date have shared in the elevatory movements which gave rise to these mountain chains, and may be found perched up, in some cases, many thousand feet high upon their flanks. And evidence of equal cogency demonstrates that, though in Norfolk the forest bed rests directly upon the chalk, yet it does so, not because the period at which the forest grew immediately followed that at which the chalk was formed, but because an immense lapse of time, represented elsewhere by thousands of feet of rock is not indicated at Cromer.

I must ask you to believe that there is no less conclusive proof that a still more prolonged succession of similar changes occurred before the chalk was deposited. Nor have we any reason to think that the first term in the series of these changes is known. The oldest sea beds preserved to us are sands, and mud, and pebbles, the wear and tear of rocks which were formed in still older oceans.

But, great as is the magnitude of these physical changes of the world, they have been accompanied by a no less striking series of modifications in its living inhabitants.

All the great classes of animals, beasts of the field, fowls of the air, creeping things, and things which dwell in the waters, flourished upon the globe long ages before the chalk was deposited. Very few, however, if any, of these ancient forms of animal life were identical with those which now live. Certainly, not one of the higher animals was of the same species as any of those now in existence. The beasts of the field in the days before the chalk were not our beasts of the field, nor the fowls of the air such as those which the eye of man has seen flying, unless his antiquity dates further back than we at present surmise. If we could be carried back into those times, we should be as one set down suddenly in Australia before it was colonized. We should see mammals, birds, reptiles, fishes, insects, snails, and the like, clearly recognizable as such, and yet not one of them would be just the same as those with which we are familiar, and many would be extremely different.

From that time to the present the population of the world has undergone slow and gradual but incessant changes. There has been no grand catastrophe—no destroyer has swept away the forms of life of one period, and replaced them by a totally new creation; but one species has vanished and another has taken its place; creatures of one type of structure have diminished, those of another have increased, as time has passed on. And thus, while the differences between the living creatures of the time before chalk and those of the present day appear startling, if placed side by side, we are led from one to the other by the most gradual progress, if we follow the course of Nature through the whole series of those relics of her operations which she has left behind.

And it is by the population of the chalk sea that the ancient and the modern inhabitants of the world are most completely connected. The groups which are dying out flourish side by side with the groups which are now the dominant forms of life.

Thus the chalk contains remains of those strange flying and swimming reptiles, the pterodactyl, the ichthyosaurus, and the plesiosaurus, which are found in no later deposits, but abounded in preceding ages. The chambered shells called ammonites and belemnites, which are so characteristic of the period preceding the cretaceous, in like manner die with it.

But amongst these fading remainders of a previous state of things are some very modern forms of life, looking like Yankee peddlers among a tribe of Red Indians. Crocodiles of modern type appear; bony fishes, many of them very similar to existing species, almost supplant the forms of fish which predominate in more ancient seas; and many kinds of living shell fish first became known to us in the chalk. The vegetation acquires a modern aspect. A few living animals are not even distinguishable as species from those which existed at that remote epoch. The *Globigerina* of the present day, for example, is not different specifically from that of the chalk; and the same may be said of many other *Foraminiferæ*. I think it probable that critical and unprejudiced examination will show that more than one species of much higher animals have had a similar longevity, but the only example which I can at present give confidently is the snake's head lamp-shell (*Terebratulina caput serpentis*), which lives in our English seas and abounded (as *Terebratulina striata* of authors) in the chalk.

The longest line of human ancestry must hide its diminished head before the pedigree of this insignificant shell fish. We Englishmen are proud to have an ancestor who was present at the Battle of Hastings. The ancestors of *Terebratulina caput serpentis* may have been present at a battle of *Ichthyosauriæ* in that part of the sea which, when the chalk was forming, flowed over the site of Hastings. While all around has changed, this *Terebratulina* has peacefully propagated its species from generation to generation, and stands to this day as a living testimony to the continuity of the present with the past history of the globe.

