and I know of no means of overcoming that unfair competition. I do not believe in forming the cheesemakers into a syndicate and controlling the whole thing, but I do believe that we should have a cent and a half for making and that we should do the very best we can under those circumstances. Mr. Scott, who spoke here the other day, is in the same position; he would be very glad to get more for making his cheese if he could, but if he raised his price a large number of his patrons would go to Sheboygan Falls, which is almost as near to many of them as his place is. Now, if there was any way of reaching those factorymen who are cutting their own throats, so to speak, we would like very much to reach them. On this question of one factory taking milk rejected by another, our boards of trade have wisely passed a resolution, that no man can belong to our board of trade or sell cheese upon it who has taken milk that has been refused at any factory, consequently, we do not have that trouble of a man running from one factory to another. We are attending these conventions year after year, aiming to reach the weak spots in our system of making cheese, and I hope that during the next year we can so far come together that we will be willing to stand together upon a fair basis for manufacturing cheese.

HINTS UPON THE CONSTRUCTION AND EQUIPMENT OF CHEESE FACTORY BUILDINGS.

U. S. BAER, MADISON, WIS.

LOCATION OF FACTORY.

In the location of a cheese factory no one thing is more important than to secure a well drained site, and yet, this is, in many cases, the last thing thought of. The foundation of cleanliness in a cheese factory begins with the sewer. Other things being equal, then, elevated ground should be selected as a proper site for a factory. Another matter that may prove of
considerable value is a regard for the natural or artificial shelter that may be given the factory building. A difference of eight or ten degrees in the curing room temperature can oftentimes be secured by having a due regard to the advantages of shade from groves or the channels of natural air currents. The surroundings should be such as to insure pure air with little dust. Trees and shrubs around the factory aid in purifying the air. If you can choose a site for the placing of the factory, a north side hill is better than any other. The east is better than a west slope, but a north exposure for the curing room is the best, so that if you have windows they may be on the north side. It is not well to locate the building on a bleak site, exposed to the full rays of the torrid summer sun or to the cold winds of winter. A reliable supply of good, pure, cold water is another requisite of very great importance to be considered in the selection of a factory site.

SEWAGE.

The problem of sewage is "How shall the organic matter present in the washings or sewage of factories be so disposed of with the least cost that they shall not create nuisances either on the surface of the soil, along the banks of streams, or by their excessive presence in the water of streams, or that they shall not pollute the water of streams or wells which may be drunk either by man or beast with injury to health as a result?" On the papers distributed I have had struck off the plan of surface system sewage as presented before this convention at the 1902 meeting by Prof. Archibald Smith of Strathroy, Canada. I am informed that this is giving entire satisfaction wherever the system has been installed.
Fig. 2.
A—Pipe from factory to box.
B—Ventilator.
C—Goose-neck pipe.
D—Box where sewage empties.
E—Partition.
F—Overflow from No. 1 to No. 2.
G—Overflow from No. 2.
H—Float.
K—Indicator.
L—Plug.
M—Filter bed.
N—Under drain.
O—Second Box.
S, S—Ventilators filter bed.
A—Boiler.               J—Wash Sink.
C—Sterilizing Oven.      L—Curd Sink.
F—Scales.                O—Office Desk.
G—Conductor Spout.       P—Office Chair.
H—Bottle Rack.           Q—Truck.
S, S, S, S, S, S—Steam Radiators.

The cut shows plan designed for large model cheese factory converting from twelve to twenty thousand pounds of milk into cheese daily. The contour of building, and arrangement of apparatus is recommended for neatness, convenience and economy of space and cost. Another advantage which this plan offers is that which admits of the weighing in of the milk at one end of the building and the delivery for transportation of the finished product at the extreme rear end without the unnecessary transferring of the milk, curds or cheese back and forth in the process of manufacturing and curing as is often the case in factory buildings improperly constructed and equipped.

The locating of the office, bath and store rooms between the make and curing rooms shuts off the heat of the make room from the walls of the curing room and places the office and store rooms in the most convenient and accessible position from all parts of the building.

The cost of a first class building of this style with ten foot ceiling and cement floors throughout will approximate $1,100.00.

The accompanying specimen outfit will cost in the neighborhood of $1,100.00. Total cost of factory complete, $2,200.00.

