the lower bearing of K is on a small piece of cork in a friction cup, *r*, in the top of the spindle, *h*, of the driving pulley, which has an adjustable bearing, *i*, below, as shown in the cut. The upper part of the shaft, *k*, rotates in the stuffing box, *g*, provided with an elastic packing ring, *o*, and self-lubricating cup, *v*. The bearings of the pulley spindle, *h*, are also self-lubricating. The cover, C, of the chamber, A, is in the form of an inverted funnel, the mouth of which is bolted to the top of the chamber by four bolts, two only of which are seen in the section (fig. 33). To prevent the atmospheric action on the nuts of the bolts inside the case, a cap (not shown in the cut) fits neatly over them. Immediately below, *c*, is another funnel, *w w*, with a pendant tube, *b*, from one side, as shown in the illustration. The former, *c c*, is the milk funnel, and the latter, *w w*, the cream funnel. A broad collar, *m m*, fits loosely on to the top of *c c*, for the purpose of guiding the milk into the receiver, G. The top of the cream funnel, *w w*, is also surrounded with a collar, *n*, for guiding the cream into the receiver, H. The receivers, G and H, are of the nature of funnels, *p* and *q* being the discharge pipes. They are made separately of white metal, the pipes forming handles. G fits on easily to the top of the lid, E, of the outer case, B; and H fits on to G, whilst a cover, T, fits on to H, best seen in the profile

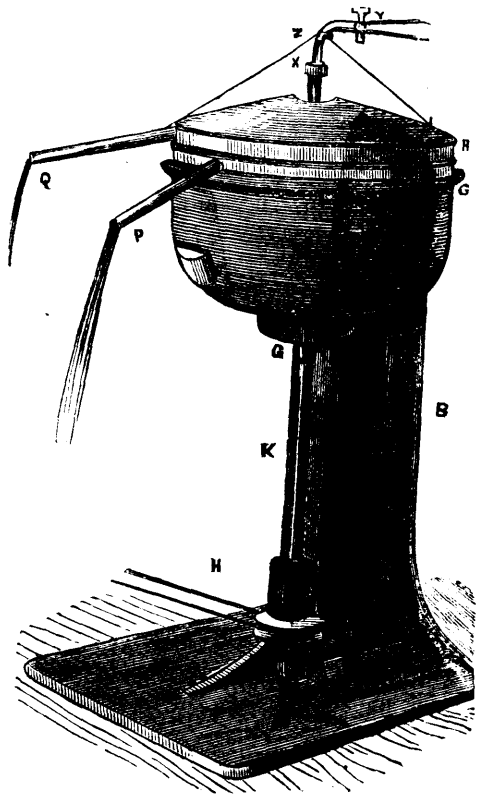

Fig. 34.

(fig. 34). The receivers, G and H, being circular, the discharge pipes, *p* and *q*, can be placed to deliver the milk and cream on any side of the separator. Thus (fig. 34) shows both set for discharging on one side, and (fig. 33) on opposite sides.

The supply tube, *a*, is screwed into the bottom of the chamber, A, centrally with the shaft, *k*. It has two discharge pipes, s s, opposite each other. The upper end, *x*, of the supply pipe rises a little above the cover T, best seen in the profile, with sufficient space all round for the escape of animal odour.

The vessel for supplying the whole-milk is not shown in the cut, but the cock, *y*, will be understood as proceeding from it. The mouth of the cock is held in position by a three-legged stay, not shown in the section.

In the internal arrangement of the separator there are three concentric tubes, to which special attention requires to be called. First, there is the central tube, *a*, down which the milk flows, with its two exits, s s. Second, there is the cream tube, w w, which surrounds *a*; and third, the milk tube, *c c*, which surrounds w w. All the parts, tubes, collars, and funnels are so designed as to be easily taken to pieces for being cleaned and put together again for work by any unskilled labourer—the only education required being to see the thing once done.

