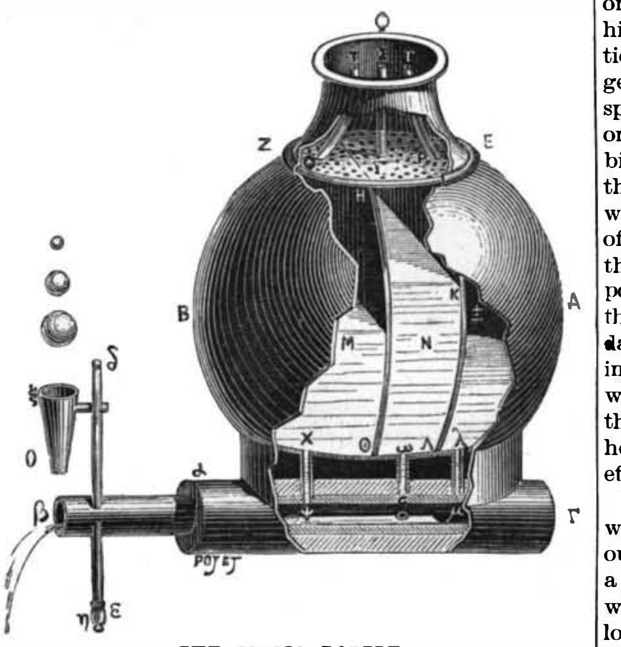
THE MAGIC BOTTLE.

The apparatus represented in the accompanying figure presents an arrangement similar to that of the inexhaustible bottle of Robert Houdin, but it is more ingenious. The problem proposed, as enunciated by Heron, the Greek engineer, who describes the apparatus, is as follows: Being given a vessel, to pour into it, through the orifice, wines of several kinds, and to cause any kind that may be designated to flow out through the same orifice, so that, if different persons have poured in different wines, each person may take out in his turn all the wine that belongs to him.

Let $A B$ be a hermetically closed vessel whose neck is provided with a diaphragm, $E Z$, and which is divided into as many compartments as the kinds of wine that it is proposed to pour into it. Let us suppose, for example, $H \Theta$ and $K \Lambda$ are diaphragms forming the three compartments, M, N, and Ξ, into which wine is to be poured. In the diaphragm, $E Z$, there are formed small apertures that correspond respectively to each of the compartments. Let O, Π and P be such apertures, into which are soldered small tubes, $\Pi \Sigma$, $O T$ and $P \Upsilon$, which project into the neck of the vessel. Around each of these tubes there are formed in the diaphragm small apertures like those of a sieve, through which the liquids may flow into the different compartments. When, therefore, it is desired to introduce one of the wines into the vessel, the vents, Σ, T and Υ are stopped with the fingers, and the wine is poured into the neck, Φ, where it will remain without flowing into any of the compartments, because the air contained in the latter has no means of egress. But, if one of the said vents be opened, the air in the compartment corresponding thereto will flow out and the wine will flow into such compartment through the apertures of the sieve. Then, closing this vent in order to open another, another quantity of wine will be introduced, and so on, whatever be the number of wines and that of the corresponding compartments of the vessel, $A B$.

