor began his first series of test "hops" aboard Navy bomber planes not long after Kaiser Wilhelm started out to conquer the world singlehanded.

The first move was to overcome the wobbly effect which would appear in reproductions of motion pictures made aboard flying machines. "Still" pictures, i.e., "snapshots" pictures, could very successfully be made from planes, of course, but motion pictures could not.

So two methods to hold the camera steady were tried. The first consisted in mounting the camera on a heavy leather belt buckled around the waist of the cameraman as he stood in the gunner's cockpit aboard the plane. It was quite successful, and many excellent movies were made over Washington with this arrangement.

The other method tried consisted in hanging the camera in a compass bearing frame and loading it with a pendulum weight so that the wobble of the

ship would have little effect on the camera because of the inertia residing in the heavy pendulum. The resultant pictures were quite satisfactory.

A further modification was later made in the camera itself, a continuous movement of the film being substituted for the usual intermittent movement. The film was drawn across a very narrow transverse slit. The traveling lens-image at the slit is an image of the terrain being flown over. And as the movement of the film is adjusted to approximate the movement of the ground image at the slit, sharp pictures are made. The result is a panorama picture of the course flown, an inch wide and two hundred feet long.

This panorama picture film is about an inch to the mile at suitable elevations. The usual length of a motion picture film for the same 200 miles would be about 15,000 feet long, or a ratio of advantage in cost of the new to the old method of approximately one hundred and fifty times.

These tests in airplane flights showed the inventor the opportunities, outside of motion pictures, for offense and defense, residing in the plane. Some suggestions were found useful and were adopted by our military forces, though none of them issued as patents until after the war. The government's rule of secrecy on inventions of war usefulness decreed, however, that applications thereon should not be issued during the war period, and so applications were tied up in the Patent Office for action later.

Before the entrance of the United States into the World War, the motion picture interest had begun to feel the inconvenience and handicap of the absence of standards. Efforts were made to form standards committees within the industry itself, but all such attempts were fruitless, principally because of a lack of mutual confidence in the integrity of purpose of competing interests. It looked as though this plan could not be made to work out successfully, so Mr. Jenkins decided to form a society of standard-

izing engineers on his own responsibility. Returning from the last of these previously fruitless attempts, he sent telegraphic invitations to engineer friends to meet him in Washington for the purpose. Thirteen came, and the Society of Motion Picture Engineers was organized and incorporated. Mr. Jenkins was selected president, but for some time he found holding the membership together a difficult task because of the skepticism resulting from the failure of all such previous efforts at standardization.

But hard work and member confidence in the integrity of the founder maintained the solidarity of the organization through the crucial period, and at this writing, the Society of Motion Picture Engineers has a world-wide membership, and its recommendations are accepted by the industry as though they were enforcible orders.

The Society will never compare in membership with the numbers enrolled in other similar societies, for example, the Society of Automotive Engineers, because of the relatively limited number of engineers involved in the industry. There are but three manufacturers of theatre motion picture projectors in this country, while there are hundreds of manufacturers of automobiles, motor boats, and flying machines, and employing thousands of engineers.

But as color and sound were added to the motion picture the development in related arts was applicable, and so new groups of engineers were added to the initial photographic talent involved. Engineers are now enrolled in the Society from some of the largest industries of our nation, and its accumulated store of information so attractive that the membership is now universal.

When the United States joined the defenders of the peace of the world, the new society of motion picture engineers found that its standardization had anticipated a forced standardization, and was, therefore, more useful because it was ready with standardizing service.

The portable projector, the Graphoscope, previously designed for school use, proved to be admirably adapted for use in cantonments and aboard troop ships, and thousands of them were put to entertaining and instructing the soldiers. Three were used aboard the U. S. S. *George Washington* which carried President Woodrow Wilson to France, and back again to his home country.

Mr. Jenkins volunteered for this and such other service as the government might find for him, and ultimately was sent his "dollar-a-year" check, following the wild scenes of Armistice Day and its release from the pent up sorrow and terror of the unknown.

During the war activities the inventor had seen the need for a simple, single piece device which would give to a stationary beam of light impinging on one side of it an oscillating motion on the emergent side, and as soon as released for independent work again, the discovery of such a device was undertaken. This research resulted in the invention of the prismatic ring, a new shape in glass, a new contribution to optical science.

A ray or beam of light incident on the ring from a fixed point is given an oscillating motion on the emergent side of the ring in rotation. It is comparable to a solid glass prism which changes the angle between its sides.

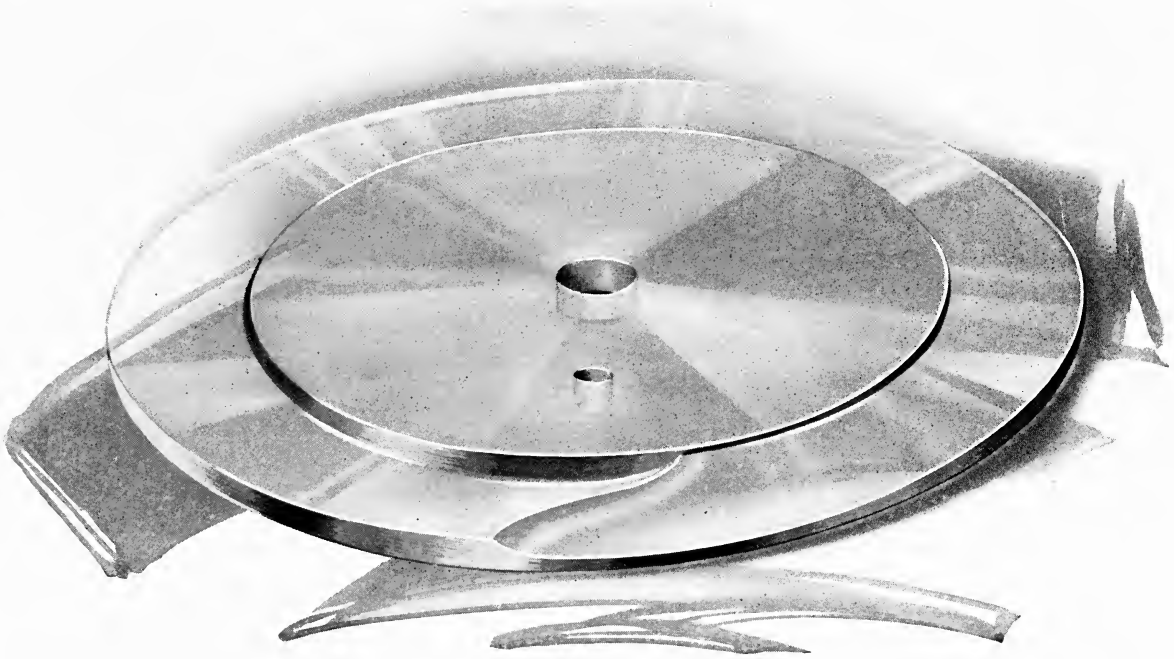
The prismatic ring was found very valuable in mechanisms for the transmission of photographs by radio, as will be explained later; and in a direct-reading ground speedometer for airships. As the ring becomes better known doubtless many other uses will be found therefor.

Some time after the signing of the Armistice Mr. Jenkins wrote a letter to the Secretary of the Navy requesting the privilege of purchasing a flying boat from the Navy surplus supply in store at Hampton Roads. Presenting the letter to Assistant Secretary Franklin D. Roosevelt, and after some pleasant

banter about the danger of flying, the letter was initialed. That evening Mr. and Mrs. Jenkins took the night boat to Old Point Comfort. After breakfast they crossed the Roads to the Navy storehouse where a flying boat was selected, this being the first intimation Mrs. Jenkins had had of the object of the journey. But the only criticism she made was: "I hope we will not regret having bought it." Later she repeatedly rode in that same flying machine, and enjoyed it, for Mr. Jenkins flew these boats, i.e., this boat and its three successors, for eight years without a single mishap of any kind whatever.

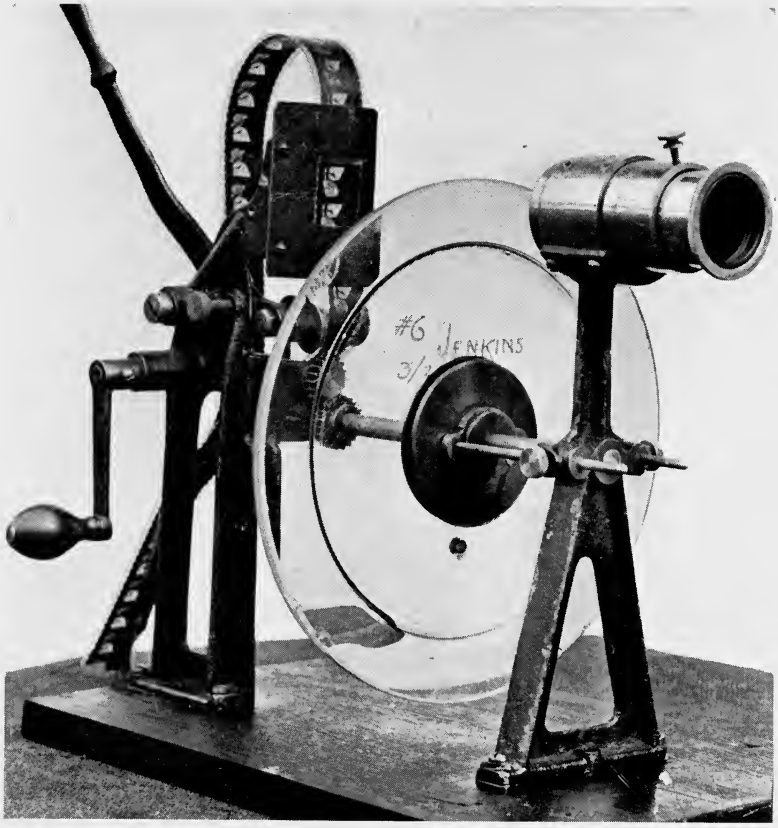
When this first flying machine was taken out of its 30-foot boxes, it was successfully assembled by following the blue prints which accompanied it. A check-up by Lt. Edw. W. Rounds, a Navy test pilot, was requested, and instructions in flying it. But this latter request was not favorably received. "You are too old," the lieutenant advised; "you must be nearly fifty." "I am past fifty," Mr. Jenkins replied, "but I am familiar with the principles ininvolved, and shall fly it intelligently." The pilot thought a moment and then said: "All right, if you will promise, on your honor, not to solo until you have been up with me for twenty flying hours." To which Mr. Jenkins replied: "I will promise not to take my first solo without your consent." In twelve hours the instructor's consent was given, and plans were made for the momentous event. With friends in a motor boat as "official observers," one of whom was the instructor's sweetheart, and others a boy friend and his sweetheart, with Mr. Jenkins' mechanic operating the motor boat, all was ready. After a few minutes in the air with the instructor, the plane was brought down on the water, and the motor boat moved up to it. The instructor goes overside and his place is taken by a bag of gravel so that the balance of the plane might not feel unnatural to the student.

The motor boat backs away, and Mr. Jenkins



Prismatic ring (disc type) for giving oscillation to a beam of light passing therethro.

Prismatic ring (band ring type). In rotation, gives oscillation to a beam of light passing therethro.



The prismatic ring can be rotated to follow any moving object; e.g., a motion picture film; or if fitted with a high-reading automobile speedometer the speed of an airplane or dirigible can be read directly off a dial by the navigating officer.

Every normal man instinctively seeks a recreational activity —hunting, fishing, riding, tennis, golf. The author's relaxation from research work is flying an airplane—and it's delightful sport.

"gives her the gun"; the plane skims along the water surface for a hundred yards or so, and then gracefully lifts, to sail around as obediently as before; and his first solo flight had passed into personal history.

Through the courtesy of Lieut. Col. C. O. Sherrill, in charge of U. S. public buildings and grounds, and later his successor Lieut. Col. U. S. Grant, 3rd, permission was given Mr. Jenkins to change passengers from the sea wall of Haines Point, one of Washington's playgrounds. A friend would be taken aboard and the plane headed out into the river by persons running along the wall and pushing on the wing tip. When out in the river, Mr. Jenkins would stand up on the seat, give the motor crank a pull, and the motor never failed to start. This was made possible by a little "jigger" which Mr. Jenkins had put on the motor, although before that it required three men to turn the motor over with snap enough to make it fire. Having started the motor he would drop down into the seat, fasten the safety belt, and they were off.

It was not always understood by onlookers that it was only friends who were taken up, and no fare charged. This sometimes resulted in comedy situations, as when the dear old lady handed her hat to a friend saying she would go next. Unfortunately, she could not be taken, though she said she "would be willing to wash his clothes for a year if only Mr. Jenkins would take her up."

Soon after beginning to solo Mr. Jenkins found that flying was much more restful than automobiling, for there was no anxiety of collision, and the monotonous drone of the motor tended to clear the mind for straight thinking.

On one such flying trip down the river, at a point in the air above Mount Vernon, perhaps two thousand feet, there flashed into his mind the solution of a camera problem which had baffled him for many years, namely, from the time, 1894, when he had received his patent thereon.

The camera was what Mr. Jenkins christened a Chronoteine camera, i.e., a time-stretching camera. Two hundred feet of film runs through the camera per second, and thirty-two hundred exposures are made thereon in that brief time; namely, sixteen exposures per foot of film, with each exposure located thereon with such microscopic exactness that when prints from this negative were made and projected in a theatre machine the resultant screen picture was clear and steady. This reduction rate is 200 times slower than the time of the original performance itself, enabling the human eye to see things it had never before been able to see.

The last problem was to prevent the ignition and destruction of the film if it touched anything when running through the camera, which it did at a rate above two miles a minute. Of course, it was necessary to hold the film with extreme accuracy in the exact focus of the 2-inch photo lenses used. The slightest wobble at this point would cause blurred pictures. And yet how could the film be held so exactly without touching it?

It was this problem the solution of which was found a half mile up in the air over Washington's tomb. The solution was almost self-suggesting when it was remembered that anything moving rapidly through the air attracts to its surface a skin of air which is dragged along with it. Thus if the film should be pulled down through a narrow channel in the focus of the lens, the skin of air clinging to the two sides of the film would hold the film in the exact focus of the lenses. And that is the way it worked out in practice.

This Chronoteine camera is unique, the only camera ever made which will run film therethrough at such high speed and successfully record pictures thereon with only summer sunshine for illumination.

Perhaps the most noteworthy pictures made with this camera were the now famous "pigeon pictures" which disclosed that birds do not manipulate their

wings in flight as had previously been believed.

Another interesting series of pictures were those made in 1930 of Bobby Jones, the golf champion, and which surprisingly disclosed to Bobby that he played golf differently from the way he taught it.

These same Bobby Jones pictures also visually proved that there is a perceptible time interval between the moment an image falls on the human eye and its pictorial reception on the brain.

In 1921 the Jenkins Laboratories was set up and incorporated to develop radio movies to be broadcast for entertainment in the home. A staff of young ladies and young men was gotten together, each selected for latent talent capable of being directed to the particular development planned. A new building, fortunately, was found in the better section of Washington, and an intensive attack on the problem of visual radio was undertaken.

In less than a year such success was attained that demonstrations of the transmission of "still" photos could confidently be made for friends who happened in unannounced. Among those much appreciated visitors was Henry D. Hubbard, Secretary of the Bureau of Standards, who predicted that "motion pictures also will be similarly transmitted soon."

Later, photographs were transmitted over the city telephone system to the Navy radio station at Anacostia, and there put on the air. These photos were received in northwest Washington in the presence of Dr. A. Hoyt Taylor, of the Navy Research Laboratories, and J. C. Edgerton, radio officer of the Post Office Department, each of whom kept as souvenirs examples of the photos received.

Tracing the process is interesting. First the photograph was analyzed in a machine which, in successive lines, translates its light values into electric current. These variations of current representing picture values were then translated into sound in an earphone, which latter, held to the mouthpiece of the telephone on Mr. Jenkins' desk,

changed the sound back into current. This modulated current then passed through two telephone exchanges, and at the receiver in the radio station in Anacostia was changed back into sound and then into radio signals which were broadcast. At Mr. Jenkins' home a radiovisor picked the signals out of the air and changed them back into the original light values, which in turn were recorded photographically. It was indeed an interesting succession of transpositions, but was very successfully done.

Later in the same year, 1922, a public demonstration was put on for friends in the Navy, who came to the Laboratory to see it done—Admirals Robinson and Ziegemeier, Captains Tomkins and Foley, Commander S. C. Hooper, and others. A portrait of Secretary Denby was transmitted from Navy radio station NOF, in Anacostia, and received in the Washington Laboratory, in the presence of these gentlemen. The picture was reproduced in the Washington *Star* with a write-up of the event.

With such surprisingly good radio-photo results the Navy officials continued their generous aid in further experiments, and on March 3, 1923, radiophotos of President Warren G. Harding, Secretary of Commerce Herbert Hoover, Governor of Pennsylvania Gifford Pinchot, and others were radioed from NOF to a receiver set up in the *Evening Bulletin* building, Philadelphia, by courtesy of Mr. Robert McLean. Some of the pictures were reproduced in a special 5 o'clock edition of March 3.

Laboratory experiments were continued looking to the refinement of apparatus and methods, and later hundred-line radio-photos were made of President Calvin Coolidge, Dr. J. S. Montgomery, Chaplain of the U. S. House of Representatives, Hon. William Jennings Bryan, and others.

Still later in the year a message in Japanese characters by Charge d'Affairs I. Yoshida, of the Japanese Embassy, Washington, addressed to the captain of a warship then in Boston Harbor was

This and succeeding pages are examples of photographs received by radio from a distance, by the Jenkins system, some of them from Washington to Philadelphia, and represent the best work done in 1922, 1923, and 1924.

THE WHITE HOUSE
WASHINGTON

December 5,1922.

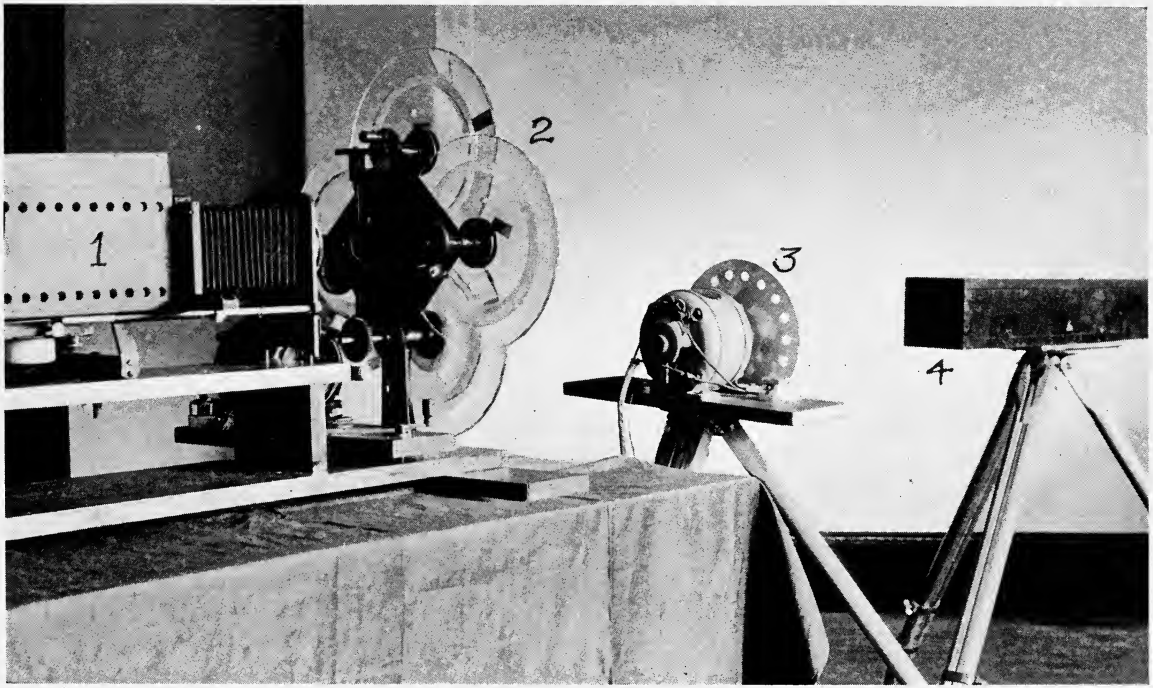
Dear Mr.Jenkins:

Please accept my thanks for the radio photograph which you were good enough to send to me. The production of a picture in this fashion is certainly one of the marvels of our time and I am under obligation to you for sending me this handsomely mounted copy which will be preserved as a very much prized souvenir.

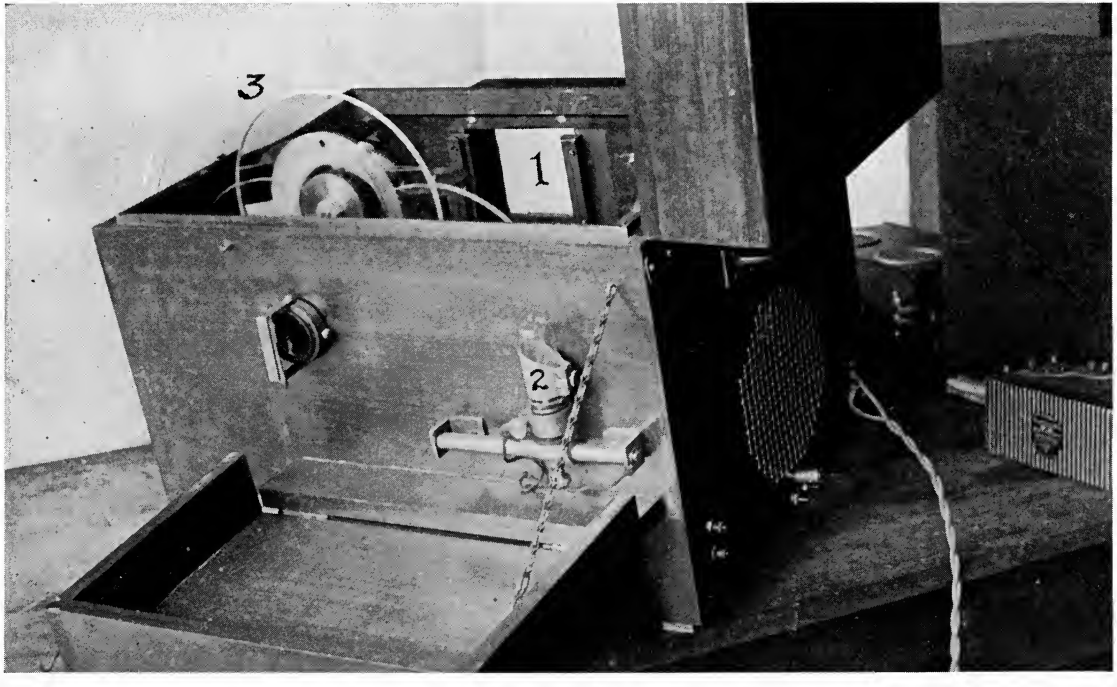
Gratefully yours,

Warren G. Harding

Mr.C.Francis Jenkins
1519 Connecticut Avenue,
Washington,D.C.



Jenkins radio-picture transmitter set up in Navy Station NOF for broadcasting pictures.



Radio-picture camera in which pictures from Washington were received in Philadelphia and in Boston.

DEPARTMENT OF COMMERCE

OFFICE OF THE SECRETARY

WASHINGTON

February 1,1924.

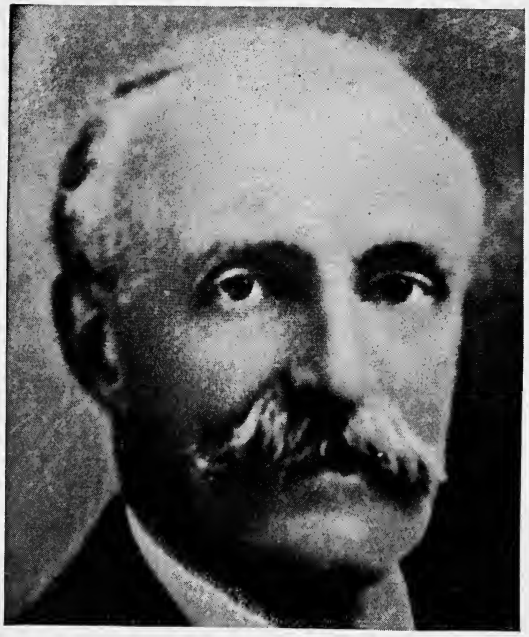
Mr.C.Francis Jenkins,
1519 Connecticut Avenue,
Washington,D.C.

Dear Mr.Jenkins:

I wish to express my appreciation for the photograph which you so kindly sent me. It represents a very startling development in radio and sometime when I have some leisure I would be interested in discussing the method with you.

Yours faithfully,

Herbert Hoover



Commonwealth of Pennsylvania

Governor's Office
HARRISBURG

October 23, 1923.

