

the old formula (kerosene, 2 gallons; whale-oil soap, one-half pound; water, 1 gallon), is prepared in the same way as the distillate and used at the same strength. It does no harm to use double the quantity of soap indicated, securing in this manner a rather more stable emulsion and one not so easily affected by hard water. It is always advisable, however, to break the water with lye, as indicated above. This emulsion, while perhaps somewhat less efficient than the distillate emulsion, differs from the latter in effectiveness very slightly at the most, and is always available where the latter may not be in reach. It may be prepared on a small scale with an ordinary hand pump, but is best prepared in large quantities with a gasoline or steam-power pump to mix and emulsify it after the soap has been dissolved in the water by boiling.

The Resin Wash.—This wash is especially valuable against the California red scale. It may be also used against any other scale insect, including the black scale and the various armored scales affecting citrus trees. The wash is made as follows: Resin, 20 pounds; caustic soda (78 per cent), 5 pounds; fish oil, 2½ pints; water to make 100 gallons. Ordinary commercial resin is used, and the caustic soda is that put up for soap establishments in 200-pound drums. Smaller quantities may be obtained at soap factories, or the granulated caustic soda may be used, 3½ pounds of the latter being the equivalent of 5 pounds of the former. Place these substances with the oil in a kettle with water to cover them to a depth of 3 or 4 inches. Boil about two hours, making occasional additions of water, or until the compound resembles very strong, black coffee. Dilute to three times the final bulk with hot water, or with cold water added slowly over the fire, making a stock mixture to be diluted to the full amount as used. When sprayed, the mixture should be perfectly fluid, without sediment, and should any appear the stock mixture should be reheated; in fact, the wash is preferably applied hot. This wash is much more difficult to prepare than the kerosene emulsions referred to above, and, while it is an excellent wash, it probably will be ultimately largely supplanted by the emulsions of kerosene.

HOW ARCTIC ANIMALS TURN WHITE.

By R. LYDEKKER.

ALTHOUGH I have not the details of any one particular case before me, so many instances are chronicled in which the hair of human beings, under the influence of strong mental emotion due to terror or grief, has become suddenly blanched within a single night or some such period of time, that the occasional occurrence of such a phenomenon must apparently be accepted as a fact. Such a change is, of course, due to the bleaching of the pigment with which the hair is colored, although we need not stop to inquire by what particular means this bleaching is accomplished; all that concerns us on the present occasion being to know that the hair in man may turn white in this manner under abnormal circumstances. And there appears to be evidence that under equally abnormal conditions a similar change may take place suddenly in the hair of the lower animals. This is exemplified by the well-known experiment made considerably more than half a century ago by Sir John Ross on an Arctic lemming—a small mouse-like rodent, which habitually turns white in winter, although dark-colored in summer. In this instance the little animal was kept in a comparatively warm room till winter, was well advanced, when it was suddenly exposed to a temperature of 30 deg. below zero; a continued exposure to this and a still more intense degree of cold eventually resulting in its death, which took place within three weeks of the commencement of the experiment. In consequence of the conditions under which it had been kept, this lemming was still brown in midwinter, when it ought to have been white. As a result of its first night's exposure, the fur on the cheeks and a patch on each shoulder became completely white, and by the end of the first week the whole coat had turned white. On examination it was found that only the tips of some of the hairs had become blanched, and that these white-tipped hairs were longer than the rest of the coat, apparently owing to a sudden growth on their part in the course of the experiment. By clipping these long white-tipped hairs the animal was restored to its original brown condition.

Nothing is said with regard to any change of coat on the part of this lemming previous to the experiment, but it is probable that none occurred. It seems, however, to be clearly demonstrated that the tips of the hairs lost their color by bleaching, induced by sudden exposure to the intense cold, and that the hairs thus blanched increased considerably in length in a very short period.