Let us now see how each person in turn can draw his own wine out through the same neck. At the bottom of the vessel, $A B$, there are arranged tubes, which start from each of the compartments, to wit: The tube, $\chi \psi$, from the compartment, M, the tube, $\omega \sigma$, from N, and the tube, $\lambda \mu$, from Ξ. The extremities, ψ, σ and μ, of these tubes should communicate with another tube, α, in which is accurately adjusted another, $\beta \Gamma$, closed at Γ at its lower extremity and having apertures to the right of the orifices, ψ, σ and μ, so that such apertures may, in measure as the tube revolves, receive respectively the wine contained in each of the compartments and allow it to flow to the exterior through the orifice, β, of the said tube, βT. To this tube is fixed an iron rod, $\delta \varepsilon$, whose extremity, ε, carries a lead weight, η. To the extremity, δ, is fixed an iron pin supporting a small conical cup whose concavity points upward. Let us therefore suppose this truncated cone established, its wide base at ξ, and its narrow one (through which the pin passes) at θ.* Again, one must have small leaden balls of different weights, and in number equal to that of the compartments, M, N and Ξ. If the smallest be placed in the cup, $\xi \theta$, it will descend on account of its weight until it applies itself against the internal surface of the cup, and it will be necessary to so arrange things that it may thus cause the tube, $\beta \Gamma$, to turn so as to bring beneath ψ that one of the apertures that corresponds to it and that will thus receive the wine of the compartment, M. This wine will then flow as long as the ball remains in the cup. If, now, the ball be removed, the weight, η, in returning to its first position, will close the orifice, ψ, and stop the flow. If another ball be placed in the cup, a further inclination of the rod, $\varepsilon \delta$, will be produced, and the tube, $\beta \Gamma$, will revolve further, so as to bring its corresponding aperture beneath σ. Then the wine contained in the compartment, N, will flow. If the ball be removed, the weight, η, will redescend to its primitive place, the aperture, σ, will be closed and the wine will cease to flow. Finally, upon placing the last ball (which is the heaviest), the tube, $\beta \Gamma$, will turn still more, so as to cause the flow of the wine contained in the compartment, Ξ.

It must be remarked that the smallest of the balls should be so heavy that when placed in the cup it shall outweigh the weight, η, and consequently bring about the revolution of the tube, $\beta \Gamma$. The other balls will then be sufficient to cause the revolution of the said tube.—Les Origines de la Science.



THE MAGIC BOTTLE.

*The text does not agree with the figure given by the MSS. Moreover, there is an arrangement here that it is difficult to understand from Heron's description.

BICYCLE "GEAR"—WHAT IT MEANS.

In a discussion of the relative merits of their machines by two riders of the wheel, it is safe to say that after the invariable question, "What make do you ride?," the next will be, "What is the gear?" There is probably no feature of the wheel which is more discussed than this, or in which a wider difference of dimensions exists; yet, strange to say, there is no feature which is less understood.

There are thousands of riders who have no clear perception of the change of mechanical conditions which takes place when, by substitution of a smaller sprocket on the rear wheel, he "raises the gear" of his machine.

True, when he mounts and begins to apply pressure to the pedals, he is sensible of a change which in its effects is truly remarkable. If his first ride with the high gear be taken on a smooth and level road, for the first few revolutions of the cranks he will be disappointed, if not disgusted, at the sluggishness of the machine, and he will have to apply a much greater pressure to the pedals than was necessary on the old gear. When the bicycle is fully in motion, however, he will be agreeably surprised to find that, with the same speed of rotation of his pedals as with the low gear, and apparently with the same pressure, he covers what to his pleased and excited imagination appears to be fifty per cent more distance. His satisfaction will last until the first hill or a head wind is encountered, when all the life and mettle will suddenly die out of his "high gear" wheel, and to the redoubled pressure on the pedals there will be apparently but little response.

For the benefit of those of our readers who may not have a clear conception of the part played by "gear" in the mechanics of the bicycle we have prepared the accompanying diagram. The comparison is based upon the proportions of the now extinct "ordinary," or high wheel, bicycle; and it shows how the introduction of the rear-driven "safety," with its multiplying gear, has increased the capacity of the bicycle in respect of the amount of ground which can be covered by one revolution of the pedals. In the old "ordinary" bicycle, in which the cranks were attached directly to the driving wheel, the diameter of driving wheel which a rider could use was determined by the length of his leg. For this reason a 50 to 52 inch wheel was the common size, and a 60 inch wheel was an object of positive wonder on the road or on the track. This was the size ridden by Dr. Cortis (the Zimmerman of those days) when in 1880-81 he astonished the world by riding 20 miles in one hour on the track. In those days it was largely the high velocity of the pedals that limited the speed, and every rider chose the largest wheel that he could comfortably bestride, without impairing his effective work on the cranks.

