LAYOUT OF A METAL WORKING PLANT

Thesis

By

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May 28, 1927.

Professor A. L. Merrill
Secretary of the Faculty
Massachusetts Institute of Technology

Dear Sir:

In accordance with the requirements for graduation we, herewith, submit a thesis entitled: "Layout of a Metal Working Plant."

We wish to take this opportunity to express our hearty appreciation for the assistance rendered us in our work by Mr. Frank Mesker and also by Messrs. Kolmer, Stevens, Hoefel, Allen, Wilcox, Leveranas, and Gribel, who aided greatly in the compilation of the data involved.

We further wish to thank Mr. David Houston of the firm of David Houston, Bond and Company of Newark, N. J., and The Truscon Steel Company for their helpful estimates on the costs involved in effecting the layout.

Respectfully submitted,

George C. Houston.

Francis A. Mesker.

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SUMMARY

SUMMARY

In order to determine the best possible layout for the metal working plant under consideration, in the event of their constructing a new building, we have conducted an exhaustive investigation of the present plant, the production processes, the business methods and policies of the company, the capacity of present and proposed plants, the cost of the proposed improvements and the best possible location for the new building.

We feel that the proposed layout of the new plant, as described and discussed in this thesis, will eliminate the disadvantages of the present layout and will have sufficient additional advantages, so that a decided increase in productive efficiency will result. The new layout also provides amply for the expansion of the business.

Although the plant is not running at full capacity just now, we have estimated that when it is operating at full estimated capacity under the new layout a saving in production cost of approximately $19,000. per annum will be realized from the increased efficiency of the plant. The annual savings will increase, of course, with production to a certain maximum point.

We find that the cost of the improvements will be about $179,000., if the new plant is built on the present site, while the cost will be only $95,500., if the plant

is built on another suitable location where land is cheaper.

With these findings in mind, we advise that a market analysis be carried out to determine whether or not there is sufficient existing or potential demand to make it possible to increase production to the point where the economies of the new layout will be sufficient to justify its existence. If such a market analysis proves satisfactory, we recommend that the business be built up as far as the capacity of the present plant will allow and that the new layout be then effected as proposed in this thesis.

INTRODUCTORY

LAYOUT OF A METAL WORKING PLANT

INTRODUCTION

Object of Investigation.

This problem deals with the changes in the layout of a metal working plant incidental to the construction of a new building to replace the present inadequate conglomeration of buildings. A new layout is necessary under these conditions since in the development of the present layout no adequate consideration was given to departmental relations, economics of layout and efficiency of production flow. In this investigation we have kept the cost of all changes continually in mind, since cost will be one of the most important factors in determining the feasibility of adopting the proposed layout.

Scope.

The proposed layout embodies the re-location of the departments of the plant with respect to one another and the re-location of the machinery within each department, in such a way as to meet the needs of that department and the outside demands of the other departments. Consideration of stores location, machine shop location, tool room location, intra-factory transportation, power requirements,

working conditions, and cost of changes was deemed essential to the proper solution of the problem. With the layout itself determined, investigation as to the most suitable type of building to house the installation was made and details regarding the building were decided. An estimate of the cost of erecting such a building was then secured. Finally, in order to provide for all contingencies, investigation was made as to the advisability of re-locating the entire building to take advantage of more favorable transportation facilities or better business conditions elsewhere.

Method of Procedure.

In order to study the business in all its phases and to secure sufficient data from which to determine the final layout, two weeks were spent in work at the plant itself. Following the investigation, all data was compiled in proper form and after a thorough study and experimentation with various layout schemes, the final plan was decided upon.

The first step was to lay out a ground plan of the land already occupied by the plant and showing the land available for expansion. Then a thorough survey of the plant was made and a list of all machinery compiled which showed the name, make, location, floor space occupied, and functions of each machine. A mnemonic system

of classification was applied to all machines, which grouped them by departments. Workbenches and storage spaces were classified in a similar manner.

Next, drawings were made of the floor plans of each of the three floors and basement showing the location of each machine on that floor. Flow sheets were then prepared for each department showing the location of machines and the routing of the work from raw material to finished products.

From the catalogs of the company, a complete classification and listing of all products was made, employing the mnemonic system used by the company. Figures on the usual amounts of finished stock on hand were obtained for standard steel sash, since these are the only products whose manufacture is sufficiently standardized to permit stocking. All other work was found to be special order work. Figures on amounts and kinds of semi-finished stock were obtained and also a list of amounts and kinds of raw materials carried. Figures on number of employees and on comparative speeds of standardized operations were compiled.

Finally a consultation was held with each of the three foremen. On the assumption that each department would be entirely located on one floor of the new building, each foreman was given a sheet of drawing paper

with a space equivalent to one-third of the available floor area ruled off to scale. He was told to arrange his machines in that space in any manner which he considered most efficient. These plans were collected and are incorporated in this thesis.

The size and scale of the final layout plan were then determined and a templet was cut to scale from cardboard to represent each machine. These templets were arranged on the drawing board and re-arranged several times until the most feasible layout was obtained taking into consideration all limitations and influencing factors.

Finally, a payroll analysis for a period of one month was secured from the company and estimated savings in production cost resulting from the new layout were computed. Estimates on cost of building on present location and on a new location were secured, so that a complete cost analysis was made possible.

HISTORICAL SKETCH

Like many other similar concerns, the company started in the late eighties in a very small way. The owners rented a small portion of another plant in which they started operations in the metal working line. Even the machines used were rented. After securing the confidence of the trade, they developed the business rapidly, purchasing their own factory and equipment and making additions to both building and equipment investment as the enterprise grew.

The metal working business has always been subject to frequent and drastic changes. One year metal working plants may be turning out cornices and house fronts, while a year or so later, the vogue for metal cornices having died out, they will be manufacturing cook-stoves or windows. The entire trade is at the mercy of the buying public. They make whatever the public wants. This situation arises mainly because the business is a special order business. An order for a certain job or article comes in. The article proves to be popular and results in repeat orders or new orders for the same thing. The company starts pushing it with advertising and produces it in quantity. Then, when the demand for that particular article dies out, something else takes its place.

The company started off making cornices and house fronts. During the war they made cook-stoves and tent pins. Now they are making hollow metal windows, steel sash, metal stairs, coal chutes, etc. There is no telling what trend the business will take in the future.

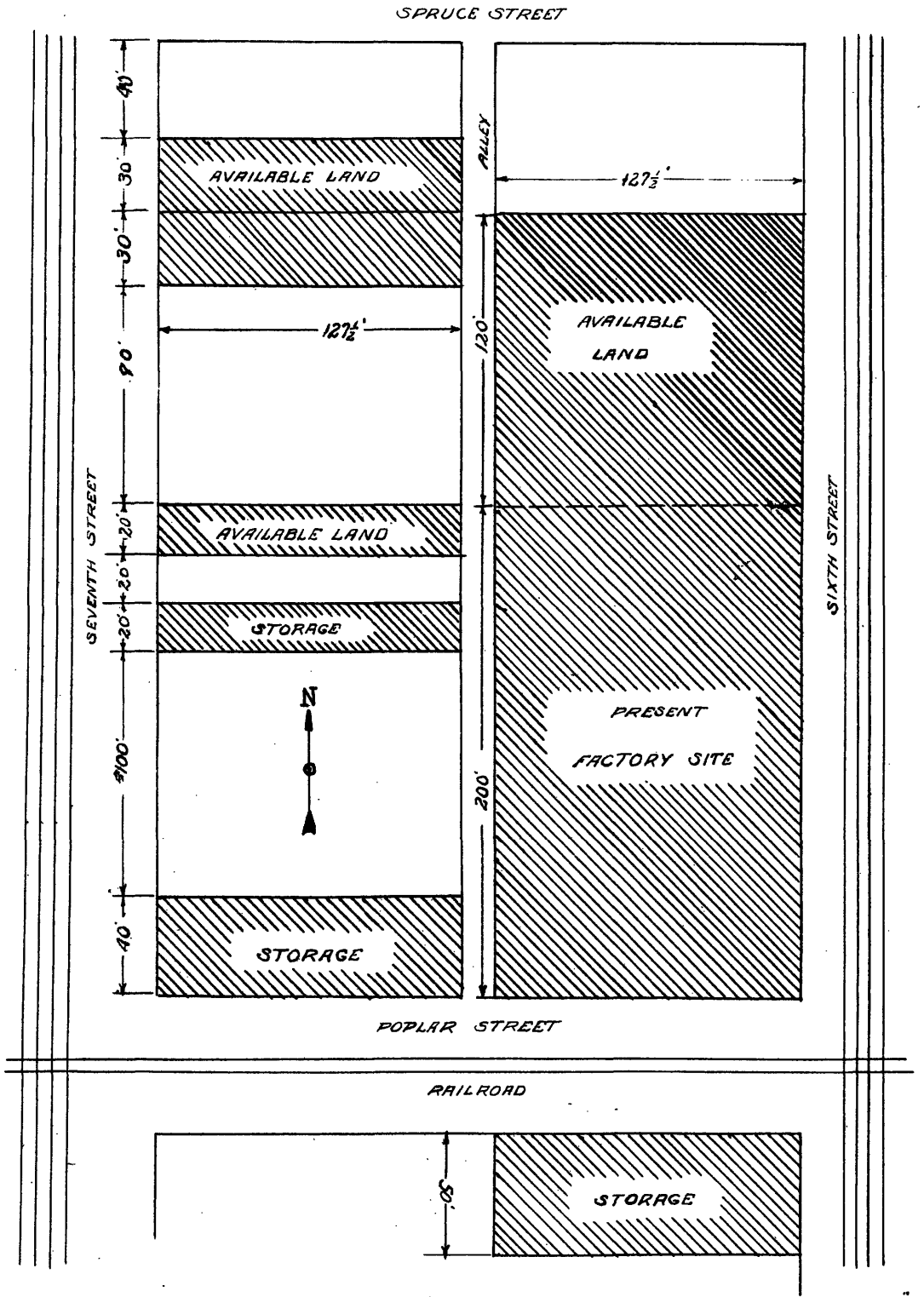
THE PLANT AS IT NOW STANDS

The present plant is an extremely odd conglomeration of semi-modern and ancient buildings with machinery and departments arranged in a more or less haphazard fashion. The ensemble is the result of an expansion policy whereby additions were made to the buildings or new and adjoining buildings occupied as the business developed, and its productive capacity outgrew its cramped quarters.

The plant is right alongside of a spur track of the Missouri Pacific Railroad, although there is no facility for loading directly from factory to freight car as the spur track has no branch leading to the plant. During the course of the business, several parcels of real estate adjoining the original portion have been purchased to allow for future expansion. The accompanying chart shows the real estate holdings of the company.

A detailed and accurate description of the buildings is hardly possible without producing a confused picture in the reader's mind. Let it suffice to give a general idea of the location of the various departments with relation to one another. At present there are three production departments and a machine shop. The three production departments are Sash Department, Stair Department

PROPERTY
OF
MESKER BROS. IRON CO.



CITY BLOCK Nº 146

SCALE: 1/16" = 10'

and Hollow Metal Window Department. The Sash and Stair Departments are on the ground floor or basement. The machine shop is on the first floor and the Hollow Metal Window Department partly on the third floor and partly on the ground floor. The remainder of the first and second floors is used for storage in process or for special work such as making fireproof doors, ventilators, etc.

The machinery consists mainly of heavy presses and punches of different makes. Most of the machines are rather old, the majority being purchased second-hand. The nature of the business, however, does not demand the latest kind of machines so that the majority of those in use at the present time are perfectly capable of handling the work efficiently and well, although a few have reached the point of obsolescence or are of too low capacity.

Several of the machines are used by more than one department and one in particular is used by all three. The location of the machines with proper consideration for the routing of the work and use of the machine by more than one department has never been properly attended to. Additions to machine equipment have been made from time to time and have been located wherever most advantageous at the time. Considerable lack of co-ordina-

tion results from this situation. Wasteful and avoidable movement of material from one department to another or up and down stairs is often necessary in order to use the machines as they are now situated. A single freight elevator handles all vertical movements. Handtrucks for lighter objects and travelling cranes, hand operated, for heavier pieces are used for horizontal transportation.

Work in process is stored in the plant, finished goods in an adjoining building which is used as a warehouse, Tee bar stock is stored alongside the cutting machines, sheet steel adjacent to the shears, and the rest of the stock in an underground stock room. The tool room and supply room is on the second floor. Practically all incoming and outgoing shipments of material are made by truck. An alley running through the property is very useful in this respect.

There is very little standardization in the business. The only department that is standardized and produces to stock is the Sash Department. Practically all of the work in the Hollow Metal Window Department and all the work in the Stair Department is special order work.

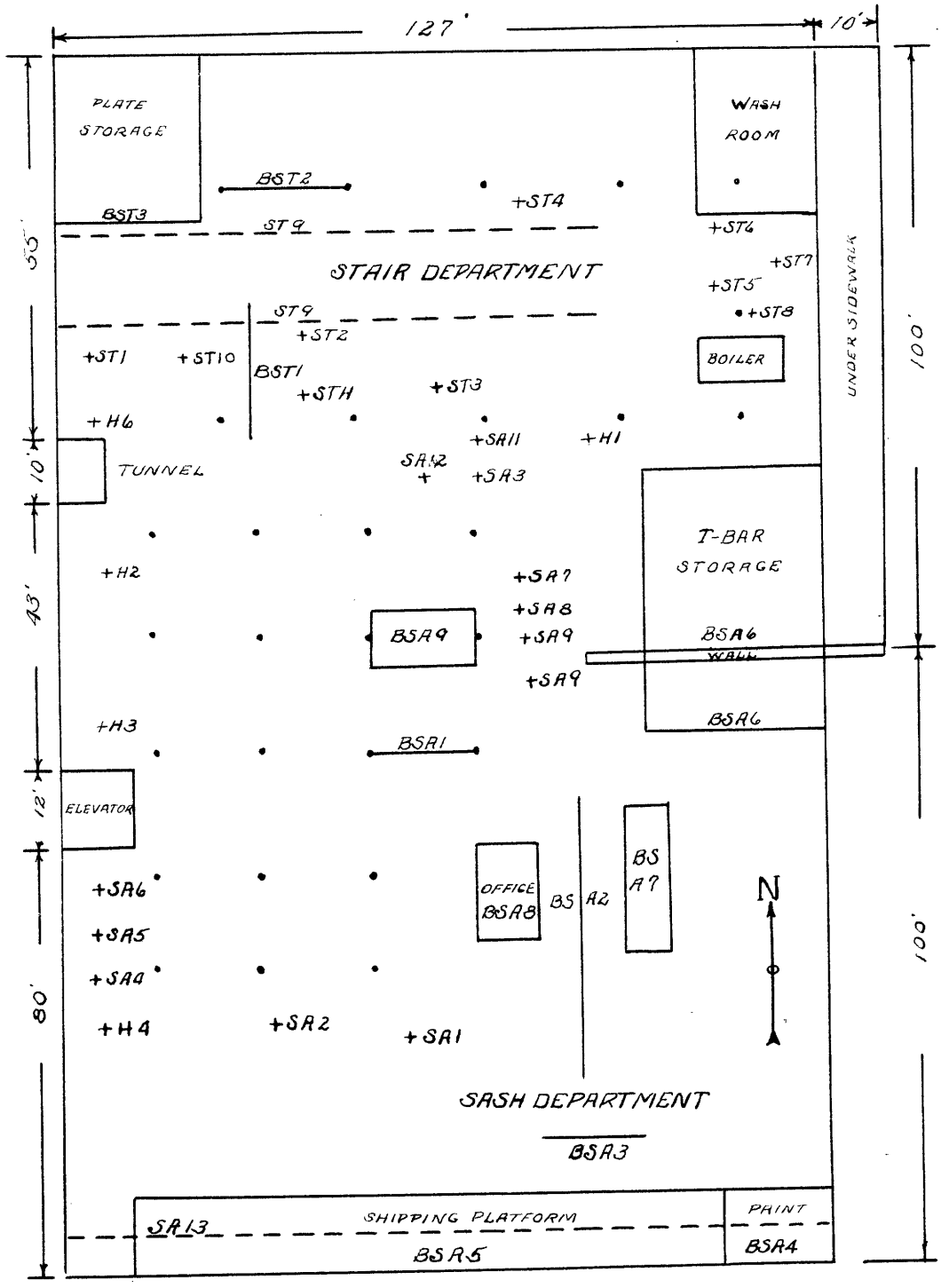
The plant employs about forty-five laborers, including foremen, and an office force of about fifteen, as shown on the chart on Page 92. The manufacturing processes are such that little skilled labor is needed ex-

cept in the machine shop, where a number of expert die-cutters and machinists are constantly busy.

A classified list of the products of the company is shown on Page 105. The catalog of the company is herewith attached in Appendix A.