In spite of the very obvious fact that these changes occurred under extremely abnormal circumstances, it has been argued that Arctic mammals which turn white in winter do so normally by a similar blanching of the hair of the summer coat, and that the greater length of the winter, as compared with the summer dress of such white animals, is due to a lengthening of the individual hairs of the former.* Moreover, it has been inferred that the color-change is directly under the control of the animals themselves. Quite apart from many other considerations, one weak point in this argument is that the hairs in the subject of the experiment were white only at their tips. It was doubtless assumed that had the experiment been continued over a longer period, the white would have gradually extended downward till the whole hair became blanched. But had this been the normal way in which the change from a dark to a white coat is brought about, it is obvious that animals ought frequently to be captured in which the coat is in the same condition as that of the lemming. So far, however, as I am aware, no such condition has ever been described.

Moreover, it is perfectly well known that, apart from those which turn white in winter, a large number of animals have a winter coat differing markedly in color, as well as in length, from the summer dress.

The roebuck, for instance, is of a brilliant foxy red in summer, while in winter it is gray fawn with a large patch of pure white on the buttocks. And it is quite clear that the change from red to gray, and the development of the white rump-patch, is due to the shedding of the short summer coat and its replacement by the longer winter dress. Obviously, therefore, it is natural to expect that a similar change of coat takes place in the case of mammals which turn white in winter.

That the change in spring from a white to a dark dress is due to a shedding of the fur seems to be admitted on all hands, for it would be obviously quite impossible for long hairs to become short, or for white ones to turn brown. And even in animals which do not alter their color in any marked degree according to season, the spring change of coat is sufficiently obvious. For the winter coat, owing to the long time it is worn and the inclemency of the season when it is in use, becomes much faded and worn by the time spring comes, and the contrast between it and the fresh and brilliant summer coat is very striking indeed. On the other hand, the summer coat is only worn for a comparatively short season, and that at a time of year when it does not become much damaged by the effects of the weather. Consequently no marked change is noticeable as the long winter hairs grow up through it; and it has accordingly become a common article of belief that, whether there is a change of color or not, the long winter coat is produced by a lengthening of the summer dress.

Apart from the evidence of animals like the roebuck and many other deer as to the existence of an autumn change of coat, as deduced from a difference in color, the fact of such a shedding of the fur is demonstrated by the circumstance that in many species—as, for instance, the mountain hare—the individual hairs themselves, as seen under a microscope, differ appreciably in caliber at the two opposite seasons of the year. In that species, for example, the hairs of the winter coat are of a much finer character than are those forming the short dress of summer, which are comparatively coarse and thick. Moreover, in spite of the natural tendency to believe in blanching on account of the aforesaid abnormal instances of turning white in a single night, there is abundant evidence to show that even in human hair the change from dark to white as age advances is brought about by the replacement of dark hairs by white ones, and not by the bleaching of the former. In this case, however, the change, instead of being seasonal and sudden, is gradual and due to age. If the change was due to blanching, we should, of course, find some hairs which were partially white and partially brown (or black, as the case may be). And here it may be remarked that if such partially blanched hairs were met with, we should naturally expect to find that it would be the basal half which was white, and the terminal half which retained its natural coloring. In other words, precisely the reverse of the condition obtaining in Sir John Ross' lemming; thereby affording further presumptive evidence as to the abnormal condition of the change in that animal.

As a matter of fact, however, those of us who have reached an age when silver hairs have begun to make their appearance among the brown can easily satisfy themselves that such hairs are white throughout their entire length, and that a hair half-white and half-brown is quite unknown. From this we infer that the change from brown to white takes place in human beings by the gradual shedding of the dark hairs and their replacement by new ones from which pigment is entirely absent. So that normally there is no such thing as bleaching of individual hairs. The change is, indeed, precisely similar to that which takes place at the approach of winter in mammals that habitually turn white at that season, with the exception that, as a general rule, it is extremely slow and gradual, instead of being comparatively rapid, and also that the white hairs differ from their dark predecessors solely by the absence of coloring matter. Unfortunately, there is no subsequent replacement of the white hairs by dark ones.

