

# Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT  
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH.

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One copy, one year, postage included.....\$3 20  
One copy, six months, postage included..... 1 60

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Ten copies, one year, each \$2 70, postage included.....\$27 00  
Over ten copies, same rate each, postage included..... 2 70

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VOLUME XXXIII., No. 2. [NEW SERIES.] Thirtieth Year.

NEW YORK, SATURDAY, JULY 10, 1875.

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## THE TRUSTWORTHINESS OF THE SENSES.

This world is all a fleeting show, for man's delusion given, wailed poor Dr. Young, when the lady of his affections cruelly told him that, however much she might love his soul, she could not abide alliance with the diminutive casket that enshrined it.

Since that day thousands have sung the mournful song without the author's excuse, and curiously unconscious of the terrible charge it carried against the Being they were professedly worshipping. If the world is really such a misleading affair, for our delusion given, surely the giver of it can be nothing less than a swindler, an infinite swindler! It was no original thought of the love-lorn poet. It probably occurred to the first speculative loungeer that thought he recognized a phantom under world, mimicking the upper in some still pool.

It certainly creeps out in the earliest speculative writings. It had its disciples in India thousands of years ago. It was a fundamental dogma of the founder of Buddhism, who confessed it impossible to tell how far the world without us is a phantom, how far a reality. The followers of the Greek Pythagoras were more positive; the world and its phenomena, they said, are all illusions. Centuries later the Egyptian mystic Plotinus taught the same doctrine, that the external world is a mere phantom; and the mystical schools of Christianity took it up in turns. Nor did Mahomedan philosophy escape the delusion. The Arabian philosopher Algazzali writes in this strain: "I said to myself: During sleep you give to visions a reality and consistence, and you have no suspicion of their untruth. On awakening you are made aware that they were nothing but visions. What assurance have you that all you feel and know when you are awake does really exist?"

In every age the mystically inclined have delighted in dreaming that everything is a dream. A favorite American poet does it prettily in one of his poems. He lies on a grassy river bank, watching the clouds sail across the sky, seemingly far down in the still water. The image of a kingfisher flits across his vision. He knows that a corresponding bird flew through the air above his head, while he gazed upon the phantom beneath his feet. He calls it a real bird; but what assurance has he that the kingfisher in the air is any more real than the image in the water? May not it be merely the visible reflection of an invisible reality?

"All this that you call material," said a fanciful friend the

other day, in response to some remark of ours implying the absolute existence of those "permanent possibilities of sensation" known as *things*, "all this is but the fleeting image, the reflection, as in a glass, of the truly real, that is the spiritual, to which we shall some day attain."

Just here, perhaps, in the misapprehension of the phenomena of reflection, we may find the key to the entire scheme of mystical philosophy, and prove it based, not on the refinement of reason, as its disciples fondly imagine, but on an optical blunder. We may possibly find also a sufficient answer to the aspirations which the same school of thinkers are wont to cast on the integrity of our senses.

Sitting at our table, we seem to see at this moment, in the broad window of a shop across the street, the image of a workman repairing the street. By direct vision, we can see neither the man nor the work he is engaged upon. Across the room hangs a mirror; in it appears the reflection of a window, and in the window the reflection of a passing cart. Neither cart nor window is directly visible from where we sit. Using a form of common speech inherited from an unscientific age, we say we see, in the glass and on the window, images of the objects mentioned; but in reality we see nothing of the sort. The cart seen through the double agency of window and mirror is no image of an image, but the cart itself, as positively as though we were looking directly at it. The bending of the light rays in their passage from the objects to our eyes does not affect the message they bear in the least. In the case of the man, the light which brings us information of him is bent or turned back once, in the case of the cart, twice; our vision is indirect, not direct; yet it is absolutely the man and the cart that we see, not images of them. So with the poet's kingfisher. It was the living bird he saw, not a phantom; the seeming under world was really the upper world indirectly seen. In this and all similar cases, the delusion lay in the mind of the mystic, not in the things seen.

Equally so with the Arab philosopher's dreaming. It matters not whether the reflection is at one or a thousand removes; it is the reality which we see. By what means the brain mingles and combines the impressions of sense in dreaming we may not know; but this we know, it always combines and never creates. The man blind from birth sees no visions in his sleep; the man born deaf and mute hears no voices in the dream world.