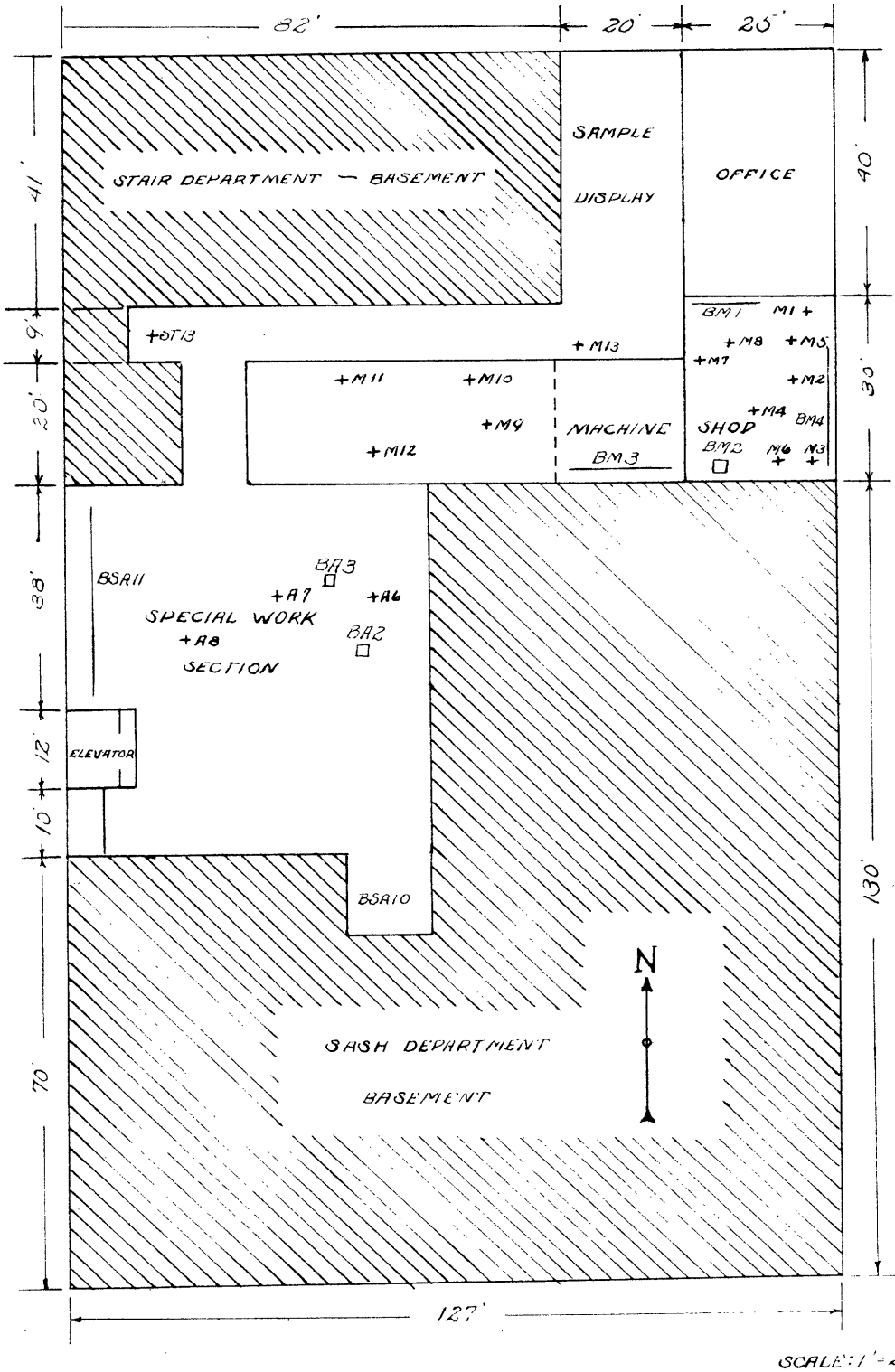
PLAN VIEW

BASEMENT



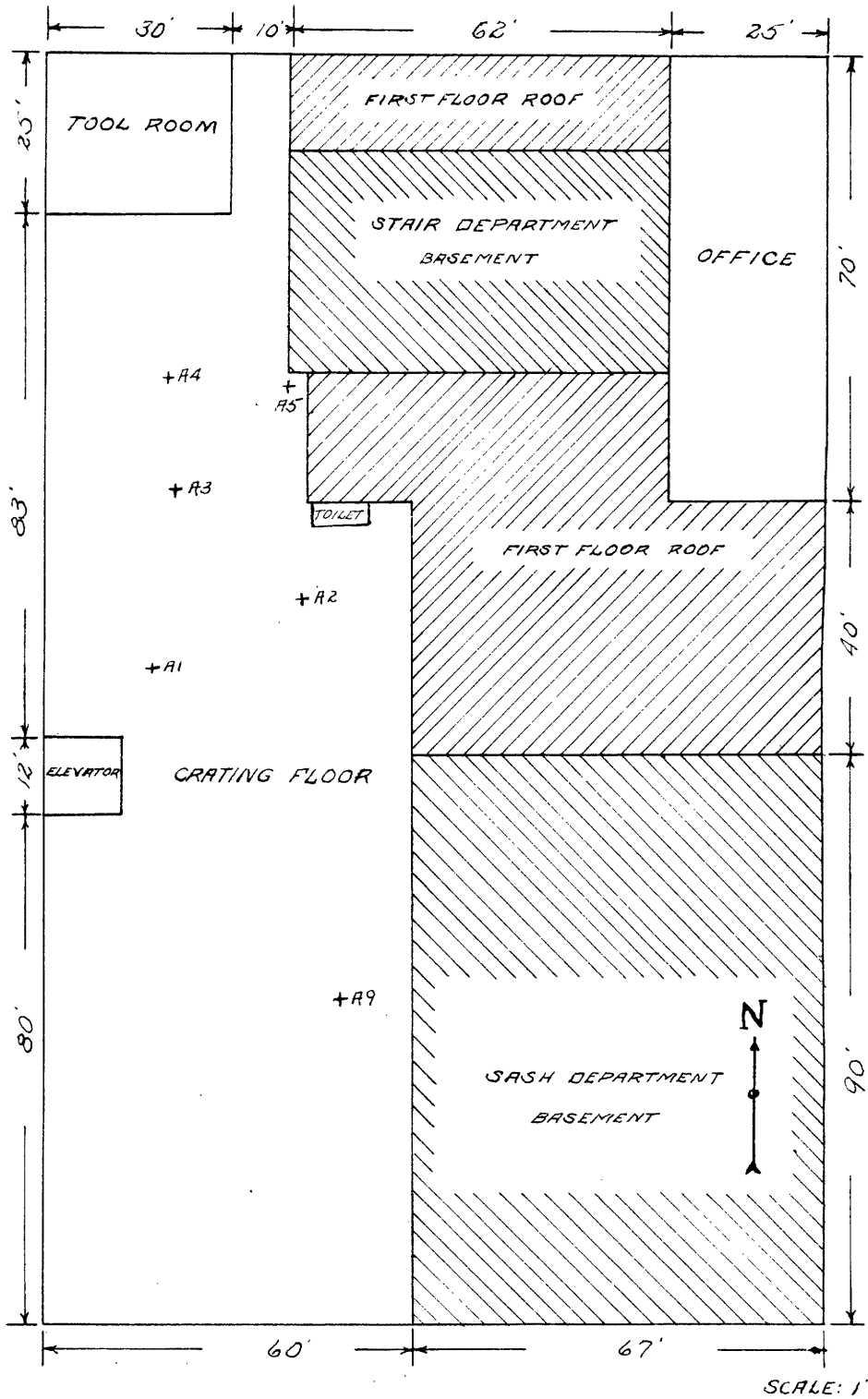
PLAN VIEW

FIRST FLOOR



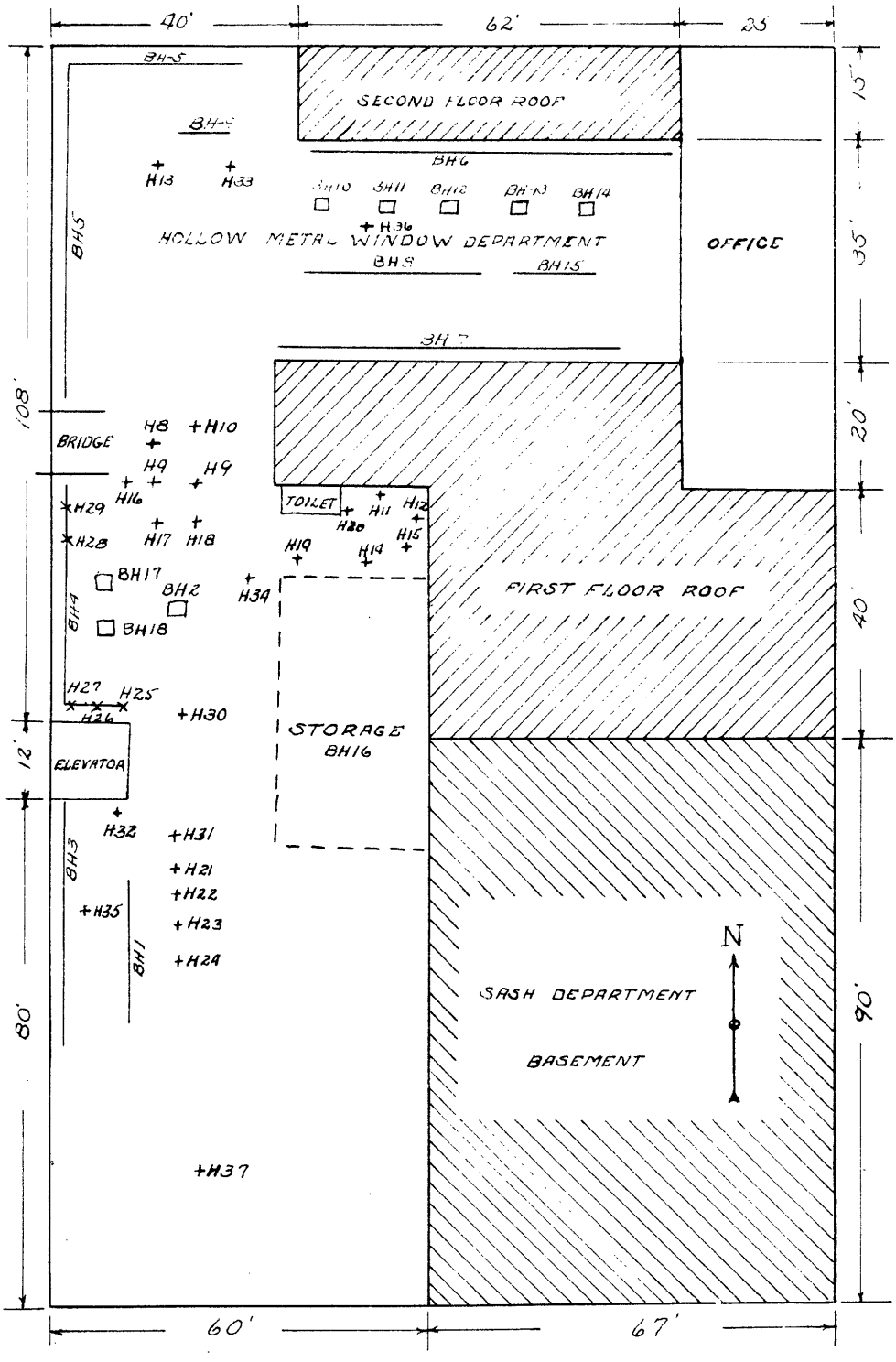
FLOOR PLAN

SECOND FLOOR



PLAN VIEW

THIRD FLOOR



PROCESSES OF MANUFACTURE

PROCESSES OF MANUFACTURE

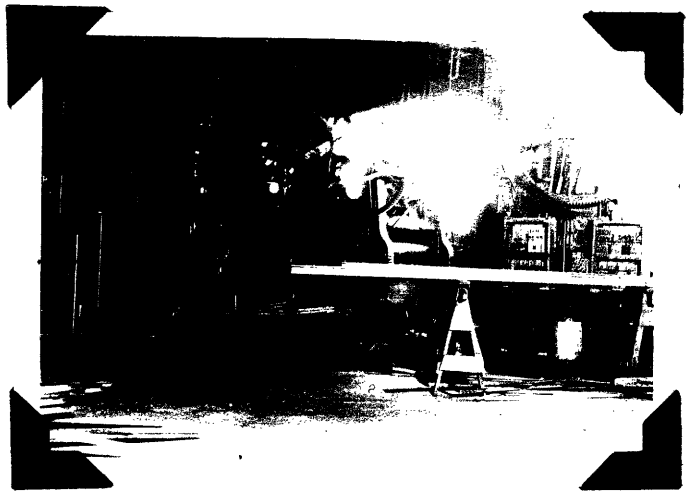
Standard Steel Sash.

Because of a fair degree of uniformity in builders' specifications for windows, standardization is possible to a limited extent in the Sash Department. The different articles produced in all their shapes and sizes are at least one-hundred and thirty-four in number, of which approximately one-half or seventy varieties are manufactured for stock. In other words, even although this is the only department in which standardization is possible, there is still a great deal of special order work, and the demand for each size or variety produced is only large enough to justify stocking in about 50% of the varieties.

In this department various types of steel sash are made. This includes sash with and without ventilators, casement sash, basement windows, etc. (see Appendix A. All types of sash go through the same operations in manufacture, namely: cutting and punching of Tee bar stock, for both frame and field bars, bending of frame bars, assembling of field bars in the frames, caulking, upsetting ventilators and fitting water angles, attaching hardware, fitting ventilators in sash, painting and drying. In the case of sash without ventilators, the sash go straight from the caulking machine to the paint bath. From data available, calculations were made to determine the rela-

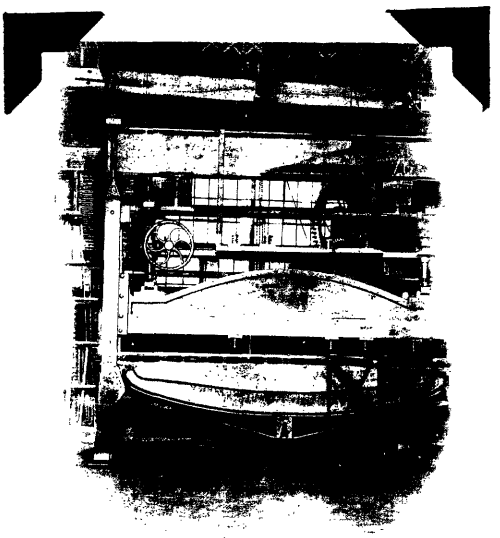
tive speeds of these various operations. This data proved useful in deciding how much space to allow between operations for piling up of work on large jobs.

Cutting and punching of field and frame bars is done on large Ohl machines. Tee bar stock is stored in thirty foot lengths a little to one side of the Ohls so that it can be fed directly into the machine whenever needed. After a batch of tee bar has been cut, the dies in the machine are changed and the batch run through again to be punched properly. Punchings differ according to whether the bar is a field or frame bar. Frame bar punchings depend on how many lights there are in the sash, while field bar punchings depend on whether the bar is horizontal or vertical and whether adjacent to a ventilator or not. In the larger sizes, frame bars are made in more than one piece.

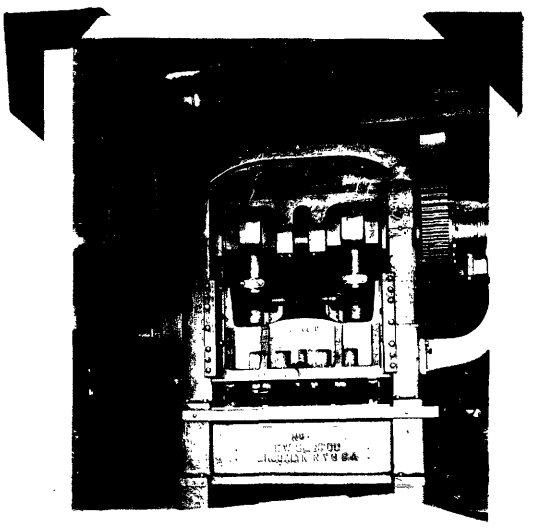


"Ohl Machines"

After punching, frame and field bars are stored according to classes until an order comes through for the assembling of a certain number of any size of sash. The frame bars are then formed into frames on the bending rack and the ends joined. These frames then go to the assembly table where the field bars are fitted in place. The fitted frames then go to the caulking machine where a stamping action binds the joints and eliminates riveting. Up to this point both ventilators and sash proper go through the same operations separately.



Caulking Machine

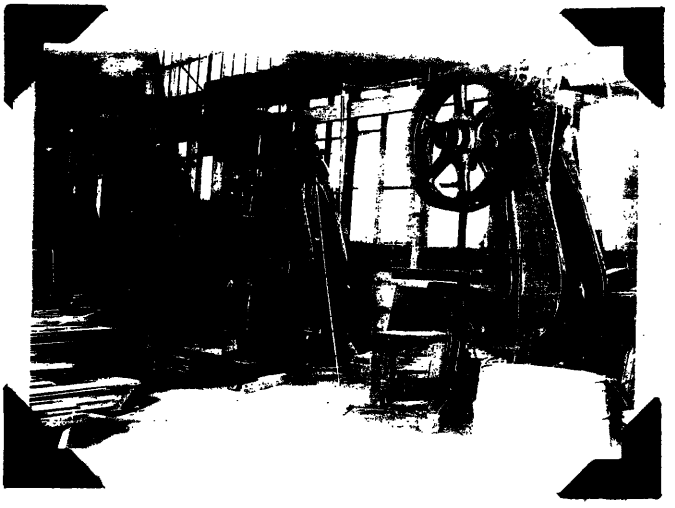


. Upsetting Machine

Following the caulking, ventilators are sent to the upsetting machine where they are bent slightly to permit

the pivoting action necessary for opening and closing. Then they are moved to a table for attachment of hardware and water angles. Sash proper move directly from caulking machine to hardware table.

Finally, the ventilators are fitted in the sash and the ensemble is dipped in a paint bath and allowed to dry. Usually ventilators are made up for stock and stored until needed, since all ventilators are made in a few standard sizes.



Swain Punches

The hardware is punched out on small Swain punches from scrap tee bar collected from the Ohls. Glazing angles are cut on another small punch from special stock. These are used to eliminate putty in cases where fire-underwriters so specify, but are not used on all sash.

Water angles are also made up from special stock.

Sash are either shipped direct from the drying platform or stored in the warehouse until called for.

Stairs.

Unlike the steel sash department, standardization is utterly impossible in the stair department. In fact, there are seldom if ever two jobs exactly alike. This means more care in scheduling the work, since orders cannot be rushed through by the mere assembly of stocked parts.

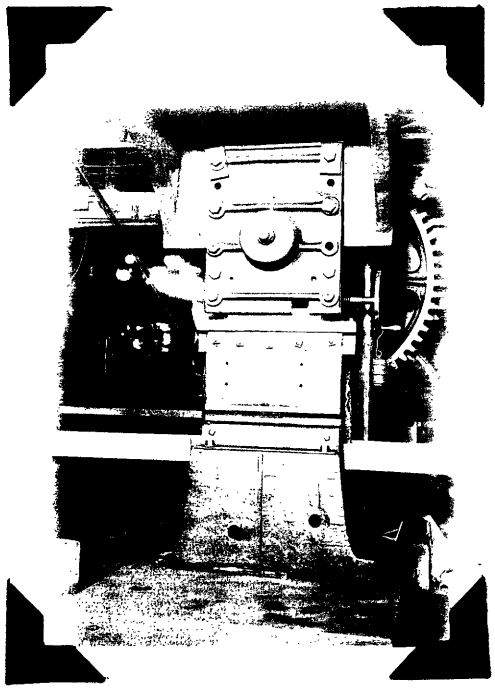
On receipt of the stair order, together with the plans of the building, one-half inch scale drawings are made of the stair work, showing its exact position in the building. After the prints have been approved by the architect as to design and by the contractor as to measurements, drawings are placed in the shop with the shop orders for the foreman's action.

The usual stair job is composed of six components: treads and risers, stringers, railings, newels, moulding and tread angles, and platforms.

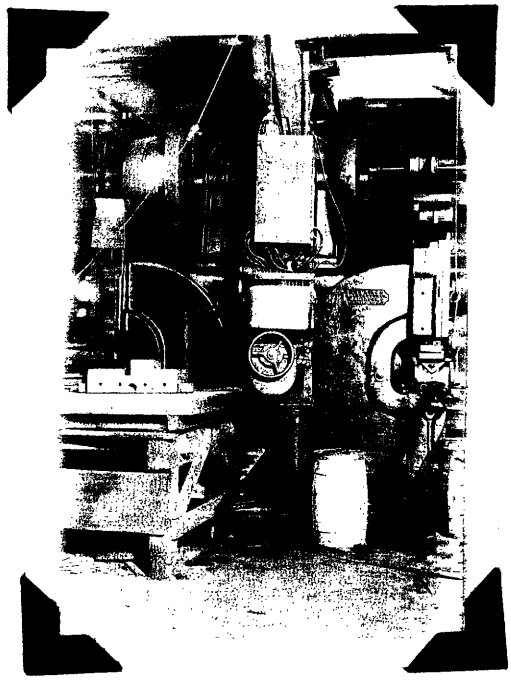
The treads and risers are first cut to size from #13 gauge rolled steel sheets on the 12 ft. shear. They are then placed on a truck and taken to the 10 ft. Ohl and gang-punched for bolting the pan tread to the under

side of the nosing. From there they go to the small Long & Alstetter on the north side of the shop for punching to receive the tread angles and bolting to the stringers. They are then taken back to the 10 ft. Ohl and bent into form for the finished product. On some special jobs the treads are roughed on a special Long & Alstetter press.

In the meanwhile the foreman or layout man lays out the stringers and marks them with a center punch to indicate position for punching holes for riveting tread angles to the stringer. After marking, the ends of the stringers are cut and notched on the hand shear to permit their proper resting on the concrete or steel beams at the head and foot of the stair at the wellhole line. Punching of the stringers is done on the Long & Alstetter #6. The 14" x 3/16" stringer plates are then formed into channel shape on the 10 ft. Ohl if their length is not excessive and on the Totten press is they are too long for the Ohl to handle.

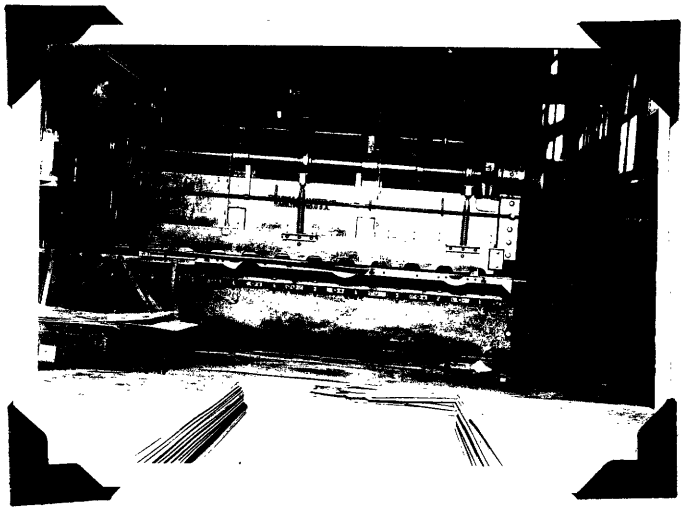


Totten Press



L & A #1

The balustrade railing is made of 1" or 1½" channel iron at the top and bottom. These are mortised on the Long & Alstetter #6 to receive the vertical members or balusters, which are usually made of ½" square iron. These balusters are tenoned and cut to pitch and to proper length on the Long & Alstetter #1. Railings are then assembled on heavy timbers resting on wooden horses. The vertical members fit into the mortised channels at top and bottom. These channels are temporarily tacked to the wood to hold them in position and at the proper pitch or bevel. The vertical members are then riveted in with a pneumatic hammer.



Twelve Foot Shear

Newel posts are usually made of #13 gauge rolled steel, cut to size on the 12 ft. shear, slotted to receive stringers on the Long & Alstetter #6, bent to 4" square tubes on the 10 ft. Ohl, and welded with an acetylene torch at the welding bench. Some special newels are stocked ready made.

No. 16 gauge pressed steel moulding is carried in stock and made up on stock orders for quantities approximating 5000 ft. at a time. This steel is cut on the 12 ft. shear and formed or pressed on the Bliss 7-E. Moulding is usually made up in 13 ft. lengths. The 1½" x 1½" x 3/16" tread angles are usually carried in stock in barrels near the point of assembly. They are punched and cut to size on the Long & Alstetter #6.

Platforms are cut from #13 gauge rolled sheet steel

and platform stiffeners are forged by hand.

So much for the machine work and fabricating.

The stairs are then assembled. Tread angles are riveted by hand to the stringers and mouldings are attached. Then the treads and risers are bolted in position. Finally the railings are attached.

Stairs which are not unusually cumbersome are placed in position as they will exist in the building, so that dimensions can be checked and unusual conditions verified before shipping. This eliminates many discoveries of errors after stairs have reached destination.

Hollow Metal Windows.

In the Hollow Metal Window Department there is a slight attempt at standardization. Although the majority of the work is done on special orders, there are about forty-two varieties and sizes catalogued, which the company considers standard. No attempt is made, however, to make assembled windows to stock, although some of the components are stocked.

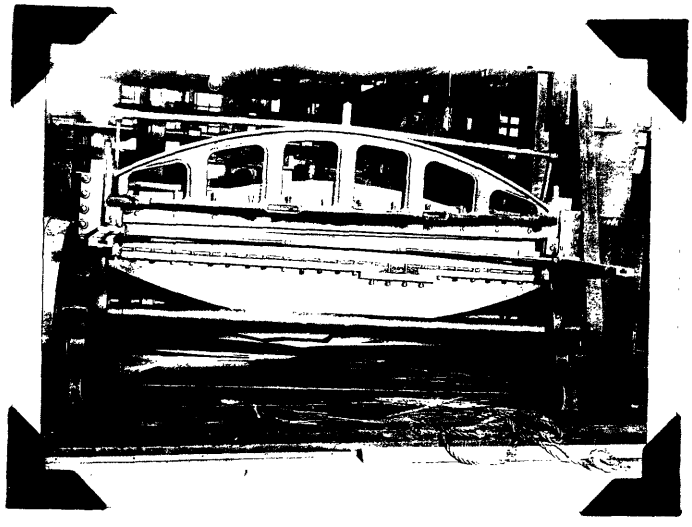
The distinguishing characteristic of the method of making hollow metal windows is the large amount of hand labor required. Bending, punching, soldering, etc. must all be done by hand. Furthermore, the assembly of the components of the window is all done by hand and is the biggest part of the job.

