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A. D. MELVIN, Chief of Bureau.

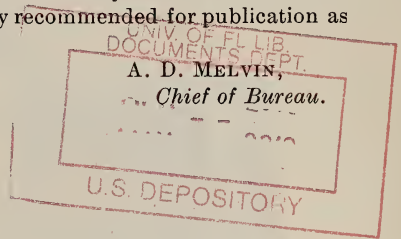
WASHINGTON, D. C., *October 1, 1907.*

The accompanying paper, prepared by Dr. Victor A. Nörsgaard, formerly Chief of the Pathological Division of this Bureau, and revised by Dr. John R. Mohler, the present chief of that division, is respectfully recommended for publication as Circular 23 (third revision) of this Bureau.

Very respectfully,

Approved:

JAMES WILSON,
Secretary of Agriculture.



DIRECTIONS FOR THE USE OF BLACKLEG VACCINE.

The blackleg vaccine, as prepared by this Bureau, consists of a brownish powder, which is put up in small envelopes, each containing either ten or twenty-five doses. To prepare this powder in such a way that it may be injected hypodermically, it is necessary to obtain certain apparatus, which, together with the hypodermic syringe, are known as a vaccinating outfit. This consists of a porcelain mortar and pestle, a small glass funnel, and a measuring glass. For filtering the vaccine, we have found absorbent cotton to be most suitable. Figure 1 is an illustration of the vaccinating outfit recommended by this Bureau. All of the utensils, including the hypodermic syringe and a package of absorbent cotton, are fitted in a strong polished oak box which, by means of an adjustable wire loop, serves also as a support for the funnel when the vaccine is filtering. The syringe, two hypodermic needles, and an extra glass barrel are packed in a separate metal case which is inclosed in the oak box.

The syringe (fig. 2) has a capacity of 5 cubic centimeters, and the piston is graduated from 1 to 5, each division being subdivided with half and quarter notches. The screw regulator (fig. 2, *sr*) may be placed at any mark on the piston, thus insuring that the animal to be vaccinated receives exactly the proper dose. The plunger (fig. 2, *pl*) is made of rubber; it should fit air-tight in the glass barrel and still be susceptible of being moved up and down smoothly. By means of the milled head (fig. 2, *mh*) at the free end of the piston the rub-

ber of the plunger may be expanded or contracted simply by screwing the head to the right or left. This arrangement insures a close fit without taking the syringe apart. If the plunger should become dry or for other reasons does not move smoothly up and down in the barrel, it is necessary to unscrew the milled cap *c* and pour a drop of glycerin into the barrel. A small bottle of glycerin is furnished with each outfit for this purpose. Oil or grease should never be used, as these substances destroy the rubber. Extra washers to be placed inside of the cap at each end of the glass barrel are also furnished with the syringe. It is of the greatest importance that the