The fact that the change from brown to white in the mountain hare (*Lepus timidus*) is really due to a change of coat and not to bleaching was known at a very early period to the English naturalist, Pennant; and the existence of this coat-change was likewise recognized by Macgillivray. It was not, however, till Dr. J. A. Allen, in a paper on the color-change in the North American variable hare, published in the Bulletin of the American Museum of Natural History for 1894, demonstrated by actual experiment the truth of Pennant's statement that the fact of the complete autumnal change of the coat in animals that turn white in winter was generally recognized by naturalists. So far as the spring change from the white to the brown dress is concerned, his conclusions are fully confirmed by Mr. G. E. H. Barrett-Hamilton, who communicated some interesting notes on the change in the European mountain or variable hare to the Proceedings of the Zoological Society of London for 1899. The fact that the vernal color-change is due to a shedding of the coat seems, however, as already mentioned, to have been much more generally admitted than was the case with regard to the autumnal transformation.

Dr. Allen arrives at the conclusion that both the autumn and the spring change take place periodically and quite independently of the will of the animal, and also that they are but little affected by phases of the weather, although they may be somewhat retarded or accelerated by the prevailing atmospheric temperature.

So far as the fact of the seasonal change being normally beyond the control of the animal in which it occurs, Mr. Barrett-Hamilton is in full accord with the American writer; but he goes somewhat further, and believes that it is quite uninfluenced by temperature or at least by such variations of the same as may be met with in different parts of the area of the British Islands; and, as we all know, these are considerable.

As in the case of many other animals—deer, for instance—the change from the winter to the summer coat takes place very late in the season in the mountain hare in Scotland, specimens undergoing the

change being often taken early in May. But the date of the spring change is no earlier in the South of Ireland, where the climate is much milder, although the amount of whiteness assumed in that district is very much less than in the North. This seems to demonstrate the contention that temperature has little or no influence on the change, so far as season is concerned.

That the animal has no control over the change from brown to white in autumn seems to be proved by instances referred to by Mr. Barrett-Hamilton, "in which variable hares transported from Scotland and from Irish mountains to southern and low-lying regions continued for some seasons to appear in the northern garb of snowy whiteness. This persistence of the habit of turning white, even in unsuitable conditions, together with the lateness of the moult, resulted frequently in the curious spectacle of a mountain hare running about in all its conspicuous arctic livery under the bright rays of an April or May sun. After a few years such imported hares, or more probably their offspring, ceased to turn completely white, and the breed assumed the appearance of the ordinary hares of the southern locality to which they had been transported."

It would, of course, be extremely interesting to ascertain whether such transported individuals ever do give up the practice of turning white in winter, or whether it is only their offspring that do so; but, in any case, it is clearly demonstrated that the habit is very deep seated and difficult to overcome.

Very curious is the circumstance that the mode in which the coat is changed in the variable hare at the two seasons of the year differs in toto as regards the parts of the animal first affected. On this subject, with one verbal change in the first sentence, we may quote from Dr. Allen, who writes as follows:

"In the fall the change begins with the feet and ears, the sides of the nose and the front of the head, which often become radically changed before the body is much affected; while as regards the body, the change begins first at the base of the tail and extreme posterior part of the back, and at the ventral border of the sides of the body, working thence upward toward the middle line of the back, and from behind anteriorly, the crown of the head and a narrow median line over the shoulders and front part of the back being the parts last changed. In the spring the order of change is exactly the reverse, the moult beginning on the head and along the median line of the anterior half of the dorsal region, extending laterally and gradually to the ventral border of the sides of the body and posteriorly to the rump, and then later to the ears and down the limbs to the feet, which are the parts last affected, and which often remain but little changed till the head and body have pretty completely assumed the summer dress."