Windows are made from ordinary galvanized sheet iron. Each complete window is composed of twelve distinct parts, namely:

1. Sill.	Frame
2. Head.	
3. Cover.	
4. Separators.	
5. Jambs.	
6. Bottom Sash Rail.	Sash
7. Bottom Meeting Sash Rail.	
8. Top Meeting Sash Rail.	
9. Top Sash Rail.	
10. Side Sash Rail.	
11. Stops.	
12. Muntins.	

Big Ohl

As for the heavy machinery employed, all component pieces are cut on the Niagara 10 ft. power shear, and formed on the Henderson Brake. The large Ohl machine is used for forming pockets and moulds, while a power press punches pockets and pulley slots. Some of the riveting and cutting is done by power, but the majority of the small punching, notching, etc. is done by hand. (See Appendix C for machinery employed and Appendix A for list of operations.



Niagara Shear

Henderson Brake

THE LAYOUT

DEPARTMENTAL RELATIONS

There is just enough relationship between departments so that the position of one department in the layout scheme, with respect to the others, cannot be overlooked. Except for one or two considerations, each of the three departments operates as a complete entity with the processes so separate that as far as necessary relationships go, each could be housed in a separate building.

The first important consideration is the fact that one line of products of the company is processed partly in the Standard Steel Sash Department and partly in the Hollow Metal Window Department, namely the combination windows. The frames and muntins are made and assembled in the Hollow Metal Window Department while the sash are made and assembled in the Sash Department. The windows are fitted in the Hollow Metal Window Department. This relationship necessitates the close proximity of these two departments although it would not prevent placing them in separate buildings if so desired, provided the buildings were adjacent. Having them under the same roof, however, facilitates the small amount of interdepartmental transportation necessary.

The second consideration is that some of the machinery employed in the Hollow Metal Window Department is also employed in the Stair Department, namely the big Ohl machine, the Bliss #7E press, and the Vulcan shear. These machines are of considerable bulk and massiveness and re-

present a substantial investment so that the company has only installed one of each, evidently with the feeling that the amount of work demanded of each type of machine mentioned was not sufficient to justify investing in two separate machines of any type. The large Ohl is the only one that is really used to any great extent by the two departments. However, unless another Ohl machine is purchased, it will be necessary to have the Hollow Metal Window Department adjacent to the Stair Department. The advisability of purchasing a new machine depends on the capacity of the machine now in use to satisfy existing and possible future demands on it.

With these considerations in view it seems that the most convenient layout will result with the three departments in line on one floor, the Hollow Metal Window Department in the center with the Sash Department adjoining on one side and the Stair Department on the other. The Hollow Metal Window Department will then be located in proper relation to the other departments.

There is no interdepartmental problem as far as raw materials go. Each department has its own distinct raw materials. No two departments use the same kind of raw material so that the handling of this raw material is purely a problem for the individual department.

Furthermore, there is no interdepartmental labor problem. There is very little, if any, shifting of men from one department to another and the operations are all confined to the individual department areas so that the men in one department do not in any way interfere with those in another. There are no racial, religious, or prejudicial differences among the employees sufficient to cause any trouble. Of course there are no women workers other than in the office. The company has been practically free from labor difficulties.

STORES

Raw Material Stores.

The present method of storing raw materials is to place the material as near as possible to the machine which starts it in process. The only exception to this practice is in the case of the hardware and railing stock for the stairs, which are kept in the basement of another building on the other side of the alley. All tee bar, sheet iron, and galvanized iron are stored beside the machines.

This system as applied to the present layout and buildings has the following disadvantages:

1. Lack of a perpetual inventory on all stock stored at machines.

2. Location of basement storeroom for Stair Department awkward and at too great a distance from machines.

3. Stock occupies valuable floor space that might be used for production purposes.

4. Difficulties in unloading stock from carrier to floor. However, the principle of storage-at-machine has several inherent advantages:

1. Elimination of intra-factory transportation of raw materials, thus reducing haulage labor.

2. Saving of time required to get piece from storeroom to machine, thus speeding up production.

3. Cutting down on the use of aisles for trucking.

4. Possibility of storage in easy position for feeding stock into machine.

In devising the storage system for the new plant, it was felt that if the disadvantages of the present system could be overcome, the main principle of storage-at-machine would be the most economical and efficient method of handling all raw materials.

If the new plant is to be erected on the same site as the present buildings there will be two difficulties to overcome in locating storage places for raw materials. These difficulties result from the nature of the land on which the plant is to be erected. The first is that if the plant is to be laid out all on one floor as is proposed, the available floor area will not be unlimited. A careful estimate shows that practically the entire 40,000 square feet available will be taken up by machinery and working room. This means that with this limited floor area the less space rendered "dead" by storage, the more room will be available for working space. Thus if we can take the storage off the main floor, the operation of the plant will be bettered.

The second difficulty inherent in the land is that the ground slopes to the extent that it will be necessary

in building the new plant to have a deeper excavation at one end of the property than at the other. This is the case at the present time but since the new plant will be longer than the present one the excavation at the deep end will be greater. This depth will probably amount to as much as ten feet below the level of the ground at the deepest end. With such a condition existing, there arises the problem of unloading materials from trucks as they arrive at the plant and getting them down to the lower level where the machines are located.

To meet with these difficulties and to overcome the disadvantages of the present system of storage of raw materials, a plan has been devised whereby a mezzanine floor will be constructed for a distance of two-hundred and twenty feet along the alley side of the plant and at a height of ten feet from the floor on which the machinery is located. It is then proposed to unload materials from trucks directly from the alley onto this mezzanine platform, where they will be stored in suitable manner until needed in production. This plan will effect all raw materials except the tee bar stock, which is unloaded and stored on the other side of the shop near the Ohl machines as it is in the present plant.

To give an idea of how this proposed scheme will work in actual practice, let us follow a shipment of material from delivery truck to machine. The mezzanine will be

built so that for a distance of about one-hundred feet along the alley its height above the ground will be such that the floor of a truck backing up for unloading will be just level with the mezzanine floor. This makes for an ideal unloading arrangement. The stores'clerk checks the goods as they arrive and enters them on the inventory as they are placed in the proper bins and racks. All the hardware for the Stair Department, the railing stock, stringer and tread stock, and galvanized iron sheets are thus stored. Since the shears for cutting the sheet iron are located practically under the mezzanine, these sheets are stored directly over the machines and lowered to them as needed. Suitable lowering devices are to be installed to transfer stock from the mezzanine to the factory floor when called for.

In this way a complete perpetual inventory of stock may be kept. Workmen will not be allowed on the storing platform without special permission and material may not be removed from storage without requisition. No one but the storekeepers and assistants will be on the mezzanine so that stock will remain untampered.

Furthermore, the factory floor under the mezzanine will be available for production so that there are no dead storage spaces on the factory floor other than the tee bar. Finally, the present basement storeroom referred to previously will be done away with.

In this way we have a storage system with all the advantages of the storage-at-machine method and with none of the disadvantages and difficulties of the present system. The mezzanine storage will be located at the point where the materials stored thereon go into process.

In the event of the possible moving of the plant to a new site, instead of building on the present site as now planned, the changes in layout necessary as far as storage is concerned would be very slight. In moving to and building on a new site a location would probably be chosen where land values are such that sufficient land could be purchased to provide adequate room for the proposed plant as well as ample provision for expansion. Such a step would obviate the necessity of the mezzanine plan, the logical thing being to store everything on the ground floor as close to the machines as possible. Such a plan is all right when there are no hampering space limitations. The storage system outlined for the mezzanine floor would be used just the same except that the storage area would be laid out on the ground floor directly adjoining and in the same relation to the production area as the mezzanine. The difference would be merely the occupation of a greater ground floor area, and the necessity of a more rigid stores' control, since the exclusiveness of the mezzanine would be lost.

Storage In Process.

Storage in process occurs in two departments only, the Standard Steel Sash Department and the Hollow Metal Window Department. Work in the Stair Department is done entirely by jobs and each job is finished before another is started so that there is no in-process storage problem.

In the Sash Department, storage in process consists of cut frame and field bars and ventilators, principally, although there may be some piling up of work between the assembly and caulking operations, between the caulking and fitting operations and prior to painting. In the Hollow Metal Window Department, storage in process consists entirely of the various component parts of sash and frames prior to assembly.

Present methods of storage in process seem perfectly adequate so that the storage provisions for the new plant will involve no major changes in methods and are designed to fulfill the needs of the processes. Cut frame bars are stored in racks by sizes near the bending rack. Cut field bars are stored under and adjacent to the assembly tables. Ventilators are usually made up to stock and stored until ready for fitting. These will probably be stored on the portion of the mezzanine floor in the Sash Department, near the elevator. Storage between operations on the sash usually takes the form of loaded hand trucks and is allowed for by proper location of machines with respect to each other. Finished components ready for assembly in

the Hollow Metal Window Department are to be stored near the assembly tables.

Finished Product Storage.

Finished products are stored only in one department, the Standard Steel Sash Department. This is possible because of the standardization of products in that department to the extent that they can be made up to anticipate the demand. Since such a course is not practical in either of the other two departments, most of the work is job work and the jobs are shipped out immediately on completion or soon afterward, so that there is no storage of finished products in those two departments.

In storing the finished sash, the warehouse on the other side of the alley from the factory is utilized and sashes are transported from factory to warehouse by an overhead travelling crane. This method is entirely adequate since it keeps the finished stock from piling up in the factory and since the warehouse is handy to transportation facilities. If the new plant is erected on the present site, finished stock storage will probably be handled in the same manner as at present. Should a new site be selected, an area, apart from but adjacent to the production area, will be set aside for the purpose.

MACHINE SHOP AND TOOL ROOM

Machine Shop.

At present the machine shop is located on the first floor between the Stair and Sash Departments. The main function of the machine shop is to make and repair the dies for cutting and forming pieces in the heavy presses and punches. Repairing of broken machines, tools, etc., and rigging up of new machines are also delegated to the machinists and their helpers.

Regarding the location of the machine shop, there are three primary requisites:

1. It must be located where there is plenty of light, since the work is of rather an exacting nature, especially in the case of die-making and other skilled operations.

2. The machine shop must be as central as possible with regard to the three departments, since each department utilizes the services of the machinists to a greater or less degree.

3. It must be located somewhere near the tool room and supply room, so that the machinists can have their needs supplied at once on the spot.

With these considerations in mind, we have located the machine shop on the mezzanine floor on the other side of the elevator from the tool and supply room. The reason for locating on the mezzanine is purely dependent on the space requirements in the production departments of the

plant. If the plant is to be built on the present site, the floor space available for production in any department is barely enough to satisfy the needs of that department, so that if the machine shop were placed on the main floor, it would be occupying valuable space which could be more efficiently used in one of the productive processes. For instance, in the Sash Department the process is not exactly continuous, but the work goes through in jobs in such a way that there is a constant piling up of work between operations, which calls for every available square inch of floor space not actually used by machines and moving work.

As far as lighting is concerned, the proposed location is not as ideal as the present position at the other side of the shop because the light from the alley is admittedly not as good as the light from the wider street. However, in the proposed location the machine shop will receive good lighting from at least two sides, fair lighting from the alley, and not much light from the side facing the elevator. We feel that there will be adequate lighting in this location to justify it considering the other advantages of the position.

The only other disadvantage of the proposed location is that it is not quite as central as might be desired. It is very handy to the Sash Department and H.M.W. Dept. but not quite so near the Stair Department. However, we must also have it near an elevator and near the tool room

so that in satisfying these two conditions we have to sacrifice somewhat a central location. Such a sacrifice does not appear to be very serious since the difference in walking distances to be covered by machinists, travelling to and from repair jobs, etc., will not be increased, materially, especially since the majority of their work is in the Sash Department.

In constructing the machine shop, it is thought advisable to have it enclosed in glass, so that it may be kept warmer than the rest of the shop in the winter and still enjoy all the light available. A little more heating is necessary in the machine shop since the men are not performing labor as strenuous as that done in the main plant. To increase the lighting in the machine shop, it is further advisable to build the roof over the mezzanine with a monitor sash so as to allow light to enter from above.

Tool Room.

The function of the tool room is to serve as a combined tool room and store room. Besides handling tools and miscellaneous supplies for the machine shop and the production departments, the small stock for the Stair Department, such as newel caps and drops, rivets, etc., is also stocked in the tool room. Handles, locks and other hardware for the various types of sashes made can also be stored there.

The tool requirements for the plant as a whole are very small. The hand work necessary in any of the processes demands no special tools. Hammers, soldering outfits, screw drivers, electric or hand drills and the like are about the only tools required. A sufficient number of such general tools are usually kept about the plant instead of having the men requisition the tool room whenever a tool is required. The men are not required to have individual sets of tools, but as a rule they manage to keep for their own personal use such tools as they need in the performance of the work in which they are engaged. If a man is using a hammer in his particular work he sees to it that he has a hammer and usually hangs onto it when he gets it.

Thus, practically the only use made of the tool room as far as tools are concerned is for replenishments as tools wear out, are broken or are lost. In a sense, then, the tool room is a stock room for tools, supplies and other accessories needed in production. As far as tools go, the main users of the tool room are the machinists.

At present the tool room is located in perhaps the worst possible place. It is up on the second floor where it is not only difficult to reach with incoming supplies, but is extremely unhandy to the workman requisitioning tools or supplies, since it is off the main production floor in an out of the way place.

Inasmuch as the tool room is utilized to practically

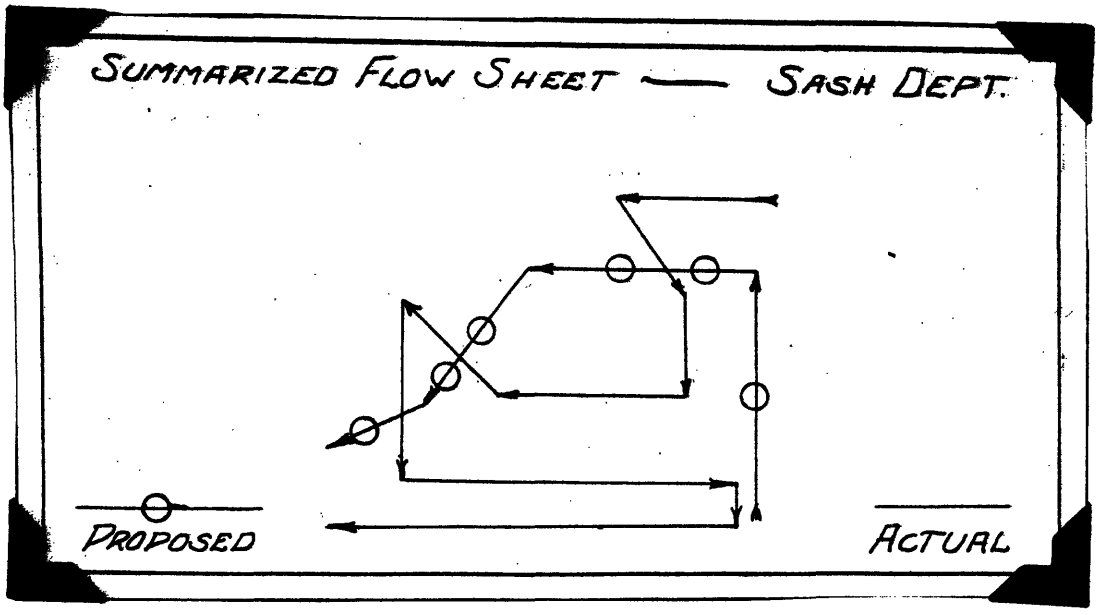
the same extent by all departments, the ideal location would be as central as possible and as near the machine shop as possible. The proposed location embodies both these features. By placing the tool room on the mezzanine floor on the other side of the elevator from the machine shop, it is not only central but admirably placed for handling incoming and outgoing supplies. Requisitions and deliveries can be made by a dumb-waiter arrangement so that the workman will have no occasion to go up to the mezzanine and the tool room clerk can exercise uninterrupted control over the stock. The elevator can be used for large orders. Furthermore, the machinists will have easy access to the source of tools and supplies.

MACHINE LAYOUT

In laying out the machines within the three departments, the primary decision, which has already been discussed, was to have all departments on the same floor and located in the same straight line with the Hollow Metal Window Department in the center and the Sash and Stair Departments on either side. Drawings of the present layout and the layouts suggested by the foremen were made. With these as guides and taking into account the necessary departmental relations, the proposed layout was constructed. The prevailing idea was to approximate straight line flow of work as closely as possible and to get away from backtracking and side-tracking of work. Requirements for storage in process were also taken into account. The proposed layout will be discussed by departments.

Standard Steel Sash Department.

The main problem in the laying out of the Sash Department is to provide sufficient space and facilities for storage-in-process between operations, to take care of any piling up of the different kinds of work that may occur in the course of the regular operation of the plant. Of course, the flow of work should be continuous, in the same direction, and in as straight a line as possible from raw materials to finished product.



This piling up of work-in-process can in no way be obviated. It is necessary because of the nature of the business. Even though the process of sash manufacture has been fairly well standardized and the number of sizes made also standardized to a certain extent, we still have the jobbing aspect of the business to deal with. All the work is job work and the jobs are so varied as to quantity and sizes of sashes ordered, that it would be highly wasteful to put each job through the production process as a unit. Lumping of orders must be the policy if production economies are to be secured. Thus, frame and field bars are made up to various stock sizes in advance and stored until needed to fill the various orders. Ventilators, hardware, water angles and glazing angles are also made up to stock sizes and stored until called for. Finally, there is storage

between operations, due to one operation being faster than the following operation. Thus we find a large problem of storage-in-process.

The existing layout (see next page) is almost as efficient with respect to storage-in-process and flow of work as could be desired. Both the foreman's plan and the proposed layout involve only minor changes in the existing layout. The changes involved in the proposed layout are necessitated by the following difficulties in the existing plan:

1. Poor location of tee bar storage in relation to unloading of the stock from trucks. Backing trucks up against the curb is not allowed on the street on which the bars must be unloaded at present. Unloading from trucks parked parallel to curb involves turning the thirty foot bars through an angle of ninety degrees and lowering them into the basement.

2. Location of water angle and glazing angle stock in basement storeroom at a great distance from machines.

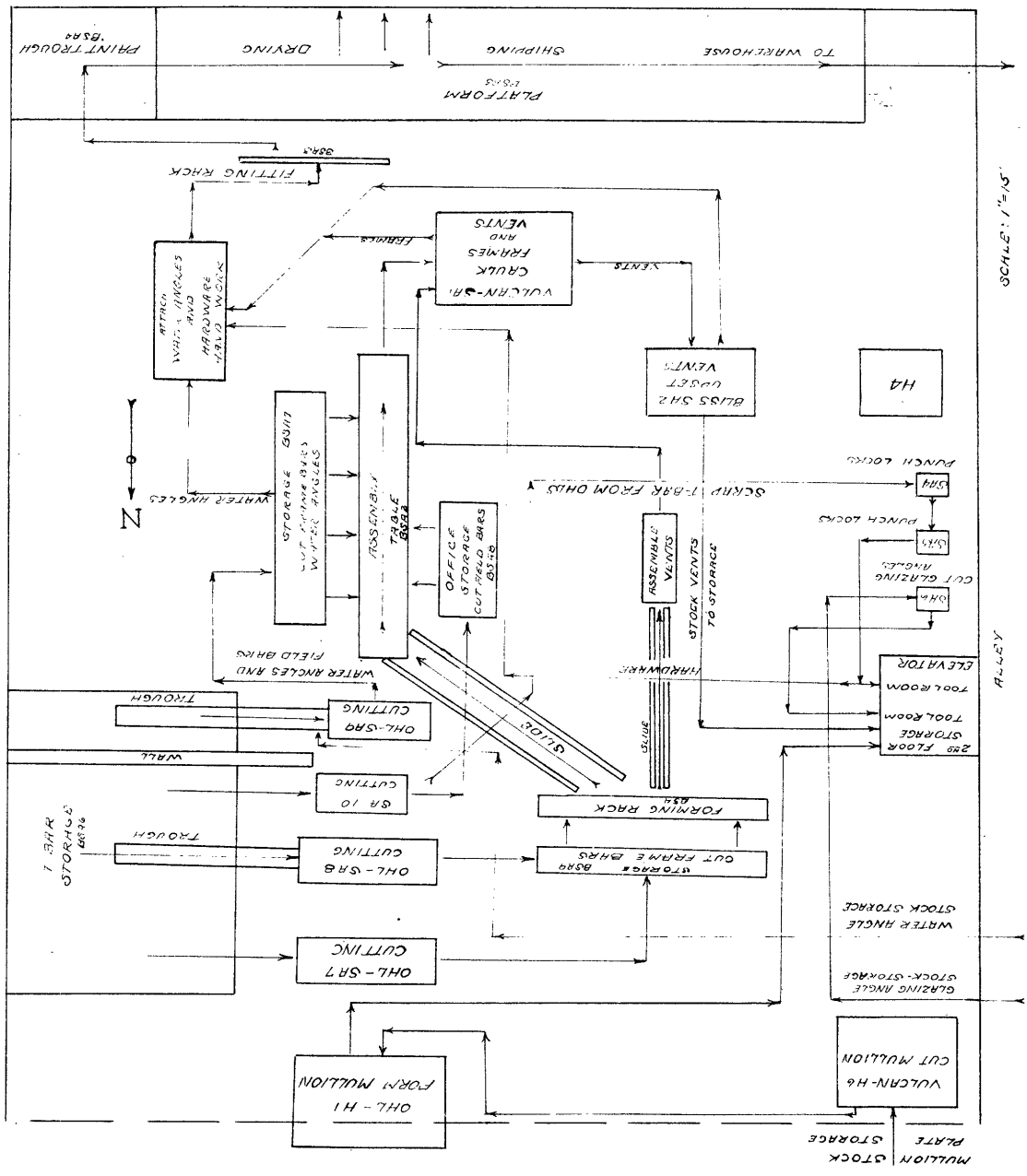
3. Location of machines for cutting glazing angles and making hardware at a point outside of the regular production flow, instead of at the point where these parts go into process. They are also remote from the Ohl machines from which scrap tee-bar for making hardware is obtained.