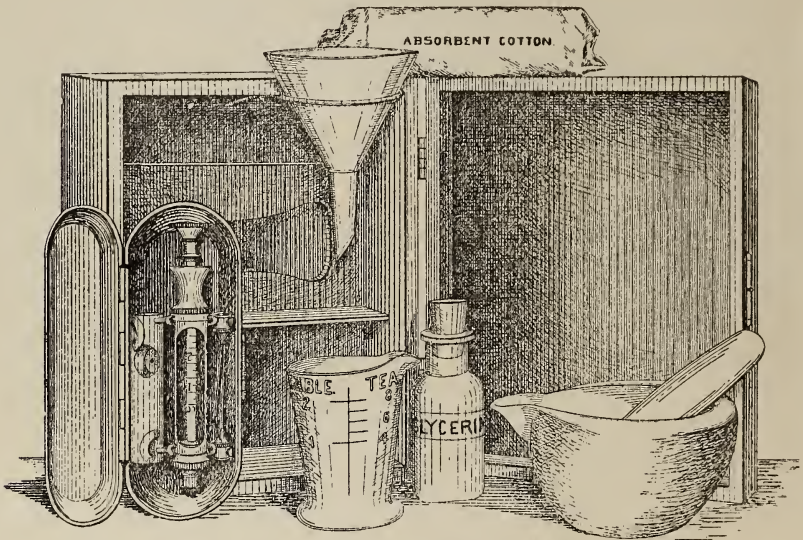


FIG. 1.—Vaccinating outfit.¹

syringe be perfectly tight, in order that not a drop of vaccine may escape except through the point of the needle (*h*). If a leak occurs, unscrew the cap of the syringe, withdraw the glass barrel, and replace the old washers with new ones. In order to prevent the plungers and washers from drying out, the small loose cap *lc* should always be tightly adjusted to the peg *p* when the syringe is not in use. The hypodermic needles should be kept very sharp, in order to pass easily through the skin, and when not in use should have a fine brass wire passed through each to prevent rusting on the inside.

¹ A complete vaccinating outfit, including hypodermic syringe, can be obtained from Z. D. Gilman, 627 Pennsylvania avenue NW., Washington, D. C., for the sum of \$4. The outfit is prepared by the firm named in accordance with the plans of this Bureau. Similar outfits will no doubt be for sale by other dealers furnishing this class of supplies, but until this may be the case, the unusual course of mentioning a dealer by name in a Department publication is followed.

Whenever the point of the needle becomes blunt it is very difficult to pass it through the skin, the fingers of the operator become sore from attempting to force it, and frequently the needle either bends or breaks. It is, therefore, of importance to have a small oilstone at hand on which to sharpen the point of the needle. Before using the syringe, it should be tested thoroughly with pure water to ascertain that it is in perfect working order. For this purpose, fill the syringe slowly by withdrawing the piston. If the syringe is perfectly tight, it should fill completely; if it contains air bubbles, turn it with the point upward and press the piston until the water comes out of the point, then refill. The same precaution must be taken when filling the syringe with vaccine.

STERILIZATION OF UTENSILS.

Before preparing the vaccine all the utensils must be thoroughly sterilized. This is done by putting the mortar, pestle, measuring glass, funnel, and needles, together with the syringe, in a pan of water and placing it over the fire. After boiling for twenty minutes, the pan with the contents should be allowed to cool off slowly; then remove the utensils from the water and wipe them dry with a clean linen cloth which has been previously boiled. When the vaccine has been prepared, the utensils for this purpose should be cleansed thoroughly and replaced in the box. After the injections the syringe should be again boiled (sterilized) for twenty minutes, carefully wiped dry, and the brass wire replaced in the needles.

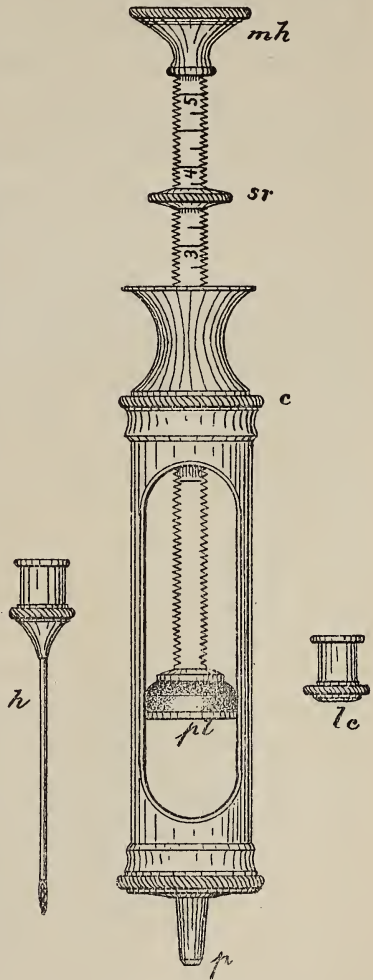


FIG. 2—Hypodermic syringe.