The introduction of the rear-driven safety bicycle, with its multiplying gear, has changed all that, and, as our illustration shows, the short rider can now bestride a bicycle the effective diameter of whose driving wheel may be greater than that of our swiftest express locomotives. In passing it may be mentioned that if the rider of a 72 gear safety were seated upon an ordinary of equivalent diameter his eyes would look out upon the world from a point some 9 feet above the ground, and the riders of the 153 gear sextuplet would look down upon the earth from an elevation of fully 16 feet.

The distance traveled for one revolution of the cranks of the largest ordinary bicycle is 15 feet 8 inches; for the 92 gear racer it is 24 feet; and for the 153 gear sextuplet it is 40 feet; and such has been the improvement effected by the rigidity of the safety frame, the better position of the rider for his work, the excellence of the bearings, and, above all, by the recuperative action of the pneumatic tire, that the cranks of the 92 gear, modern, racing bicycle can be propelled with greater ease than those of the old 60 inch ordinary machine; as the respective speeds attained by two types would seem to prove. But while this is true on the race track, where the riders are men of muscle and endurance, on the country road the advantages of excessively high gear are not so manifest. For although the rider of an 80 gear machine covers about a yard more ground than the rider of a 70 gear machine, at each revolution of his cranks, he has to exert theoretically one-seventh more pressure upon the pedals, provided the other conditions, such as length of cranks and weight of rider and machine, be equal. Upon the level and on good roads this extra pressure is not discernible, when once the machine is fairly under way; but upon a rough road, or in climbing a hill, or against the wind, the extra effort is very evident, and in the case of weak or tired riders, painfully so.

Broadly speaking, the question of "gear" is one of the lever, in which the radius of the driving wheel is the long arm, the crank the short arm, the resistance being applied at the long arm and the power at the short arm. When the machine is running at any given speed, the pressure on the pedal multiplied by the crank length will just equal the total resistance of the machine (due to internal friction, wind, the irregularity of the ground, and the inclination of the grade, if climbing a hill), multiplied by the theoretical radius of the driving wheel. Evidently, if the driving wheel, or gear, be increased, the length of the crank should be increased in like proportion if the pressure on the pedals is to remain the same; and in general it will be found advisable to do this. On the other hand, increased length of cranks means greater travel of the rider's leg, or increased "knee action," and an increased fatigue on this account alone.

As a rule, it may be said that the question of gear must be determined by the general make-up of the rider himself. The man of quick, nervous action will

BICYCLE GEARS AND THEIR EQUIVALENTS.

do better work with moderate gear and rapid stroke; while high gear and slower stroke will suit the more powerful but less active rider.

The Fire Loss in 1895.

To most persons the subject of fire losses is interesting, even if it does not appeal to them personally. For twenty-one years the Chronicle, the principal organ of the insurance interest in this city, has published tables setting forth the annual fire loss in the United States, and this year these tables, comparing similar losses in earlier years with those of last year in all parts of the country, are more interesting and illuminative than ever before.

In considering the loss by fire, insurance men look at the subject from two points. The property loss is one thing to them, the insurance loss is another. The first is the total loss; the second, the loss that falls upon the insurance companies. In brief, there were 38,003 fires in 1895, which destroyed 53,961 pieces of property; the total loss amounted to $142,110,233, and the insurance loss to $84,698,030. These amounts are enormous in themselves, but it is to be recorded that the average property loss and the average insurance loss were smaller than ever before, being $3,793 for the former and $2,228 for the latter, as against $3,938 and $2,530 respectively in 1894. That is, in 1895 the insurance covered 64 per cent of the loss, while in 1894 it covered less than 60 per cent.

