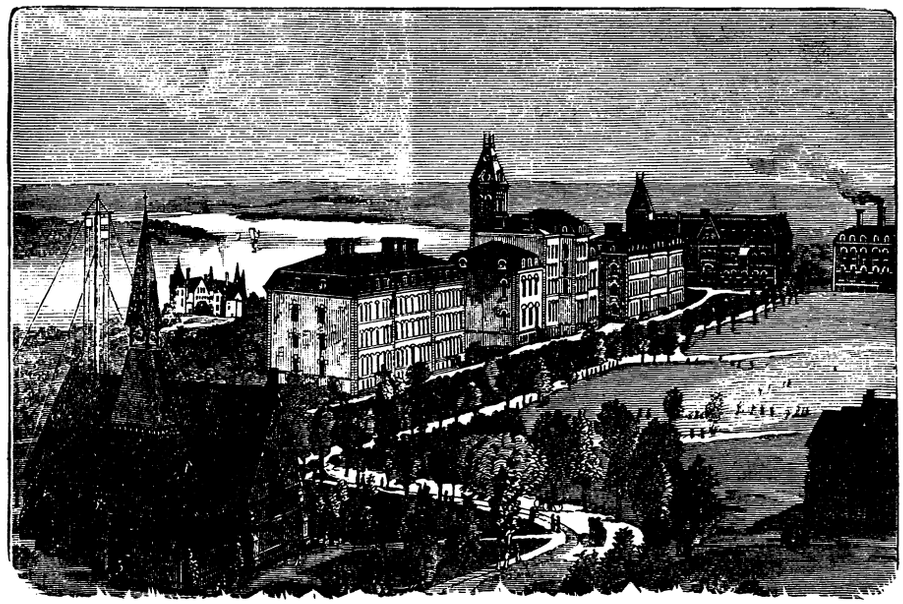
and fresh swill, fed with a suitably prepared ration of other articles of food to healthy cows, having clean, roomy stables, and plenty of exercise, is injurious to the milk, but it is this: Is wholesome milk produced by feeding swill under the conditions in which it is fed in practice, and must be fed in order to make it a profitable industry?" And finally, as Professor Rohé so well expresses it, "a scientific solution of the question will not be furthered by prejudiced appeals or unreasoning denunciation. Patient investigation, keeping in view all circumstances of the question, and avoiding all one-sidedness in considering the matter, will alone bring about the object desired."

With these suggestions to those having in charge the experiment stations, we leave the subject with our readers. We shall be glad to record any observations or experiences which any one may send us in the future; so that, even if public interest cannot be sufficiently aroused to bring about a proper investigation of the subject at the present time, it may, by a reminder from time to time, be kept alive until the demand for such an inquiry becomes irresistible.



NORTHERN HALF OF CAMPUS FROM SAGE COLLEGE, CORNELL UNIVERSITY.

THE SIBLEY COLLEGE EXTENSION, CORNELL UNIVERSITY.