The question of the cost of a cheese factory depends upon the number of cows cheese is to be made from, and the style and capacity of machinery. The figures given will enable anyone to make their plans with safety.
SPECIMEN OUTFIT LIST.

For 800 to 1200 Cow Cheese Factory.

1 12-H. P. Boiler complete with all fittings and stack.
1 8-H. P. Horizontal Engine, Complete.
1 4x6 Marsh Deep Well Pump.
3 Sets Baird's Automatic Curd Agitators.
1 36-bottle Turbine Tester, Complete.
2 "Barber-Colman" Check Pumps.
2 900-gal. Galvanized Steel Whey Tanks.
3 600-gal. Improved Steam Cheese Vats.
2 Continuous Pressure Steel Gang Presses.
1 Curd Sink with Racks and Castors.
1 Power Knife Curd Mill.
1 600-lb. Scale, Double Beam with Wheels.
1 240-lb. Tin Scoop Counter Scale.
1 80-gal. Weigh Can.
1 Conductor Head and 10 feet of Trough.
50 14½-in.x7-in. Tinned Gang Press Hoops.
2 8-in.x20-in. Horizontal Curd Knives.
2 8-in.x20-in. Perpendicular Curd Knives.
4 Long-Handled Half-gallon Dippers.
1 Strainer Dipper.
3 Half-round Whey Strainers, with Spouts.
2 Tin Curd Scoops.
2 Flat-sided Curd Pails.
2 Marschall Rennet Tests.
2 16-oz. Glass Graduates.
1 Tinned Cheese Knife.
1 Set Months and Dates.
1 Set Test Instruments with Quevenne's Lactometer.
1 24-bottle Curd Test.
12 doz. Composite Milk Jars.
6 8-in. Floating Dairy Thermometers.
1 Hygrometer.
1 Shelf Scraper.
1 6-in.x5½-in. Cheese Trier.
2 14-in. Wood-head Mops.
4 Floor Brushes.
6 Heavy Floor Brooms.
6 Scrub Brushes.
6 Composite Test Jar Brushes.
1 Bath Tub.
1 Office Desk.
1 Office Chair.
1 Sterilizing Oven.
5 4-ft. Cast Iron Radiators.
2 8-ft. Cast Iron Radiators.

Necessary connection pipe for boiler, engine, pump, wash-sink, tester, vats, radiators, and whey tanks.
Necessary check, globe, and angle valves for above connections.
Necessary ells, tees, unions, nipples, reducers, couplings, plugs, etc., for above connections.
Necessary shafting, hangers, wood-split pulleys, and belting for driving curd agitators, curd mill and well pump.
TWELFTH ANNUAL MEETING.

CONSTRUCTION OF MAKE ROOM.

Since cheese making is carried on in such wide ranges of latitude and longitude and under such varied conditions, it becomes impossible to have a set plan for a factory building suitable for all conditions and requirements. There are, however, some essentials which every cheese maker should take into consideration in arranging his building and equipment to secure both convenience and cleanliness as to perform the daily labor in the factory in the easiest possible manner and under the most economical conditions. The size of the building is, of course, to be measured by the amount of milk to be manufactured therein, but the same internal arrangement is needed alike in both small and large factories.

On the papers you hold, will be found figures showing floor plan of cheese factory, sections of cheese curing rooms and of multiple sub-earth ducts.

Without question a brick building is not only the most sanitary but is also the cheapest in the long run. Although the first cost may be somewhat greater in some localities of the state, for a brick than a frame building, yet, when we consider the high insurance and the necessary repairs of a frame building, the brick or grout building is none too expensive or elaborate for a cheese factory. Because of the short time at our disposal we shall briefly consider the construction of the frame building only.

The building should be laid upon solid foundation walls rather than upon piers. Besides adding decidedly to the appearance of the building, it aids materially in keeping the building warm in winter and cool in summer.

The upper-structure, consisting of make-room, boiler-room and curing-room, should offer as good protection from the elements as a well built house does. The building should be covered on the outside with two thicknesses of boards, with a layer of 3-ply acid and water-proof paper between. The outer thickness of boards should be good drop siding. The inside finish should be of matched and planed lumber, thoroughly protected with hard oil. The outside should be neatly and tastefully painted. Use light colors as they reflect the sun heat while dark shades absorb the heat. Put an awning roof over the de-
livery window, wide and large enough to cover a wagon and team. Construct the platform for the scales and weighing-can on a level with the top of the vats.