It is very hard indeed to conjecture any satisfactory reason for this remarkable difference. The American variable hare ranges, at ordinary levels, about as far south as Massachusetts—that is to say, nearly to the latitude of Madrid—and throughout the whole of this extensive tract it turns white in winter. On the other hand, owing to the much milder climate of western Europe, no color-change takes place in the mountain hares of Ireland, while it is reported that in those introduced in Ayrshire and the neighboring counties of southwestern Scotland the change is much less complete and regular than in those inhabiting the northern parts of the country.

An impression appears to be prevalent that in the more northern portion of their range both the mountain hare and the ermine (or stoat) are white at all seasons, but this does not seem to be authenticated.

Observations are wanting as to whether the changes of coat and color in the mountain hare bear any relation to the appearance and disappearance of snow, or whether they occur regularly at the same season of the year. In the case of the ermine in the Adirondack region of New York, Dr. C. H. Merriam tells us that in this animal the white livery is assumed only after the first fall of snow, while the resumption of the brown does not take place till the snow begins to melt. Unfortunately he says nothing in regard to change of coat. The late Dr. Coues stated, however, that in the case of the ermine the bi-annual change of coat takes place at the same season, but that it depends upon the condition of the temperature at the time whether the new coat differs in color from its predecessor. In other words, the change from brown to white might be due either to shedding the coat or to bleaching of the hair subsequent to such shedding. The case of the mountain hare is, however, strongly suggestive that the color-change is in all instances coincident with the shedding of the coat.

It is, of course, quite evident that the assumption of a white winter livery by mountain hares and ermines living in regions where the snow lies on the ground for a considerable portion of the year is for the purpose of rendering such animals as inconspicuous as possible when in their native haunts. And, so far as we know, such a change is universal among the species named when dwelling in high northern latitudes.

There is, however, another animal inhabiting the north polar regions of both hemispheres in which the change to a pure white winter dress is limited to certain individuals. The species in question is the Arctic fox, of which the beautiful fur, in both the white and the blue phase, is now much affected by ladies. That both the white and the blue individuals of this species are in the winter dress will be evident to every one who examines such furs carefully; the length and thickness of the hair being quite decisive on this point.

As it has been stated in several works that the white is the winter and the blue the summer phase of the Arctic fox, it may be well to quote from a letter written to me in answer to inquiries on this subject by Dr. Einar Lonnberg, of Upsala, whose observations are based on personal experience:

"The 'blue' foxes are uniformly dark-colored both summer and winter, and do not change to white at any time. In summer they are very dark—dark brown, in fact; in winter they are also dark, but more bluish. The individuals which turn white in winter are during the summer ashy gray on the upper parts

* See G. B. Poulton, "The Colors of Animals," Chapter vii. (1900).

and limbs, but have the tail, underparts, more or less of the flanks, and the ears and muzzle white. The distribution of the gray and white is, however, subject to individual variation. The blue fox is, in fact, merely an individual variety of the white one. Both breed together, and sometimes there are dark and light individuals in the same litter. A friend of mine observed on Bear Island a pair in which the female was white and the male blue. In Iceland it is stated that all the Arctic foxes are blue."

With this single exception it appears that the white and the blue phase are met with throughout the habitat of the species. In other words, the animal is "dimorphic," if it be permissible to apply this term to a case where the difference between the two phases of a species is restricted to coloration.

What makes the matter so puzzling is that if "blue" foxes are able to thrive during winter in a snow-clad country, what necessity is there for their fellows—and, indeed, for any species—to turn white at that season of the year?—Knowledge.

PHOTOGRAPHIC NOVELTIES.

The Lesueur "Sinnox."—In all apparatus in which glass plates are employed, recharging by daylight is impossible, unless the plates have been first inclosed in frame or some other device; and such operation can be performed only in darkness or a red light. The great advantage claimed by manufacturers for film in rolls is that it can, without any preparation, and just as it is found in the market, be put into and removed from the apparatus in broad daylight. M. Lesueur, who is a manufacturer of glass plates, has desired to give the same facility for the use of these, by means of a peculiar mode of packing, and of an apparatus called the "Sinnox," especially constructed for the purpose, and that may be introduced directly into the apparatus just as it has been purchased. Through the mere maneuvering of the drawer of the sinnox, the box opens and the plates arrange themselves in succession in the focus of the objective; and then, in measure as they are used, they are repacked in the same box, which may always be removed from the apparatus at any moment in broad daylight.