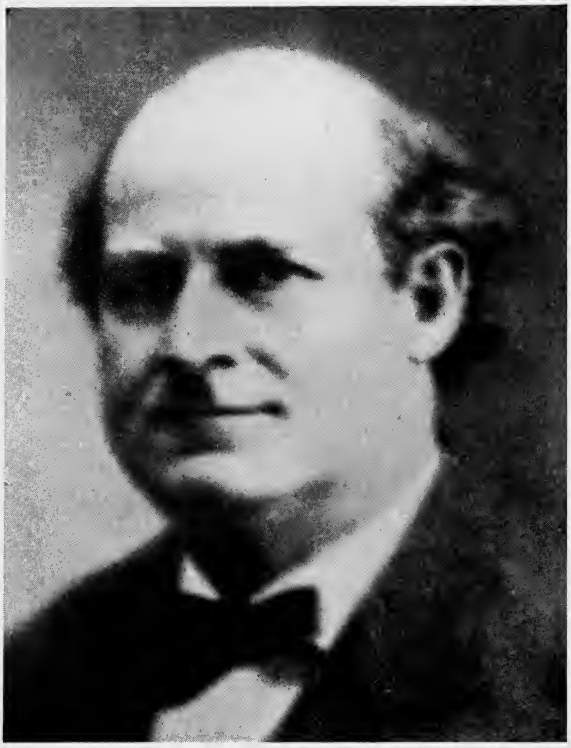
Mr. C. Francis Jenkins,
5502 Sixteenth Street,
Washington, D.C.

Dear Mr. Jenkins:

My heartiest thanks for your letter of October 17th and for the copy of my first photograph by radio. I appreciate it more than I can easily say, and think it is a perfectly marvelous piece of work under the circumstances. Also it is more than pleasant to have it from you, in view of our long association, and so beautifully mounted.

With renewed appreciation, and heartiest thanks for all the trouble you took in getting it up.

Sincerely yours,



WILLIAM JENNINGS BRYAN
VILLA SERENA
MIAMI, FLORIDA

July 29,1924.

Mr.C.Francis Jenkins,
1519 Connecticut Avenue,
Washington,D.C.

Dear Mr.Jenkins:

I thank you for the Radio Photograph--it is wonderful! What is there left to be discovered?

Appreciating your friendly interest, I am,

Very truly yours,

W. J. Bryan

GENERAL ELECTRIC COMPANY

In Reply Refer to

WEST LYNN, MASS.

November 28,1922.

Mr.C.Francis Jenkins,
1519 Connecticut Ave.,
Washington,D.C.

Dear Mr.Jenkins:

I am in receipt of yours of November 25th, enclosing the radio picture, for which I thank you. It certainly shows a successful result.

When I first read of your prismatic ring arrangement in the "Scientific American", I recognized that it was the solution of a problem which I had often thought of as possible, and I can well understand that it may have applications which we do not even now think of. It is perfectly possible, as you say, to employ the method of radio transmission of pictures on a very considerable scale, which would hardly be possible in transmitting them by the ordinary telegraph.

With best regards, and gratification to know that you are progressing, I am,

Very truly yours,

Elihu Thomson

THE FRANKLIN INSTITUTE
OF THE STATE OF PENNSYLVANIA
PHILADELPHIA

March 8,1923.

Mr.Francis Jenkins,
5502 Sixteenth Street,N.W.,
Washington,D.C.

My dear Mr.Jenkins:

I want to say to you how delighted I was to receive your letter of March 6th, accompanied by the beautiful examples of your success in transmitting photographs by radio. I enjoyed very decidedly the opportunity that you gave me of seeing the process of receiving these pictures and have found since that a number of those whose attention I called to your work, took advantage of the opportunity and were greatly pleased with the results.

I can only say that I appreciate to a certain extent, at least, the tremendous energy and persistence that you have put into the development of this new art and most heartily congratulate you on the success that you have obtained.

I am promising myself that if I come to Washington at any time in the near future to make a visit to your laboratory and see you in your own private lair. Hoping that such an opportunity will not be too long delayed. I am,

Sincerely yours,

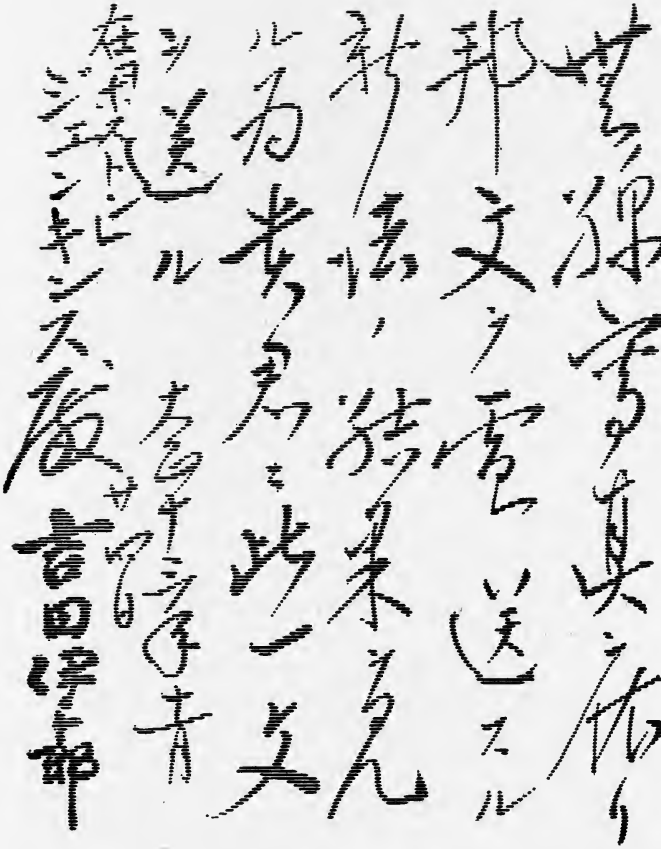
Geo. A. Hoadley.

S. and A. Assistant.

COL.PAUL HENDERSON, OCTOBER 1,1924.
ASSISTANT POSTMASTER GENERAL,
WASHINGTON,D.C.

MY DEAR COL.HENDERSON:- THIS IS AN EXAMPLE OF OUR NEW RADIO-PHOTO LETTER, A METHOD OF TRANSMITTING MESSAGES BY RADIO INSTEAD OF BY STEAMSHIP. WASHINGTON TO PANAMA IN FIVE MINUTES. IT HAS THE AUTHENTIC CHARACTER OF AN AUTOGRAPHED LETTER, AND THE SPEED OF RADIO. IT IS THE BEGINNING OF A RADIO SERVICE TO THE EYE, WHERE HERETOFORE RADIO HAS BEEN AN ADDRESS TO THE EAR ONLY. WILL THE TIME SOON COME WHEN THE POST OFFICE DEPARTMENT WILL DELIVER BY RADIO PHOTOGRAPHIC COPIES OF OUR BUSINESS LETTERS AT THE SPEED OF LIGHT RATHER THAN THE LAGGARD DELIVERY OF THE ORIGINALS BY MAIL-PLANE. SUCH AN EXCHANGE OF INTELLIGENCE WOULD WONDERFULLY SPEED UP INDUSTRY BECAUSE, LIKE AN ARMY, INDUSTRY CAN GO NO FASTER THAN ITS MEANS OF COMMUNICATION.

J Erskine



Japanese and Chinese messages can be sent in native characters only by visual radio.

transmitted by Mr. Jenkins, again through the courtesy of the Navy, from station NOF, near Washington, to the Amrad station, WGI, at Medford Hillside, Mass. It was received at night and through the worst static condition of the year. The message was readable though covered with "static tracks." The message was reproduced in the *Boston Traveler* the following day.

This same apparatus was then set up on the Post Office airways with one transmitter-receiver located at Omaha and the other at Iowa City, a section of the night-flying air-mail route from New York to San Francisco. The first message, a hand-written message, was put through the night of December 15, 1923. A few days thereafter Col. Paul Henderson, Second Assistant Postmaster, called Mr. Jenkins advising that General Lord, head of the Federal Budget Bureau, had told him that there was no appropriation out of which such experiments could be paid for, and they must stop. They stopped; and the young men came home for Christmas.

In August, 1923, Mr. Jenkins went to Omaha as the guest of Col. Paul Henderson, then Second Assistant Postmaster General, to watch, for an exciting week, the experiment of carrying mail by airplane at night.

The flying field had been established at Fort Crook, some ten miles out of town. An automobile carried the officers to and from the hotel. And no one attempted to conceal a feverish interest in the possibilities which would be opened to the United States mail, directly, and aviation development indirectly, by a successful conclusion of the courageous venture.

Of those who were in attendance, some came because they had designed the field-lighting system, or the beacon equipment and course markers which stretched their winking chain from Chicago to Cheyenne across the black prairie. Others, like Glenn L. Martin, the airplane builder, to watch the

performance of the flying equipment, and still others like Mr. C. Townsend Ludington, of Philadelphia, with no immediate interest, perhaps, but who may have been studying the feasibility of the New York—Philadelphia—Washington passenger air line which he later established (1930), and which was so well thought out in advance that it broke all passenger-carrying records from the take-off of the very first ship. And there was Col. I. E. Dains, come simply to see his friend succeed 100 per cent in what many called a very doubtful experiment.

On a table in headquarters the night mail route had been marked by a tape, to represent the course from one terminal to the other. As the reports of the passing of the ships were received from observation stations color-headed pins would be moved from point to point along the tape. Observing the advance of these pins the excited watchers followed the movement of the eastbound and westbound mail through the night. As each approached Omaha, the mid point of flight, all would tumble into the automobile and hasten to the field.

The party would be no more than outside the city boundary before the night-piercing beam of the rotating beacon would be seen sweeping across the sky. Arriving at the field, everyone began watching toward the east and toward the west for the tiny wing lights which each plane carried.

Presently from the beacon tower platform would come a voice—"Mail," followed by excited field activity. The big beacon light was turned off; the field flood-lights turned on; and the mail truck made ready to run out to receive the Omaha mail when the plane came in. Then presently out of the dark into the field would glide this new thing, the night-flying mail, with all the importance of a living soul.

Whether the west-bound or the east-bound mail came in first could not always be determined, so nearly exactly were the flying times. But many a calculating glance at the wind-sock was made in an

effort to predict which plane would have an opposing head wind and which a helpful tail wind. But whether the east or west-bound plane got in first made little difference, for almost before one realized it the mail was unloaded and reloaded in the waiting plane which had already been warming up. The cockpit straps were buckled, the engine "reved" up, and then down across the field, up, and away into the night the mail speeded bearing its messages of love and cheer, or only of prosaic business.

The show was over, and the auto radiator cap pointed toward town and sleep, to dream of those pioneers cleaving the dark night toward opposite ocean shores.

The experiment of carrying the mail on night flights now having been completed, and 100 per cent perfect, demonstrating its entire practicability, all eyes were turned homeward. Colonel Henderson, explaining that the official party would start for home by train that night, asked Mr. Jenkins if he would go back with the party or did he prefer to go back by plane as far as Chicago. His selection of the plane did not surprise Colonel Henderson, who, knowing Mr. Jenkins's delight in flying, had already arranged for one of the pilots to carry him into Chicago next morning. The trip can be no better described than it was in a letter to Mrs. Jenkins, written that night in Chicago.

"Hopping off from Fort Crook field about nine o'clock, the plane held a compass course for Chicago, 2,000 feet up and a hundred miles an hour with almost monotonous rhythm over this level country.

"But suddenly the big Liberty motor cuts out. Instantly the pilot swings the dead plane around on one wing, over a house and barn, low over an orchard, and sets it down in a pasture lot without a jar. An investigation soon discloses that the gasoline had water in it, gasoline bought at a distant field the day before by one of the 'joy hoppers.'

"Hardly was the plane on the ground until visitors

began to pour into the field from every side. Daddy in straw hat, and overalls stuck in hightop boots, driving the 'tin Lizzie,' and with mother in sunbonnet and apron on the back seat, and Mary and Johnnie standing on running boards holding onto the bows. But the farmers' telephones are not permitted long-distance connections, so the pilot and Mr. Jenkins accept a kindly farmer's offer to carry them to a nearby town where Omaha can be asked to send another plane. The farmer hurries his guests back to the disabled plane, with his auto skittering this way and that over the greasy surface of a muddy road, for it had been raining the night before. The pilot, who had just had a forced landing as a part of the day's hazard, looks with anxiety at his fellow passenger and whispers: 'He is going to kill us yet.'

"But they arrived unharmed, and gossip with the neighbors in the shadow of the airplane wings until suddenly a boy jumps up and, pointing into the western sky, cries: 'There he is.' But some doubted, for his sharp eyes had picked up that tiny speck in the sky much before his elders could see it.

"Soon the pilot 'dipped' his ship to advise the down plane pilot that he was seen. So the cows and horses were driven to one side of the pasture, and the automobiles brought in close, so that the pilot could have plenty of room to get down alongside the cripple. The pilot-mechanic got out with a grin on his face: 'I know what's the matter, there's water in the gas. Take this ship and get on in. Bill and I will filter your gas, and hop off in an hour for home.' So changing baggage to the other plane it was soon in the air headed for Chicago.

"Colonel Henderson had asked the pilot to point out to me a particular beacon tower. As he passed he shook the plane, by kicking the rudder bar, to call his passenger's attention, and then pointing to the tower; another way of getting attention amid the pounding roar of the motor exhaust.

"It is the longest air trip I have taken to this time, and forcibly impressed me with the stupendous possibilities of a roadway unlimited in direction; for which no right-of-way must be bought, no grading done, no bridges built, and no curves to straighten or grades to level.

"But presently the roar of the motor stopped and the plane glides to a landing in the Chicago airmail field. The trip is finished, the transportation lesson learned, emphasized when, on reaching the hotel, it is found that Colonel Henderson and his party has not yet arrived."

In September Mr. Jenkins was invited to join a visitors' and observers' party aboard the U. S. S. *St. Mihiel* to witness the experiment of sinking a battleship by airplane bombs. At the Arsenal dock the party went aboard this old transport ship. Among those going, and still much in the public eye, was Gen. John A. Pershing. Other well known personages were Major Gen. M. M. Patrick and Rear Admiral W. A. Moffit. Altogether there were too many to attempt a listing. The ship cast off her mooring lines late in the afternoon, and early next morning, in Hampton Roads, the Assistant Secretary of War joined the party. The trip was indeed an eventful one, perhaps no better told here than by quoting from a letter Mr. Jenkins wrote Mrs. Jenkins while aboard.

"Well, I've just seen a big battleship shot down. To be sure it was an antiquated old tub, but she looked big and formidable as she rode at anchor while the planes flew overhead, 10,000 feet up and looking very small indeed. But watching intently one could see the bombs released, and could follow each all the way down, about 10 seconds usually. They shot all morning at the *New Jersey* anchored about five miles south of Diamond Shoals light-ship, off the North Carolina coast, placing the bombs all around her, with spouting geysers of water following each explosion. Finally the order was given to 'Sink her.'

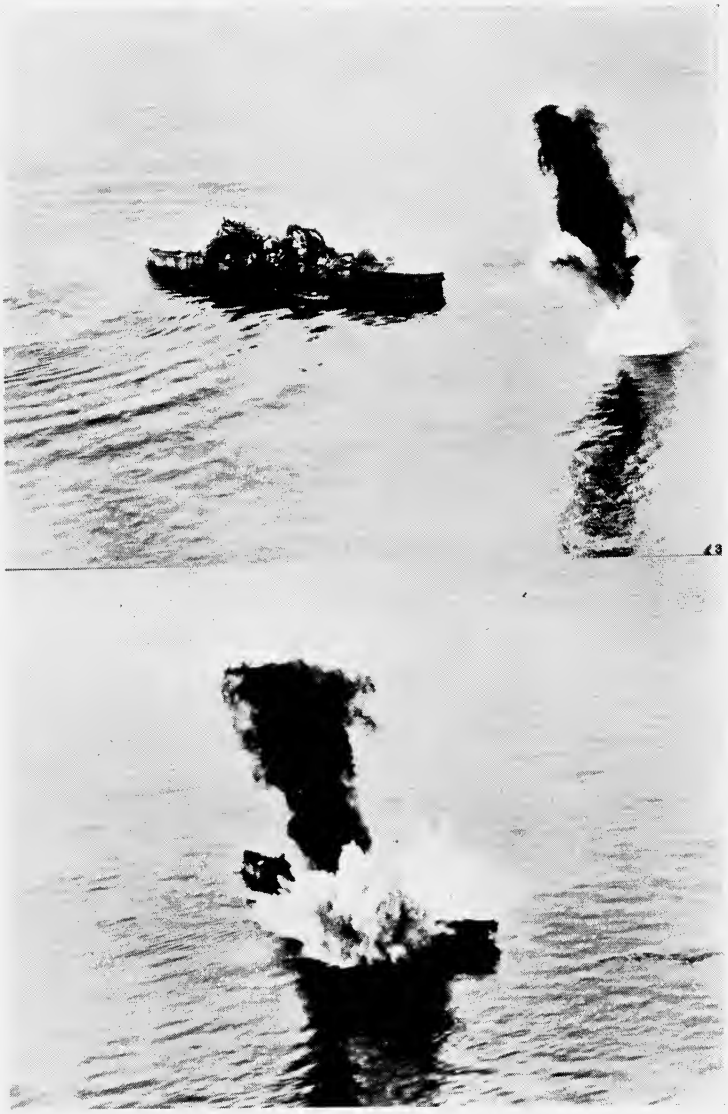
We were all extra alert then, for this was the big show. The next bomb struck squarely amidships, with a great cloud of black smoke and debris, for it tore up her decks, knocked down both lattice masts and funnels. In fact, her whole upper structure was shot away. Our boat then steamed toward her from our location about two miles away. However, before we got very close in, she listed badly, and soon turned over completely. She then began to settle by the stern, water spouting out of the holes in her hull, and soon went under. We steamed over her grave in a great oil slick which marked the spot.

"Those of us who watched her go down were silent and rather awed, I think. I know I felt as though she hadn't been given a sporting chance, but, like Edith Cavell, she had been cruelly and unfairly shot down. A foolish feeling, of course, but a sensation of resentment came over me as she went under. It didn't seem quite sportsmanlike.

"The attack on the *Virginia* was practically a repetition of that on the *New Jersey*. General Mitchell's men seemed to put the bombs exactly where orders directed. The only difference I noticed was that the bomb which sank the *Virginia* struck on the forward deck, but her fate was just as definitely determined by the shot. I think it was the general conclusion that a battleship has little chance to successfully defend herself against a fleet of airplanes.

"Well, it's all over, and we are steaming toward home. I had troubled dreams last night, dreams of again seeing the bombs strike. And some two seconds later a shudder would pass over our ship, to be followed eight or ten seconds later by a 'boom,' which indicated we were two miles away; about the same distance from the target as the bombing planes were above it. When I awoke the dream seemed as real as the reality of the day's work itself.

"But after breakfast my friend, Mr. Preston Bassett, of the Sperry Gyroscope Co., took me up



10,000 pound bomb of TNT, dropped on battleship from plane flying two miles high; a miss (above) and a hit (below).

into the wheelhouse to observe the behavior of the master gyro compass, and also the distant controlled compasses at various stations on the ship. The gyro compass is a great achievement. Then after we were seated with our feet on the deck rail, as the ship slips through the quiet water, he explains also the working of the 'Iron Mike,' the gyro-controlled automatic steersman which holds the ship on her course from port to port. It has been a great treat, this demonstration. We shall be in shortly now. I excused myself to my friend to write you this story."

Early in the week of June 7, 1925, Mr. Jenkins considered the development of radiovision, radiomovies and television had proceeded so far that a public disclosure of radiovision and radiomovies might be undertaken. Orders were therefore given the staff to set up a transmitter in the NOF station, at Anacostia, which had again been offered by the Navy for the demonstration. A receiver was ready in the laboratories in Washington. The last adjustment had been made, and everything set for the "big show." Saturday early morning testing was satisfactory, and Mr. Jenkins went to the phone and called his friend of science, Dr. George M. Burgess, director of the Bureau of Standards; the Secretary of the Navy, Curtis D. Wilbur, who asked if he might bring others; Admirals S. S. Robinson and H. J. Ziegemeier, and Captains J. T. Thomkins and E. C. Hooper; Judge S. B. Davis, Department of Commerce; and Mr. W. D. Terrill, of the Radio Division. All of them apparently wanted to come, Dr. Burgess saying he was dropping everything to come at once.

A few minutes later Mr. Jenkins walked back into the receiving room to see that everything was ready, just as Dr. Burgess was announced. To his consternation he found something had gone wrong; there were no radiomovies coming in. Crestfallen, Mr. Jenkins greeted the doctor, and with dragging feet led him to the rear room of the laboratory, where

Sunday Star

SHINGTON, D. C., SUNDAY MORNING, JUNE 14, 1925

"Radio Vision" Shown First Time In History by Capital Inventor

C. Francis Jenkins' New Wireless Apparatus Depicts Moving Objects Miles Away—U. S. Officials See Test.

"Radio vision," long the fantastic dream of science, became an accomplished fact yesterday afternoon, with Secretary of the Navy Wilbur and other high Government officials witnessing the feat.

With the aid of a remarkable apparatus invented by the Washington scientist, C. Francis Jenkins, the Secretary of the Navy, Dr. George M. Burgess, director of the Bureau of Standards; Admiral D. W. Taylor, Capt. Paul Foley of the Naval Research Laboratory and others actually "saw" by radio an object act in motion several miles distant in front of a "radio eye" installed at the Naval Radio Station, NOF, at Bellevue, D. C.

It was heralded as the first time in history that man has literally seen far-away objects in motion through the uncanny agency of wireless.

As Secretary Wilbur watched the image of a revolving propeller, selected as the "subject" to be broadcast, as it cavorted on a small screen in the Jenkins laboratory, at 1519 Connecticut avenue, he remarked:

"I suppose we'll be sitting at our desks during the next war and watching the battle in progress."

"That's perfectly possible, Mr. Secretary," the inventor replied seriously.

The demonstration was of a strictly private nature and, in the words of Mr. Jenkins, did not pretend to be a "show."

"It is merely a scientific test that proves we have attained our goal," Mr. Jenkins told his visitors. "By making numerous improvements in our sending and receiving machines we expect to be able shortly to stage a 'radio vision show,' with the talent performing at the broadcasting station and the audience watching the performance at the receiving studio miles distant."

What the officials saw yesterday afternoon was the image of a small cross revolving in a beam of light flashed across a light-sensitive cell at Station NOF. No other objects were used in the test. The image, while not clear-cut, was easily distinguishable.

Director Burgess of the Bureau of Standards, in congratulating the inventor, said: "You've certainly got it, all right, if my eyes aren't deceiving

(Continued on Page 4, Column 6.)

Washington

NGTON: SUNDAY, JUNE 14, 1925.—EIGHTY-SI

First Motion Pictures Transmitted By Radio Are Shown in Capital

Government Officials and Scientists, Summoned Quickly by Telephone, View Successful Experiment in Laboratory of C. Francis Jenkins—Small Apparatus Functions Perfectly.

A group of distinguished government officials and scientists, called unexpectedly from their offices and laboratories, sat yesterday morning in the laboratory of C. Francis Jenkins, at 1519 Connecticut avenue northwest, and saw for the first time in history motion pictures of a moving object miles away, received over the radio and thrown upon a miniature screen.

Among the visitors who had been called hurriedly on the telephone by Mr. Jenkins when he found the machine functioning perfectly, and who visited the laboratory at various hours in the morning, were Secretary of the Navy Wilbur, Dr. G. K. Burgess, director of the bureau of standards; Stephen B. Davis, Acting Secretary of Commerce; W. D. Terrill, of the radio department of the Department of Commerce, and two San Francisco scientists, who heard of the experiments and accompanied the officials to the laboratory.

Although the image broadcast was devoid of dramatic interest of itself, being merely a small model windmill with the blades in motion, NOF, the old naval radio station, which was turned over to Mr. Jenkins for experimental purposes when the department erected a larger one. It was from NOF that Mr. Jenkins broadcast still photographs to Philadelphia, Boston and other cities in 1923.

To illustrate motion, a small model Dutch windmill was erected and the blades propelled slowly by wind from an electric fan. The image of this was through a lens onto a ground glass. From this ground glass the image was picked up by Mr. Jenkins' apparatus in much the same fashion that it is for a still photograph. That is, a small sensitive pencil travels across it making approximately fifteen lines to the inch, converting the light intensity into electrical intensity or electrical modulations.

These modulations were broadcast over a wave-length of 545 meters and picked up in Mr. Jenkins' Connecticut avenue laboratory. Here the modulations were converted back into light values and a pencil of light made to travel in the same fashion as the sending

Dr. Geo. M. Burgess, Director U. S. Bureau of Standards, inspecting apparatus Mr. Jenkins used to receive "Vision-by-Radio" on the occasion of the first transmission of vision and movies by radio from Navy Station NOF to the Jenkins Laboratories, Washington, June 13, 1925.

the receiver was located. As he went along he explained that "too much should not be expected," and in this wise began building up an excuse for the balky machine. But the excuse was never made, for as the door opened it was discovered that the mechanism was again performing, beautifully.

Only the pioneer will ever appreciate the relief of that moment, when anticipated chagrin was superseded by congratulations. And happily the apparatus continued to operate perfectly. Then finally a petty officer, at the direction of one of the admirals, stood before the transmitter in that remote radio station and wig-wagged a message to his superiors standing before the radiovisor in the surcharged atmosphere of that first television receiving room.

Congratulations were in order, but they seemed to be given in a rather awed manner as the unfathomable possibilities of this new extension of human vision came to be more and more realized.

Two years later, 1927, the A. T. & T. Co. made a one-way television demonstration over their wires between Washington and New York City. Wide publicity resulted from this demonstration, and a tremendous impetus was given the development of television, as it doubtless appeared to engineers and inventors everywhere as an endorsement of the pioneer attainments and predictions of Mr. Jenkins and his staff of assistants.

