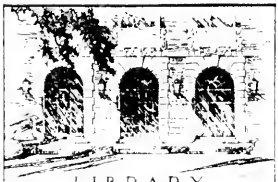

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THE PREHISTORY OF AVIATION

BY

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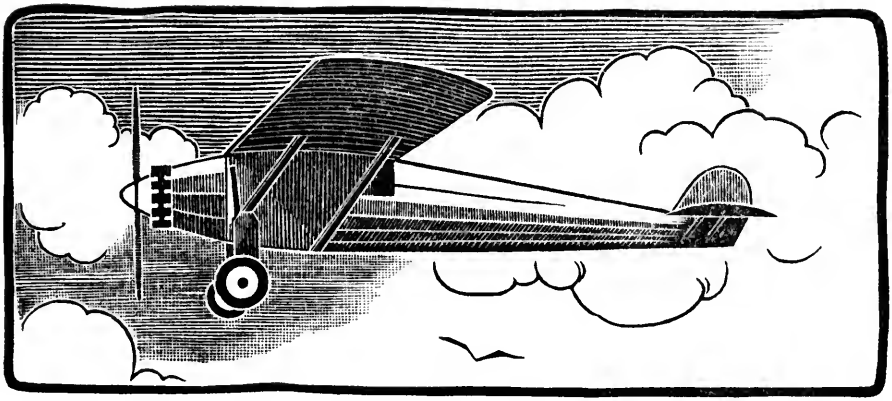

THE PREHISTORY OF AVIATION

INTRODUCTION

A French miniature of the fourteenth century depicts the Spirit or Angel of Youth, who is never fatigued and whose course nothing can arrest. He is arrayed with wings on his feet, soaring over the sea. The wings are tinted green, the color of hope. Youth has fair hair and a blue robe. He carries on his shoulders a pilgrim who is in the vigor of age, and while crossing the water, addresses to him these lines:—

I am called Youth, the nimble,
The tumbler and the runner,
The grasshopper, the dasher,
Who cares not a glove for danger.
I see, I come, I bound, I fly,
I sport and caracole.
My feet they bear me whither I will,
They've wings; your eyes may see them.
Give here thine hand, with thee I'll fly
And carry thee over the sea.

On May 20-21, 1927, Colonel Charles A. Lindbergh accomplished his solitary transoceanic flight from New York to Paris and stirred the entire world. We experienced the same thrill as in our boyhood days when we were first reading about the campaigns of Alexander the Great or Columbus' voyages of discovery.

Yet, the desire to fly is as old as mankind. "Oh that I had wings like a dove! for then would I fly away, and be at rest," sings the

royal psalmist (Psalms 55, 6). In all ages man's imagination was fired by the sight of soaring birds and was seized by the ambition to migrate and to sail upon the wind like one of them. Many daring men tried nobly and less nobly to emulate the ways of the eagle in the air. It is a long record of ventures, experiments, and failures, but remains the most fascinating romance in the history of mankind.

In his excellent "History of Aeronautics in Great Britain," J. E. Hodgson divides the history of the subject into four eras covering very unequal periods of time. His first he titles the legendary and prehistoric era with its tale of mythological and fabulous stories of flight, verging gradually into the historic, and extending to about the end of the fifteenth century. As examples of this prehistoric period he cites Daedalus and Icarus from Greek mythology and Bladud, the flying king of Britain in 800 B.C. However, China, India, and the rest of Asia remain out of consideration in this scheme. Moreover, the ideas registered by Hodgson under his three historical periods of Europe, like aspiration, speculation, endeavor, romance, limited achievement, are no less conspicuous in the Orient. His second or first historical period in Europe, which dates from the sixteenth to beyond the latter half of the eighteenth century, is characterized thus: "The practicability of flight was a matter of speculation and discussion, became the subject of imaginative romance, and was made the object of theoretical projects and not a few practical attempts."

It will be demonstrated on the following pages that all these features were in evidence among Oriental nations in early times, many centuries before their dawn in Europe, and that the fundamental ideas underlying the principles of our present aviation take their root in the Orient. My conception of the so-called mythological and legendary period in the history of aviation differs widely from that of my predecessors. It is a comfortable method and no more than a conventional form of thinking to stamp early traditions as mythological or legendary. This is a scholastic phrase from which little is gained, no tangible significance accrues. An inquisitive mind is intent on unravelling the fabric of a myth, on seeking an interpretation of its origin. If myth it is, how did the myth spring into existence? As there is a logic of human reasoning, so there is a logic of human imagination. The imaginative faculty of the human mind cannot conceive things that have absolutely no reality in existence; the product of our imagination is always elicited by something that exists or that we have reason to believe to exist.

H. G. Wells, who, being a novelist and artist, is possessed of the insight, vision, and intuition which most scholars lack, is on the right track when in his "Outline of History" he comments on the Daedalus story as follows: "Greek legend has it that it was in Crete that Daedalus attempted to make the first flying-machine. Daedalus ('cunning artificer') was a sort of personified summary of mechanical skill. It is curious to speculate what germ of fact lies behind him and those waxen wings that, according to the legend, melted and plunged his son Icarus in the sea." In his manner of reasoning Wells certainly is superior to the majority of schoolmasters who pitifully dismiss Daedalus as a myth.

The prehistory of mechanical science is shrouded in mystery, because primitive man was unable to render an intelligent account of it. In the same manner as natural phenomena were regarded by him as wonders or miracles wrought by supernatural agencies, so any mechanical devices were interpreted as the outcome of witchcraft: the skilled artificer and every investigator and experimenter of prehistoric and early historic days has gone down in history or tradition as a sorcerer, enchanter, wizard, or magician, who made a pact with demoniacal powers. Many of these so-called magicians were simply clever mechanics whose work was beyond their contemporaries' comprehension or whose achievements were so singular and awe-inspiring that supernatural forces were believed to have inspired their genius. This is the reason why those who made attempts at aerial flights are usually associated with magic and necromantic art or why in our middle ages solely devils and witches are endowed with the faculty of flying. John Wilkins, in 1648, wrote seriously, "Witches are commonly related to passe unto their usual meetings in some remote place; and as they doe sell windes unto mariners, so likewise are they sometimes hired to carry men speedily through the open air. Acosta affirms that such kind of passages are usuall amongst divers sorcerers with Indians at this day. So Kepler in his Astronomicall dream doth fancy a witch to be conveyed to the moon by her Familian."

The ancient traditions regarding mechanical wonders must therefore be divested of their legendary garb and exposed in their historical nucleus. On the other hand, it is always the marvelous and romantic that lingers in the memory of man. The dry and bare bones of historical events are apt to be relegated to the wastebasket of oblivion. We do not retain in our minds the dates of wars and battles or the chronological tables of dynasties we had to memorize in school, but we remember many heroes by anecdotes and bons mots which the

stern historian will frown at as unauthentic. No historian's pen has preserved a record of the Trojan War, but Homer has sung it in the form of epic poetry which has been enjoyed by a hundred generations and which has been more often read than any accurate report of a war published by the competent staff of any war ministry. Alexander the Great is not remembered by Oriental nations as their conqueror, but as a deified hero of marvelous exploits, as he appears in the Greek Romance going under his name. Therefore it is just man's ingrained love for the fabulous and fanciful, for the wondrous and extraordinary to which we are indebted for the preservation of ancient records of flight.

In the same manner as astrology was the precursor of astronomy and alchemy evolved into the science of chemistry, so there is an abundance of primitive lore which godfathers the history of aviation. To distinguish that primeval stage from aviation as an accomplished fact of the present time, we might coin for the former the new term "aviology" in imitation of astrology, but the public mind is sufficiently alarmed by an exuberance of ologies, and it is therefore preferable to speak simply of the prehistory of aviation. It must not be imagined that the latter is set apart as a thing in itself, fundamentally distinct from the history of aviation. The two, in fact, are closely allied and interwoven, inseparable, merging into each other, and the recent historical development is unintelligible without a knowledge of its prehistoric setting and background. Thus, it will be seen, our aeroplanes are pedigreed from kites which have their origin in China. Our modern progress in aviation is not solely due to efforts of the present generation, stupendous and admirable as they may be, but presents the process of a gradual evolution of ideas which have grown out of the imagination, endeavors, experiments, triumphs, and failures of many past ages. Stress must be laid on the word "imagination," for there is no field of human exertions in which imagination and romantic dreams have played a greater role and have proved more fertile than in the development of aviation. Intuition, romance, and adventure are its leading motives; for man, from the very moment he had grown into a full-fledged human being, never lived on bread and love alone. We have conquered the air in this age of science and unprecedented progress of mechanics, but in the last instance this conquest goes back to the trend of man's mind toward the romantic and adventurous. Describing merely the gradual perfection of mechanical devices does not make a complete history of aviation. It is the spirit and the idea behind the devices that count,

the idea itself means everything. The will to fly is the will to conquer, and this will has pervaded the hearts of men in the earliest stages of the great civilizations of Asia.

Many visions and reveries of the Orient have been brought true by modern inventions, but the Orient merits credit for the genesis of the idea. The notion of Roentgen rays, for instance, was anticipated both in ancient China and India. The Chinese have several accounts concerning metal mirrors which would light up the interior organs of the human body. The emperor Ts'in Shi (259-210 B.C.) is credited with the possession of such a mirror which was styled "the precious mirror that would illuminate the bones of the body," or "the mirror illuminating the gall." This mirror was discovered in the palace of the Ts'in emperors at Hien-yang in Shen-si Province by the founder of the Han dynasty in 206 B.C., and is described as follows: "It was a rectangular mirror four feet wide, five feet and nine inches high, brilliant both on its outer and inner sides. When a man stood straight before it to see his reflection, his image appeared reversed. When some one placed his hands on his heart, he observed his five viscera placed side by side and not impeded by any obstacle. When a man had a hidden malady within his organs, he could recognize the seat of his complaint by looking into this mirror and laying his hands on his heart. Moreover, when a woman had perverse sentiments, her gall would swell and her heart palpitate. The emperor Ts'in Shi therefore constantly availed himself of this mirror to test the women of his seraglio: those whose gall would swell and whose heart would be agitated, he ordered to be killed."

Jīvaka, a celebrated physician of ancient India and contemporary of Gautama Buddha, called the king of doctors, at least had the idea that it was necessary to illuminate the organs of the body for the purpose of making a diagnosis and perform surgical operations. He practised trephining, and this appeared to his contemporaries so wondrous that it was interwoven with many legends. Jīvaka is said to have discovered in a load of fagots a marvelous gem possessed of the virtue that "when placed before an invalid, it illuminated his body as a lamp lights up all objects in a house, and so revealed the nature of his malady." He laid this gem on the head of a sick man, and found that there was a centipede inside of his head (probably a brain tumor); he opened his skull with an instrument and pulled the centipede out with a pair of heated pincers, whereupon the patient recovered. According to another version, it was a piece of wood from a tree, called "the king of physicians," which enabled Jīvaka

to see plainly the five viscera, the intestines, and the stomach; and he availed himself of a golden knife in opening the skull.

True it is that the first actual bombardments from the air took place but recently during the World War, but the idea itself is not novel. It was forestalled in the seventeenth century by Francesco Lana (below, p. 22), and the first air-bombardier was the giant bird Rukh when he hurled huge bowlders at Sindbad's ship.

The story of a flying Uganda warrior who engaged in efficient bombardments from the air was graphically recorded in 1871 by the famous explorer, Henry M. Stanley, in his work "Through the Dark Continent":—

"One of the heroes of Nakivingi [one of the ancient kings of Uganda,—the Charlemagne of Uganda, as Stanley calls him] was a warrior named Kibaga, who possessed the power of flying. When the king warred with the Wanyoro, he sent Kibaga into the air to ascertain the whereabouts of the foe, who, when discovered by this extraordinary being, were attacked on land in their hiding-places by Nakivingi, and from above by the active and faithful Kibaga, who showered great rocks on them and by these means slew a vast number. It happened that among the captives of Unyoro Kibaga saw a beautiful woman, who was solicited by the king in marriage. As Nakivingi was greatly indebted to Kibaga for his unique services, he gave her to Kibaga as wife, with a warning, however, not to impart the knowledge of his power to her, lest she should betray him. For a long time after the marriage his wife knew nothing of his power, but suspecting something strange in him from his repeated sudden absences and reappearances at his home, she set herself to watch him, and one morning as he left his hut, she was surprised to see him suddenly mount into the air with a burden of rocks slung on his back. On seeing this she remembered that Wanyoro complaining that more of their people were killed by some means from above than by the spears of Nakivingi, and Delilah-like, loving her race and her people more than she loved her husband, she hastened to her people's camp, and communicated, to the surprise of the Wanyoro, what she had that day learned. To avenge themselves on Kibaga, the Wanyoro set archers in ambush on the summits of each lofty hill, with instructions to confine themselves to watching the air and listening for the brushing of his wings, and to shoot their arrows in the direction of the sound, whether anything was seen or not. By this means on a certain day, as Nakivingi marched to the battle, Kibaga was wounded to the death by an arrow, and upon the road large drops of blood

were seen falling, and on coming to a tall tree the king detected a dead body entangled in its branches. When the tree was cut down, Nakivingi saw to his infinite sorrow that it was the body of his faithful flying warrior Kibaga."

If this tradition had been recorded in recent years, we should be inclined to trace it to the influence of World-War stories spreading to Africa, but it was recorded by Stanley in 1871 when there were no Zeppelins and aeroplanes in sight.

In the seventeenth century Joseph Glanvill predicted that to future ages it might become "as ordinary to buy a pair of wings to fly into remotest regions, as it then was to buy a pair of boots."

John Logan, a Scotch poet of the eighteenth century, has the lines:—

Oh could I fly, I'd fly with thee!
We'd make with joyful wing
Our annual visit o'er the globe,
Companions of the spring.

Erasmus Darwin (1731-1802), grandfather of Charles Darwin, in his *The Botanic Garden* (1789), utters the prophetic words:—

Soon shall thy arm, unconquer'd steam! afar
Drag the slow barge, or drive the rapid car;
Or on wide-waving wings expanded bear
The flying chariot through the field of air.

In 1907 Dr. Alexander Graham Bell wrote, "It has long been recognized by a growing school of thinkers that an aerial vehicle, in order to cope with the wind, should be specifically heavier than the air through which it moves. This position is supported by the fact that all of nature's flying models, from the smallest insect to the largest bird, are specifically heavier than air in which they fly, most of them many hundreds of times heavier, and that none of them adopts the balloon principle in flight... It is certainly the case that the tendency of aerial research is to-day reverting more and more to the old lines of investigation that were pursued for hundreds of years before the invention of the balloon diverted attention from the subject. The old devices have been re-invented; the old experiments have been tried once more. Again, the birds are recognized as the true models of flight, and again men have put on wings, but this time with more promise of success."

THE ROMANCE OF FLYING IN ANCIENT CHINA

Among the many singular coincidences of events that loom up in ancient books of the East and the West, none perhaps is more captivating than that an imperial flyer appears at the threshold of the earliest recorded history of China and that a royal flyer opens the chapter of the early history of Great Britain.

Bladud, the legendary tenth king of Britain, father of King Lear and founder of Bath, is said to have made wings of feathers by means of which he attempted an aerial flight that unfortunately resulted in his death in 852 before our era. This story is recorded by Geoffrey of Monmouth (A.D. 1100-54) in his Historia Regum Britanniae, written in or about the year 1147 (first printed in 1508). Naturally, Bladud is made by tradition a necromancer and performer of magical tricks, in the same manner as attempts at flying were connected with magic in China and elsewhere.

The Chinese emperor Shun, who lived in the third millennium before our era (traditional date 2258-2208 B.C.), is not only the first flyer recorded in history, but also the very first who made a successful descent in a parachute,—an experiment first made or repeated in the midst of our civilization as late as A.D. 1783.

Shun's early life teemed with thrilling adventures. His mother died when he was quite young. His father, Ku Sou, himself of imperial descent, took a second wife by whom he had a son. He grew very fond of his offspring from this new union, but gradually conceived a dislike for Shun, which resulted in several conspiracies against the poor youngster's life. In each case, however, he was miraculously rescued, and in spite of severe persecution continued in exemplary and dutiful conduct toward his father and stepmother. By his filial piety he attracted the attention of the wise and worthy emperor Yao whose name is suggestive of China's golden age. Yao had two gifted daughters, Nü Ying and O Huang, who instructed Shun in the "art of flying like a bird." In the commentary to the Annals of the Bamboo Books (that is, records inscribed on tablets of bamboo), an authentic ancient historical book, Shun is indeed described as a flyer. There it is written, "Shun's parents detested him. They made him plaster a granary and set fire to it at its foundation. Shun donned the work-clothes of a bird, and flying made his escape." Then his parents caused him to descend a deep well and heaped stones on top of it. Shun donned the work-clothes of a dragon and crawled

out of the well from the side. He was endowed with a dragon's countenance and thus shared the dragon's natural ability to fly and to crawl. Shun was not a notoriety seeker; he did not fly for the sake of glory or establishing a record; he flew because sheer necessity compelled him to fly to save his soul. For this purpose he availed himself of a flying apparatus based on the principle of bird-flight.

But this is not all. Se-ma Ts'ien, the father of history, as he is justly called, has preserved the following tradition. Ku Sou bade his son Shun build a granary and ascend it, and thereupon set the structure on fire. Shun, who stood on top of the tower, spread out two large reed hats which he used as a parachute in making his descent, and landed on the ground unscathed. Considering the fact that Chinese reed hats are umbrella-shaped, circular, and very large in diameter (some such hats in the Museum's collection from Korea measure two feet three inches to three feet in diameter), this feat would not seem impossible. In the use of the parachute the Chinese have forestalled us a considerable span of time; for Leonardo da Vinci (1452-1519), the great artist, scientist, and mechanician, was the first in our midst who conceived the idea of the parachute. Leonardo writes, "If a man have a tent roof of calked linen twelve yards broad and as many yards high, he will be able to let himself fall from any great height without danger to himself." In one of his manuscripts he has also given the figure of a man descending with this kind of parachute. About 1595 Fausto Veranzio, a Venetian, published a modified design, doubtless inspired by Leonardo's sketch, in which a sort of square sail extended by four rods of equal size is used. There is, however, one great difference between Leonardo and Shun: the former was merely a theorist who never used a parachute, while the latter really performed the trick. The first real descent in a parachute in Europe was not made till 1783 when Lenormand carried out a successful experiment from an observatory at Montpellier.

To complete Shun's story,—he married the two sisters, his teachers in the art of flying; and Yao, his father-in-law, gave him a share in the government of the empire. On the latter's death he succeeded to the throne and ruled as the model of a good and wise sovereign.

Chinese writers fable about a country of Flying Folks (Yü min), located in an island in the south-eastern ocean, living on high peaks near the sea-shore, and described as people with long jaws, bird's-beaks, red eyes, white heads, covered with hair and feathers, able to fly, but not over a long distance; they are said to resemble human beings, but to be born from eggs. The conception of bird-men is

quite familiar to ancient Chinese mythology. A deity with outspread wings, seated on a pedestal, is shown on the pediment of a gravestone of the Han period (Plate I), from about the middle of the second century of our era. Winged attendants fly above him, and others approach him, holding gifts or offerings. On the left are two kneeling figures, holding tablets in the attitude of adoration, the first with a horse's-head, the second with a bird's-head, both winged, but for the rest human and clad in wide, long gowns. Behind this pair appears a walking bird with long tail-feathers, but with human head, holding the leaf of a plant. This picture represents the abode of the aerial spirits. In Assyrian-Babylonian monuments winged figures, man-headed or bird-headed, are frequent, but they are always represented standing or walking, never flying, which makes for a net distinction from the Chinese flying bird-men. As in the sculptures of Mesopotamia winged bulls, lions, griffins, and horses appear, so we meet also in China statues and relief representations of winged monsters, tigers, lions, and horses.

Lei Kung, god of thunder and lightning, has wings attached to his shoulders, usually wings of a bat, and by means of these appendages he directs his course through the air to wherever he desires to produce a thunder-storm.

Tung Yung, a legendary personage, who is supposed to have lived in the second century of our era, was rewarded for his filial piety by the Spinning Damsel, an astral deity, from whom he received two boys whom she had deposed under an elm-tree. One of these had under his arm-pits fleshy excrescences in the shape of wings, and his face displayed a bird's-beak. When grown up, he excelled in muscular strength and supported his father and younger brother with the fruit of his manual labor. His employer complained of his insatiable appetite, but was pleased, as he performed the work of two men. One day the bird-man announced that his mother had appeared to him the previous night, inviting them to rejoin her; then he unfolded his wings, shouldered his father, and sailed up skyward.

"Ascending to heaven by means of flight" is expressed in Chinese "by means of feathers he was transformed and ascended as an immortal"; and "feather scholar" or "feather guest" is a term for a Taoist priest.

Winged flight, however, appears but seldom as a real attempt. The emperor Shun is practically the sole example, and seems to have found few imitators, quite in distinction from Daedalus, whose feat

has stimulated so many until recent times. Another instance of winged flight known to me is one that occurs in a dream.

T'ao K'an, a celebrated Chinese statesman (A.D. 209-334), once had a dream which led to his advancement. He dreamt that he scaled the heights of heaven with the aid of eight wings, and passed through eight of the celestial doors, but was driven back from the ninth by the warder, who cast him down to earth. When he landed there, the wings on his left side were broken. Subsequently he entered public life, and was appointed governor of eight provinces, which was interpreted as a realization of his dream.

The first description of an air-journey is found in the celebrated poem Li Sao ("Fallen into Sorrow") by K'ü Yüan (332-295 B.C.), a loyal statesman, who enjoyed the confidence of his sovereign until impeached through the intrigues of rivals. Despondent over his disgrace and concious of his own integrity, he found solace in composing a poem, which is an allegorical picture of his search after a prince who would listen to good counsels in government. The poet kneels at the grave of the emporer Shun, and is then carried up into the air in a chariot built in the form of a phoenix to which are yoked four dragons smooth as jade. In this vehicle, through dust and wind, he suddenly ascends on high toward the K'un-lun range of mountains. Wang-shu, the charioteer of the moon, is his precursor, and Fei-lien, god of winds, follows him as attendant.

> I ordered the phoenix to fly aloft,
> And continue its flight day and night.
> But a whirlwind brought together my opponents,—
> Clouds and rainbow were led to meet and oppose me.
> In multitudes they assembled, now dividing, now collecting.
> In confusion they separated, some going above, others beneath.

In his search he surveys the earth to its four extreme points, travels all over the sky, and then descends to the earth. Again he undertakes a journey into the air above the Kun-lun Mountains, in a chariot adorned with jade and ivory drawn by a team of eight flying dragons.

> I turned my course to K'un-lun;
> Long was the way, and far and wide did I wander,
> Amidst the dark shade were displayed the rainbows in the clouds,
> While the jade bells about the chariot tinkled.
> I started in the morning from the Ford of the Sky,
> And in the evening I arrived at the extreme west.

The idea of a flying chariot or airship, usually drawn by dragons, is not alien to ancient Chinese art. An aerial contest of winged beings

astride scaly and horned dragons (Plates II-III) is skilfully represented on a grave-stone of the Han period (second century A.D.). This picture is animated by life and motion: an exalted winged god is enthroned in a flying chariot set in motion by fleet dragons and floating over clouds. The pilot of the airship is leaning forward, tapping a dragon's tail as though eager to spur him on. Two winged standard-bearers mounted on swiftly moving dragons follow the car as escorts. Four dragon-riders precede it, and the procession moves on toward a winged flag-bearer standing on a cloud, while another person kneels in front of him. The clouds are represented as birds on the wing, their bodies consisting of spirals which are symbolic of clouds.

