Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year $3 00
One copy, six months 1 50
CLUB RATES { Ten copies, one year, each $2 50 ..... 25 00
Over ten copies, same rate, each 2 50

VOLUME XXXI, No 8. [NEW SERIES.] *Twenty-ninth Year.*

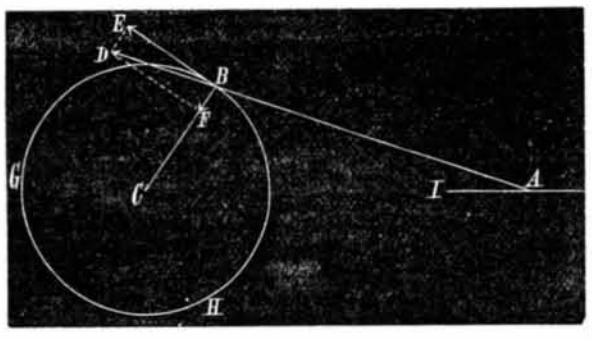
NEW YORK, SATURDAY, AUGUST 22, 1874.

Contents:

(Illustrated articles are marked with an asterisk.)

ROTATIVE VERSUS ROTARY ENGINES.

An engine having a crank actuated by a reciprocating piston is commonly known as a rotative engine; and one in which the piston is attached directly to the shaft, so that it always moves in the same direction, is called a rotary engine. Each style of engine has advantages peculiar to itself, but the controversy between the relative merits of rotative and rotary engines is not infrequently discussed upon improper grounds. We are continually in receipt of letters of the same general tenor as the one which lies before us at present, in which the writer asks: "What percentage of power is claimed to be lost in a steam engine by the piston movement, and what is the probable percentage which would be gained by rotary motion?" Our readers are doubtless ignorant of the frequency with which these queries are sent to us. Our object, in this article, is to give a general answer on this subject. We have no idea of opening our columns to discussion on the supposed loss of power in the crank, any more than to arguments of perpetual motion or methods of squaring the circle. But there are numerous points of interest in the theory of the crank, and thorough explanations are only to be found in works which are inaccessible to many of our readers. Hence it may be well to devote a little space to the consideration of these points; and first we will endeavor to state with all fairness the argument of those who contend that there is a loss of power in the use of the crank as applied to the steam engine with the reciprocating piston.



Let the circle, B G H, represent the path described by the center of the crank pin, in one revolution of the engine; let C B be the direction of the crank, and A B, the direction of the connecting rod, at some given point of the stroke. The pressure on the piston is transmitted through the connecting rod to the crank pin at B, and may be represented in quantity and direction by the line, B D. But the only part of this force which can produce motion in the crank is that which acts tangentially to the circle at B, or perpendicularly to the crank, B C. This can be represented graphically by resolving the force, B D, into its components perpendicular and parallel to B C, by the principle of the parallelogram of forces; and this being done, it appears that B E, less than B D, represents the part of the force on the piston that tends to move the crank, while the component, B F, acting in the direction of the crank, is apparently lost, as it has no effect in causing motion. Suppose, for instance, that the angle, B A I, between the connecting rod and the guides, is 30°, and that the pressure on the piston is 100 pounds. Then the force tending to move the crank is found (by multiplying the pressure on the piston by the cosine of 30°) to be only 86·6 pounds. At other points of the stroke, the effective pressure on the crank pin will be much less, being reduced to nothing when the direction of the connecting rod passes through the point, C, or when the crank is on the center; and the only point in which the effective pressure on the crank pin is equal to the pressure on the piston is that for which the connecting rod is perpendicular to the crank. Taking the mean of the effective pressures on the crank for successive points, it will be found that, if the mean pressure on the piston during a stroke is 100 pounds, the mean effective pressure on the crank pin will be 63 66 pounds. Hence, say those who insist that there is a loss of power in the crank, we have a loss of 36·34 per cent in a rotative engine, as compared with a rotary engine of the same dimensions. This, we believe, is a fair statement of the argument usually advanced by opponents of the crank, and as far as the facts are concerned they are correct; it is only the conclusion to which we demur. We will now present our argument, based on these same facts. An examination of the connecting rod, of an engine in motion, will show that the two ends pass over different spaces in a given time. If, for instance, in one stroke, the end of the connecting rod that is attached to the crosshead moves through one foot, the end which is attached to the crank pin, and makes half a revolution in the same time, passes through 1·5708 feet. Now power is something more than mere force or pressure; it is force acting through space. Suppose that an engine is placed with its crank on the center, and steam is admitted: no motion will be produced, and consequently there will be no power developed, and no expenditure of steam. But let the piston make a stroke: the power exerted is equal to the force or pressure acting on the piston multiplied by the space passed through, or it will be 100 foot pounds, assuming the data of the preceding instance. During the same time, the crank pin has passed through a space of 1·5708 feet, and the force or pressure exerted has been 63·66 pounds, so that the power exerted during this time, or the product of 1 5708 multiplied by 63 66 pounds, is 100 foot pounds. Hence there is no loss of power in the use of the crank, in theory, all the power exerted on the piston being imparted to the crank. The reader who has pursued this discussion attentively will probably be able to detect the fallacy in the argument of the opponents of the crank. It consists in confounding power and pressure, forgetting that a small force exerted over a great distance in a given time may develope as much power as a large force exerted over a small distance in the same time.