The alleged untrustworthiness of our senses, we flatly deny. In health, they invariably tell us the truth. We frequently misinterpret the message they bring, it is true, but that is no fault of the senses. The interpretation of sense impressions is something to be learned; we never learn it fully; we are liable to blunder throughout all our days; but that gives us no right to call our senses liars. It is our judgment, not the sense of sight, that is deceived when we stumble, with the mystics, into Alice's "World behind the Looking Glass."

We learn, for example, to associate certain plays of light and color with certain natural gems. When we see the same effect produced by artificial pastes, we mistake them for real gems; but it is not our eyes that cheat us; they simply report the flashing lights, and, through our lack of knowledge, we make an inference not in accordance with fact.

Again, when we see the same play of color, we say it is produced by a gem, natural or artificial,—and it may be neither, but only a bit of glass with tinsel underneath. We discover the imitation, and therefore know that there are three ways of producing that particular play of color, and we estimate the probable one in any case by the attending circumstances.

We witness a spectacular play, and see the actors luminous with—what shall we call them? Not real gems, for they are too numerous; possibly imitation gems, still even they would be too costly; we reason therefore that they must be tinsel-lined glasses. But we are wrong; there are no gems, real or artificial; there are no glass-covered bits of tinsel; they are simply angular cavities of bright metal bathed in colored light.

Did our eyes deceive us? Not at all. They simply told of flashing lights, the mechanism of the flashes being left for the other senses to determine. A child bred in a theater, and used to the phantom gems only, might be as much deceived by real gems as we were by the metallic reflections; but in neither case would the deception lie with the sense of sight. We not only wrong our honest senses but lose our grip upon this most substantial world of ours when we let mistaken metaphysics persuade us to doubt the testimony they bear.

## THE KEELY MOTOR DECEPTION.

The value of any known substance as a heat or force generator may be determined and mathematically expressed with the precision of a simple sum in arithmetic. Thus, it has been settled that the combustion of one pound of coal yields a motive force equal to a weight of eleven millions of pounds; if the combustion occupies one minute of time, the pound of coal yields a driving force of over three hundred horse power during that period; if the combustion is spread through an hour's time, we have five horse power from the pound of fuel; while one fifth of a pound of coal, burned per hour, yields one horse power during that period. But our best engines and boilers are so imperfectly made and managed that so much power as this is never, in practice, realized. The best practical results rarely exceed one horse power per hour from 1½ lbs. of coal.

This result, although defective, although indicative of the need of improvements in steam apparatus, is, nevertheless, economical as compared with any other known method of generating power. Reduced to money, with coal at \$5 a ton, the cost for steam power fuel, in Philadelphia, using the best

engines and boilers, is less than three cents per day of ten hours for each horse power.

We think it will be hard for Keely and his assistants to supply motive power any cheaper than this, allowing them the full benefit of the extravagant assertions they set up.

They now aver that they cannot transmit the new "power" under a less pressure than 1,000 lbs., to the square inch, and expect to keep their "receivers" full of their "new cold vapor," at a pressure of 30,000 lbs. per square inch. To manage this pressure will involve expenses that steam power does not require, even though the air and water, out of which the "cold vapor" is manufactured, cost nothing.

But what is the new power, of what is it composed, from what is it generated, how is it prepared, what are the principles involved, what is the nature of the apparatus?

During the past week we have had conversations with Mr. H. C. Sergeant, of this city, who is one of the principals in the Keely motor concern, the chief machinist of the establishment, and one of the four persons to whom only, Mr. Sergeant assures us, the nature and *modus operandi* of the "great secret" has been communicated. Mr. Sergeant has long been known in this city as an able mechanic, and is a gentleman of the highest integrity. He informs us that neither Mr. Keely nor himself have anything to do with the sale of stock shares, but are honestly engaged in the endeavor to reduce the motor to practical working harness. The shares are bought and sold by other persons who have faith, but know nothing whatever of the principles involved or the method of operating the apparatus. This informant states that the official report, from which we made extracts last week, was not intended for publication, and contains statements which more recent experiments have shown to be untenable or unnecessary.