In 1895 there were 22,711 fires in dwelling houses; next in number were the fires in stores and offices, which amounted to 12,543; livery stables, barns, and tobacco barns (a rather strange combination) came third, with 8,142 fires. Three hundred and two colleges, schoolhouses, and convents were burned, 503 theaters and public and private halls, and 340 churches. Manufacturing establishments to the number of 5,231, and hotels, clubs, and restaurants to that of 1,332, were injured more or less seriously by fire. Of the 53,961 pieces of property injured, 15,953 caught fire from exposure to fires originating elsewhere, and the loss caused by these 16,000 fires amounted to nearly $38,000,000—equal to more than 26 per cent of the total loss.

Naturally, the summer months show the lightest losses. May was the month of lightest property loss and June that of lightest insurance loss. The greatest insurance loss and the greatest number of fires occurred in October, seemingly because the furnace fires began to be lighted in that month. The greatest property loss, however, occurred in March; in that month occurred seven fires involving losses of more than $200,000 each, while three of them caused losses of more than $400,000 each.

The Western States provided a larger percentage of the fires than ever before, with 40·7 per cent to their account; the Middle States had 26·5 per cent. The fires in these two sections were more numerous than in 1894, but in the Eastern, the Southern, and the Pacific States the percentage decreased.

A table of especial interest is that showing the fires caused by electric wires or lights. Naturally, the question of electricity as a cause of fire did not come up very long ago; in fact, it is only for the ten years 1886–1895 that figures on the matter are to be had. In 1895 there were 249 fires caused by electricity, as against 217 in 1894; but the fires caused by exposure to those started by electricity numbered only 89, instead of 169 in the former year. So the total number of fires caused by electricity was 338 in 1895 and 386 in 1894, a very marked falling off. It is evident that greater care in insulating wires and in other matters connected with electrical plants is taken.

A table of the losses by their causes occupies a considerable part of the Chronicle's book and affords much of interest and instruction. Accidents caused 298 fires, 29 of them in the District of Columbia and 27 in New York State. Hot ashes and coals started 318 fires, and bonfires only 49, while burglars caused 65. Candles set 248 fires, and carelessness only 203, while children playing with fire were responsible for 71. Fires to the number of 536 were due to cigars, cigarettes, and tobacco pipes, while 3,607 were caused by defective flues. Of these, 358 were in Illinois and 331 in this State. Drunken men set 16 fires in 13 States. Explosions caused 3,051 fires; of these 6 were dust explosions, occurring in Illinois, Iowa, and Wisconsin. Fireworks and firecrackers caused 319 fires; incendiarism, 3,521; lightning, 839; and matches, 1,771. Mischievous children started 21 fires and natural gas 81, two of which were in New York State. The much maligned plumber caused only 61 fires with his furnace, while locomotive sparks set 427. Spontaneous combustion is held responsible for 521 fires, stoves for 1,546, and tramps for 268. Of unknown and unassignable origin were 5,981 fires, while 8,361 were not reported as insurance losses. A study of the cause tables enables the Chronicle to say that the inherent and common causes show each an increased percentage, while the indirect (of criminal and mischievous origin) and the unknown and unreported show each a decreased percentage.

In the twenty-one years covered by the tables 25 gymnasiums have been burned, 138 armories, 13 chambers of commerce and boards of trade, and 3,144 churches. In fourteen years 59,570 barns and stables were burned and 170,949 dwellings.

Fifty-seven grand stands have gone up in smoke; 73 artificial ice factories, 2,150 ice houses, and 51 refrigerator factories have succumbed in twenty-one years, and so have 941 theaters and opera houses. In four years 16 tin plate factories have been burned. On the other hand, the business failures and the fires do not maintain an even ratio, in spite of the humorists of the weekly papers; in 1895 there were 13,013 failures and 38,003 fires, while in 1894 the figures were 12,724 and 35,549; and in 1893, 15,508 and 35,188 respectively.