Up to this moment I have stated, so far as I know, nothing but well authenticated facts, and the immediate conclusions which they force upon the mind.

But the mind is so constituted that it does not willingly rest in facts and immediate causes, but seeks always after a knowledge of the remoter links in the chain of causation.

Taking the many chances of any given spot of the earth's surface, from sea to land and from land to sea, as an established fact, we cannot refrain from asking ourselves how these changes have occurred. And when we have explained them—as they must be explained—by the alternate slow movements of elevation and depression which have affected the crust of the earth, we go still further back and ask Why these movements?

I am not certain that any one can give you a satisfactory answer to that question. Assuredly I cannot. All that can be said for certain is, that such movements are part of the ordinary course of nature, inasmuch as they are going on at the present time. Direct proof may be given that some parts of the land of the northern hemisphere are at this moment insensibly rising and others insensibly sinking; and there is indirect but perfectly satisfactory proof, than an enormous area now covered by the Pacific has been deepened thousands of feet since the present inhabitants of the sea came into existence.

Thus there is not a shadow of a reason for believing that the physical changes of the globe in past times have been effected by other than natural causes.

Is there any more reason for believing that the concomitant modifications in the forms of the living inhabitants of the globe have been brought about in other ways?

Before attempting to answer this question, let us try to form a distinct mental picture of what has happened in some special case.

The crocodiles are animals which, as a group, have a vast antiquity. They abounded ages before the chalk was deposited; they throng the rivers in warm climates at the present day. There is a difference in the form of the joints of the backbone, and in some minor particulars, between the crocodiles of the present epoch and those which lived before the chalk; but in the cretaceous epoch, as I have already mentioned, the crocodiles had assumed the modern type of structure. Notwithstanding this, the crocodiles of the chalk are not identically the same as those which lived in the times called "older tertiary," which succeeded the cretaceous epoch; and the crocodiles of the older tertiaries are not identical with those of the newer tertiaries, nor are these identical with existing forms. (I leave open the question whether particular species may live on from epoch to epoch). Thus each epoch has had its peculiar crocodiles, though all since the chalk have belonged to the modern type, and differ simply in their proportions, and in such structural particulars as are discernible only to trained eyes.

How is the existence of this long succession of different species of crocodiles to be accounted for?

Only two suppositions seem to be open to us—either each species of crocodiles has been specially created, or it has arisen out of some pre-existing form by the operation of natural causes.

Choose your hypothesis; I have chosen mine. I can find no warranty for believing in the distinct creation of a score of successive species of crocodiles in the course of countless ages of time. Science gives no countenance to such a wild fancy; nor can even the perverse ingenuity of a commentator pretend to discover this sense, in the simple words in which the writer of Genesis records the proceedings of the fifth and sixth days of the Creation.

On the other hand, I see no good reason for doubting the necessary alternative, that all these varied species have been evolved from pre-existing crocodilian forms by the operation of causes as completely a part of the common order of nature as those which have effected the changes of the inorganic world.

Few will venture to affirm that the reasoning which applies to crocodiles loses its force among other animals, or among plants. If one series of species has come into existence by the operation of natural causes, it seems folly to deny that all may have arisen in the same way.

A small beginning has led us to a great ending. If I were to put the bit of chalk with which we started, into the hot but obscure flame of burning hydrogen, it would presently shine like the sun. It seems to me that this physical metamorphosis is no false image of what has been the result of our subjecting it to a jet of fervent though no wise brilliant thought to-night. It has become luminous, and its clear rays penetrating the abyss of the remote past, have brought within our ken some stages of the evolution of the earth. And in the shifting "without haste, but without rest" of the land and sea, as in the endless variation of the forms assumed by living beings, we have observed nothing but the natural product of the forces originally possessed by the substance of the universe.

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THE BEST MODES OF TESTING THE POWER AND ECONOMY OF STEAM ENGINES.