As Mr. Sergeant is a very practical man, we hoped to be able to obtain from him a full history and description of the motor. But he said he preferred to defer the matter until the new apparatus, now nearly finished, has been tried, its results ascertained, and the patents secured. However, he gave us a little preliminary information:

What is the new power? Our informant avers that it is a "cold vapor," an entirely new article, its composition unknown either to Mr. Keely or himself.

From what is it generated? It is generated, our informant states, from air and water, without fuel, heat, chemical action, or the use or consumption of any substance, save air and water.

How is it produced? Mr. Sergeant states that it is produced "purely by mechanical manipulation, which evolves a cold vapor; and by graduating his vaporizer or generator, Mr. Keely is able to produce a pressure of 10,000 to 15,000 lbs. per square inch in a receiver of greater volume than the total contents of the generator, with great rapidity and certainty."

What are the principles involved? The principles are not yet accurately determined, but appear to consist in the communication to the air and water, by mechanical means, of a certain sort of initial vibrations, the resultant whereof is the aforesaid "cold vapor."

What is the general nature of the apparatus employed? A series of simple pipes, nozzles, and check valves. Nothing more.

As to the properties of the "cold vapor," Mr. Sergeant gravely avers that its natural volume is over five hundred thousand times greater than the water from which it is derived; and that by a sudden enlargement of its containing chamber, the vapor suddenly condenses into water again.

These are curious statements, especially when we consider that the elementary gases resulting from the decomposition of a given body of water, H<sub>2</sub>O, have a volume of only two thousand times that of the water from which they are obtained.

Our informant states that he has searched the principal fountains of knowledge and consulted the most eminent professors of chemistry, in the hope of ascertaining what the "new vapor" is. But all the oracles of Science are dumb; they are unable to grasp the problem, they afford him no information whatever. We suggest that the new article may be "luminiferous ether," that imponderable substance that fills infinite space and occupies the interstices of the molecules of hydrogen gas and all other bodies. No one has heretofore succeeded in imprisoning this intangible ether, for it passes through glass, metal, and all substances in Nature as if they were so much fog. But then, Mr. Keely, it is alleged, generates an enormous pressure, suddenly, rapidly, with certainty; and perhaps by this means, without knowing it, he compresses several of the atoms of the luminiferous ether into one, before they have time to escape, thus enlarging their size sufficiently to prevent their passage through the molecular spaces in the metallic walls of his generators. But this is merely a suggestion of ours.

Such, in brief, is the latest information we have been able to obtain, from probably the best informed individual connected with the affair. That our informant is laboring under a strange hallucination is most certain. That so able, practical, and excellent a man should, under the pressure of a delusion, become the unwitting assistant of a deception by which hundreds of innocent people are being led to loss of their property, is a matter of profound regret.

In our paper of last week we quoted from an article upon the Keely Motor Deception published the previous year, May, 1874, in which an extract was given from the Keely Company's pamphlet, wherein the names of several well known professional gentlemen were given, by the Keely people, as witnesses and referees to the correctness of the motor performances, and the truth of the statements given in the pamphlet. Among the witnesses so cited by the Keelyites was Wm. W. Wood, Chief of Bureau of Steam Engi-

neering, U. S. N. In view of the following letter, our Keely friends will have to cross out that gentleman's endorsement:

NAVY DEPARTMENT,  
Washington, D. C.

To the Editor of the Scientific American:

My attention has been directed to an article in your paper of recent date, relating to the so-called Keely motor.

My name has been mentioned as one of the advocates of the alleged invention without my authority. I know nothing about the construction or operation of the device; and as I am not in the habit of endorsing inventions of which I am ignorant, of course I could not endorse the so-called Keely motor. I am, respectfully, your obedient servant,  
June 24, 1875. Wm. W. W. WOOD.

The editor of the *Leader*, of Cleveland, Ohio, has been to Philadelphia, seen with his own eye the Keely gage go up, has become a full convert to the wretched deception, and answers the strictures of the SCIENTIFIC AMERICAN by calling us a scientific ass. Well, it is better to be an honest ass than a blind hack-leader of a deception.

Every perpetual-motionist, for the last generation, has considered us an ass, because we could not recognize his errors as truths, or his deceit as facts. The Ericsson hot air stock-jobbers pronounced on us the same epithet. Paine and his water gas people did the same. So did the Paine electro-motors, of more recent date, and the pendulum motors, and the spirit motors, and now we have it from the cold vapor motors. We candidly admit that it requires but a small amount of intelligence to discern such deceptions, less even than that of the dullest member of the long-eared but useful family to which the *Leader* refers.