During the week of September 25, 1925, Mr. and Mrs. Jenkins were guests of Mr. Roger Babson, at Babson Park, Mass., the week of the Babson Annual Business Conference, when Mr. Jenkins read a paper describing the progress he had attained in fac simile radio transmission, radiomovies, and television, and predicting a wide service when an acceptable public introduction had been attained.

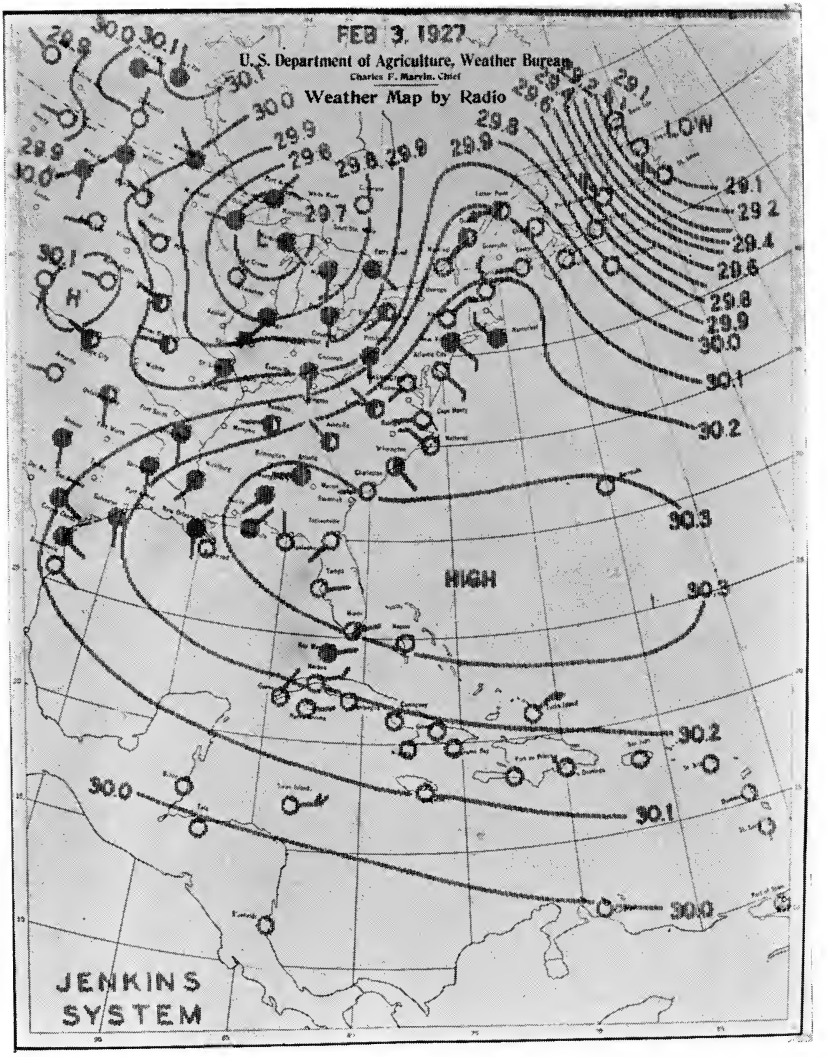
A year later Mr. Jenkins again attended as a guest speaker, and read a paper on the immediate future development of the airplane in business, prophesying

a "shuttle line" or "taxi air service," from the flying field to the business center of the city. This prophecy now seems likely soon to be realized in the use of the slotted flap wing, and the autogyro; the most spectacular feat of the latter was landing in, and flying out of the tree-bounded lawn of the White House when President Herbert Hoover, on April 22, 1931, awarded the Collier trophy to the American developers of this "windmill" plane.

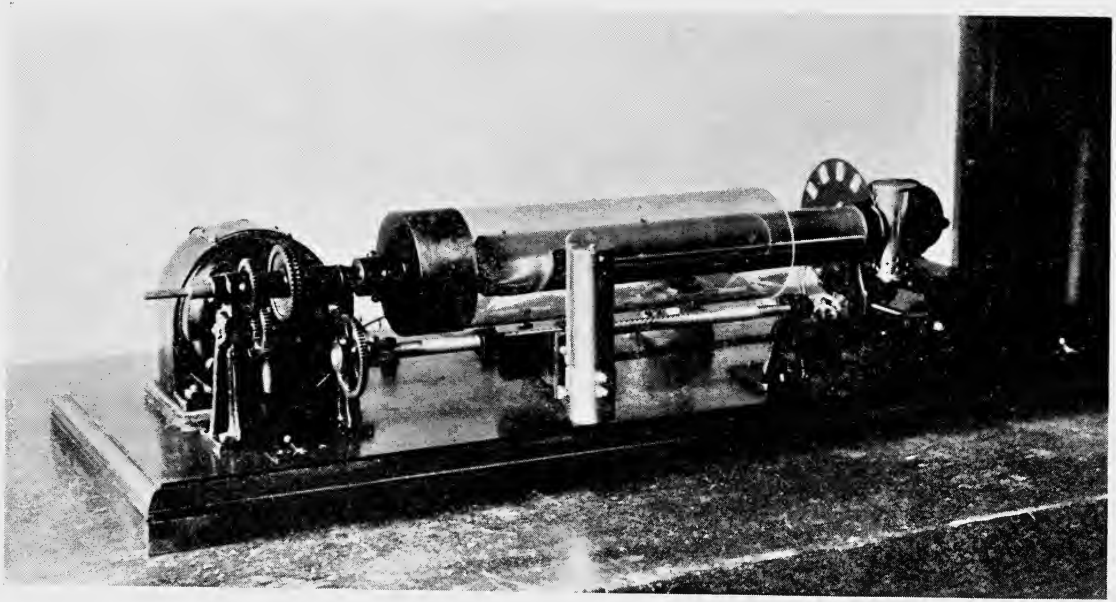
The next suggestion of a new development came from outside the Jenkins Laboratories, when in July, 1926, Capt. Ridley McLean and Capt. S. C. Hooper, of the U. S. Navy, and Prof. C. F. Marvin, of the Weather Bureau, met in Mr. Jenkins' office for a conference on the feasibility of an experimental weather map service by radio to ships at sea.

After some discussion Mr. Jenkins agreed to design and build the special machines required, and to have them ready to install and operate within five weeks. The Weather Bureau agreed to furnish a current (8 x 10 inch) weather map every morning; and the Navy was to furnish a radio transmitter at Arlington Wireless Station and the ships required to carry the map receivers in this triangular experiment.

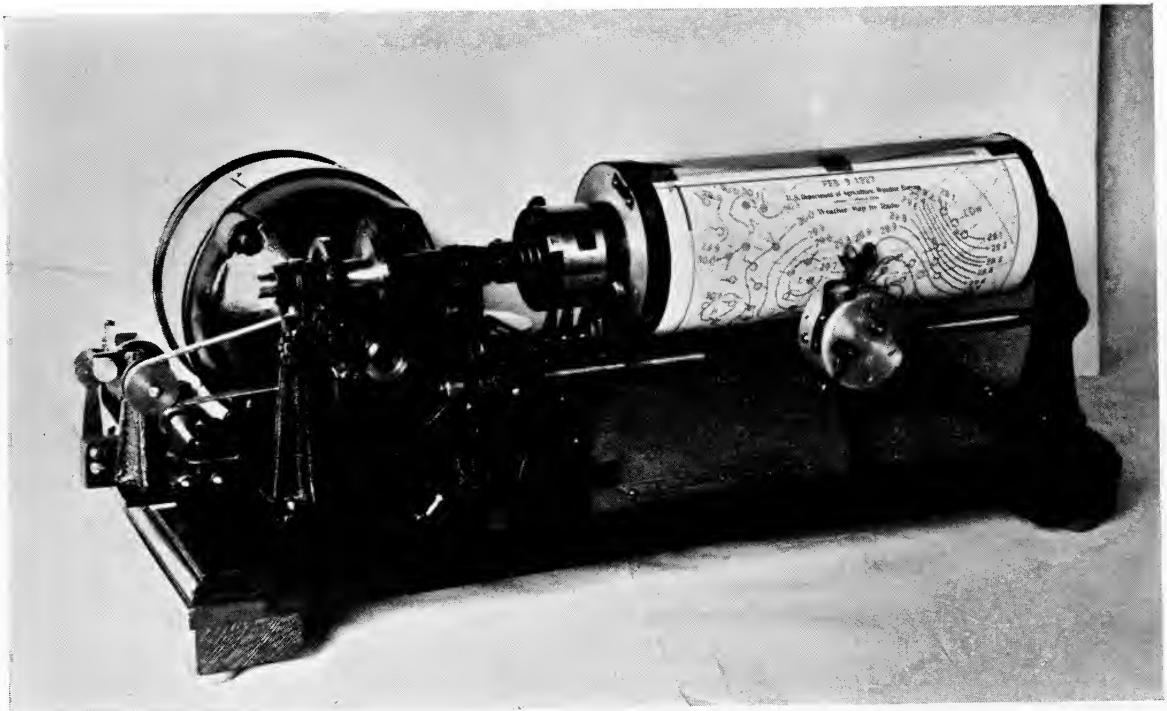
Within the time specified two weather map transmitters and six receivers were ready. One transmitter was set up in the Jenkins Laboratories, and attached to a short-wave radio broadcast instrument; the other was set up in the Recreation Room of the Arlington Wireless Station, where it was operated on 36 kc. until cold weather. It was then moved into the Navy Building, in Washington, and set up in a room off "Radio Central" in the Bureau of Communications, and connected with Arlington by wire.



Weather Map by Radio
(original 8 x 10-inch)



Jenkins Radio Weather-map Transmitter. May be attached to any broadcast station equipment, of any wave length or frequency. Built for 8 x 10 inch Weather Map, and used from September, 1926, to March, 1927, inclusively, in a cooperative experiment by the Jenkins Laboratories, the U. S. Navy, and the Weather Bureau.



Jenkins Radio Weather Map Receiver. Used in daylight aboard Navy vessels by the radio operator; no dark room or photographer was required. The weather map was received in red ink on a brown printed base map. Perfect registry was attained aboard a rolling ship 2,000 miles at sea.

FROM: USS KITTERY
ACTION: OPNAV
NIFO: HYDRO. BUENG.
1016 REF YOUR 1914 1215 SECOND HIGH FREQUENCY MAP PERFECT 0225
0–35863

FROM: USS KITTERY
TO ACTION: OPNAV
INFO: BUENG HYDRO WASHN.
1023 FORTY FIFTEEN KCS MAP EXCELLENT 1455.
DL 1826.

FROM: USS KITTERY
TO ACTION: OPNAV
INFO: BUENG HYDRO WASHN.
1023 FORTY FIFTEEN KCS MAP EXCELLENT 1455.
DL 1826.

FROM: USS KITTERY
TO: OPNAV
1022 MIDNIGHT MAP EXCELLENT RECEIVED DURING LOCAL THUNDER SHOWER 1400.
2034 MM.

FROM: USS KITTERY
TO ACTION: OPNAV
INFO: BUENG HYDRO.
1020 NIGHT MAPS EXCELLENT ON FOUR THOUSAND FIFTEEN KCS 0010.
1154 Z I–4406.

FROM: USS KITTERY
TO ACTION: OPNAV
INFO: BUENG HYDRO
1029 BOTH MAPS THIS DATE EXCELLENT 1432.
XL 1529

NAM NR 4 Z LARK V NHW N BOND COIN GR 11
FROM: USS KITTERY
TO ACTION: OPNAV
INFO: BUENG HYDRO.
1009 FIRST WEATHER MAP RECEIVED AT SEA INTERMEDIATE FREQUENCY PERFECT 2230.
JT 1028

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1 DN V PT Z LARK V NHW N BOND COIN GR 17 BT
FROM: USS KITTERY
TO ACTION: OPNAV
INFO: BUENG.
1011 MAP OF LABORATORY PERFECT TODAY WITH TWENTY SIX DEGREE ROLL OF SHIP 0100
718 AM—I—38773.

FROM: USS KITTERY
ACTION: OPNAV
INFO: HYDRO BUENG
1015 YOUR 1914 1215 HIGH FREQUENCY MAP LABORATORY PERFECTION 1015
19 ORIG 20 B 20 C BUENG HYDRO:
2045 DH.

FROM: USS KITTERY
TO ACTION: OPNAV
INFO: BUENG HYDRO.
1019 MAP FORTY FIFTEEN KCS EXCELLENT 0715.
DR—416 I–44332.

NAU 383 Z LARK V NHW N BOND COIN GR 17
FROM: USS KITTERY
TO ACTION: OPNAV
INFO: BUENG HYDRO.
1015 ALL WEATHER MAPS FOUR THOUSAND FIFTEEN KCS EXCELLENT 2336 BC
19 ORIG BUENG HYDRO—42888

One of the receivers was located in the Jenkins Laboratories for checking purposes; another in the Navy Building; one in the Weather Bureau; one in Chicago; one aboard the flagship of the Atlantic fleet, the U. S. S. *Trenton*; and one on the U. S. S. *Kittery*, Naval Operations Base, Hampton Roads, Virginia, from which point she made cruises to Guantanamo Bay, Port-au-Prince, St. Thomas, and other points in the Caribbean Sea, a territory noted for its severe static disturbances.

The transmitter consisted of a motor-rotated glass cylinder upon which a photo-negative of the ink-drawn weather map was wrapped. The light-sensitive cell signals representing the elementary areas of the map were amplified and used to control the output of the radio-transmitter of the broadcast station.

The map receivers aboard ship were rather simple devices, of light weight, and consisted of a motor-rotated cylinder upon which was fastened an 8 x 10 inch base map printed in brown. The motor was driven by the ship's lighting circuit, and the marking pen was attached to the radio code receiver in the "radio shack."

At a scheduled hour, after the usual code announcement, the radio man would hear: "Stand by for a weather map." Thereupon he would cut-out his loudspeaker and cut-in his map machine. In a few minutes a weather map in red ink on the brown-printed base map would be ready to hand the captain of the ship.

The very first cruise of the U. S. S. *Kittery* with the weather map receiver aboard covered the time of the (1926) "Florida hurricane." The hurricane was recorded on the 15th, 16th and 17th of September, three days before it struck the Florida coast. Only a casual inspection of these maps showed that if the ship held her course she would encounter the maximum fury of the storm with consequent jeopardy of lives, ship and cargo. The ship's course was

temporarily changed to an easterly direction and she rode out the blow safely, though many other ships went down.

The later weather maps were rather uneventful, except that the quality of the maps continued to improve as skill was attained by the operators at both the transmitting and receiving instruments. But the fact was established by these tests that a weather map could be successfully made during bad static weather when weather reports by code could not be received at all. The explanation is that the map can be read by its context, as a whole, where code signals are often blotted out by static making the message unintelligible.

Following the weather map experiment, transmitting a newspaper front page was attempted. An analyzer was sent to Chicago and set up in the powerful Wrigley broadcast station. The receiver was set up in Washington.

The newspaper page was 14 x 19 inches, to date the largest surface ever transmitted over a radio channel. The results of this single attempt were surprisingly good, but refinement was not continued.

Mr. Jenkins believes that ultimately a page of principal news items and daily financial quotations will be broadcast by the great newspapers of our country, to be received at outlying summer camps and winter resorts, and duplicated by a chemical process, say, blue prints or the like, and furnished individual and bill board subscribers. By this means this news sheet would be read thousands of miles away before the main publication would be put on the streets of its home town.

Having now established priority in visual radio in general, and radiovision and radiomovies in particular, with a workable knowledge of the essentials in mechanisms and methods for each, Mr. Jenkins began in earnest to push development toward the broadcast of radiomovie entertainment for the home. Apparatus was designed and built for the visual

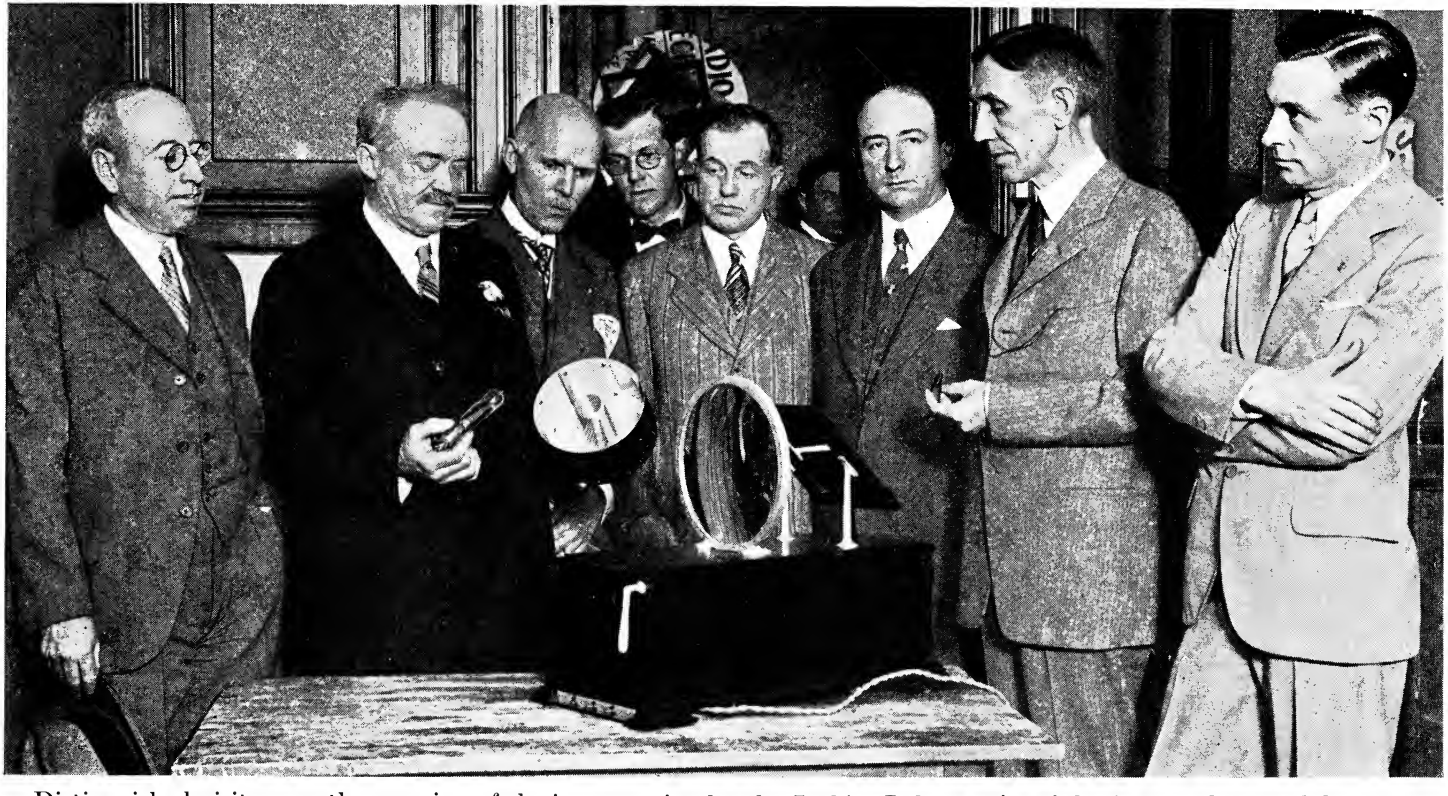
radio transmitter; and broadcast station equipment was built and installed.

Application for simultaneous broadcasts on a plurality of wave-lengths, preferably harmonics, had been made of the Federal Radio Commission, and, on explanation that this should, theoretically at least, overcome the bugaboo of skip distances, four channels were assigned by the Commission for the experiment, and a station signature 3XK, later W3XK.

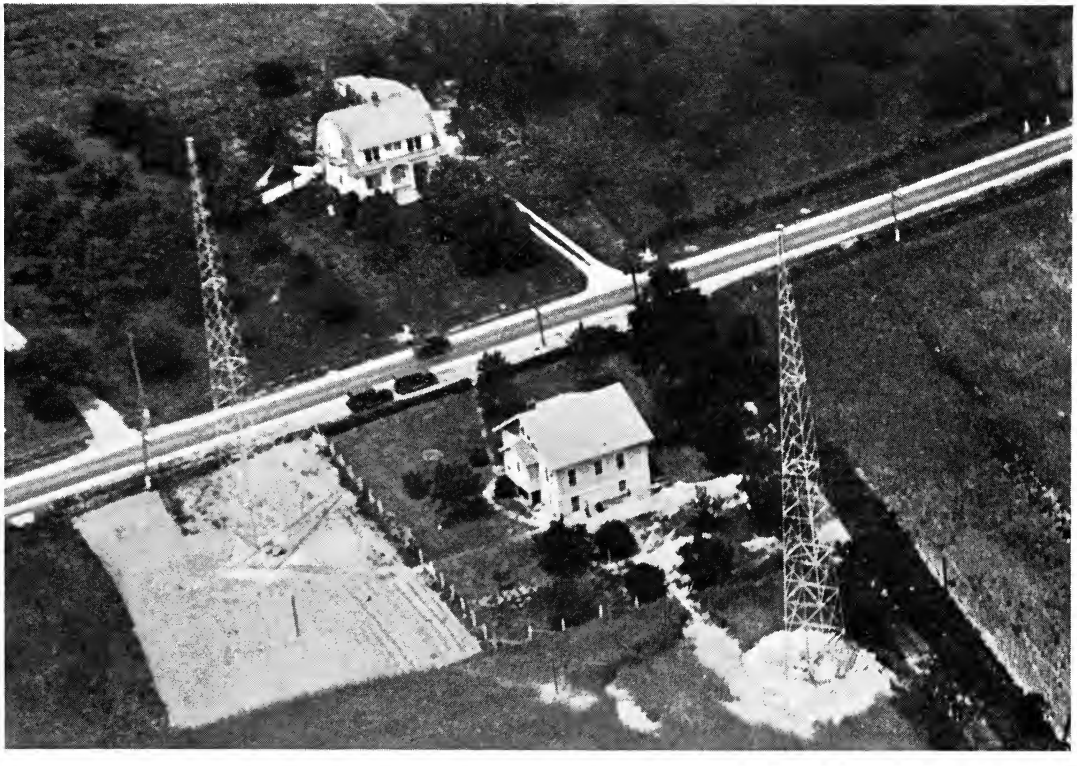
July 2, 1928, was determined on for the initial radiomovies broadcast, and friends invited to be present. Among them were members of the Federal Radio Commission and their technical advisers. The morning was spent in a survey of the station and equipment by the visitors, with Mr. Jenkins describing the function of the different mechanisms. Later demonstration broadcasts both of television and radiomovies were put on. There was discussion of applications of service for the new venture, and predictions as to its ultimate value in commerce, in education, and in entertainment. All signed the laboratories guest book, and departed talking of the possibilities of this pioneer contribution in radio.

That evening the first scheduled broadcast of picture story entertainment was made, to be followed every evening thereafter (except Sundays and holidays) at 8 o'clock E. S. T., and without a miss.

The radio amateurs of the country were invited to participate in this pioneering by equipping their short wave radio sets with picture receivers, and then reporting on the quality of picture reception. The response was instantaneous. But as many of them found it difficult to accurately perforate a scanning disc for the picture receiver, Mr. Jenkins designed a "Kit" of parts out of which an excellent radiovisor could easily be made. The Kit contained every element necessary to a complete receiver, namely, the neon lamp, scanning disc, synchronizer, mounting, etc., everything but a motor, for $7.50.



Distinguished visitors on the occasion of the inauguration by the Jenkins Laboratories of the first regular scheduled broadcasts of radiomovies, July 2, 1928. Left to right: Capt. S. C. Hooper, Navy; C. Francis Jenkins; Gen. George O. Squire; Capt. Guy Hill, Signal Corps, Army; Comimssioner Harold A. LaFont; Commissioner Judge Ira E. Robinson; Commissioner Sam Pickard; and Carl Butman, Secretary Radio Commission (in rear).

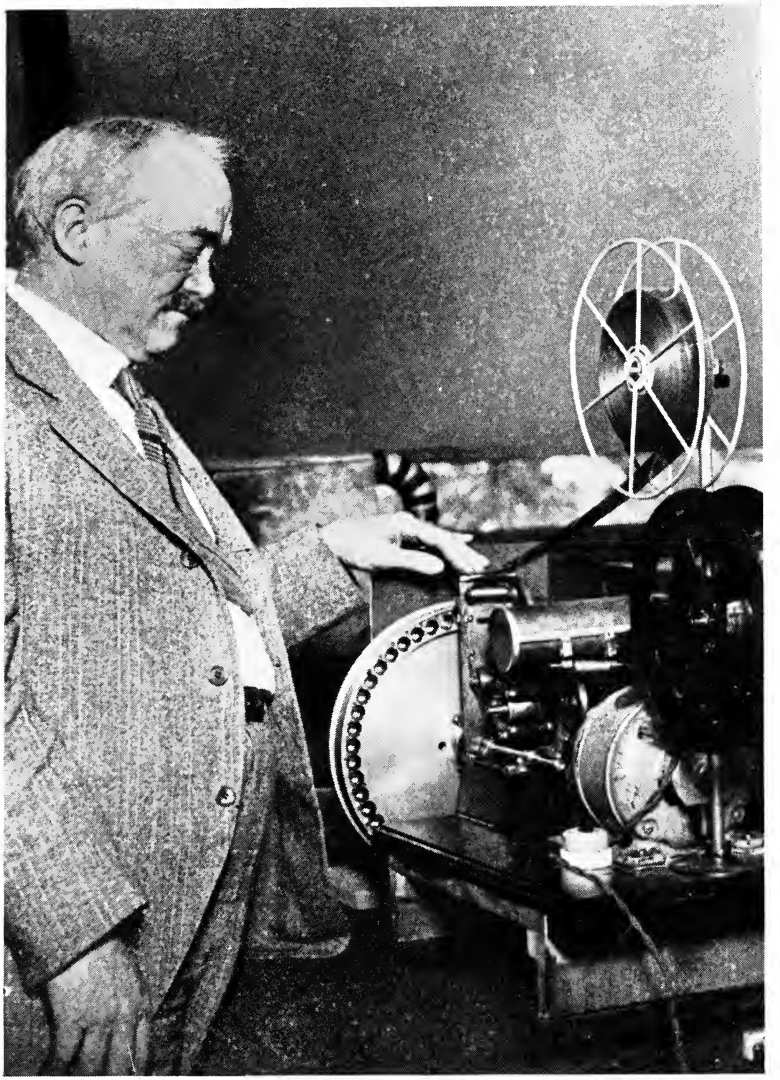


The Jenkins Radiomovie Broadcast Station, W3XK,
located five miles north of Washington, D. C.