BY CHARLES E. EMERY, LATE OF THE U. S NAVY AND U. S. STEAM EXPANSION EXPERIMENTS.

Read before the Polytechnic branch of the American Institute, Oct. 22, 1868.

It is unnecessary for us to do more than simply call attentian to the extended usefulness of the steam engine. It is the only motor that has successfully competed with or supplanted the changeable and uncertain power derived from animal muscle, and the natural forces of wind and water, and its varied adaptations and applications have brought it into general use throughout the civilized world—not only in stupendous water works and manufactories and in furnishing reliable and rapid communication by land and sea, but also in reducing the physical exertions of both sexes in the less grand but more important operations of the producing community in the forest, field, and farm house.

Surely, then, the steam engine is not an experiment. Years ago it was made a success, and soon became a necessity; and notwithstanding the grand discoveries that have been ade in theoretical and practical science, the steam engine has to this day remained unchanged in every important particular. The principal advance has been in the perfection and general adoption of the simple high pressure engine. Many of the so-called improvements, were mere variations in form and in the details of construction, which often failed to produce as economical results as older well-tried mechanism. Nearly all the true improvements have been in workmanship and in adaptations and applications to various uses. A few of the general principles which influence the economy of the steam engine have long been known; and our manufacturers have, in very many cases, claimed a superiority for their engines on account of alleged excellence in the details of the valve gear, or other mechanism, designed to secure the results promised by theory—forgetting that theoretical propositions are of little value unless all the conditions assumed are the same as those in practice, which is rarely the case. It therefore often happens that engines which, in the opinion of the educated engineer, possess many of the elements considered necessary for economical working, do not have those elegant, moving details which fix the attention of the amateur and delight the eye of the skillful mechanic. Business men seek only to sell, and therefore push into chief importance such points as the purchaser can see and understand. Statements are made also regarding actual performance, but they cannot be considered impartial, because the trials upon which they are founded are made by interested parties, with no competition present. We have therefore to conclude that the purchaser of a steam engine has to base his selection, almost exclusively, upon the excellence of simple mechanical details; and having done this, if the engine works well, and especially if it does better than the old neglected one, with its worn out boilers, he is entirely self-satisfied, and ready to sign a recommendation to the public of the engine which *he* has selected, thereby benefiting the manufacturer and flattering his own vanity. But little true progress can be made in this way, as each manufacturer and purchaser knows little more than the result of his own experience.

To bring the steam engine to a high standard of efficiency, accurate comparative trials should be publicly made of every different system of construction. This would be most satisfactory, if it could be done in the same place, doing the same work, under the same circumstances. This would require the erection of costly experimental fixtures, which could be done by private enterprise, for expected gains, or by the combination of several wealthy manufacturers; or, better still, by some scientific organization. The majority of cases must, however, be reached, by trying the steam machinery in the actual performance of the duty for which it has been purchased. We desire, then, in our present inquiry, to ascertain methods and means to test the power and economy of the steam engine in a strictly scientific manner, which shall be above criticism, and also under the practical circumstances of every day use.

We propose, first, to mention some of the terms in general use on the subject; then to discuss the ways and means employed to measure the power and its cost, and afterward to select proper units of comparison, and point out the manner of their practical application.

A steam engine is simply a heat engine. The heat evolved by the combustion of fuel is imparted in the boiler, to water, separating and agitating its molecules, and thus forming steam. The steam exerts pressure, varied according to its density, upon all sides of the vessels in which it is inclosed. This pressure or force is measured in pounds per square inch. The elastic force of the steam, acting upon the engine piston, produces motion, which is measured in feet. The combined effects of force, acting through distance, produce mechanical work, which is measured in foot pounds. The number of foot pounds which an engine is capable of developing, in a given time, expresses the power of the engine. The unit of the power is one horse power, the value of which is conventionally fixed at 33,000 foot pounds per minute.

In proportioning steam machinery for any particular purpose, the first thing to settle upon is the amount of power reqnired; and this being fixed in all cases within certain limits, the practical question is, to obtain a certain power, at the least possible cost.