Besides the epithet mentioned, the *Leader* gives as a reason for its support of the Keely deception that the SCIENTIFIC AMERICAN is chiefly devoted to the puffing-up of inventions patented through its agency. It is true that a very large portion of all the patents granted for new inventions are obtained through the agency established thirty years ago by the proprietors of this paper. Our experience has undoubtedly been greater in this line than that of any house in the world. But it is equally true that the SCIENTIFIC AMERICAN is an impartial recorder of all interesting or important inventions and discoveries, and that its scientific information is in general reliable and valuable. This is shown by such facts as that, in patent trials in this country, the back volumes of the SCIENTIFIC AMERICAN are constantly produced as authorities upon disputed scientific points; while in the hundreds of libraries and reading rooms, scattered the world over, it will be found that the volumes and files of the SCIENTIFIC AMERICAN are more closely studied, more highly valued, and in greater demand than any other scientific publication extant.

When the editor of the *Leader* recovers from his present Keely delusion, when this attack of new motor epizootic passes over, he will, we feel confident, think better of the SCIENTIFIC AMERICAN.

We gave in our last number a few brief examples of ways whereby small quantities of "cold vapor" might be readily produced by concentrating water weights upon confined air. On this our friend of the *Leader* argues, in support of the Keely motor, that he could, by simply turning a hydrant pressure of 26 lbs. to the inch into a six-gallon kitchen water boiler, make the water issue from the boiler into a bath tub at a pressure of 240 lbs. to the inch. We will not dispute the hydraulic capabilities of our friend; but we feel confident that no one but an out-and-out disciple of the Keely-motor confederacy could accomplish what he claims, in the way he describes.

#### THE NATURAL HISTORY OF SWINDLES.

The swindler is perennial, and always busy. His methods vary with time and circumstance, but at bottom he is always the same. And there is, in the permanent propensity of men to be swindled, a never-ending inducement for him to concoct his swindling schemes. He simply furnishes what the public call for.

What is the basis of this irrepressible tendency to be "taken in"? What are the fundamental conditions of its development?

We refer chiefly to the amazing gullibility which induces or suffers men—practical men, so called—to honestly enter upon mechanical and financial schemes of enormous promise and certain failure. The swindler has a motive that cannot be mistaken; but what is the motive of the victim? Is it native stupidity, invincible ignorance, eagerness for sudden riches, or what, that makes capitalists, notoriously shy of taking hold of enterprises of real merit, so ready to invest their money in palpable frauds?

There is need of another Darwin to study the genesis of the various species of swindles. Do they follow a consistent law of evolution, and mark successive stages of individual unwisdom and popular incapacity for learning? It would be a curious study—a consumedly interesting study: we fear it would be as humiliating to human pride and disastrous to our theories of popular progress. To say the best, it does take mankind a terrible while to learn anything, by experience or otherwise.

A good deal of light has been cast on many phases of gregarious foolishness—of human sheepishness, as Sir Arthur Helps cleverly characterizes the tendency of men to "go with the crowd," right or wrong—by the study of epidemic delusions, wherein whole communities, often whole nations, have gone mad with some dominant idea, as of witchcraft or the like; but such studies throw little direct light on the philosophy of swindles. Those take possession of crowds; these are limited in their operations to individuals.

Besides, epidemic delusions are always of an emotional character, and have to do primarily with spiritual affairs,

though their manifestations and results are often enough grossly physical; while the swindle has always a material object. To use a rough but sufficiently accurate figure, the one usually speculates in corner lots in the New Jerusalem, the other in swamp lots in some wild cat city of the Far West. The one trades on the transmutation of the base metals of human weakness and wickedness into celestial gold by the violation of all social and moral principles; the other on the conversion of common lead into double eagles by some impossible circumvention of the laws of Nature.

In both there is a firm, often intense, belief in the incredible. In both there is a confident expectation of getting a very large something out of nothing, or what is worse than nothing. In both epidemic and individual delusions, too, the victims are often men who, on other subjects, are shrewd, sane, practical.