Unique silhouette studio in which motion picture stories in black-and-white were made for broadcasting of first radiomovies.

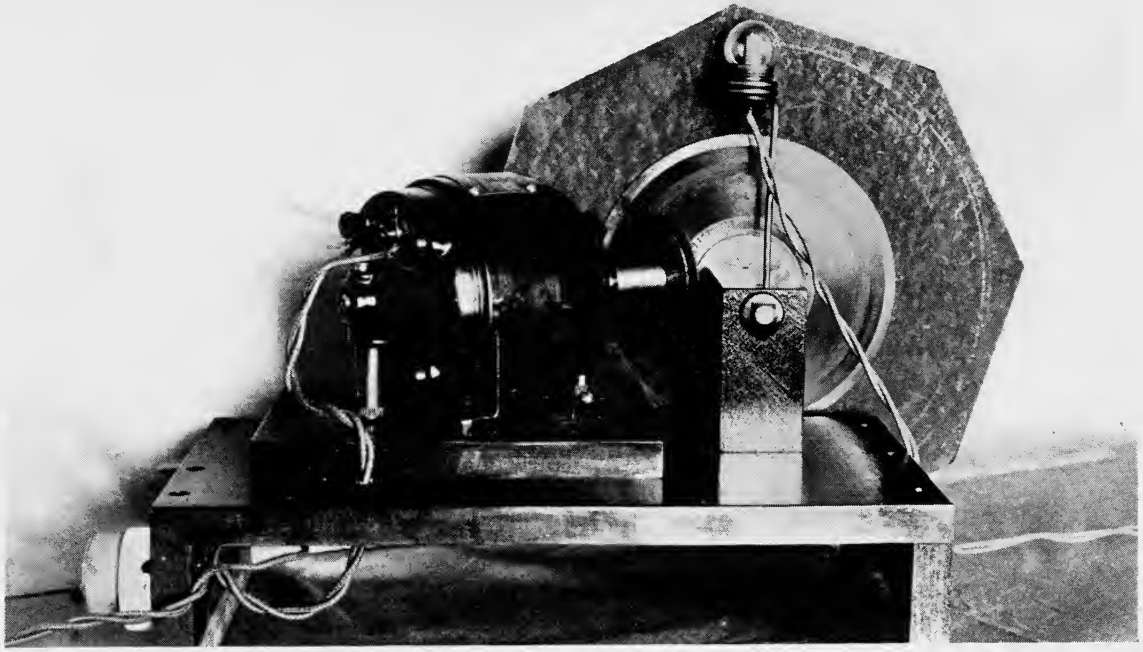
Frames taken from early (1928) Radiomovies broadcasts from W3XK. The Jenkins Laboratories, Washington, D. C.

Frames taken from early (1928) Radiomovies broadcasts from W3XK. The Jenkins Laboratories, Washington, D. C.



The Jenkins Lens-disc Radiomovies Transmitter of 1928. Lenses arranged in a circle; film moves continuously.

"The time is not very far off now when inaugural ceremonies, ball games, pageants, and other notable events may be seen reproduced in action on a small screen in the home, carried there by radio."



Completed Radiomovies Receiver as it was assembled by an amateur

Dr. William John Cooper, U. S. Commissioner of Education, investigates the future possibilities of radio movies and television in teaching.

The Kit cost more than that to manufacture, even in considerable quantities, but the reports which the amateurs sent in were of inestimable value in improving the broadcasting, more than worth the difference.

These first broadcasts were on four wavelengths, one of which was a 47 meter radio wave. And as the 18,000 amateurs had their own communications wave at 40 meters, it was easy to tune in the picture signals, and the microphone announcement which preceded.

The channels assigned to the new station were but 10 kc. wide, and so silhouette pictures only were broadcast at first. As but a single station only was served, the whole cost of making these movie story films had to be charged to this station. So the pen-and-ink cartoon pictures seen in theatres were, obviously, entirely too costly to buy and use. Therefore, a silhouette studio, unique in the movie art, was designed and set up by Mr. Jenkins, in which silhouette story films could be made as cheaply as ordinary movie films.

The stars of these radiomovie plays were recruited from the laboratory staff, except for those parts taken by children. For these parts little friends came in, selected for their cleverness and amenability. Among these was little Miss Jans Marie, who came to be known all over the continent as "the little girl bouncing the ball."

The studio director was from the laboratory staff, Mrs. Florence Clark, as was also the cameraman, Teddy Belote. Others of the "stars" were from the office force, Mrs. Sybil Windridge and Miss Hunter. When additional male characters were required in the cast they were had from the radio room; for example, Stuart Jenks, Paul Thomsen and Dick Battle. The scenario writer was Elwood Russey. The whole of this studio equipment was built under the immediate supervision of John Ogle, as was also the radio broadcast station analyzers.

Incidentally, it may be of passing interest to note

that soon after Mr. Jenkins had read, before a meeting of the Society of Motion Picture Engineers, a paper describing this new silhouette studio, a similar studio was set up in Hollywood and theatre productions were made, the entire story, action, actors and background, all in black and white only, pictures which caught the popular fancy at once.

Later on, as technical skill was attained, and mechanisms and methods improved, the Federal Radio Commission was asked for wider radio bands, over which halftone pictures could be broadcast. Channels 100 kc. in width were granted. A more powerful broadcast station was then immediately planned. Approval of a location five miles north of Washington was asked and granted, and steps were immediately taken to build and equip such a 5 kw. station. As soon as it was ready, the broadcasting was uninterruptedly transferred to this station for the nightly picture entertainment broadcasts, thus keeping faith with the host of friends scattered over the country, and who had learned to trust Mr. Jenkins' promise of "picture stories by radio every evening."

As was to be expected, the widespread interest created by continued successful nightly broadcast from W3XK, of radiomovie stories for home entertainment, began to attract the attention of keen men of affairs. And in November of 1928 a financier of New York City and Palm Beach undertook the merchandising (under the corporate title, The Jenkins Television Corporation) of the devices developed in the Jenkins Laboratories, the latter owning by assignment all the patents issued and pending applications on visual radio.

On the evening of January 22, 1929, Mr. Jenkins, as guest speaker at the "Indiana Home-Comer's Week" banquet, in Indianapolis, again spread the tidings of television, giving credit to the climate of the Hoosier state, whose sons have made names for themselves in so many lines of human progress.

The program seemed to be well received, due to

interest in the subject, and to the excellent public address system in use. But to Mr. Jenkins the most pleasing part was the delightful introduction by Mr. Howe Landers who, referring to the Arabian Night's Tales, with its "magic mirror," in which the wanderer could see the folks back home as he listened to their hearthstone conversation, said he was introducing the inventor of that "magic mirror." It was a clever thought and interestingly appropriate.

Pending the completion of the transfer, after the sale of the Jenkins Laboratory stock, and the tooling of the factory, Mr. Jenkins took advantage of the opportunity for a vacation, going to Miami Beach, Florida, in time to witness the Seagrave-Gar Wood international boat race, which he described in a letter to a friend as follows:

"Well, this has been a big day for the nautical sportsman. And he is here at Miami Beach in numbers, too. The lobby of the hotel is crowded with canvas shoes, flannel trousers, blue coats, and white caps, with commodores, captains, and mates inside these jolly uniforms. And many an 'Avast' hail is heard above the gentler greetings of their diaphanously-gowned, sun-tanned women folks.

"For me the day began when I was wakened by the noisy sunrise work-out of the contestants. The most conspicuous were the busy little outboard motors with their vicious machine-gun clatter. They are all over the place, shooting this way and that, without rhyme or reason, as they tear around, jumping erratically from crest to crest of the tiny waves they themselves kick up.

"Out of this persistent racket comes a new sound, a deep-throated ominous growl from the multi-motored Miss England, as Major Seagrave puts her through a final try-out. But while she slips through the water with astonishing speed, one has the feeling that the Major is not showing all that he expects of her later.

"Aboard the yachts, which seem almost to fill

this part of Biscayne Bay, activities began early. Sailors in dungaree are mopping decks, polishing brass, and generally dressing ship. Many already have run up their string of flags, from stem to stern over the mastheads. Some of those tied up at the dock are casting off their lines preparatory to taking their positions inside the circuit of the course.

"The bell boys from the hotel have put chairs on the grass inside the concrete walk along the seawall. There must be a mile of them, at least, as they range away in a double row along the shore. The wharf, now cleared of boats, is roped off for the special benefit of those holding hotel guest tickets.

"Workmen have also erected on the lawn some temporary grandstand seats of green boards and risers, which, finished, look for all the world like circus seats, except that they lack the sheltering shadow of the 'big top.'

"On the roof of the wharf shelter the microphone man is stretching his wires; and on the lawn below our window a Scottish band is taking its position. Their kilties and plumed turbans add gayety and color to the scene. The only incongruous feature is the hatless bandleader in a palm beach suit, beating time, but with a lack of snap and enthusiasm quite unusual. He leisurely surveys the crowd seated all about, and now has actually gone away and lets the music run along by itself.

"But to bring us back with a snap to a realization that this is a modern show, some big tri-motored planes sail overhead, giving their passengers a more inclusive view than even we get from our sixth-story window, and that is not bad at all.

"But now the course is cleared. The press boat is making a preliminary photographic survey, with much sighting of cameras and turning of movie cranks. The official starter's boat is taking its place away off at the other end of the course from us, and a general tenseness of expectancy seems to possess everyone. Yes, this is going to be a sure-enough show.

"There goes the starter's gun, ordering the contestants to 'line up.' From here the darting specks on the water remind me of the 'skeeters' we boys used to watch, in the long ago, shooting this way and that on the surface of the little stream which ran along the side of the big road at the end of the lane.

"Again the smoke of the gun, followed a few seconds by a 'boom,' which reaches us away off here after the boats are actually started. But long before they come abreast of us, the contestants have strung out, as they jump about to the tune of a planing mill hum out of all proportion to the size of the craft.

"Redbird leads, and oh, boy, how he is coming. Round the marker buoy he goes, keeping right side up by a miracle, into the back stretch, not daring to slow up, for the others are pushing him hard, two, three, four, five, in a row, Orange Blossom in fifth place. Now they round the home buoy and head toward us again. But, look, Orange Blossom, with her 80-pound girl skipper, has waked up, she passes four, three and two. Jemima, how that girl drives.

"Redbird hears that terrifying roar as he nears the upper marker. Imprudently looking behind him he makes a bad turn and Orange Blossom passes him. And, boy, oh, boy, how that girl hangs onto her lead as she heads for the judge's boat.

"Orange Blossom wins. And she gets the purse. But I'll bet she thinks the worth-while reward came when she took the lead away from Redbird. That was real gratification, putting it all over that presumptuous man—he thinks he can drive, pugh!

"But there goes the starter's gun again, and toward us, abreast, come four low-lying, long, thin boats, with a steady, determined stride that means business. They begin to string out as the outside boat takes the lead and steadily widens the gap. Around the marker they go; down the back stretch; around the home buoy, and toward us again as steady as sail boats. Pshaw, this isn't a race, it is just a bit of a day's grind for a money purse.

"If Gar Wood and Major Seagrave don't give us more of a thrill than that, I shall be disappointed.

"But look, they are towing Miss England to the starting line. I guess she must be a delicate creature. But I think the Major intends to get every ounce of energy out of that motor even though he drives it to destruction during this one race.

"And here comes Miss America, proceeding under her own power, to take her place on the starting line. She is the huskier of the two boats, and gives one an impression of enormous power.

"They line up. And they are a grim, determined looking pair as they jockey into position for the start, each with a small grove of black exhaust pipes sticking straight up out of the engine cockpit in the stern.

"Boom. They are off. A good start. Miss America immediately begins to draw away from Miss England. They round the first buoy, Miss America still gaining. The American boat makes the turn much better than the British boat. Around the home buoy, and around the distant buoy again, with Miss America steadily increasing her lead. She is rounding the home marker, and—but something is wrong, she shoots off on a tangent to the turn; straight ahead, out of control, with a broken steering gear.

"Miss England keeps on for the required two more laps to win the race.

"Such is the hazard of sport. It promised to be a fine race, but 'flivvered.' Fortunately, however, not before it was very evident that Gar Wood's boat is still the fastest water craft ever built.

"And so the crowd disperses; the sun goes down in a golden glow; the evening sky a pink glory behind the spires of the Magic City across the Bay. The lights go on along the causeways, as the fairy islands clothe themselves in shadowy mystery; and in solitary grandeur, the Flagler monument, bathed in soft light, points its slender shaft to the darkening sky."

Joy hops from Florida airfields revived Mr. Jenkins'

dormant love of flying and soon after his return to Washington he went to Detroit and purchased a 4-place cabin plane, powered with a "Whirlwind" motor. It was past noon when the plane was ready, so he flew to Richmond, Indiana, where his two brothers lived. Next day the hop was continued, the older brother, Atwood L. Jenkins, going along to Washington for the ride.

The object of the purchase was both pleasure and research, and one of the first uses to which the plane was put was an actual flying test of a theory Mr. Jenkins had, namely, that an electrical (engine-ignition) shadow existed behind the metal fire-wall of every airplane, and that if the radio antennae were flown aft instead of below the plane, no engine ignition interference would be picked up by radio receivers carried by the plane. On test the fact was established.

Air equipment for two-way radio communication aboard a ship in flight was then immediately designed, built and put aboard the plane for longer flight tests. Flights between Washington and Philadelphia, and between Washington and Langley Field, Virginia, were made with perfect success, and without ignition interference of any kind. The set was then taken out of the plane for further refinement, in anticipation of flights of still longer duration.

In June, 1929, Earlham College, at Richmond, Indiana, wrote Mr. Jenkins that the faculty had voted him an honorary degree, and inviting him to be present at the annual graduation exercises on the 17th to receive the award in person.

Learning of this, the youngest brother, Mr. A. W. Jenkins, guessing that Mr. and Mrs. Jenkins would fly out to Richmond for the ceremonies, telegraphed asking permission to come on to Washington and ride back with them. Though the brother was not a pilot, he was a good civil engineer, and could read maps, and his presence was welcomed.

So in the morning the hangar attendants filled

the fuel tanks, rolled the plane out onto the flying field, and warmed up the engine. The three got into the plane, waved adieu to friends on the field, and with a roar the plane took the air for Mrs. Jenkins' first long flight in the new plane.

A course was set for Richmond, Indiana, over the Allegheny Mountains, and crossing the Ohio River at Wheeling, West Virginia, In four hours the plane circled the Richmond field, and turning, Mr. Jenkins set it down headed into the wind, but only to find the field surface so soft that when the plane stopped rolling it was stuck and had to be pulled out with a tractor. It had been raining almost steadily for two weeks.

A few days later, the ceremonies over, and the brother willing to read maps again and check the return course, the three took their places in the plane, and C. Francis Jenkins, D.Sc., "gave her the gun." The return trip was broken, however, by a stop at Columbus, Ohio, for a few minutes greeting of a sister, Mrs. Alice Maxfield, and children.

After learning that there was fog in the mountains, but good visibility and high ceiling beyond, with sunshine and clear skies at the Washington airport, the plane was put into the air and a return course set to again cross the Ohio River at Wheeling. From there the plane climbed rapidly until when the fog and clouds of mountains were encountered an altitude had been attained known to be well above the mountain tops. Sight of the ground below was, of course, soon lost and the ship was navigated by compass for more than an hour. At the end of that time the plane was cautiously nosed down until, when it broke through the clouds at about two thousand feet, it was seen that the ship was off the course less than ten miles.

With the Potomac River a silvery ribbon to the left, and the Washington Monument a landmark ahead to guide the pilot in, the plane soon glided into the field, rolled to a gentle stop at the loading

Mr. C. Francis Jenkins, Mrs. Jenkins, and Mr. A. W. Jenkins en route Washington, D. C., to Richmond, Indiana, June 15, 1929. Plane owned and piloted by "C. Francis."

Mr. Jenkins, pilot, and Paul Thomsen, radio officer, successfully complete two-way radio communication test flight Washington-Detroit in unshielded engine cabin plane.

platform, and another delightful trip was complete.

In anticipation of the use of the plane to carry a television transmitter, further radio broadcast tests were arranged, and for distance. It was believed that scenes flown over might be radioed back to the more powerful ground station for re-broadcasting, so that regular television "fans" served by W3XK might see on their radiovisor screens in their homes everything the lens aboard the plane was looking at as the ship passed over cities, farms, mountains, fortifications, or fleet maneuvers.

To test the adequacy of the radio for distance, the specially designed transmitter-receiver set was, in September, put aboard the plane and a course set straight for Detroit from Washington. The outfit complete with power supply weighed but 28 pounds; 11½ pounds for the radio transmitter-receiver, and 16½ pounds for battery. Mr. Paul Thomsen was in charge of the set and Mr. Jenkins flew the plane. Two-way communication with Teddy Belote, the operator on watch in Washington, was maintained by phone until the skip distance for that wavelength, 47 meters, was encountered. The signals faded out as the first range of mountains was reached. A key was then substituted for the microphone, and contact again established, about the time the plane crossed the Ohio River. Two-way code communication was maintained from then on all the way to Detroit.

In the early afternoon Mr. Jenkins, from the pilot's seat aboard the plane, sent a message to Mrs. Jenkins back in Washington that he was nearing Detroit and that the antenna would soon be reeled in for a landing, a message doubted by the radio man on watch in Washington until he heard the carrier wave die out.

And thus another record was established for two-way communication with an airplane in flight, the plane powered with an unshielded engine, and with an unprecedented light-weight radio set.

The feat was possible only because the antenna was flown aft of the plane in the electrical shadow projected by the fire wall of the plane. With a long antenna flown aft, a light-weight, small-gain radio set is adequate, for no engine ignition interference will be encountered.

In June, the father, Amasa M. Jenkins, then stopping in Washington, expressed, at the dinner table, a desire to visit friends in Greensboro, N. C. Mr. Jenkins, always looking for an excuse to fly, immediately offered to carry him down, as an 86th birthday gift. So next morning the plane was rolled out on the field, and warmed up. With passenger and baggage aboard, Mr. Jenkins invited a friend at the field to go along for the company of his presence on the way back. Of course, the invitation was accepted. It would be.

Hopping off, the course was laid over the beacon-marked mail route south, past Richmond, Virginia. In three hours the plane glided to a landing at the air-mail field serving Greensboro, High Point and Winston-Salem. The children of the friends who were waiting at the field were given a local hop, and then the parents themselves.

Refueling, and bidding the friends good-bye, and leaving the father in their kind care, the return trip was started. But before proceeding very far Mr. Jenkins believed he detected a new note in the drone of the engine. A little later smoke was detected coming up from the base of the cylinder in which the master connecting rod worked. The smoke increased in volume, and the noise got worse. Mr. Jenkins asked his friend to look on the map and see if the nearest emergency landing field was to the rear or ahead of them. It was found that the nearest field was located just beyond a small town in sight two or three miles ahead. Mr. Jenkins throttled the engine to a low r.p.m. hoping to carry the plane to the field before serious damage to the engine would result. It was not successful, however, for in a

few seconds more the cylinder was knocked loose, although it was prevented from falling to the ground by the exhaust and intake manifold. An attempt to stop the engine disclosed that the throttle wire had been cut somehow. Neither did opening the ignition switch stop the engine, for it was so hot that pre-ignition kept it running. Meantime the hot oil was pouring out of the crankcase, and making sight through the windshield impossible.

Turning the plane over to his pilot friend, Mr. Jenkins loosened his safety belt and reached down under the instrument panel and cut off the flow of gasoline in the fuel line from the wing tanks. Getting back in the seat and fastening his belt again, the plane was then slipped down "on the wing" from its 2,500 feet altitude to a few feet above a plowed field, across which it was guided. The throttle having now been shaken wide open, the plane was flying a hundred miles an hour, with a carburetor bowl of fuel to be burned up before the motor would stop.

Straight for a mountain at the far end of the field the plane flew, the engine showing no indication of stopping. When a crash was seen to be inevitable the plane was pulled up through the tops of the pines and cedars of the mountain side until the plane stalled. Pushing the stick forward the plane rammed its nose into the earth from the height of the trees, and with neither occupant hurt at all. The plane was hardly down, it seemed, before visitors from the fields and from the nearby town came running up through the woods, disappointed perhaps because of the lack of excitement usually attendant upon someone being killed.

As the friend was willing to stay and put the plane and engine aboard a freight car for shipment to the factory, Mr. Jenkins accepted the kind offer of the minister of the little church of the town to carry him to Danville, some fifteen miles away on the main line railroad.

Calling Mrs. Jenkins on the phone she immediately said without waiting to be told of the crash: "You've had an accident. I told you this morning you would. You remember I didn't want you to go." A woman's intuition. "Are you hurt?" On being reassured, she was happy again, only to await the return of her husband by rail that night, a seven hour ride which by plane would have been completed in less than two hours.

In the spring of 1930, Mr. George Sargent, of the Professional Golf Association of America, called on Mr. Jenkins, in Washington, explaining that a golf stroke was so fast that its exact technique was not definitely known, and that it had been suggested that perhaps the Chronoteine camera might permit an exact analysis of the stroke to "take the guess out of golf." Mr. Jenkins said he believed the camera amply fast enough to do this.

And so a phone call engagement was made with Bobby Jones to meet him in Atlanta, late in July. The result of this meeting is well told by Mr. O. B. Keeler, in *The American Golfer*, which is quoted from by permission:

"'This will take the guess-work out of golf instruction,' said George Sargent. He spoke with some emphasis. He went on:

"'The teaching of golf has been a matter of theory from the beginning, cluttered up with tradition more and more, as the profession grew older. The trouble was, nobody knew for sure what happened during the golfing stroke. Now we are going to find out. This machine of Mr. Jenkins will discover it, every detail. For the first time since golf has been played, and taught, we shall see what makes it tick. The Jenkins pictures leave nothing whatever to the imagination.'

"Mr. Sargent of the Professional Golfers' Association of America made this statement in Atlanta the latter part of July. He was there, with C. Francis Jenkins, of Washington, and John N. Ogle, cameraman unto Mr. Jenkins, to make motion pictures of

Bobby Jones in action, at the rate of 3,200 pictures per second, using the highest-speed movie camera in the world. Following two afternoons' work at East Lake, Bobby's home course, Mr. Sargent and Mr. Ogle were to sail August 5 for England, there to make similar speed-films of the methods of Miss Joyce Wethered and Harry Vardon.

"'It is the beginning of a new era in golf-study and golf-teaching,' said Mr. Sargent, with a certain solemnity. 'I believe it to be the longest step forward the instruction of the game has ever taken.'

"To set this out understandingly, it may be explained that film exposed at this rate (3,200 per second), and projected on the screen at the normal speed of the theatre, would require four minutes for Bobby Jones' driving, which consumes scarcely more than a second in actual execution. It exacts only a moderate exercise of the imagination faculty to grasp the extraordinary usefulness to the golf teacher, or the golf pupil, of being able to observe the excellent swing of Mr. Jones, or of Miss Wethered, or of Harry Vardon, slowed down to four minutes and yet perfectly reproduced in all the details and phases by which that swing takes the ball and dispatches it accurately.* * *

"'We have selected Harry Vardon as the master stylist of the preceding era,' said Mr. Sargent, 'and Bobby Jones as the master stylist and most effective player of this generation, and Miss Wethered as unquestionably the greatest woman golfer thus far.'

"'Of course, these sets of films will be made up in prints and supplied to all the teaching members of our Association who desire them—and you may imagine that will be all of them. With a simple projecting machine and a small screen, the professional then is equipped to study golfing methods at first hand as never before, and to teach them with an authority and a verity hitherto unknown and impossible.'

"Which, I confess, sounded to me like a new epoch

in golf instruction. I regarded the maneuvers on the first fairway on the new course at East Lake with a reverential eye, and I saw things in motion pictures I never saw before.

"The incredible mechanism employed on the golf swing was patented, for example, in 1894. 'I spent the next thirty years trying to make it work,' said Mr. Jenkins with a chuckle. It works now.

"Mr. Jenkins, to begin with, is an extraordinarily interesting gentleman. You probably have read a good deal about him in the papers, in connection with some startling subjects—radiomovies, radiovision, television, vision by radio, radio photographs; and such astonishing matters.

"One thing which you will readily appreciate, if you know the first thing about the motion picture camera, is that the flow of film at this appalling speed must be continuous.