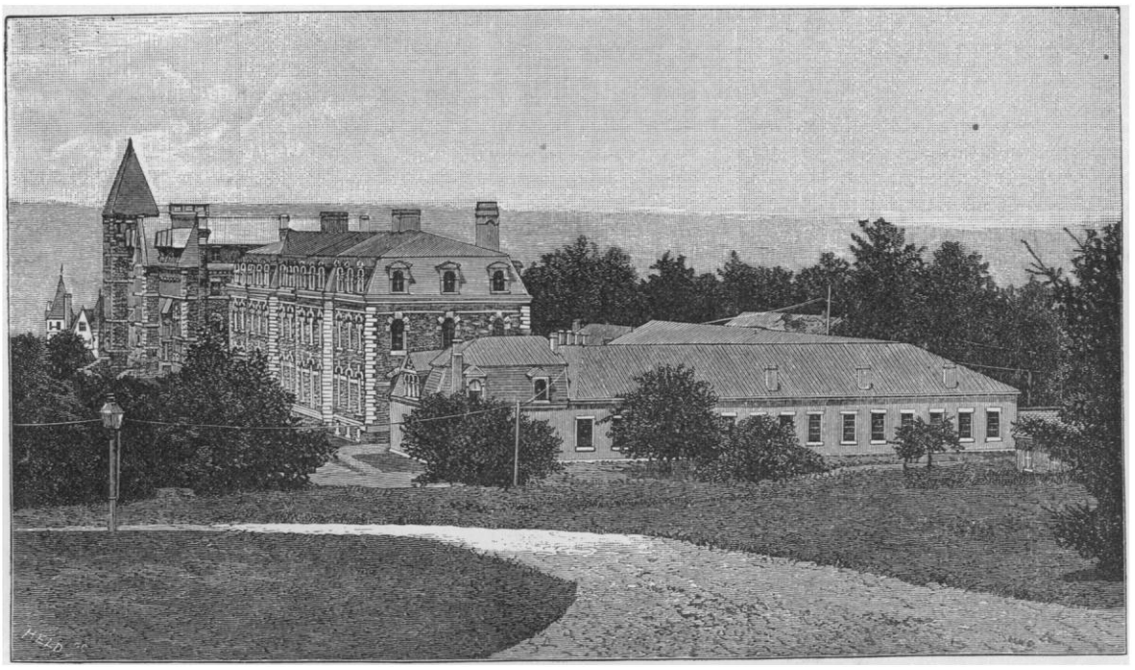
THE extraordinarily rapid growth of the Sibley College of Cornell University since its re-organization and expansion of two years ago, with the introduction of the course and department of mechanical engineering under Professor Thurston, the extension of its shops and department of the mechanic arts under Professor Morris, and the formation of a carefully planned department of the graphic arts under Professor Cleaves, — all under the general direction of Dr. Thurston, — has compelled a corresponding extension of the accommodations for class and lecture rooms, and especially for shops and drawing-rooms. Two years ago, before this re-organization had taken effect, the number of students taking this course was very small, varying from twenty to thirty, perhaps. Last year the freshman class, including mechanical engineers in regular course, in electrical engineering, and special students with the resident graduates, numbered above eighty. The number of applicants this year is so large that the limit for the entering class is necessarily fixed by the capacity of the shops and buildings, including the mechanical laboratory. It is probable that the numbers received in all classes will exceed two hundred and fifty. When all classes are filled on the basis now taken, the college will number something over three hundred students.

But it was originally designed to accommodate very small classes; and, notwithstanding the fact that within a few years it has been more than doubled in extent, it could only accommodate, up to the present time, about two hundred students. To prepare for the incoming class of 1887, therefore, it became necessary to still further extend its buildings. It was thought advisable to more than double the size of the wood-working shops, to increase facilities for instruction in the other shops, and to secure fifty per cent more space for drawing-rooms. The freehand-drawing class alone, this year, which includes students from several other courses not included in the mechanical engineering departments, is expected to number over two hundred and fifty students, and occupies two floors of the main building. The wood-working part of the establishment must accommodate between one hundred and one hundred and twenty-five men, and the other shops as many more. To meet this emergency, a new building was planned, into which all the laboratory apparatus used in either instruction or research could be removed; thus giving ample space, for the present at least, for the extension of the shops, by giving to them the considerable space so vacated, while the remainder of the new structure could be devoted to the purposes of the departments of drawing and machine design.