CONSTRUCTION OF FLOORS.

In the choice of floors there is no longer any question but what cement fills all the requirements and if constructed properly, is sanitary, substantial, and much superior to wood. The floor should be laid the last thing after other work is completed. The floor corners should be rounded. A wainscoting of two feet, built of cement, will be found advantageous. The ground floor should be thoroughly tamped so that no future settling shall occur to crack the cement. Next comes a good, thick layer of cinders, which insures a dry floor. Four inches of concrete, made with good Portland cement, using one part of cement with from four to six parts of coarse, clean gravel and sand free from earth, is laid upon the tamped cinder bed. The finishing coat should be made with fresh Portland cement and clean, sharp sand or finely crushed granite in the proportion of one of cement to two of sand, laid three-fourths of an inch thick.

The concrete should be laid in strips about four feet wide across the floor and thoroughly rammed, then cut crosswise into blocks four feet square. As soon as one strip is laid, rammed and cut, it should be given its finishing coat of Portland cement, thoroughly trowelled while setting to avoid shrinkage checks. After the blocks have been trowelled, they should be wet with a brush and sprinkled with dry, pure, Portland cement and then trowelled smooth and hard so as to give a glossy surface which will be water tight and easy to clean. Each strip of the floor should be completely finished before beginning the next, and the materials mixed only as fast as needed for use. The floor should slant rapidly to the gutter, also made of cement, so that all water will quickly run off. It is useless to have a factory floor wet all of the time; it can be kept neat and dry by a suitable system.
Fig. 3.—Showing the construction of wooden curing room. 1, 1, 1, Sill; 2, 2, 2, a two-by-ten spiked to ends of joist; 3, 3, 3, a two-by-four spiked down after first layer of floor is laid to toe-nail studs to; 4, 4, 4, a two-by-four spiked to upper ends of studding of first story. A, A, A, A, three-ply acid and water proof paper. The drawing in the center shows space between studding filled with saw dust and another dead-air space to be used when the best ducts cannot be provided.
Fig. 4.—Section of cheese curing room and horizontal multiple sub-earth duct. A, inlet to curing room; B, end of sub-earth duct in bricked entrance to factory; C, cross-section of the multiple ducts. D, E, bricked entrance under funnel at outer end of sub-earth duct; F, funnel with mouth 36 inches across; G, vane to hold funnel to the wind.
Fig. 5.—Showing vertical section of factory and sub-earth duct in well. A, A, funnel taking air into well; B, B, B, duct leading air from well to curing room, C; D, ventilator.
Fig. 6.—Showing vertical sub-earth duct. A, brick chamber 25 to 30 feet below surface and 40 inches inside diameter; B, tile or conductor pipe of galvanized iron; C, main shaft of funnel; D, brick chamber at upper end of duct. The circle and section represent a cast iron plate to cover brick chamber A.
Fig. 7.—Showing method of cooling air with cold water. A, curing room; B, duct leading into curing room; C, E, galvanized iron drums, air and water tight; F, thirteen or more 5-in. chutes of galvanized iron, 10 ft. long, soldered water tight to drums to cool air; D, main air duct from funnel; G, water pipe from pump; H, overflow pipe; I, damper in main shaft; J, 4-inch pipe leading from blower to use when there is no wind; K, smoke stack of boiler; L, ventilator from curing room to smoke stack; N, boiler.
Fig. 8.—Showing how funnel and vane may be mounted. A, funnel; B, shaft of funnel; C, C, C, 1-inch gas pipe; D, D, 1½-inch gas pipe; E, cap for support of 1-inch gas pipe; F, G, H, and M M and N N are stays of band iron bolted together and to the sides of the shaft to support the axis of the funnel; J, weather collar to turn rain out of shaft. K, L, band iron to stiffen vane and attach it to funnel.
CONSTRUCTION OF WOODEN CURING ROOM.