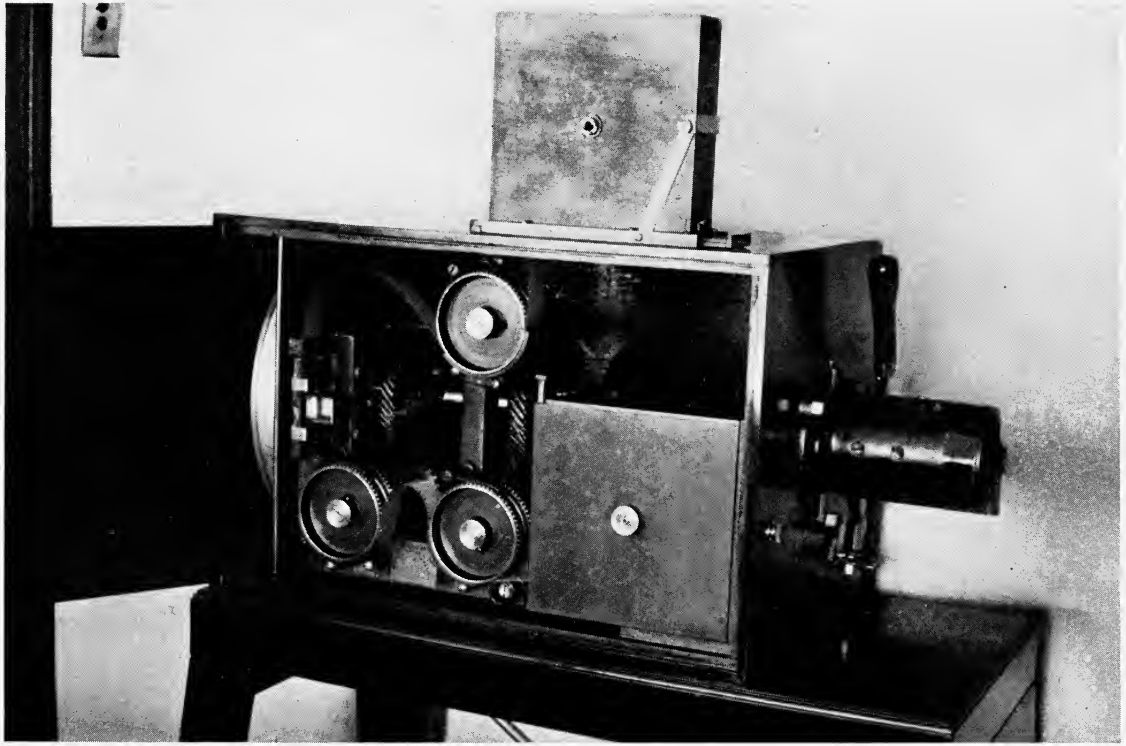
"In the ordinary movie camera, the film comes to a complete stop back of the lens for each exposure or picture.

"But the first thing Mr. Jenkins explained to me was the continuous flow of the film through the camera and how photographs were made on it without its stopping.

"It is really very simple. The only trouble is to make it work.

"Instead of a single fixed lens, the Jenkins camera has forty-eight lenses mounted near the rim of a spinning disc of magnesium, which revolves at the correct distance in front of the flowing film at a speed precisely synchronized with it. The forty-eight lenses are so spaced that as each 'frame,' or place for a photograph on the film, comes opposite the opening through which the object is seen, one of the lenses will be there, moving in the same direction and at the same speed as the film, and hence, to all intents and purposes, stationary with it.

"To the simple layman, as myself, confronted with the problem of synchronizing the rim of a revolving



Chronoteine camera in which motion pictures are made 3,200 exposures per second, later to be projected 16 pictures per second for study 200 times slower than taken.

Mr. Jenkins explains his Chronoteine camera to Bobby Jones, international golf champion, Atlanta, Georgia, July 18, 1930.

disc with the speed of a strip of film moving at a rate of more than two miles a minute and carrying the synchronization to a point where the area of critical definition in photography is not disturbed, would do well immediately to drown himself or give up and let Mr. Jenkins do the inventing.

"George Sargent, however, says there is a new era in golf instruction in it. He says we shall know more about everything, when the films of Bobby, and Harry and Miss Wethered are printed and projected."

Perhaps it is sufficient to say that when the Bobby Jones, Joyce Wethered, and Harry Vardon pictures were developed, printed and projected it was definitely known for the very first time that golf experts play the game in exactly the same way. It was not certainly known before.

When Mr. C. Townsend Ludington, of Philadelphia, whom Mr. Jenkins had first met in Omaha during the week's night-flying mail experiment, set up the hourly New York-Philadelphia-Washington passenger airline, in September, 1930, he invited Mr. Jenkins, with others, to an initial trip over the route.

For some of the guests this was their first air trip, although to others it was a familiar experience. There was Mrs. Mabel Walker Willebrandt, prohibition prosecutor for the U. S. Department of Justice, who always takes a plane to her destination where a plane is available; Major General J. E. Fechet, head of Army Air Service when *Question Mark*, made its refueling endurance flight; Mr. J. V. Magee, who assisted Col. Paul Henderson, Second Assistant Postmaster General, in establishing new routes of the flying mail service; Commander J. Q. Walton, of the U. S. Coast Guard Service, and others with whom Mr. Jenkins was less well acquainted.

The route from Washington was past Baltimore, crossing the Susquehanna River at Havre de Grace, in sight of the Conowingo Dam power development; past Wilmington and Philadelphia for a stop in the

Guests on the initial trip of the Ludington Line between Washington and New York City with intermediate stop at Philadelphia.

new Camden airport (home field of the line); thence over Trenton to the landing terminal at Newark Municipal Airport for luncheon. Mr. Jenkins stopped off at the Camden field for lunch with Mr. and Mrs. Ludington.

Being acquainted with the physical conditions involved, and numbering as friends the personnel as well as the executives and owners of the line, Mr. Jenkins watched its development and its growing patronage with an intensity out of all proportion to his interest therein. His satisfaction grew accordingly as the line set new world records for passengers carried, and with a 100 per cent safety factor to date.

Perhaps the establishment of no other airline ever so stimulated the development of air travel. At least it demonstrated that the traveling public would patronize an airline for its advantages in speed, safety, comfort and absence of dust and other earth annoyances, when the fare charged was comparable with that for other available travel facilities.

Mr. Jenkins confidently believes in the future wide use of the unobstructed, unlimited highways overhead, so prophetically described by Tennyson in his Locksley Hall:—

"For I dipt into the future far as human eye could see,
Saw the vision of the world, and all the wonders that would be;
Saw the heavens fill with commerce, argosies of magic sails,
Pilots of the purple twilight, dropping down with costly bales;
Heard the nation fill with shouting, and there rain'd a ghastly dew
From the nations' airy navies grappling in the central blue."

Mr. Jenkins referred to the airplane as particularly advantageous in the development of Canada's wide

virgin territory, on the occasion of an invitation visit to speak before the Royal Canadian Institute, at Toronto (and the Canadian Club, a day later), of his audio-radio and visual-radio research, and its usefulness in two-way communication in passenger airplane operation.

It was gratifying to find, not only the scientists of the Institute, but the "hard-boiled" business men of the Canadian Club, both attentively interested, and many of them believing in the prophecy and the probability of its realization. One of them wrote:

"My mind is still full of what you told us in your fascinating address. I would not have believed that anyone could make a scientific subject so thrillingly interesting to a meeting of four or five hundred hard-headed business men. Your delightfully humorous touch, and the inconceivable possibilities which you place before us for the future, provided a combination of entertainment and absorbing interest which it would be hard to equal."

Dr. T. A. Russell, president of the Institute, had invited governmental officials and representative business men, and their ladies, to meet Mr. and Mrs. Jenkins at his home; and the generous attendance and enthusiasm of the reception and subsequent discussion seemed to be an indication of their confidence in the future of aviation and radio as promoters of national and international business, especially in the far-flung territories of Canada.

Mr. Jenkins believes that ultimately there will be found more opportunities for young men and young ladies in these two rapidly growing industries, i.e., aviation and radio, in their almost limitless applications, than in any other two of our industries, big as some of them are.

In the set-up of the 1928 corporation Mr. Jenkins had been elected "Vice President in charge of Research," but in the early summer of 1930 he suggested to the board of directors that the financial stringency would be relieved somewhat if he were to resign, as

he was the highest paid officer in the company.

After some weeks of consideration the board of directors accepted the resignation. Mr. Jenkins took over the lease of the Washington laboratories and continued their operation, but on his own individual responsibility, and with the same staff of assistants.

After ten years of diligent effort in the development of the old Nipkow "scanning disc" method, in one modified form or another, Mr. Jenkins now found himself free to undertake a different scheme, which he had had in mind for a long time, in which persistence of elementary picture areas was substituted for persistence of vision of the eye.

In the old spirally perforated scanning disc, a single point of light is made to sweep across a latent picture surface in adjacent parallel lines, to build up a picture (on the brain of the observer) by persistence of vision of the eye.

It may be of passing interest to note that in this old scanning disc method the picture does not physically exist where it appears to be, i.e., in the plane of the scanning disc, but is purely an illusion, the picture existing only on the brain of the observer. There is never more than a single, tiny spot of light in the apparent picture plane, and nothing else. This is readily proved by photographing the scanning disc plane with a "snapshot" camera; a spot of light, or a blurred line at most, is all that is recorded on the negative plate.

From his own ten year efforts, and the observation of the limited results attained by the great industrial giants in radio with unlimited resources in money, facilities and talent, Mr. Jenkins had definitely decided that the inherent limitation in the old method is insurmountable. Less than one six-millionth of the intensity of the light source effectively reaches the eye of the observer. That is a discouraging handicap.

In the new scheme proposed by Mr. Jenkins the

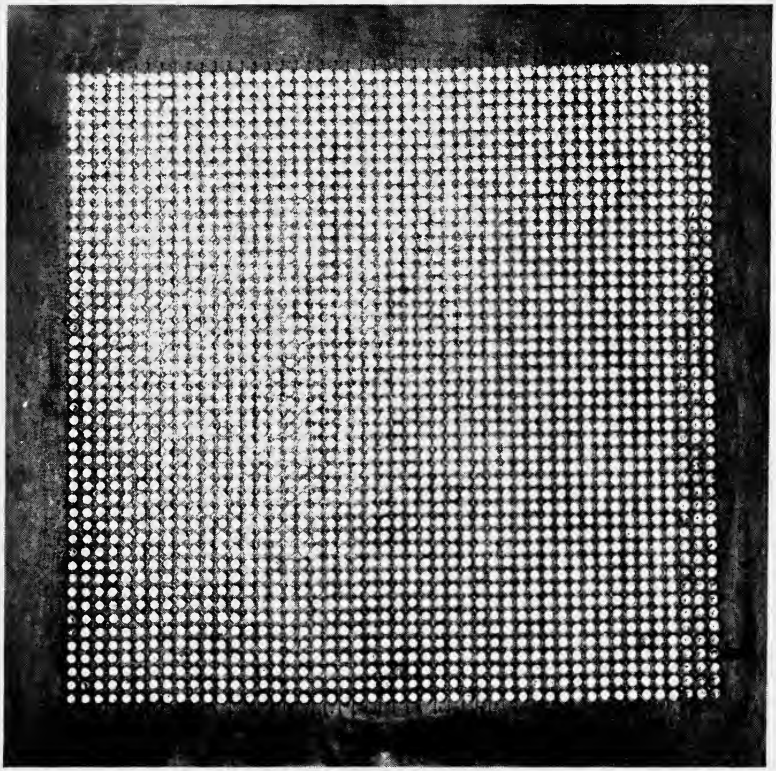
entire picture-light reaches the eye, or the picture screen, which is 100 per cent more than is now received on the same size screen of a motion picture theatre (because of the 50 per cent loss due to the projector shutter which closes off the light every time the film is moved), or the same brilliancy of theatre radiomovies with half the present projector light intensity at the source.

Several schemes of construction to put this new method into effect were tried by Mr. Jenkins and his staff, with varying degrees of success, but proving the soundness of the underlying theory. One set-up consisted of a grouping of 2,304 flash-light bulbs (48 horizontal rows with 48 bulbs in each row), the assembly acting as a light source. Another scheme consisted of a 48-row bank of light cells, or light-passing apertures, with 48 cells in each row. A light was located behind the cell-bank, and the cells closed by the incoming radio signals acting on tiny electroscopes to close commutator-selected cells to build up a shadow picture when projected on the screen. The picture changes with the charging and discharging of the electroscopes in the cells of the cell-bank.

But the most promising prospect consists of a transparent lantern slide the surface of which is effected to selectively obstruct the light (passing therethrough to the screen), by radiations sweeping across the lantern slide surface in the usual adjacent parallel lines.

The successful effect of this method is to build up light-obstructing dots, or spots, on the lantern slide, in chemical color (or diffraction dimples or bubbles) for example, resembling the dots of the printer's halftone block used in newspaper illustrations.

Now if this grouping of dots on the lantern slide followed the order of the grouping of such dots on the picture image at the radio broadcast station, obviously the lantern slide picture would be a facsimile of the person, object, or scene at the distant



Face of the Jenkins Plate Receiver. It has 2,304 elementary-area light-sources, arranged in 48 rows with 48 in each row. Persistence of light of each elementary area is substituted for persistence of vision, of the old spirally arranged disc-aperture method.

TRANSMITTING PICTURES BY ELECTRICITY.

BY C. FRANCIS JENKINS.

One of the most interesting subjects before scientific societies at the present time is the problem of transmitting images to a distance by electricity. I offer for what it is worth a theoretical device which may be added to the

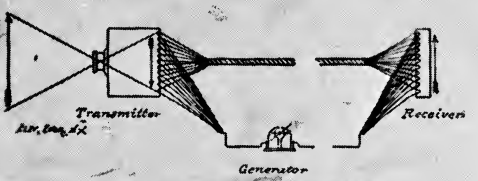


DIAGRAM OF JENKINS' PHANTOSCOPE.

methods already suggested for the accomplishment of this object. My scheme contemplates the use of selenium for a receiver, and the apparatus is substantially as follows:

A rectangular or circular non-conducting plate is set up behind a lens in such a manner as to receive the image or scene to be transmitted. This plate or board has upon its back a number of small short wires of selenium or sulphur, one end of each of which is thrust through the non-conducting board and immediately turned back, coming out again upon the same side and very near where it was thrust through. The board is covered with these little loops, one end of each of which is joined to a common conductor, the other ends having separate conductors extending over the distance intervening between the transmitting and receiving stations. At the receiving end is a large flat electric lamp of ground glass with filaments in number and position corresponding with the loops at the transmitting station—a filament for each loop and in circuit with it. We now have a number of selenium loops, each upon a separate circuit, which are affected by the light passing through the lens at the transmitting station, and in circuit with these loops, filaments in a lamp common to all the circuits. As the conductivity of each circuit is affected by the light impinging upon the selenium loop at the transmitting station each circuit carries a different quantity of the electric current generated by a dynamo in the wire common to all the circuits. The result is that all of these little filaments glow, but each with a different intensity and the light diffused over the flat surface of the ground glass lamp at the receiving station appears brighter in some parts than in others, the bright parts corresponding in position to the bright parts of the image projected upon the board by the lens at the receiving station.

The scheme, if practicable when necessary modifications are made, is objectionable in that it contemplates a multiplicity of conductors, but as a basis for study the method has its merits. I should be glad to learn of the success of such an experiment by some one, as I cannot at present test it myself.

broadcast station. And, of course, this lantern slide picture can be projected onto a large screen in the usual fashion.

Now if this lantern slide picture would fade out, another might replace it arranged in a slightly different way. And if these pictures and fading could follow each other fifteen times every second, a new form of motion pictures would result.

A fluid lantern slide, in which bubbles are electrically formed to build up the picture on the screen, seems to have solved the problem. These bubbles burst to obliterate the picture, with new bubbles in new places formed to give the constantly changing picture.

Again, if these lantern slide pictures could be built up by amplified incoming radio picture signals, then radiomovies could be distributed from Hollywood to every theatre of the country by radio instead of by film.

Later on, as refinement is attained, radiovision pictures of distant scenes and events could be reproduced on theatre screens, and on smaller screens in the home, simultaneously with the event itself.

Naturally synchronous sound will be broadcast with the pictures, a realism absolutely uncanny, for one will both see and hear the distant speaker, and see and hear the distant ceremonies at the instant of their happening, and in any part of the world.

In conclusion, and as suggested in the beginning of this narrative, perhaps this inventor's boyhood activities, likes and attainments, studied in conjunction with the recital of his accomplishments in later life, may lead to a discovery in other youths of a latent inventive talent; and which may then be cultivated, or at least given the opportunity for development.

Such opportunity for latent musical and pictorial talent is quite common, of course, and conservatories of music and art schools are maintained for this very purpose. But schools for the development of latent creative talent in mechanical, electrical, chemical,

and similar lines of human endeavor are lacking. The engineering, scientific, or chemical curricula of our colleges and universities cannot be so considered, for these studies are usually pursued as leading to a place in established industrial activities. They are never considered as an effort to develop latent creative talent to bring forth original additions to man's evolution in the tools of civilization; as, for example: ships, locomotives, automobiles, flying machines, in transportation; an alphabet, movable type, the printing press, typewriter, telegraph, telephone, and type-setting machines, in communication; or the photograph, halftone block, lithograph, movies, and radiovision, in pictorial presentation.

And as inventive history records only the financially poor as discoverers of great revolutionary inventions, which have started new industries, it would seem to suggest that aid and opportunity for inventive talent might increase the pace of our civilization.

Comparatively few inventions make money for the inventor; in fact, one Commissioner of Patents, in his annual report, declared that not one in a hundred of the more than fifty thousand patents issued yearly make enough money to pay the cost of securing the patent.

When the young man of this narrative resigned his position in the government service, his only source of income, to take up inventing as his sole employment, he adopted the least promising, most discouraging, and most heart-breaking profession in all the world. And yet his contributions have added to human progress, and he stands among the ten who have each taken out more than 300 United States patents.

On the other hand, whether aids would really help in the birth of new revolutionary inventions which start new industries, like the telegraph, telephone, typewriter, talking machine, motion pictures, etc., is not yet proved, indeed may be doubtful, judged from an historical listing of their inventors.

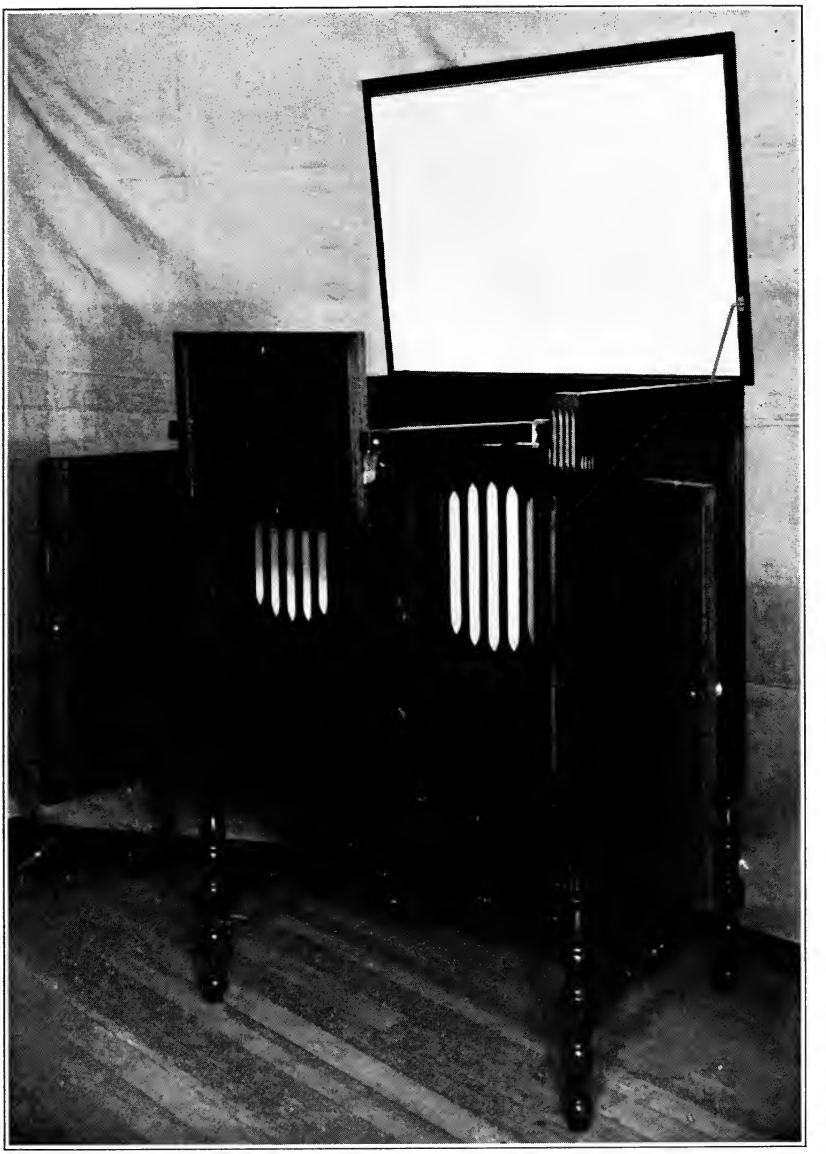
It is true that several of the great industrial organizations maintain research laboratories, but the research is in the line of their industrial product, and to date no new, revolutionary invention, which has started new industries, such as listed above, has come from such laboratories.

Revolutionary inventions seem to be an avocational gratification rather than a vocational product. And human nature being what it is, aid might defeat the very intent of the bonus to the inventor. Who may know before it is repeatedly tried?

Stuart Jenks Elwood Russey Vera Hunter John Ogle Paul Thomsen
Sybil Almand Windridge C. Francis Jenkins Florence Anthony Clark

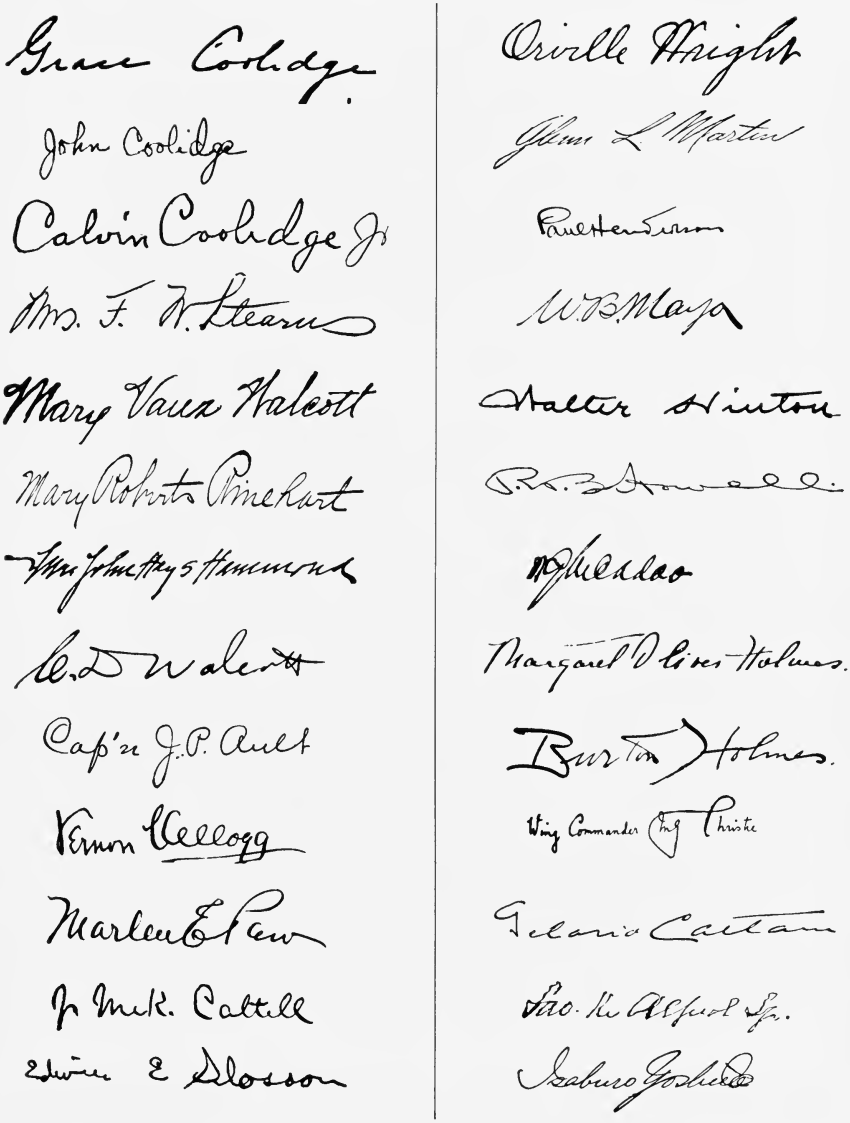
JENKINS LABORATORY STAFF

An evening's entertainment of talkie-movies.