4. Storage of glazing angles and hardware in tool room on second floor remote from point where used in process.

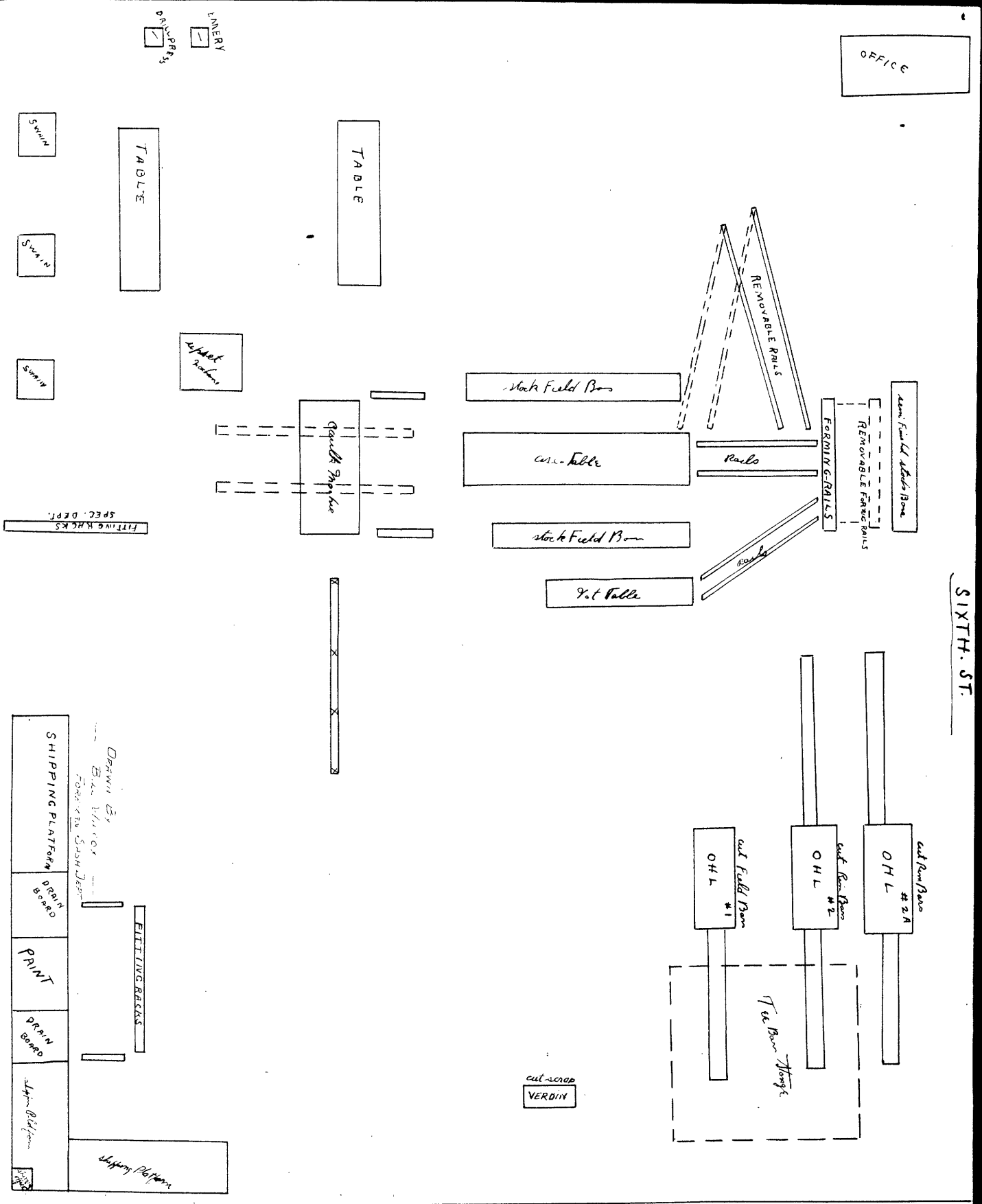
5. Poor location of machine for upsetting the ventilators with respect to the flow of work.

DIAGRAM OF OPERATIONS

STEEL SASH AND FITTINGS



Foreman's Plan - Sash Department.



6. Storage of finished ventilators on first floor away from fitting racks.

In making the proposed layout the following changes were made to take care of these difficulties:

1. The entire layout, as it exists, was first shifted around through an angle of ninety degrees so that the tee-bar storage is located on Poplar Street, which runs at right angles to 6th Street. With this location, it is possible to back trucks up to the curb and shoot the bars right into storage. No lowering is necessary since the factory floor is practically level with the street.

2. Water angle and glazing angle stock is piled adjacent to the tee-bars and also near the machines in which the stock is used.

3. The Swain punches for making glazing angles and hardware are located next to the Kappes-Verdin and at the point where these fittings are attached to the sash. They are also near the source of supply of scrap tee-bar.

4. Glazing angle and hardware are stored in bins at the point of production so that these fittings will be on hand when it is desired to attach them to the sash.

5. The Bliss upsetting machine for upsetting the ventilators is located between the caulking machine, from which it receives ventilators ready to upset, and the tables for fitting the water angles and hardware on the ventilators.

6. Finished ventilators can be stored either on the floor near the caulking machine or on the mezzanine floor near the elevator. This latter possibility would not involve very much extra handling and is advisable if storage for any length of time is contemplated, since it prevents cluttering up of the production area with stored ventilators. The floor could be used for short time storage of ventilators.

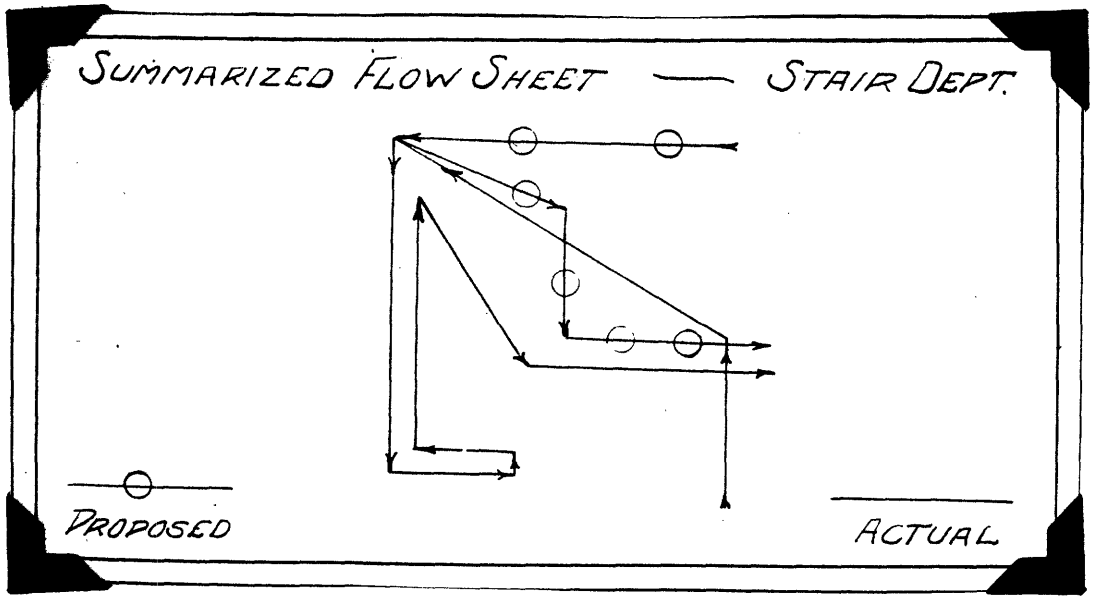
A section has been set aside for specialty work. There are often special orders for sashes, which involve unusual specifications. Most of the special work occurs after the caulking operation, the process being the same for all jobs up to that point. This specialty work is therefore carried on at tables near the caulking and upsetting machines.

At present the sashes are painted by dipping them into a horizontal paint trough. This means picking up the sash so that it hangs parallel to the ground and then lowering it inot the paint bath. There are also considerable evaporation losses, due to the large surface of paint exposed to the air. In the proposed plan, two vertical paint troughs are installed which make it possible to pick the sashes up on end and dip them into the paint troughs. Evaporation losses are reduced and floor area is conserved by this method, in addition to increasing the ease of handling.

Sufficient area for storage between operations has been allowed. (See proposed layout, Appendix E.

Stair Department.

The work of the Stair Department, instead of being a more or less continuous flow process such as that in the Sash Department, is an assembly process in which eight components are manufactured and finally assembled to make the finished product. The same machines are often used in the manufacture of all the components and hence each machine has a number of different tasks to perform. Such a situation makes it very hard to do anything more than approximate a straight line flow of work. All that can be done is to eliminate conflicting elements by having the work flow in lines as nearly parallel as possible and in the same general direction from raw material to assembly, avoiding cross-tracking and back-tracking of work.



The difficulties in the existing layout (see next page) may be listed as follows:

1. There is insufficient floor space allowed for assembling the stairs. More head-room might also prove an advantage on some of the larger jobs.

2. Moving the finished stairs from the assembly floor to trucks for shipment is quite a problem at present. Stairs must be moved by man power to the elevator and then lifted to the alley level. Then they have to be loaded onto the trucks by hand. This wastes a great deal of time and energy that might be saved.

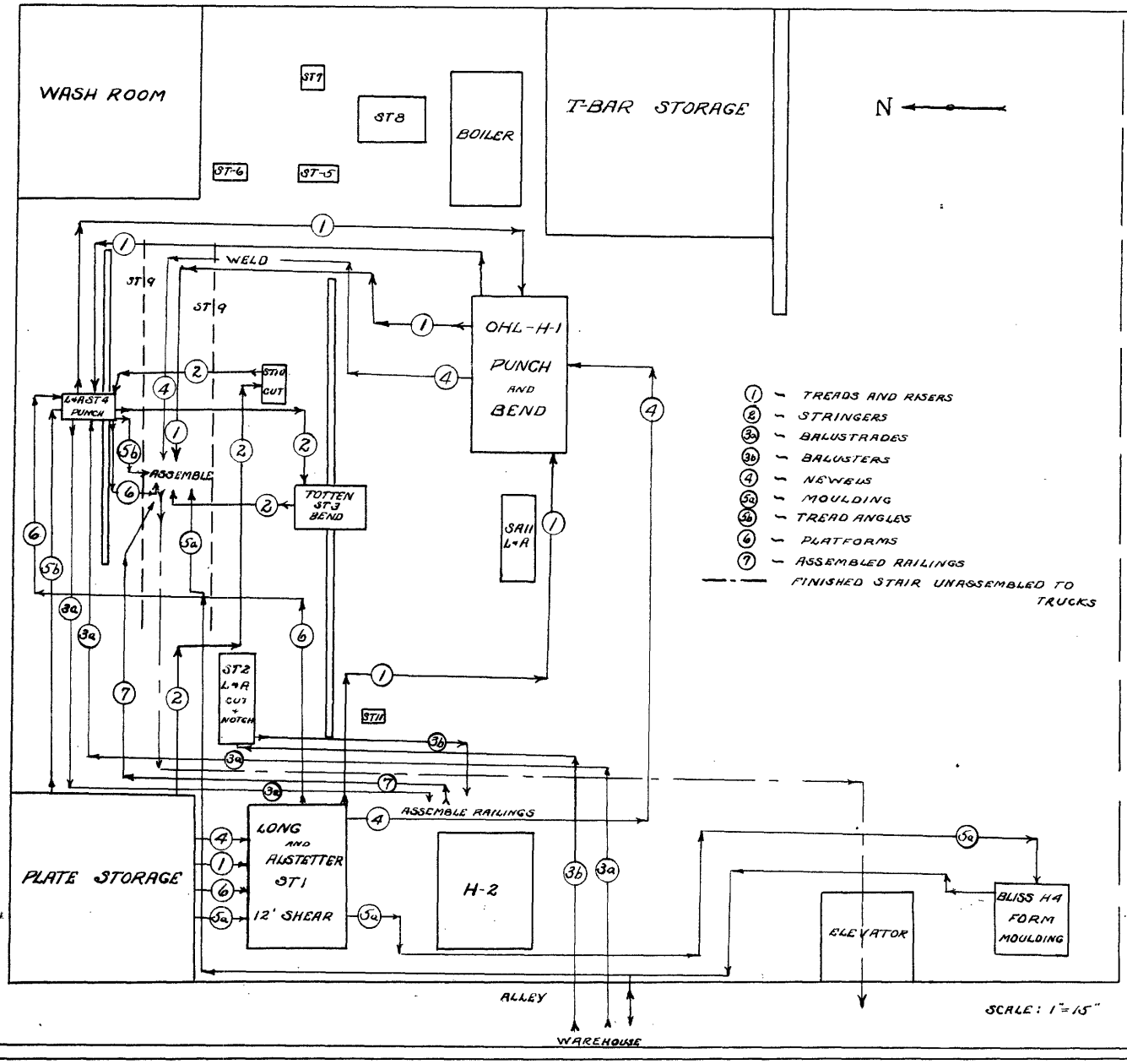
3. The railing assembly bench is not near the general stair assembly space, whence the railings go when assembled, so that in making the railings a great deal of back-tracking of work results.

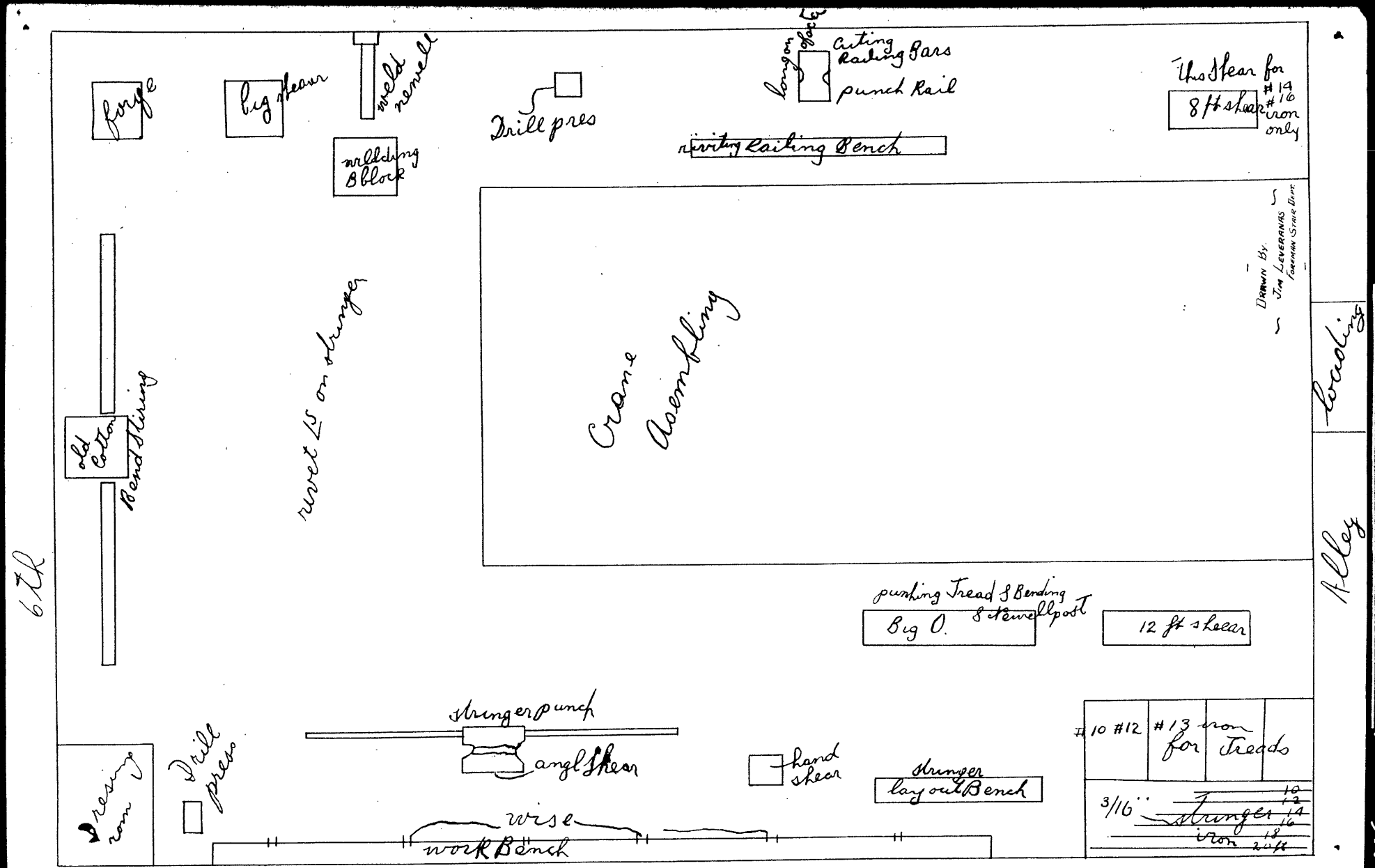
4. The Bliss machine on which the stair mouldings are formed is located almost at the other end of the shop in the Sash Department instead of in the Stair Department where it belongs. This necessitates a lot of needless transportation of stock and finished mouldings.

5. As a result of the present location of machines with respect to one another and the flow of work from one to the other, there is considerable movement of work of various kinds from one side of the shop to the other. These cross currents seriously interfere with the assembly work and cause conflicts with the movement of work in the

DIAGRAM OF OPERATIONS

STAIRS AND FITTINGS




forge
big shear
weld renewell
welding Block
Drill pres
long on floor
Cuting Racking Bars
punch Rail
This Shear for #14 #16 iron only
8 ft shear
riveting Raiting Bench
Drawn By: Jim LEVERANAS Foreman Stair Dept
old Cotton Band Sawing
rivet 45 on stringer
Crane Assembling
loading
Alley
6th
pushing Tread & Bending & Newellpost
Big O.
12 ft shear
stringer punch
angl shear
hand shear
stringer layout Bench
Drill press
dressing room
wise
work Bench
#10 #12
#13 iron for Treads
3/16"
Stringer 10 12 14 16 18 iron 20ft

shop to a greater or less degree.

6. The forge is located rather far from the assembling area, where the platform supports and other fixtures made there are used.

In making the proposed layout of the Stair Department, every effort was made to eliminate these difficulties. The following changes from the existing layout are embodied in the proposed plan:

1. The area provided for assembly and erection of the stairs, prior to shipment, is approximately ninety feet by fifty feet. This should be ample for assembly and erection of the largest sizes of stairs made by the company. Thirty foot headroom is being allowed.

2. A double-track, hand operated travelling crane is being installed for the purpose of moving assembled stairs in the trial erection, which follows assembly, and also for loading the stairs onto trucks for shipment. The travelling crane at present installed in the plant cannot move the stairs out to the alley to be placed on trucks. It is proposed to build the crane out for a short distance beyond the building, so that it overhangs the alley. The stairs can then be lifted up to the level of the trucks, hauled out into the alley, and lowered onto the trucks. This will produce a considerable saving of labor and time.

3. The rail assembly bench is located at one side of

the assembly area between the two Long & Alstetter punches from which the components of the railing come. The finished railings then go directly to the assembly.

4. The Bliss Machine used for forming mouldings has been moved into the Stair Department and placed adjacent to the large shear from which it receives its cut stock ready for forming. The moulding thus made is stored on the mezzanine until needed at the stair assembly.

5. An examination of the proposed layout (see Appendix E) will show practically no cross-shop movement of work. This is made possible by having all the machines used in making the various components of the stairs on one side of the shop or at either end. Nothing but the forge, the foreman's office and a few workbenches are located on the other side of the shop. The general lines of flow for all components are parallel and take a sort of semi-circular path to end up in the center or assembling area.

6. The forge has been shifted until it is now adjacent to the assembly point.

The location of the foreman's office is particularly advantageous since he is afforded a clear view of all operations and particularly of assembly and erection of the stairs.

Hollow Metal Window Department.