Huang Ti, one of the ancient legendary emperors, attained immortality by mounting a fantastic creature with the body of a horse and wings of a dragon (called *tse-huang* or *ch'eng-huang*). According to another version of the legend, he made his ascent on a long-bearded dragon strong enough to transport also his wives and ministers,—more than seventy persons. The officials of lower rank who were not able to find a seat on the dragon's back (not unlike the strap-hangers in our street-cars) clung to the hairs of the dragon's beard; these, however, gave way, the passengers plunged to the ground and also dropped the emperor's bow. The multitude of spectators reverentially watched the apotheosis from a distance, and when Huang Ti had reached his destination in heaven, they picked up his bow and the dragon's hairs. This story is a cheery example of the Chinese sense of humor: other myth-framers would have been prone to push their principles to extremes and, endowing the dragon's beard with divine strength, would have conveyed the strap-hangers straight heavenward.

Under the reign of the emperor Ts'in Shi (259-210 B.C.), Mao Mong, great grandfather of Mao Ying, styled "the true man of sublime origin," ascended Mount Hua, mounted the clouds and bestrode a dragon which was hidden in the clouds, rising into the azure spaces of heaven in broad daylight.

In a hymn to the god of Heaven composed under the emperor Wu (140-87 B.C.) of the Han dynasty, the deity appears amid dark clouds in a chariot drawn by winged flying dragons and adorned with many feathered streamers; the rapidity with which the deity descends is compared with that of the horses of the wind.

Pei Ti, god (literally, "emperor") of the north, much worshipped at Canton under the name Pak Tai, was after a long career of holiness elected to the office of chief minister of the gods. Angelic messengers

descended from heaven, presenting him with silk robes, red shoes, flying swords, and a chariot of nine colors in which he ascended to the celestial abode at the time of the reign of Huang Ti.

When the mind of a nation is filled with the romance of the air, when the air surrounding it is populated with winged genii and flying chariots, and when such subjects are glorified by art and adorn the stone walls of the grave chambers, it is the logical step that imagination thus impregnated leads one or the other to attempt the construction of some kind of an airship.

The *Ti wang shi ki* ("History of the Ancient Emperors"), written by Huang-fu Mi (A.D. 215-282), contains this notice:—

"Ki-kung-shi was able to make a flying chariot which driven by a fair wind travelled a great distance. At the time of the emperor Ch'eng T'ang (1766-54 B.C., founder of the Shang dynasty) the west wind blew Ki-kung's chariot as far as Yü-chou (Ho-nan). The emperor ordered this chariot to be destroyed that it should not become known to the people. Ten years later when the east wind blew, the emperor caused another chariot of this kind to be built by Ki-kung and sent him back in it."

The term "flying chariot" (*fei ch'o*) used in this passage is now current in China for the designation of an aeroplane.

A similar account is contained in the *Po wu chi*, written by Chang Hua in the third century of our era, but with the difference that the invention of the flying chariot is ascribed to the Ki-kung *nation*. A tribe of this name is mentioned in the *Shan hai king* ("Book of Mountains and Seas"), an ancient collection of (partially absurd) geographical fables, where the Ki-kung are characterized as single-armed (the very name means "one upper arm"), three-eyed, hermaphrodites, and riding on striped horses. Shen Yo (A.D. 411-513), the commentator of the Bamboo Annals, speaks of the Ki-kung or their chief as having arrived in a chariot at the court of the emperor Ch'eng T'ang in 1766 B.C., but he says nothing of a flying chariot, nor does the *Shan hai king*, which attributes to them horses as means of conveyance. At the outset it is hardly probable that single-armed hermaphrodites should have a special talent for aviation. It is therefore obvious that in the above notice of the *Po wu chi* two distinct traditions are contaminated: there was, in my opinion, an individual who lived in times of antiquity, Ki-kung by name, who invented an airship or endeavored at least to construct one; and there was also a tradition current about a fabulous tribe accidentally bearing the same name, which had nothing to do with aviation; because, however, the Ki-

kung people arrived at the imperial court in chariots, it was easy to confound or identify these chariots with the flying chariot made by the mechanic, Ki-kung by name. On the other hand, it is suspicious that the latter also is supposed to have come to the court of Ch'eng T'ang, and this date is surely the outcome of an afterthought and devoid of historical value. Be this as it may, the interesting point to be retained is that the Chinese possess an apparently old tradition regarding an airship driven by the force of the winds.

A wood engraving of what in the estimation of Chinese draughtsmen this airship looked like is on record and reproduced in Plate IV. Here we see two men standing in a square, box-like affair, with flags flying, comfortably sailing in the clouds; the car is set in motion by two curious wheels. It will be noted that the two men are just human, having two eyes and two arms; and it should be borne in mind that this illustration is not contemporaneous with the story, nor is it handed down from ancient times, but that it is of comparatively recent origin and merely reconstructed upon the slender fabric of the ancient tradition. It has as much value for the reconstruction of the airship in question as, for instance, Doré's illustrations of the Bible have for the reconstruction of ancient Hebrew life and archaeology. Professor Giles, who first called attention to this drawing in his article "Traces of Aviation in Ancient China," has also published an earlier woodcut of the same subject, taken from a rare book in the Cambridge University Library, that was published in China in the latter part of the fourteenth century; the Ki-kung car illustrated in this book, aside from minor details, is practically identical with the later production aforementioned. Professor Giles adds this interesting comment: "It is noticeable at once that the occupants of the car, especially in the later illustration, are not one-armed. Also, that the wheels fore and aft are at right angles to the direction in which the car is flying through rolling clouds; and further, what is most curious of all, that the wheels appear to be constructed on the screw system, like the propeller of a steamer. Now, in the published description of Latham's flying-machine, we read, 'For the cross-Channel flight a fifty horsepower Antoinette motor has been mounted. This drives a screw which, placed in front of the machine, cleaves a way through the air, pulling the machine after it. It is called a tractor screw.'"

In the attempt to reconstruct the flying chariot, the Chinese draughtsman stressed the second part of the compound and produced the picture of a two-wheeled cart. In this point he is decidedly wrong,

for a vehicle of this type could never rise into the air. We have to fall back on the words of the account itself, in order to form some idea of what this airship might have been. The sole indication of a motive power given in the text is the wind: the vehicle in question depended upon favorable winds, and was propelled by the east wind if it wanted to go east, and by the west wind when it was to return west. For this reason it cannot be presumed that a car or chariot, in the strict sense of the word, is involved. The word *ch'o*, which means a "car," refers also to machines, engines, or contrivances which do not move; thus, for instance, *hua ch'o* ("smooth car") signifies a "pulley"; *shan ch'o* ("fan car"), a "winnowing mill." Now, as far as ancient China is concerned, there were only two devices known as capable of setting a vehicle in motion,—a sail and a kite. As to sails, the Chinese very efficiently applied them (and presumably still apply them) to wheelbarrows, as I repeatedly noticed myself on my travels in Shan-tung Province; but a sail alone cannot lift any vehicle from the ground. This, however, may be accomplished by several powerful kites. The Chinese were the inventors of the flying-kite, as will be set forth in the following chapter, and were in possession of kites at an early date, assuredly in the third century of our era, the date of the *Ti wang shi ki*. I imagine, therefore, that Ki-kung's "flying chariot" was built on the aerostatic principle, being driven by a combination of sails and kites, and was very much like the kite-chariot constructed by George Pocock in 1826 and discussed in detail below (p. 41). The "chariot" part of Ki-kung's machine may have been a very simple affair: all he needed was a seat for himself, which may have been made of light wood, bamboo, or basketry.

The famous boat-shaped aerial car, theoretically conceived by the Jesuit Francesco Lana (1631-87), is reproduced in Plate V, not for its own sake, but because it exhibits some affinity with Ki-kung's machine and, mutatis mutandis, may help us visualize it to better advantage. It was Lana's idea of lifting his ship into the air by means of four large, hollow globes of very thin sheets of copper, from which the air had been wholly extracted, thereby causing them to weigh less than the surrounding atmosphere, and enabling them to rise and support the weight of the ship in the air; propulsion and direction were to be obtained by sails and oars. The question of the practicability of this proposal does not concern us here; what I wish to point out is merely this, that if in Lana's sketch the four copper globes are replaced by four powerful paper kites, we may realize what the Chinese aerostat might have been.

The Chinese emperor, in the above story, caused the airship to be destroyed, as he did not wish his own people to see it. He evidently was anxious to remain intrenched on his throne and to steer clear of innovations that might menace the safety of his realm. Francesco Lana, in his Prodromo (1670, p. 61), gives us the best explanation of the reasons which may have prompted that autocrat to his action. Having developed his plan of an airship with sail and oars, as pointed out above, the Jesuit author winds up thus: "I do not see any other difficulty that could prevail against this invention, save one, which seems to me weightier than all others, and this is that God will never permit such a machine to be constructed, in order to preclude the numerous consequences which might disturb the civil and political government among men. For who sees not that no city would be secure from surprise attacks, as the airship might appear at any hour directly over its market-square and would land there its crew? The same would happen to the courtyards of private houses and to ships crossing the sea, for the airship would only have to descend out of the air down to the sails of the sea-going vessels and lop their cables. Even without descending, it could hurl iron pieces which would capsize the vessels and kill men, and the ships might be burnt with artificial fire, balls, and bombs. This might be done not only to ships, but also to houses, castles, and cities, with perfect safety for those who throw such missiles down from an enormous height."

The first author in Europe who discussed the possibility of a flying chariot was John Wilkins (1614-72), bishop of Chester from 1668 and subsequently Master at Trinity College, Cambridge, one of the founders of the Royal Society, to which he acted as first secretary. His writings, particularly his "Mathematicall Magick" (1648), contributed much toward arousing public interest in the problem of flight. He distinguishes (p. 199) "four several ways whereby this flying in the air hath been or may be attempted. Two of them by the strength of other things, and two of them by our own strength: 1. By spirits or angels. 2. By the help of fowls. 3. By wings fastened immediately to the body. 4. By a flying chariot." This fourth and last way seems to him altogether probable and much more useful than any of the rest. "And that is by a flying chariot, which may be so contrived as to carry a man within it; and though the strength of a spring might perhaps be serviceable for the motion of this engine, yet it were better to have it assisted by the labour of some intelligent mover as the heavenly orbs are supposed to be turned. And therefore if it were made big enough to carry sundry persons together, then each

of them in their severall turns might successively labour in the causing of this motion; which thereby would be much more constant and lasting, then it could otherwise be, if it did wholly depend on the strength of the same person. This contrivance being as much to be preferred before any of the other, as swimming in a ship before swimming in water."

Kung-shu Tse, also called Lu Pan, "the mechanician of Lu," because he was a native of the state of Lu in Shan-tung Province, was a contemporary of Confucius and a clever mechanician. In the work going under the name of the philosopher Mo Ti (chap. 49) who lived in the fifth century before our era, he is said to have carved a magpie from bamboo and wood; when completed, he caused this artificial bird to fly, and only after three days it came down to earth. According to another tradition, Kung-shu himself made an ascent riding on a wooden kite in order to spy on a city which he desired to capture. Other Chinese writers ascribe the manufacture of a wooden kite to Mo Ti, or to the collaboration of both Kung-shu Tse and Mo Ti, saying that it could fly for three days without resting. Han Fei, a philosopher of the third century before our era, relates that Mo Ti worked for three years at a wooden kite, but that after flying for a single day it was smashed. It is obvious that in these various accounts there is a confusion of "three days" and "three years," while no clear idea is conveyed of the construction and mechanism of the artifact. Some Chinese authors regard this wooden kite as the beginning and forerunner of the later toy, the paper kite; but this view seems erroneous, as the bird is described as being carved from wood, and as paper was unknown during the period in question. It appears to have been rather an automatic, mechanical contrivance that was capable of rising to some extent into the air,—a sort of affinity to the dove of Archytas (p. 64). Certain it is that it was not Mo Ti, as asserted by Han Fei and Lie-tse, who made the flying kite: in the first place, Mo Ti was a philosopher of ethical and social tendencies who did not engage in manual labor; second, Mo Ti himself saw it fit to condemn the invention of the flying kite as an idle and useless plaything.

Kung-shu Tse is credited with several other inventions,—two kinds of a grinding mill and a scaling-ladder used in besieging cities, known as "cloud-ladder" (*yün t'i*). He is also said to have made wooden horses which moved by means of springs and could draw carriages; or, according to another version, he made for his mother

a wooden coachman who drove an automobile. At present Kung-shu Tse is worshipped as the patron-saint of carpenters.

There is a curious incident on record in the Book of Rites (*Li ki*), which illustrates the fact that even in his youth his thoughts were concentrated on problems of engineering and that his contemporaries were averse to his innovations. A certain individual's mother had died, and Kung-shu asked leave to lower the coffin into the grave by means of a new mechanical contrivance invented by him. Its application was objected to by one present at the funeral on the ground that the ancient practices of the principality of Lu ought to be upheld, and it was ironically suggested to the inventor that he should test his ingenuity rather on his own mother than on that of another man.

It is small wonder that later legends have grossly exaggerated Lu Pan's mechanical skill. Thus a story is current that he made a wooden kite which was mounted by his father, and the old man flew as far as Wu-hui, a town in the prefecture of Su-chou, Kiang-su Province, the ancient kingdom of Wu. The people there took the landing flyer for a devil and slew him. Lu Pan, infuriated at this detestable crime, carved a wooden effigy of some evil spirit, whose hand pointed in the direction of Wu and caused a drought there for a period of three years. On consulting the oracle, the inhabitants of Wu recognized that this calamity was brought about by Lu Pan, and appeased his wrath with supplications and presents, whereupon he chopped off the hand of the statue, and rain fell abundantly in the kingdom. According to another legend of comparatively recent date, Lu Pan made a wooden kite; all it was necessary to do was to rap at the door-post three times, and the kite flew off, carrying away the person who was mounted on it. There is reason to believe that Kung-shu Tse and Lu Pan are two distinct individuals and that the two were merged into one by subsequent traditions, but this question does not concern us here; we are interested in the mechanical contrivance itself, and for this purpose the texts of the early philosophers only merit consideration.

Wang Ch'ung (A. D. 27-97), philosopher, critic, and sceptic, who poked fun at the literati, discredits Lu Pan's invention in the following discourse:—

"From wood he carved a kite capable of flying for three days without descending. It is possible that he made a wooden kite and was able to fly it; but the report that it did not alight for three days is exaggerated. Carving it from wood, he gave it the shape of a bird;

how, then, could it fly without resting? If it could soar, why just for three days? In case it was equipped with a mechanism by which it was set in motion and continued to fly, it might not have descended. In this case it should be said that it flew continually, not for three days. There is a report that through his own skill Lu Pan lost his mother. Being a skilled mechanic, he had constructed for her a wooden carriage and horses with a wooden charioteer. When the apparatus was completed, he set his mother in the carriage which sped away and never returned. Thus he lost his mother. Provided the mechanism of the wooden kite was well arranged, it must have been like that of the wooden carriage and horses; in this case it would have continued to fly without stopping. On the other hand, a mechanism functions but a short while, and for this reason the kite could not have kept up its motion for more than three days. This also holds good for the wooden carriage, which should have come to a stop after three days on the road, instead of going on so that his mother was lost. Apparently the two stories are untrustworthy."

It is obvious that as early as the first century of our era real knowledge of this contrivance was lost.

Aside from the dove of Archytas to which reference has been made, Lu Pan's wooden magpie or kite meets with another curious parallel in the West. The astronomer Regiomontanus, who lived at Nuremberg in the fifteenth century, is said to have constructed an eagle which, on the emperor's (Charles V) approach to the city, he sent out high in the air a long way to meet him, and which accompanied him to the city gates. I. B. Hart furnishes this comment, "Shorn of all the inevitable additions of credulous narrators, the probability is that Regiomontanus, who was of a mechanical turn of mind, fashioned a clockwork contrivance which, more by luck possibly than by design, acted as a glider when released." Regiomontanus is also credited with having had an automaton in perpetual motion in his workshop and with having made a fly which, taking its flight from his hand, would fly around the room, and at last, as if weary, would return to his master's hand. Francesco Lana, in his "Prodromo" (1670, pp. 50-51), has given directions as to how to make birds which fly through the air. Considering the fact that such like contrivances are reported from different parts of the world and at widely varying times, we cannot refrain from concluding that a grain of truth must underlie these accounts and that Lu Pan's wooden kite also, even granted that like other inventions it has been magnified, to some extent was an object of reality and had a foundation in fact.

Perhaps it was a primitive form of glider, perhaps it was connected with and raised by a flying kite.

Starting from realistic means of flight, Chinese efforts did not continue in this direction. Strangely enough, from realism they developed into mysticism and magic. From the second century B.C. alchemical lore coming from the West began to infiltrate Chinese thought; quest of the elixir of life and the desire to transmute base metals into gold allied themselves with ancient native conceptions of formulas for securing longevity and immortality in a better land. The notion of flight was a link of paramount importance in this chain of mystic dreams which held the minds of the people enthralled for many centuries.

Liu An, commonly known as Huai-nan Tse (second century before our era) was much given to alchemistic studies and to search for the elixir of life on which he published several treatises. Tradition credits him with the discovery of an elixir which he finally drank, with the effect that he rose to heaven in broad daylight. The vessel which contained the beverage of immortality he dropped into his courtyard, and when the dogs and poultry sipped the dregs, they immediately sailed up to heaven after him.

Li Shao-kün, an adept of alchemy and the magic arts under the emperor Wu of the Han dynasty (140-87 B.C.), over whom he gained great influence, made an elixir of life and pretended to be able to transmute cinnabar into gold. He described his magic powers in this strain, "I know how to harden snow and change it into white silver. I know how cinnabar transforms its nature and passes into yellow gold. I can rein the flying dragon and visit the extremities of the earth. I can bestride the hoary crane and soar above the nine degrees of heaven."

Indeed, the riding conveyance favorite with Taoist saints for taking passage into the beyond is the crane, a bird famed in Chinese lore and endowed with many supernatural attributes. He is said to reach a fabulous age, and when six hundred years old, to dispense with solid food, but to continue to drink water. Of the four kinds of crane,—the black, the yellow, the white, and the blue ones,—the black one is the longest-lived. He is hence reputed as the patriarch of the feathered tribe, and manifests a particular interest in human affairs. Men have repeatedly been transformed into the shape of a crane, and he transports to the regions of eternal bliss those who have

attained the degree of sainthood in this life, as he also serves as a vehicle to the goddes Si Wang Mu (Plate VI). This picture is a small section from a large embroidered screen in twelve panels in the Museum's collection, depicting the celebration of the goddess' birthday when the Eight Immortals appear to offer congratulations and rich gifts. The goddess surrounded by attendants alights from her celestial quarters on the back of a flying crane.

Wang Tse-k'iao, who was the eldest son of king Ling of the Chou dynasty and lived in the sixth century before our era, studied the black art for thirty years under a magician named Fou-k'iu Kung. One day he sent a message to his kin, saying that he would appear to them on the seventh day of the seventh moon on the summit of a mountain; and indeed, on the appointed day, he was seen riding through the air on a white crane, waving his farewell to the world and ascending to heaven to join the ranks of the immortals.

Ting-ling Wei (second century of our era), a student of the black art, was transformed into a crane a thousand years after his death, that he might revisit earth and his old home, when he bewailed the changes that time had wrought upon men and their hearts.

Wang K'iao, who lived in the first century of our era, used to report regularly at court; but as he had no chariot or horses, the emperor Ming of the Han dynasty was curious to learn how he managed to travel such a long distance, and instructed the Grand Astrologer to find out. The imperial messenger was amazed to discover that Wang did the trick by riding upon a pair of wild ducks, which bore him swiftly through the air. Hence he lay in wait and threw a net over the birds; but when he went to seize them, he found only a pair of official shoes which had been presented to Wang by the emperor.

Less frequently a tiger is made the aerial courser. This was the climax of the life of Madame Ts'ai Luan, who lived in the fourth and fifth centuries of our era and made a study of the black art. These efforts, however, did not have any riches in store for her; for she remained poor and eked out a meagre livelihood by making copies of a dictionary of rhymes, which she sold to scholars. Her reward came ten years later when she and her husband went up to heaven on a pair of white tigers.

Some accomplished the ascent to heaven even without the medium of a riding animal. Thus Ma Tse-jan, reputed for his wide knowledge of simples and in great demand as a physician, studied

the doctrines and practices of Taoism, and was ultimately taken up to heaven alive.

Plate VII illustrates a Taoist saint comfortably flying in the air from cliff to cliff, simply driven by the wind, while two wanderers on the mountain path gaze at him in bewilderment. This picture is a landscape drawn in ink, probably of the Ming period.

"Shoes which enable one to ascend the clouds" (*teng yün li*) are ascribed by tradition to Sun Pin; they were made of fish-skin and enabled their wearer to walk on water and to tread onc louds. "Flying cloud shoes" (*fei yün li*) are attributed to the famous poet Po Kü-i (A.D. 772-846): when he was engaged in preparing an elixir on Mount Lu in Kiang-si Province, one of the haunted grottoes of the Taoists, he made these shoes of fine black damask, cutting a cluster of clouds out of plain raw silk which he dyed with four choice aromatics. When he moved around in these shoes, he looked like smoky mist, as though clouds were rising from beneath his feet and as though he would before long ascend to the celestial palace. These magic shoes are an echo of the thousand-league boots of our folk-lore of which more will be said in the chapter on India.

In the long history of this struggle for the conquest of the air, two singular ideas finally come to the fore—levitation by means of starvation and application of remedies taken internally. The slogan of this school was: Live on air to conquer the air!

These Taoist ideas may partially be traceable to India. The Buddhist saints of the Tantra school also had the notion of obtaining supernatural powers which would enable them to transmute their bodies and to assume any shape at will, as well as to traverse space with the most rapid possible motion.

Leading a natural life in the seclusion of mountains in close contact with nature was believed to be conducive to obtaining longevity and immortality. The highest ambition of many Taoist hermits, then, was to reduce their weight, to lighten their bodies, to release their souls, and thus to obtain the ability to fly toward heaven. Chang Tao-ling (A.D. 34-156), known as the first Taoist pope, retired to the mountains and devoted himself to the study of alchemy and to cultivating the virtues of purity and mental abstraction. The white tiger presiding over the west and the green dragon ruling the quarter of the east appeared in the air above his habitation, and finally he reached his goal and found the elixir of immortality. He swallowed a dose of it, and the sixty year old man was suddenly transformed into a vigorous youth. Soon after when he made a pilgrimage to a

sacred mountain in the proximity of the city of Ho-nan, he met on the road a man who disclosed to him the location of a cave; it concealed, he intimated, occult writings whose study would enable him to obtain the power of flying skyward. After fasting and purifying himself he found the books in question, and by studying these he attained the gift of ubiquity, and was capable of assuming simultaneously various shapes. After years of meditation and efforts spent on exorcism of demons he was deemed worthy of appearing before Lao-tse, and ascended as an immortal to the heavens with his wife and two favorite disciples.

An-k'i Sheng, a legendary magician who lived on the Isles of the Blest in the Eastern Ocean and possessed the power of rendering himself visible or invisible at will, visited the Lo-fou Mountains in Kwang-tung Province, where he subsisted only on the stalks of water-rushes; by virtue of this diet he finally became emancipated from the dross of earth, and ascending the summit of the White Cloud Mountain, rose to heaven before the eyes of his companion. The recipe "living on air" was tried, for instance, by Chang Liang, who died in 187 before our era. He began to eliminate food in the hope of gaining levitation of the body and finally immortality, but failed, because he once yielded to the solicitations of the empress and ate a bit of rice.