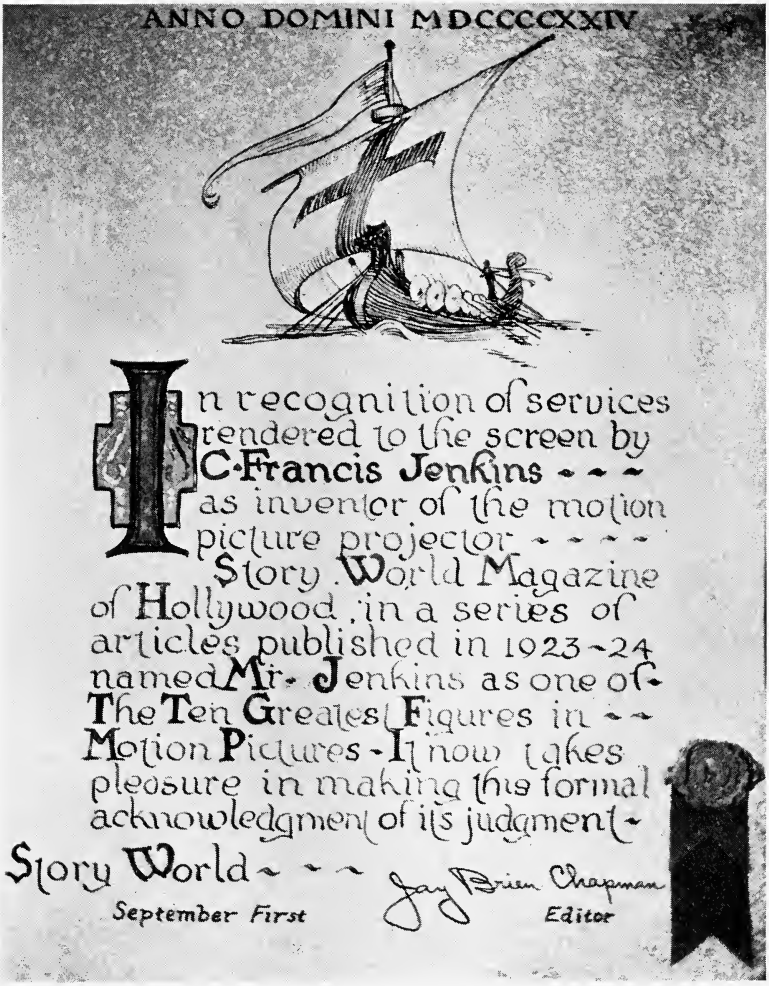


Jenkins Talkie-Movies in the home.

VISITORS


Grace Coolidge
John Coolidge
Calvin Coolidge Jr
Mrs. F. W. Stearns
Mary Vaux Walcott
Mary Roberts Rinehart
Mrs. John Hays Hammond
C. D. Walcott
Capt. J. P. Ault
Vernon Kellogg
Marlen E. Pew
J. Mck. Cattell
Edwin E. Slosson
Orville Wright
Gilmer L. Waston
Paul Henderson
W. B. Mayo
Walter Hinton
R. B. Howell Jr.
W. J. McGee
Margaret Davies Holmes
Burton Holmes
Wing Commander Eng. Christie
Edwin Canfield
Geo. H. Alford Jr.
Isaburo Yoshida

VISITORS


ANNO DOMINI MDCCCCXXIV
In recognition of services rendered to the screen by C. Francis Jenkins as inventor of the motion picture projector
Story World Magazine of Hollywood, in a series of articles published in 1923-24 named Mr. Jenkins as one of The Ten Greatest Figures in Motion Pictures - It now takes pleasure in making this formal acknowledgment of its judgment
Story World
September First
Jay Brien Chapman
Editor

BROADCASTS

The Genesis of Radio

A Broadcast from WRC, November 20, 1924

C. Francis Jenkins

The history of radio is unique—at first only a scientific curiosity, and for years thereafter a boy's plaything; when, all at once, without warning, the public takes it up with a suddenness no one foresaw, and for which no one was prepared.

An invention which behaves so peculiarly excites one's curiosity to a study of its strange attraction; and of the beginnings of the scientific principles involved, now so knowingly discussed by mere youngsters.

Why, boys in the whole range of their teens discourse with fluency and understanding such mysteries as inductance, impedance and capacities; reactance, reluctance and rotors; harmonics, aerials, and mush; choppers, chokes and cheese; heterodyne, neutrodyne, and iodine; and we oldsters don't know whether they are talking of medicine, music or food.

The only thing that saves us from everlasting embarrassment is that we have the gumption to keep our mouths shut.

So, determined to be ready for these "kids" the next time they come into my august presence, I start in to "bone up" on some of these funny words, and for a start I turn to a musty volume printed by Congress in 1879.

It appears that on January 16 of that year the business of Congress was stopped, and, in solemn procession, led by the Sergeant-at-Arms, the Chaplain, and the Vice-President, the Senate proceeded to the House Chamber, where the Speaker handed

his official gavel to the Vice-President, who said:

"The Senators and Members of the Congress of The United States are here assembled to take part in services to be observed in memory of the late Joseph Henry."

And, as I read the addresses made on that memorable occasion, and look up the references cited, I get the solution to my problem.

I find it was Joseph Henry who first discovered that breaking the circuit in a coiled wire "gives a more intense spark than the same wire uncoiled." And so inductance was born, and later in his honor we name its unit of measure a "henry."

Then he put iron inside the coil and got the first magnetic field; next he found that when he arranged a second similar coil near the first, the spark appeared in a gap of the second circuit, and so we have the first transformer.

He put parallel metal plates across the circuit, and he had a condenser; and finally he separated the circuits by many hundred feet, and the first radio signals were broadcast and picked up.

So we learn that to this modest but remarkable man we owe the simple coupling coil that the boys of the past twenty-five years have been using to telegraph to each other wirelessly.

And it is these American youngsters who have developed radio; who first set up two-way communication half-way around the world; who, through their Radio Relay League, kept Captain McMillan in touch with home during his long winter nights in the Arctic ice; who kept the *Shenandoah* in constant contact with headquarters in Washington during her recent transcontinental trip, official acknowledgment

of which was publicly made by the Secretary of the Navy.

Radio eventually will touch our lives at more points directly and indirectly than any other discovery in the history of mankind, unless, perhaps, I should make an exception in favor of fire.

And the delightful thing about it all is that the inaccessible places are benefited the most by radio, those in the out-of-the way places are less lonesome, and the long day of the sick and shut-in is more endurable.

The farmer has his market reports on the minute, his weather forecasts in time for action, and he sets his clock by radio and gets his entertainment from the air.

Dispatched and guided by radio, the flying mail goes day and night with such clock-like regularity that its remarkable performance is no longer "news," although industry has not yet waked up to the advantage and economy which can be effected by a larger use of the airmail.

Ships are guided into harbor through fog by wireless direction, and the captain was guided thereto by radio compass and radio beacon, and at sea summons aid in case of mishap or danger.

In commerce one may send letters, telegrams, bank drafts, or engineer's drawings, as radio photographs of the originals, with photographic accuracy and autographic authenticity.

Men on the ground talk with men in a flying machine out of sight in the sky, an almost inconceivable fact.

This reason alone would warrant one in predicting that the defense of our country is definitely going

to pass from the limited activities of the Army and Navy to an Air Department, for the plane has no boundary or limit of range in offense or defense.

And in addition there is the wireless direction of bomb-dropping airplanes, torpedo submarines, and floating mines, inanimate agencies obeying the distant, unseen hand.

And ultimately power will be transmitted to populous areas, over wireless channels, from the enormous unworked coal fields away up in the Arctic Circle.

The applications of radio are coming so fast in industry that it is hard to keep informed, but doubtless its most extended use will be in the home.

The use of microphone modulated radio to carry music and speech to our homes celebrated its fourth anniversary only two weeks ago.

And yet in this brief space (1) millions on millions have been entertained with the very best the artist has to offer; (2) a singer has been heard around the world; (3) and our President has addressed his fellow Americans as a single audience.

When onto the boundless range of audible radio is grafted the world-wide appeal of the picture, the ideal means of entertainment would seem to have been attained, for the picture is without language, literacy or age limitation.

By radio we shall see what is happening in a distant place; inaugural ceremonies, football, baseball or polo games; flower festival, mardi gras, or baby parade.

So when the development of radio as a service to the eye has progressed to a like extent with ear-service radio, we will bring the entire opera to your

home in both acting and music or even the Olympic games from across the sea.

It has been most satisfying to have had a part in the development of this wonderful medium of contact between individuals and between nations. My part being principally visual radio, I expect great things from Radio Vision.

And did you ever notice the curious fact that a great laboratory, despite its inestimable contributions to science and engineering, has never yet brought forth a great, revolutionary invention which has subsequently started a new industry, like the telegraph, telephone, and telescope; motion picture, typecasting and talking machines; typewriter, bicycle and locomotive; automobile, flying machine, and radio vision.

It has always been a poor man to first see these things, and as a rule the bigger the vision the poorer the man.

And, do you know, that is right comforting, too; for I sometimes think that perhaps I myself may yet do something worth while if I only stay poor enough, long enough.

The Engineer and His Tools

Banquet Address, Society Motion Picture Engineers, at its Washington Meeting, Columbia Broadcast Chain, Wednesday, May 7, 1930, 10:15 P.M., E. S. T.

C. Francis Jenkins

We are here tonight for a recreational hour in a convention of the Society of Motion Picture Engineers, a group of specialists gathered together with a basic thought, namely, to improve the tools of the profession.

The line of our particular activities is picture entertainment, but all such conventions of engineers in every line have a like purpose, namely, to improve the facilities of their particular employment.

Has it ever occurred to you that we act like civilized beings only because we have such a great and varied collection of tools—such a collection of tools that we can live together in communities of common interest?

The tools available to us and our engineers are the things which enable us, we moderns, to remain alive at all, although we usually think of them as means to decrease our labor and increase our leisure.

As a definition I refer to "tools" as any physical aid to an end; and any clever applicator as an engineer, whether he be of uncultured mind or of a trained intellect; but each is helpless without tools.

Tools have been the only civilizing influence in all man's history. It has changed him from a selfish food robber to a sympathetic neighbor.

I cannot agree with some of my evolution friends. The preponderance of evidence proves there has

been no evolution of man, but only an evolution in his tools.

The stone age man was as clever and ingenious as modern man. His earliest handicraft was as adaptable and symmetrical as that of today.

The scope of his works and the fineness of detail of the product has developed with the refinement and additions to his available tools.

Man's first aids doubtless were devices employed to obtain food and clothing more easily than he could do with hands and teeth alone; to be followed by tools to improve his shelter and security.

Later he began to impress his will on others, requiring them to use these tools to the master's advantage; and so slave labor became an established institution. Next he turned to his personal use the natural forces about him, i.e., "fire, water, earth, and air."

The known works which early man performed with an abundance of slave labor and more and more ingenious tool equipment are marvels to this very day. Nothing in modern times exceeds these early examples in majesty, in beauty, or in symmetry.

Scientists of the National Museum tell me that "the beautiful leaf-shaped flint blade has never been made by modern man"; and that "today's quarryman cannot even guess how his predecessors removed and set up the great monuments of the past."

But eventually tools were so many and so varied that they could not be learned unaided in a single lifetime. So institutions were set up to teach the young the artifices available to make easier for him the getting of food, clothing, and shelter; for ex-

ample, an alphabet; the three R's; the multiplication table; pi times the diameter; the hammer; the level; the transit; the telescope, etc.

But eventually tools became so numerous and so varied that no one man could master them all, even with every possible instructional aid, so he must learn the tools of a single trade; and thus specialists became common.

The modern machine age really began when America was settled by the white man, for from that date the evolution of machine tools has grown with unprecedented rapidity.

Soon the perfect slave of man was the machine; and as it developed into an aid a thousand times more efficient than the human slave, the human slave was liberated.

Our food, our clothing, our shelter, our transportation, our communication, which make living together possible for us, are products of tools, tools, tools; the human hand only guides the tool.

But man is the same man he has always been; he is of the same stature, he is no more clever, is no more ingenious today than was primitive man. All known evidence is to that effect, and no evidence to the contrary exists.

Why, if his evolution had been in stature, comparable to the evolution of his tools, he would today be taller than the mountains; or if his evolution had been in mental attainment, he would be a superman indeed, even a super-god.

There has been no evolution of man, but only an evolution of his tools; and this fact is irrefutable proof that man is a spiritual being, sprung from a discrete cell, not an offshoot from some early animal

plasm. His evolution of tools differentiates him from all other living creatures.

And as tools accumulate, more tools are available with which to make more tools, a tool evolution which equips the inventor to evolve newer tools for the use of the engineer in his attainments of greater and greater feats. Tomorrow's tool equipment is inconceivable today, and what can be done therewith impossible of prediction.

With this infinite evolution of tools we have put more and more of nature's forces to work for us: coal, oil, gas, water; all of them sources of energy we can see and touch.

Tomorrow we will put to work those sources of energy which could rather more properly be spoken of as the intangible forces of nature—"a double bit on the teeth of the lightning."

And these new forces will be distributed over like intangible channels. Long copper wires will not be so essential as today. And over these intangible channels power can then be delivered where wires cannot reach.

In 1844 a wire was stretched from Washington to Baltimore over which enough energy was transmitted to operate a telegraph recorder. But now a similarly stretched wire carries the power to drive heavy interurban railway trains between these cities, and with the swiftness of the wind.

Comparably, today, over an intangible radio channel, we send aloft energy enough to operate a communication device aboard an airplane in flight. Tomorrow we will transmit over this same intangible channel enough power to drive the motors of the plane itself.

The next age is the age of electronics, the age of intangible contacts of man with man, and over channels against which physical obstacles will have little effect. Energy to light, to heat, and to cool our houses, and for general communication, transportation, and control, may then be distributed without limits over the whole earth.

As far as our picture engineers are interested, I confidently assert that the tools are now within sight when distant scenes and notable events may be reproduced in our homes and on the screens of our theatres simultaneously with their happening; and when motion pictures will be distributed from Hollywood directly by radio instead of by film.

The Society of Motion Picture Engineers, in the fourteen years since its organization, has seen tremendous developments in this greatest of human entertainment, motion pictures; but the next fourteen years will see even more startling developments, and the audience many times multiplied, as radio is substituted for film as a carrier of this entertainment.

The Law of Free Movement

C. Francis Jenkins

On occasions I have wondered if there are not daily phenomena so familiar to us that we accept them as facts without stopping to study the underlying law, and thus overlook the possibility of useful application elsewhere.

Just for example, there is the fluttering flag with which we are all familiar since our youth. Why the flutter? Why doesn't the flag stand out straight from the staff like a piece of tin? A flag does not flutter in water. So where does the flutter come from?

The only explanation I now recall I found many years ago in "Alice in Wonderland," where she tells us that the Old-Man-in-the-Mountain supplied flutters for flags, rustles for silk dresses, and a very superior quality of post-hole.

But when I reached man's estate I did not find Alice's explanation quite satisfactory, and so began to puzzle out a reason for myself, and to my surprise I found it fitted many other observed happenings, of interest to all kinds of folks—to you, and to me, to insurance men, to airplane designers, to engineers in general.

So for my own guidance I wrote the explanation into a physical law which I could apply, and which is, practically, the Bernouilli theorum in the workable phraseology of the man of the street, as follows:

Any object free to move in a fluid will move toward that part of the fluid having the swiftest motion.

That is why the flag flutters, that is why leaves are "sucked up" from the ground, and that is why frame buildings are often pulled apart in violent windstorms.

The ball stays in the stream of air issuing from the pipe

The law also explains why great plate-glass windows are "blown out" in high winds. In normal conditions of quiet air the pressure on each side of the glass is equal; but as the wind grows in velocity, the air-pressure decreases on the outside, the gusty side of the glass, until the static pressure inside the window overcomes the strength of the plate and the whole gives way with explosive violence, the thousands of pieces being blown outward onto the sidewalk. The precaution is obvious: i.e., if you would save your plate-glass windows during storms, leave a door open.

During the latter part of the war two airplane hangars stood near each other on a flying field. On the approach of black clouds indicating a violent storm, hurried efforts were made to close the hangars, but there was time to close only one of them. The open one weathered the storm safely, but the sides of the closed hangar were sucked out in the wind and the heavy bridge-truss structure of the roof dropped down on the planes, wrecking them.

It is no uncommon thing, as many of you know, to have the tin covering pulled off roofs. But the tin is never pulled

She pushes the ball down the air-stream into the cup without touching the ball

off old buildings, which are open because the windows have been broken out.

The ball cannot be blown out of the cup by the stream of air issuing therefrom

A little neighbor of mine delights to spring on the unsuspecting a trick of her own which depends upon this reduced pressure effect of moving air streams. Sticking a pin through a visiting card, she drops the pin into the hole through a spool, and dares anyone to blow the card off the end of the spool by blowing through the hole. One can't do it; to blow hard only makes it stick the closer. The quiet air above the card holds it hard down on the moving air escaping in a thin stream between the card and the spool end. If, however, the quiet air above the card is disturbed by air leaking past the pin, or one blows over the card, then the card is easily lifted off.

There is abundant evidence that the law applies equally well to liquids also, explaining the peculiar behavior of bodies in moving water.

Showing how stream of air at 45° will hold ball suspended above ground

Why, for example, a log thrown into a swiftly running stream is quickly "drawn" to the middle and rides on the crest of the freshet, the crest itself resulting from the same cause. I think one would naturally expect the log to

A jet of air cannot hold a square box in the air stream, as it does a sphere

be pushed aside by the rushing water.

A light canoe going through the rapids does not collide with the ugly looking rocks, but is carried therebetween, and comes safely through if it does not upset.

Every summer we read of strong swimmers drowned in the ocean undertow. Into the outrunning water next to the smooth sandy bottom the swimmer is pushed and held down by the relatively motionless water at the surface.

A speed-boat sinks by the stern for the same reason, i.e., the water under the boat is thrust aft by the propeller faster than the surface water, and so the stern sinks, deeper and deeper as the speed increases.

Buoyant bodies going over a waterfall come to the surface only in the quiet water of the stream some distance away; though a like bolt of wood dropped endwise into a quiet pond jumps up immediately.

You have all seen the bobbing ball in the water fountain on the lawn. But do you know that only a round ball will stay up? A small square box will not stay in the stream, whether the jet be water or air. Walter Johnson cannot curve a hexagonal ball; nor can the Flettner

Walter Johnson can throw a curve only with a spherical ball

ship use rotating square cylinders to get power out of the wind.

Put a stiff visiting card (with a pin in it) on the end of a spool

Did you ever drop a small marble into the funnel-shaped end of the lawn hose nozzle and discover that the water cannot dislodge it. It can't; and the more the water pressure the more resistant the marble is to dislodgment, which is a surprise to most folks.

The law applies as well to two dissimilar fluids, water and air, for example, and that is the reason for the waves on the ocean, which are higher the stronger the wind. The passing wind lifts the water into a wave; this wave hump slows up the air movement; and as this robs the air of its lifting power, the wave collapses, releasing the wind to movement again, and to again pick up a wave. And this is repeated over and over again as long as the wind blows.

The card can't be blown off by blowing through the spool (if the corners of your mouth don't leak)

The steam injector, I believe to work on exactly the same principle, although I am aware that it is usually explained otherwise. It is the velocity of the water, sucked forward by contact with the high velocity steam, that carries the water into the boiler, the steam being dissipated by condensa-

Blowing gently across the top of the orer-turned scale pan will lift it

sation in the cold stream.

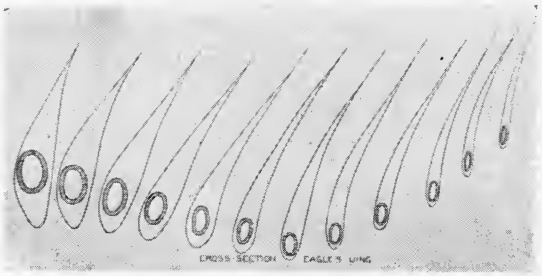
Liquids may also capture air. When one draws a glass of water at the kitchen sink, the stream carries air down into the glass and the glass is filled with water plus air, bubbles of which latter rising to the top escape to leave the glass less than full, when the glass is quietly removed from under the running faucet.

A very simple air-pump is made on this principle, a pump without moving parts. Vertical pipes are set under a waterfall, and the water capturing the air carries it down the pipes, to be collected in a chamber below, the air pressure being proportional to the height of the waterfall, and the area of the water exit from the chamber.

The grain-elevator man employs this same principle to move tons of wheat, by pouring a stream of it onto a swiftly running flat belt conveyer. The wheat humps itself up into a ridge in the middle of the belt as soon as it takes up the belt speed; not a grain falls off.

This law also explains why soaring birds ride the air with little effort. The eagle is noted for this gift of nature, though he soars too high for con-

The forward stroke sustains the pigeons; the backward stroke advances them

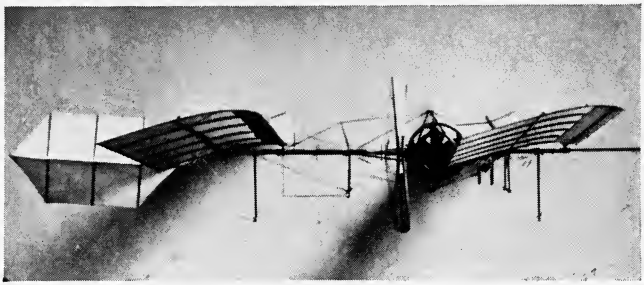


Cross sections of eagle's wing showing camber of wing

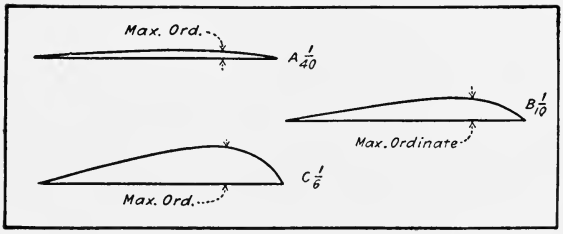
venient observation. But seagulls and the albatross perform low, where their movements can be studied easier. Into the wind each seems to advance without effort, going up and ahead on motionless wings.

On occasions when the wind is blowing from the Canadian side down into the gorge just below the falls at Niagara, one often may observe gulls glide into this down-air stream and be carried out of the gorge, up over the edge into the wind.

The thick leading edge of the bird's wing with its eddy-forming hollow underneath, just behind the bone, tends to slow up the air stream below, while the "down hill" slope of the smooth upper surface of the wing increases the wind velocity above. So with the air movement increased above and retarded



The Langley tandem monoplane wtih cambered wings

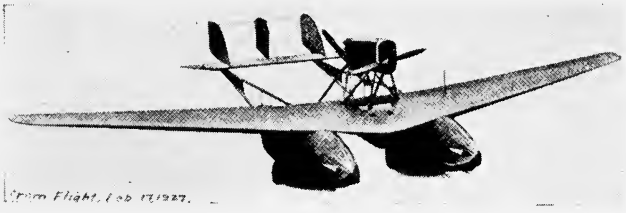


Diagrams show increased depth of cord for increased lift

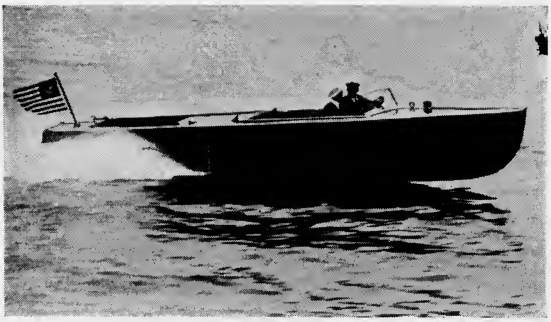
below we find a great upward pull on the wing. More than 90 per cent of the support of the bird is in the air passing above the wings, while the air beneath, slipping out from under the bent-up feathers of the wings tips, propels him forward.

Professor Langley incorporated this hump on top of the wing of all his models, but whether or not he copied from the outstretched wings of the soaring eagle he had mounted for his study of aerodynamics, I do not know.

It is now well understood by the designer of gliders, as well as powered planes, that 75 to 80 per cent of the lift of the plane is obtained from the air passing over the wing, and but 25 to 20 per cent of lift from air striking underneath. And an increase in the camber of the aerofoil increases the lift; and so we find planes designed for carrying heavy loads have very thick wings.



Santa Maria with engines so high the whole slipstream passes over the wings

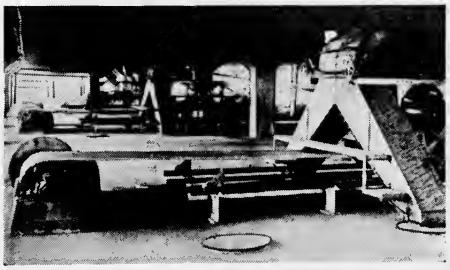


Speed boat with submerged propeller sinks by the stern

With the lift proportional to the air speed above the wing, one naturally concludes that the greatest lift and the greatest fuel economy should result from passing the whole of the propeller slip-stream above the aerofoils.

And such is the case. The British light-plane distance-and-fuel-economy contests of 1923 were won by monoplanes with the propeller elevated on stilts until the whole of the slip stream passed above the wings.

The Italian-built flying boat, *Santa Maria*, in which Col. Marchese de Pinedo flew from Italy to South America; over to Savannah, Georgia; across the United States and back again; and thence home, a 30,000-mile trip, had all his motors located high above the wings. His fuel economy was surprising.



Flat belt for grain conveyor

The great 60-passenger German Dornier has its motors similarly placed. Here in America we don't

yet built to economize on gasoline—it's too cheap.

To those research laboratories now experimenting on jet propulsion for aircraft instead of the usual propeller, may I suggest that, whether jet propulsion is sufficient or not, the jet will lift more if the air stream is directed across the top of the aerofoil. So directed, the thrust will be just as great, while the lift will be more than if the stream is directed beneath the wing.

In 1894 I patented a camera through which I am running 200 feet of motion picture negative film per second. The mechanical problem of moving the film, and the optical problem of sufficient exposure, were readily enough solved, but I worked for twenty-five years before I learned to successfully hold the film in the exact focus of the lens during exposure; for when the film at that speed contacted with the light tension spring members usual in other cameras, the film would catch fire. But in time I found that film moving 200 feet a second attracts air to its surfaces and holds it with "bulldog" tenacity. So I solved my problem by building a narrow channel through which the film should pass in the focus of the lens, held exactly in the middle of the channel by the film of air clinging to each face of the motion picture negative. The camera has worked perfectly ever since.