In practice, it is to be expected that the friction of the working parts will absorb some of the power exerted by the piston. Mr. Scott Russell, in his "Treatise on the Steam Engine," gives, as the result of some careful experiments on rotative engines, that the work done amounted to 90 per cent of the power exerted by the pistons. It may be added that this book contains an excellent discussion of the theory of the crank, as well as a careful comparison of the relative merits of rotative and rotary engines.

Another stumbling block in the way of many is the fact that the motion of the piston is continually stopped at the end of a stroke, preparatory to the commencement of a stroke in the opposite direction. But it should be remembered that while one end of the connecting rod is subject to this reciprocating motion, the other end has a rotary motion, always in the same direction. Now it will be found by observation that all single rotative engines are provided with heavy parts, such as fly wheel, disk cranks, and counterweights, which also have a rotary motion when the piston is in action. These heavy parts acquire energy during the stroke to continue the motion past the centers, where the pressure on the piston produces no effective pressure on the crank pin; and it would be easy to show, did space permit, that, by proper attention to the proportion and arrangement of these heavy parts, all trouble arising from what are known as dead points can be overcome. Indeed, most of our readers must have noticed that this trouble is only imaginary, and does not exist in practice in the case of a well designed rotative engine.

Our readers must not conclude from the foregoing remarks that we intend to induce inventors to give up designing rotary engines: we only wish to place the matter in its true light. If a practical rotary engine can be produced, one that can compete successfully with our best rotative engines in regard to economy and durability, the advantages of lightness, compactness, and capability of high piston speed are so important as to render its success almost certain. We only wish to dissent from the opinion that, other things being equal, the rotary engine is better than the rotative because the latter applies the power by means of a crank, thereby occasioning a loss, since this is not a fact.

THE FABRICATION OF ANTIQUES.

Apparently the most thriving branch of manufacture in the East is the production of pretended relics of the past, gems, coins, statues, ornaments, arms, written documents, everything that archæologists can desire being turned out in quantity to meet the liveliest demand, and so skillfully done that the expertest judges find it difficult to detect the fraud. One of the most successful manufactories in Constantinople is devoted entirely to the fabrication of coins of the time of Constantine and his mother, to be palmed off on collectors and tourists by confederate dealers who profess to obtain them from workmen engaged in pulling down old houses. A Greek monk in Athens drives a busy trade in spurious Greek coins, their composition regulated by such profound numismatic knowledge that much learning and great technical experience are required to distinguish them from genuine antiques. Equal adroitness is displayed in getting rid of his productions, which are never offered for sale in Athens, though it is known that they are sent by special emissaries to Constantinople and others of the larger capitals of Europe. The most successful agents, however, are herdsmen and shepherds of the provinces, who find a ready market among tourists and scientific explorers.