A good example of this sort of hunger-strike apostle is presented by Li Pi (A.D. 722-789), who as a youth was keenly devoted to the study of Taoism and would roam in the mountains, pondering upon the secret of immortality. He declined to marry, abstained from all substantial food except fruit and berries, and practised the art of breathing, which is believed by the Taoists to conduce to immortality. He finally became reduced to a skeleton, and received the nickname "the Collar-bone Immortal of Ye." Chang Cho also, a scholar of the ninth century, trained himself to get along without food. He was able to cut butterflies out of paper, which would flutter about and return to his hands. Lu Ts'ang-yung, son of an official, flunked in the civil service examinations and retired with his brother to the mountains, where they lived as hermits and studied the art of getting along without food (which in our own times many students of art and science have involuntarily imitated).

The climax of this movement was reached in the preparation of a nostrum for promoting the art of flying.

T'ao Hung-king (A.D. 452-536), a distinguished physician and a celebrated adept in the mysteries of Taoism, compounded what is

known as the "flying elixir" (*fei tan*): it did not contain any medicinal drugs, but was a mixture of gold, cinnabar, azurite, and sulphur,—ingredients which had been contributed by the emperor. This compound is said to have had the color of hoarfrost and snow and to have been bitter of taste. When swallowed, it was believed to produce levitation of the body. The emperor tasted and tested it, found it beneficial, and conferred honors on the manufacturer. I think this is the only example in the history of the world in the way of teaching to fly by means of a medicine taken internally; but from the viewpoint of Chinese alchemical and religious lore it is quite intelligible how this notion could spring into existence.

In speaking of the Yogins of India, Marco Polo writes, "They are extremely long-lived, every man of them living to a hundred and fifty or two hundred years. They eat very little, but what they do eat is good; rice and milk chiefly. And these people make use of a very strange beverage; for they make a potion of sulphur and quicksilver mixed together, and this they drink twice every month. This, they say, gives them long life; and it is a potion they are used to take from their childhood." The alchemists of both Asia and Europe regarded sulphur and mercury, combined under different conditions and various proportions, as the origin of all metals. Mercury was called the mother of metals; sulphur, the father.

The desire to obtain eternal youth focused on the elixir of immortality, the fountain of youth, or the rejuvenescent water of life, has haunted mankind through all ages. It was this theme that occupied Nathaniel Hawthorne's mind throughout his life and that culminated in his unfinished romance which rested upon his coffin.

KITES AS PRECURSORS OF AEROPLANES

A flying-kite may be defined as an aeroplane which cannot be manned, and an aeroplane may be defined as a kite which can be manned. This definition implies the interrelation of the two mechanical devices. How this development was brought about will be demonstrated on the following pages. Kites were invented and first put to a practical test in ancient China; hence the Chinese must be credited with a substantial contribution to the advance of aeronautics. In January, 1894, O. Chanute wrote in Chicago, "It would not at all be surprising to find, should a stable aeroplane be hereafter produced, that it has its prototype in a Chinese kite." And history proves him right.

It must not be imagined that the Chinese kite is anything like the flimsy, cross-shaped structure of wood covered with paper of a diamond-shaped surface that we used to fly in our boyhood days. This toy is a poor degenerate orphan put to blush in comparison with the ingenious creations of the Chinese, which are wonders of both technique and art. The ordinary Chinese kites are made of a light, elastic framework of bamboo over which is spread a sheet of strong paper painted in brilliant hues with human or animal figures. They generously display that love of art and that whole gamut of decorative design which runs through the life of the Chinese nation. Favorite subjects are mythological figures and monsters, dragons, actors, and heroes of popular plays, beautiful women, animals of all descriptions, birds of prey, serpents, frogs and fishes, flies and butterflies as well as centipedes, also flower-baskets and boats. In the bird-kites the thin paper attached to the wings is moved by the wind and simulates the flapping of the wings. It goes without saying that, as indicated by the common term "paper kite" (*chi yüan*) for the device, kites are a favorite pattern frequently in evidence. Not only the great variety of quaint shapes and designs is amazing, but also the correct calculation or premeditated evaluation of the distance effect; viewed in close proximity the kite pictures may seem disproportionately large or exaggerated or even distorted, while naturally they are designed for a distant vista and in fact, when towering high in the air, appear most beautiful and so life-like that they may be taken for real birds. Again, the kite in the air is hardly ever stationary, but constantly on the move, hovering and soaring, and as it moves on, appears more and more as a legitimate denizen of the atmosphere.

And then the stupendous skill of the hands which manipulate the flying monsters! A long coil of tough cord is wound over a reel, and it is the reel, not the cord, which is held in the hand and is continually turned as the paper plane rises.

The most complicated and ingenious of these flying-machines is the centipede kite. One which I obtained at Peking in 1901 for the American Museum of Natural History in New York (together with a collection of some seventy kites, all of different types) measures forty feet in length, and is made to fold up accordion-like. The fierce head of the creature with huge eyes and gaping jaws is surmounted by long, protuding horns. The body consists of a series of some twenty-five disks, about a foot in diameter, formed of a bamboo frame covered with paper. These are painted with concentric zones in black, yellow, and white. The disks are connected with one another by two cords which keep them equidistant, and are fastened to a transverse bamboo rod from which sticks run crosswise to the centre of the disks. The latter revolve when the kite is being flown. The rear disk is provided with streamers that form the tail. It requires great skill to raise this kite, and cords are attached to three or more points of the body to keep it under control. In a strong wind several men are required to hold the reel. Seen in the air with its gigantic proportions, its huge glaring eyes swiftly twirling in their sockets, its weird, wriggling, serpentine motions, it conveys the impression of some fossil monster of bygone ages having suddenly come back to life. A centipede kite of smaller dimensions is also made in Hawaii.

O. Chanute justly calls attention to the fact that this device resembles in arrangement the multiple disk kites suggested and designed for life-saving in shipwrecks by E. J. Cordner, an Irish Catholic priest, in 1859.

Mechanically kites are constructed on the principle underlying the behavior of a soaring bird which performs its movements with peculiarly curved and warped surfaces.

The ninth day of the ninth month in the autumn is devoted to the festival called Ch'ung-yang which is celebrated by ascending hills. Friends and acquaintances join for a picnic on some eminence in the neighborhood of their town and set kites adrift, as the autumnal breezes favor the sport. This also is the great day for holding kite contests. Any kite, no matter to whom it belongs, may be cut down by another. For this purpose the cord near the kite is stiffened with crushed glass or porcelain smeared on with fish-glue. The kite-flyer manoeuvres to get his kite to windward of that of his rival, allows

his cord to drift against that of his opponent and by a sudden jerk to cut it through, so that the hostile kite is brought down.

A musical kite was first invented by Li Ye of the tenth century of our era, an expert kite-maker, who was purveyor of kites for his imperial majesty. He made an ordinary paper kite with a string attached to it and fastened to the kite's head a bamboo flute. He flew this kite in such a manner that when the wind struck the holes of the flute and produced sounds like those of a harpsichord (*cheng*), which originally had twelve, at present, however, has thirteen, brass strings. Hence a new term for kites came into vogue—"wind harpsichord" (*fung cheng*), which is now used indiscriminately for any kite.

Such flutes are still occasionally used in connection with kites. They consist of a short bamboo tube closed at the ends and provided with three apertures,—one in the centre and one at either extremity. When the kite is flying, the air, in rushing into the holes of the instrument, produces a somewhat intense and plaintive sound, which can be heard at a great distance. Sometimes three or four of these bamboo tubes are placed one above another over the kite, and in this case a very pronounced deep sound is produced. Imagine that hundreds of such kites may be released at a time and are hovering in the air, and there is a veritable aerial orchestra at play. This music has a beneficial effect, for it is thought to scour evil spirits from the atmosphere. To strengthen this benevolent influence, a captive kite, during the prevalence of winds, is often affixed to the roof of a house when during the whole night it will emit plaintive murmurs. Still more frequently, at least in Peking in the age of the Manchu dynasty, there was attached to the top of a kite a musical bow of light willow-wood or bamboo strung with a silken cord. When struck by the wind, the instrument would produce humming sounds like an Aeolian harp. Thus the Chinese were the first who knew how to produce "music on the air." At night paper lanterns with a lighted candle inside were sometimes suspended from small kites in the shape of butterflies, and these were again attached to the main or pilot kite of much larger dimensions. Ear and eye are thus treated to a feast, but this is not all. To make the performance still more spectacular, messengers consisting of bamboo frames with fire-crackers attached are sent up the strings from which the kite is governed, and the crackers are timed to explode on reaching the top.

Archdeacon J. H. Gray, in his excellent book "China" (1878), says, "In the centre of Chinese kites, four or five metallic strings are

fixed on the principle of the Aeolian harp. When they are flying, 'slow-lisping notes as of the Aeolian lyre' are distinctly heard."

He then records from oral tradition the following story in explanation of this musical apparatus: "During the reign of the emperor Liu Pang, the founder of the Han dynasty, a general who was much attached to the dynasty which had been obliged to give way before the more powerful house of Han, resolved to make a last vigorous effort to drive Liu Pang from the throne he had recently usurped. A battle, however, resulted in the army of the general being hemmed in and threatened with annihilation. At his wit's end to devise a method of escape, he at last conceived the ingenious idea of frightening the enemy by flying kites, fitted with Aeolian strings, over their camp in the dead of night. The wind was favorable, and when all was wrapt in darkness and silence, the forces of Liu Pang heard sounds in the air resembling *Fu Han!* Beware of Han! It was their guardian angels, they declared, who were warning them of impending danger, and they precipitately fled, hotly pursued by the general and his army."

Kites were originally used in China for military signalling and for such purposes only, but in the beginning they were not connected with any religious practices, as is erroneously stated by several authors. Thus Hodgson (History of Aeronautics, p. 368) writes, "It cannot be doubted that the kite, though of uncertain, is nevertheless of very ancient origin... Though in wide-spread use as a pastime among the Chinese, Japanese, Maoris, and other peoples, its origin is usually ascribed to religion." Originally it was not a toy either; this is a later development which set in from the time of the Sung dynasty.

There is no Chinese document dealing with kites that contains a word about religious observances in connection with them. The idea that a kite functions as a scapegoat charming away the owner's sins and misfortunes is a recent development to be found locally and sporadically, but it is not general; it is more developed in Korea than in China, but at any rate it bears no relation to the origin of kites.

The beginning of kites in China cannot be clearly traced. It is a curious fact that just in those things which are characteristically Chinese their records fail us—partially perhaps because these things seem trivial, partially because Chinese scholars are of the bookish type and poor observers of real life. A paltry object like a kite was somewhat below their dignity; nevertheless kites have been made the subject of a score of poetical compositions. In times of early antiquity kites did not exist: they are not mentioned, for instance, as it might be expected, in the treatise on the Art of War which Sun Wu

wrote in the sixth century before our era and of which we have an excellent English translation by Lionel Giles.

It has been pointed out in the preceding chapter that Kung-shu's wooden bird was not a flying-kite. The earliest notion of this device looms up in the life of Han Sin, who died in 196 before our era. He is known as one of the Three Heroes who assisted Liu Pang in ascending the throne as first emperor of the Han dynasty. He was desirous of digging a tunnel into the Wei-yang Palace, and is said to have flown a paper kite for the purpose of measuring the distance to the palace. Some explain that he did so by measuring the length of the cord fastened to the kite; others with a bolder grip of imagination pretend that he himself ascended on the kite to gain a free outlook on the palace. It is more probable that Han Sin introduced kites into warfare, using them in trigonometrical calculations of the distance from the hostile army. Be this as it may, the story is not well authenticated; it is not contained in contemporaneous records, but only in comparatively late sources. If for no other reason, it is suspicious that Han Sin's kite is said to have been made of paper, while paper was invented only three hundred years later.

Chinese authors are wont to speak of "paper kites," but rag-paper was invented by Ts'ai Lun only in A.D. 105. Ever since paper has come into use, kites have been made of this material, and no other is employed for them. Nevertheless it is not reasonable to argue that prior to the invention of rag-paper kites could not have been made; the framework might have been covered with silk, hemp, or some other light fabric as well,—only Chinese records are reticent as to this point. The Polynesians enlist bark-cloth (tapa) for their kites, and as will be seen below, the first kite made in England was of linen, while Benjamin Franklin's famous kite was of silk.

In A.D. 549 Hou King (502-552) besieged the city of T'ai in which Kien-wen, subsequently the emperor Wu of the Liang dynasty, was bottled up. Unable to communicate with the outside world, Kien-wen had a paper kite made with a message attached to it and sent it up into the air that his friends might be advised of his perilous plight. One of Hou King's officers, Wang Wei by name, saw the kite rise and ordered his best archers to take a shot at it (first example of anti-aircraft practice). The kite dropped, but, as tradition has it, was transformed into a bird that escaped into the clouds, no one knowing where it went—which probably means that the kite, after all, had not been hit. This story is on record in the *Tu i chi* written by Li Yu of the T'ang dynasty. In A.D. 781 when Chang P'ei, a loyal general,

defended the city Lin-ming against T'ien Yüe who had revolted against the reigning house of T'ang, Chang released a kite to inform Ma Sui of the predicament of the garrison which was exposed to starvation. Again, in this case, the kite was espied by the hostile camp, and T'ien commanded his archers to bring it down, but in this attempt they failed. The garrison held out until Ma Sui came to its relief when a crushing defeat was inflicted on the besiegers.

Many European authors who are only too prone to accentuate the topsy-turvy-dom of the Chinese assert wrongly that kite-flying is exclusively pursued in China by adults, not by boys. It is certainly true that the men are passionate and expert kite-flyers, and it is equally true that many kites, owing to their enormous size and weight, can be manipulated by grown-ups only. But how should the man acquire his skill had he not gained his practice from early boyhood days? Boys assuredly play with kites, and have done so from the days of the Sung dynasty (the end of the tenth century). From that period onward there are many records and pictures testifying to the kite-flying of youngsters, and they are even encouraged to indulge in this wholesome pastime for the reason that "it makes them throw their heads back and open their mouths, thus getting rid of internal heat." Plate VIII illustrates an outdoor scene: boys sporting with kites from a Sung painting depicting the games and entertainments of a hundred boys, by Su Han-ch'en, a renowned artist of the twelfth century.

From China kites were diffused to all other nations of eastern Asia who experienced the influence of Chinese civilization—Korea, Japan, Annam, Camboja, Siam, Malaysia, inclusive of the Philippines and Borneo. As in China, kite-flying has developed into a national pastime in Korea and Japan which received their culture from the mother-country.

In some parts of Indonesia, Micronesia, and Melanesia kites are turned to a practical purpose for catching fish. A fishing-line to the end of which is fastened a baited hook or noose is attached to a kite which is flown from the end of a canoe over the water; the bait is made to play over the surface of the sea by the movements of the kite in the wind. When the fish bites, the kite goes down. In Polynesia kite-flying is pursued for amusement only, chiefly in New Zealand, the Cook group, Tahiti, Hervey Islands, the Marquesas, Tuamotu, Easter Island, and Hawaii; kites are unknown in Samoa and Tonga.

Kites were introduced into India from China either through the Malays or Chinese immigrants or both. Kite-flying is a popular amusement in India during the spring. Matches are often made for considerable stakes. As in China, the strings are coated with crushed glass smeared on with glue, and each player seeks to manoeuvre his kite so as to cut his rival's string. Respectable elderly gentlemen also take keen interest in the game.

In Siam, kite-flying was a state ceremony as well as a public festivity. Large paper kites were sent up into the air with the object of promoting the seasonal wind by the fluttering noise made by them. The festival was obviously connected with agriculture and the appearance of the north-east monsoon.

The ancients were not acquainted with the flying-kite. Archytas' wooden dove, as pointed out on p. 64, is not a kite. There is no reference to a kite in the writings of any Greek or Roman author. The fact remains that kites were introduced into Europe from the East not earlier than the end of the sixteenth century. The Chinese were the inventors of it, and all data at our disposal go to prove that the kite spread from the Far East westward to the Near East and finally to Europe, and that it makes its debut in Europe as a Chinese contrivance, not as a heritage of classical antiquity.

Musailima, the false prophet, a contemporary of Mohammed, is said to have employed at night paper kites with musical bows in order to convey the impression to his adherents that he was communicating with angels. Al-Jāhiz, who died in A.D. 869, in his Book of Animals (Kitāb al-hayawān), speaks of "flags of the boys which were made of Chinese carton and paper; to these tails and wings were attached, little bells were tied to their fronts, and on breezy days they were released into the air from long and firm threads."

Kite-flying is well known to the Turks as a sport both for children and adults. The kite is called in Osmanli *kartal* ("eagle"), in Jagatai and Cumanian *sar* ("sparrow-hawk").

In European literature kites are first described by the Italian Giovanni Batista in his book on natural magic (Magia naturalis, 1589) and by J. J. Wecker (De secretis, 1592). The Jesuit Athanasius Kircher (Ars magna lucis, 1646) was well acquainted with kites. As is well known, he also wrote a book on China which is based on information received from the members of his order working in China.

Francesco Lana (1670, p. 50) informs us that in his time kites were manipulated by the children of Italy. He calls them *drago* ("dragon"), while the Italians now designate them *aquilone* ("north

wind"), *cometa* ("comet"), or *cervo-volante* ("flying-stag") in accordance with French *cerf-volant*. German *drache* is doubtless based on the Italian appellation, and the Russians speak of a serpent (*zmäi* or *zmäika*). The Spaniards style a kite *pajaro* ("bird, sparrow") or *papagayo* ("parrot"). Curiously enough, the correct Chinese term "kite" (*yüan*) is preserved in our English word, and this seems to hint at the fact that paper kites were directly imported from China into England with the correct label attached.

J. Strutt, in his classical book "The Sports and Pastimes of the People of England," informs us that the kite probably received its name from having originally been made in the shape of the bird called a kite and that in a short French and English Dictionary published by Miege in 1690 the word *cerf-volant* is said to denote a paper kite,—the first registration of the word he found. "I have been told," he winds up, "that in China the flying of paper kites is a very ancient pastime, and practised much more generally by the children there than it is in England. From that country perhaps it was brought to us, but the time of its introduction is unknown to me; however, I do not find any reason to conclude that it existed here much more than a century back" (Strutt wrote in 1801). Certainly kites were used in England a considerable time prior to 1690.

In the middle of the seventeenth century kites were commonly employed in England for the purpose of letting off fireworks. John Bate, in his "Mysteries of Nature and Art" (1634), describes the making of a kite to this end, though he avoids the word itself. "You must take a piece of linnen cloth of a yard or more in length," he writes, "it must be cut after the form of a pane of glass; fasten two light sticks cross the same, to make it stand at breadth; then smear it over with linseed oil and liquid varnish tempered together, or else wet it with oil of Peter; and unto the longest corner fasten a match prepared with saltpeter water upon which you may fasten divers crackers, or saucissons; betwixt every of which bind a knot of paper-shavings, which will make it flie the better; then tie a small rope of length sufficient to raise it unto what height you shall desire, and to guite it withall; then fire the match, and raise it against the wind in an open field, and as the match burneth, it will fire the crackers and saucissons, which will give divers blows in the ayer." Bate's kite is reproduced in Plate IX. It has the shape of a lozenge, and is equipped with a tail to afford stability. This type of kite was commonly used in England down to the latter half of the nineteenth century.

S. Butler (*Hudibras*, 1664) alludes to the kite in scoffing at the prophecies based on the appearance of comets:—

> It happen'd as a boy, one night,
> Did fly his tarcel of a kite;
> His train was six yards long, milk-white,
> At th' end of which, there hung a light,
> Inclosed in lanthorn made of paper...

A tarcel is a young hawk. The Oxford English Dictionary contains an interesting quotation from Marvell (1672): He may make a great paper-kite of his own letter of 850 pages.

In Europe, finally, kites were employed for scientific purposes, for the first time, it is said, by Alexander Wilson, professor of astronomy at Glasgow University, who claimed in 1778 that he used kites attached to wire for electrical experiments long before Franklin in 1749 and that with four or five paper kites strung one above another he raised thermometers to an altitude of three thousand feet, in order to determine the temperature in the clouds.

In 1752 Benjamin Franklin made his experiment of collecting atmospheric electricity through the medium of a kite covered with silk and fitted at the top with a metal point. This experiment demonstrated the identity of lightning with electricity. Franklin's kite consisted of a framework in the shape of a cross made of two light strips of cedar. Over this frame was stretched a silk handkerchief tied to the four ends. From the top of the upright stick of the cross extended a sharp-pointed wire the length of a foot. A silk ribbon was tied to the end of the string which held the kite, the end next the hand, and a key suspended at the junction of the twine and silk. The kite was raised by Franklin during a thunderstorm in June, 1752, and almost immediately he experienced a spark on applying his knuckles to the key. When the cord was moistened by a passing shower, the electricity grew abundant. A Leyden jar was charged at the key, and by the spark thus obtained spirits were ignited, and other experiments performed.

Franklin's memorable experiments established definitely the service of the kite for scientific purposes. It was adapted especially to meteorological work, self-registering thermometers being sent up with it. Thus it is an efficient means of obtaining observations in the free air at moderate elevations. For all greater heights a balloon is used; the kite, however, can be used in stormy weather when the balloon is not serviceable; but the special advantage of the kite lies in the fact that the self-recording apparatus is thoroughly ventilated by the

wind, and therefore gives the temperature and moisture of the free air with the least possible error introduced by solar heat or instrumental radiation.

Both in China and Japan there are stories current about men riding on kites through the air. There is a tradition alive in Japan that Yui-no Shosetsu, who tried to overthrow the Tokugawa government in the seventeenth century, made a large kite on which he ascended in order to spy on the Shogun's palace of Yedo. The Shogun and his court were taken aback, and the construction of large kites was forthwith forbidden under penalty of death. Shosetsu was subsequently seized and compelled to commit harakiri. A famous brigand of the seventeenth century, Ishikawa Goyemon, is said to have attempted to steal the gold from the huge golden fish or dolphin on the tower of the Castle of Nagoya by mounting on a kite. He succeeded in abstracting three golden fins. Since that hime large kites have been prohibited in Owari. Tametomo, of the Minamoto family, a hero of the twelfth century, who lived in exile on Oshima Island, is said to have sent his young son from there to Kamakura by means of an enormous kite. There are other stories of valiant cavaliers who used kites as airplanes by flying on them over the enemy's camp for purposes of reconnaissance.

On September 24, 1927, the Associated Press reported by cable from Constanza, Rumania, that while Robert M. Patterson, American Chargé d'affaires in Rumania, was motoring along the beach on the Black Sea, he heard cries for help from a small naked boy flying a huge kite which threatened to fly away with him or to pull him into the sea. The frightened boy turned out to be five year old King Michael, who, the dispatch said, despite his elevation to the throne, cares more about kites than kingdoms. Mr. Patterson, who knew Michael from babyhood, stopped his motor and ran to his rescue. Taking the thick cord from the boy's blistered hands, he pulled in the kite which was twice the size of the young king. It required all his strength. "Don't tell my mother," whispered the anxious monarch, "she will kill me, she doesn't know I'm out." Mr. Patterson placed him in his car, and driving to Princess Helene's residence, deposited the little king safely in the hands of his English nurse.

Now if this or a similar story were found in a Chinese record, all the gray-haired sinologues would shake their wise heads and de-

nounce it as an anecdote without a foundation of reality; but such things will happen, and even more than that.

Athanasius Kircher was well posted on the subject of kites, and in his work "Ars magna lucis" (Rome, 1646, p. 826) mentions the fact that in his time kites were made of such dimensions that they were capable of lifting a man.