PREPARATION OF THE VACCINE.

Place the contents of one packet of the vaccine in the porcelain mortar, previously sterilized, and add a few drops of boiled water. (The water must have been previously boiled and allowed to cool.) Work the powder thoroughly with the pestle and then add, little by little, as

many cubic centimeters of water as the packet contains doses. As the syringe contains exactly 5 cubic centimeters, it may be used for measuring the water. A packet containing ten doses of the vaccine should be dissolved in two syringefuls of water, and one containing twenty-five doses in five syringefuls. Care should be taken that the syringe is full every time. To filter the vaccine, place the wooden box on end, as shown in figure 1, and adjust the wire loop in the two eyelets. Place across the mouth of the funnel a thin film of absorbent cotton and press it lightly into the lower end of the cone, holding it in place with the thumb and index finger over the rim of the funnel, so that it will not sink down into the neck of the funnel and clog the free flow of the fluid; moisten the cotton with a few drops of boiled water and let it drip off. Stir the mixture in the mortar thoroughly, and before it has had time to settle pour it into the funnel, under which a measuring glass has been placed. The solution coming through the funnel must not be perfectly clear. If this is the case, the cotton has been pressed too closely into the neck of the funnel. The straining is done simply to prevent the coarser particles of the powder, which are suspended in the solution, from clogging up the needle when the vaccine is injected, and as the effectiveness of the vaccine depends upon the number of attenuated spores in the solution, it is obvious that a perfectly clear solution will not be as effective as one which is cloudy. It is, therefore, of the greatest importance that much time and care be spent in grinding the vaccine powder as fine as possible before the bulk of the water is added, as otherwise the greater part of the germ-carrying particles are left on the cotton instead of passing through it. If too much water is added at first, it is almost impossible to grind the powder, and it becomes necessary to place the mortar, with its contents, in a warm and airy place in order to allow some of the water to evaporate. Only sufficient water, a few drops, should be added to the powder to make it form a paste, in which condition it may be ground extremely fine. A better plan is to grind the dry vaccine in a perfectly dry mortar until it becomes an impalpable powder with no gritty particles present. Then add at first a very little water to form a paste, then the balance of the water to form the fluid vaccine. If the vaccine is ground fine enough the needle will not become plugged. The vaccine need not then be filtered through the cotton at all. In this manner a more concentrated vaccine is obtainable.

When the vaccine is prepared at home, a small sterilized medicine bottle may be substituted for the measuring glass under the funnel. The stopper of this bottle, if cork, must have been thoroughly cleaned and boiled before use. The vaccine is carried in the bottle to the place of operation, where it may be transferred, a little at a time, to the measuring glass; from this it may conveniently be drawn into the syringe. In doing this it is of importance to remember that, when

standing for some time, a slight sediment will form at the bottom of the vessel or bottle, and the vaccine should therefore always be well shaken or stirred before the syringe is filled. When some time elapses between the vaccination of two animals, and the syringe still contains one or more doses of vaccine, the operator should turn the syringe up and down frequently to insure an even distribution of the germ-carrying particles throughout the vaccine.

No more vaccine should be prepared at one time than can be used the same day. While the vaccine powder will remain unchanged for some months, the solution deteriorates very quickly and must be used within twenty-four hours after it is made.

ANIMALS TO BE VACCINATED.

Calves, as a rule, should not be vaccinated until they are 6 months old. Under this age they are practically immune from blackleg, and it has been claimed that when vaccinated before they are 6 months old they are liable to lose the artificial immunity induced by means of vaccination and become susceptible again. Animals more than 2 years old are seldom affected, and the mortality among them is so small as to make vaccination unprofitable. It is the animals between 6 months and 2 years old which should be vaccinated.

Vaccination has no ill effect on calves under 6 months old, but it should be a rule that when very young animals are vaccinated they should be revaccinated before the beginning of the following blackleg season.