The social conditions and current beliefs, which prepare the way for the reign of the first, can be clearly made out. Is it possible to do the same for the second? To estimate how far the two rest upon a common basis of misconception as to the conditions of existence, and how far the swindle depends on individual conditions of heredity, environment, want of knowledge, and greed of gain?

We are inclined to think it is quite possible; but we leave it to the future Darwin of this department of natural history to undertake the task. It will be sufficient for us, when time and space permit, to notice a few of the determining conditions which make the trade of the swindler so enticing and remunerative.

#### RECENT IMPROVEMENTS IN GLASS MANUFACTURE.

The recent discoveries and inventions of M. De la Bastie, in France, in annealing glass, the improvements on his process by Mr. Charles Pieper, of Germany, and the method of hardening glass by Mr. Macintosh, of England, show that, whatever we may know about the chemical constituents of different varieties of glass, its physical properties are still almost a *terra incognita*.

We have been so accustomed to consider fragility as unavoidably connected with the conception of any glass object, that the idea of a glass bottle or goblet which may be knocked about and thrown on the floor, or of a glass pane which will not break when a stone is flung against it, appears an impossibility, if not an absurdity.

At the same time, all well informed persons know that the value of precious gems consists in their hardness, which enables them to keep their polish, while all glass imitations tarnish soon; that the test wherewith to distinguish a gem from a glass imitation is the application of the corner of a steel file, which will scratch glass but not a real gem. If now Mr. Macintosh finds a way to make glass as hard as a diamond, so that powder obtained from such glass can be used in place of diamond dust, what will become of all the comparative degrees of the value of gems? If paste (a soft lead glass imitation of diamond, which very nearly equals the diamond in luster) can be made as hard and as lasting as the genuine gem, what is the difference to the wearer, except that he knows that his ornament cost only \$5 or \$10 instead of \$1,000 or \$5,000? We have heard the most eminent jeweler of New York city declare that paste imitations are often so fine that, when worn in the evening, it is impossible to distinguish them from the real article. He confessed that he was unable to decide as to their genuineness unless he were allowed to have the articles in his hands under daylight illumination.

Glass appears, then, to have properties similar to those of steel which relate to hardening and annealing. We may change the temper of a steel tool by heating and slowly cooling, and this is what is done with glass by De la Bastie and Pieper, by the intervention of a proper bath, the chemical nature of which undoubtedly plays an important part. On the other hand, we may make steel hard by suddenly cooling it when very hot, and we may modify the nature of the steel by exposing it to the action of diverse substances, among which carbon is the most important, the influence of the carbon being very powerful, as the addition or abstraction of one half to one fourth per cent of carbon, to or from the steel, results in a great difference in its physical qualities. It is so with glass. Mr. Macintosh, after having pressed the heated glass to the proper shape in iron molds, according to the usual method, transfers it to thin platinum molds, brings it nearly to the fusing point, and then suddenly plunges it into a freezing mixture containing snow, ice water, and salt, or their equivalents, or in some other mixture producing an intense cold, different kinds of glass requiring different mixtures. This latter point is now under investigation, and the results promise to teach us a great deal more about the most remarkable and useful material, without which, as Liebig remarked, our progress in Science could only have been very limited. It is hardly necessary to enumerate our obligations to glass. Without it no telescope nor microscope, no barometer, could have been invented; and no modern astronomy, hardly any chemistry, and but a little physical science would have been possible.

#### THE PLANETARY ATMOSPHERES.

The most recent researches into the nature of the gaseous envelopes of the planets are embodied in a work lately written by Dr. Vogel, director of the observatory of Bothkamp, Germany, in which the author describes the results obtained by analyzing the light of each planet by the aid of the spectroscope. A previous study with the telluric lines, lines produced in the solar spectrum though the absorption of the terrestrial atmosphere, enabled him to draw comparisons between the latter and the atmosphere of the planets, and to recognize in some instances a similarity.

The principal lines in the spectrum of Mercury coincide

absolutely with those of the solar spectrum; and it further appears that certain lines, which are not produced in the latter save when the sun is very low on the horizon, and when the absorption of our atmosphere is very considerable, permanently exist in the Mercurial spectrum. There is, therefore, a gaseous envelope about that planet, the absorption of which is equal to that of the earth's atmosphere at its maximum.