The fact that it is not impossible to lift a person into the air by means of two or several powerful kites combined may be inferred from experiments made in England and America during the nineteenth century. About the year 1826 the principle of the kite was turned to a practical purpose by George Pocock, a schoolmaster of Bristol. Interested in kite-flying from the days of his boyhood, Pocock found through various experiments that by attaching several kites, one beneath another, they could be elevated above the clouds. Then he attached to the cord of the kite a board which was dragged along rapidly like a sledge, and next a car with a full load of passengers was drawn easily over the turf. The first person who soared aloft in the air by this invention was a lady, who, seated in an arm-chair, was raised by the kite to a height of a hundred yards. Several years later he developed this "aeropleustic art" (a term invented and used by him alone) by constructing a four-wheeled carriage which he termed "char-volant" (flying car). It was set in motion by two or more large kites made to fold up and controlled as to angle and obliquity by four lines. He demonstrated that two large kites with a surface of a hundred square feet sent up in a gentle breeze had a draught power of three hundredweight or nine hundredweight in a brisk gale. On January 8, 1827, Pocock claimed to have covered several miles between Bristol and Marlborough at twenty miles an hour—a speed which he remarks need not be thought dangerous—and that on this occasion the London mail-coach was easily overtaken. Pocock proposed also to apply kites to marine purposes for towing boats or life-saving from shipwrecks on a lea shore, and suggested their military use for elevating a man in reconnaissances and signalling—which the Chinese had done centuries ago. Pocock's kite-chariot, of course, was not a practicable scheme, as it depended on the winds, but it has a decidedly Chinese flavor. In 1876 Joseph Simmons, it is said, was drawn into the air to a height of six hundred feet or more by means of two superposed kites, and then adjusting his weight by means of guy lines glided down to earth. He filed a patent for his invention (No. 2428, 1875) as "improved means and apparatus for conveying or carrying human beings or objects into mid-air." In

1868 Biot, a French engineer and a lifelong experimenter with kites, was lifted from the ground by a large apparatus of this kind. In 1894 Captain B. F. S. Baden-Powell, of the Scots Guards, constructed a kite 36 feet high consisting of four or five superposed kites, with which he successfully lifted a man on different occasions to a height of a hundred feet. In 1897 Lieutenant H. D. Wise made experiments in the United States with large kites of the Hargrave type and succeeded in lifting a man forty feet above the ground.

It was Laurence Hargrave, an Australian, who then gave a fresh impetus to scientific kite-flying. He realized that the structure best adapted for a good kite would also be suitable as a basis for the structure of a flying-machine. He introduced a new principle and invented what is known as the "cellular construction of kites." This is a kite composed of two rectangular cells separated by a considerable space—known as "the Hargrave box kite" (figured in *National Geographic Magazine*, 1903, p. 221). This type of kite, which surpassed in stability all previous examples, formed the starting-point of Alexander Graham Bell's epoch-making researches and his constructions of triangular and tetrahedral kites. In 1903 Dr. Bell wrote, "I have had the feeling that a properly constructed flying-machine should be capable of being flown as a kite; and, conversely, that a properly constructed kite should be capable of use as a flying-machine when driven by its own propellers."

In December, 1907 Dr. Bell experimented with a gigantic man-lifting kite, the Cygnet, more than forty feet long, which was sent up both with and without a man. Lieutenant Selfridge, of the United States Army, ascended with this kite to a height of 168 feet and remained in the air for over seven minutes. Illustrations of these highly interesting experiments may be viewed in the *National Geographic Magazine* for 1908.

Dr. Bell's prophetic words uttered in 1903 have at present been fulfilled. The wings of the modern biplane are closely patterned after the Hargrave box-kite on which Dr. Bell inaugurated his experiments. The man-lifting kite has developed into an airplane. The speed plane of our times is but a first cousin to the kite.

Another Chinese apparatus deserves mention here, as it served as a source of inspiration to Sir George Cayley (1774-1857), one of the great pioneers of modern aviation. His interest in aeronautics was aroused in boyhood by the invention of the balloon in 1783. He him-

self tells us that his first experiment in such matters was made as early as 1796 with a Chinese or aerial top, which served at once to illustrate the principle of the helicopter and the air-screw. Though but a toy of a few inches in length, its capacity to demonstrate certain elementary, but important principles in aeronautics made a lasting impression on Cayley's youthful mind, and only three years before his death he sent to Dupuis Delcourt a drawing of one which he had had made, the best he had ever seen, and capable of rising ninety feet in the air. This drawing is reproduced in Hodgson's book (Fig. 135). The original of one of these aerial tops is still in the possession of Mrs. Thompson, a grand-daughter of Cayley.

THE DAWN OF AIRSHIPS IN ANCIENT INDIA

Although the Aryan Indians of the Vedic period had numerous aerial deities, like the Gandharvas, elfs haunting the "fathomless spaces of air," no allusion is made in the Rigveda to their manner of locomotion, and none is described as possessed of wings. Among the divine steeds there is one named Dadhikrā, praised for his swiftness, speeding like the wind, and equipped with bird's wings; he is likened to a swooping eagle and even directly called an eagle. The Vedic gods did not fly, but preferred driving in luminous cars usually drawn by fleet horses, in some cases by cows, goats, and spotted deer. Indra, the favorite national god of the Vedic Indians, primarily a storm and thunder-god, conqueror of the demons of drought and darkness, and also a god of battle who aided the advancing Aryans in their struggle against the Dasyus, the aboriginal inhabitants of India, is borne on a golden chariot which is swifter than thought. This vehicle is drawn by two or more tawny, sun-eyed chargers with flowing golden manes and hair like peacocks' feathers. Snorting and neighing, they rapidly traverse vast distances, and Indra is transported by them "as an eagle is borne by its wings." His weapon is the thunderbolt (*vajra*), which personifies the lightning stroke and with which he slays his foes. A myth of post-Vedic times tells of quaking mountains provided with wings and gifted with the power of flight: they flew around like birds, alighted wherever they pleased, and with their incessant motion made the earth unsteady. With his thunderbolt Indra clipped the wings of the restive mountains and settled them permanently in their place; their wings were transformed into thunder clouds.

The Açvins ("horsemen"), twin deities, presumably symbolizing the dawn and the morning star, travel in a sun-like chariot all parts of which are golden and whose construction is based on the number three, having three seats, triple wheels, and triple fellies. It moves lightly, is swifter than "thought or the twinkling of an eye," and is drawn by horses, but more commonly by birds, swans, eagles, or eagle steeds. It touches the ends of heaven and extends over the five countries, it races round heaven, and traverses heaven and earth in a single day. They also have a car which without draught animals traverses space. The Açvins are domiciled in heaven or in the air, and appear at the time of the early dawn when they yoke their chariot to descend to earth and receive the offering of worshippers. Ushas, the maiden goddess of dawn, the most poetical figure of the Vedic

pantheon, awakes the twin gods; she drives in a brilliant, well-adorned chariot drawn by ruddy steeds or kine. The Açvins follow Ushas in their car, and thus their relative time seems to have been between dawn and sunrise. The twin brothers have the particular function of coming to the rescue of people in distress, and are constantly praised for such deeds. The story most often referred to in the Rig-veda is that of the deliverance of Bhujyu, son of Tugra, who was abandoned in the midst of the ocean or in the water-cloud and who, tossed about in darkness, invoked the succor of the youthful heroes. They rescued him with animated, water-tight ships which traversed the air (a sort of hydro-aeroplane), or with an animated winged boat (compare Lana's flying ship, Plate V), or with three flying cars having a hundred feet and six horses. The twins are wedded to the sun-maiden or the daughter of the sun, and in the marriage rite they are invoked to conduct the bride home in their chariot.

The Maruts, gods of the winds, children of the storm-cloud, born from the laughter of lightning, speed in cars which gleam with lightning, drawn by spotted coursers; brilliant as fire, they carry spears on their shoulders, anklets on their feet, golden ornaments on their breasts, fiery lightnings in their hands, and golden helmets on their heads. They are also described as having yoked the winds as steeds to their pole; that is, their chariot is driven by the winds.

Sūrya, the sun god, the far-seeing spy of the whole world, who beholds all beings and the good and bad deeds of mortals, moves in a chariot drawn by one steed or by seven horses or mares. In various passages, however, he is conceived as a bird traversing space, is represented as flying, and is compared with a flying eagle. The god Agni, the personification of the sacrificial fire, which is the centre of the ritual poetry of the Veda, drives in a lightning chariot, described as golden and luminous, drawn by two or more horses impelled by the wind. He yokes them to summon the gods to the sacrifice, and then acts as their charioteer, bringing Indra from the sky, the Maruts from the air. Agni is also likened to or directly designated a bird, and in one passage is spoken of as the eagle of the sky.

Another Vedic god, Pūshan, who is closely connected with the sun, moves in golden ships sailing over the aerial ocean (the sky is conceived as an ocean: thus, also, the Açvins' chariot approaches from the celestial ocean), acting as messenger of Sūrya, the sun-god; making his abode in heaven, he moves onward, beholding the universe. He is praised as the best of charioteers or air-pilots, and drives with a pair of goats, presumably because the goat is a bold

climber and appears fittest to clamber the dizzy heights of heaven. The sun likewise appears as a boat in which Varuna, the god of the encompassing sky, navigates the aerial sea. This primitive conception naturally arose from the experience of seeing the sun set in the ocean, and being animated with a personality, he required a ship to guide him out of the sea toward his path along the sky. On the one hand, therefore, the sun functions as a charioteer, and is symbolized by the horse and the wheel; on the other hand, as a boat and boatman. Hence, in India, the idea of an airship developed from that of a solar ship. Similar notions occur among other peoples. Re, the Egyptian sun god, is the owner of two barks, changing from one to another in the morning and evening.

Greek philosophers style the sun "boat-shaped," and Helios rides in a golden boat from sunset to sunrise. In songs of the Letts the setting sun must be rescued and taken in a boat to save his life; or the sun sadly bewails the sinking of the golden ship into the sea, and is consoled by the wish that God might build a new one.

In one of the Jātakas (No. 159) or stories of the Buddha's former births, a king of Benares owns a jewelled car in which he used to race through mid-air. Gunavarman (A.D. 367-431), a Buddhist monk from India, sailed from Ceylon to Java, where he was to convert one of the kings to Buddhism. A day prior to his landing in Java, the king's mother had a dream to the effect that a religious friar had embarked on a flying ship and would enter the kingdom; on the following morning Gunavarman indeed arrived in person. In the prelude to the fifth act of Bhavabhūti's drama Mālatīmādhava, a sorcerer's maid appears in "a chariot traversing the air."

In post-Vedic literature, the vehicle of the god Vishnu is Garuda, the chief and lord of birds, a celestial bird,—originally a solar bird. This purely mythological conception proved very fertile in stimulating imagination and, according to Indian stories, led to constructions of airships and attempts at flying.

The Panchatantra (I, 5), the most popular collection of Indian folk-lore, contains the story of the Weaver as Vishnu. A weaver became infatuated with the king's daughter; and his friend, a carpenter, made for him a wooden airship in the shape of a Garuda, the mythical bird and vehicle of the god Vishnu, which was set in motion by means of a switch or spring. Equipped with all paraphernalia of the god, the weaver mounted the machine; and when the carpenter had explained to him how to manipulate the switch, he hopped off

and dropped in on the seventh story of the palace, where the princess had her apartment. Seeing him astride the Garuda in the splendor of Vishnu's regalia, she took him for the creator of the three worlds, and he married her instantly according to the rites of the Gandharva marriage (i. e. by mutual consent, without ceremony), and then continued his relations with the princess for some time until her guards suspected her and made a report to the king. He questioned her, but her explanation that she is the consort of a god gratified his vanity. Believing himself in alliance with Vishnu who would grant him the rule over the world, the king became overbearing toward his neighboring kings, who consequently made war on him. Through his daughter he implored the pseudo-Vishnu to come to his rescue. This one, in despair, appeared in the air above the battle-field, armed with bow and arrow and ready to die; but Vishnu himself, fearing that if the weaver disguised as Vishnu were killed his own authority among men might suffer, entered into the weaver's body and scattered the king's enemies. After the victory was obtained, the weaver descended from the sky; and recognized by the king, his ministers and the people, told the whole story, whereupon the king highly honored him, solemnly married him to his daughter, and rewarded him with a large estate. The most interesting point of this story is that the bird-plane is utilized for military purposes to defeat and rout an army. When we read that Abhayākara, a saint of the ninth century from Bengal, assumed the form of a Garuda to disperse an army of Turushkas (Turks), we must understand that he was mounted on a Garuda-plane which functioned as a war-plane.

A dirigible airship is described in the celebrated old collection of Indian stories known as "The Twenty-five Tales of a Vetāla," which is as well known in India as the Panchatantra and which was translated into Tibetan and Mongol; it is usually quoted under its Mongol title Siddhi Kür. The heroes of this tale are six young men,—the son of a rich man, a physician's son, a painter's son, a mathematician's son, a carpenter's son, and the son of a smith, who leave home in quest of adventure in a foreign land. The first of them won the hand of a beautiful woman of divine origin, but she was soon kidnapped by a powerful king who took her into his harem. The six youths conspired to rescue the stolen wife from her captivity, and the carpenter's son hit upon the scheme to construct a wooden bird, called Garuda, whose interior was equipped with an elaborate apparatus which allowed the machine to fly in various directions and to change its course at will: it was provided with three springs. When the

spring in front was touched, the aeroplane flew upward; when the springs on the sides were tipped, it floated evenly along; when the spring beneath was pressed, it made its descent. The painter's son decorated the Garuda in various colors, so that it could not be distinguished from a real bird. The rich youth boarded the machine, pressed the spring, and crossed the air in the direction of the king's palace, where he soared above the roof. The king and his people were amazed, for they had never before seen such a gigantic bird. The king bade his consort to ascend the palace and offer food to the strange visitor. So she did, and the bird descended. The aviator opened the door of the machine, made himself known, seated his former wife inside, and hopped off with her, navigating his way back to his companions—in the same manner as we have all seen it in the movies with modern airships.

In the Sanskrit version of the same story, as embodied in Somadeva's Kathā Sarit Sāgara ("Ocean of Streams of Stories"), an excellent Brahman, Harisvāmin, has a beautiful daughter who wants to marry only a man possessed of heroism and knowledge, or magic power. The first suitor, thus informed, professed to command magic power. At the father's request to demonstrate it, he immediately constructed by his skill a chariot that would fly through the air, and in a moment he took Harisvāmin up in that magic chariot and showed him heaven and all the world, and he brought him back delighted to the camp of the king of the Deccan to whom he had been sent as an ambassador to negotiate a treaty. Then Harisvāmin promised his daughter to that man possessed of supernatural power. His son promised her to a man skilful in the use of missiles and hand-to-hand weapons, and his wife promised her to a man who professed to have supernatural knowledge. When the three bridegrooms appeared on the wedding day in Harisvāmin's house, it happened that the intended bride had disappeared in some inexplicable manner. The possessor of knowledge soon found out that an ogre (Rākshasa) had carried her off to his habitation in the Vindhya forest. The possessor of magic power prepared, as previously, a chariot that would fly through the air, provided with all kinds of weapons. Harisvāmin, the man of knowledge, and the brave man jumped into the airship with him. In a moment they were carried to the Rākshasa's dwelling-place. The giant was duly slain by the brave man, the Brahman's daughter was released, and they all returned home in the flying chariot.

A fundamental document referring to airships is found in Budhasvāmin's Brihat Kathā Çlokasamgraha (edited and translated into

French by F. Lacôte, 1908), a collection of stories written during the eleventh century. Vāsavadattā desired to mount an aerial chariot and thus to visit the entire earth. Vasantaka, the master of games, exclaimed laughingly, "The wives of the king's servants had just the same craving. I said to all, 'Suspend a swing with long poles, mount it, and you will ascend into the air. Your husbands do not know of any other way of satisfying your desire.' If she had a notion to travel through the air, she must be content with the same medium." All burst out laughing. "Stop joking, and come to the point," Rumanvat said. "What good is it to dream thereof?" Yaugandharāyana spoke, "This is exclusively an affair of artisans." Rumanvat summoned the carpenters and enjoined them to make without delay a machine capable of traversing the air. After a long deliberation these said frightened and stammering, "We know only four kinds of machines, but as regards flying-machines, they are known only to the Yavanas (the Greeks), but we never had occasion to see them."

Farther on, in the same story, Viçvila mounts a mechanical cock and makes a trip through the air. At his return he speaks to the king's ambassadors thus: "It is not proper to reveal to any one, artisan or any other person, the secret of the aerial machines, which is difficult to obtain for whoever is not a Yavana (a Greek). It is the same matter as the secret of the manufacture of beds; if it leaks out, it would become common property, and the public would treat it with disdain, for fashion is the creation of the moment. To bring this respectable art into disfavor is a grave sin, so let us drop this matter." A month later Pukvasaka, a clever carpenter and craftsman, said to Viçvila, who was his son-in-law, "The king took me aside to-day and told me with a gentle smile that I must reveal to him this science of aerial machines. I replied that I did not reveal it to you, but that it was Greek artisans with whom you had curried favor. The king waxed angry and threatened my life. Save my life and my sons, therefore, by revealing to the king the secret of these machines, since it is his desire!" Viçvila consented, but during the night awakened his sleeping wife, Ratnāvalī, and said, "I have to inform you that I am returning to my country. Your father employs intrigues to banish me from this place: he wants to wrest from me the secret of the flying-machines which it is our duty to keep concealed, as a miser guards his treasure. But enough, it is my life or your father who is dear to you. In order to guard my secret, I shall go so far as to forsake you!" He and his wife mounted the machine in the form of a cock, and during the night made an ascent and escaped into the

country whence he had come.... The commander-in-chief assembled all the artisans, gave them a flogging, and ordered them to construct a flying-machine. Meanwhile a stranger appeared and said, "I shall construct the machine for you; do not flog the artisans! Give me immediately the necessary appliances." These were at once furnished by Rumanvat. One of the artisans said to the stranger, "Ask the commander-in-chief for the number of passengers. Because they did not know how many passengers they could transport, kings saw their chariot sink, and more than one artisan, it is said, has therefore suffered their wrath." The other responded, "These must have been wretched village artisans! But it is of no avail to waste so many words. Wait a moment!" In the nick of time he produced a flying chariot in the form of a Garuda, adorned with Mandāra flowers, and said to the king, "Oh king, Vishnu of the kings, mount the Garuda and traverse the earth formerly traversed by Vishnu!" "Madam," the king said to the queen, "what do you tarry now? Mount this chariot and depart in accordance with your wish!" "My consort," she responded, "without you I do not even go into the garden; without you, how could I support myself in the vacuum of the celestial space?" The king reported these words to the craftsman, who exclaimed, "But this chariot can carry the entire city!" Thereupon the king took his seat in the chariot together with the personnel of the harem, his wives, his officials, and a section of each urban corporation. They gained the pure spaces of the firmament, and finally took the route of the winds. The chariot circumambulated the earth girt by the ocean, and then was directed toward the city of the Avantis, where the festival of the offering of the water was held. The machine was stopped, so that the king might enjoy the spectacle. After a brief stay the king departed for Kauçambi under the eyes of the multitude which admired the chariot, and acquitted himself of his obligations toward the immortals, the priests, the sacred fires, his parents, his servants and burghers. Then he commanded to do honors to the craftsman.

In a Sanskrit romance, the Harshacharita ("Deeds of King Harsha"), written by Bāna in the seventh century, mention is made of a king, Kākavarna. Being desirous of marvels, he was carried away, no one knows whither, on an artificial aerial car made by a Yavana (Greek) who had been taken prisoner. The term used in this passage means literally, "a mechanical vehicle (*yantrayāna*) which travels on the surface of the air;" that is, an airship.

From the preceding texts it follows that the Indians profess to have had two distinct types of flying-machines,—the Garuda airship of native manufacture constructed on the principle of bird-flight, and the Yavana airship ascribed to the Yavanas or Greeks, the manufacture of which was scrupulously guarded as a secret.

The first question to be raised is, Did the ancient Indians really navigate the air? Are their dirigibles realities or fiction, merely the upshot of a poetic imagination? To my way of thinking this point is irrelevant. The main point is: they had the idea; and their ideas about aeronautics were not worse or more defective than those entertained in Europe from the sixteenth to the first part of the nineteenth century.

The Indians saw two points clearly—that aircraft must operate on the principle of the flight of birds and that a mechanism is required to start the machine, to keep it in mid-air, and to make a descent. Whether they actually flew or not, whether they succeeded or failed, the stories cited (and another will be given below) are sufficient evidence of the fact that they devoted considerable thought to problems of the air and aeronautics and that as a sequel of a highly developed mechanical science efforts were made to construct aircraft of various types.

The second query that we may revolve in our mind is, Did the Greeks, as asserted by the Indians, really supply them with flying-machines? A direct response to this inquiry is not forthcoming from the Greek camp. The Greek mechanicians, in the ingenuity of their inventions perhaps the greatest of all times, are silent as to aircraft. Perhaps the information is lost; for myself I see nothing impossible in the assumption that the Greeks of the Alexandrian epoch should have made successful experiments in mechanical flights.

Greek mechanics and artisans enjoyed a high reputation in India, and marvellous inventions were ascribed to them. The Indians have numerous stories of wonderful automata set in motion by intricate machinery; for instance, movable figures of beautiful women who may even assume life, tempt men and cause a quarrel among them, wooden figures of men able to strut, sing and dance, artificial elephants moving by means of a mechanical apparatus, or artificial fishes which appear to swim under a floor of rock-crystal looking like water. It is noteworthy, again, that in some tales such mechanical marvels are attributed to the Greeks; thus, a painter from central India once travelled on business to the land of the Greeks (Yavana), and took up his abode in the house of a mechanician who made an arti-

ficial maiden to wait upon the painter. She washed his feet and then stood still; he called to her to draw near, but she made no reply. He seized her by the hand, and when he tried to embrace her, the figure collapsed and turned into a heap of chips. In another tale, an Indian carver in ivory travels to the land of the Greeks and settles in the house of a Greek painter. The great mechanicians of Alexandria were very proficient in the construction of mechanical toys and figures, and we still have Heron's work on the Automatic Theatre (Automatopoietika), written in the second century before our era. Heron was the founder of a school, surveyor, mechanician, and the greatest physicist of ancient times.

Maybe, because so many wonders of technique were created by the Greeks, the poets of India reasoned that aircraft also must have been due to their genius. We do not know, but what we do know at present is that in the records of ancient Indian lore are distinguished two types of flying apparatus—the native Garuda airship and the imported Yavana airship. Here remains a fascinating problem which more abundant documentary material that may come to light in the future will help us solve.

As regards winged flight, only one example is known to me from Indian literature. The Kathā Sarit Sāgara ("Ocean of Streams of Stories") contains the following good tale: "Once upon a time there was a young Brahman who one day beheld a prince of the Siddhas flying through the air. Wishing to rival him, he fastened to his sides wings of grass, and continually leaping up, he tried to learn the art of flying in the air. As he continued to make this useless attempt every day, he was at last seen by the prince while he was roaming through the air. The prince thought, 'I ought to take pity on this boy who shows spirit in struggling earnestly to attain an impossible object, for it is my duty to patronize such.' Thereupon, being pleased, he took the Brahman boy, by his magic power, upon his shoulder, and made him one of his followers." In Indian art, particularly in the sculpture of the Buddhists, winged beings in the act of flying are frequently represented, and such types like the Apsarases and Kinnaras have also been adopted by the Chinese. Plate X illustrates a fine Chinese marble sculpture from the Blackstone Chinese Collection of the Museum: two Apsarases or heavenly nymphs are flying down from Indra's celestial abode to guard the Buddha Amitābha.

I shall not dwell at length on the alleged power of flightacquired by magical practices or witchcraft, first taught in the Yoga system

and from it transplanted into Buddhism. Among the marvellous abilities promised as a reward of Yoga practice there were understanding of the speech of animals, assuming any shapes, resuscitating the dead, descent into the inferno, fast locomotion, penetrating everywhere as air does, being poised cross-legged in the air, and traversing the air. What has been observed of "flying" among the modern Yogins proved to be walking or hopping close to the surface of the ground without seemingly touching it. A few examples from Buddhist literature may suffice.