We will first discuss the ways and means used to measure and determine

I. THE POWER.

It has been said the power of an engine depends upon the work done in a given time; and as work implies force and motion, we must ascertain three things before we can calculate the power; namely, the mean force and the distance through which it is exerted, also the time required for the movement. Having these, we first ascertain the distance moved per minute; and this, multiplied by the mean force, gives the number of foot pounds per minute, which, divided by 33,000, gives the horse power. The distance through which the force is exerted is usually calculated from the number of revolutions made per minute by the engine, which can be ascertained approximately by actual count, but better by means of a register. The speed of the engine is varied more or less by every change in the load, or in the pressure of steam, even when a governor is used; for a change in speed must take place before the governor can operate. The variations are small, with sensitive regulators, but in a majority of cases would materially affect the result. The true plan, then, is to attach a register to the engine, the indications of which should be taken once an hour to check mistakes; and in the calculations, the revolutions per minute should be an average for the whole time through which the trial extends. If the power is to be calculated from the pressure on the piston, the piston movement is also used and ascertained by multiplying the revolutions per minute by double the stroke of the engine, when the latter is double acting. When the tension of a belt, or series of springs, is to be used in calculating the power, the movement of each must also be found, and may be calculated from the speed of the engine. It will thus be seen that two elements of the power are easily ascertained; namely, the time and the distance through which the force is exerted. The mean driving force is more difficult to obtain. There are two instruments in use for measuring this, namely, the indicator and dynamometer. These two names are used in this paper in a restricted sense. The first is applied only to the well known steam engine indicator, and the latter to that form of dynamometer which is used to measure the force transmitted by revolving wheels or shafts.

It would be impossible, in the limits of this paper, to give a detailed description of the indicator. We therefore will mention only such features as are necessary to explain its mode of operation. The indicator is so constructed and attached that steam from the main cylinder presses upon one side of a small piston in the instrument, the atmospheric pressure being upon the other side. To the indicator piston is attached a spring and a pencil, the latter arranged to mark on paper. The predominating pressure on the indicator piston, whether of the steam or of the atmosphere, extends or compresses the spring in proportion to the intensity of the pressure, and moves the pencil up and down on the paper. The paper is arranged on a drum, which is so connected that it has a side motion corresponding to that of the engine piston. Consequently, as the engine piston moves the paper is moved sideways, and, as the pressure changes, the pencil is correspondingly moved up and down; so that the figure or diagram traced on the paper is a combination of the two movements, and should show the pressure at each and all points of the stroke. The mean of a number of ordinates on the diagram represents the mean pressure per square inch of piston, which, multiplied by the area of the piston, gives the total force which produces the piston movement, from which the power may be calculated, as has been before explained. The indicator is a beautiful instrument, of such great value to the steam engineer that it may be said to deserve the numerous words that have been spoken in its praise. Still, in many cases where it has hitherto been considered practically perfect, its indications are of the most deceitful and unreliable character. It shows very perfectly whether the valves are adjusted properly; and often, when applied to an engine which is working improperly, a mere glance at the diagram will reveal the difficulty, and suggest the remedy. Large leaks in the valves or piston may also be detected in this way. The indicated pressure at the end of the stroke has very often been employed to determine the quantity of steam used by the engine. Calculations founded on such a basis are entirely worthless, as will be explained when treating of the cost of the power. It has often been attempted, also, to calculate the friction from indicator friction diagrams; but the system is practically erroneous, as will be explained hereafter. The indicator is chiefly employed, however, to determine the power of an engine, it being supposed that the diagram shows correctly the pressure at all parts of the stroke. Even this it fails to do under certain circumstances. The moving parts of the instrument must have weight and friction, and some force is necessarily required to overcome the latter, and put the mass in motion. If, therefore, the pressure be ascending, the indicator will show less than it should; and when the pressure is descending, the instrument will show more than it ought. In either case, then, the length of the ordinates is increased during any change of pressure, whence the mean pressure indicated is greater than actually existed in the cylinder. Until quite recently we supposed that these inaccuracies were too small to require serious attention. Experiment has, however, proved the contrary.