The construction of the curing room should be on the principle of cold-storage buildings. The studding outside should be covered with matched sheathing and drop siding, with a layer of water-proof paper between. For the inside, a layer of matched sheathing is first nailed to the studding, then strips of one inch in thickness by two inches in width, to which are nailed two thicknesses of matched sheathing, with a layer of water-proof paper between. The space between the studding should be filled with cork or sawdust or some similar material. The inner spaces must be closed air-tight at the ceiling and floor.

The ceiling should consist of two thicknesses of matched lumber laid with tight joints with the layer of water-proof paper between.

In the construction of the curing room floor there are certain fundamental conditions which should be observed. The cooling effect derived from the ground temperature should be utilized. Therefore the floor ought always to be made of some good conductor so that it will be always cool. The most available material for this purpose is the solid concrete with the same finish as that recommended for the make room floor. To avoid the danger of cracking the cement, it may be best to dig holes twelve inches square and a foot deep where the supports for the cheese tables are to come, and fill them with concrete so as to form piers to carry the weight.

METHODS OF COOLING THE AIR IN CHEESE CURING ROOMS.

It is plain that no matter how perfectly a curing room has been constructed, its temperature must rise steadily higher and higher as the summer advances. If, therefore, the temperature is to be held down, some cooling device must be adopted. There are a number of methods by which this cooling may be effected. Stimulated by the energy of Mr. E. L. Aderhold, State Traveling Cheese Instructor, the possibility of utilizing the lower temperature of the sub-soil and of the ground water have been put to a practical test at a number of factories in this state,
with very gratifying results. Referring again to the papers which you hold, there will be found figures with foot-notes as presented in the Wisconsin Experiment Station Bulletin, No. 70, by Prof. F. H. King.

These cuts show various types of available methods applicable to the different conditions found in different sections of this state. In Figure 4 is shown a section of a cheese curing room and horizontal multiple sub-earth duct, made of 13 lines of 6-inch drain tile, laid in two tiers. This duct is 104 feet in length, placed 12 feet below the surface of the ground.

Quoting from Professor King in the bulletin referred to, we find the following:

"Only the lower lines of tile have the greatest cooling effect, because these are in the closest contact with the coldest soil. The lines of tile above the bottom are nearly cut off from the cold ground below by the air-spaces formed by the lower lines of tile, and the soil above them is relatively warm both from the heat brought in by the air and that coming down from above.

"Instead, therefore, of using thirteen lines of 6-inch tile in two or three tiers, one above the other, a single row of larger tile is likely to give as cool air and not to impede the flow of air so much. I should recommend, therefore, for the horizontal sub-earth duct 12 feet below the surface, either three rows of 10-inch drain tile or five rows of 8-inch tile, 100 feet long.

"If the digging is done by hand and it is not desired to remove so much dirt, then the trench may be dug narrower and a foot or two deeper and the tile placed one above the other. As each line of tile will be in direct contact with the cold earth on both sides, an even better cooling effect will be produced than where the tile lie side by side at a higher level."

BOILER AND GENERAL FITTINGS.

I believe it to be false economy to equip a cheese factory with the self-heating vats. I know of several small factories which get along admirably with such apparatus, but a steam boiler, properly insulated on the outside, requires less labor in firing, insures more uniform and exact temperature in the cheese vats, and, best of all, provides the operator with live steam and hot
water for cleaning purposes. The cheese maker with a high appreciation of cleanliness and a due regard for lessening his daily labors will, I think, agree with me that the boiler and engine are hardly to be dispensed with.

In the matter of vats, they should be equipped with large gates and some sort of convenient tilting device, affording an easy and rapid means of tilting and draining.

Automatic curd agitators are a necessity. The "agitator" is superior to hand labor for the following reasons: 1st, the curd is kept in constant motion from one end of the vat to the other, allowing it to cook more evenly than when stirred by hand; 2d, by this process of gentle and constant stirring the curd is not crushed or squeezed, thereby securing an increased yield of cheese, and of superior quality; 3d, the saving of labor whereby one man can perform the work of two or three when two or more vats are used; 4th, that without any further expense the machinery which runs the agitator also pumps the water and supplies the power for the curd mill.

One of the most important auxiliaries in cheese making is the curd sink, supplied with racks. One prominent Canadian cheese buyer has said that a large share of the success achieved by Canadian makers was due to its use. It should be supported on legs with castors. In no other way can the work of draining, milling, airing, and salting be accomplished so easily and perfectly as in the sink. In the purchase of a curd mill, do not make the mistake of buying any of the peg mills now on the market. Secure a knife mill easy of operation and simple of construction, one that cuts the curd into uniform cubes and does not tear or mash the curd, working injury to both the texture and the yield of the cheese.