It is all very plain when we remember the law, i.e., that the pressure is always toward the rapidly moving body; and that this force is increasingly powerful as the difference in velocity increases.

I believe engineers generally will find many useful applications for this phenomena when they come to think of it as familiarly as they do other physical

laws—the law of gravitational acceleration, for example.

So now we know why flags flutter. With the elastic air passing down the sides the bunting moves to the fastest side. The hump thus formed slows up the flow of air on that side, and the bunting moves over into the swifter air of the other side. This hump in turn slows up the air on that surface and the action is repeated, over and over again, as long as the wind blows. And so, with the air moving down opposite sides of the bunting in alternating pulses, the flag moves from side to side in successive waves down its length from staff to trailing edge. The stream of elastic air makes humps and hollows in the bunting, waving or fluttering the flag as the wind is gentle or is strong.

And it is thus "Old Glory" flies from many a proud staff.

Evolution of Civilization

C. Francis Jenkins

We do not know how or whence life came upon this earth.

The assumption that all life began with "a single cell in the ooze" of a preglacial sea does not seem sufficient explanation of observed phenomena.

For if all the species came from the same cell, then it should be easy to propagate a new species by crosses between any two of them.

But such attempts at crosses have invariably resulted in failure. The product is always sterile. The new line ends with the first offspring. For examples, the mule, the carideer, the catelo, the zebrule, the tigon. Scientists produce variants in species, but never a new species.

If all life came from a single cell where did the cell come from, and what caused the separation into 10,000,000 different species, extinct and living, from microbe to mastodon? Why more than one species from one cell?

To assume the evolution of the red rose, the honey bee, the eel and the giraffe on the single cell hypothesis strains credulity, no matter how many millions of years are assigned to evolution.

All life reproduces its species, lives its allotted span, and dies; whether it be the minute cell of typhoid fever or the African elephant.

To sustain the single cell theory it is also necessary to introduce migrations to populate the earth. But except for man there has been little migration of living things.

It is far more logical, and biological, if we assume millions of life cells, each starting and developing its particular species of plant, fish, reptile, bird, and beast, each with its own discrete cell beginning, and not necessarily simultaneously. A separate habitat for each, in widely separated locations, is not then illogical, and proof of a world-wide migration is not needed.

And a plurality of widely scattered cells would also explain the difference in the staple grain food of the two hemispheres; namely, why wheat should be the native grain of the eastern hemisphere and maize the native grain of the western hemisphere.

If primitive man had migrated to the western hemisphere from the wheat growing eastern hemisphere, he would have brought his grain seed with him. But we find maize the staple grain in the western hemisphere.

But whether life had a single or a multiple cell beginning, one does not study *man* very long before it is evident that man is not an evolutionary animal product. Man sprang from a distinct sperm; he is not a descendant from a monkey in spite of a similarity of skeletal form.

Certainly scientists are not in agreement on this evolutionary theory. Among eminent scientists there are those who deny that man was ever arboreal; or that he ever walked otherwise than upright. The Darwinian theory, accepted so long, is waning in the minds of many. The "missing link" has not been found, because it never existed.

An occasional embryonic tail, which later is absorbed and disappears, does not prove man a descendant of a monkey, any more than a skeletal

resemblance does. The monkey does not lose his tail. The frog is born with a tail which he later loses. May one then facetiously inquire if man descended from a frog, or is a frog descended from a monkey?

To many students the contention that man's attainments are those made possible by evolution from an animal is ridiculous. We have no animal from which a spiritual being like man could have come by evolution.

As for myself, I prefer to study man as a living being in considering his relation to other mammals, rather than limit my study to bleached bones of questionable origin.

The following are some of the preponderant reasons why I conclude man is not an evolutionary animal product.

Man invents tools.

Man alone uses fire.

Man burys his dead.

Man has a commerce and trade.

Man draws pictures, and can read and write.

Man is a spiritual being, and believes in a life after death.

Man worships a power outside himself; and builds altars and temples for such worship. No animal does any of these things.

Man is found in all quarters of our earth. Every beast, bird, fish and reptile has its particular habitat; but man is not limited to localities.

Man is constantly increasing in numbers; no other living thing is so increasing.

Man has a civilization, a civilization developing in exact proportion to the development of his collection of tools.

There has been no evolution of man, but only an evolution of his tools; e.g., an alphabet, the three R's, a hammer, the transit, etc.

Man is no more clever today than was earliest historic man. Beyond history we can only guess, but we are guided in our guess of what happened before records were kept by what has happened since then.

Our earliest records are the tools and picture writing of a time as far away as twenty thousand years.

The Sumerians of ten thousand years ago had a varied collection of tools showing surprising artistic merit.

The Cretans almost as early had many of our conveniences: corsets, flounces, festivals, writing, baths, and bronze plumbing, the work of trained artisans who produced objects of beauty and symmetry, as well as utility.

Egyptian exploration has disclosed an organized civilization as early as eight thousand years ago, with tool makers and tool users of a cleverness unsurpassed to this day.

If civilization may be defined as collective social development then our civilization probably began with the expansion of the family unit, at first probably for the protection which numbers afford.

The head of the family was usually the father of all the children of the family for several generations, the mothers being his sisters, his daughters, and their maids. Biblical history refers to this "multitude of sons and daughters" as the tribe or house; e.g., "the tribe of Abraham," "the house of David."

This was the custom of the time. The Pharaohs of Egypt perpetuated the family line by marrying their

sisters; a development of a ruling family head into the ruling head of a nation.

The longer the unbroken reign of this kingly line the more the arts enlarged and the more civilization developed.

But sumptuous living ultimately undermined the keen judgment and physical vigor of the rulers, exposing the kingdom to successful attack by covetous barbarians.

Such conquests resulted in the destruction of many of the tools of civilization, and death to many of those skilled in the use of these tools. The artisans, builders and workmen who escaped were made slaves of the new rulers, whose direction was prompted by a knowledge of a far less varied collection of tools, and so civilization was set back by centuries, to begin again its slow climb to an even more advanced development by the time of the next conquest.

Civilization has several times been thus built up and destroyed within recorded history. But always there has been a residue of tools and skill which has resulted in a greater advance by man before disaster again overtook him.

And as the accumulation of tools enlarged, the lot of the common man has improved, and man's cruelty to his fellow man has softened. He takes less pleasure in sports which cause pain, bloodshed, and death.

Wherever machine tools are used the common man's labor is lightened, his work time shortened, and his standard of living raised.

America has more machinery than any other country, and so America is the envied workplace of the world. In no other country is the workman so well fed, clothed, housed, and entertained.

The value of machines per capita in the United States is more than twice that in Great Britain; more than ten times that in India; and more than thirty times that in China; and the common man's lot in these several countries similarly corresponds to these ratios.

With increase in machines the product of the worker's hands has so enlarged that from 18 hours of labor, 6 hours of sleep, no hours of play, and seven days a week, he has already arrived at 8 hours of work, 8 hours of play, and 8 hours of sleep, six days a week; and as more tools are invented still further changes will be made, increasing leisure and its attendant problems.

In all ages man's collective activities with tools have been directed by men of constructive minds; and necessarily so, but often to cruelly selfish ends.

But the collective activities of today are directed by men of broader vision, and more and more to the common good of all, including the workers themselves. It can continue in no other way.

The most of us, the toilers, can be directed to our own and the common good only by such trained minds; most successfully by those themselves familiar with the use of the tools involved in collective activities.

But with increasing leisure resulting from increasing use of machines, the common man's estate is continually more and more the affair of the managerial mind who installs the machines.

Those who are in charge of the great machinized enterprises must, sooner or later, undertake the care of their workers as scrupulously as they care for their dividends. Dollars can lie dormant, but human

beings must have food, clothing and shelter all the time.

Bread lines we have always had, but never before has this condition been considered by the public so much a corporate disgrace as at the present time. The heads of some of our great enterprises recognize their responsibility in the matter and are already sympathetically engaged in working out plans accordingly. Many more will ultimately decide it is a better policy to cut dividends than to cut wages, and to lay off dollars rather than to lay off workers.

The measure of our civilization is the degree of tranquillity and well-being of the whole people. This condition is attained in a constantly increasing degree with the increase in the tools of production, distribution, communication, transportation, education, and recreation, for civilization is directly the product of the artisan. You don't believe it? Then try to imagine a civilization without tools and workmen who know how to use them.

The evolution of our tools, and the tranquillity of those who use them, is a direct index of our civilization, and always will be.

Note: As Washington is the birthplace of more revolutionary inventions, upon which great industries have been built, than any other ten-mile territory, it may be interesting, and appropriate, to add here a recount by Mr. Jenkins of Washington's claims to intellectual stimulus.

—EDITOR.

Washington, the City of Enchantment

Broadcast from WCAP, September 26, 1924

C. FRANCIS JENKINS

WASHINGTON is the home of our Federal Government; but it is more than that—it is a delightful place to work, a stimulus to excellence in mental activity. Those of us who had wandered about more or less aimlessly before we discovered Washington well understand how its genial climate called forth the Presidential praise of our honor guest from the cool, green hills of Vermont.

Add to the delight of the climate, the charm of Washington's setting, and one appreciates why, from the Executive Mansion outward to the very rim of federal activity, all remain, if they can, after leaving office. Woodrow Wilson stayed here until he passed away. President Harding was hurrying home when his end came. The only living ex-president resides in the District.

Abraham Lincoln was loath to leave Washington, it is said, and so preferred a summer cottage in the Soldiers' Home Grounds, as did many of his successors, rather than a more elaborate executive residence elsewhere, while the White House was getting its annual dressing.

In the house now occupied by the Cosmos Club, Dolly Madison ruled social Washington in such a scintillating setting that even the widows of presidents, with few exceptions, have made their later homes here.

Nor is it strange, for this is the city the unequaled plan of which was worked out with such loving care by Major Charles L'Enfant, as he leaned over a drawing board in his home near the old Tudor Mansion; the parks of the plan later beautified by the landscape gardener, Andrew J. Downing.

And this magnificent dream city had the proper antecedents, too, for it was from this very site the old Indian chief Powhatan ruled his own vast territory before ever the white man had set up the capital of a nation dedicated to peace and opportunity.

Many eminent statesmen and great orators have found Washington environs so satisfying that they have spent their last years within this forest-like city. The inimitable Henry Clay was buried here in 1852; Elbridge Gerry, a signer of the Declaration of Independence, lies in the Congressional Cemetery; and John Lee Carroll, a former Governor of Maryland, found his last resting place in a local graveyard.

It was in Washington as the head of the Federal Party that that distinguished orator, Daniel Webster, made his indelible impress on American history.

In the old "Union Tavern," on a site now occupied by a large apartment building, one could have found hobnobbing with resident genius, in that early yesterday, such guests as Louis Phillipe, Count Valney, Lord Lyons, Baron Humboldt, Charles Talleyrand, Jerome Bonaparte, Washington Irving, Charles Dickens, General St. Clair, Lorenzo Dow, John Randolph, and perhaps Charles Goodyear, when he was asking for a patent for vulcanizing rubber.

Even the dashing Robert E. Lee, leaving his ancestral home overlooking Washington, rode regretfully away to duty in his beloved South.

One may perhaps concede that associations would attract retired admirals and generals to a residence here—Admirals Evans, Dewey, Schley, Sampson, Peary, and Generals Greely, Crook, Wheeler, Miles and Pershing, within my own unprompted memory. But what is the secret which brings back to Washington those who have looked upon the enchanting spots of our wonderful country; the three Johns, for example, John C. Freemont, the great northwest pathfinder; John W. Powell, explorer of the Grand Canon of the Colorado; John A. Sutter, discoverer of gold in California.

Even Governor Shepherd, who *made* Washington, and afterward was practically banished to Mexico, prayed that he might be brought back to the city of his dreams, and his wish gratified, he lies at rest amid the grassy slopes of Rock Creek Cemetery.

It was ever thus; even stubborn old Davy Burns must have thought well of Washington for he brought from his native land not only a charming daughter but the bricks with which he builded the chimney of a cottage for her, and from whose humble door this

Scottish lassie later went to a haughty family and a mansion as the wife of Major General Van Ness.

Not only from official life, but from all fields of activity, the capital city attracts to itself an unusual aggregation of mentality—scientific and literary and industrial.

Poets and great writers, noted scientists and renowned inventors have done their best work in the invigorating atmosphere of the capital, washed clear by the mist of the Great Falls of the Potomac.

It was here Francis Scott Key lived when he wrote "The Star Spangled Banner," a spot marked by the new memorial bridge just completed; here Harriet Beecher Stowe wrote that immortal story, "Uncle Tom's Cabin"; Walt Whitman the first edition of his "Leaves of Grass"; James Bryce "The American Commonwealth"; and Owen Meredith his "Lucile."

In a rose-covered cottage on the heights overlooking the river, across from the Arlington National Cemetery, Mrs. E. D. E. N. Southworth wrought; and in a less flowery abode impecunious Edgar Allan Poe wrote much of his "spooky stuff."

Looking down upon the city from the east, John Howard Payne, in tranquil contentment, on his return from a sojourn in a foreign land, wrote the one song which will never die, "Home, Sweet Home."

In isolated serenity in Rock Creek Park stands the cabin of Joaquin Miller, "the poet of the Sierras," now the shrine of the artist as well as the writer.

Across Lafayette Park, opposite the White House, George Bancroft, the great historian, calmly laid down his pen in his 91st year and passed to his great reward.

And it was here that the painter James McNeill

Whistler began his climb to an artistic, world-renowned fame.

As for science, why Washington is the scientific center of the world. More revolutionary discoveries which have been the foundations of great industries have been made in the District of Columbia than any other ten miles square in all the world.

It was here that the great Joseph Henry spent the most prolific period of his sixty years of usefulness.

On the bosom of Rock Creek, Fulton first floated the model of his steamboat, the *Clermont;* and on the Potomac River, Professor Langley tested out the aerodynamic principles upon which all airplanes are built, and at a time when the "flying machine" was a subject not mentioned in elite scientific circles.

In the observatory on Cathedral Heights, that great astronomer, Simon Newcomb, worked; and, nearby, Cleveland Abbe, the famous meteorologist, published the first daily weather reports.

Between Washington and Baltimore, Professor S. F. B. Morse, in 1844, put his telegraph to work, the first telegraph operator being Theodore N. Vail, late president of the A. T. & T. Company. Dr. Graham Bell perfected his telephone here, Professor Tainter the wax cylinder phonograph, and Mr. Berliner the talking machine.

Both the typecasting machines, the linotype and monotype, were invented in the District; and here a stenographer in the Life Saving Service invented the first motion picture machine, the prototype of the projector used in every picture theatre the world over to this very day.

From the hills of Virginia across the river, the first wireless message ever transmitted was sent into

Washington; and from Washington to Philadelphia the first photographs by radio were sent.

When the Daughters of the American Revolution sought a permanent home no place could successfully compete with the charm of Washington; and here also the American Red Cross and the Pan American Union set up their respective domiciles.

In Kendall Green Park, in the northeast section of the city, the Columbia Institute for the Deaf was set up, the only institution of its kind in the world, the gift of Gallaudet to the afflicted.

It was in Washington that another philanthropist, William W. Corcoran, built the Louise Home for Southern gentlewomen, as well as the Corcoran Art Gallery, the latter a gift to the city. He was laid away in Oak Hill Cemetery, the resting place of an unequaled gathering of distinguished Americans.

In the north of the city is the Walter Reed Hospital, named in honor of Dr. Walter Reed, who heroically risked his life to prove that yellow fever germs were communicated by mosquitos.

The Carnegie Institute "for the encouragement of investigation, research and discovery," and the Carnegie Geophysical Laboratory are both located here.

In Washington the Geographic Society was established, and the unique *Geographic Magazine* is published; and here the beautiful home for the National Academy of Science has just been dedicated.

So the atmosphere of Washington works its witchery on resident as well as those who stop here but briefly, a mental stimulus of no uncertain potency; and as for scenic beauty, it is unequaled

and getting more beautiful and more attractive all the time.

As I fly above the city its streets are hidden under a criss-cross of green trees, with the superb white dome of the Capitol standing out above the verdure in majestic splendor; and over to the west the Lincoln Memorial, looking for all the world like a jewel box of alabaster. And on the rim of the mist beyond stands a bowl-like marble amphitheater keeping watch over the grave of the Unknown Soldier, while still farther around to the north looms the great National Cathedral on Mount St. Albans, where lies "the man of peace."

And it was this inspiring sight that greeted the homeward bound, round-the-world flyers as they glided over the city to a landing in Bolling Field.

An annual pilgrimage to this mecca of glorious past and wondrous present, with its wealth of white buildings, its miles of park roads, its spring cherry blossoms and autumn colors is always inspiring.

From whatever point of view, Washington well deserves the pride of possession of all worthy Americans.

The Picture of Peace

Broadcast from WNAC, Boston, December 28, 1923

C. Francis Jenkins

Since the beginning of time the advance in human progress has been determined by two factors—transportation and communication. These have resulted in continually lengthening periods of peace, and constantly widening areas of tranquillity.

At first man ruled with a club from his doorway, he was constantly on the defense, and his cave was his sole place of safety. But cautiously venturing about he became more familiar with those near his abode, and his terrors were somewhat allayed. As he still further widened his contact with more distant neighbors, by signals and better means of travel, his territory of free movement was still further enlarged.

If this process had expanded from a single nucleus, and one language, it would have tended largely to universal and enduring peace. But there were many nuclei, and many languages, and so suspicion and hatred endured. For it is the stranger whose language is not understood that we instinctively regard as an enemy. Wars between unlike tongues have been far more frequent than civil wars; and war is destructive and disarranging, while peace is constructive and makes for progress.

There is no doubt whatever that the more speedy and complete the facilities for transportation and communication, the greater is the assurance of peace.

The airplane swiftly carries the traveler into strange countries, making the stranger less strange, and, therefore, less an enemy.

Radio is doing the same thing for communication. It broadens and speeds up intercourse, similarly making the stranger's personality familiar because of the frequent contact, and therefore less a menace.

We are afraid of the silence and of the dark—of what we do not see. To know quiets our fears, just as light in dark places makes dark places safer.

For this reason, pictures, which speak a universal language, tend greatly toward universal peace, by making people better acquainted.

When, then, onto the boundless range of the radio is grafted the world-wide appeal of the picture, the ideal means of communication would seem to have been attained.

This is the goal of the activities of a modest little laboratory in Washington, the director of which, thirty years ago, invented the original motion picture projecting machine now used in every theatre the world over.

With this foundation of thirty years of experience to build upon, it is not surprising that this station is now successfully transmitting Pictures by Radio, over considerable distances, already 135 miles. Within the limits of the laboratory, Radio Vision, the ability to see in one place what is happening in a distant place, is also a daily demonstration.

Galileo's telescope enables us to see to great distances, but only away off into space, for our vision through the telescope is limited to straight lines.

With the radio we can see along curved lines; therefore, we can see around obstructions, and over mountain ranges—one day may even see around the earth. For as we are now seeing over short distances with a low power radio station, it naturally

follows that as development lengthens the reach of the radio, so the range of our Radio Vision will increase.

Our President may then look on the face of the King of England, as he talks with him; or upon the countenance of the President of France, when exchanging assurances of mutual esteem.

The Chiefs of Staff of our Navy and Army may see at headquarters all that a lens looks upon as it is carried aloft in a scouting airplane. "The eyes of the fleet" will then be more than just a figure of speech.

And when the *Shenandoah* carries our flag over the North Pole next summer, the Secretary of the Navy, in his office, with invited guests, might see all that those see who are aboard this great airship, if the craft should be suitably equipped.

And very soon now, when the Radio-Visor-set-for-the-Home shall have been sufficiently developed, folks in California and in Maine, and all the way between, will be able to see the inaugural ceremonies of our President, in Washington; the Army and Navy football games at Franklin Field; the struggle for supremacy in our national sport, baseball; and both see and hear grand opera broadcast from the theatre anywhere.

Perhaps at this point the lads and lassies among my listeners may like a brief explanation of the methods by which these objects are to be attained, although I shall not attempt a technical description.

But have you never put a nickle under a piece of paper and by drawing straight lines across it with a very dull pencil made a picture of the Indian appear? Well, now, that isn't so very different from the way we do it. In place of the pencil we draw

parallel lines across the white surface with the image of a small light.

When the machine is turned over slowly this little light looks for all the world like a tiny twinkling star as it travels across the white surface changing in its light values to correspond in intensity to the light values of the scene before the lens at the broadcasting station.

But when the machine is speeded up until the succession of lines recur with a frequency that deceives the eye into the belief that it sees *all* these lines *all* the time, then suddenly a picture flashes out on the screen in all the glory of its pantomime mystery.

And the apparatus is very simple, too, for we, the young ladies and young men, my assistants, have found that is is more a matter of learning how than of intricate apparatus. For the reception of picture there is only a little box, the wires of which you attach to the head phone binding posts of your receiving set, and which contains nothing but a small motor rotating a pair of glass discs; and a miniature, high frequency lamp for outlining the pantomime picture on the screen.

When these machines are available to all of you, then motion pictures at the fireside, broadcast from some distant station, will be the evening's entertainment, and perhaps the daily source of news; the long day of the sick and shut-ins will be more endurable, and life in the far places will be less lonely, for the flight of the Radio Picture is not hindered by rain, or sleet, or snow blockades.

Am I too optimistic? I hardly think so. It is not with cold reason that the possibilities of a new

discovery in science and invention may be gauged.

Professor Langley went to his grave a martyr to his isolated belief in the heavier than air machine, though little more than a decade later Lieutenant Stone, of the Coast Guard Service, piloted the U. S. Navy plane, NC-4, across the ocean, from America to England.

Dr. Bell found scant reception for his telephone at the Philadelphia Centennial, though today there are 150,000,000 of them in daily use.

In 1896 a road race for horseless carriages was held near Chicago over a 20-mile course. There were three entrants, and one of them actually made the distance before sunset.

Still pictures are being transmitted by radio every day, over greater or lesser distances; some weeks ago they were sent from a Navy Station in Washington to the Philadelphia *Evening Bulletin.*

And Radio Vision, which is only a speeding up of the same mechanism slightly modified, is a matter of daily laboratory demonstration, now.

Is it not, then, within the limits of reasonable expectation that the near future will fulfill the predictions just made, when we may freely look directly upon the activities of the great outside world from our comfortable chairs by the fireside?

The Value of a Hobby

Address, Men's Club, Calvary Methodist Church, Washington, D. C.

C. Francis Jenkins

When horseless vehicles first came to town I lived on a street leading up out of the park. Through that summer, as theretofore, Mrs. Jenkins and I often sat out front and watched across the valley the changing glow of the pink and gold of the sunset.

But every now and then our reveries would be broken by an old one-lunger trying to make the grade. You remember the kind; engine underneath, cranked from the seat, steered with a tiller, and you watched the road over a beautifully curved dash, a copy of a fashion plate toboggan sled. They were short on power, those old busses, but long on noise, and their negotiation of the grade was an ever recurring mechanical tragedy. One always thought that this time they would surely make it, but they never quite did. Running in high gear, at smart speed, with delightful confidence, at the foot of the hill, they would get slower and slower until at last, near the top, they would go into low with such a distressing final effort as would wring pity from a stone.

It has often seemed to me that many men are like that old "one-lunger." As long as they find easy work, one cylinder is enough, and they go blissfully along drawing a satisfying pay envelope every Saturday. But when hard times come, and the force is cut, they find their one vacation is not enough to get them over the grade without distress. If, however, he has spent some of his leisure hours in recreational study, the loss of position does not embarrass him over much.

I know a machinist who lost his place last spring because of failure of the firm he worked for. This workman, for several summers past, had been growing flowers about his little place. In time he became very fond of them, and so took up the study of botany. When he lost his position, he began cultivating flowers in earnest, selling them where he used to give them away. He made more money this past summer with flowers than he did last summer at his machinist's trade.

Another workman, when his blue envelope day came, began selling bread his wife made, for she was a locally famed breadmaker. The trade grew beyond their equipment, and a small baking machine was bought; and now he is about to install a second because the first is already over-worked.

It would add to human blessings and individual independence if every man had both a vocation and an avocation; no matter how high or how low his position in our industrial scheme, he should be able to do more than one thing well.

I am aware that there are those who advocate specialization, and quote someone as saying that—"If he build a mousetrap better than anyone else, a path will be worn to his hermit dwelling in the wood." But if we suppose all the mice are caught, Mr. Hermit would subsist much better, it seems to me, if he knew something about gardening as well as mouse trapping.

I feel that I am entitled to speak with authority, for, although I am engaged in the most hazardous of human occupations, i.e., inventing for a living (because it sounds so much nicer, I like to call it research work), nevertheless, in spite of this uncer-

tain employment my equipment is such that I look forward to the evening of life without timidity.

If to make one's point it were permitted to cite personal history, I might venture to recount my own mental and manual endowment, because I know myself better than I know anyone else, although many another country boy has built up a far wider range of knowledge—perhaps the man at your very elbow.