To be continued.]

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THE NATURAL AND THE ARTIFICIAL.

All artificial forms have sprung from natural forms. The proof of this is simple. Imagination is the grouping together of remembered images. Forms thus imagined, and constructed, although as a whole they may differ from anything else known, still are derived forms, so far as their elements are concerned. The first objects ever copied by man must have been natural forms. The grouping together of these gave new patterns for imitation, and the re-grouping of secondary forms others, and so on until those now in vogue in various departments of the arts were obtained.

A principal element in a good design is that the suggestive forms, the elements of the composition, should be so combined that no single one is conspicuously shown. If the contrary is the case, there is a want of harmony—of tone; the eye is carried from a general to a particular effect; from the result to one of the means intended to produce the result. Hence in the composition of designs for dress patterns, paper hangings, etc., it is rare that natural forms and colors of objects are preserved. The form may be retained and the color altered, or *vice versa*; or both may be modified to suit the general character of the design.

A chaste design always subordinates details to general effect. To this end a rose is often painted green or blue; blackberries may be represented as growing upon grapevines; any other incongruity may form a part of the composition. It is evident then that the profession of a designer in any department of the arts, requires great skill and judgment. There is only a short step from the harmonious and tasteful to the monstrous and disgusting; and the multiplication of new combinations, to the extent required in some departments of industry, calls for talents of a very rare and peculiar type. Especially is this the case in the manufacture of prints, and paper hangings, and a close scrutiny and criticism of the patterns of such goods exposed for sale in the shop windows, will soon convince the observer that a truly chaste and harmonious conception, is the exception not the rule. It is hardly possible from the circumstances of the case that this could be otherwise, but it is equally obvious, that there is much room for improvement in these designs,—not impossible improvement, but such as might easily and profitably be made.

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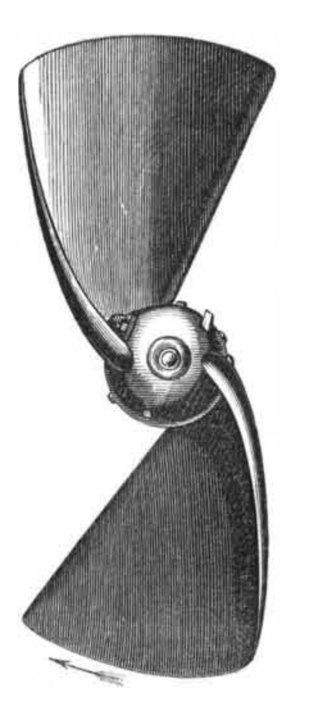
HANCOCK'S SCREW PROPELLER.

The many advantages offered by screw propulsion over the paddle-wheel system have led to innumerable improvements and modifications in the former principle. Some of these are to be taken for what they are worth—which is little or nothing—while others possess a practical value which has led to their adoption. Among the most recent inventions in this direction, and one which has given the most signally successful results under competitive trials, is the screw propeller of Messrs. F. and C. Hancock, of Dudley. This screw has recently been tried against a two-bladed Smith's screw with results entirely in favor of the former. In the interests of steam navigation, we propose to place before our readers all the facts we have obtained respecting the trial, feeling assured that the Hancock screw embodies elements of superiority which entitle it to every consideration, and which there is every reason to believe will place it before every other competitor. The trial in question took place in a steam tug belonging to the Shropshire Union Canal Company, on one of their lines of water near Wolverhampton. This company for some years used a Griffith's screw in their tugs, but the results being unsatisfactory they instituted a series of experiments, at a cost of several thousand pounds, with the view of obtaining an efficient screw propeller. These experiments led to the adoption of a two-bladed Smith's screw, the blades each filling a quadrant of the whole circle, so that the entire screw area is equal to half the area of the circumscribing circle. No other form of propeller, Messrs. Hancock's alone excepted, has given such good results as this on the Shropshire Union Canal, and it was one of these against which the Hancock screw recently competed. The same boat was used in all cases, the screws only having been changed as required. The screw shaft makes two revolutions while the screw makes three, and the relative speeds of the crank and the propeller shafts remained the same throughout, the screws only being changed.