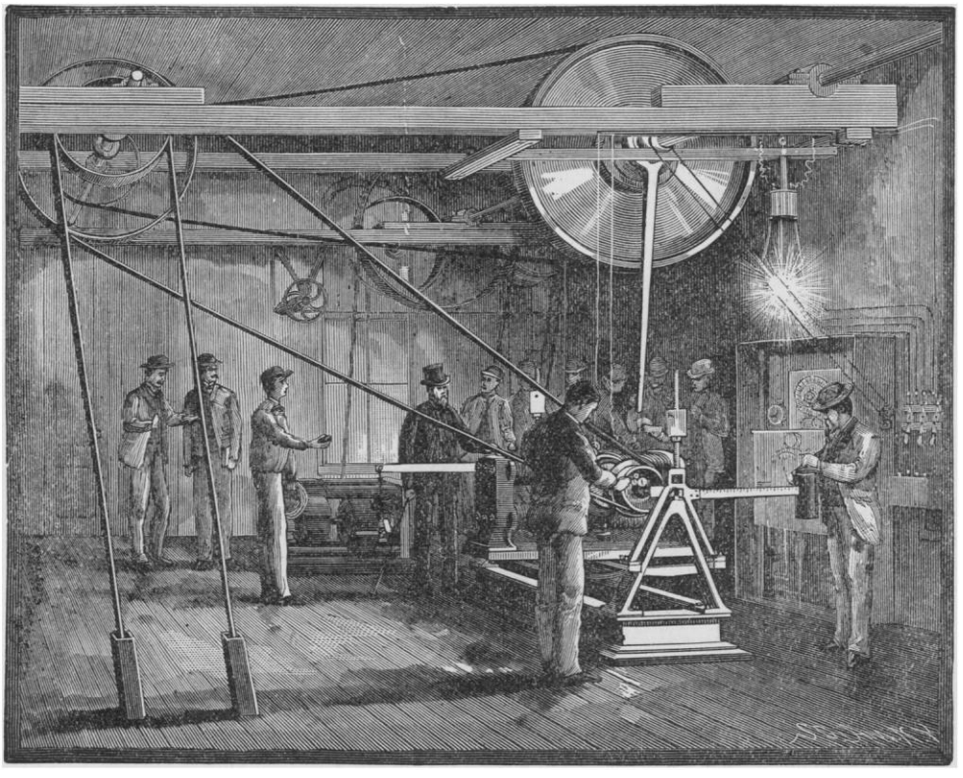
The engraving on the next page shows the extent and arrangements of the departments of the original group of Sibley College buildings. The main building is seen at the front and left; while beyond it is the laboratory building, in which instruction in chemistry and physics, and the principal part of the tuition and practice in electrical engineering, are carried on. The dynamo-room is in the rear of the main building of Sibley College, and contains a considerable number, and hardly less variety, of dynamo-electric machines, used in the course in electrical engineering principally. The lower floor of this building is devoted to the purposes of library and reading-room, museums, a lecture-room for the junior class, and the rooms of the professor of the mechanic arts. The second floor contains two large drawing-rooms, the lecture-room of the professor of mechanical engineering, and the rooms of the director. The third floor is occupied by the rooms of the professor of drawing, — his office, lecture-room, and two large drawing-rooms like those below. All these drawing-rooms are expected to be occupied by the lower classes; while the senior and junior-classes will have their drawing-rooms in the new structure, now just occupied, which building will also accommodate the resident graduates, professors, and others coming to Cornell for advanced work in this department of the university.

The accompanying plans present the arrangement of the building forming the last of the Sibley College extensions, and now just completed for occupation at the beginning of the college-year 1887–88. It is calculated to be of sufficient size to accommodate the ac-

cessions of the present year. Should the limit of numbers admitted be increased another year, further extension will be again necessary. This number (one hundred in the freshman class and about three hundred total) cannot, however, be increased until the science laboratories are enlarged. The physical laboratory, which was built to give ample accommodation to the classes of three or four years ago, and to work forty or fifty students, was last year called upon to receive eighty, and must this year accommodate one hundred. Further extension must precede any further increase in numbers received there; and as this is an essential part of the work of the mechanical engineers, both of the regular and the electrical courses, this limits the number which can be taken as that of the entering classes in the Sibley College as effectively as the size of the college itself. The number of students in the technical courses of Cornell University this year is not far from six hundred, in the university a thousand undergraduates.