The time to vaccinate depends largely upon circumstances. In nearly every part of the country where blackleg is known there is a distinct blackleg season, and the proper time to vaccinate is just before the arrival of this season. Every practical ranchman and farmer, as a rule, knows when to look for blackleg, and as the disease may appear a little sooner or later, according to climatic conditions, it is always better to vaccinate two or three weeks before the beginning of the blackleg season. In some parts of the country it is not unusual that the calves commence dying when only 4 months old, while in others they seldom become affected until they are 8 months old. It is, therefore, much a matter of judgment when to vaccinate and what should constitute the minimum age at which the calves should be treated.

Vaccination and castration should not be performed at the same time. Castration is always a severe operation, and in some cases decreases the vitality of the animals to such an extent as to make them unable to resist the effect of the vaccination. The same principle applies to all surgical operations (castration, spaying, dehorning, etc.) as well as to those cases where the constitution of the animal has been impaired from injuries, external or internal.

Ten days to two weeks should be allowed to pass after vaccination

before any surgical operation is undertaken, and, if performed before vaccination, ample time should be allowed for the part to heal and for the animal to regain its lost strength.

THE DOSE TO BE INJECTED.

Animals 1 year old or over are injected with a full dose of vaccine; that is, 1 cubic centimeter of the solution. Under this age the dose may be reduced to one-half or three-fourths of a full dose, according to the size and development of the animal. Less than one-half a dose should never be injected. In determining the dose for each animal more consideration should be given to the size and development of the animal than to its exact age.

HOW TO OPERATE.

When the animals to be vaccinated are gentle and accustomed to being handled, vaccination may be performed on the standing animal. Range cattle or other half-wild animals must be thrown or secured, as in a dehorning chute.

The most convenient place to inoculate is on the side of the neck, just in front of the shoulder, where the skin is loose and rather thin. If the animals are secured in a dehorning chute, it is easier to vaccinate them on the side of the chest just behind the shoulder.

All animals should be vaccinated on the same side and marked in such a way that they may be easily recognized. The best way to mark them is to use a small branding iron in the shape of a V, or to fasten a metal tag in the ear. As calves which have been vaccinated for black-leg frequently command a higher price than the unvaccinated calves, it is of importance that they be plainly marked.

When the animal is secured, fill the syringe with vaccine, and ascertain that it contains no air bubbles. Then insert the needle by grasping a fold of the loose skin between the thumb and forefinger of the left hand and pushing the needle through the skin. The operator now adjusts the peg of the syringe tightly in the cap of the needle and injects the dose, which has been previously limited by the screw regulator on the piston. The needle is then withdrawn without detaching the syringe, and, to prevent any of the vaccine from escaping through the hole of injection, the skin is pressed tightly around the receding needle. The latter is then detached, the regulator screwed back to its proper place, according to the size and age of the animal to be next vaccinated.

When a large number of cattle are to be vaccinated, it is of importance to have a sufficient number of assistants, as otherwise the process becomes exceedingly tiresome and fatiguing, both to the operator and to the assistants. The herd to be treated is confined in a pen, from which a small number, from five to ten, according to the number of

assistants at hand, are driven into a smaller pen, where the assistants throw them and hold them down. Very wild range cattle must be lassoed, but graded or fine stock, being less unmanageable, should be seized by the head and thrown. The first method requires a larger pen, but when the assistants are skilled in handling the lasso it is by far the quickest way. The animals should all be thrown on the same side. One assistant sits across the side of the thrown animal with his face toward its head and holding the upper fore leg pulled back and up. When secured in this way, it is almost impossible for a well-grown yearling to free itself.

With older and stronger animals it is safer to have two men to hold each of them, as an animal which succeeds in getting up before all have been injected and marked will frequently make things very unpleasant for the operator and assistants, chasing them from the pen and necessitating a repetition of the whole process.