The Smith screw is 3 feet 1 inch in diameter, 4 feet pitch, and 20 inches along the shaft, and is driven by a double cylinder engine of upwards of 20-horse power. The Hancock screw is of an entirely new curve, as will be seen by the annexed engraving; it revolves from left to right, that is, the concave face moves forward. It is 3 feet in diameter, 6 feet pitch, 6 inches along the shaft, and has two thirds less surface than the Company's screw. The following tabulated statement gives the results of two runs with the tug boat alone, one with the Hancock and the other with the Company's or Smith's screw:

HANCOCK'S SCREW.

	Pressure in boiler in lbs.	*Revolutions per minute.*	*Miles run.*	*Time in minutes.*
First mile, not full steam	22	68	1	21
Second mile, full steam	23	80	1	17
Half mile, full steam	23	80	½	8
Total			2½	46

THE COMPANY'S SCREW.

	Pressure in boiler in lbs.	*Revolutions per minute.*	*Miles run.*	*Time in minutes.*
First mile, full steam	45	115	1	19
Second mile, full steam	45	115	1	21
Half mile, full steam	45	115	½	11
Total			2½	51

It will be seen by the above statement that the Company's screw had double the pressure of steam, and made upward of thirty-five revolutions per minute more than the Hancock screw. It is, therefore, fairly to be inferred that double the quantity of coal was consumed with the former, while a lower rate of speed was speed was obtained than by the latter screw. The value of a screw on a canal is its power to carry weights behind it; experiments were therefore made in towing, and the tug boat took in tow four loaded boats containing 95 tuns of goods. The first run of 2½ miles was made with a four-bladed Hancock screw. The pressure in the boiler was 50 lbs. full pressure; the run was accomplished in 67½ minutes, the engine making 86 revolutions per minute. The Hancock screw was then removed and the Smith screw put on, the boiler pressure remaining the same. The same four boats, with their 95 tuns of cargo on board, were again taken in tow, and the run was accomplished in 65 minutes, the engine making 148 revolutions per minute. From these figures it would appear that nearly the same results were obtained in both cases with a very different consumption of steam, and consequently of fuel, highly in favor of the Hancock screw. In a third experiment with the Hancock screw, the boiler pressure being 60 lbs., the engine made 103 revolutions per minute, and the run of 2½ miles, towing the four boats loaded as before, was accomplished in 55 minutes, upward of half a mile an hour faster than the run with the Company's screw. Such a result was certainly never obtained with the ordinary screw. Although we have no exact figures as to the consumption of fuel, neither were any indicator diagrams taken from the engine, there is evidence of a considerable saving in fuel. As this saving has been realized on the narrow and shallow waters of a canal, we may anticipate similar results with increased speeds in ocean steamers fitted with the new propeller. It should be borne in mind that speed cannot be obtained, however great the power used, in shallow canals where the boat draws four feet of water, as was the case in the present instance, leaving only six or eight inches of water below the bottom of the tug boat. It was found that with the Hancock screw no vibration whatever was experienced, while in all cases with the Company's screw, and in fact with all other screws, considerable vibration results.