The method of packing the plates consists in gluing them by the four corners to a sheet of black paper of slightly larger size, and in afterward piling them one upon another in a cardboard box. This latter does not open in the usual way, but rather after the manner of a cigar case. It is represented half open to the left of the engraving in Fig. 1. The part that has received the plates slides in a cardboard case that envelops it completely. In the figure, a portion is removed in order to show the interior, in which the first plate is concealed by black paper. The upper part of the box terminates in a sheet of cardboard that overlaps it slightly on all sides so as to form a cover in resting upon the edges of the case, after the box has been slid to the bottom. The imperviousness to light is assured by connecting this cover with the case by paper glued thereto externally, and that is slit with a penknife at the moment of using the box. The entire package of plates is held by a pin that traverses the cardboard of the box and all the papers at the upper part; so that if the box be held vertically and the edge of the cardboard cover be grasped, and the case be drawn with the other hand, the case may be removed without the plates falling out. It will be seen in our engraving that the bottom of the paper support is cut into steps and is provided with apertures. The paper is doubled in this place in order to make it stronger. If we suppose the box to be closed, and we pass a needle through the bottom of the case in such a way that it shall traverse one of these apertures, it will be seen that when the box is

package of plates does not move, and the first sheet, *D*, is exposed. When the drawer is pushed in again, the sheet ascends against the plate, and the case closes. When the pin is inserted in aperture No. 2, the first paper is traversed as before, as is the paper-support, and things proceed as in the first place, save that it is the plate that has been used that is carried along. In order that the focusing may be effected automatically, the apparatus is formed of two boxes, *H* and *E*, that slide one within the other, and a spring causes the interior extremity of *E* always to bear against the plate that is exposed. In order to close the drawer, *B*, it suffices to pull the front of the camera forward. Any make of objective or shutter may be used, and the same may be said of the plates.

The Pankoras.—Although magazine apparatus are now very extensively employed, there are still many partisans of the separate frame apparatus. MM. Du-

plomers, who have to contend against heat and humidity.

The Fetter Apparatus.—In devising this apparatus, M. Fetter seems to have aimed to prevent any entrance of light at the moment of the opening of the plate holder. The fact is well known that in cameras in which plate holders are employed there are often difficulties to overcome, and photographers who operate with such apparatus are in the habit of enveloping them with a black cloth at the moment of opening the shutter. M. Fetter's plate holders (Fig. 3) open like a book, the hinge being placed crosswise.

In order to place one of them in the apparatus, we open the door that closes the back of the latter and place the holder therein in such a way as to engage the two small rods, *A* and *B*, that are carried by its back shutter in the fork, *C* and *D*, that terminates the movable frame, *H*, fixed upon the door, which is afterward