In the selection of a gang cheese press, it ought always to be a continuous pressure. The adjustable steel frame in which the side rails are laterally movable has distinctive features which up-to-date cheese makers will appreciate. Crooked cheese are an impossibility in this form of press. Hoops are not subjected to the severe side strain due to "bulging" and will wear longer. The diameter of cheese can be changed without having to reconstruct or change the frame or to buy a new press.

There are a host of tools of minor importance, convenient
about a make room, but the description of which would be so long that it is better not to mention them in a paper of this kind.

Every cheese factory should have a sterilizer and dry room. This can be most economically located near the boiler where the heat of the boiler will serve to dry the utensils. The sterilizing oven will be found very serviceable in the proper cleansing of starter-cans, pails, dippers, faucets, etc., etc.

A power force pump will save time and many a back-ache, and when supplied with hose connections may be of inestimable worth in case of fire. To those makers who delight in a neat, clean factory, the power pump equipped with hose of sufficient length to admit of moistening down the drive about the factory before the arrival of the morning milk wagons, will be much appreciated. Five minutes’ work with hose and cold well water on a hot, dusty drive around the factory will prevent dust and dirt from blowing into the building and upon the utensils, and at the same time tend to freshen and cool the atmosphere in and about the building.

**WHEY TANK.**

The whey tank should be lined or made of galvanized iron in order that it may be kept clean and sanitary. It should be constructed above ground at considerable distance from the factory; equipped with sewer connections so that it can be drained and washed out daily. To do away with a breeding place for flies and to prevent rain, dirt and dust from entering the whey, a good tight cover should be provided. Make this cover in halves, on hinges fastened to a center piece, so that each side can be opened towards the center of the tank. A skim-milk weigher will facilitate an equal division of the whey and tend to keep the surroundings clean and free from the mud hole so often found in front of the tank. The whey should be scalded to keep it sweet and the tank scrubbed and steamed daily. The ground surrounding the tank ought to be paved in such a way that the drip, if there be any, will pass off into the sewer.

**BATH ROOM AND OFFICE.**

Last, but not least, the factory to be complete should have a bath room and office. A room four by eight feet just off the
office room, with a floor of galvanized iron and a bath tub equipped with hot and cold water, is a most desirable thing to have.

Cleanliness is a virtue practiced almost universally throughout the animal kingdom; the only exceptions we can think of just now are the swine, some dairymen and a few cheesemakers. Personal cleanliness on the part of the maker becomes a mark of distinction before the patron and aids in increasing the cheese maker's honor.

I have often heard factory proprietors complain that the cheesemaker did not keep up his books and records of the factory's business in a neat and orderly manner. No man should expect scientific and scholarly book-keeping of one forced to balance the flat side of a cord wood stick over the corner of a vat to suffice for a writing desk.

The modern cheesemaker is a business man and should have the conveniences usually accorded a man of that profession. Give him a small, light, airy room away from the heat and noise of the factory proper, fitted up with a desk or writing table and an easy chair. It will prove a good investment.

Do not put a bed in this office room for your unmarried cheese maker. Secure a decent boarding place for him. Do not build living rooms over any part of the factory or adjoining any side of it for your married cheesemaker. Provide a decent house for him, situated conveniently near to his work.

He labors for you seven days in the week for which it is said the Lord has no mercy on his soul. If this be true, he is surely entitled to some of the comforts of this life. He should have a home so that he may rest, improve his morals, keep a clear conscience, retain the respect of his neighbors, secure a competency of this world's goods and thus live to a good old age.
DISCUSSION.

Mr. Van Leeuwen: Is a galvanized iron whey tank very satisfactory?

Mr. Baer: I do not know what the life of the galvanized iron whey tank is, but I do know that so long as they last, they are more sanitary and more easily kept in condition than wood.

Mr. Van Leeuwen: I haven't found them near as cheap as a good tin whey tank, because they will not last with us. Of course, if we kept the whey perfectly sweet, it might be different, but in some cases it will get a little sour. We elevate all our whey, and pasteurize it. We have been using our old vats. They commence to leak a little bit, and we mend them and elevate them and use them for whey tanks, and put new vats into the factory. I believe that the galvanized tank is not a success, they do not last more than two or three years, and a tin tank will last a long time.