The action of the separator is as follows :—When the power is turned on, the application being by friction gear throughout, the speed gradually rises, and when the chamber, A, attains about 6000 revolutions per minute the tap, *y*, is opened, when the milk flows down into the chamber, A. The calculated speed is, of course, determined by the intermediate motion, and it is easy to see when this has been communicated to A. Thus at first the mouth, *x*, of the supply pipe is seen to move, but when once the desired speed has been attained it appears at rest, like a top when spinning at full speed; and, like the top, too, it stands vertically erect, as if at rest, without any vibration, although making 8000 revolutions per minute, which is about the maximum speed. But to effect this, in fixing the separator, the common axes of the pulley spindle, *h*, and shaft, *k*, must be vertical. To insure this, the mouth of the outer case, B, on to which the lid, E, fits, is turned true at right angles with the central axis. This being done, the outer case can be properly fixed by a spirit level across the mouth of the case, as will readily be understood from fig. 34. The work of fixing is thus simple, but it has to be accurately done.

The separation of the milk from the cream is effected within the chamber, A, by centrifugal action. The supply pipe, *a*, has a head pressure equal to *x n* on the cream, and *x m* on the milk, but no head pressure is required until the close of the work, when the remainder of cream has to be forced out as subsequently noticed. The separation of the milk from the cream and the cream from the milk being continuous, the centrifugal action of the effluent tubes, s s, has a greater effect in throwing the milk beyond their mouths than head pressure when they are making from 6000 to 8000 revolutions per minute. The cream and milk mixed together as they come from the cow are thrown towards the walls of the chamber, where the separation commences; close to the small supply pipe, *a*, about an inch in diameter, centrifugal force *nil*. It is necessary to bear this closely in mind in order to comprehend the course which the globules of butter take on their way to *w w*, from the place in which they are first deposited in the chamber, A. [The (so to speak) skim-milk tube is fed from the outer portion of the revolving contents, and the cream tube from the inner portion next the axis. It is there the cream finds itself, owing to the denser milk being thrown outwards; and the escape being urged both by centrifugal action and head pressure alike, the outer and inner portions of the contents are delivered by two different tubes at two different spouts, the one of them rich and the other poor in butter globules. Ed. *A. G.*] The milk, thus delivered free from cream, yields in fact less butter than skimmed milk when the cream is raised in the common way. Thus according to an extensive course of experiments made at the Royal Agricultural College of Alnarp, Sweden, during last June (1879) by Professor Hjalmar Nothorst, Principal of the College; and Dr. Nils, Engstrom, Professor of Chemistry, the general result was that by the iced method there was always used about 1.5 lb. more milk to make 1 lb. of butter than by de Laval's separator.

Without going further into the consideration of the subject, the path of the butter globules is no doubt an upward curve towards *w w*. Were a chamber made with side walls of glass sufficiently strong to bear the speed of 8000 revolutions per minute, the path of the cream would be seen, whilst the more important question would be determined as to whether the form of Mr. de Laval's chamber is the best that can be made in its minor details. In principle its construction appears to be sound, and the small percentage of butter left in the milk may be taken as presumptive evidence that the whole may yet be removed by the inventor. The principle of construction practically is twofold, first the separation of the milk by the tube, *b*, at the extremity of the radius of an oblate spheroidal chamber revolving on its minor axis; second, the removal of the cream centrally by the tube, *w w*.

The milk is discharged over the collar, *m*, and the cream over the collar, *n*, each in a very thin sheet by centrifugal action. The receivers, G and H, with their respective collars, *m* and *n*, are stationary, and incline each downwards, in the form of an obtuse cone, to the spouts, P and Q. Down these inclines the milk and cream flow, spreading thinner and thinner towards the perpendicular rim of G and H, thus affording a ready means of escape for animal and other odours and gases, and without the milk coming in contact with the atmosphere, which is objectionable, especially