Not only did October, 1895, lead the months in the number of its fires, but it has led them in the matter for twenty years. During that time 33,995 fires started in October; December comes next with 33,806 fires.

During the past twenty years New York suffered a property loss of $320,003,720; Pennsylvania, one of $173,086,623; Illinois one of $125,735,034; and Massachusetts, one of $125,246,015. Ohio will be glad to be fifth in losses, with $121,180,936 damage.

The average loss at a fire was less in 1895 than ever before, but this was due to the absence of any very great fire; the actual number of fires was greater by 1,695 than that of 1894. The total loss during the twenty-one years considered in the tables amounts to $2,219,500,491. This is absolutely and entirely lost, an average of more than $100,000,000 a year. Such a loss demands serious practical consideration, but, says the Chronicle, "there does not seem to be very much hope of any material reduction, but rather of a gradual increase in the fire waste. The people would rather lose their property than to take effectual steps to preserve it."

Danger of Rinderpest in America.

There is considerable alarm felt in Canada over the much dreaded rinderpest, which it is thought may be introduced into that country through the medium of hides imported from South Africa. Protests have been made by the leading experts in Canada, but their warning has had no effect on the authorities as yet. Of course a similar danger exists of the plague being brought into the United States. Pleuro-pneumonia among Canadian cattle has been traced to infected hides imported from England. The danger from this disease is of course as nothing compared with the ravages wrought by the rinderpest, which is at present decimating so many of the herds in South Africa. When the disease last visited England, over 73,000 head of cattle were attacked by it and 41,000 died.

RECENTLY PATENTED INVENTIONS.

Mechanical.

SAW.—John Morrish, Mayville, North Dakota. For buck saws, hand saws, ice saws, etc., this inventor has devised a blade designed to smoothly enter the material without jerking or jumping, doing the most cutting on the forward stroke, and readily removing the dust in coarse pieces. The blade has groups of teeth separated by throats, each group having several cutting teeth and a rake tooth, the cutting teeth having no pitch at the outer end of the blade and gradually increasing in pitch toward its butt end, the throats also gradually increasing in depth from the point to the butt end.

LUBRICATOR.—William A. Seibel, Independence, Iowa. This in an improvement on a formerly patented invention of the same inventor, and provides for conveniently lubricating parts of elevated machines without waste of oil and while elevating and moving the can. According to this improvement, the bail of the oil can is engaged by a cord passing over a pulley at an elevated point above where the oil is to be applied, there being also a projection on the part to be lubricated adapted for engagement with a hook on the oil can spout, so that, as the can is raised, it will be tilted to permit the oil to flow through the nozzle to the part to be lubricated. The invention is especially applicable for oiling the running parts of a windmill.

ELEVATING AND DUMPING DEVICE.—Louis E. Hoy, Fremont, Neb., and Harman Hoy, Baltimore, Md. This is an improvement on formerly patented devices of the same inventors for elevating and dumping the boxes of wagons, cars, and other vehicles, and provides simple means for holding the running gear of the vehicle in place while the box is automatically locked by the elevating device, and raised, dumped, and lowered to its original position. A framework has a track by which the vehicle is guided to proper position, while movable in the framework is an open bottom cage provided with spring-actuated means to engage and lock the bed of the vehicle, and pivoted to the upper part of the frame is a chute adapted to receive the contents of the cage when it is dumped.

Mining, Etc.

CONCENTRATOR.—Reuben D. Woodward and Willard C. Brown, Leadville, Col. For separating the precious metals from sand, gravel, etc., these inventors have devised a simple and inexpensive machine, to be operated with a minimum of power and requiring but little water. In a suitable frame an inclined shaking trough is held, to the upper end of which water is admitted, the material being shoveled in. The trough has screens by which the coarser matters are separated and thrown out, while through a screened hopper beneath the finer particles are passed to a semi-cylindrical rocking amalgamator, in the bottom of which is a quantity of mercury, and in which revolve knives to stir up the material.