In a Buddhistic story entitled The Magician's Pupil (Schiefner-Ralston, Tibetan Tales, p. 288) a man of the Chandāla caste (the lowest and most despised Pariah class) is versed in spells and magic lore, and obtains by means of spells from the Gandhamādana mountain fruits and flowers as are not in season, and these he presents to the king. A Brahman youth becomes his pupil, and when taught the art of magic, immediately makes a trial of his art on the spot and soars into the sky, reaching the fabulous mountain where he plucks fruits and flowers.

In one of the Jātakas (No. 186) is mentioned a gem endowed with magic power and capable of raising into the air whoever holds it in his mouth. By his own miraculous power the Buddha is able to rise in the air, to be poised in mid-air, and to travel through the air wherever it pleases him.

What is more interesting are two charming motifs of folk-lore presented by India to the world— the magic boots and the enchanted horse.

The Kathā Sarit Sāgara contains the following tale (in the translation of C. H. Tawney):—

"King Putraka, faithful to his promise, entered the impassable wilds of the Vindhya, disgusted with his relations. As he wandered about, he saw two heroes engaged heart and soul in a wrestling match, and he asked them who they were. They replied, 'We are the two sons of the Asura Maya, and his wealth belongs to us,—this vessel, this stick, and these shoes; it is for these that we are fighting and whichever of us proves the mightier is to take them.' When he heard this speech of theirs, Putraka said with a smile, 'That is a fine inheritance for a man!' Then they said, 'By putting on these shoes one gains the power of flying through the air; whatever is written with this staff turns out true; and whatever food a man wishes to have in the vessel is found there immediately.' When he heard this, Putraka said, 'What is the use of fighting? Make this agreement,

that whoever proves the best man in running shall possess this wealth.' Those simpletons said, 'Agreed,' and set off to run, while the prince put on the shoes and flew up in the air, taking with him the staff and the vessel. Then he went a great distance in a short time and saw beneath him a beautiful city named Akarshikā and descended into it from the sky. Subsequently the king fell in love withthe daughter of a king, and one night flew up through the air to the window of her room by the aid of his magic shoes. Later on he eloped with her by taking her in his arms and flying away through the air, finally descending from heaven near the banks of the Ganges."

This story is also extant in a Chinese translation (S. Julien, Avadanas, No. 34, and E. Chavannes, Cinq cent contes, Vol. II, p. 185), and has likewise migrated to Europe (Grimm, Märchen, No. 92, where the three wondrous objects are almost identical).

The legends of later Buddhist saints, as related in Tibetan records, frequently mention a "swift-foot apparatus" for rapid locomotion. In one case we are informed that such boots were made of the leaves of trees, the underlying idea apparently being that they should be as light in weight as possible. The owner of this footgear was the saint Vararuchi who had obtained it by virtue of magic spells; whenever he donned it, he was able to penetrate into the abodes of gods and serpent-demons (Nāgas) and to abstract many treasures with which he delighted the hearts of the poor. Once he had a quarrel with the king who suspected him of using evil spells against his life and who sent a messenger to do away with him. Vararuchi put on his magic boots and fled to the city Ujjayini. The king employed a woman to trick him out of his boots, and when unable to flee, he was overpowered by the royal henchman.

The thousand-league boots are well known to European folk-lore; they belong, for instance, to the equipment of the ogre in the tale of Petit Poucet.

In a Swedish story entitled "The Beautiful Palace East of the Sun and North of the Earth" a youth acquires boots by means of which he can travel a hundred miles at every step, and a cloak that renders him invisible in a very similar way.

A recipe for making magic boots is thus given in an Icelandic story: "A giant told a woman that Hermodr was in a certain desert island which he named to her; but could not get her thither unless she flayed the soles of her feet and made shoes for herself out of the skin; and these shoes, when made, would be of such a nature that they would take her through the air, or over the water, as she liked."

The enchanted horse of later Indian folk-lore is doubtless evolved from the solar horse of early Vedic mythology. From India this motif spread westward and was adopted into the Arabian Nights and many other collections of stories. In the Nights the flying horse, made of ebony, can perform in a single day a journey which under normal conditions would take a year; for the purpose of making the horse descend it is necessary to rub the switch on its left shoulder.

In an Armenian story of Persian origin, entitled "Solomon's Garden and Its Mysteries," Ġül, a servant of Solomon, possesses two wonderful steeds,—the horse of the wind and the horse of the clouds, which Solomon had bequeathed to him. The cloud-horse was not so fleet, but always followed in the track of the wind-horse.

In a collection of Jaina stories (Samyaktvakaumudī) it is narrated that Samudradatta was a groom in the service of a horse-dealer and received from him in compensation two horses which he was allowed to choose himself. He won the love of his master's daughter at whose advice he picked two ill-shaped horses: one of these was capable of running through the air, the other was able to go through water. On the air horse he returned home together with his wife.

In Jātaka No 196 the Bodhisatva comes into the world as a flying horse, white all over and with a beak like that of a crow, possessed of supernatural power, able to fly through the air. From the Himalaya he made a non-stop flight to Ceylon. There he passed over the ponds and tanks of the island and lived on wild-growing rice. Then he took back a number of ship-wrecked traders who had fallen into the hands of flesh-devouring ogres,—some climbing up on his back, some laying hold of his tail,—and conveyed all of them to their own country, and set down each in his own place.

The collection of stories known as "The Thirty-two Tales of the Lion-throne" or "Tales of King Vikramāditya" contains the account of an air-journey on an enchanted horse (No. 8), treated very much like the Garuda airships aforementioned, and is remarkable for the vividness of impressions received by the traveller in the air.

A carpenter once appeared before a king, leading a wooden horse richly caparisoned and in every respect looking like a live animal. The king did not think much of it, except that it was a clever model of a horse as any workman could accomplish, when the carpenter called his majesty's attention to the mechanical apparatus in the interior, which would allow him to reach any place he wished in a few moments. The king, who was interested in every uncommon thing and had never before seen a mechanical contrivance of such

wonderful make, bade the carpenter to mount the horse. In an instant the man was seated on its back, and before any one had time to notice what he did in setting the machine in motion, both horse and rider had flown up and vanished. In a quarter of an hour he alighted on the ground, guiding his horse to the foot of the throne, and dismounted. When the king had seen the amazing speed at which the horse could fly through the air, he was seized by the ardent desire to possess the magical steed and paid the carpenter a large sum for it (two lakhs of rupees; that is, two hundred thousand rupees).

The following evening the king mounted the hippoplane, and turning the starting switch, took to the air and was out of sight in a moment. The rapid movement took the king by surprise: he felt dizzy and saw nothing around him but blue ether, wishing he had never made the ascent. For an hour he continued to rise higher and higher till the mountains below could not be distinguished from the plains, and in a moment all earthly landmarks passed out of sight. Then he thought it was time to descend, and imagined that all he had to do was to turn the same switch in the opposite direction, but to his horror he found that, turn as he might, he did not at all change his course. In his impatience to acquire the horse he had forgotten to inquire how to descend to earth. He set about to examine the horse's neck, till at last he discovered a tiny switch close to the right ear. This he turned and the next moment found himself dropping down toward the earth, somewhat more slowly than he had ascended. It was dark, and as he was unable to see, he was fain to allow the horse to take his own course. It so happened that the machine struck against the top of a tree, and the king, bruised and bleeding, fell to the ground, but escaped serious injury. He had landed in a dense jungle, where he discovered an enchanted princess with whom he fell in love.

It is interesting to note his experiences in the air, as he relates them to the princess: "In an instant I was soaring much faster than the speed of an arrow, and I felt I was approaching the sky so closely that I should soon hit my head against it. I could discern nothing beneath me, nothing around me save the invisible air, and for some time I was so confused that I did not know in what direction I was travelling. At last when it grew dark, I found a second switch near the horse's right ear, and on turning it, I began slowly to sink toward the earth. I was forced to trust to chance, content to abide by whatever my destiny had in store for me, and it was just midnight when finally I found myself landed safely on firm ground. I soon dis-

covered that I was in the midst of a forest, and passed the remaining hours of the night among the branches of a tree. I thank the tree for having afforded me the means of discovering this palace, and still more, of discovering you."

Finally the king escaped with the princess, mounting the magic horse and seating the princess on a pillion behind him, and when she was firmly seated with her hands holding tightly to his belt, he touched the button, and the horse began to ascend heavenward like a rocket. They raced through the atmosphere like a flash of lightning, and the king, now an experienced air-pilot, guided his horse so skilfully that in a few hours the temples and towers of Ujjain appeared beneath the horse's feet. They alighted outside the city gate and walked to the royal palace.

FROM BABYLON AND PERSIA TO THE GREEKS AND THE ARABS

The earliest traditions of the Euphrates Valley carry us back to a mythical age in which rulers are pictured as deities or of divine descent. Among these is the legendary sovereign, Etana, a shepherd, who is the hero of various tales of which large fragments, though not all, have been recovered. This is not the place for a discussion of the entire myth. An eagle has a struggle with a serpent who badly tears his wings and feathers, and leaves him in a mountain-pit to die. The eagle appeals to Etana to release him from his prison, and as a reward promises to fly with Etana to the dwelling of the gods. Etana mounts on the back of the eagle, and together they fly upward. They reach the heaven of Anu and halt at the gate of the ecliptic. At this point there is a gap in the narrative, and when the thread is taken up, the eagle urges Etana to continue the journey in order to reach the place where Ishtar (the planet Venus) dwells. As in the case of the first flight, a distance of three *kasbu* or six hours is covered. Whether at this point the eagle's strength becomes exhausted or whether the goddess herself intervenes, the precipitous descent begins. The eagle drops through the space of three double hours and reaches the ground. The close of the story is wanting, but clearly the purpose of the flight has failed.

It seems that there is no other myth relating to a flight preserved in cuneiform literature, and G. Hüsing is probably right in evaluating the Etana myth, together with many others preserved in Babylonian records, as non-Babylonian and hailing from the Caucasus region. Be this as it may, the Etana myth is Aryan, not Semitic, and may also be derived from Iran.

A Babylonian seal cylinder, which is preserved in the Berlin Museum, represents the story of Etana, the flyer. He is shown being carried on an eagle's back, soaring between heaven and earth. The crescent of the moon is to his left, the sun to his right. A man standing on the ground looks up at the strange spectacle in amazement, and two dogs bark at the flying pair. On the left side of the seal impression appears a flock of sheep in a fold, guarded by a shepherd—obviously the herd belonging to Etana. The British Museum owns another seal illustrating the same subject: here Etana is seated on the eagle, who is bearing his burden aloft in the sight of an admiring and upward-gazing dog. See, further, note on p. 91.

An ancient Persian tradition is of especial interest, as it was transmitted to Europe at an early date and exerted no small influence on those occupied with dreams of aviation. This story forms a chapter of its own, and its fate will be traced down to recent times.

In the ancient semi-legendary history of Iran, Kavi Usan (in Persian: Kai Kawus) is the second king of the dynasty of the Kaianians. He was not a wise ruler, but was a rather imperfect character, easily led astray by passion. He ascended Mount Alburz, where he built seven palaces, one of gold, two of silver, two of steel, and two of rock-crystal. He then endeavored to restrain the demons of Mazandaran. One of these evil spirits retaliated by a ruse and sowed in his heart the seeds of discontent with his sovereignty on earth, so that he set his mind on aiming at the supremacy of the celestial abode. Yielding to the temptation of the Evil One, he seated himself on a throne which was supported and raised by four eagles, and as an incentive to fly up four pieces of flesh were fastened to the top of four spears planted on the sides of the throne. In this manner he sought to be transported into the empyrean; but the flight was of brief duration: the strange vehicle soon came down in a crash, and the grandees found the king unconscious in a forest.

In his great epic poem, the *Shahnameh* ("Book of Kings"), Firdausi (935-1025) describes this event as follows (in the translation of Warner):—

The Shah mused how to roam the air though wingless,
And often asked the wise, "How far is it
From earth to moon?" The astrologers replied.
He chose a futile and perverse device:
He bade men scale the aeries while the eagles
Were sleeping, take a number of the young,
And keep a bird or two in every home.
He had those eaglets fed a year and more
With fowl, kabab, and at some whiles with lamb.
When they were strong as lions and could each
Bear off a mountain-sheep, he made a throne
Of aloe from Komor (Khmer) with seats of gold.
He bound a lengthy spear at every corner,
Suspended a lamb's leg from every spear-head,
Brought four strong eagles, tied them to the throne,
And took his seat, a cup of wine before him.
The swift-winged eagles, ravenous for food,
Strove lustily to reach the flesh, and raising
The throne above earth's surface bore it cloudward.
Kawus, as I have heard, essayed the sky
To outsoar angels, but another tale
Is that he rose in this way to assail
The heaven itself with his artillery.
The legend hath its other versions too;
None but the All-wise wotteth which is true.
Long flew the eagles, but they stopped at last,

Like other slaves of greed. They sulked exhausted,
They dropped their sweating wings and brought the Shah,
His spears and throne down from the clouds to earth,
Alighting in a forest near Amul.
The world preserved him by a miracle,
But hid its secret purposes therein.
Instead of sitting on his throne in might
His business then was penitence and travail.
He tarried in the wood in shame and grief,
Imploring from Almighty God relief.

An illustrated Persian manuscript of the *Shahnameh*, dated 1587-88, which is preserved in the Metropolitan Museum of Art, New York, vividly depicts this aerial flight (Plate XI). The ambitious Shah clad in a pink robe, with feathered turban, is seated on a green mat spread on the bottom of a yellow hexagonal couch, holding a bow in his left hand and an arrow in his right, a fully laden quiver resting in front of him. He is ready for an attack from the air at any price against any enemy who might dare oppose his will. Four black eagles, on the wing, are harnessed to the sides of the throne, eagerly looking up and striving toward the flesh tied to four spears with fluttering red flags. The flyers are soaring in yellow and black clouds set off from the blue ether, leaving beneath them the highest mountain top from which a goat and another animal gaze at them in bewilderment.

This Iranian motif of an aerial conveyance lifted by starved eagles, like many other Oriental motifs, was adopted by the Greek Romance of Alexander the Great, which during the middle ages was translated into most European languages and thus became widely known. I quote from Dunlop's classical book "History of Fiction." Having reached the extremity of the world, having received homage from all nations who inhabit its surface, and being assured that there remained nothing more to conquer, Alexander formed the inconsiderate project of becoming sovereign of the air and deep. By the conjurations of the eastern professors of magic, whom ne consulted, he was furnished with a glass cage of enormous dimensions, yoked with eight griffins well matched. Having seated himself in this conveyance, he posted through the empire of the air, accompanied by magicians, who understood the language of birds, and asked of the most intelligent natives the proper questions concerning their laws, manners, and customs, while Alexander received their voluntary submissions. So far Dunlop. The common version of the story is that the birds of prey were first starved for three days and then put to a carriage, while a horse-liver was stuck on a spit in front of them. Greedy for the flesh, the birds drew the vehicle and in it Alexander up

into the air until a bird with human face met him and bade him return to earth. Dunlop has justly remarked, "This aerial journey, like most of the fictions concerning Alexander, is of eastern origin. An old Arabian writer, in a book called Malem, informs us that Nimrod being frustrated in his attempt to build the tower of Babel, insisted on being carried through the air in a cage borne by four monstrous birds." Mediaeval miniatures illustrating this air voyage show Alexander with full regalia seated in a palanquin impelled by sixteen gryphons.

Francis Godwin (1562-1633), bishop of Hereford, wrote a romance entitled " The Man in the Moone, or a Discourse of a Voyage Thither by Domingo Gonsales the Speedy Messenger," first published in 1638 after his death. In this story Gonsales, on account of sickness during a voyage, is abandoned on the then uninhabited island St. Helena, and passes his time by training a number of wild swans to obey his call and gradually to carry small burdens while flying. He conceived the idea of harnessing several birds together and devised a mechanism whereby the difficulty of distributing the weight equally at the start of the flight might be overcome. With a team of seven birds Gonsales experimented on a lamb, and by increasing their number to about twenty-five, he was himself carried aloft to his great satisfaction. "For I hold it far more honor," he says, "to have been the first flying man than to be another Neptune that first adventured to sail upon the sea." On his return to Spain Gonsales was saved from shipwreck by his birds, who subsequently flew with him to the moon—a journey which lasted eleven days. He finally learned that the birds he had trained were not really denizens of St. Helena, but of the moon. "The Man in the Moone" had a considerable influence on literature. Swift is said to have derived from it the idea of the flying island in Gulliver's Travels (1727). Several features of Godwin's romance were borrowed by Capt. Samuel Brunt in his "A Voyage to Cacklogallinia," which recounts adventures among a nation of bird-men and a voyage to the moon. The frontispiece to this book shows the voyager conveyed through the air on a palanquin supported by four large birds—the same conception as found in the Shahnameh (Plate XII).

Hodgson adds the following interesting comment to Godwin's romance: "Godwin's name is now seldom remembered save by scholars.. , but his name deserves to be kept in remembrance in aeronautical history. For though flight had been an aspiration and an object of achievement long before Godwin's time, the idea that

'the first flying man' would be greatly deserving of honor, finds its earliest expression in the sentiments above quoted. Moreover, that ingenious pioneer of flight, Domingo Gonsales, though an imaginary creation, is inspired with an admirable spirit of enthusiasm for aerial adventure of a kind that has since inspired a countless succession of real pioneers in aeronautical endeavor. To suggest that Godwin's book created that spirit would be to press the point unduly—the motif of a first success has ever been a strong one, and one which usually predicates the impulse of enthusiasm."

In April, 1786 M. Uncles announced that he was constructing a balloon to be drawn by "four harnessed eagles, perfectly tame, and capable of flying in every direction at their master's will." In May he disclosed that nothing prevented an ascent save the unsettled weather, the birds being "well-practiced." The trial was deferred, however, until August when the eagles were ready on the ground at Ranelagh, the inflation proved a fiasco, and the balloon did not rise from even the ground.

In July, 1835 Thomas Simmons Mackintosh proposed a scheme by which balloons may be conducted in moderate weather with safety by having a sufficient number of larger birds, such as hawks—eagles would do better if they could be tamed, but perhaps strong pigeons would do very well,—and let them be harnessed to the balloon to draw it along. In a "sketch of an aerial ship" Mackintosh shows his balloon formed like the hull of a ship with an additional frame-work keel on either side of which are "harnessed" eight eagles, immediately controlled or "driven" by the aeronauts seated in a small car between the two keels. A colored reproduction of this airship is contained in Hodgson's book (Fig. 113).

J. Kaiserer published in 1801 at Vienna a pamphlet on his invention to direct an air balloon through eagles ("Ueber meine Erfindung einen Luftballon durch Adler zu regieren"). A plate depicts the inventor in his balloon driving (as it were) a pair of harnessed eagles. The same idea was revived in France in 1845, and as it has been demonstrated, this idea has its root in an ancient Persian tradition transmitted to Europe through the medium of the Romance of Alexander the Great.

Daedalus ("Cunning Worker") was an ingenious craftsman of an inventive turn of mind; he is the representative of the mechanical arts of the later Minoan age. While in the service of Minus, king of Crete, he built the labyrinth for the confinement of the Minotaur, but

incurred the king's wrath; and to escape imprisonment, he fashioned a pair of artificial wings coated with wax for himself and his son Icarus. Thus they fled and flew westward across the sea. The father enjoined his son not to fly too low lest the wings dip in the brine and the wax which held them together be softened, nor too high, lest the heat of the sun melt the wax. Icarus disregarded the paternal admonition, came too near the sun in his lofty flight, the wax which fastened the wings to his shoulders melted, and he fell headlong into the sea which is still named for him the Icarian Sea. The more cautious Daedalus landed safely on Sicily. Of all flying stories of classical antiquity it is this one which has left a lasting impression on future generations and fired the ambition of many imitators; and it is on this point, its moral effect, that the importance of the story rests. Daedalus was an historical personage, a many-sided artisan who surely made some attempts to fly. Like many others of his type he was not understood or even was misunderstood by his contemporaries, and his story has been handed down in the form of poetic romance and exaggerated legend.

And what, after all, is the difference whether the Daedalus story is true or not? It is not the gray, cold, naked objective truth that counts in the history of mankind and will advance the cause of civilization, but it is the flight of human imagination, the impulses and visions of a genius, very often his errors and miscalculations, which have stimulated inventions and progress. Ever since Daedalus' alleged or real flight men in Europe have tried and died until finally success was insured.

Daedalus' adventure finds an echo in the Germanic saga of Wayland the Smith (Anglo-Saxon Wêland, Old Scandinavian Völundr), the artificer of marvelous weapons extolled in Icelandic, English, French, and German poetry. King Nidung endeavored to keep him in his service by cutting the sinews of his feet and thus laming him forever. Wayland forged a feather robe and, flying up to the highest tower of the royal castle, revealed his purpose to the king, and flew off to his home on Seeland. Wayland is represented on an Anglo-Saxon box of walrus bone of the eighth century, covered with Runic inscriptions; in this carving, his brother, Egil, is engaged in capturing birds from whose skins the clever smith will prepare his feather-shirt.

To mention all the winged gods of Greece and their flights through space would mean to pass in review a substantial portion of Greek mythology which is a subject of common knowledge. Suffice it to

refer to Hermes or Mercury, the messenger and herald of the gods, of supernatural swiftness, often represented with winged shoes and cap; and to Perseus, who received from the nymphs a pair of winged sandals, a pouch, and the cap of Hades which rendered the wearer invisible.

On the Greek stage theatrical machines (*mechanē*, *geranos*) were used to convey the illusion of persons descending from the air or being lifted upward; for instance, in Aeschylus' *Fettered Prometheus*, where the choir descends on a winged chariot and where the god Okeanos arrives on a fantastic conveyance.

Archytas was a Greek who lived at Tarentum in southern Italy (about 428-347 B.C.). He was a philosopher of the Pythagorean school, mathematician, statesman, and general. Numerous fragments and titles of works are ascribed to him, but the authenticity of some is doubted. He attained great skill as a practical mechanician, and his flying dove of wood was one of the wonders of antiquity. He lost his life drowning on a voyage in the Adriatic. What his flying dove was is not clear from the few succinct and unsatisfactory accounts we have. It is described as having consisted of a wooden figure balanced by a weight that was suspended from a pulley; it is said to have soared in the air and to have been set in motion by a current of air "hidden and enclosed" in its interior, or by compressed air escaping from a valve. Some scholars incline to the opinion that it was an anticipation of the hot-air balloon; others think that it was an aerostat or glider, as it is said it could fly, but not rise again after falling. It may also have been on the order of Lu Pan's wooden kite (p. 23), but assuredly it was not a paper kite, as sometimes assumed.

Reference has been made to the Indian traditions of Greek airships (p. 51), but thus far no confirmation of such flying-machines has been found in Greek sources.

It will not be amiss to cast a glance at the writings of Lucian, that delightful satirist and divine liar of the second century of our era, as his imageries of air voyages have inspired such eminent authors as Rabelais, Cyrano de Bergerac, and Swift. In his "Icaromenippus or the Journey above the Clouds" Lucian introduces the flyer Menippus as a persiflage of Daedalus, who goes one better than his predecessor by refraining from the use of wax. He took an eagle and a vulture of the largest kind, clipped their wings off together with the shoulders, and fastened to himself the eagle's right wing and the vulture's left wing by means of strong leather straps, to the ends of which two handles were attached as a grip for his hands. Thus he essayed to

fly, first timidly, leaping with a movement of his hands and, as geese do, keeping close to the ground on tiptoe and flapping his wings. Seeing that he succeeded, he attempted a bolder stunt, ascended the citadel, plunged downward, and flew to the theatre without a mishap. After several minor trials and exercises he scaled the Olympus, and carrying a supply of victuals as light as possible, started his flight skyward, crossed the clouds, and reached the moon.