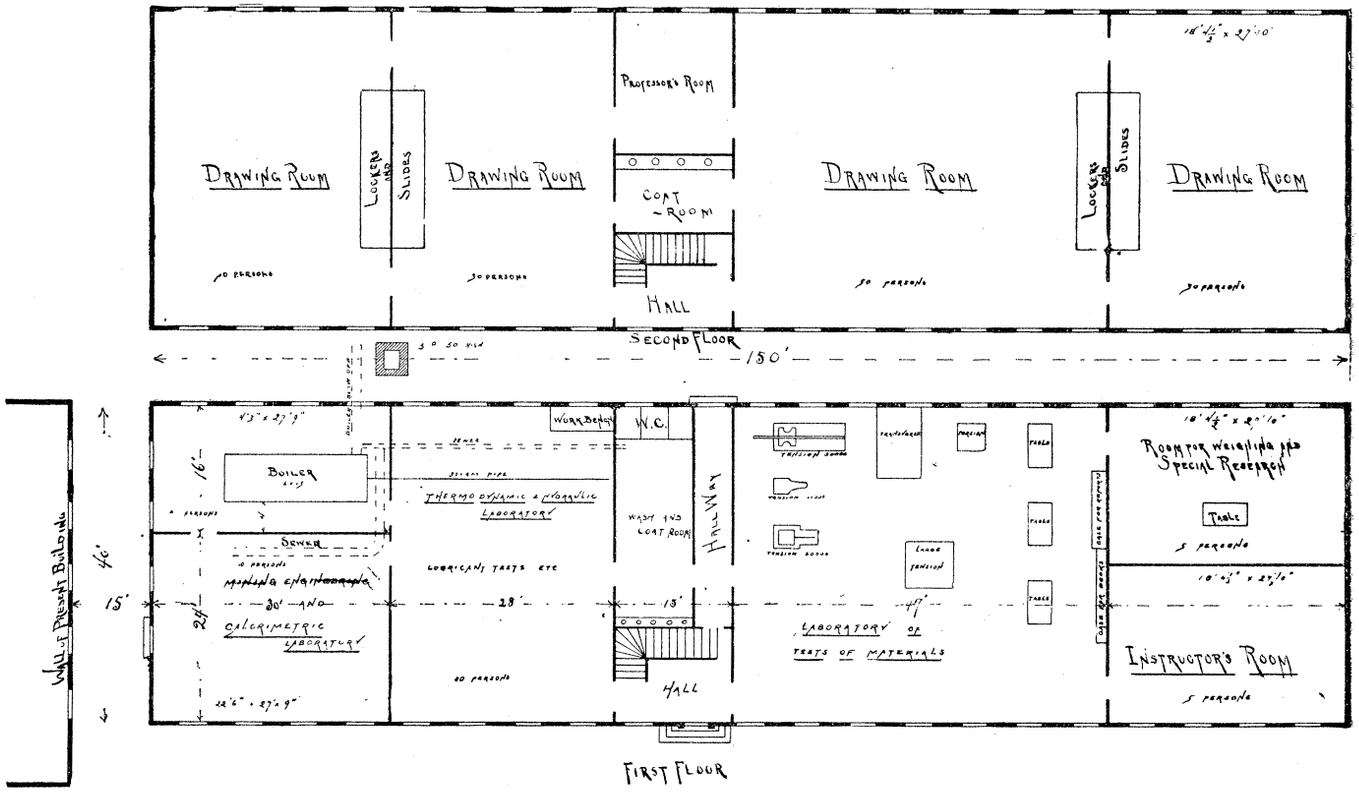
SIBLEY COLLEGE (FROM THE EAST).



SIBLEY COLLEGE DYNAMO AND ELECTRICAL ROOM.

Referring to the plans which are given below, it will be seen that the whole upper floor, an area 150 feet long by 40 feet in width, is devoted to drawing. The larger rooms are for the use of the lower, and the smaller for the higher classes. Ultimately it is supposed that the whole building may be appropriated to the work in machine design and experimentation, the lower floor being used for the pur-

poses of research, and furnishing the data used on the upper floor in the designing of machines and structures. A room is set apart on the upper floor for the use of the professor having direction of the work, and taking charge of the building and apparatus. A toilet and coat room is provided here, also, for the use of such students as work on this floor. All these rooms are without other finish than kalsomining on the walls; but this is of a light-buff shade, and the ceilings are finished in oiled yellow pine, with the heavy beams supporting it painted a blue-white. Thus the rooms are all well lighted, and are exceedingly bright and cheery. All the heating-pipes are placed overhead; and it is expected that the experience already had with this arrangement will be here repeated, and a thoroughly equable and pleasant temperature obtained. The steam-pipes are also out of the way, and desks, tables, benches, or other furniture can be placed at the windows, and no annoyance felt from the uncomfortable proximity of the source of heat. Lockers are provided for the drawing-boards, while the tables are constructed with drawers to take in the small apparatus; and cases on the walls will be arranged for T-squares and other instruments either too large to be otherwise cared for, or, being the property of the college, such as must be accessible to the instructors at all times.



SIBLEY COLLEGE EXTENSION, CORNELL UNIVERSITY.

The lower floor is constructed and is finished very much like the upper; but it is appropriated to a most interesting and novel part of the work of the college. In the middle of the building is a transverse hall out of which opens the toilet and coat room. At the right, on the east side of the hall, is a large room, of similar size to the great drawing-room overhead, in which are placed all the testing-machines for use in investigating the strength and other properties of the materials used in mechanical engineering and construction, including several tension-machines made by Rhiele, Fairbanks, Olsen, and Brown & Sharpe, a transverse testing-machine built by Fairbanks, an 'autographic recording testing-machine' of the Thurston pattern, designed by Bond, and built by the Pratt & Whitney Company, two sizes of Thurston's lubricant testing-machines, dynamometers of various types and sizes, and miscellaneous apparatus of similar character. Farther toward the right, and at the east end of the building, are a room for an instructor and for the use of students working up their data, and another room for special research, which will contain the balances, the few pieces of chemical apparatus needed for gas-analysis, and other work which can best be done here rather than in the general and larger laboratories. The centre of the large room is reserved for a very heavy testing-machine, which it is proposed to place there at some future time.