Spurious Mahommedan coins and gems are manufactured throughout the East, particularly in Persia, with surprising skill and boldness. A coppersmith in Shiraz is said to be able to supply anything of the sort—genuine, of course—that the traveling connoisseur may desire, as much as forty ducats having been paid him for a silver coin made in his own manufactory to represent one struck for the Khalif Ali. Bagdad sends forth gems on which Sassanian busts and Pehlevi inscriptions are reproduced with masterly skill; their only drawback is the fact that the characters, though admirably done, never admit of being reduced to legible words, much less to sense. The Byzantine coins made at Constantinople have the same failing. Dr. Mordtmann, who exposes these nefarious practices at great length in communications to a German paper, asserts—as evidence of the grave dimensions of the evil and the skill with which even experts are defrauded—that the great part of a large collection recently purchased in the East by no less a connoisseur than the Count de Gobineau, and described by him in the *Revue Archæologique*, consists of modern and spurious stones and medals. One of the stones bears an inscription of two words in Pehlevi characters, in which modern Persian, modern Greek, and Mohammedan elements are blended to form a pretended antique! Others of the stones and tablets are flagrantly evident copies of well known rock carvings in Asia Minor.

Special warning is given against a spurious gem fabricated by Persians and now offered for sale in Constantinople for the modest sum of 2,000 francs. The fraud is betrayed by the inscription, which, though handsomely cut, is only a bit of artistic patchwork. The recent swindling of the Berlin Academy by a Greek forger, and the reported purchase of a lot of well made Bagdad "antiquities" by the British Museum for $10,000, are proof enough that the warning is not uncalled for.

METEOROLOGICAL AND MEDICAL STATISTICS.

A Boston scientist has observed that a diminution of atmospheric pressure, indicated by a low state of the mercurial column of the barometer, not only increases largely the gases set free by putrefactive fermentation, but even causes such gases to be evolved in localities otherwise considered healthy, often manifesting their presence by a nauseating odor in the best portions of cities like New York or Boston. This discovery may be unexpected by some persons; but it is not by others, who are aware that a similar effect of diminished atmospheric pressure is experienced in mines. Evolutions of explosive or suffocating gases are always more common when the barometer is low; while the evolution is stopped, and even the gases filling some galleries in the mines will disappear, when the mercury in the barometer ascends. The increased atmospheric pressure which causes the rise in the mercurial column prevents the expansion of the gases in the subterranean caves and crevices, and may in some localities, favorably situated for the effect, press the gas from the mining gallery or shaft back again into the recesses whence it was evolved by diminished pressure. All this explains the reason why explosions in mines seldom or never take place when the barometer is high, but usually when it is low; whence some mining masters always recommend special care in regard to the use of safety lamps, etc., when the mercury is descending; and at very low states of the barometer, they even stop the working in certain galleries of dangerous mines altogether.

We see then how dangers may increase from changes in natural conditions. A change in atmospheric pressure, which here is the inducing cause, is not an isolated illustration of this class. Local changes in gravitation, for instance, will also result in the production of unusual phenomena; such local changes are constantly being brought about by the moon, as seen in the ocean tide wave. When at new moon, the combined attraction of both sun and moon, acting in the same direction, diminishes the regular terrestrial gravitation in a certain locality; and when to this diminished gravitation, a diminished atmospheric pressure adds its influence, the terrestrial crust is more easily ruptured, and volcanic gases escape, especially in localities where its weight is scarcely sufficient to resist the upward pressure of the liquid or gaseous material confined under the solid shell which constitutes the terrestrial envelope. It has indeed been observed, in volcanic countries, that eruptions and earthquakes more commonly occur at new moon, and they are especially most common when, at the same time, the barometer—that is, the atmospheric pressure—is low.

That diseases like yellow fever, typhoid fever, fever and ague, consumption, etc., are more common in certain defined regions, and that some of these are confined within given belts of low, moist countries, and that they are comparatively unknown in certain dry, elevated plateaus, situated at from 5 000 to 10,000 feet above the surface of the ocean, proves that emanations produced by excess of moisture are powerful helps for the engendering of miasma; while a change of wind has often had the most striking effect in arresting the virulence of an epidemic.