The most drastic changes in layout were made necessary in the Hollow Metal Window Department because in the

present plant the department is located on two different floors. Changing all the machines to one floor involves practically a complete new layout with very few points in common with the old plan. (See next page)

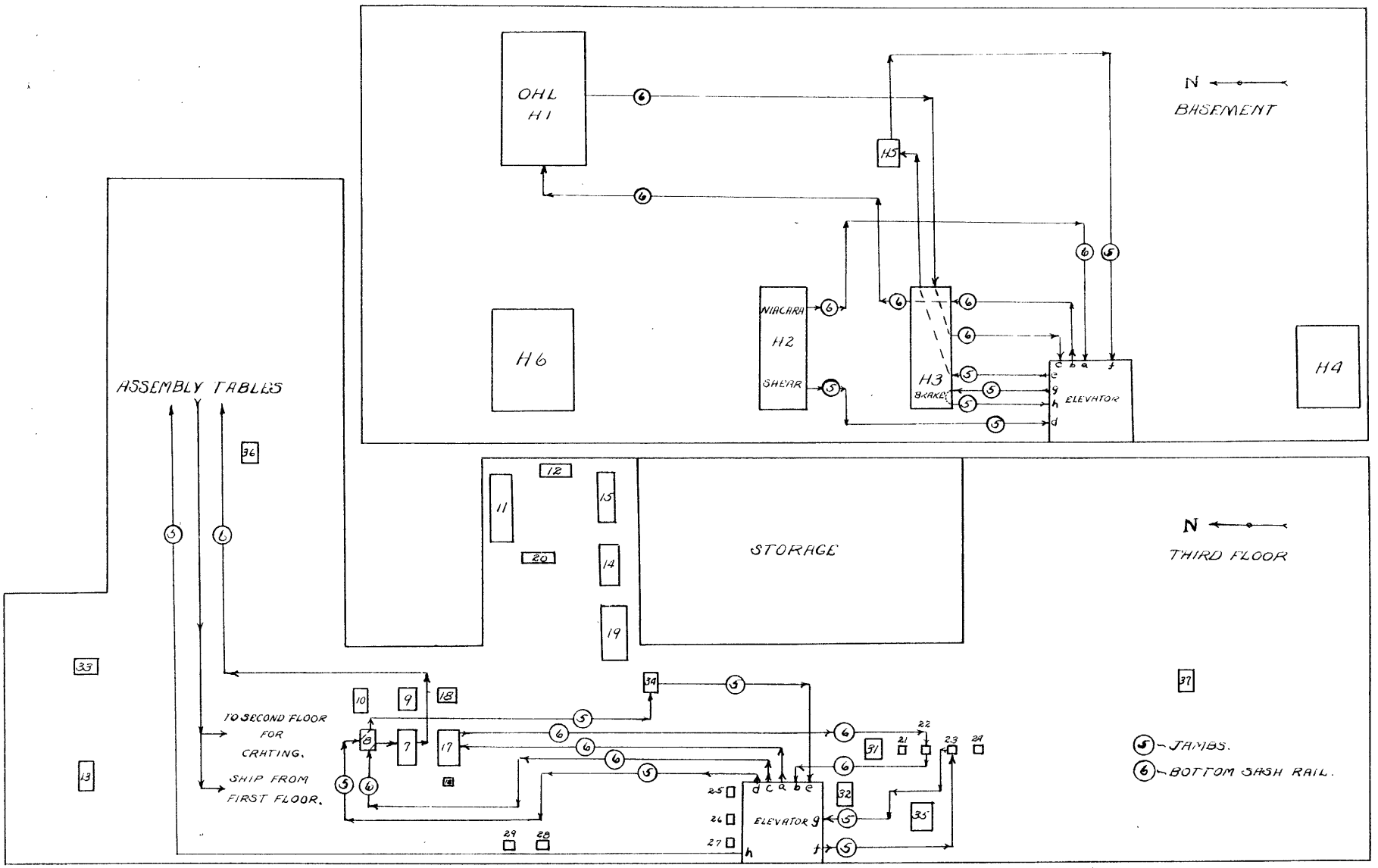
Assembly work also characterizes the process in this department. Both sashes and frames are composed of several components which are first manufactured and then assembled.

The stock for each component is first cut on the power shear. Then follows a series of varied operations prior to forming on the Henderson Brake. Practically every component goes through this general procedure. Thus we see that in laying out the department we must plan to place a group of various machines between the shear and the Henderson Brake to take care of the intermediate operations. The proper location of these intermediate machines with respect to each other and to the general flow of work is the most important problem in the layout of the Hollow Metal Window Department. Work must be kept moving in the same general direction and back-tracking avoided. The situation is unavoidably complex because of the large number of components involved, so that the routing must be simplified as much as possible.

In the present layout, the intermediate machines (mentioned above) are mostly located on the third floor, so that a piece is cut on the shear in the basement, goes to

DIAGRAM OF OPERATIONS

HOLLOW METAL WINDOWS



SCALE: 1"=15'

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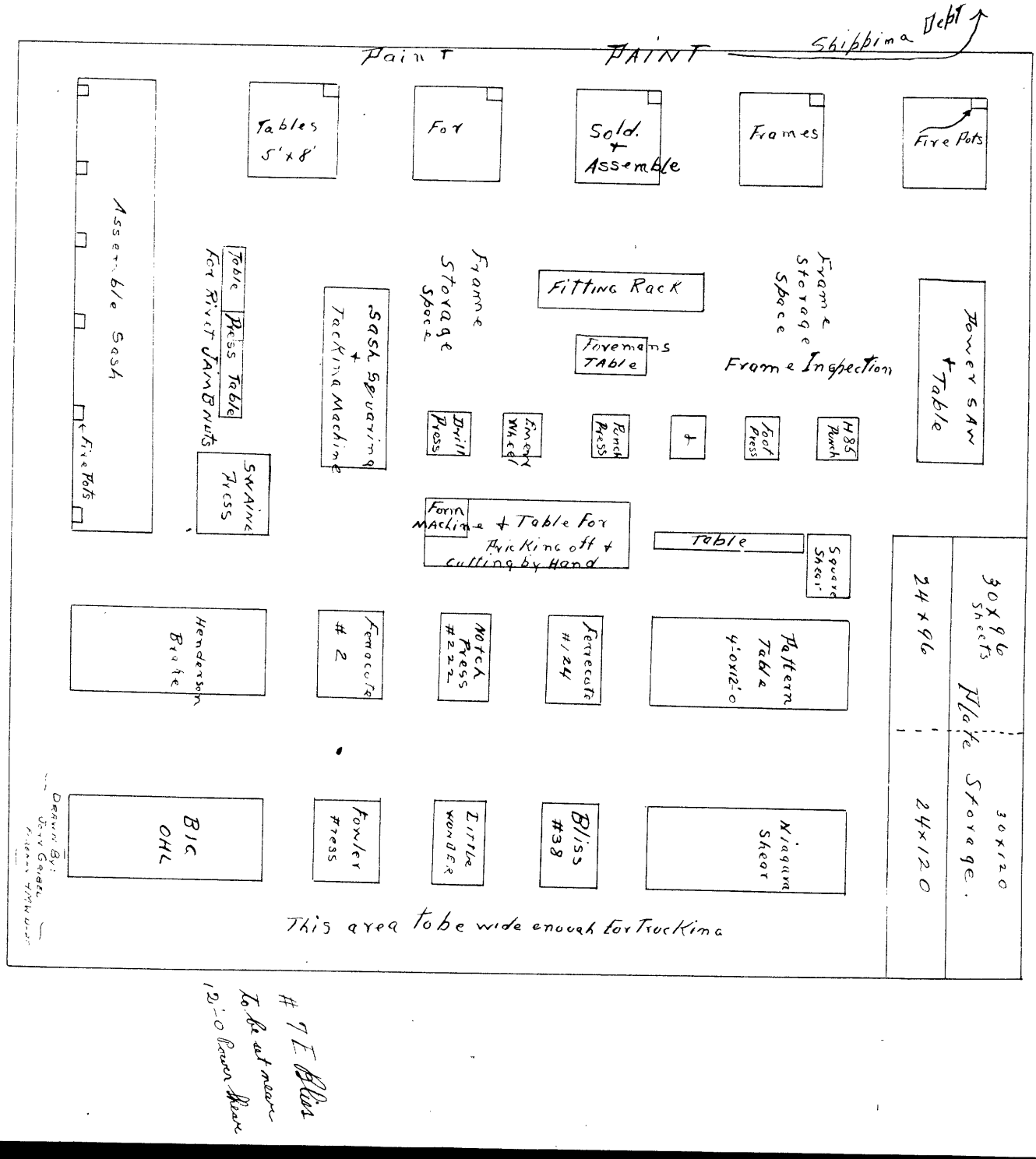
Foreman's Plan - Hollow Metal Window Dep't.

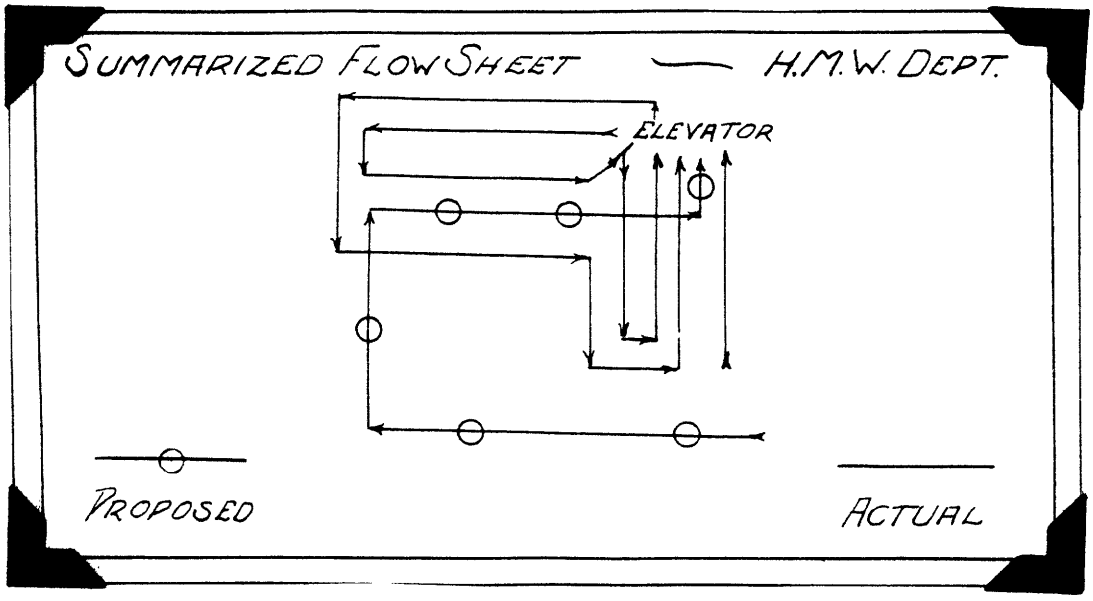


the third floor for intermediate operations, and then back to the basement for forming. Finally, it returns to the third floor for finishing and assembly.

All this up and down movement of work is a great waste of time, labor and power - a most expensive necessity. In view of the existing layout, this waste may be classed as unavoidable and hence a necessary evil. Aside from its direct wastefulness it hampers production, decidedly, greatly decreasing the productive efficiency of the department.

A comparison of the existing and proposed layouts would be of little value other than to show whether or not the present defects have been remedied. Suffice it to say that all vertical motion has been eliminated and the intermediate machines have been carefully located with respect to one another between the shear and the brake.

These intermediate machines have been arranged in two parallel lines facing each other. The power machines are lined up on one side of the central working area between the two lines and the hand machines on the other. This makes it possible to drive the entire group of machines by one motor through a single long section of line-shafting.



Back-tracking has been almost entirely avoided and the least possible cross traffic in the working area has been allowed to enter into the flow of work. In making the flow diagrams on the drawings of both existing and proposed layouts, it was found impossible to follow every component through from start to finish without overcrowding the drawing and rendering it ineffective. Two representative components, one sash component and one frame component are traced on the drawings from start to finish to give an idea of the general flow of work. (See Appendix E)

The frames are to be assembled on the Sixth Street side, so that the assembly tables will be well illuminated by windows from the street. The sashes are to be assembled on the side of the departmental area facing the sash department. Stocked components can be stored under the assembly

tables in properly constructed racks.

The frames and sashes are fitted and painted near the sash assembly place. Sufficient space has been allowed between the Hollow Metal Window Department and the Sash Department to take care of a moderate accumulation of finished stock awaiting shipment. Such an accumulation will never be very great since most of the jobs are shipped immediately on completion. If there is any great delay, the finished stock can be placed in the warehouse along with the finished sashes.

The proposed layout offers a much better opportunity for the foreman to control the operation of his department than exists at present, since the entire process is under his surveillance at once. It also makes for closer relations between the Hollow Metal Window and Sash Departments, since sashes for combination windows can be shipped from the Sash Department directly to the fitting area of the Hollow Metal Window Department, to be fitted in the frames made in the latter department.

It will be noted that the machines have been so arranged that the large Ohl machine, which is used by both the Stair Department and the Hollow Metal Window Department, is accessible to both these departments at the proper point in the productive process.

Specialty Department.

Besides the three main production departments and the machine shop, the company maintains also a small Specialty

Department. This department does such work as making fire-doors, ventilators, crating and general repair work in the roofing and carpentry line.

In the existing layout this department is located on the second floor. The equipment involved consists of work tables and several general purpose machines such as drill presses and band saws.

In the proposed layout the department is located on the Sixth Street side of the plant between the Sash Department and the Hollow Metal Window Department. Here it does not interfere with the work of either department and has ample room and light for its own needs.

The main material used by this department is tin plated sheet iron. The materials used here do not take up much space as most of it is bought when the time warrants. The fire door business is small and the crates used are only for special work, which does not necessitate a large stock to be carried. On the whole the department is truly a specialty department and does not require any particular location except that it be central to take care of special work of all the existing departments.

THE GENERAL OFFICES.

Present Location of Offices.

At present the general offices occupy a portion of three floors of the building facing Sixth Street. The executives have their desks in the third floor portion of the office, adjacent to the drafting and planning room. The purchasing manager, bookkeeper and several stenographers occupy the second floor office. The first floor office serves mainly as a waiting room with the telephone operator and stenographers in charge.

The very division of the office force in this way makes for lost motion, lack of co-operation and poor supervision. In addition, working conditions in the office are not of the best. The building is old and shaky, so that it is very hard for the draftsmen to work at times.

Proposed Plan for the Offices.

It is proposed to locate the offices on the mezzanine floor on the Sixth Street side of the new building (see Appendix E, Page148. Separate offices with glass partitions are to be provided for the executives. The entire office force will be located in one room, separated from the executive offices by a waiting room and conference room. The planning and drafting room occupies a part of the mezzanine adjacent to the general office and will be separated from it by a glass partition.

We feel that better co-ordination of work and supervision will result from such an arrangement. Furthermore, by using the mezzanine idea the floor area under the offices may be utilized for production work.

POWER REQUIREMENTS

In this type of business, where the demands on any one machine are intermittent rather than continuous and the total power being used by the plant at any one moment is likely to fluctuate, considerably, there is no need for an elaborate investment in a steam power plant. Such a plant could hardly be run, economically, under such varying conditions of load. The tendency, therefore, in this business is to use electric motors to drive the machines. This means individual drive on the larger machines and group drive on the smaller ones.

The present plant employs twenty-three motors. In addition to the individually driven machines, there are five groups of more than one machine. (See Appendix C. A rather awkward and cumbersome system of belting is used to integrate these groupings and connect the various floors of the plant.

The proposed plan presents a simpler power problem. The belting problem is practically eliminated, although the number of motors required is substantially the same. In the Sash Department, where the machines are all large and heavy and the work is fairly standardized and continuous, it has been decided to have individual drives throughout. This involves no change from the present system, which has proved quite satisfactory.

In the Hollow Metal Window Department the machines intermediate between the shear and the brake will all be connected to the same line-shafting and driven by one motor. Any one machine in this group is seldom used for a long period, so that the one motor can easily carry the load of the entire group at any one time. The shears, brake and all the machines in the Stair Department will be individually driven. As at present, group drives will be used in the machine shop and specialty department.

The big saving resulting from the new layout will be the elimination of power losses, due to the inefficiency of the present belting system.

ADVISABILITY OF A CHANGE IN LOCATION

ADVISABILITY OF A CHANGE IN LOCATION

The proposed layout has been made with the assumption that the new plant will be erected on the site of the present buildings and available land adjoining. Nevertheless, we feel that this thesis would be incomplete without some consideration of the advisability of a change in location. There are certain inherent disadvantages in the present location and also certain advantages, not to be ignored, of moving to a new location, which demand the most careful consideration when a decision regarding location is involved.

Mr. David Houston, President of the firm of David, Houston, Bond and Company of Newark, N. J., and a specialist in industrial real estate, has very kindly reviewed the entire situation and given us the benefit of his advice and experience in the matter. (See Appendix D, page 144 for Mr. Houston's letters).

In the light of Mr. Houston's advice and our own knowledge of the situation we feel that even though the management of the company has requested that we design the new layout to fit the present site, it would be highly desirable to move to another location which provided less expensive land and more room for expansion, horizontally.

Let us review the disadvantages of the present site and the advantages of a new location:

Disadvantages of the Present Location.

1. Land too Valuable for Manufacturing in a One-story Structure.

Local trends in the value of real estate show that the value of the land owned by the company has been and is increasing. The section in which the present plant is located is becoming more and more a warehousing district. These warehousemen can put up multi-story buildings, for such buildings are well suited for storage purposes. They can therefore afford to pay more for the land than a person requiring considerable ground floor area, since the ground floor area needed is only a small portion of the total floor area of the warehouse. The warehouseman also picks a location where transportation facilities are good. Both these factors make land values in a warehousing district very high and explain the reason for the rise in the value of the land owned by the company.

Such land is absolutely too valuable for manufacturing in a one-story building. Not only would the taxes on the land be too large in proportion to the size of the business, but the fixed investment in land and buildings would also be abnormal for a business of this size. As Mr. Houston suggests in his letter, sufficient money could probably be realized from the sale of the land now owned by the company to purchase twice as much land in another suitable locality and to practically finance the construction of the new plant. This statement should throw the proper light on the situation.

The business is not suited for a multi-story structure, so it must locate where land is cheap and sufficient can be purchased to fill the needs of the company.

2. Restrictions on Expansion in Present Location.

If the new plant is to be built on the present site, the land available at the date of writing (see Page 12) is a plot 320 feet long by 127½ feet wide. This allows no room for expansion since the present plant will occupy the entire area.

However, the company owns a few scattered lots on the other side of the alley, some of which it is now utilizing for storage purposes. There is a possibility of being able to purchase the entire remaining land on the other side of the alley so as to give the company ownership of the entire block across the alley. This addition would practically double the available area on which to erect the plant. As far as space is concerned, therefore, if such a purchase of land were made, there would be plenty of room for expansion.

The difficulty comes in the presence of the alley which bisects the property. This alley would prevent equal expansion of all departments into the added available area. What would probably result would be the location of two departments on one side of the alley and one on the other.

With such an arrangement the liason between departments would be greatly damaged, to the extent of either slowing up production or raising production cost. Furthermore, it would be impossible when locating the departments to forecast which one will grow fastest and to locate them, accordingly. The alley thus becomes a nuisance.

3. High Cost of Building on the Present Location.

The cost of putting up a new plant on the present site would be exceedingly more than the cost on most other suitable location for the following reasons:

a. The sloping character of the land would necessitate considerable excavation - an expensive undertaking.

b. The existence of present buildings on the land would involve the expense of wrecking these buildings.

c. The presence of the alley would necessitate the construction of two separate buildings where one might suffice were there no alley on the property.

Advantages of a New Location.

1. Makes Possible a Considerable Saving.

As already stated, it is felt by Mr. Houston that considering the present value of the land owned by the company and the probable value of suitable land available, sufficient money could be realized from the sale of the present property of the company to purchase twice as much land in another suitable locality and to practically finance the construction of the new plant.

2. A Location can be Selected which Suits the Needs of the Business.

In selecting the new location a place can be found which fits the needs of the business, instead of fitting the business to the available land as would be done if the company were to build on the present site. Ample provision can be made for expansion and land can be purchased which does not have undesirable features, such as alleys and necessary excavations. Proper railroad facilities can be secured and the relation to the labor supply can be considered. The mezzanine feature and all vertical transportation can be eliminated. In fact the new location, if properly selected, should have all the advantages of the present with none of its disadvantages.

3. Cost of Moving into New Building Would Not be Greater.

The new building could be completed ready for occupation without disturbing production, then departments could be moved in one at a time during a dull period of the year when stock had been built up to carry the company through the transition period. The cost of transporting machinery would surely not be greater than the losses incidental to continuing production during construction on the present site.

Changes in Proposed Layout Resulting from the Selection of a New Location.

If the new plant were to be erected on a new location,

the proposed layout would serve admirably with a few minor alterations. These alterations would comprise:

1. Increasing the dimensions of the departmental areas to allow for expansion, but keeping the arrangement of machines, etc. within the department just as planned in the proposed layout.

2. Abolishing the front mezzanine floor comprising the general offices and placing these offices on the ground floor in the center-front of the building.

3. Removing the machine shop from the mezzanine as proposed and placing it on the ground floor in some central position in the plant.

4. Removing the stores and tool room from the mezzanine and placing them on the ground floor. This would also involve developing a new system of stores control. Raw materials would have to be kept as near the point where they go into process as possible.

ESTIMATED SAVINGS DUE TO PROPOSED LAYOUT

SAVINGS TO BE EXPECTED FROM THE NEW LAYOUT

Method of Estimating Savings.