At the left of the hall, and in the west end of the building, is a group of rooms having special interest to the engineer engaged in work related in any way to steam-engineering. The largest room of the three is devoted to tests of engines, steam-pumps, and various motors (steam, air, gas, and water driven), which will be set up permanently, and to the temporary mounting of small motors sent in for test. A steam-pipe from the boilers in the adjacent apartment, and connecting also with the larger boilers in the main part of the college group of buildings, supplies steam to the steam-engines and steam-pumps. Amongst the machinery here mounted are a straight-line engine built in the college workshops, a Westinghouse engine, a Brayton petroleum-engine, an Ericsson engine (given to the director by his friend, its distinguished inventor), various makes of steam-pump of the best types in the market, and other apparatus and machinery that properly fall into this class.

At the extreme west end of this floor are the boiler-room, in which are the heating-boilers, which are placed there as a reserve and for experimental purposes, and all boiler accessories. A space is reserved at one side for the large experimental boiler, which is proposed to be used in making boiler trials on a larger scale, and for investigations at pressures exceeding those commonly employed, and ranging up to possibly five hundred pounds per square inch. The second of these two rooms is appropriated to calorimetric investigations, including the calorimetric tests of the quality of steam, which are to-day — more than fifteen years after their introduction in this country by Emery and Thurston, and abroad by Hirn — just coming to be recognized as essential to any satisfactory determination of the efficiency of boilers. The various forms of calorimeter now in use will be set up here, and made useful both in regular instruction, as is all the apparatus of the laboratory, and in special researches involving their use. Just outside this end of the building

is a chimney seventy-five feet in height, and having a flue about four feet square, which will be amply sufficient to carry away the gases, and to provide good draught to all the boilers together. It is given this height, partly to give a strong natural draught, such as will be needed in investigations of the efficiencies of boilers at different rates of combustion, and to insure that the adjacent buildings, some of which may ultimately be carried up to a considerable height, may not interfere with its action, and may not receive gases blown from its top. The ceiling of these rooms, and floor of the upper portion of the building, are given the standard 'mill construction,' and consist of two floors of yellow pine, separated by an intermediate layer of cement. The floor is carried on heavy beams, and left unlathed and unplastered; the lower surface of the ceiling being given an oil finish, and the beams painted as over the upper apartments.

The structure is an example of a successful attempt to secure large, comfortable, and well-lighted rooms at small cost. The construction is as simple as possible, and the finish is of the most inexpensive character. The result is thoroughly satisfactory, if we may judge from the limited experience so far had with it.

CO-OPERATION ON THE CONTINENT OF EUROPE.

III.— AUSTRIA, ITALY, BELGIUM, SWEDEN, AND THE NETHERLANDS.

FROM Austria the answers to Lord Rosebery's circular (see *Science*, No. 220) are based on the reports of the inspectors of industries. In Vienna there are several societies founded by workmen, which, from small beginnings, have so developed that they now afford facilities of cheap supply to many thousand families. One of the most important of these associations is the *Arbeiter-Spar-und Consumverein* (Workmen's Saving and Supply Association) in Fünfhaus (registered as an unlimited liability company), founded in the year 1865 by fifteen working-men, and which now contains about 3,800 members. Any person, without distinction of station or sex, can become a member of the association. Nearly half the members, about 1,600, belong to the class of working-men, while the remainder are independent mechanics, tradesmen, small officials, pensioners, widows, etc. Each member pays an entrance-fee of 30 kr. to the reserve fund, and a subscription of 10 fl. for a share.

The members have the right of speaking and voting at the general meetings, of procuring goods at the stores of the society, and of claiming a share in the profits. In addition, each member is allowed to make savings deposits to the amount of 500 fl. These deposits yield an interest of six per cent, and can be withdrawn at any time, together with the interest, on giving notice beforehand. All goods bought must be paid for in cash.