It was my good fortune, then, to have chosen farmer forebears, of sturdy Quaker stock, and so with a natural inquisitiveness, a mechanical intuition, and a red head, it fell to my lot very early to keep in running order the varied machinery of the farm; to put coal oil on the mold-board of the plows when they were set away in the shed for the winter so that they would scour immediately when put into the ground in the spring; to fix the mower so that it would cut the heavy and the down and the tangled grass; to make the self-binder tie every sheaf of wheat, missing none; to stop a leak in the crown sheet of the boiler of the traction engine, and set the slide valve for lap and lead; to oil the windmill to insure an amply supple of water for the stock; to keep the trip-trigger adjusted on the harpoon fork that put the hay away, in the big mow. I also learned to create, build wagons and sleds and miniature railways; to set deadfalls for game and steel traps for fur. It was on the farm I learned the rudiments of weather cloud and goosebone lore; learned which was the north side of trees, the woodsman's natural compass; and how that the great dipper would tell me the time of night. In common with other farm boys, I knew the habits of bird, and beast, and fish, and, of

course, could ride well, and could shoot straight.

And as learning is only adding a little more, day by day, to one's store of knowledge, is it any wonder that, later, when I left home to see the world, even while I was yet a lad, that I found the activities of the great logging camps of Oregon and Washington were not so strangely different from our work in clearing the Indiana farm; that mining silver in the Southwest rather resembled well-digging back home; that the great mills were simply enlargements of machinery with which I was already acquainted, or like most new things simply old familiar principles put together in a new way. I didn't have to lay awake nights to figure out the mechanics of "bronco-busting," or to practice very long before, riding range, I could rope and brand cows, and cook jerked meat on a hot stone.

When I built bunk-houses, I found the work and carpenter tools just the same as when, only a little tyker, I built dog kennels with hammer and saw. I found the construction of an irrigation dam in the desert unexciting, for hadn't I already builded mud dams and waterwheels between the clay banks of old Deer Creek.

Even surveying and running levels, while requiring somewhat more accurate instruments, was very much like the fun we used to have sighting across the tops of two pins stuck in the ends of a shingle floating on a pan of water; nor was the installation of electrical machinery totally strange to the boy who had strung a wire to a neighbor's house and set up a telegraph instrument at each end. Neither was I surprised when I found the locomotive familiarly like our old traction engine, the evening I enticed away the watch-

man at the railhead, so that I might borrow the locomotive and take my prairie playmate for a ride.

And ride, why, I've taken her, perhaps there have been more than one of her, rides in buggies, and sleighs, and toboggans; on bicycles, and motor cycles, and automobiles; in canoes, and sail boats, and ice boats, and motor boats; and even flying machines.

And, by the way, that last is a comforting notation, for I am told flying is a young man's game, and as I became an accredited pilot after I was fifty, I feel that I am entitled to consider myself a very young man yet.

I have always been an insatiable reader, and perhaps you will say that this is the explanation. So it may be, to an extent, for I learned shorthand sitting on a plow beam while the horses rested, probably because someone had carelessly left a text-book lying around where I got hold of it. And shorthand led to skill on the typewriter, though I vividly remember I thought at my first session with the thing, that some of the letters had been left off the keyboard.

My photographic attainments are also without farm-initiated antecedents, although from these came the motion picture, and as a hobby has been pursued until this past summer we have been making pictures at the rate of 3,200 exposures per second, 200,000 per minute.

I drew the architectural plans of our home; I am a designer of machinery, a mechanical draftsman, and a registered patent attorney.

Perhaps there has been an incidental smattering of financial and executive skill withal, which has

relieved me of any very acute financial worries, but the greatest reward of resourcefulness has been the pleasure which has attended each new acquisition my whole life through.

But being resourceful has its drawbacks. When things are easily done, the doer is inclined to neglect that milling grind that makes for perfection, and this results in over-confidence and subsequent embarrassment on occasions. I remember that one time I jumped my bicycle up some steps into a hall and began circling the floor showing off my fancy riding, presently dismounting to receive the thunderous applause of an admiring audience. Well, I didn't get it, and presently I learned why, for a ragged chap mounted a frowzy-looking wheel and began doing things with it that made my riding look like thirty cents. I think even my bicycle was crestfallen as I sneaked out of there.

Another time I remember, with no very happy recollection, was my first formal dance;—oh, so very formal, with bemedaled ambassadors and gilt braided officers in terrifying profusion. I had not yet worn a dress suit long enough to be entirely unconscious of it, as I recall; and my hands bothered me, they were so big and no place to put them. And I was just sure my white tie had slipped around, but I didn't have the courage to investigate. Altogether I wasn't getting on very pleasantly, though I did feel better when the music commenced, for I had a charming partner with whom it was always a delight to dance. Of course, the music had to stop when I was in the middle of the floor, a mile or so from the side lines where a thick rug gleefully waited to trip me up. It was soon over, I suppose, but it

seemed an age and I felt that all of Washington was looking at me as I picked myself up, and besides I had split the collar band of my new dress shirt. Well, we just went away from there; though I might add, perhaps, that my loyal little partner was very indignant that they all laughed at my embarrassing predicament.

However, I do not mean to imply that everyone must have as varied an assortment of attainments to insure smooth sailing through periods of financial depression, but skill in more than one thing surely gives more than one opportunity to keep usefully and profitably employed, and creative work is just about the most satisfying thing there is.

The World War brought to light the avocational talent of many a man, and woman, too, for that matter. I have in mind a young man who regularly helped his father, a successful builder, in the summer between scholastic terms, though during the winter after school hours he repaired automobiles. Another winter he tended horses and did like chores on a farm a few miles out of town. When the United States entered the great war he volunteered. It was soon learned that he knew concrete work, and he was transferred to a big ordnance proving ground, made a lieutenant, and put in charge of all road making, foundations, and other concrete work. He knew automobiles as well as he did concrete and presently the automobile-and-tank division of the grounds was added, and with a promotion. And later the stables with their two hundred horses were also put under his charge. About this time he was given a chair on the other side of the desk of the colonel, the post commandant, who also recommended a captaincy for

him. The young man's rise from the ranks was meteoric, and some jealousies developed, but the colonel, a wise old owl, always stilled criticism by replying: "If any of you can do any of those things as well as he can, you may have the command; but the work must go on." I think you will agree with me that the young man's advance was due to his versatility.

Has it ever occurred to you that each of the great discoveries has been the result of an avocation, a plaything during rest time from the task-weary monotony of regular employment?

The father of photography was an army officer; of the electric motor, a book-binder's clerk; the inventor of the telegraph was a portrait painter; and of the Jacquard loom, a dressmaker. A farmer tinkered up the typewriter; a poet, the sewing machine; a cabinet maker, the cotton gin; and a coal miner, the locomotive. The telephone was the "after school" work of a teacher of the deaf; the disc talking machine, the night work of a clothing salesman; the wax cylinder phonograph, of a lawyer's clerk; and the type-casting machine, a groceryman. A physician made the first pneumatic tire, because his little son was a wheel-chair invalid. The hand camera was invented by a bank clerk; the film roll, by a country preacher; the motion picture, by a stenographer. The steam automobile was the plaything of a photo dryplate maker; the dry-blast steel process the brain child of a preacher's son; the tunneling shield, of an editor; and the stock ticker, a dentist. The long distance telephone loading coils were figured out by a professor of mathematics; bicyle repairmen made the first operative man-

carrying airplane; a soldier the wireless telegraph; a druggist's clerk, the audion tube for broadcasting daily news, stock quotations, grand opera, and the loud-speaking telephone.

This has been the story of every great invention. Each has been the result of someone's riding a hobby, a kindly soul tinkering around in the woodshed with what the neighbors were pleased to call his "crazy" idea.

I have also observed that a new thing always originates in a single brain, usually the brain of a poor man. It is not the product of great wealth and a great laboratory. Money only develops, it never originates; I guess it's because money doesn't work in a woodshed.

And that is encouraging too, for I am led to hope that I myself may yet do something worth while if only I stay poor enough, long enough.

May I, then, go back to the original suggestion—don't be a "one-lunger." Be skilled in your vocation, an expert, even a specialist if you like, but have an avocation as well. Get a hobby, and ride it. Not only is it the most satisfying sport there is, but it holds potential opportunities of immeasurable good to your fellowman.

A happy disposition and a hobby—what wonderful possibilities are conjured up by the contemplation of such an endowment.

The Way of the Inventor

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C. Francis Jenkins

I am an inventor, a professional inventor, like a tramp, having no visible means of support. Many a time my dear old Quaker mother has admonished me to "stop messing" and go to work. She detested the word inventor. So later, when I had learned to make inventing a gainful occupation, I asked her for a title. She replied: "Well, thee is a finder-out." And I guess she wasn't so far wrong at that, for a finder-out is an investigator, an observer, one who "inquires to know." And I think, therefore, that I and my kind may claim a long line of antecedents, for certainly Moses was an observer. You remember the Biblical story of how, returning at evening from tending the flocks of his father-in-law, he noticed that a certain bush, which was burning when he passed in the morning, was not yet consumed, and he said: "I will turn aside and see this great sight, why the bush is not burnt."

But I think one may go even farther back than that, for we are told that Eve "took fig leaves and fashioned them aprons." So it seems that a woman was the first inventor after all. And she did it easily too, for Mrs. Adam had the advantage of a mind free from cluttering precedents. There were no wheels yet to fill the inventor's head.

But let me stop here to pay tribute to the woman, for to her we owe some of our most useful inventions. The printer's roller is a woman's invention, and so is the snap-fastener. The Jacquard loom was in-

vented by Mrs. Jacquard, the sewing machine by Mrs. Elias Howe, and the cotton gin by Mrs. Greene; the Whitney story, like many another hastily written story, was not the whole truth.

The inventor has given you everything you enjoy today. Do you wear shoes, clothes, hats and gloves, every one of them is the result of hundreds of patented ideas. Do you visit a friend, it is probably in an inventor's steam train, electric car or benzine buggy; and you send an advance notice by telephone, telegraph or self-sealing envelope. Why, even babies are raised on patent foods.

I frankly admit that at times some of us and our ideas appear crazy, but we don't know it and so we go blissfully along "wasting" our time inventing telegraphs, telephones, typewriters, harvesting machines, railway trains, automobiles, steam boats, printing presses, talking machines, motion pictures, wireless, and flying machines.

So, go gently, brother, gently, for sometimes I think the inventor is almost human. At any rate, he is an optimist. He has to be. A pessimist would never invent anything, for he would start with the idea that the thing could not be done anyhow. So the inventor goes blithely ahead; cold facts do not disturb him. He believes that if it is only difficult it is as good as done; if impossible he will require a little time for its accomplishment.

With the "finder-out" so far ahead of the crowd, he is obliged to blaze his own trail into the unknown, for no one has ever gone before to show the way. So his proposition necessarily appears foolish to the business man. And the more successful the business man is, the more certainly will the new idea be turned

down. Perhaps he hasn't the prophetic vision necessary to be a successful pioneer.

And here's just as strange a circumstance: a new and revolutionary invention almost never interests an established concern. In the rare cases where a going concern does take up a new invention it is in some other line. The early model of a well known typewriter was brought to the Remington gun factory by a Mr. Dinsmore, a professional man, who had bought an interest in the joint invention of Mr. Sholes, a farmer, and Gideon, a junk dealer, and you know the remainder of that story.

New inventions are almost invariably promoted by men of no previous business experience. The wax cylinder phonograph was brought to its present great business success by a stenographer, the official reporter at the trial of President Garfield's assassin; the disc talking machine by an obscure mechanic in a little alley shop in Camden, N. J.; the telephone by an ex-soldier; the casting machine by a sign-painter. "Every big business is the lengthened shadow of a single man."

It is also an historical fact that the telephone was offered to the owners of the telegraph interests. It was very naturally supposed that those engaged in facilitating communication would be interested in a better and more rapid means. But they waved it aside, saying they were engaged in business and wanted nothing to do with a scientific toy. But the toy grew until it bought the telegraph company as an auxiliary feeder.

Invested capital does not develop pioneer inventions. I think it is because money is the most timid thing in all the world. Did you ever hear of a banker

taking a risk? Why, he makes you put up gilt-edged collateral for twice the value of what you borrow, and even then takes out the interest before he hesitatingly gives you what remains. And you go out of the awful presence on tip-toe, feeling somehow very like a thief. Money does not develop inventions; it takes courage and vision to do that.

Edward A. Guest has put it thus:—

"There are thousands to tell you it can't be done,
There are hundred to prophesy failure,
There are dozens to enumerate, one by one.
The dangers that wait to assail you;
But just buckle in with a bit of a grin,
And take off your coat and go to it;
Just start in to sing as you tackle the thing
That cannot be done—And you'll do it."

And who are the discovers of great inventions? They are almost invariably not persons engaged in a kindred line of employment. This probably is because each knows nothing about the subject in which he essays to invent, and dares rush in where knowing ones hesitate. The inventor of the telephone was a teacher of the deaf; of the telegraph a portrait painter; of the disc talking machine a clothing salesman; of the monotype casting machine a groceryman; of the motion picture projecting machine a stenographer; of the pneumatic tire a physician; of the kodak a bank clerk; of the film roll a country preacher; the steam automobile a photo dry plate maker; the tunneling shield an editor; the dry-blast steel process a preacher's son; the stock ticker a dentist; the long distance telephone loading coils a professor of mathematics; the airplane bicycle repairmen.

More patents have been taken out on farm machinery than on any other class of instruments, near fifty thousand, but only a few of them by farmers. They have been inventing in other lines. The typewriter was a farmer's invention.

Remember I am talking of epoch-making discoveries, not patented improvements on other inventions.

For if one may call an inventor anyone who takes out a patent, then, like the rabbit, he is a prolific type, and like the rabbit, anybody can take a pot shot at him, anywhere and anytime, there is no closed season for either of them.

The first man to take a shot at us is the mail-order patent attorney. There's a pot of gold at the end of the rainbow he paints. We simply can't lose. "No patent, no fee." That is, we can't lose the patent, for he is a poor attorney indeed who can't persuade the Government to give us some sort of a paper with a blue ribbon and a big red seal. But surely none of you believes there is a fortune made out of each of the fifty thousand patents issued yearly by the Patent Office.

Of course, your particular patent is the exception, for proof of it you could point to letters received, immediately on the issue of your patent, from enterprising persons asking if you would be willing to take $100,000 for it. They say it is at least worth that, and they will gladly undertake its sale for you at no cost whatever, if only you will send them $7.50 to illustrate a description of it. (The illustration later proves to be a small zinc etching costing 13 cents.) So your patient wife lets you pawn her wedding ring, and you send the money. She had already put up her mother's watch for the patent fees.

It was one of these smooth gentry who first promulgated the fiction that an unnamed brewer would pay a million dollars for a nonrefillable bottle. The attorney wore hoofs and horns, and had a lively progeny.

I talk like I had taken the full course, don't I? Well, I have, and a post-graduate course also. But I am now about ready to believe I have learned some of the fundamentals. First, then, don't waste time and money offering a really great invention to those who ought to buy it. They won't. Second, don't go for financial aid to a monied man. He has only money.

On the other hand, be on your guard, for if your invention is good, you are likely, sooner or later, to meet a prosperous looking gentleman who sympathizes with you, says he believes in you, and you sign a contract with him and go to work to develop the invention, your time against the money he supplies. When you have the thing almost completed, and need only a little more, the promoter advises he will put up no more money, although, as a matter of fact, he has never put up any, the little cash involved coming from the friends you introduced him to. The business is then sold for debt, and you find you have the experience while the promoter has the more tangible assets. You also learn that you have made enemies of your friends who bought stock because the promoter looked like a million dollars, and you, the inventor, were known to be honest.

Or perhaps the patented article is exploited without your consent. One day an inventor found out that a gas-stove patented by him was being marketed. When he called on the makers and showed them the

patent, they laughed and asked him to close the door as he went out. Now as a boy this inventor had been red headed and, while the red had mostly disappeared from his hair, the fight was still under it. So he laid the matter before a friend, who, for a half interest, sued the infringers, and got judgment and an accounting. The market for the article being already made, another company promptly bought the right and continued the business on royalty, with everybody happy but the infringer.

Another time the same inventor placed a patent on royalty with a big manufacturing concern in a distant city. Three years later, unable to get any remittance, he turned the contract over to an attorney with instruction to begin suit. The attorney was crooked and sold the contract to the company for his own profit. This time everybody was happy but the inventor.

Of course, some of you will get a bona fide offer for your patent, perhaps one out of the eight hundred issued weekly. Take it. For if you are a real inventor you can make another. A Commissioner of Patents in his annual report once said that not one patent in a hundred ever returned to the inventor so much as the amount of the patent fee.

When to sell a patent is, therefore, as important as how to sell it. And if I were asked when a patent should be sold, I would answer, whenever you have an offer, if you are not going to exploit it yourself. Value and necessity will dicker to set the price.

I once sold a patent, that had but three years more to run, for ten thousand dollars; even money, no cents. At another time, I was offered a thousand dollars for a newly issued patent, and *did not* take

it. A few weeks later it wasn't worth anything at all. Again, no *sense*.

Perhaps as apt an illustration as any I know showing the danger of holding a patent too long, occurred in street car trolley development. The story was told me by the attorney for the greedy patentee. He had obtained a patent on a current-collector which ran on top of the trolley wire. It was the best of many, and embodied a very ingenious scheme for passing the cross-overs and wire supports, and he was offered $350,000 for it. The attorney urged him to take it, but the inventor wanted a million. The following Tuesday a patent was issued on the present simple under-running trolley-arm, and immediately the $350,000 patent was absolutely worthless.

While a great many inventors have made fortunes out of their discoveries, I don't believe it has often been the quest for wealth that has kept them patiently pegging away. Like the scientist and the artist, the inventor has an ideal which is very satisfying to him, the pursuit of which, however, not only most often keeps him a poor man, but unfortunately works a hardship on those near and dear to him. This situation, that is, the necessity of earning daily bread for himself and his, has, I believe, wrecked the completion of more worthy inventions than any other cause. If the backers of a new idea had the foresight to also finance the inventor's domestic needs, many great inventions would reach their fruition which are now lost to the commonwealth when the inventor must turn aside to earn money to feed the family.

I have spoken of several Washingtonians and

their great discoveries. Has it ever occurred to any of you to note that Washington is the birthplace of more revolutionary inventions, which have been the foundation of great industries of enormous wealth, than any other ten miles square on the face of the earth? From Washington to Baltimore Professor Morse stretched his first telegraph wire; on Rock Creek Fulton tried the model of his steamboat *Cleremont;* nearby Professor Henry laid a miniature electric railway and lighted it with electric lights; here Dr. Bell developed the telephone, Tainter the wax cylinder phonograph, and Berliner the disc talking machine; both type-casting machines were invented in the District; Fessenden, an army officer, invented his wireless telegraph system here; the first successful power flying machine was made here, and here the motion picture machine was perfected. Nor does this exhaust the list by any means.

Again, many inventions are conceived before the public is ready for them, and the inventor dies unrewarded and unknown, or even in disgrace. My father tells me he rode in an automobile at the Philadelphia Centenial in 1876. Too soon. We pity Professor Langley now that the airplane is a great success; but his misfortune was a jest when an accident wrecked his man-carrying machine at its first launching.

Public prejudice also has held back many an inventor. Early railway trains were required by law to be preceded by a man on horseback with a red flag, and the law has never been repealed. Even to this day street-surfacing rollers, having a speed of but two miles per hour, must be preceded by a man on

foot. City fathers don't want automobiles to shy at the thing and run amuck.

More than a hundred years ago an English inventor of a horseless vehicle was ruled off the highways because he ran into a neighbor's fence at the frightful speed of five miles per hour, and knocked off several palings. Whereupon laws were passed limiting motor vehicles to four miles per hour. This law was responsible for British backwardness in automobile development, for it was not repealed until 1906.

The *Great Eastern* steamship was not a paying investment, not because she wasn't successful, but because she was too far in advance of progress. We have much larger vessels now, but it was nearly fifty years before another of her size was built, although she has the distinction of laying the first Atlantic cable.

Again, one is often astonished to note on what a tiny thing, apparently, an inconsequential thing, a gigantic business may hinge. For example:—

The present great telephone industry literally turned on the half rotation of a screw. Two inventors contending for priority before the U. S. Supreme Court used identical exhibits as proof, i.e., small boxes in which a certain screw was employed, and the decision was given to the party who proved that he had turned the screw a half revolution more than the other, for his turn of the screw made one box a successful telephone transmitter while the other was a failure.

The prototype of the motion picture projecting machine, the one type which is today used the world over, differed from others principally in the size of the shutter opening. One was a success while the

others were failures. But as a difference of degree is not patentable, the patent examiner would not consider the case. However, when the Commissioner was shown that it was the difference between success and failure a patent was granted, a patent which later was sustained by the courts, and the basis of an investment of a thousand million dollars already.

And again, on occasion, an invention, wonderful as it may be, lacks just some little thing to make it commercially useful, until presently some keener mind sees its true application and the flood gates of business are opened. It was the central telephone exchange that made the scientific toy widely useful; while the five-cent theatre made the motion picture the entertainment of the masses, and already the fifth largest business in the world.

Research work is the new idea in inventing, and most large manufacturing concerns have adopted the plan, employing hundreds of young men, mostly college graduates, to improve present apparatus and methods, the patents being taken out in the name of the inventor, and assigned to the company. A notable example of this is the metallic tungsten lamp-filament which the scientific books told us could not be made, and explained why. But it was done because of the unlimited force of money and brains a big concern was able to bring to bear on the subject.

It will be noticed, however, that the old rule still holds good, i.e., paid men only improve, while the revolutionary discoveries still continue to be made by the poor man—a further evidence that money has no brains.

The American patent system was founded in 1792, and the early patents were signed by our first President, General George Washington, and Secretary of

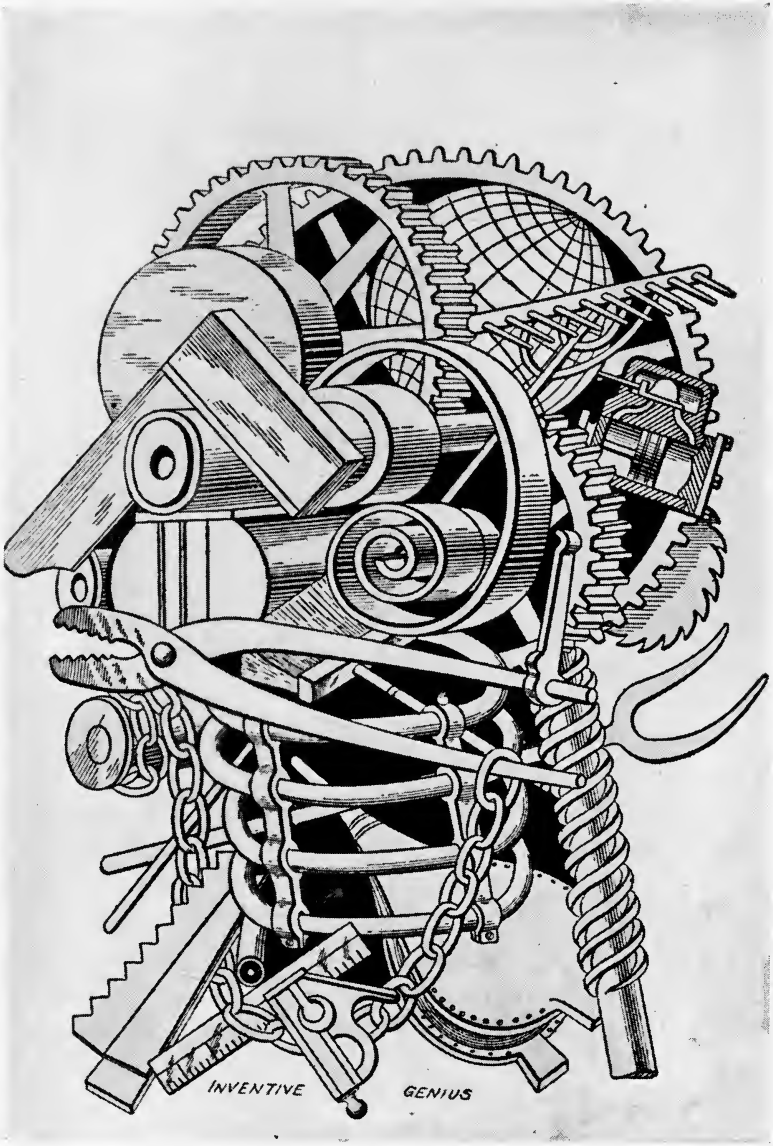
State Thomas Jefferson. The whole thing was a very hazy conception, however, for the thought in the mind of the founders seems to have been that there could be no *new* inventions, but only improvements on old ones, and so the act declared that the inventor should "positively specify and point out the part, improvement and combination" which he claimed as his own invention.

As further evidence, Commissioner Ellsworth, in 1864, contemplating the thirteen thousand patents which had then been issued, made this prediction: "The advancement of the arts, from year to year, taxes our credulity, and seems to presage the early arrival at that period when human endeavor must end."

But more than a million patents have been issued by the United States since then, making by far the greatest record of any country in the field of invention, whether reckoning by number of pioneer products, their ingenuity, or their far-reaching effects, and in the greatest diversity of fields.

The preamble of our United States patent alleges to guarantee the inventor the exclusive right to his invention. But, in fact, it does nothing of the kind. A patent on a valuable invention is more correctly a governmental license to litigate, and that with many an inventor is impossible, although, in the hands of the right party, a patent is the foundation of great good to a great many.

Whether the United States is preeminent in the more scientific industries because of, or in spite of her patent system, may never be known, perhaps, but certain it is that no one in all history has worked so hard to make hard work easy as has the Yankee, and he is still at it, and not likely ever to stop.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