The light emitted by Venus resembles in its essential traits that of the sun, with a few lines added, which may be identified with those of the absorption spectrum of the atmosphere of the earth. Since the modifications of the solar spectrum which can be traced to the planet's atmosphere are very slight, it must be concluded that the majority of the solar rays are almost wholly reflected from the cloud envelope which encompasses the planet. According to Janssen's observations, the telluric lines are due largely to watery vapor, and hence it may be admitted as very probable that the atmosphere of Venus contains water.

A large number of the lines of the solar spectrum are found in the spectrum of Mars. In the less refrangible portions of the latter appear certain bands, which do not belong to the solar spectrum, but which coincide with the terrestrial absorption spectrum. It may from this be concluded with certainty that Mars possesses an atmosphere which does not differ essentially from our own, and which is rich in watery vapor. The red color of the planet is owing to a complete absorption of the blue and violet rays. There appear to be some lines which are peculiar to the planet, but their position has not been definitely fixed, owing to the too feeble luminous intensity.

The majority of lines which distinguish the spectrum of Jupiter coincide with the solar lines. The Jovian spectrum, however, differs from that of the sun in the presence of a few obscure bands in the less refrangible portion, and especially in one band in the red, the length of an undulation of which has been determined to be 2471.5 hundred millionths of an inch. The other lines foreign to the solar spectrum coincide with the telluric lines. The more refrangible blue and violet radiations are uniformly absorbed. The Jovian atmosphere, it is concluded, exercises on the solar rays which traverse it an action analogous to that produced by the earth's atmosphere, whence the presence of the vapor of water in the former may be predicated. It is doubtful whether the band in the red, above mentioned, results from the presence of some special body not found in our atmosphere, or from the fact that the gases encompassing Jupiter are mixed in different proportions from those in air. It is possible, however, that the two atmospheres are similar, but that their actions on the solar rays differ on account of circumstances of temperature and pressure. The spectra of the dark belts, observed on the disk of Jupiter, are characterized by the marked uniform absorption of the blue and violet rays. No new absorption bands appear, but the lines are broader and more marked than elsewhere, proving that the dark belts are deeper than the adjoining regions. The solar light penetrates more profoundly into the atmosphere of the planet at such belts, and hence is submitted to more marked alteration.

The spectrum of Saturn shows the most marked lines of the solar spectrum, and gives bands which, with one exception, coincide with those of the spectrum of our atmosphere. In general, the Saturnian spectrum is closely analogous to that of Jupiter. The spectrum of the ring, however, is very different, and shows no atmosphere, or at most a thin gaseous envelope of feeble density.

The faint light of the spectrum of Uranus does not admit of distinguishing the Fraunhofer lines. Certain bands have been noted, the undulations proceeding from which have been measured, and which without doubt result from the absorption of solar rays in the enveloping atmosphere of the planet. To what bodies such absorption is due, it is impossible to tell. One band, however, corresponds exactly with another found in the spectra of both Jupiter and Saturn. The spectrum of Neptune differs essentially from the solar spectrum and is characterized by a few large absorption bands, generally it appears, identical with those of Uranus.

Among the small planets, M. Vogel has examined Vesta and Flora, with uncertain results, however, owing to their lack of brilliancy. There appear to be indications of an atmosphere about Vesta.

#### What Inventions Do.

The following colloquy recently took place between Recorder Hackett and a criminal before him for examination in this city. From it we conclude that, while human depravity is not less prevalent than formerly, modern inventions protect mankind from the depredations of the vicious, by rendering their operations considerably more hazardous:

"What is your business?" asked the Recorder.

"I am obliged to work."

"Don't you like it?"

"No."

"Why not? What was your business?"

"A cracksman." (Frank answer.)

"Well, then, you have given up that business?"

"Yes. You see, Counsellor, what with the burglar alarms in houses and stores, and the district telegraphs, and people growing economical and careful, and the newspapers hounding us, burglary, garotting, and highway robberies, and such things, is actually hazardous, and ain't so easy to be did."

To make waterproof packing paper, dissolve 1.82 lbs. white soap in 1 quart water. In another quart water, dissolve 1.82 ozs. troy of gum arabic and 5.5 ozs. glue. Mix the two solutions, warm them, and soak the paper in the liquid, and pass it between rollers or simply hang it up to drip.