The operator should have an assistant insert the needle, while he himself adjusts the regulator. After inserting the needle, the assistant lifts the skin fold, presenting the cap of the needle so that the operator

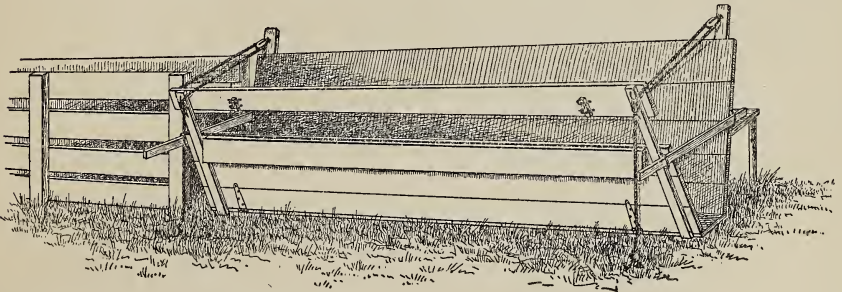
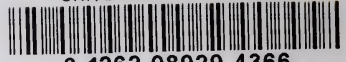


FIG. 3.—A vaccinating chute.

may easily grasp it and attach the syringe. In this way from 90 to 100 head of yearling calves may be vaccinated in one hour, with ten men to handle the animals and one assistant to insert the needle; but such a rate can only be maintained for a limited time without changing the men. With one set of men not more than 400 or 500 head, according to the age and size of the animals, should be vaccinated in one day.

On many large ranches, where vaccination for blackleg is practiced as regularly as branding, special vaccination chutes (see fig. 3) have been constructed, which in principle resemble the ordinary squeezer, or branding chute. One side of the chute is hinged to the base and may, by means of a block and tackle, be pulled over against the opposite side, thus squeezing the calves and preventing them from struggling while the needle is inserted and the vaccine is injected. One of the planks in the movable side, at a proper distance from the ground, is loose and hinged to the plank below it, so that it may be opened and



give the operator access to the sides of the animals. The chute may be built as long or as short as desired, or may be made portable and carried to any pasture on the ranch and connected with the stationary chutes and pens. Such a chute enables three or four men to vaccinate the same number of calves as ten to twelve men can vaccinate in the same length of time when every animal has to be lassoed or thrown.

SYNOPSIS OF VACCINATION PROCESS.

- (1) Sterilize outfit by boiling.
- (2) Place the contents of one packet in the dried mortar and add a few drops of water; or grind the dry vaccine to an impalpable powder until no gritty particles remain.
- (3) Work the mixture well with the pestle.
- (4) Add two to five syringefuls of water, according to the size of the packet, and stir well.
- (5) Place cotton in glass funnel and moisten with water.
- (6) Filter vaccine into the glass or bottle; however, if the vaccine is ground fine enough, filtering is unnecessary.
- (7) Secure the animal to be injected.
- (8) Insert the needle through the skin.
- (9) Fill the syringe and adjust the screw regulator on the piston. If the first animal is a yearling or older, place regulator at No. 1 on the syringe (fig. 2).
- (10) Fit the peg of the syringe into the cap of the needle and inject the dose.
- (11) Withdraw syringe and needle together. If the syringe is removed from the needle before the latter has been withdrawn, some of the injected vaccine will flow back through the needle and be lost. In this case the animal does not get its full dose and will consequently be insufficiently protected.

ATTENTION.

- (1) *Cattle owners are hereby requested to report immediately all deaths from blackleg which occur within one week after vaccination. For this purpose a separate blank and return envelope (which requires no postage) are furnished with the vaccine.*
- (2) *Vaccine which for any reason is not used should be returned to this office immediately, and in acknowledgment of the same a new application blank will be forwarded to the sender.*
- (3) *Do not castrate, spay, or dehorn at the time of vaccination.*
- (4) *Do not vaccinate heifers when they are far advanced in pregnancy.*