Agricultural.

SEED PLANTER AND CULTIVATOR.—Vinson V. Hill and March Holman, Norwood, Ga. This invention provides a machine to be operated by a spring motor, dispensing with the use of horses. When used as a cultivator the seed box and covering roller are detached and a gang of cultivator teeth and a seat, if desired, are attached to the machine. A little distance back of a front caster wheel is a main running wheel, to the axle of which power is applied by a set of gears from a spring motor, wound up by a key. Within the seed box is a stirrer revolved from one of the gear wheels, and the driving mechanism is readily thrown out of gear.

STUMP PULLER.—Alfred S. Oberson, Westby, Wis. This is a strong, easily operated machine, so built that the winch cannot fly backward, should the harness at the connection between the horse and the winding sweep be broken when there is a heavy strain on the pulling cable. On a suitable base are uprights supporting a head plate, and affording a bearing for a vertical shaft on which is a ratchet wheel adapted for engagement by a pawl, while a winch rotating on a shaft has a bearing through the head block, a sweep arm to which a lever is pivoted extending horizontally from the upper end of the shaft, and a ratchet wheel on the winch being adapted for engagement by the lever.

Miscellaneous.

BICYCLE.—John C. Raymond, New York City. This is a machine designed to utilize the strength of both arms and legs in its propulsion, affording a more natural position of the body in working the machine and insuring a more uniform development of the muscles. The treadles are connected with pitmen by which the drive wheel gears are operated, and levers connected with the handle bar can also be connected with pitmen for the propulsion of the wheel, the handle bar being worked back and forth for this purpose, and the steering being effected by rocking the handle bars up and down. The machine is adapted for use by both ladies and gentlemen.

VELOCIPEDE SPRING MOTOR.—Martin J. McDonald, Trenton, N. J. This is a mechanism for accumulating surplus power in descending a grade, and storing such power, to be subsequently applied to the propulsion of the machine, the mechanism being contained in a frame which may be attached to the frame of the machine by clips. The power is received and stored by helical springs connected to and wound on a shaft journaled in the frame, the direction of movement to and from the springs being governed by adjustable gearing and clutch mechanism, that the motor may accumulate or give out power.

DRY DOCK.—John W. Boggs and Archibald Cameron, Portland, Oregon. This dock has at one end a sliding gate for opening and closing the inlet to a front dock chamber, at the rear of which is the dry dock proper at a higher level. The gate is adapted to slide into a chamber at one side of the front dock chamber at its entrance, and is adapted to hold water in its interior by which the gate is forced downward, the gate having packing strips for forming water-tight joints between it and the posts and the bottom of the dock chamber, and the gate and posts also carrying devices for compressing the strips when the gate is closed.

LABELING MACHINE.—Herbert Rawlinson, San Francisco, Cal. This is a machine for automatically attaching a label or wrapper to circular bodies as they roll down an incline, a paste-supplying cylinder imparting paste to the rolling body, and the label, as it is rolled up on its periphery, being closely and firmly pressed in place. One body after another is fed at the upper end of the guideway on to a stop wheel, which automatically releases the bodies in succession during the continuous operation of the machine.

AQUATIC EXERCISING APPARATUS.—George C. Tilyou, Brooklyn, N. Y., and Jean M. A. Lacomme, New York City. This is an apparatus for use at a seaside or other watering place, or at a river bank, to facilitate taking baths by persons of all ages and sexes, without danger or inconvenience, promoting also the taking of hygienic exercises and learning to swim, etc. The invention consists primarily of a column or post placed at a suitable distance out in the water and having at its top a horizontal revolving wheel which supports sheaves and hanging ropes or cables at whose ends are eyes or rings, or a swimming belt, whereby bathers may be supported as desired in the water, or a boat may be attached and carried around by the revolutions of the wheel.