The Chairman: It is a good one if it does last two years, if you use it the year around.

Mr. Baer: I do not know what kind of galvanized tanks you people buy. We have galvanized tanks at the Wisconsin Dairy School that have been used for whey and skim milk for the last ten years, and they are still in first class condition. I think they have cost us thirty-five cents to solder up one hole a couple of years ago, and I know of several galvanized iron tanks, properly taken care of in different cheese factories, that have been standing three, four, five and six years. My experience among the cheese factories of Wisconsin has taught me that it requires considerable work to keep a wooden tank in a cleanly condition, and makers are apt to let them get pretty bad and they leak more or less, especially in the spring of the year when only a little whey is run into the bottom of the tank for a week or ten days. They neglect to tighten the hoops or to caulk up the seams at the top of the staves, and there is more or less whey all around the outside of the tanks.

Mr. Alvis: Would you prefer a tank for water works, or just a force pump for the water supply of a factory?

Mr. Baer: Oh, I should prefer a tank to a force pump, an
elevated tank. I should want some sort of a power pump to get the water into the tank.

A Member: Would an underground curing room under an ice house be a good plan?

Mr. Baer: I think I would prefer to have it above ground.

Mr. Aderhold: I know of some cases where the room is simply divided and one side of the partition has the ice in it and the other side has the cheese. There is an opening at the top and the bottom of the partition and the cool air goes through the lower opening, and the warm air works back through the upper one.

Mr. Swingel: I have an ice house connected with the west side of my curing room and I do not find any benefit as far as cooling the curing room unless I put ice in the curing room. My ice house holds about thirty tons.

Mr. McCready: Mr. Swingel has a shelf in his curing room which he fills with ice every day. He is handy to the Wisconsin river. He keeps his room cool by having this ice rack.

Mr. Wallace: Which is preferable, to put in weighers for the whey or let the farmers help themselves?

Mr. Baer: I think some sort of a scheme, milk pump or weigher, facilitates an equal division of the whey and stops controversy among the patrons in that respect and keeps things in a more cleanly and sanitary condition. Of course, I mean one that works correctly.

Mr. Wallace: What can they be gotten for?

Mr. Baer: Check pumps, I think, are sold for about $50 each.

Mr. Alvis: Suppose a patron has lots of milk and he doesn’t care for the whey, so that there is some left, what would you do with it?

Mr. Baer: I would have sewer connections with the whey tank and let it run out every day. I would put in the septic sewerage system, and let it run off as far from the factory as I could get it.

Mr. Alvis: Do you think that system would take up all the whey that would not be taken home in the best season of the year?

Mr. Baer: I never had any experience with a cheese factory where the patrons left much whey. As a rule, it is short.
Mr. McKinnon: I want to tell you what I did this summer, and it gave the best satisfaction to my clients of anything I ever did, and that is, I built over my whey tank a little building, so that when a man stands there and pumps his whey he is protected from the weather, and also his wagon. I have built up a wind-break about ten or twelve feet high, so that the horses are protected by it. It didn’t cost much, but it has caused every man to smile when he came to the factory and saw how it worked.

Mr. Alvis: Did they take any more whey?

Mr. McKinnon: I think very often they did take more whey.

Mr. Aderhold: I was at one factory last summer where they had an old cheese vat beside the whey tank. They had no tile drainage of any kind, and every day the whey tank was cleaned out and the washings were put over into the little tank beside it and when that was filled up pretty well, somebody would pump it into barrels and haul it away, and I suppose they dumped it onto somebody else’s land, but at any rate it was a good way to keep the whey tank clean and to prevent any bad smell around the factory.

Mr. Baker: How do you prevent these whey tanks freezing in the fall of the year?

Mr. Alvis: It would be a good idea to put a building over it and a stove in it.

Mr. Aderhold: You might put in a furnace.

Mr. Wallace: I kept my whey tank out till Christmas, and it never froze.

The Chairman: In case it is elevated, it might be necessary to put a stove under it. Where it has been heated up pretty well, or pasteurized, it doesn’t freeze very much.