In another work known as *The True History,* Lucian relates how, prompted by curiosity, he sailed from the pillars of Hercules and launched into the western ocean. A whirlwind carried him with his mariners toward a resplendent island which turned out to be the moon. There they were met by a curious class of creatures who styled themselves Hippogypes ("Horse-vultures"),—men riding on huge vultures which they rode like horses. These vultures were of enormous size, almost all of them provided with three heads; each of their feathers was longer and thicker than the mast of a large transport-vessel. The Hippogypes had the duty of encircling the island and conducting any stranger they encountered to the court of the king. This was Endymion, king of the moon, who at that time was engaged in a war with Phaeton, king of the sun. Lucian and his crew were graciously received by his lunar majesty, who requested their cooperation in the ensuing campaign, and as an inducement offered to furnish each with one of his royal vultures and the equipment pertaining to it.

The importance of Lucian's work rests on the fact that it gave the impetus in France to a class of fiction known as "voyages imaginaires" in which are recounted imaginary excursions to the planets or moon, like Cyrano de Bergerac's adventurous journey to the lunar world. Following Godwin's example (p. 61), Cyrano de Bergerac (1620-55) wrote the "Histoire comique de la lune et du soleil," relating aerial journeys to the lunar and solar worlds, wherein flight is achieved by such chimerical contrivances as the ascensive power of the dew when contained in glass balls and subjected to the sun's rays (an idea probably borrowed from Francesco Lana, see p. 21), or the use of a "very light machine of iron" drawn upward through the atmosphere by the attractive power of the loadstone.

The Arabs, the heirs of Greek philosophy and science, were clever mechanicians, and independently made considerable progress in mechanical devices. They were, as Washington Irving characterizes

them, a quick-witted, sagacious, proud-spirited, and poetical people, and were imbued with Oriental science and literature. Wherever they established a seat of power, it became the rallying-place for the learned and ingenious.

About the year 875 of our era an Arabic mechanician of Spain, Abu'l Qāsim Abbās Ibn Firnās, called the Sage of Spain, devised a contrivance to make his body rise into the air; he made a pair of wings, clothed himself with feathers, and flew quite a distance through the air, but, as he had not taken into consideration what would happen during his descent, he fell and injured his buttocks. He was ignorant of the fact, the Arabic chronicler adds, that a bird falls only on his rump, and had forgotten to make a tail for himself. This man was the first who manufactured glass in Spain and who constructed clepsydras. In his house he made a model of the heavens in which he showed the stars, clouds, lightning and thunder. It is therefore credible that a man of his mechanical ability was led to make attempts at flying.

The story of a flying architect is handed down by Ibn al-Faqih, an Arabic geographer, who lived in the tenth century. He erected in Hamadan, Persia, a huge tower for King Shapur I, son of the founder of the Sasanian dynasty of Persia. The jealous king decided to leave the master-builder on the top of the tower, as he did not want any one else to profit by his genius. The architect consented, but asked one favor of the king; he was permitted to erect a wooden hut on the tower to protect his corpse from the attack of vultures. The king granted the request and ordered to supply him with as much timber as he needed. Then the architect was abandoned to his fate. He took up his tools, made a pair of wings from the wood left with him, and fastened them to his body. Driven by the wind he rose into the air and landed unscathed at a safe place, where he kept in hiding. This tradition exhibits a striking affinity with the Daedalus story. The same Arabic author, in describing the scenes represented in the chamber of Perwiz near Behistun, mentions the figure of Fattūs, a celebrated Arabic architect, outfitted with the wings of a bird,—presumably an emblem of architecture and sculpture.

Under the emperor Manuel Comnenus a Saracen tried to show his skill in flying before a large audience at Constantinople. An eye-witness relates the story as follows: "It was on the occasion of the festivities held in honor of a Sultan of the Seljuks, who had come on a visit. The Saracen clambered a tower of the hippodrome where the horse-races were held, and announced that he would fly across the

race-course. There he stood on the tower, clad in a very long and wide garment of white color braced with rods of willow-wood laid over a frame-work. The cloth was loosely draped over this frame, and he intended to fly like a ship with its sail, hoping that the wind would catch in the folds of his garment. All eyes were intently fixed upon him, and the onlookers, enjoying the spectacle, kept on shouting, 'Fly, fly!' and 'How long will you put us off, Saracen, and estimate the wind from the tower?' The emperor sent a messenger over to detain him from the adventure. The Sultan, who was among the spectators, was filled with fear and hope, and worried about his compatriot. He, however, remained undisturbed, frequently examined the wind, and put the audience off. He often raised his arms, used them like wings, and lowered them to catch the wind. When the wind appeared to him favorable, he soared like a bird and seemed to fly in the air."

Oliver (also Eilmer or Elmer) of Malmesbury, an English astrologer and mechanician, who lived early in the eleventh century, is said to have fitted wings to his hands and feet and to have attempted to fly off from a tower with the help of the wind. He fell and broke his legs, and attributed his failure to the lack of a tail. Milton, in his "History of Britain" (1670), thus relates the story of the attempted flight: "He in his youth strangely aspiring, had made and fitted wings to his hands and feet; with these on the top of a tower, spread out to gather air, he flew more than a furlong; but the wind being too high, came fluttering down, to the maiming of all his limbs; yet so conceited of his art, that he attributed the cause of his fall to the want of a tail, as birds have, which he forgot to make to his hinder parts." Hodgson regards this story as legendary. Be this as it may, it bears such a striking resemblance to the Arabic accounts of flying aforementioned that a connection between the two must inevitably be assumed: either Oliver made his attempt in imitation of the Arab of whose experiment he had heard or read, or the story itself is patterned after the Arabic model.

Giovanni Battista Danti, a mathematician of Perugia, is said to have attempted about 1490 winged flights over the lake of Trasimeno in Umbria.

A similar adventure is ascribed to John Damian, abbot of Tungland, an Italian by birth, who came to Edinburgh from France in 1501 and became the favorite of King James IV, residing at the Scottish court in the capacity of physician to the king's household. In the autumn of 1507 when an embassy had been sent to France,

Damian averred he could overtake it by flying and to arrive in France before the ambassadors. He made from bird-feathers a pair of wings which he fastened on to himself, and hopped off from the top of Stirling Castle, but shortly fell to the ground and broke his legs. This failure he attributed to the fact that some hen feathers were contained in his wings and showed a natural affinity to return to the barnyard instead of maintaining flight skyward. John Lesley, bishop of Ross, who records this story in his "History of Scotland" (1578), winds up with the remark that in this adventure Damian was endeavoring to outdo King Bladud (p. 14). At any rate Damian was not so wrong from the standpoint of his time in laying the blame for his misfortune on the chicken feathers. During the middle ages it was a wide-spread superstition that one could not sleep well on a feather pillow, nor could one easily die on it. Bird-feathers were believed to retain the soul, hence the pillow had to be pulled away from under a moribund. In Ireland the belief prevailed that when a dying man suffered great agony, it was due to the presence of chicken-feathers in his bed, and his friends would sometimes lift him up and place him upon the floor to relieve him. In Norway it was a rule not to have chicken-feathers in one's pillow, for the chickens have a certain feather known as "restless feather" on which no one can sleep or die.

Roger Bacon (1214-94), the Franciscan monk, one of the few great scholars of the middle ages, merits a place in the prehistory (I say advisedly prehistory, not history) of aviation, as he points to the possibility of a flying-machine. In his "Epistola de secretis operibus," written about 1250, he affirms in the chapter "Of Admirable Artificial Instruments," "Likewise flying-machines con be made in such a way that a man is seated in the midst of the machine, revolving some sort of device by means of which wings artificially composed may beat the air after the fashion of a flying bird." The Latin original is as follows: "Item possunt fieri instrumenta volandi, ut homo sedeat in medio instrumenti revolvens aliquod ingenium, per quod alae artificialiter compositae aerem verberent ad modum avis volantis." Discussing other mechanical devices, Bacon continues that "all these were made in ancient times and have also been made in our times, as it is certain, with the sole exception of the flying-machine which I have not seen, nor do I know any one who has seen it, but I know an expert who has thought out the way to make one" (Haec autem facta sunt antiquitus, et nostris temporibus facta sunt, ut certum est, nisi sit instrumentum volandi, quod non vidi, nec hominem qui vidisset cognovi; sed sapientem, qui hoc artificium excogitavit explere, cognosco).

Roger Bacon has been greatly overestimated in modern times, until Professor Lynn Thorndike in his "History of Magic and Experimental Science during the First Thirteen Centuries of Our Era" (1923) has successfully refuted the exaggerated and distorted estimate of his importance and uniqueness and has presented the man and his work in a critical and just attitude. In fact Bacon was as superstitious and credulous as the majority of his contemporaries. In the chapter just cited he speaks, for instance, "of machines that can be made for walking in the seas and rivers, even to the bottom without danger; for Alexander the Great employed such that he might see the secrets of the deep." The story of Alexander diving into the sea in a sort of submarine is, of course, not historical, but appears only among the fictions of the Alexander Romance, which Bacon evidently swallowed as historical truth. What his real notions of flying were appears from the following passage inserted in the midst of his discussion of experimental science (characterized by Thorndike as "an instance of his gullibility"): "It is certain that Ethiopian sages have come into Italy, Spain, France, England, and those Christian lands where there are good flying dragons; and by an occult art that they possess, excite the dragons, and drive them at top speed through the air, in order to soften the rigidity and toughness of their flesh, just as boars, bears, and bulls are hunted with dogs and beaten with many blows before they are killed for eating. And when they have tamed the dragons in this way, they have an art of preparing their flesh. . . which they employ against the accidents of age and prolong life and inspire the intellect beyond all estimation. For no education which man can give will bestow such wisdom as does the eating of their flesh, as we have learned without deceit or doubt from men of proven trustworthiness." This much the Chinese knew centuries before our era. The preceding quotation shows that Bacon's mind was steeped in Oriental lore, and there is no doubt that his notions of flying are traceable to this source. In particular, the legend of men who tame flying dragons by their incantations and magic appears among the thirteenth century additions to the famous letter of Prester John in which the marvels of India and adjacent territories are recorded, and this must be the source of Bacon's version.

We know that Bacon to some extent was under the influence of Arabic science. His mathematical ideas are based on Latin translations of Arabic works, particularly through the medium of Witelo, a Polish scholar, his contemporary, who studied the writings of Alhazen (Ibn al-Haitham, 965-1038) and Avicenna (Ibn Sina, 980-1037).

It is therefore an exaggeration to say with Hodgson that "the first dawn of a rational idea of flight and of a belief in the possibility of achieving it is revealed in the writings of Roger Bacon," or with Brown that "with prophetic vision he saw the wonders that the future might hold." After quoting the above passage with reference to a flying-machine, Brown continues, "This single observation can hardly justify us in regarding Roger Bacon as a student of aeronautics, and the thought behind it was alien to the thought of the time. Nevertheless, it was a portent that the mental attitude of the middle ages would not last for ever." On the contrary, the thought was not at all novel or alien to his time, but was merely the echo of an ancient idea that we have traced in China and India as well as among the Persians and Arabs. Bacon is very far from being the herald of a new era and opening the historical period of air navigation; his place is at the end of the line of its prehistoric age.

The modern history of aviation begins with Leonardo da Vinci (1452-1519), who was a true pioneer of science by studying the flight of birds and left several sketches of aeroplanes in his manuscripts which were hidden in obscurity for nearly three hundred years until their existence was revealed in 1797. This subject, however, as well as the modern development of aircraft is beyond the scope of this inquiry.

THE AIR MAIL OF ANCIENT TIMES

To one who look'd from upper air
O'er all the enchanted regions there,
How beauteous must have been the glow,
The life, the sparkling from below!
Fair gardens, shining streams, with ranks
Of golden melons on their banks,
More golden where the sun-light falls;—
Gay lizards, glittering on the walls
Of ruin'd shrines, busy and bright
As they were all alive with light;—
And, yet more splendid, numerous flocks
Of pigeons, settling on the rocks,
With their rich restless wings, that gleam
Variously in the crimson beam
Of the warm west—as if inlaid
With brilliants from the mine, or made
Of tearless rainbows, such as span
The unclouded skies of Peristan!

Thomas Moore, *Paradise and The Peri*

Air-mail service was first established in the United States in the year 1918 when the New York-Washington mail route (218 miles) was inaugurated on May 15. A year later the Cleveland-Chicago route (325 miles) was opened. The New York-Cleveland service (430 miles) followed on July 1, 1919. On August 16, 1920, the Chicago-St. Louis service (300 miles) was inaugurated, and on September 8 of the same year New York was connected by air mail with San Francisco (2,651 miles).

While our air mail is one of the epoch-making innovations and achievements of modern times, there was also a "prehistoric" air mail which is no less admirable—carried on the wings of pigeons. This prodigious institution we also owe to the Orient. I propose to survey it from China and India to Persia and the Near East and to show how it was transmitted from there to Europe.

The first Chinese who has gone down in history as having made use of carrier pigeons is Chang Kiu-ling (A.D. 673-740), who flourished as a statesman and poet under the emperor Ming Huang of the T'ang dynasty. In his youth he was in the habit of corresponding with his relatives by means of a flock of carrier pigeons which he trained in large numbers and which he called his "flying slaves." *Fei nu* ("flying slaves") is still a designation of a carrier pigeon. The messages were attached to the feet of the birds, and they were taught how to deliver them.

It is singular that the government organs of China never saw this opportunity and never availed themselves of pigeons for conveying

important messages, as it was done by the kings of India and by the Mohammedan rulers in the Near East. The employment of carrier pigeons remained restricted to private correspondence, chiefly for commercial purposes. They were of great service to merchants in conveying intelligence to the producing districts, or bringing news of the arrivals of cargoes and the ruling prices of the markets. In the old days of the Manchu empire merchants of Hongkong used pigeons in sending news to their business partners at Canton of the arrival of the English, French, or American mails. In Canton they are termed *ch'ün shü kop* ("letter-transmitting pigeons").

Up to the time of the introduction of telephones in Peking, carrier pigeons (called *sung sin*, "letter-carriers") were used to send quotations of money exchange rates from the banks located in the Chinese City to those in the Manchu City.

The Chinese say that carrier pigeons are difficult to train and that it takes two or three years before they can be employed for long distance flights, which quite agrees with our own experiences. It takes about three years to determine the qualifications of a good homing pigeon for a five-hundred-mile flight.

While the Chinese have never bred carrier pigeons on a large scale or intensively, they have added to the art of pigeon-training an attractive means of amusement: in the same manner as they were the first who communed with the air by means of kites, they also were the first who created "music on the air." This was accomplished by means of whistles extremely light in weight, attached to the pigeon's tail-feathers. These whistles consist of two, three, or five reed tubes of graded length in the shape of a Pandean pipe, varnished yellow, brown, or black; or of a small gourd into which reed pipes are inserted. A collection of these whistles, some engraved with the names of the makers, is on view in a case illustrating the musical instruments of China in the West Gallery of the Museum; there also a mounted pigeon outfitted with the whistle and photographs of live pigeons thus equipped and taken in Peking may be seen. When a flock of pigeons circles the air, the wind strikes the apertures of the instruments which are set vibrating, and produce a not unpleasing, open-air concert whose charms are heightened by the fact that the whistles used in a flock are tuned differently. The Chinese explain that the sounds of the whistles are intended to keep the flocks together and to protect the birds from onslaughts of hawks and other birds of prey. This rationalistic interpretation, however, is not convincing. It is not known and at least doubtful whether such music makes an im-

pression on either pigeon or hawk, and would it really prevent the famished princes and pirates of the air from making a swoop at their quarry? Even supposed this might happen once in a while, we must consider that this music constantly fills the atmosphere year by year, and the unrelenting foes of the pigeon will gradually become accustomed to it and treat it with disdain or disregard. It seems more plausible that this quaint custom has no rational origin, but that it rather is the outcome of purely emotional and artistic tendencies. Psychologically, the pigeon whistles move along the same line as the musical bows attached to kites. It is not the pigeon that profits from the aerial music, but the human ear that feasts on the wind-blown tunes and derives esthetic enjoyment from them.

The pigeons which fly about with whistles attached to them are termed "mid-sky beauties" (*pan t'ien kiao jen*).

In India the use of carrier pigeons goes back to a great antiquity, and may with certainty be assumed as having been in full swing in the beginning of our era. The Arthaçāstra, an ancient handbook of polity and state wisdom written in Sanskrit by Kautilya, a minister of state, gives us the specific information that the kings of India received news about the movements of hostile troops by air mail, through domesticated pigeons which brought them stamped and sealed letters.

In Indian stories various kinds of birds appear as harbingers of messages. A white wild goose, for instance, who had been with a prince all his life carries to him a letter from his parents into a remote kingdom, and returns there with a response from him (in the legend of Kalyānamkara and Pāpamkara). Aryadeva received an invitation to come to Nalanda by a letter attached to the neck of a crow (in Tāranātha's History of Buddhism in India). Parrots frequently appear in the role of winged messengers.

Linschoten, who travelled in India in the seventeenth century, mentions the fact that he met in India a Venitian who had brought carrier pigeons along to try them out and naturalize them. John Fryer, who travelled in the East from 1672 to 1681, notes in his description of Surat carrier pigeons with blubbered noses and of a brown color to carry letters. The fact that Darwin received carriers from Madras would seem to point to their use in southern India.

As regards Persia, an interesting bit of evidence is preserved by Twan Ch'eng-shi, author of the *Yu yang tsa tsu* (ninth century), to the effect that on the sea-going vessels of the Persians many pigeons were kept, capable of flying several thousand *li* (Chinese miles); these

were released and at a single flight returned to their homes, bearing as it were the tidings that everything on board was well.

Ch'ang Te, a Chinese traveller, was sent in 1259 by the Mongol emperor, Mangu, as envoy to his brother Hulagu, king of Persia. He kept a diary of his journey which was edited in 1263 by Liu Yu. Speaking of the postal service of Persia in his time he mentions a special kind of swift camel trained for the service of couriers, as well as pigeons which transmit news to a distance of a thousand *li* (Chinese miles) in one day. In mediaeval times Persian authors repeatedly refer to the conveyance of letters by pigeon-mail in western Asia, even in time of war. In 1262 when the Mongols besieged the city of Mosul, they caught a tired pigeon which was perching for rest on one of their catapults and which carried a message for the beleaguered. The letter was intercepted, and was found to contain news of the approach of an army for the relief of the city. This enabled the Mongols in time to throw an army against the onmarching enemy.

The pigeon appears in love-songs of the Baluchi, an Iranian tribe inhabiting Afganistan. One of these love-messages begins, "Oh dove! Oh pigeon, among the birds be thou a messenger of my state to my love. Travel over the long distance, I beg of thee, blue bird, fly from the cliff where thou dwellest night, from the rugged rocks of the fowls of the air, go to my beloved's home and perch on the right side of her bed." In another love-song it is said, "Oh pigeon, peahen among the birds, be a messenger of my state to my true-love, to that modest fair one." (M. L. Dames, Popular Poetry of the Baloches.)

Pigeons were used by the ancients for sending love messages (Anacreon IX, 15; Martialis VIII, 32), news of a victory in the Olympic games, or letters into a besieged city. The earliest Greek allusion to a carrier pigeon is found in one of the fragments of Pherecrates, a writer of comedies, who lived in the fifth century before our era. Greek seafarers are said to have carried on their ships pigeons for the purpose of sending home tidings of their welfare.

Aelianus, who lived in the second century of our era, tells this story, "When Taurosthenes won the laurels in the Olympic games, intelligence of his victory was conveyed to his father at Aegina on the same day by means of a pigeon whom he took away from her young ones who were still unfeathered. He attached a purple piece of cloth to the bird and released her; she sped away to her young ones and in a day returned from Pisa to Aegina."

Pisa was an ancient town in the territory of Elis in the western part of the Peloponnesus, not far from Olympia, where the celebrated

athletic games and contests were held. The distance from Pisa to Aegina amounts to about twenty-three and a half geographical miles. It will be noticed that in this case not a letter, but merely a pre-arranged token of victory was attached to the flying messenger; purple was a symbol of victory.

Pliny (X, 110) relates that pigeons have acted as messengers in important affairs (internuntiae in magnis rebus fuere) and cites as example that during the siege of Mutina, Decimus Brutus, who was beleaguered in that city by Antonius from December, 44, till April, 43 B.C., sent into the camp of the consuls (Hirtius and Pansa) dispatches fastened to pigeon's feet (epistulas adnexas earum pedibus). A somewhat different version of this event is contained in the work of Frontinus (Strategemata III. 13, 8) of the first century of our era: the Consul Hirtius attached letters to the neck of pigeons by means of strong hair; previously he had starved the pigeons in a dark room; thereupon he released them near Mutina, where they settled on the roofs of the houses, and were caught by Brutus, who in this manner was duly informed of the events. Caesar is said to have been advised of a revolt in Gaul by pigeon-post just in time that he could lead his legion down the Alps to suppress the rebellion.

However, what is known about the use of carrier pigeons among Greeks and Romans is restricted to isolated instances. We must not generalize that it was a customary practice, for there are no records of carrier pigeons having been kept and trained for such purpose in large numbers, nor was there anything like a regular pigeon-mail. The curious fact remains that carrier pigeons were not transmitted from Italy to northern Europe in the wake of Roman civilization. The North-European nations first made the acquaintance of carrier pigeons in the Orient during the Crusades, and from that time onward they appeared inEurope, inclusive of Italy, as a novel affair. Therefore it is reasonable to conclude that among the ancients the whole business was of no great significance and that it was extinct in the days of the declining Roman Empire. The consensus of opinion is that the Greeks derived the institution from the Near East, and we have to wend our way back again to the Orient to learn more about its history.

Mesopotamia appears to be the home of the domesticated pigeon, and the domestication of the bird was accomplished as early as pre-Semitic times by the Sumerians. In Sumerian documents the pigeon is referred to as a domestic bird. Among the Semites pigeons were

closely connected with religious practices. They are sacred to the goddess Ishtar (Astarte), the mother goddess or great goddess personifying the productive powers of the earth, life, generation, and death.

Lucian, in his treatise on The Syrian Goddess, informs us with reference to Syria, "Of birds the dove seems to be the most holy to them, nor do they think it right to harm these birds, and if any one have harmed them unknowingly, they are unholy for that day; so when the pigeons dwell with the men, they enter their rooms and commonly feed on the ground."

It is unknown, however, when and where pigeons were first trained for conveying messages. Nothing to this effect has as yet come to light in the cuneiform literatures or on Egyptian monuments; both in Egypt and Mesopotamia the practice was unknown. At the outset it is improbable that it might have been developed in the Euphrates valley, where clay tablets were the common writing-material, which on account of their weight could not have been attached to pigeons; in later times, of course, parchment and papyrus were also used in Mesopotamia.