At least five per cent of the net profits are paid to the reserve fund, so long as the latter does not amount to twenty-five per cent of the members' capital. Out of the amount which remains, interest at six per cent is paid on the shares, and, should any further sum remain, it is paid in dividends to members according to the amount of goods purchased by each during the year from the society. The association is managed by the board of directors, the council of inspection, and the general meeting. The board of directors, which is composed of the manager, the cashier, and the goods manager, are elected for a period of three years from among the members in a general meeting. The board of directors represents the society in its public dealings, and is charged with conducting all its business affairs. The members of the board receive a salary. The council of inspection, which is charged with watching over the management of the business by the board of directors, consists of fifteen elected members, who receive no salary. The general meeting has to consider and decide upon all matters of importance which affect the society, and these meetings are held quarterly. The accounts are balanced quarterly.

It seems that the governmental reports furnish no statistics of the number of co-operative societies in the whole of Austria. The only reliable information on the subject is found in a report drawn up in 1881 by Dr. Hermann Ziller, editor of the *Genossenschaft*, the organ of the General Union of Industrial and Provident Societies in Austria, of which union he is the founder and director.

The subjoined table gives the number of co-operative societies in lower and upper Austria, Salzburg, Tyrol, Vorarlberg, Styria, Corinthia, Krain, the seacoast, Bohemia, Moravia, Silesia, Galicia, Bukovina, and Dalmatia, in 1881:—

People's banks	1,129
Consumers' societies (selling food, clothing, etc.)	235
Societies for assisting artisans in buying materials wholesale	6
Societies for supplying agricultural implements, manure, etc.	14
Raw material and selling-depots	2
Selling-depot	1
Artisans' producing associations	41
Agricultural producing associations	61
Building societies	5
Trading societies	10
Insurance societies	2
Various	9
Total	1,515

All societies in Austria, of which the number of members is unlimited, and which seek to benefit them by carrying on business in common, are required, by a law passed in 1873, to be registered either as limited or unlimited liability companies; the measure of liability in the former case being fixed by their rules, which, however, do not generally make members liable for more than double the value of their shares, and their responsibility terminates by law after their membership has ceased for a year. In unlimited companies the liability extends through the second year after the expiration of membership. In 1881 something less than two-fifths of the societies tabulated above were registered with unlimited, and rather more than two-fifths with limited liability; about one-fifth were unregistered.

People's banks are the most numerous co-operative societies in Austria. As has been already seen in Dr. Ziller's table, there were 1,129 of those associations in 1881. They were unequally distributed over 10 different provinces; Bohemia having 425, Moravia 304, Galicia 140, and Lower Austria 128, the other provinces only contributing in numbers varying from 2 to 33 to the total. About half these societies were unlimited as to liability.

The people's banks may be divided into two groups. The first, the majority, are open to all classes, and their members are generally tradesmen, artisans, and farmers; the minority, which form the other category, are open only to officials. The total number of the latter kind of societies in Austria was 79, more than two-thirds of which are in Lower Austria, the metropolitan province. Only 696 societies made a return of the number of their members, which amounted to 296,648, giving an average of 426 members per society.

Austria has no co-operative societies for shipping or fishing. Of the 61 agricultural co-operative societies, 59 are dairies and cheese-farms. There is one co-operative association for bee-culture, and one for hop-growing. In 1881 five co-operative building societies existed. Their object was to provide dwellings for artisans. They were not financially successful, and are now in liquidation.

In Italy co-operation has gained much ground since 1883, though it has been known for twenty-five years. Before 1883 co-operative institutions were hampered by legal restrictions. The old commercial code did not recognize co-operative societies as such, and they had to exist as limited liability companies. The code of 1883, however, directly recognizes co-operative societies, and regulates their administration.

Instances of various kinds of co-operative associations are now to be found in Italy; but by far the most important, in regard to their numbers, capital, and success, are the co-operative or people's banks (*banche popolari*). Co-operative stores (*società co-operative di consumo*) for the purchase and retailing of provisions, fuel, and other necessaries of life, are fairly numerous and successful among the working-classes in cities and towns. In many cases their establishment is due to the initiative of friendly and mutual-benefit societies, and sometimes the two objects are combined by one association.

A law passed in 1870 exempts co-operative societies from the payment of *octroi* (or local entrance dues) "upon goods provided by them for distribution solely among their own members, for purposes of benevolence, and for consumption at the homes of those persons to whom the distribution is made."