In general, the plan was to estimate the annual saving in production cost, not including overhead, for each of the production departments. The savings in production cost, plus the annual saving in overhead for the plant as a whole, constitutes the total saving possible as a result of the new layout plan and the new building.

To estimate the saving in production cost in each department, a payroll analysis for the month of February, 1927, was secured. This statement included the payroll figures for the month in each department classified according to operations. From a study of the present and proposed layouts the percentage of labor cost, which can be saved, was estimated and the actual money saved per month on each operation was calculated. The total of these savings gave the total saving for the month of February in each department. From a study of the number of men employed each month during the year (see Page 92), it was possible to determine what percentage of the total year's work was usually done in the month of February, so that by using this figure and the total saving for February we determined the total saving for the entire year in each department at the present rate of output.

In order to calculate the annual saving in production cost for each department at the estimated production capacity of the new plant, the saving per ton of goods produced was first determined by dividing the annual saving at the present rate of production by the annual production in tons. Multiplying this saving per ton by the estimated capacity of the new plant in tons per year, a figure representing the total annual saving in each department at the estimated capacity of the new plant was obtained.

In considering the saving in overhead and other general savings resulting from the new plant and layout, the following factors were taken into account:

1. Better lighting in the plant.
2. General improvement of working conditions.
3. Increased ease in handling raw and finished materials.
4. Greater efficiency of office force due to better office layout and lighting.
5. Close inventory control afforded by mezzanine plan.
6. Power saving due to elimination of belting.
7. Reduction in building maintainance cost.
8. Better supervision of production under new plan.

These general savings are of such an intangible nature that it would be exceedingly difficult to make an accurate estimate as to their magnitude. We feel, therefore, that if the saving in production cost alone, regardless of these general savings, is sufficient to justify the investment of the capital necessary to finance the new plant and layout, the wisest plan would be to regard these general and intan-

gible savings as a sort of reserve in case the actual savings in production cost when the proposed plan is put into operation do not amount to the savings estimated in this report. At any rate, it is safe to assume that there will be a substantial margin of savings, over and above the savings in actual production cost, which will accrue as a result of the general improvements listed above.

Detailed calculation of estimated savings by departments follow. (See next and following pages).

Tabulation of Savings in Productive Labor in the Manufacturing Departments.

A. Standard Steel Sash Department.

Operation	% Saving	Reason for Saving
Cutting	4%	More efficient cutting and storing of hardware - reduced distances between operations.
Assembling	5%	Better storage space on tables and nearness to forming rack.
Caulking	18%	Elimination of all trucking through use of removable rails.
Trucking	50%	No trucking from storeroom. Less trucking of ventilators to storage. Paint bin closer to warehouse.

B. Stair Department.

Operation	% Saving	Reason for Saving
Railings	20%	Reduction of distances between operations. Elimination of backtracking. Closeness to storeroom of material.
Stringers	2%	More direct flow of work.
Platforms	10%	Reduction of distances between operations. Nearness of forge to assembling area. (Forge makes platform stiffeners).
Assembling	12%	Enlargement of assembling area gives more room to work and increases capacity. Easier to remove stairs from the department area.

C. Hollow Metal Window Department.

Operation	% Saving	Reason for Saving
Cutting	20%	Easier handling of raw material. Elimination of two elevator trips.
Forming	30%	More direct flow of work. Elimination of two elevator trips.
Assembling	25%	Assembly tables near last machine in process. Separate Assembly tables for sash and frames. Elimination of one elevator trip.
Soldering	25%	Included as part of assembling.
Trucking	75%	Elimination of practically all trucking after assembly and fitting.

Estimated Annual Savings in Productive Labor in the Sash Department Resulting from the Proposed Layout

A. Savings on Basis of February 1927 Payroll.

Operation	Present Labor Cost	Percent. Saving	Actual Saving
1. Cutting	$346.76	4%	$13.85
2. Forming	54.64		
3. Splicing	21.21		
4. Assembling	110.85	5%	5.54
5. Caulking	78.53	12%	14.12
6. Upsetting	13.59		
7. Angling	21.90		
8. Fitting	160.63		
9. Trucking	29.04	50%	14.52
10. Repairing	135.82		
11. Attaching H'dware	82.00		
12. Stacking Bars	26.06		
13. Cleaning Machines	6.64		
Total	$1087.67		$48.03

B. Yearly Saving at Present Production Rate.

Percentage of production turned out in February (See Employment Schedule, Page) is:

$$\frac{12}{165} = 7.27\%$$

$$\text{Yearly saving} - \frac{\$48.03}{.0727} = \$660.00$$

C. Yearly Saving at Estimated Capacity.

Payroll for year at present production rate	$14910.00
Savings " " " " " "	$660.00
Tonnage " " " " " "	703 tons
Cost per ton	$21.30
Saving per ton	$ 0.94

The slowest machine in the Sash Department is the cutting machine and the fastest is the caulking machine (see Page 86).

Figuring on the basis of the slowest machine, one ton of material can be cut in 140 min. or 2.33 hours. In one day (8 hrs.) 3.44 tons of material can be cut, which amounts to 1030 tons per year of 300 working days.

Figuring on the basis of the fastest machine, one ton of material can be caulked in 30 minutes or ½ hour. In one day 16 tons of material can be caulked, which amounts to 4800 tons per year of 300 working days.

With the three cutting machines now available, the plant could produce 3090 tons per year. This would produce a saving of 3090 x $.94 or $2900. per year at estimated capacity.

By adding one more cutting machine and utilizing another small cutter which they own, the company could produce 4500 tons per year on which a saving of $4230. could be realized.

The yearly saving at estimated capacity	-	$2900.
The yearly saving with additional cutter	-	$4230.

DETERMINATION OF COMPARATIVE SPEEDS OF OPERATION IN MANUFACTURE OF STANDARD STEEL SASH.

Group	Serial No.	*Space per unit time needed for: Cutting	Bending	Assembly	Caulking	Fitting Water Ang	Fitting
			SPECIAL DATA				
1.	B 32160	6.84	12.85	12.70	31.62	6.55	2.71
	B 33161	6.80	8.65	5.51	23.10	10.02	2.98
	B 34161	6.34	8.96	6.03	30.64	14.10	4.22
	B 35161	6.08	12.25	4.42	33.90	16.95	4.16
2.	B 42180	8.50	4.38	17.35	43.40	8.68	2.11
	B 44181	6.85	17.86	5.74	42.10	12.03	4.44
	B 45181	6.60	14.00	5.00	26.20	13.10	6.00
	B 54161	6.20	9.10	4.55	22.20	20.00	5.67
3.	C 32160	7.72	8.19	13.88	41.70	6.95	2.60
	C 33161	8.22		9.50	24.70	12.30	3.00
	C 34161	6.86		6.12	30.60	20.40	5.57
	C 35161	7.05		7.44	25.40	20.35	6.63
4.	C 42180	8.95		5.50	22.00	8.25	2.98
	C 43181	8.80		7.77	20.40	14.85	3.98
	C 44181	7.85		5.28	26.00	22.40	5.96
	C 54161	6.95		5.17	30.20	27.20	8.40
	Total	126.61	96.24	121.96	474.16	234.13	71.41
	Average	7.90	10.69	7.63	29.60	14.60	4.46
		Cut./Bend.	Bend/Ass.	Ass./Cau	Cau/F.W.	F.W./Fit.	
	Ratios	.74	1.40	.26	2.03	3.27	
	Approx. Ratios	3/4	1½	1/4	2	3¼	

* Figures based on previous table and hence on 100 units of each size listed.

TIME REQUIRED FOR PERFORMING MANUFACTURING OPERATIONS ON STANDARD STEEL SASH *

No.	Serial No.	Area (sq. ft.)	Time Required For: (min)						
			Cutting	Bending (Special Data)		Assembly	Caulking	Fit water Angles	Fitting
				sq. ft.	min.				
1.	B 32160	950	139	28500	2220	75	30	145	350
2.	B 33161	1433	211	17550	2030	260	62	143	480
3.	B 34161	1900	300	12500	1395	315	62	135	450
4.	B 35161	2373	390	12500	1020	537	70	140	570
5.	B 42180	1300	153	1250	285	75	30	150	615
6.	B 44181	2525	369	7500	420	440	60	210	570
7.	B 45181	3150	477	6100	435	630	120	240	525
8.	B 54161	3150	508	3000	330	692	142	157	555
9.	C 32160	1250	152	3930	480	90	30	180	480
10.	C 33161	1850	225			195	75	150	615
11.	C 34161	2450	357			400	80	120	440
12.	C 35161	3050	432			410	120	150	460
13.	C 42180	1650	184			300	75	200	555
14.	C 45181	2450	279			315	120	165	615
15.	C 44181	3250	413			615	125	145	545
16.	C 54161	4075	585			787	135	150	487

* All figures except those for Bending are based on 100 units of the sizes indicated.

Estimated Annual Savings in Productive Labor in the Stair Department Resulting from the Proposed Layout

A. Savings on Basis of February 1927 Payroll.

Because of the fact that it was impossible to segregate the payroll in this department according to operations, a slightly different method of calculation was necessary to determine the savings. Operations were weighted as to what percentage of the total production cost they represented. The total payroll for the month was then multiplied by this percentage and again multiplied by the percentage saving on the operation to give the actual saving for the month on that operation. The results of these calculations are as follows:

Operation On	Percent. of Total Payroll	Percent. Saving	*Actual Saving
1. Layout	2.4%		
2. Newels	7.2%		
3. Railings	22.3%	20%	$43.30
4. Stringers	14.2%	2%	2.76
5. Trds. & Risers	7.5%		
6. Platforms	9.2%	10%	8.92
7. Assembling	37.2%	12%	43.30
		Total -	$98.28

*Note - Total payroll for Feb. is $970.82

B. Yearly Saving at Present Production Rate.

Percentage of production turned out in February (see Employment Schedule, Page 92) is:

5 ÷ 93 = 5.38%

Yearly saving - $98.28 × .0538 = $1830.00

C. Yearly Saving at Estimated Capacity.

Payroll for year at present production rate	$18000.00
Savings " " " " " "	$1830.00
Tonnage " " " " " "	258 tons

Cost per ton	$69.80
Saving per ton	$7.10

It is estimated that since the increased assembly space in the new layout will practically double the capacity of the department and since it is not operating at full capacity at the present time, that the capacity of the new plant will be approximately four times the present production.

Yearly saving with estimated capacity of 1030 tons per year would amount to - $7320.00

Estimated Annual Savings in Productive Labor in the Hollow Metal Window Department Resulting from the Proposed Layout

A. Savings on Basis of February 1927 Payroll.

Operation	Present Labor Cost	Percent. Saving	Actual Saving
1. Layout	$ 39.39		
2. Cutting	108.03	20%	$21.60
3. Forming	177.46	30%	53.22
4. Assembling	127.43	25%	31.85
5. Die Setting	18.84		
6. Soldering	172.35	25%	43.09
7. Attaching H'dware	9.69		
8. Repairing	7.98		
9. Fitting	188.63		
10. Trucking	17.11	75%	12.84
11. Painting	1.46		
Total -	$868.37		$162.60

B. Yearly Saving at Present Production Rate.

Percentage of production turned out in February (See Employment Schedule, Page 92) is:

$$7 \div 92 = 7.62\%$$

Yearly saving - $162.60 ÷ .076 = $2140.00

C. Yearly Saving at Estimated Capacity.

Payroll for year at present production rate - $12450.00

Savings " " " " " " - $2140.00

Tonnage " " " " " " - 110 tons

Cost per ton - $113.00

Saving per ton - $19.50

It is estimated that due to improvement in layout and the fact that the department is not running at full capacity at present, that the output could be increased four times.

Yearly saving with estimated capacity of 440 tons per yr. would amount to - $8560.00

EMPLOYMENT SCHEDULE

Of

MESKER BROS. IRON CO.

Month	Department						Total
	Sash	Stair	H.M.W.	Mach.	Ship.	Gen.*	
August 1925	18	8	9	5	9	4	53
September	18	8	10	5	6	4	51
October	15	12	6	5	8	4	50
November	16	7	6	5	8	4	46
December	19	9	6	6	8	4	52
January 1926	12	5	6	4	3	4	34
February	12	5	7	4	4	4	36
March	13	5	7	4	5	4	38
April	12	5	9	5	5	4	40
May	9	8	10	5	4	4	40
June	12	10	9	4	5	4	44
July	9	11	7	5	5	4	41
Total	165	93	92	57	70	48	525
Average	14	8	8	5	6	4	45

The office force consists of:

2 Executives	
7 Men	
5 Girls	
1 Office Boy	
15	15

60

* The heading "General" includes Cleaners, Watchmen, Carpenter, and Plumber.

Summary of Estimated Savings Resulting from Proposed Layout.

The total estimated annual saving to be expected with the new layout in effect and the new plant operating at full estimated capacity may be summarized as follows:

Saving in Sash Department	-	$2900.00
Saving in Stair Department	-	7320.00
Saving in H.M.W. Department	-	8560.00
Total Saving	-	$18780.00 per year

In addition to this saving there will be the unestimated saving accruing from such general improvements as:

1. Better lighting in the plant.
2. General improvement of working conditions.
3. Increased ease in handling raw and finished material.
4. Greater efficiency of office force due to better office layout and lighting.
5. Close inventory control afforded by mezzanine plan.
6. Power saving due to elimination of belting.
7. Reduction in building maintainance cost.
8. Better supervision of production under new plan.

These general savings will probably amount to a considerable sum but we feel that it is best not to include them in the estimated savings but rather to consider them as a reserve to fall back on should the estimated tangible savings be over-estimated.

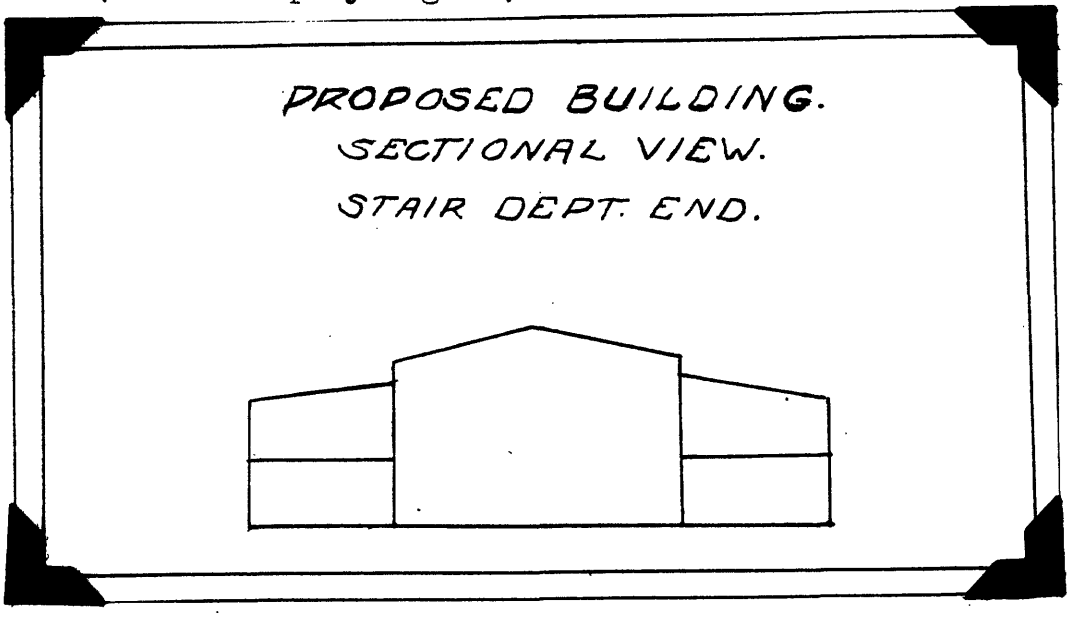
THE PROPOSED BUILDING

THE PROPOSED BUILDING

General Description.

Although it is beyond the scope of this thesis to go to any great detail into the architectural and structural design and specifications for the proposed building, which is to house the new layout, we feel it necessary to specify in a general way at this point as to the type and structure of the building.

We feel that the most suitable building for this kind of a plant is a one-story, steel-frame building of monitor or clerestory structure with side walls of steel ventilator sash. (See accompany figure)



The side walls in the part of the building which houses the Sash and Hollow Metal Window Departments are to be twenty feet in height. The monitor will run the long way of the plant and will be four feet higher than the side

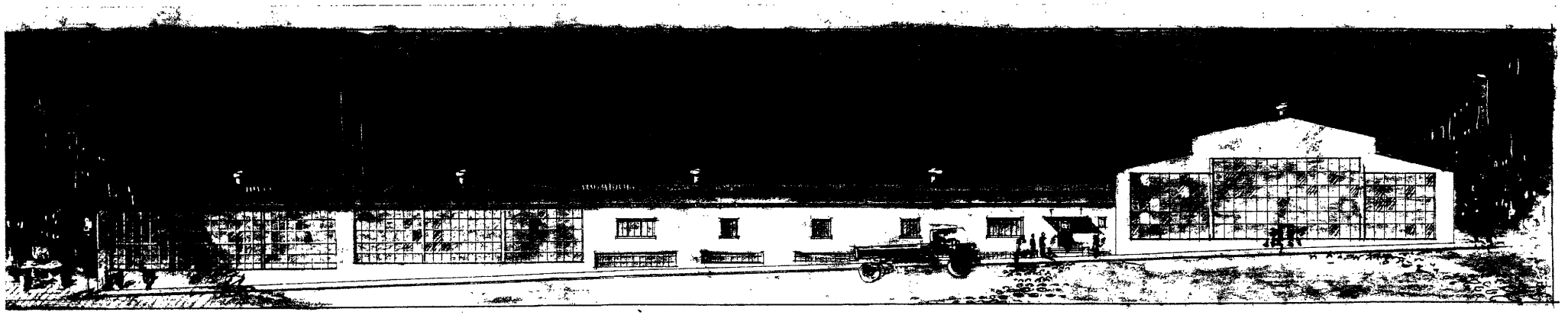
walls. The side bays, which contain the mezzanine floors, will be thirty feet wide; while the center bay, directly under the monitor, will be sixty-seven feet wide. (See Appendix E, Page 148. The roof will be of the flat, insulated type.

In the part of the building which houses the Stair Department, the height of the side walls is to be thirty feet in order to give sufficient headroom for assembling and erecting the stairs. This part of the building measures approximately 80' x 127' (see Appendix E, Page 148. The monitor here will run across the shop and will be forty feet wide with side bays twenty feet in width. Easy accomodation for the travelling crane is thus provided.

Advantages of the Proposed Type of Building.

The type of building described above has the following distinct advantages:

1. Has low first cost.
2. May be rapidly erected.
3. Maintainance is low if building is protected against corrosion.
4. Practically no fire hazard, hence low insurance rates.
5. Proper construction allows wide column spacings.
6. Can easily be added to or extended.
7. Abundant lighting possible.



SKETCH OF PROPOSED BUILDING

6th Street Elevation

Drawn by - H. K. Crowell.

96a.

8. Sash made by the company may be used throughout in the construction of the building. This will introduce a considerable saving in first cost.
9. Monitor construction suited to use of travelling cranes.

The only important disadvantage is that the heat losses from a building of this type are considerable.

Cost of Proposed Building.

Considering the estimated figure of $2.50 per square footof floor area submitted by Mr. Houston (see Appendix D, Page 144 the cost of the proposed building including heating, plumbing, etc. will amount to about $102,000. for a floor area 320' x 127.5' or 40,800 sq. ft.

COST OF EFFECTING LAYOUT

ESTIMATED COST OF EFFECTING NEW LAYOUT

Cost if Building is Erected on Present Site.

Cost of building, including heating and plumbing, etc. at $2.50 per sq. ft.	$102,000.
Additional excavating of 5950 cu. ft. (approx.) at $1.00 per cu. ft.	5,950.
Cost of moving machinery and equipment	10,000.
Cost of additional land at $3.00 per sq. ft . .	45,900.
Loss due to hold-up in production	10,000.
Total Estimated Cost	$178,850.

Cost if Building is Erected on a New Site.

Cost of 80,000 sq. ft. of land at $.50 per sq. ft.	$40,000.
Cost of building including heating and plumbing, etc..at $2.50 per sq. ft.	102,000.
Cost of moving machinery and equipment.	25,000.
Loss due to hold-up in production	5,000.
Total Estimated Cost.	$172,000.
Less value of present land -	76,500.
Total Capital Required	$95,500.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS AND RECOMMENDATIONS

Conclusions.

We feel that the proposed layout of the metal working plant under consideration (see Appendix E), as described and discussed in this thesis, will eliminate the d disadvantages of the present layout and will have sufficient additional advantages so that a decided inrease in the productive efficiency of the plant will result.

It is estimated that at the present rate of production the new layout would save the company approximately $4,600 annually. However, if the plant were operated at full estimated capacity under the new layout an annual saving of approximately $19,000 could be realised. This would justify the investment of at least $190,000 of capital in e effecting the proposed layout, figuring interest at 10% or a little higher than usual.

In order to operate at full estimated capacity, the production in the Sash Department would have to be increased about one-third, while the production in the Hollow Metal Window Department and in the Stair Department would have to be increased to four times the present output. For this reason it would be unwise to undertake the changes contemplated in this thesis until a market analysis has been made to see if there is sufficient demand to justify such increased production. If such analysis is favorable and

the business can be built up to the increased capacity it would be advisable to put the new layout into effect as soon as there is danger of exceeding the capacity of the present plant. Sufficient provision for the expansion of the business under the proposed layout has been made.

Finally, we feel that it would be highly advisable to build the new plant in another suitable locality as suggested in Mr. Houston's letter (see page 144).