The dove which Noah sent forth from the ark three times has frequently been classified among carrier pigeons, but this notion is erroneous. Noah's dove represents an entirely distinct class: it is not sent out with a message, but belongs to the category of land-spying birds, such as navigators of ancient times used to keep on board their ships and which were released by them when in quest of land if they had lost their bearings, on the supposition that the birds would fly in the direction of land; these birds, of course, never returned to their ships. In the Pāli Bāveru Jātaka, which echoes ancient commercial relations of India with Bāveru or Babiru, i.e. Babylon, the Indian seafarers are assisted by a crow which serves for the purpose of directing their way in the four quarters. The crow has a well-developed sense of locality, and in all ancient systems of divinations crow or raven auguries are correlated with the cardinal points. According to Pliny, the mariners of Taprobane (Ceylon) did not take recourse to the observation of stars for the purpose of navigation, but carried birds out to sea, which they sent off from time to time, and then followed the course of the birds who flew in the direction of land. When the people of Thera emigrated to Libya, ravens accompanied them ahead of the ships to guide their way. In the ninth century when the Vikings sailed from Norway, they kept on board birds who were set free from time to time amid sea, and with their aid they

succeeded in discovering Iceland. Land expeditions also were accompanied by land-spying birds, and tribes on the path of migration would settle in a territory where birds carried along by them would descend. The Celts, as Justinus informs us, were skilled beyond other peoples in the science of augury, and the Gauls who invaded Illyricum were guided by the flight of birds. The legendary emperor Jimmu of ancient Japan when engaged in a war expedition marched under the guidance of a gold-colored raven.

It is asserted by many authors that the ancient Hebrews were acquainted with carrier pigeons, but there is no direct evidence to this effect in the Old or New Testament.

In the present state of our knowledge we can only assert with safety that the highest development in the use of pigeon messengers was reached in the empire of the Caliphs and under the Mohammedan dynasties of Egypt when the whole business was organized and systematized on a scientific basis, while, of course, isolated cases occurred many centuries earlier. The Arabs, on their part, were only to a small extent original or inventive, but exceedingly clever in absorbing and digesting the ideas and cultures of subject nations, and thus created an imperialistic civilization as a result of their far-flung conquests. Indo-Iranian peoples may very well have given the first impetus to the training of carrier pigeons.

Damiri (1341-1405), in his Book of Animals (*Hayāt al-hayawān*), writes in regard to the pigeon, "It may be mentioned as a part of its nature that it seeks and finds out its nest even if it be set free at a distance of a thousand leagues; it carries news and brings it from a very distant place in a very short time. There are some pigeons which can fly three thousand leagues in a day. It may sometimes happen that it is caught, and may be thus away from its native place for ten years or more, but it still retains its intelligence and power of memory, and is desirous of returning to its native place, so that when it finds an opportunity, it flies back to it."

Damiri likewise informs us that the Caliph Hārūn al-Rashid (786-809) was very fond of pigeons and sporting with them. The Arabian Nights (No. 698) introduce to us the father of Dalila who was postmaster and guard of the carrier pigeons at the court of this illustrious Caliph at a monthly salary of a thousand dinars; he used to train the pigeons so that they conveyed letters and messages, and to the Caliph each of these birds was dearer at a time of distress than any of his sons. After her husband's death, Dalila and her daughter took care of the forty pigeons, and she would daily visit the state

council to find out whether the Caliph had a message to transmit by pigeon-mail.

In another story of the Arabian Nights (No. 96), Afridūn, king of Constantinople, is advised of the movements of the Mohammedan army in Asia Minor by means of a letter sent "on the wings of a bird" and brought to him by the Guardian of the Pigeons.

According to Masudi (tenth century), news of the victory over a rebel army was conveyed to the Caliph Motasim (838-847) by pigeon-post. In 1171 the Sultan Nūr-ed-dīn established a regular air mail in Syria, actuated by the desire to obtain as quickly as possible intelligence of everything that happened in all of his provinces. For this purpose he ordered pigeons to be maintained in all castles and fortresses of his empire, also had special towers erected for breeding and postal purposes, and devoted the greatest care to the training of the birds. After his death this mail service declined until in the year 1179 it was re-established by the Caliph Ahmed Naser-lidin-allah, who had a veritable passion for pigeons and bestowed a special name on each bird. In sending a letter by pigeon-mail he was in the habit of designating in the letter the exact name of the feathered messenger, thus: "This bird, son of..." or "this bird, mother of...." In this manner he conducted a voluminous correspondence with the remotest parts of his dominion. The air mail developed into a general institution in his time, and although many engaged in the business of raising pigeons whose number was enormous, their prices reached amazing figures: a well-trained pair sold at a price up to a thousand gold pieces. Baghdad was the central station of the air mail until it was conquered by the Mongols in 1258.

The price of a pigeon of the first quality amounted to seven hundred dinars (gold coins), and the egg of such a bird sold as high as twenty dinars. Genealogies of renowned pigeons were kept on special registers.

One of the most curious incidents in the history of the pigeon-mail, as reported by Makrizi, refers to the rapid transmission by air of a consignment of cherries. The Caliph Aziz (975-996) of the Fatimid dynasty, distinguished by his tolerance and his love for science, had a great desire for a dish of cherries of Balbek. The Vezir, Yakub Ben-Kilis, caused six hundred pigeons to be dispatched from Balbek to Cairo, each of which carried attached to either leg a small silk bag containing a cherry. This is the first example of parcel post by air mail recorded in history.

In his "History of Egypt in the Middle Ages" Stanley Lane-Poole writes, "The most famous and energetic of all the Bahri Mamluks, Beybars (1266-77), established a well-organized system of posts, connecting every part of his wide dominions with the capital. Relays of horses were in readiness and answered reports from all parts of the realm. Besides the ordinary mail, there was also a pigeon-post, which was no less carefully managed. The pigeons were kept in cots in the citadel and at the various stages, which were farther apart than those of the horses; the bird was trained to stop at the first post-cot where its letter would be attached to the wing of another pigeon for the next stage. The royal pigeons had a distinguishing mark, and when one of these arrived at the citadel with a dispatch, none was permitted to detach the parchment save the Sultan himself; and so stringent were the rules, that were he dining or sleeping or in the bath, he would nevertheless at once be informed of the arrival, and would immediately proceed to disencumber the bird of its message." Beybars connected Damascus and Cairo by a postal service of four days, and used to play polo in both cities within the same week. Pigeons contributed to the complete defeat of the Mongols after the decisive battle of Hims (Emesa in Syria) in 1281, when they were beaten back by Kalāūn, who harassed their retreat and sent orders by pigeons to his governors at the Euphrates to bar the fords to the fleeing enemy.

The letters, which were written on a fine tissue paper with specifications of place, day, and hour, were fastened beneath the wings, at a later time to the tail-feather.

The caretakers brought the incoming birds directly to the Sultan who alone had the right to take the letters off. The pigeons were therefore called by the Arabs "angels of the kings." An Arabic scholar says, "The carrier pigeons are arrows which reach their goal despite the resistance offered them by the clouds. There is no mistake in styling them the prophets among the birds, because like the prophets they are dispatched with scriptures." An Arabic poet has this line: "In the marvellous speed of their flight they rush ahead of the winds; swiftly like a moment they bear under their wings in rapid flight tidings of what happens in places distant a month's journey."

Another Arabic author writes, "The pigeons who forward messages are a wonder of divine almightiness worthy of being admired and praised by us. In faithfully executing their commissions they confirm the proverb which calls them birds of auspicious foreboding. Indeed they often surpass the itinerant messengers: the clouds are

their bridles, the air is the course they race through, the wings are their equipment, the winds are their escorts. They fear on their flights neither brigands of the desert nor the perils threatening from accidents on the roads."

In 1323 Symon Semeon, an Irish Franciscan, and his companion, Hugo Illuminator, were on a pilgrimage to the Holy Land and stopped at Alexandria. An entry in Symon's diary reads as follows: "The admiral [of Alexandria], on learning of the affair [the arrival of the two pilgrims], immediately dispatched a message to the Sultan at Cairo by means of a carrier pigeon. These pigeons were trained in the Sultan's Castle at Cairo and sent in cages to the governors of the various maritime cities, who whenever they wish to make something known to the Sultan dispatch one with a letter tied under its tail, which never stops until it has reached the castle from which it was brought originally; and so the Sultan and his governors are informed daily of what is going on in the country and of the necessary measures to be taken."

A German pilgrim, von Bodmann, paid a visit to the Holy Land in 1376-77, and when his ship neared Alexandria, she was boarded by two officials from the city who drew up two lists of the vessel's cargo. These, he relates, were tied to the wings of two pigeons who were dispatched to the court of King Soldan at Babylon, a distance of two hundred miles.

In the second half of the fifteenth century the governmental pigeon-post expired in consequence of political troubles, but as a means of private communication it has survived in the Orient long after and even until the present time, especially in commercial correspondence when transactions had to be made quickly or when perishable merchandize like drugs and perfumes were at stake. Travelling merchants also availed themselves of the air mail to advise their families of their safe arrival at a place.

In 1599 Thomas Dallam, the organ-builder, during his voyage from London to Constantinople, made the following observation on the use of carrier pigeons: "The firste of June thare was letters convayede varrie straingly from Alippo to Scandaroune, the which is thre score and twelve myles distance. After I hade bene thare a litle whyle, I persaved that it was an ordinarie thinge. For, as we weare sittinge in our marchantes house talkinge, and pidgons weare a feedinge in the house before us, thare came a whyte cote pidgon flyinge in, and lyghte on the grounde amongeste his fellowes, the which, when one of the marchantes saw, he sayd: Welcom, Honoste Tom,

and, takinge him upe, thare was tied with a thred under his wynge, a letter, the bignes of a twelve penc., and it was Dated but four houres before. After that I saw the lyke done, and always in 4 houres."

Linschoten, the great Dutch traveller of the seventeenth century, describes the pigeon-mail in the Turkish empire extending from Bassora and Babylonia to Aleppo and Constantinople, and writes that the letters were fastened to a ring placed around the bird's leg.

Pietro della Valle (Viaggi in Turchia, Persia e India, Vol. I, p. 284) wrote in a letter dispatched from Ispahan in 1619, "From the Province of Babylon whither I addressed a letter I am awaiting some pigeons which convey letters from one place to another and which Tasso styles 'flying carrier' (*portator volante*). They have thus been used in Asia from the earliest times down to the present."

The Jesuit father Philippe Avril (about 1670) relates how pigeon messages were sent from Alexandria to Aleppo. "No sooner had we got ashore," he writes, "but we had the pleasure to see dispatched away before us one of the messengers which they make use of in those parts to carry such intelligence as they would have speedily made known. For the doing of which, their most usual way is this. A merchant of Aleppo, who desires to have the most early information of what merchandizes are come from France or any other parts, takes particular care by an express to send away a pigeon that has young ones, much about the time that the ships are expected at Alexandretta, where he has his correspondent; who as soon as any vessel comes to an anchor, goes and informs himself of what goods the vessel has brought most proper for his turn; of which when he has given a full account in his letter, he fastens the paper about the neck of the winged courier, and carrying her to the top of a little mountain, gives her her liberty, never fearing her going astray. The pigeon which we saw let go, after she had soared a good height to discover, doubtless, the place from whence she had been taken some few days before, and pushed forward by that instinct, which is common to all birds that have young ones, took her flight toward Aleppo, and arrived there in less than three hours, tho that city be very near thirty leagues from the place from whence she was sent. However, they do not make use of any sort of pigeons to carry their dispatches, in regard that all pigeons are not alike proper for that service. For there is a particular sort of these birds, which are easily trained up to this exercise, and which as occasion serves, are of extraordinary use, especially for the swift management of business, and where speed of intelligence is required, as in the factories of the Levant, far remote

one from the other. This was the only piece of curiosity which we could observe during our stay in this same first port of the East."

During the middle ages, the European nations became acquainted with the pigeon air mail when the cross and the crescent clashed during the crusades. In the history of the enterprises against the infidels there are several stories on record which depict the wonder and amazement of the Christian soldiers at this novel experience. In A.D. 1098 the commander of the Turkish castle Hasar disobeyed his liege lord, Rodvan of Aleppo, who declared war on him. The Turkish chief was unable to resist when one of his Emirs counselled him as follows: "Recently when Christian pilgrims marched against Edessa, I captured the wife of a knight, Fulcher (also called Foulqe) of Bouillon, and married her on account of her beauty. She is acquainted with our perilous situation and advises us to seek assistance from the Duke of Lorraine, the most powerful of the victorious Franks." The aversion toward an alliance with Christians was suppressed by the apprehension of graver consequences, and a Syrian was dispatched to the Duke with a ready proposal. Succor was promised by the latter, and the son of the Turkish chief retained by him as hostage. Meanwhile Rodvan beleaguered the fortress Hasar with an army of forty thousand, and the Franks were at a loss as to how to send the tidings of the pact into the fortress. To their amazement the Turkish envoys brought pigeons forward and tied papers to the under side of their wings. The birds were released, and the Franks assured that the good news would reach the fortress and encourage the Emir in his resistance till the arrival of the relief army.

Another episode is related thus: In A.D. 1099 when the Christian army advanced from Akkon to Caesarea, a wounded pigeon, who had a narrow escape from the claws of a hawk, dropped lifeless in the camp of the Christians. The bishop of Apt picked the bird up and found under its wings a letter addressed by the Emir of Ptolemais to the Emir of Caesarea, reading as follows: "The cursed rabble of Christians has just traversed my territory, and is passing on to yours. All chiefs of Musulman towns should be informed of their onward march and take measures to crush our foes." This letter was read aloud in the council of princes and before the entire army. Surprise and joy seized the Crusaders who did not doubt that God protected their enterprise, since he sent them the birds of heaven to reveal the secrets of the infidels.

This incident has inspired Torquato Tasso (1544-95), the great Italian poet of the Renaissance, to a poetic composition, which is inserted in his *La Gerusalemme Liberata* (Jerusalem Delivered, XVIII, 49-53). I give a literal prose rendering of my own:—

"While the camp prepares for assault and the city for defence, a pigeon is seen towering high along aerial paths over the host of the Franks. Agitating her swift pinions, she sails the clear air with outstretched wings, and the strange messenger (*la messaggiera peregrina*) is just about to alight from the high clouds into the city.

"A falcon (I do not know whence) swoops downward, armed with curved beak and large claws, and obstructs her path between the camp and city-wall. She does not wait for the tyrant's claws, but he pounces upon her and chases her to the main tent. He seems to reach her now, and holds his foot over her tender head when she takes refuge in the lap of the pious Godefroy of Bouillon.

"Godefroy takes her up and protects her, then, while looking at her, notes a strange thing suspended from her neck and fastened with a thread,—a letter concealed under a wing. He opens it and unfolds it, well comprehending the terse message it contains. 'To the Lord of Judea,' the epistle read, 'the Captain of Egypt sends greetings.

"Despond not, my lord, resist and hold out for four or five days, and I will come to liberate these walls, and you will soon see your foe vanquished.' This was the secret conveyed in pagan script and confided to the winged courier, as the Levante employed such messengers at that time.

"The prince released the pigeon who, since she had revealed her master's secrets and fancied that she had betrayed him, did not dare to return as an unlucky harbinger."

The poet had evidently read about carrier pigeons in the documents of the crusades, and was profoundly impressed by this ingenious device of postal service. His detailed description, as well as his observation that this was customary in the Levante, seem to hint at the fact that letter-carrying pigeons were still unknown in the Italy of his time,—the sixteenth century.

Lodovico Ariosto (1474-1533), in his *Orlando Furioso* (XV, 90), also refers to the pigeon-post: The giant Orrilo was slain by the duke Astolfo on the lower Nile, and this event was air-mailed by the Castellan of Damiette to Cairo. This is the custom there, the Italian poet adds, and in a few hours the news was broadcast to the whole of Egypt that the bandit had met his death.

Shakespeare alludes to pigeons as letter-carriers in *Titus Andronicus* (IV, 3), where upon the entry of a clown with two pigeons Titus exclaims,—

> News, news from heaven! Marcus, the post is come.
> Sirrah, what tidings? Have you any letters?

Another interesting reference, though not to carrier pigeons, occurs in *Venus and Adonis,* where Venus rides in a chariot drawn by doves:—

> Thus weary of the world, away she hies,
> And yokes her silver doves; by whose swift aid
> Their mistress, mounted, through the empty skies
> In her light chariot quickly is convey'd;
> Holding their course to Paphos, where their queen
> Means to immure herself and not be seen.

The Crusaders brought carrier pigeons along from the Orient. Mediaeval knights used them in sending communications from one castle to another; the convents also availed themselves of pigeon messengers.

A study of the various breeds of carrier pigeons has led Darwin to the conviction that nearly all the chief domestic races existed before the year 1600 and that the names for them applied in different parts of Europe and in India to the several kinds of carriers all point to Persia or the surrounding countries as the source of this race. Certain it is that the common European breeds of pigeon were not fit for air-mail purposes, but that all varieties used in Europe for messenger service are of Oriental origin and in the last line are traceable to the bagdotte which under the name of carrier was bred to perfection in England. The Baghdad pigeons won renown everywhere, and were known simply as a Baghdad, or Babylonian pigeon. Thus Thomas Moore, in *The Fire-Worshippers*, has the line:—

> As a young bird of Babylon,
> Let loose to tell of victory won—

The great Rabelais (1483-1553), in his Gargantua and Pantagruel (IV, 3), makes Pantagruel correspond with his father Gargantua by means of a pigeon called "Gogal [the Hebrew word for a pigeon], the heavenly messenger." Whenever the son was well or successful, he tied a white ribbon to the bird's foot; in case something untoward should happen to him, they had agreed on a black ribbon. Rabelais describes in detail this manner of communication, the bird's desire to return to her young ones as swiftly as possible and the rapidity

of her flight, which seems to hint at the fact that this was a novel feature in his time.

The first employment of pigeons for military purposes in Europe took place during the war of liberation of the Netherlands in the sixteenth century. During the siege of Harlem by the Spaniards in 1573, the garrison received several advices by pigeon-mail, announcing the approach of a relief army under the command of the Prince of Orania, and therefore persevered in its resistance. In commemoration of this event the Prince caused these pigeons to be cared for until their end, and after their death they were stuffed and preserved in the town-hall of Leiden.

The breeding of carrier pigeons was given special attention in Belgium as early as the beginning of the eighteenth century. From Belgium the experience thus gained was transmitted to France and Germany. In Belgium, Holland, and France the fondness of carrier pigeons developed into a sport.

In the beginning of the nineteenth century the pigeon-mail took a new development, chiefly for commercial purposes. The story goes that Rothschild of London had his agents join Napoleon's army and received from them first-hand war news by air mail. He was advised of the emperor's defeat at Belle-Alliance three days earlier than the British Government, and correspondingly arranged his financial speculations. In the organization of the modern press and news agencies pigeons also rendered useful services. Reuter, who subsequently founded Reuter's Bureau in London, started his career by founding a pigeon-post from Aix-la-Chapelle to Brussels, and the Gazette of Cologne at first maintained such an aerial news service. In England also, a newspaper reporter equipped with a small pigeon-cage was formerly not a rare sight at public meetings from which he sent his reports immediately to his paper by a pigeon messenger. The press availed itself of pigeons especially for the purpose of reporting yacht races, and some yachts were actually fitted with lofts. I am informed by Japanese friends that pigeons were likewise employed by newspapers in Japan.

The French were the first who ingeniously used carrier pigeons for military purposes. During the siege of Paris in 1870 (till January 28, 1871) several hundred pigeons were placed at the disposal of the military service by a Carrier Pigeon Club. The sole advices that arrived at Paris from the outside world at that time were conveyed by the wings of pigeons. A hundred and fifteen thousand official dispatches and about a million private messages are said to have

reached their destination in this manner. The dispatches were reproduced on both sides of small films by means of microphotography; eighteen such films weighed a half gram, and contained from twelve to sixteen large folio pages of news on an area of about a hundred square centimetres. The contents of a complete number of the Times could be accommodated in this space. About three thousand dispatches could be copied on each film. The films were rolled and placed in a quill which was sealed and fastened to a tail-feather of a pigeon by means of a fine wire fortified by a silk thread. For the purpose of deciphering the incoming dispatches they were projected, considerably enlarged, on a screen, so that they could be easily read and copied. The price of these air dispatches was half a franc (ten cents) each word. Money orders also were sent out to the extent of three hundred francs each. The average income from every flight of a carrier pigeon amounted to 35,000 francs ($7,000).

During the World War, as is still within the memory of every one, pigeons were extensively utilized and achieved brilliant records of flight under great difficulties. A case of supreme endurance was noted on October 21, 1918, when a carrier pigeon was released with an important message at Grand Pré at 2:35 p.m. during intense machine-gun and artillery fire. This bird delivered its message to the loft at Rampont, a distance of 24.84 miles in twenty-five minutes. One of its legs had been shot off, and its breast was injured by a machine-gun bullet, but even under these conditions the bird did not fail to reach its destination. For more information on the valorous deeds of pigeons in our army the *National Geographic Magazine* (January, 1926, pp. 86-91) may be consulted. The same article contains twelve beautiful colored plates representing various breeds of pigeons.

In warfare the service of pigeons will always remain indispensable. Telephone and wireless communication are often interrupted in the zone of advance, or may be put out of commission. Scouts and couriers may be delayed or intercepted, optical signals obscured by rain, smoke, or dust, and aerial observation hampered by unfavorable weather conditions. Pigeons are not disturbed by bombardments, fog, smoke, or dust, and will work regularly under almost any conditions. In 1919 an area of Texas was wrecked by a storm, and a United States Army relief-train was dispatched to Corpus Christi. Pigeons carried on this train were released and braved storm and rain, bringing the first news of conditions in the stricken area. Even for two days after a radio had been set up and put in operation, the pigeons

were the only means of conveying news from that district, as atmospheric conditions crippled radio communication.

Pigeons are still bred and kept in large numbers for messenger service and racing. They are useful for transmitting messages wherever communication by telegraph or telephone is not available. In the beginning of this century there was still a real pigeon-mail between New Zealand and Great Barrier, a solitary and inhospitable isle about ninety km distant from Auckland, whose colonists are engaged in mining operations. A land-owner of this isle, Fricker by name, hit upon the idea to establish a permanent daily pigeon-mail with Auckland, as the mail-steamer ran but once a week. The letters had to be written on a special form, and the postage from Great Barrier to Auckland was twelve cents, in the opposite direction twenty-five cents. The Dutch Government established a pigeon-post system in Java and Sumatra early in the nineteenth century, the birds being obtained from Baghdad.

At a trial flight conducted from Compiegne in France to Antwerp a swallow previously distinguished by a special mark was released simultaneously with several carrier pigeons. The bird immediately took up its flight in the direction of Antwerp whence it had been taken, while the pigeons, as they always do, first fluttered around to find their bearings. The swallow made the way from Compiegne to Antwerp (255 km) in sixty-eight minutes, which means that in one minute it covered 3 ¾ km, whereas the first pigeon arrived only after three hours. The swallow therefore was about three times faster; it would be the swiftest winged messenger, but unfortunately it cannot be trained like a pigeon.

Amazing records of speed and endurance have been achieved by pigeons. In good weather young birds will fly about three hundred miles in from seven to nine hours, and flights of six hundred miles in one day have been accomplished by older birds. This is the maximum of a day's flight; in fact, only a very small percentage of the birds will make five hundred miles in one day. During favorable weather some pigeons will fly five hundred miles without stopping to eat or drink. The distance from Dover to London (76 ½ miles by rail, 70 miles by air-line) was once covered by a carrier pigeon beating by twenty minutes the express train which ran at a speed of sixty miles an hour.

NOTES

In regard to Shun as a flyer and user of a parachute compare E. Chavannes, Les Mémoires historiques de Se-ma Ts'ien, Vol. I, p. 74; and J. Legge, Chinese Classics, Vol. III, Prolegomena, p. 114.

The *K'ai yüan t'ien pao i shi* (ch. A, p. 9) relates that the magician Ye Fa-shan, who lived under the T'ang dynasty, had an iron mirror which reflected objects like water; whenever a person was ill and looked into this mirror, his interior organs became completely visible, and revealed any obstructions that might be there; then he was treated by means of drugs until he was completely cured. Cf. above, p. 11.