FISHING ROD SUPPORT.—Jacob A. Eicher, Trenton, Ill. In the top of a stake which may be easily driven into the ground on the banks of a stream or other place for fishing, is pivoted a curved cradle which has at its inner end a socket to receive the inner end of a fishing rod and at its outer end a groove in which the rod may lie. Pivoted to the inner end of the cradle is a toothed segmental latch bar, passed through a slot in the stake, and adapted to engage a pin therein, the latch bar sliding freely through the slot when, by depressing its rear end, the pole is to be raised, but engaging the pin to hold the pole at any desired angle over the water, and leaving the fisherman at liberty when the fish are not biting freely.

MUSICAL INSTRUMENT.—Prof. F. P. Cericola, No. 386 Thirteenth Street, Brooklyn, N. Y. This invention provides a new mechanism for organs, pianos, and organettes using music rolls for automatic playing, or perforated strips of paper fed over a barrel and having perforations coinciding with ducts in the barrel. At present the roll can only be played once without being re-suspended, but according to this improvement the roll can be folded and unfolded back automatically as it is played, permitting each piece of music to be repeated as desired, and keeping the same time, rendering the instrument of great utility for ball rooms, dancing schools, theaters, churches, etc. The instrument is preferably furnished with three music rolls, each having twenty or thirty pieces of music of different classes.

PEN HOLDER.—Hiram S. Rumfield, Salt Lake City, Utah. The body of this holder is much shorter than is usual, and is tubular, a spring-pressed sleeve sliding in the body, which is adjustably connected with the sleeve. The outer end of this sleeve, when the holder is in use, bears and is pressed against the fleshy inside part of the hand at the base of the thumb and forefinger. The pen holder sections reciprocate one on the other in the act of writing, and, after one has become used to this changed method of using a pen, the improvement is designed to afford greater ease in writing, lessening the fatigue of the thumb, fingers and hand.

DENTAL FLOSS HOLDER.—John D. Cutter, Brooklyn, N. Y. To hold floss conveniently for tooth cleaning purposes, this inventor has devised a frame consisting of a single strip of wire bent to form a handle portion and two outwardly extended flared portions, each provided with a transverse kerf, a bobbin being removably supported in the handle portion of the frame. By means of this simple and inexpensive device a small stretch of floss or similar material may be rigidly held in position to be easily inserted between the teeth.

LAMP BURNER.—Hartwell A. Crosby, Calais, Me. This is a simple form of burner in which the lamp wick may be conveniently trimmed and the flame extinguished by merely actuating the device to lower the wick. Within the wick tube is a wick-raising shaft carrying a spur wheel or disk, and this spur wheel or disk, when the wick is lowered, engages a pivotally mounted trimming plate which plays edgewise across the open end of the wick tube, to remove the crust or charred portion of the wick.

GATE.—John H. Johnson, Silverton, Oregon. This gate is centrally pivoted on lifting levers and adapted to travel between guide posts at one side of the road, pull ropes being attached to the central portion of a balance rope or link and carried over guides to opposite sides of the gate. In opening or closing the gate one of the two ropes is pulled downward, when the end of the gate farthest from the guide posts is first raised, the gate being carried through the guide posts as it is lifted, to either open or closed position.

GATE.—John F. Ferris and Warren M. Thomas, North English, Iowa. This is an improvement on a formerly patented invention of the same inventors, and provides a gate which is pivoted at its lower inside corner only, between two posts, by means of a strap on the bottom of the gate, the pivotal bolt being of such length that the gate has a small movement up and down on it. One of the main gate posts and another post the distance of the length of the gate to one side carry the mechanism of levers and connecting cords, with pull handles on each side, by means of which the gate may be readily opened and closed, the design being that the entire construction shall be simple and inexpensive and not liable to get out of order.

WIRE STAY WEAVING DEVICE.—Enos F. St. John, Highland Station, Mich. This is a simple tool where by a strand of wire of any size coil