Recommendations.

We recommend that the proposed layout be put into effect as soon as there is danger of exceeding the capacity of the present plant, providing a market analysis has been made and the estimated demand is sufficient to justify the productive capacity estimated in this thesis.

We further recommend that the proposed new building be constructed in some other suitable locality as suggested above and for reasons stated in this report. (see page 73)

Cost of Effecting Recommendations.

It is estimated that the cost of effecting the above recommendations on the present site owned by the company would amount to $178,290. (see page 99).

It is further estimated that the cost of effecting the above recommendations on a new location, where land is cheaper, would amount to $95,500.

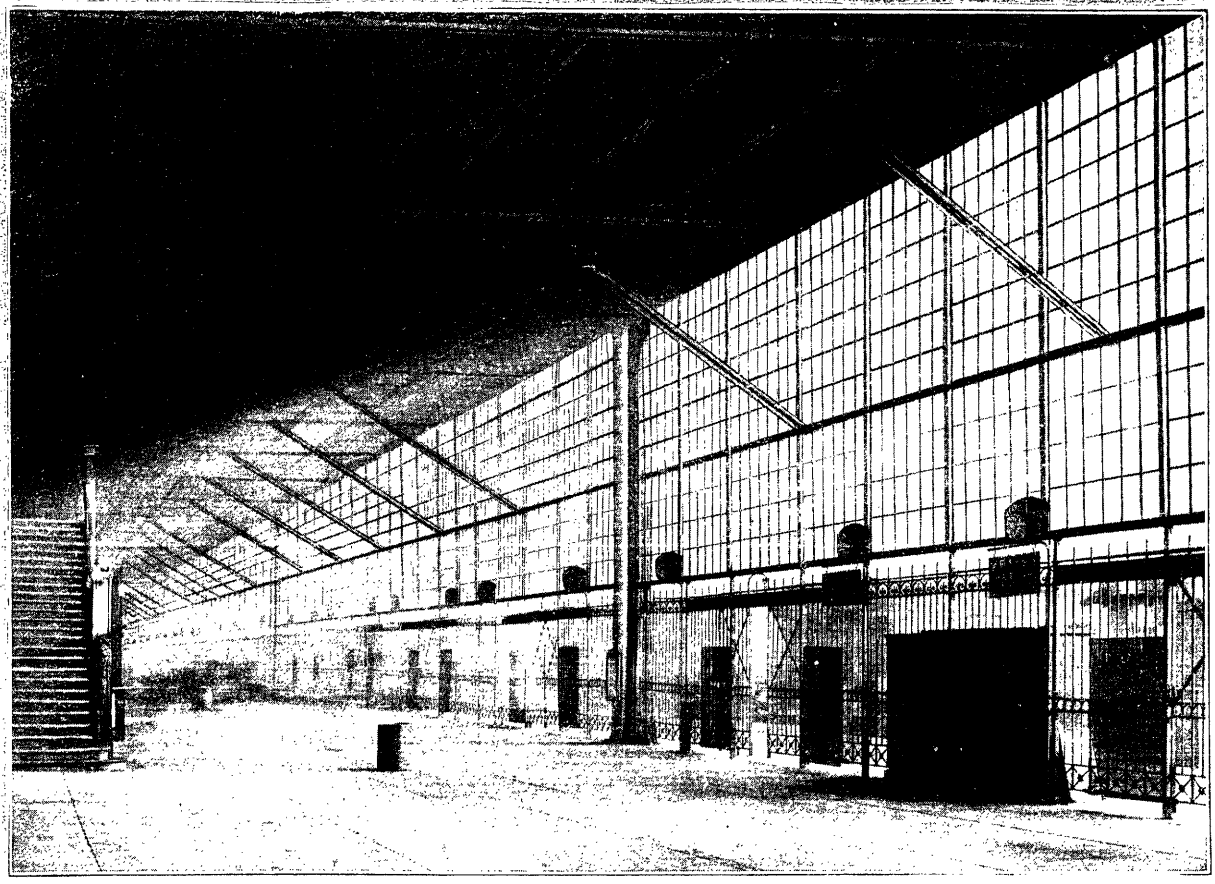
APPENDICES

APPENDIX A

Contents:

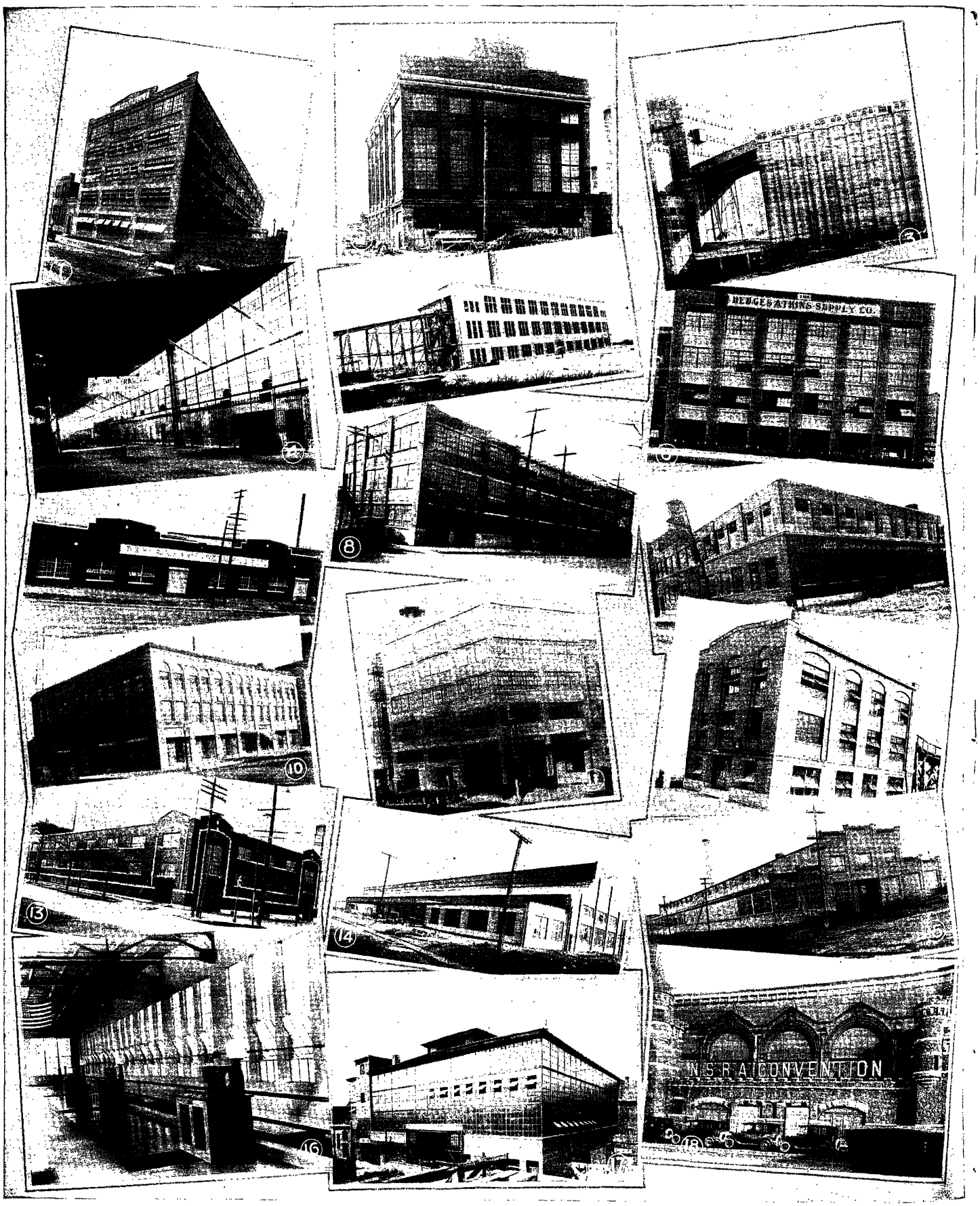
Mesker Bros. Iron Co.

St. Louis, Mo.



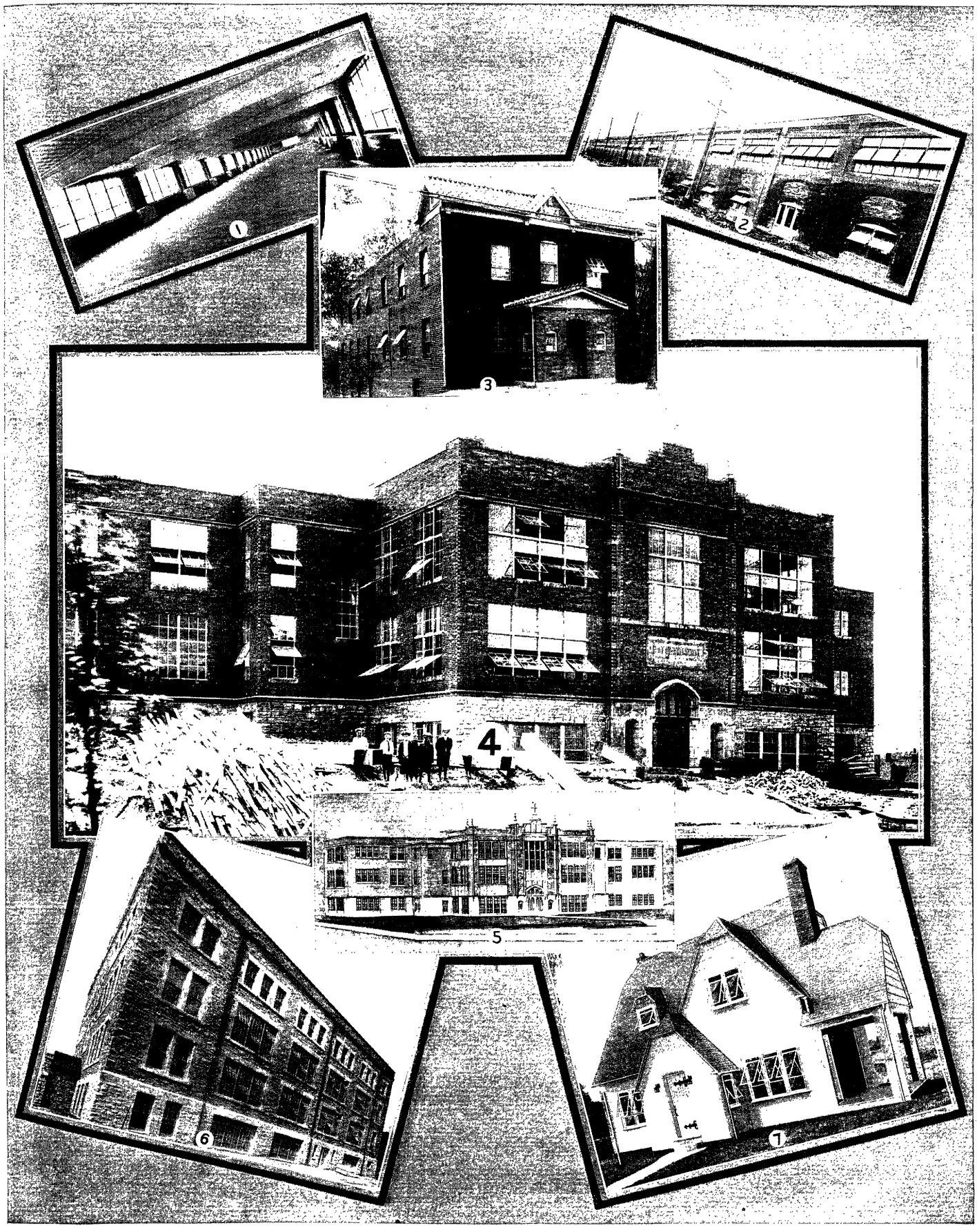
Steel Windows

Photograph shows one third of Mesker Steel Sash midway enclosure in Union Station, St. Louis, containing over 20,000 square feet, for the Terminal Railroad Association, a $100,000,000 Corporation.



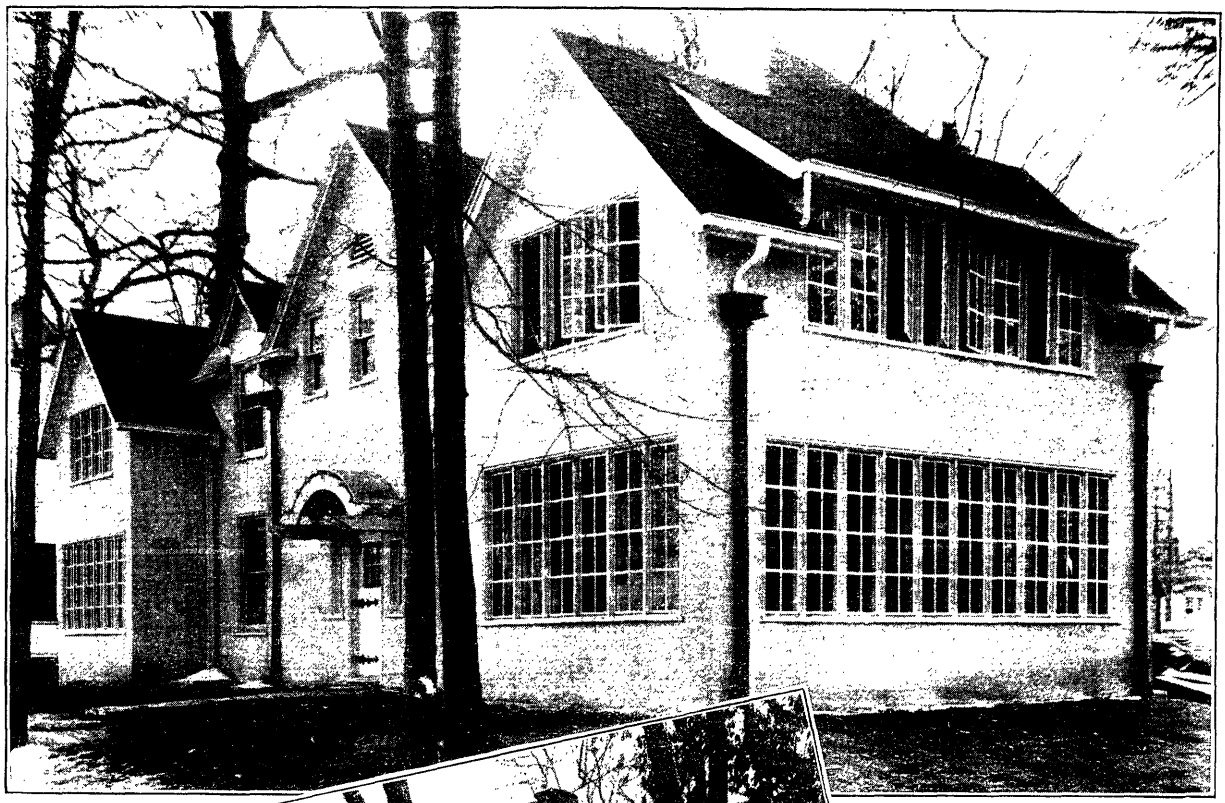
Above group is limited number of the many recently erected buildings equipped with the Mesker Standard Solid Section Steel **CENTER PIVOTED WINDOWS.**

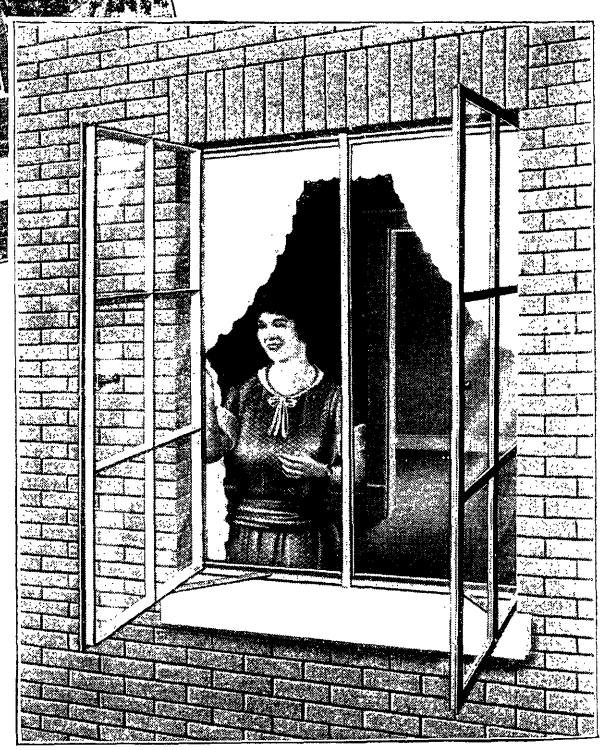
1. Champion Shoe Machy. Co., St. Louis, Mo.
2. Cosden Refinery Bldg., Tulsa, Okla.
3. Missouri Pacific Elevator, St. Louis, Mo.
4. Union Station Midway, St. Louis, Mo.
5. Standard Oil Co. Power Plant, Woodriver. Ill
6. Hedges-Atkins Supply Co., Denver, Colo.
7. A. Hardesty Mfg. Co., Denver, Colo.
8. Taige Mahogany Co., Indianapolis, Ind.
9. Charles Dempsey Garage, Chicago, Ill.
10. Barnes Business College, Denver, Colo.
11. Greer & Laing Warehouse, Wheeling, W. Va.
12. Incinerating Plant, St. Louis, Mo.
13. Eu-Clede Garage, St. Louis, Mo.
14. Johnson Anderson Co., Chicago, Ill.
15. Tulsa Stove & Fdry. Co., Sand Springs, Okla.
16. Oklahoma City Filtration Plant, Tulsa, Okla.
17. Geo. J. Fritz Fdy. & Mach. Co., St. Louis, Mo.
18. Coliseum Bldg., Chicago, Ill.



Group of a limited number of the many buildings recently erected having windows of the Mesker **EXTENDING SIDE ARM VENTILATOR** Type.

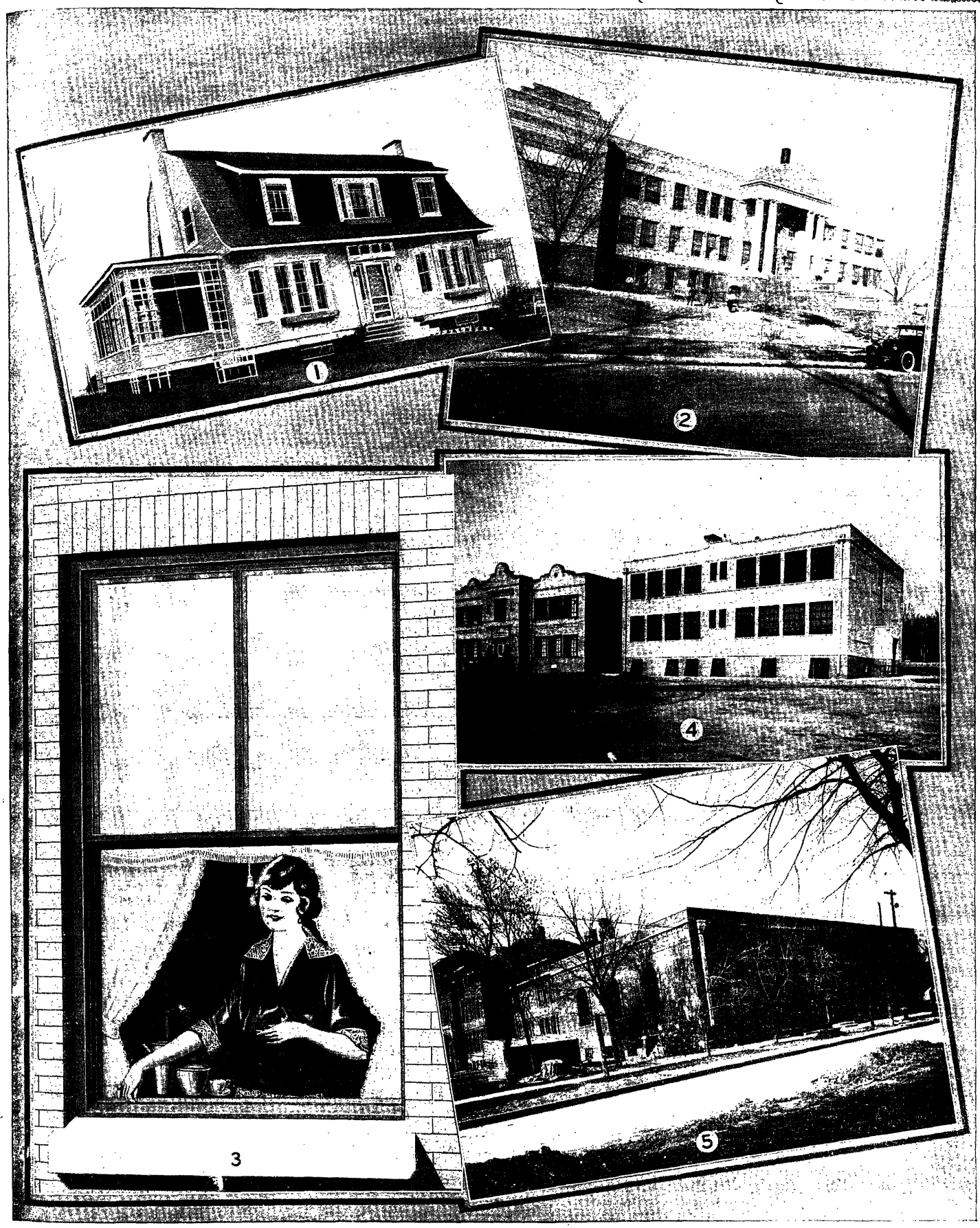
1. Terminal Railroad Association Offices, Interior, 12th and Poplar, St. Louis, Mo
2. Terminal Railroad Association Offices, Exterior, 12th and Poplar, St. Louis, Mo.
3. Prather Apartments, Maplewood, St. Louis, Mo.
4. St. Edwards' Parochial School, St. Louis, Mo.
5. St. Edwards' Parochial School, Architect's sketch
6. Blessed Sacrament Parochial School, St. Louis, Mo.
7. Typical Bungalow, equipped with Mesker Extending Ventilator Sash.