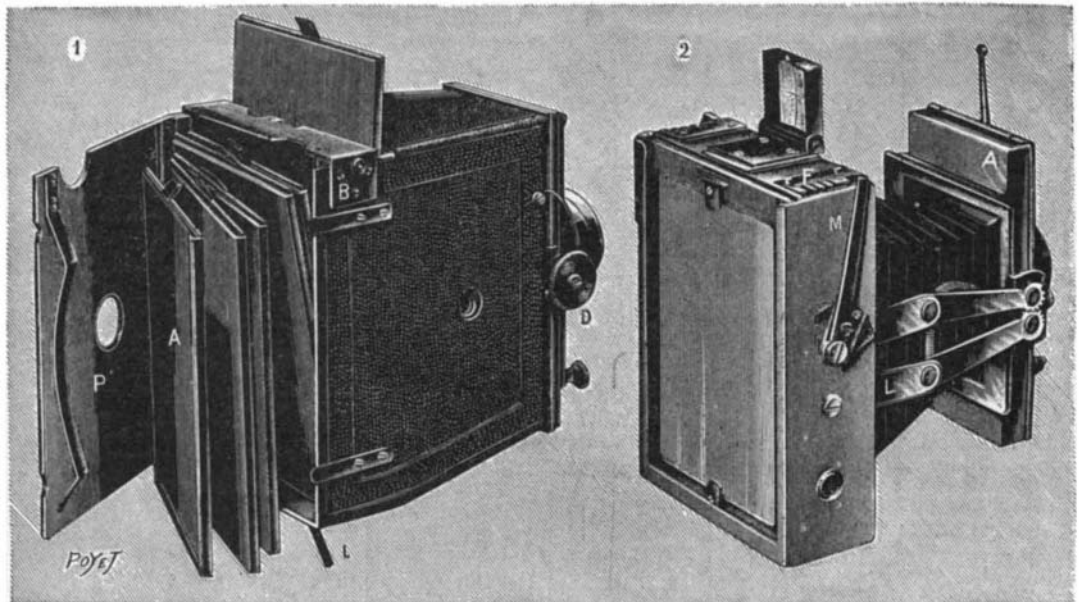


FIG. 2.—1. THE DUCOM AND ECHASSOUX "PANKORAS." 2. THE DOM-MARTIN "PLIANT."

com and Echassoux, in devising the "Pankoras," have endeavored to combine the advantages of both systems in twin lens or detective cameras provided with all the latest improvements. It is the charging of the apparatus that is especially interesting (Fig. 2, No. 1). The plates are put into metal holders, *A*, 0.15 of an inch in thickness, closed by a slide consisting of a plate of sheet iron sliding in grooves and capable of being entirely removed.

The rear of the apparatus is arranged in such a way that it can receive six of these holders placed one against the other, so as to form a magazine. As soon as a plate has been exposed, the slide of the holder is closed and the holder is expelled from the magazine by pressing upon a lever. All that has to be done then is to place it by hand behind the others, when the following holder will be in place for use. An aperture formed in the door, *P*, that closes the magazine permits of seeing the number of frames used. One of the advantages of this system is that it permits of the use of various makes of plates. As it is always possible, when desired, to effect the focusing upon the ground glass and to employ any

closed. The holder is thus entirely inclosed in the camera. In order to open it, it suffices to maneuver a small lever, *M*, situated at the side of the apparatus, and which is integrally formed with the frame, *H*. The latter swings toward the front, and, in its rotary motion, carries along with it the front shutter of the holder, while the back one, which carries the plate, is held in place by a rabbet formed in the apparatus. The closing is effected by a contrary maneuver. A bolt device at the top of the holder assures the closing of it when it is outside of the apparatus.

The camera consists of a wooden frame and a flexible leather bellows. Two metal plates, one of which carries the objective and its cap, permit of folding up the whole in such a way as to present the least bulk possible.—For the above particulars and the engravings, we are indebted to La Nature.

DEVELOPMENT OF THE KENTUCKY ASPHALT DEPOSITS.

New developments in connection with the deposits of asphalt rock in central western Kentucky are im-

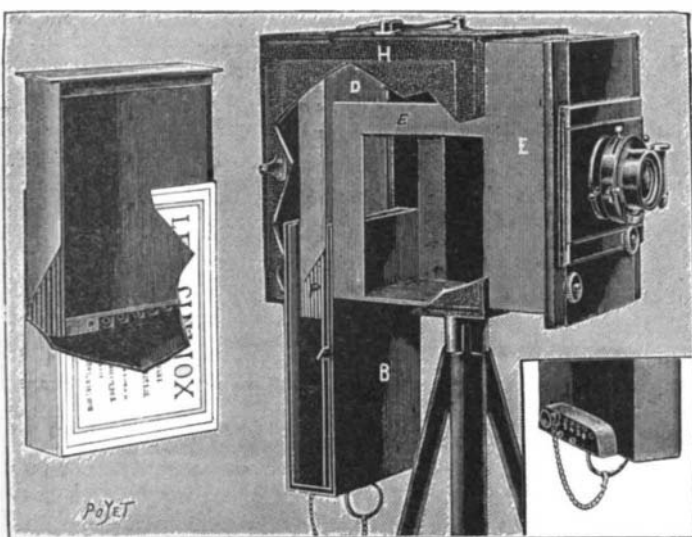


FIG. 1.—THE LESUEUR "SINNOX."