The same work also contains the first notice of carrier pigeons (p. 5) alluded to above on p. 71: "In his youth Chang Kiu-ling kept in his house swarms of pigeons. When he had to correspond with his relatives, he tied the letter to a pigeon's foot. The bird, relying on the localities to which it had been trained, flew off and delivered the letter. Chang Kiu-ling styled them 'flying slaves.' His contemporaries were all filled with admiration."

The same work (ch. B, p. 24b) contains a curious story of a swallow transmitting a letter: "At Ch'ang-an there was a man of the people, Kwo Hing-sien by name, who had a daughter called Shao Lan. She was married to a big merchant, Jen Tsung, who pursued his trade in Siang (Hu-nan). For several years he was absent from home, and no news from him had reached his family. One day Shao Lan was in the living-room of her house and observed a couple of swallows playing on the ridge-pole of the roof. She heaved a long sigh and addressed the swallows, 'I have heard that you swallows come from the east of the sea and return there and in your constant migrations must pass through Siang. My husband left home several years ago, and has not returned. There is no tidings as to whether he is dead or alive, and I have no means of knowing whether he exists or not. I trust to you to deliver a letter to my husband.' When she had finished her speech, she burst into tears. The swallows fluttered around, uttering sounds as though responding to her request. Again, Lan spoke to them, 'If you wish to be loyal to me, descend into my lap!' The swallows thereupon flew on her lap, and with many sighs Lan recited the following stanza: 'My husband has gone far away beyond the lakes; I am almost in despair, mingling bloody tears with this message. Con-

fidently I trust to the swallow's wings to transmit this letter to my unfeeling husband.' Thereupon Lan committed this brief message to writing and tied it to the foot of one of the swallows. These emitted a sound and flew off. Jen Tsung then happened to be at King-chou and suddenly noticed a swallow flying above him. He was astounded when he saw the bird who alighted on his shoulder. He observed that a tiny letter was attached to the bird's foot; he released it and read his wife's message in verse. He was deeply moved and shed tears. The swallow rose into the air and flew off. The following year Jen Tsung returned home and showed Shao Lan the verses which she had written. Subsequently the scholar Chang Yüe (a well-known poet, A.D. 667-730) recorded this story to have it preserved as a curiosity of literature."

Chao, an emperor of the Han dynasty, while hunting in a park, shot a wild goose and found a piece of cloth attached to one of its feet. It contained a message to the effect that Su Wu and his companions were in a certain marsh in the country of the Hiung-nu. Messengers were at once dispatched to the Hiung-nu to demand the release of the prisoners who had been believed to be dead (Pétillon, Allusions, p. 505; Giles, Biogr. Dict., p. 685).

The first who made the passage from the *Ti wang shi ki* known was G. Schlegel (Chinesische Bräuche und Spiele in Europa, p. 32, Breslau, 1869). Schegel, in the same manner as I, takes Ki-kung-shi (wrongly written by him Ki-kwang-shi) as the name of an individual, but draws an erroneous conclusion from this text when he observes the "the air-balloon invented in Europe in 1872 was assuredly known to the ancient Chinese." The Chinese "flying chariot" has nothing to do with a balloon which is based on the principle of a bag filled with heated air or hydrogen gas; such a contrivance was not known to the Chinese at any time, notwithstanding what has been written to the contrary. Professor Giles, in the article quoted below, justly remarks, "No credence whatever should be given to the absurd story of the French missionary, Father Besson, who is said to have written in 1694, stating that a balloon had ascended from Peking at the coronation of Fo Kien in 1306. No emperor was crowned in 1306, and no such emperor is known to Chinese history as Fo Kien."

H. A. Giles, Traces of Aviation in Ancient China (in his Adversaria Sinica, Vol. I, No. 8, 1910, pp. 229-236), cites all texts relative to the Ki-kung flying chariot, save the one from the *Ti wang shi ki*. It is noteworthy that the *Ts'e Yüan* (under "flying chariot") quotes

only the latter, which apparently is the most important, but omits the *Po wu chi, Shu i ki,* and *Kin lou tse.*

As in European folk-lore, so in China also rocks of peculiar shape, bells, statues, swords, and other objects are credited with a magic power of flight. "A rock which arrived flying" (*fei lai shi*) is shown on the sacred Mount T'ai in Shan-tung. Flying swords are mentioned in the romance of the Three Kingdoms (Brewitt-Taylor, San Kuo, Vol. II, p. 311). "Flying scissors" (*fei lai tsien*) of cast iron are figured and described by L. Gaillard (Croix et Swastika en Chine, 1893, p. 217).

Good information on Korean and Japanese kites will be found in the interesting book of Stewart Culin, Korean Games with Notes on the Corresponding Games of China and Japan, pp. 9-21 (Philadelphia, 1895); see also W. Müller, Der Papierdrachen in Japan (Stuttgart, 1914), who deals well with the construction of Japanese kites.

Those interested in the subject of kite-fishing may consult H. Balfour, Kite-fishing, in Essays and Studies Presented to William Ridgeway (1913), pp. 583-608, and H. Plischke, Der Fischdrachen, published by Museum für Völkerkunde, Leipzig, No. 6, 1922. In this monograph the distribution of kite-fishing and the use of kites for fishing in Indonesia, Melanesia, and Micronesia are set forth in detail. The author also regards China as the home of the kite whence it spread to Indonesia and the South Sea Islands on the one hand and to Europe on the other hand. His statement (p. 36) that the earliest Chinese references to the kite belong to the second and fifth centuries B.C., however, is erroneous; he has been misled by De Groot (Religious System of China, Vol. III, p. 665), who misinterprets the wooden bird mentioned by Mo Ti as a kite.

In the Panchākyānaka, a Jaina recension of the Panchatantra, we also find the story of the Weaver as Vishnu (translated by J. Hertel, Indische Märchen, 1921, p. 92); in this version, the Garuda airship is set in motion by a push of the elbows.

The story of the Bodhisatva as a divine horse rescuing merchants from flesh-devouring ogres by carrying them from Ceylon to India, traversing the clouds and passing the sea to the other side, is contained in the Valahassa Jātaka (Jātaka No. 196) and Hüan Tsang's account (S. Beal, Buddhist Records of the Western World, Vol. II, p. 242).

The influences of Greece on India are set forth in a good summary by Count Goblet d'Alviella in his book Ce que l'Inde doit à la Grèce: des influences classiques dans la civilisation de l'Inde (2nd ed., Paris, 1926). While art, medicine, mathematics, and astronomy are duly

considered, mechanics and references to airships are passed over with silence.

Sylvain Lévi, however, in his treatise Quid de Graecis veterum Indorum monumenta tradiderint (Paris, 1890, p. 24), has thus referred to the Yavana airship: "Memorandus tandem ille Yavana qui machinam per aera volantem construxerat, ut Candīs principem tolleret."

In regard to the myth of Etana see G. Hüsing, Zum Etana Mythos, *Archiv für Religionswissenschaft*, 1903, p. 149, and Die iranische Ueberlieferung (1909), pp. 39, 100; M. Jastrow, Another Fragment of the Etana Myth, *Journal American Oriental Society*, 1910, pp. 101-129; B. Meissner, Babylonien und Assyrien, Vol. II (1925), pp. 189-191. The British Museum seal representing Etana's bold flight is figured and described by P. S. P. Handcock, Mesopotamian Archaeology (1912), pp. 297-298. W. H. Ward, The Seal Cylinders of Western Asia, pp. 142-148 (Washington, Carnegie Institution, 1910), describes five seals with this subject.

The story of Kai Kawus is also recorded in the Bundahishn (translated by E. W. West in Sacred Books of the East, Vol. XXXVII, pp. 220-223) and in the Arabic History of the Kings of Persia by Al-Tha'alibi, translated by H. Zotenberg (Histoire des rois des Perses, 1900, p. 167). The Arabic chronicler gives the case a more theological flavor by making Kai Kawus construct the tower of Babylon whence he takes his skyward flight. After his fall he demands milk and water from the people who have come to his rescue, and that locality was therefore called Siraf ("Milk and Water"). In the same work (p. 13) is found the story of King Jemshed constructing a chariot of teak and ivory which is transported by demons through the air and in which he flies from Donbāwand to Babylon in a single day.

Hodgson errs in tracing Godwin's bird-airship (p. 61) to Lucian, who in fact has nothing of the kind. All that Lucian offers in regard to air voyages is given above (p. 64), and these are effected by means of wings, not of birds. Feldhaus is mistaken in permitting the Babylonian tradition of the flying Etana to migrate into Persia without even knowing the story of the Shahnameh. Etana, however, accomplishes flight merely by mounting a bird, while the Persian king Kai Kawus flies comfortably seated in a vehicle drawn by four eagles who supply the motor. The two traditions are entirely distinct and not interrelated.

The old yarn of Simon the Magician as having attempted, at the time of Nero, a flight which ended in failure, is still warmed up in

many books, recently again by C. L. M. Brown (p. 7). Suetonius (Nero, 12) reports nothing about a flight, still less lisps a word about a flight of Simon. He writes merely that at a performance of the story of Icarus in the theatre an actor (a petaurista or petauristarius) had a fatal accident and collapsed on a spot near the emperor whom he covered with his blood; the question is of a stage disaster, not of a flight. Only mediaeval legend connects Simon with a flight achieved with the devil's assistance. Arnobius, writing about the year 300 of our era, says that the people of Rome saw the chariot of Simon Magus and his four fiery horses blown away by the mouth of Peter and vanish at the name of Christ. Cyril of Jerusalem (315-386) speaks of Simon's being borne in the air in the chariot of demons, and is not surprised that the combined prayers of Peter and Paul brought him down. Finally in the *Didascalia Apostolorum*, an apocryphal work extant in Syriac and Latin, Peter finds Simon at Rome drawing many away from the church as well as seducing the gentiles by his "magic operation and virtues." Peter then states that one day he saw Simon flying through the air, but by virtue of his prayer Simon fell and broke the arch of his foot. In another, Greek version of the legend Simon announced his flight in the theatre. While all eyes were turned on him, Peter prayed against him. Meanwhile Simon mounted aloft into mid-air, borne up, Peter says, by demons, and telling the people that he was ascending to heaven, whence he would return bringing them good tidings. The people applauded him as a god, but Peter stretched forth his hands to heaven, supplicating God through Jesus to dash down the corrupter and curtail the power of the demons. He asked, however, that Simon might not be killed by his fall, but merely bruised. Thereupon Simon fell with a great commotion and bruised his bottom and the soles of his feet (compare L. Thorndike, History of Magic and Experimental Science, Vol. I, p. 422). All this is freely invented legend for a dogmatic purpose and has nothing to do with a real attempt at flight.

In regard to the letter of Prester John see the critical discussion of L. Thorndike, History of Magic and Experimental Science, Vol. II, pp. 240-245, a book that is to be highly recommended for its thorough, judicious, and critical scholarship.

The chapter "The Air Mail of Ancient Times" is the most comprehensive historical study of carrier pigeons thus far written. An interesting article on Chinese lore of pigeons is by T. Watters, Chinese Notions about Pigeons and Doves, in *Journal China Branch Royal Asiatic Society*, Vol. IV, 1868, pp. 225-242. No reference to

carrier pigeons is made in this article, although the name of Chang Kiu-ling is mentioned. Those interested in Chinese pigeon whistles may consult my article on the subject in *The Scientific American*, 1908, p. 394, where also the process of making the whistles is described with illustrations of examples and of the tools used in making them. In regard to pigeon breeds in general see W. B. Tegetmeier, Pigeons: Their Structure, Varieties, Habits, and Management, London, 1868 (with colored plates).

The Oriental origin of Greek carrier pigeons is upheld by H. Diels, Antike Technik (1914), pp. 68-69; see also my review of this book in *American Anthropologist*, 1917, pp. 71-75. There is an interesting article by F. Kluge, Die Heimat der Brieftaube, reprinted in his Bunte Blätter (Freiburg, 1908), pp. 145-154. The author of this article quotes chiefly from early German pilgrimages to Palestine to prove the Oriental origin of the pigeon-mail. He justly emphasizes the point that the ancients employed pigeons as messengers only incidentally and occasionally. L. Rauwolf's Beschreibung der Raiss inn die Morgenländer (1583), p. 215, may be added to his German sources. Compare also Gaudefroy-Demombynes, La Syrie à l'époque des Mamelouks d'après les auteurs arabes (1923), pp. 250-254.

In his charming story "Legend of Prince Ahmed Al Kamel or, The Pilgrim of Love" inserted in his *The Alhambra*, Washington Irving has skilfully combined the Oriental motives of talking birds, knowledge of birds' speech on the part of the prince, the courier pigeon carrying love letters (that "trustiest of messengers"), the enchanted horse, and the flying carpet of Solomon on which the lovers elope. Thomas Moore, in *The Veiled Prophet of Khorassan*, alludes to Solomon's silken rug in the lines—

> Waved, like the wings of the white birds that fan
> The flying throne of star-taught Soliman—

and comments that when Solomon travelled, he had a carpet of green silk on which his throne was placed, being of a prodigious length and breadth, and sufficient for all his forces to stand upon, the men placing themselves on his right hand and the spirits on his left; and that when all were in order, the wind, at his command, took up the carpet, and transported it with all that were upon it, wherever he pleased; the army of birds at the same time flying over their heads, and forming a sort of canopy to shade them from the sun. The same motif is frequently referred to in the mediaeval Midrash literature.

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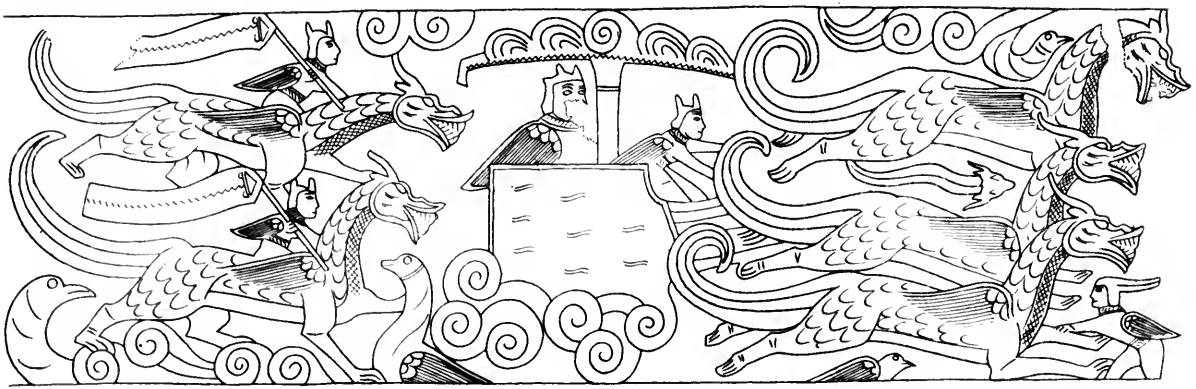

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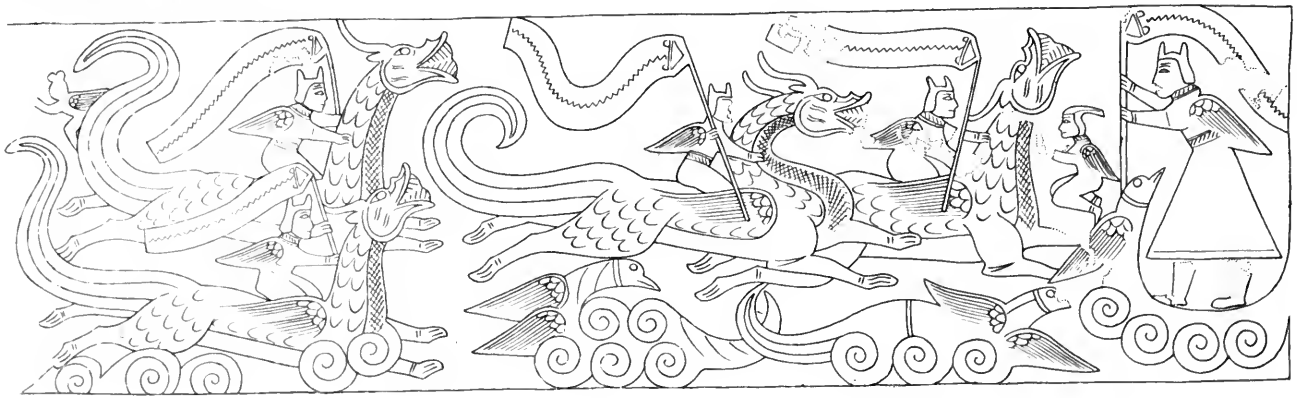

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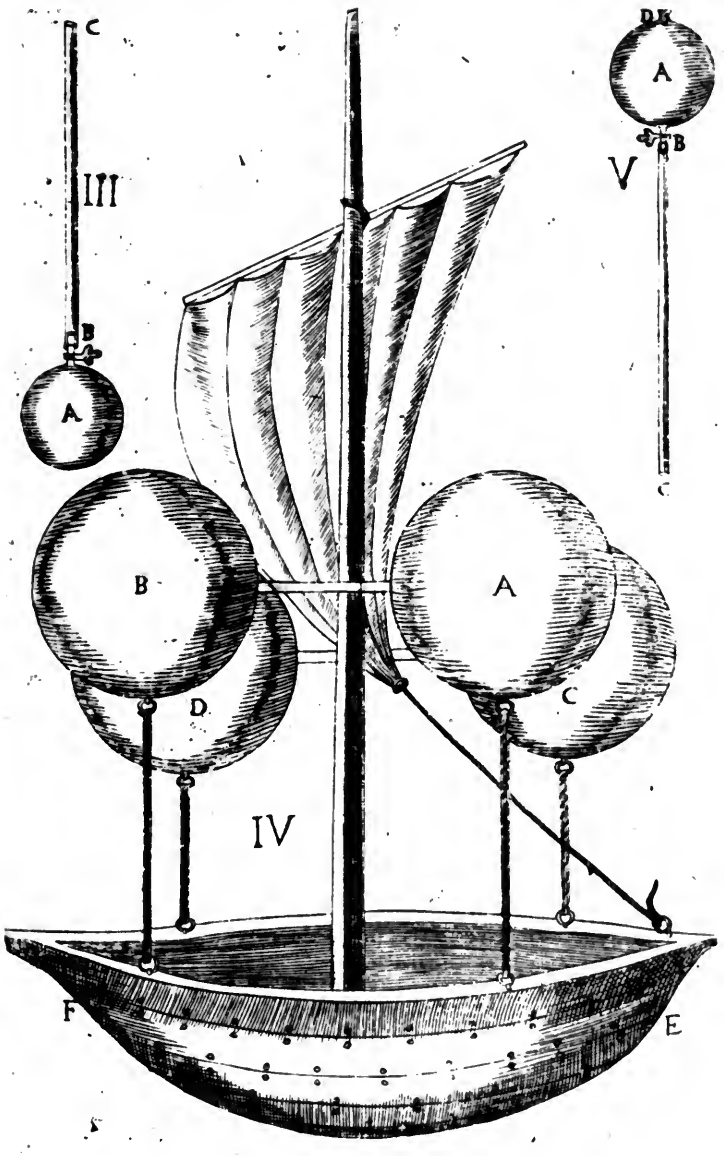

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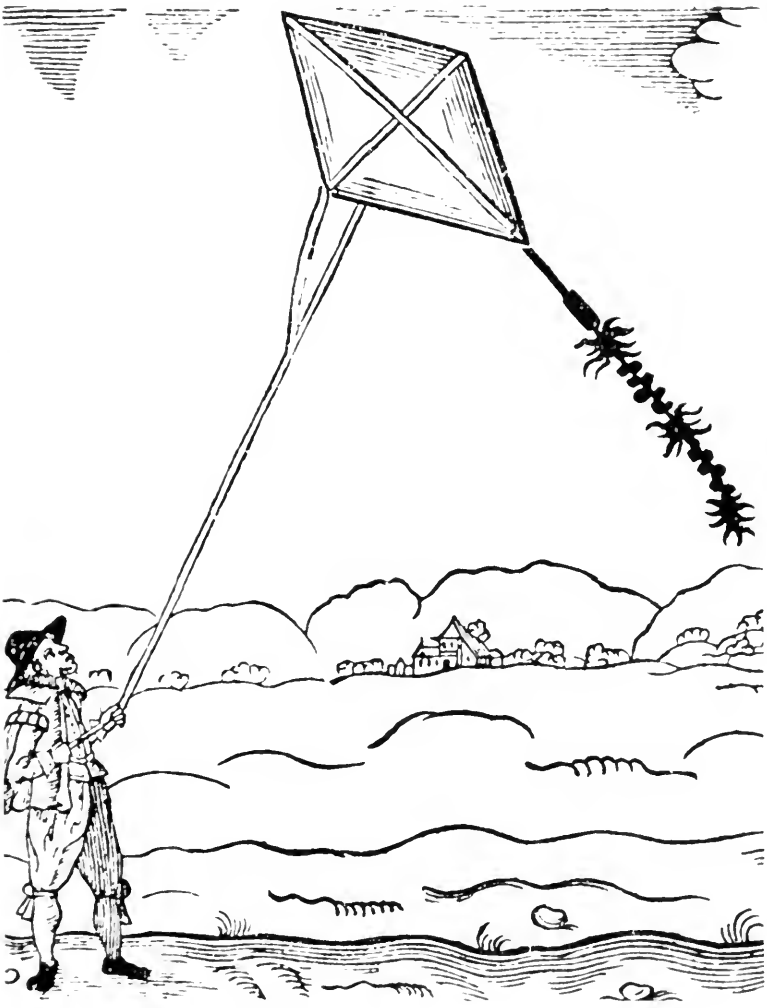

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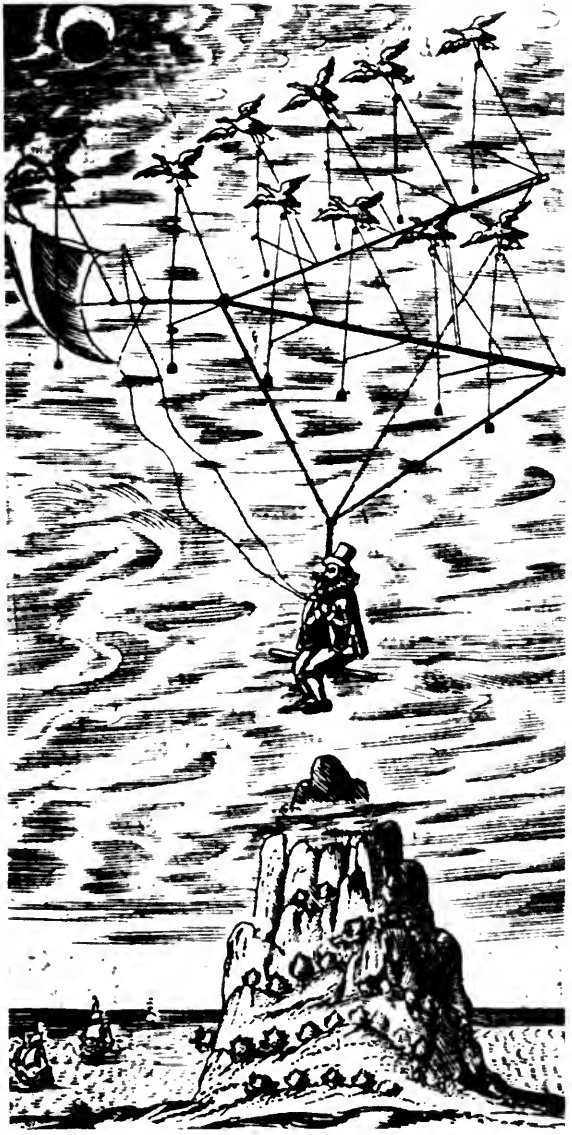

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