It was at one time hoped that a revolution of the screw would be made to give a result analogous to that of a cart-wheel. The wheel revolves upon an unyielding substance, and carries its load the entire length of the revolution, without loss or slip. But as the screw revolves the water yields to its pressure, and the fastest ships in the Royal Navy only obtain a speed of one fourth the margin velocity of the screw with a best Griffith propeller. The small steam launches attached to the navy, fitted with a pair of twin Smith screws, attain in some few cases a speed equal to about one third of the margin velocity of the screw. But then it is only in those cases where the engines are proportionately more powerful than any that could be put into a large ship. The loss of propelling power in the screw is due to the great amount of slip. The long angle screws require too much power, and throw the water sideways. The lighter angles throw the water more in a line with the vessel, but the screw requires a high velocity to obtain speed, and this is one of the great defects our large ships have to contend with. The *Warrior*, with an engine giving out upward of 6,000-horse power, has to work at about 75 revolutions per minute to give the ship its full speed. So high a speed of the engine with so large a power cannot be maintained for long with safety; and this is the general position of our navy and our merchant ships. The Hancock propeller was invented to meet this special point and to remedy this great defect. It proposes to give a higher speed to a ship, and at the same time to greatly reduce the revolutions of the engine. So far as the trials have at present gone, these results have been attained. They go to prove that the engine will work one third slower, and the ship move faster, than with any other screw. To these advantages is to be added the economy of fuel, which is a most important feature in every case. The experiments have been very conclusive in establishing the superiority of the Hancock screw for one class of navigation. That it will prove as efficient in larger vessels, and under different conditions, there is no reason to doubt. But we cannot of course pronounce a decided opinion in the absence of actual trials. The invention is one full of promise, and we shall watch with interest the progress of the Hancock screw, feeling assured, from what has already been done, that if a trial in an ocean vessel were made, and the results carefully noted in detail, such advantages would be shown as would lead to its adoption in all future cases. We look forward with confidence to this result, and in the meantime congratulate the inventors on having inaugurated a new era in the history of screw propulsion.—*Mechanics' Magazine.*

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The Water Power of Maine.

The report of the Commissioners appointed to conduct the hydrographic survey of the State of Maine contains some interesting statements. Returns were obtained from 2,015 sites of water power, all located within an area of 14,000 square miles, the entire area of the State being 31.000 square miles. The Penobscot River, in the twelve miles above Bangor, has power equal to 40,000 horses. The Kennebec River has power equal to 32,800, divided as follows: Augusta has 5,000; Waterville, 8,900; Solon, 4,900; Skowhegan, 5,700; Fairfield, 7,300; Anson and Madison, 2,000-horse power. The Androscoggin has power equal to 58,990 horses, divided as follows: Lewiston, 14,500; Brunswick, 8,600; Lisbon, 6,740; Livermore, 3,200; Jay, 4,950; Rumford, 21,000. From these figures it appears that the three principal rivers of the State afford power equal to over 130,000 horses. The report gives a total of 450,000, and taking into account the powers not reported, the aggregate water power of the State will not fall short of 1,000,000 horses. Lowell, in Massachusetts, has 9,000-horse power. The water power of Maine indicated above is, in the drouth of summer and at its present stage of development, equal to the working power of 4,000,000 of men, and is twice greater than the power, both steam and water, employed in Great Britain and Ireland, in 1856, in cotton, woolen, worsted, silk, and flax manufacture.

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TESTING THE POWER OF STEAM ENGINES.

We commence this week the publication of a paper entitled "The Best Modes of Testing the Power and Economy of Steam Engines," read before the Polytechnic branch of the American Institute, Oct. 22, 1868. The paper is a marked contrast to the majority of the papers, and the discussions which have occupied the time of the Institute for a considerable period, and although exceptions may, and probably will be taken to some of the views of the author, its perusal will be found both interesting and instructive. We therefore strongly urge our readers to give it earnest and candid attention. It will be found that the author, although in the portion of the paper that we publish this week he points out important defects and sources of error in the application and use of the indicator, still claims, as he proceeds with the subject, that this instrument is the only one that can well be universally used for testing steam engines. His directions for its proper use, and the interpretation of its diagrams, are of value to all interested in the subject.