afterward opened, the sheets traversed by the needle will be carried along when the case is drawn out. The paper of the sheets thus carried along will be easily torn at the upper part where it is held by the pin. In descending with the case, the plates and their support will uncover the plate situated behind them. Things are so arranged as to go on methodically in this manner. The box is introduced into a drawer placed at the back part and provided at the lower part with a block containing apertures lined with rubber and into which may be inserted a steel pin provided with a head and connected with the block through a small chain (see cartouche to the right of the engraving).

These apertures are situated opposite those formed in the paper-support. When the pin is placed in aperture No. 1, only the first sheet that serves to mask the first plate is traversed. Then the operator pulls out the drawer, which takes the position, *B*, in carrying with it the case, *A*, and the punctured sheet. The

holder of the series, a certain number of the latter may be charged with anti-halo plates, and others with orthochromatic ones.

The "Pliant."—This 4½ x 6-inch apparatus, constructed by M. Dommartin, is designed for the use of separate metal holders of slight thickness. The back (Fig. 2, No. 2) carries the ground glass, in the place of which slides the holder at the moment of operating. The front carries the objective and shutter mounted upon a sliding device. These two parts are connected by a slightly conical bellows, and metallic joints permit of placing one against the other, when the apparatus is not in use, so as to reduce the bulk of the whole. The focusing is effected by acting upon one of these joints by means of an eccentric controlled by a lever, *M*, the extremity of which engages in notches, *F*, carrying a graduation scale for focusing at different distances. The entire apparatus is of inoxidizable metal—an alloy of copper and aluminium—and is well adapted to the needs of ex-

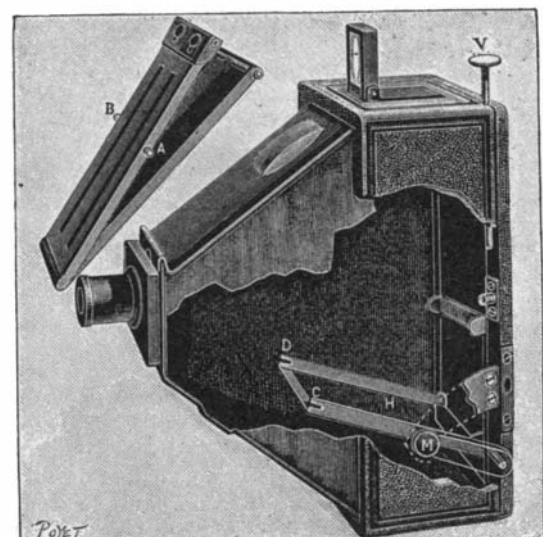


FIG. 3.—THE FETTER APPARATUS.

pending. There seem to be great possibilities in the enterprise, and material modification of the business of laying asphalt streets may result. Quietly certain strong interests have aggregated into one organization the separate holdings of almost the entire number of the deposits of asphalt rock and now state that they are prepared for effective work and active operation on a large scale.

There are about ninety different deposits in the State of Kentucky, ranging in size from 5 acres to 500, situated in the counties of Edmonson, Grayson and Hardin, with a few in the adjoining counties. The section of country in which the deposits occur is somewhat irregular in shape, but is about 30 miles long and probably 10 miles in its greatest width. The asphalt rock is called by the natives "black rock," and is found in ledges of sandstone in the upper formations and only on the higher plains and hills. It has not been found excepting in the peculiar geological formation of this section of the State.