Installations of the Mesker Standard Solid Section **STEEL CASEMENT WINDOWS.**

1. John T. Walbridge Club House, Chicago, Ill.
2. Typical Bungalow, equipped with Mesker Steel Casement Windows.
3. John T. Walbridge Club House, another view.
4. Typical Steel Casement Window installed in Residence.



Above are photographs of a few of the many installations of the Mesker **COMBINATION SHEET STEEL AND SOLID SECTION STEEL WINDOWS.**

1. Bungalow equipped with Mesker Combination Windows, Counterbalanced type.
2. School Building, Pueblo, Colo., Combination Windows, Double Hung type.
3. Typical installation of Mesker Combination Steel Window in Residence.
4. Park View School, Pueblo, Colo., Combination Windows, Double Hung type.
5. Another School Building, Pueblo, Colo., Combination Windows, Double Hung type.

Mesker Bros. Iron Co.

St. Louis, Mo.

SOLID STEEL SASH, HOLLOW METAL WINDOWS, STEEL AND CONCRETE STAIRS

INDEX OF PRODUCTS

FOR THE FOLLOWING TYPES OF BUILDINGS:—

BUSINESS BUILDINGS—
Banks, Garages and Service Stations, Greenhouses, Lofts, Office Buildings, Restaurants, Stores, Warehouses and Storage Buildings.

EDUCATIONAL BUILDINGS—
Gymnasiums, Laboratories, Libraries, Schools and Colleges.

INSTITUTIONS—
Hospitals, Homes, Sanitariums.

INDUSTRIAL BUILDINGS—
Factories, Heating and Power Plants.

MILITARY AND NAVAL BUILDINGS—
Arsenals, Armories, Barracks, Camps, Fortifications, Hangars, Magazines.

PUBLIC BUILDINGS—
Capitols, City Halls, Town Halls, Court and Custom Houses, Comfort Stations, Fire and Police Stations, Jails and Reformatories, Post Offices.

PUBLIC WORKS—
Car Barns, Destructor Plants and Incinerators, Freight Houses, Ferry Houses, Light Houses, Lighting Systems (Gas and Electric) Radio Stations, Railroad Stations, Round Houses, Signal Towers.

RELIGIOUS BUILDINGS—
Churches, Chapels and Parish Houses, Convents, Monasteries.

RESIDENTIAL BUILDINGS—
Apartments, Flats and Tenements, Dwellings, Barns and Farm Buildings, Dormitories, Garages, Hotels and Stables.

SOCIAL AND RECREATIONAL BUILDINGS—
Auditoriums and Halls, Clubs, Lodges, Natatoriums, Bath Houses, Locker Buildings, Observation Stands and Stadiums, Park Pavilions, Rinks, Theaters and Service Buildings.

GENERAL OFFICES AND FACTORY, SAINT LOUIS, MISSOURI

BRANCH OFFICES:

Atlanta, Georgia
Baltimore, Maryland
Birmingham, Alabama
Boston, Massachusetts
Bluefield, West Virginia
Chattanooga, Tennessee
Charleston, West Virginia
Charlotte, North Carolina
Chicago, Illinois
Cincinnati, Ohio
Cleveland, Ohio
Columbus, Ohio
Dallas, Texas
Dayton, Ohio
Denver, Colorado
Detroit, Michigan
Houston, Texas
Indianapolis, Indiana
Kansas City, Missouri
Little Rock, Arkansas
Los Angeles, California
Louisville, Kentucky
Memphis, Tennessee
Miami, Florida
Milwaukee, Wisconsin
Nashville, Tennessee
Natchez, Mississippi
New Orleans, Louisiana
Norfolk, Virginia
Omaha, Nebraska
Oklahoma City, Oklahoma
Philadelphia, Pennsylvania
Pittsburgh, Pennsylvania
Roanoke, Virginia
Salt Lake City, Utah
San Antonio, Texas
Spokane, Washington
Tampa, Florida
Toledo, Ohio
Tulsa, Oklahoma
Vicksburg, Michigan
Washington, D. C.
Wichita, Kansas
Wilson, North Carolina
Winston-Salem, North Carolina

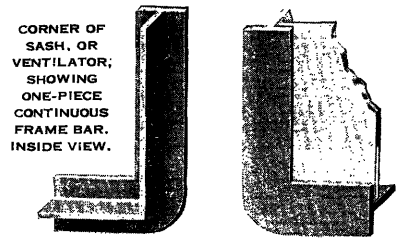
STANDARD CONSTRUCTION OF THE MESKER STEEL SASH

SECTIONS

The single bar sections for Mesker Steel Windows consist of one piece solid section rolled open hearth steel and gives maximum strength and rigidity, thoroughly weather-proof and neat in appearance.

FRAME AND VENTILATOR BARS

The outer members of the sash and ventilator frames comprising the top, bottom and two sides consists of *ONE CONTINUOUS, SOLID SECTION STEEL BAR, BENT ROUND AT THE CORNERS* (see engraving), and the two ends coming together is strongly spliced and welded. This continuous feature of the outer frame member makes the sash and ventilator at the four corners inflexible and unbreakable. It also prevents the sash from becoming twisted and warped out of square. No other sash manufactured has this superior quality.

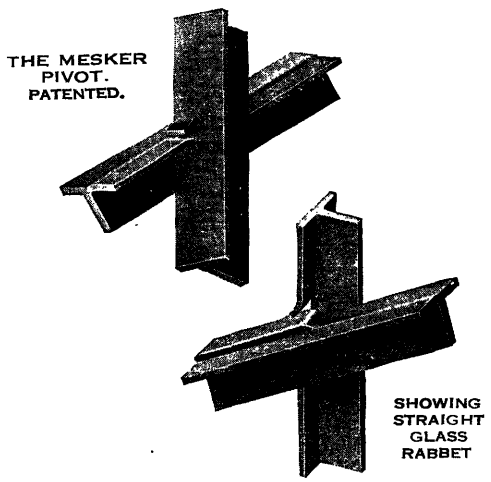


CORNER OF SASH, OR VENTILATOR; SHOWING ONE-PIECE CONTINUOUS FRAME BAR. INSIDE VIEW.

SAME CORNER, OUTSIDE VIEW, GLAZED

PIVOTS

The Mesker pivot is patented. It is not a hinge or an attachment of any kind, therefore, no plates, bolts, nuts, pins, or other loose parts are required in its make up. It cannot rust tight when not in use. Its superiority lies in the simplicity of its formation. A fulcrum bearing is provided on which the ventilator balances perfectly on its own axis and yields to the slightest touch of the push bar or chain operator. The pivot feature of the ventilator does not affect the alignment of the glass rabbets, they are as flat as the glass itself. The Mesker pivot permits the ventilator to be removed by window cleaners without the use of tools, and to be replaced without readjustment or refitting.



THE MESKER PIVOT. PATENTED.

SHOWING STRAIGHT GLASS RABBET

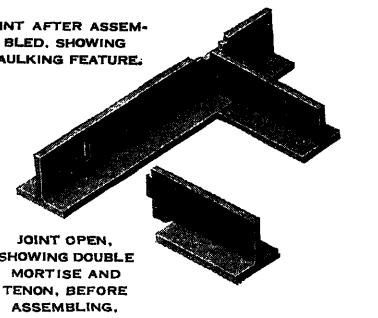
VENTILATORS

The weathering features of our ventilators are designed in accordance with the well-known principle of flat straight surface contact, overlapping the muntins three-eighth inch all around, which is preferable to the point or butt contact, making a continuous flat weathering, thoroughly rain proof. Ventilators are made entirely by machinery, assuring a closely-fitting, well-balanced sash, free from the uncertainty of hand labor, at the most important part of the window. Weep holes or drains are provided at sill of ventilator near the jamb, to carry off inside condensation.

When ventilators extend to both sides of window, keep sash slightly away from masonry to prevent ventilator from binding against the wall when opening.

JOINTS

The joining of horizontal and vertical muntins if formed by a special (patent applied for) dovetail wedge and miter. Where the muntins intersect the frame bar, a double two-way mortise and tenon feature is employed, as shown by engraving. The joints being interlocked by powerful presses gives the sash great strength against wind pressure. Hand power in the manufacture of our steel windows is entirely eliminated, assuring a perfectly fitting and high-class article impossible of attaining by hand-made process.

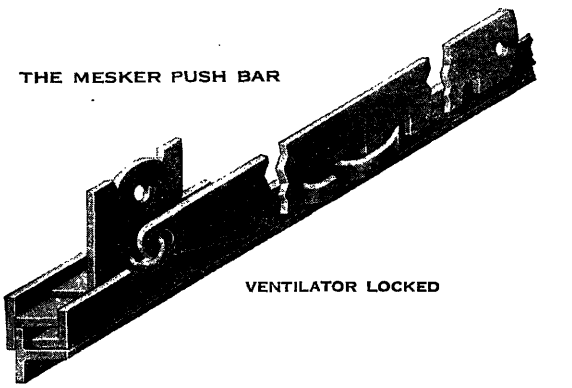


JOINT AFTER ASSEMBLED, SHOWING CAULKING FEATURE.

JOINT OPEN, SHOWING DOUBLE MORTISE AND TENON, BEFORE ASSEMBLING.

PUSH BARS

Push bar sash adjusters are furnished for all ventilators, unless otherwise specifically mentioned. They are made of heavy rolled bar iron, connected with strong eye bolt to steel angle bracket, securely fastened to bottom of ventilator. Notches in edge of push bar fit over edge of weathering angle, enabling the ventilator to be opened at any required position. When ventilator is closed the push bar is folded back, inserting its notches into loops in weathering angle securely locking the ventilator.

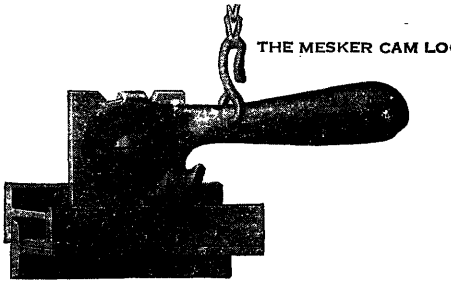


THE MESKER PUSH BAR

VENTILATOR LOCKED

CAM LOCK AND CHAIN HARDWARE

The cam lock is of heavy steel construction, connected to angle bracket with strong swivel bolt, and securely fastened to bottom of ventilator. The chain is fastened to top of ventilator by heavy steel ring, and holds the ventilator open at any desired angle by fastening the chain to cleat on wall or to hook at bottom of sash.



THE MESKER CAM LOCK

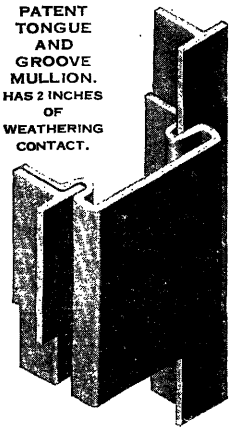
STANDARD CONSTRUCTION OF THE MESKER STEEL SASH

TONGUE AND GROOVE MULLIONS

Our **PATENTED** vertical mullions are used combining two or more units for openings of any width. The Mesker mullions consist of No. 14 and No. 16 gauge steel. They have the distinctive feature of matched tongue and groove boards, making them rainproof, windproof, and dustproof. Other superior qualities of our mullions are:

They have no unsightly bolts and nuts, or expansion slots, to mar their appearance or cause trouble in erection.

They have no seams to spread and admit water. They have two inches of continuous weathering contact. The tongue and groove feature provides for expansion and contraction, also for the most rapid installation at a reduction of 20% in cost.



See page 11 for illustration of tongue and groove mullions. They vary in width, from 3 inches up, as may be necessary to make up standard width of masonry opening.

HORIZONTAL MULLIONS

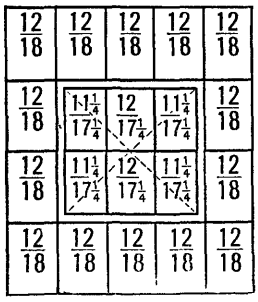
Horizontal mullions of the design here shown are desirable where one sash is set immediately above the other, and may be built up of angles and channels combined. These are never furnished by us unless specifically agreed upon, and are here shown merely as suggestion and information. The size and weight of these structurals depend on the width of opening.

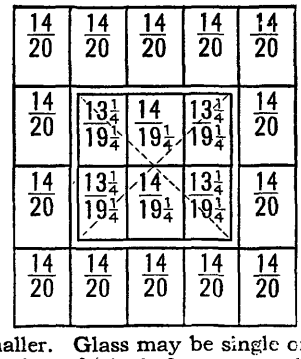
MECHANICAL OPERATORS

These devices can be furnished in connection with our warehouse and special sash at an extra charge. Sash can be arranged for their reception, but require extra time, as these operators are made to individual orders.

GLASS SIZES

Units are furnished in two standard sizes, for lights 12 x18 inches and 14 x 20 inches. Note that the lights in





the ventilator are somewhat smaller. Glass may be single or double strength American ⅛-inch or 3/16-inch factory rough or ribbed, ¼-inch rough or ribbed, maze, polished wire, or plain plate glass may be used. Adopting standard sizes will mean low cost and quick delivery, other sizes can be furnished at greater cost. All glass sizes should be rechecked.

GLAZING

Our glazing clips are of special design, devised to hold the glass firmly in place, four clips to each light. These clips take up the variation in the thickness of the glass. Special steel sash putty should be used. Ordinary putty dries out and breaks away. Spread putty on the glazing rabbet, force glass into same, completely filling the entire space between the glass and the steel. Excess putty neatly struck off and glass face puttied.

CORNER OF SASH SHOWING THE MESKER GLAZING CLIP.

PAINTING

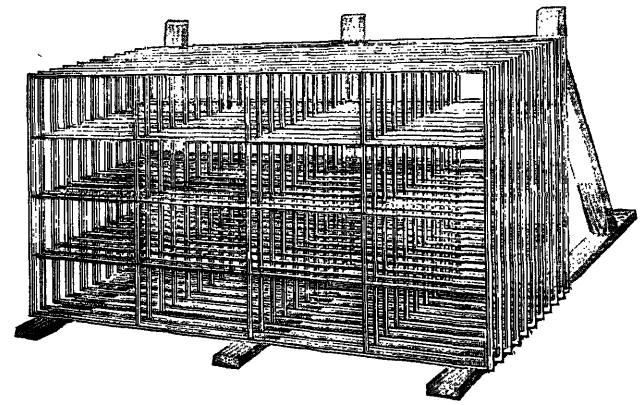
All sash receive one priming coat of paint before leaving our factory.

UNLOADING

Care must be exercised in unloading sash, lest they become damaged, making repairs necessary before installation.

STACKING

The sash should be stacked at building site in the manner shown by cut. They should never be laid flat. Lay three pieces of wood in level position, tilting sash against upright braces or lean them against building.



ERECTION

We cannot guarantee sash to be satisfactory unless they are set plumb, true and straight in the openings, which latter must have the angles true 90 degrees, when any ordinary mechanics can install them at nominal cost. Place wood blocks directly under sash at points shown in illustration and level the bottom of the sash, noting in particular that horizontal muntins line up with adjoining sash.

The steel clips with which the ventilator is fastened must never be removed until sash are ready for glazing.

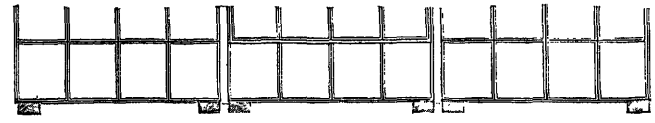
All ventilators are carefully tested before leaving the factory, but if adjusting should be necessary at the building it should be done before, not after sash are glazed.

To install single units after walls are built, leave groove in jamb on one side of opening 1¼-inch wide, and ½-inch wide in the other jamb. Slip one edge of the sash into the larger groove, and then swing the other edge into the smaller groove. Adjust the sash evenly into the opening and block up the sash at the sill, and secure upper projecting flange of sash to lintel construction, see page 11, details H1, H3, H5, H7. Build sill under sash and grout sash all around to a neat finish.

When opening has two or more units, allow ½-inch groove in masonry of each jamb. Set one sash flange into groove in either jamb and other flange into mullion. Follow in tongue and groove manner, alternating with mullion and sash, completing with sash flange inserted into ½-inch groove in opposite jamb.

Block up sash at sill with upper sash flange entering lintel and build up sill under sash. Do not crowd sash, use care, remove obstacles, and the result will be 20% saving in erection cost with tongue and groove mullions.

In concrete walls, a rebate should be formed in jambs. Install sash as directed above. Grout sash neatly all around.



USE STOCK SASH

There are forty types and forty sizes of Mesker Steel Sash now ready for your building.

PUSH BARS

Are furnished for all ventilators, except for ventilators out of reach by hand, then cam locks and chains are provided.

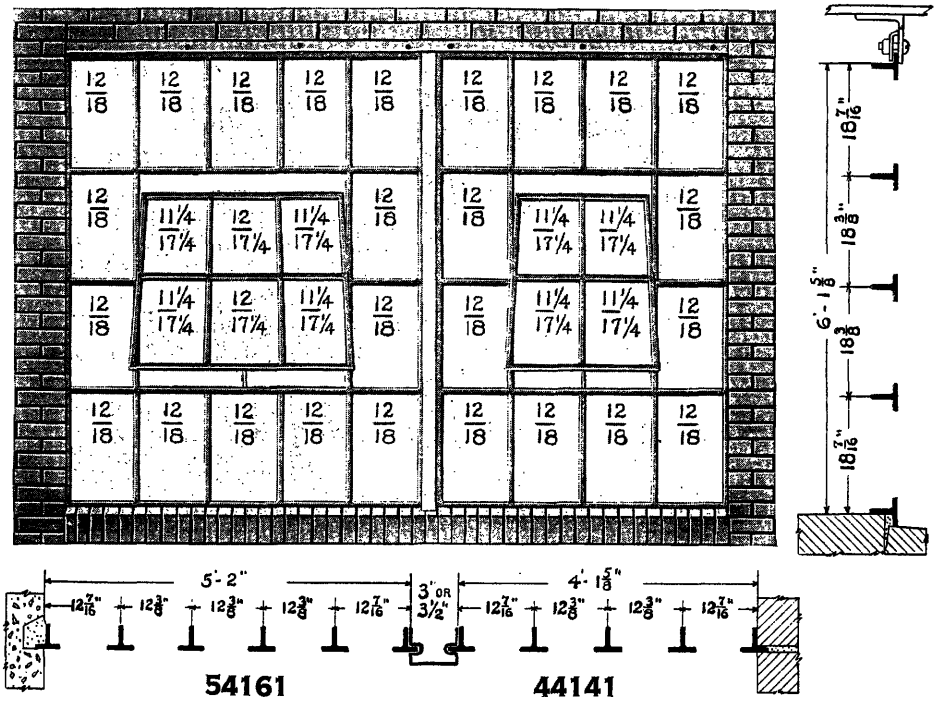
INSTALLATION AND DIMENSIONS

The above cut shows the installation of two Standard Units of Mesker Solid Section Steel Sash 54161 and 44141 for 12 x 18-inch glass, with a Mesker tongue and groove mullion joining them together.

The dimensions given are from the bar centers between the glass to the outside measure of the sash. The dimensions given ot the sash units are the clear masonry openings for single units.

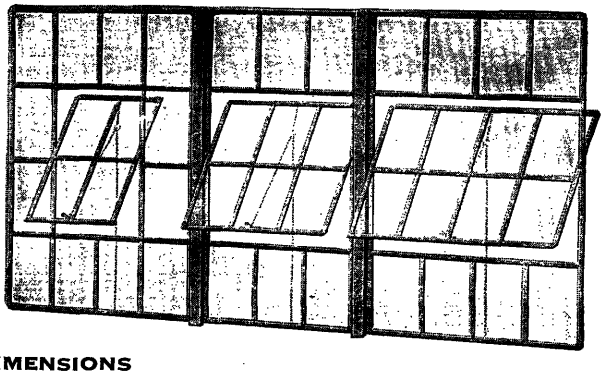
Sash measure is taken from outside to outside of stem of the sash bar, both for width and height.

The mullions joining several units may be of variable widths to accommodate the width of the openings, but standard widths and heights as given on page 10 are recommended and should be used for the most desirable installations.



UNDERWRITERS' SIDE WALL CENTER PIVOTED SASH

Are also carried in stock, and are of the same construction and dimensions as Standard Sash plus the small steel glazing angles. The sash are subject to the rigid inspection of the National Board of Fire Underwriters, bearing their labels of approval, are accepted by rating bureaus everywhere in the United States and Canada as Underwriters' Sash.



DIMENSIONS

The maximum size of units is 7 feet 0 inches by 12 feet 0 inches, and may be used in multiples, but not more than two ventilators to each unit, and no ventilator to exceed 3,000 square inches of area.

FUSIBLE LINKS

And chains are furnished with the Mesker Gravity Cam Locks, which permits ventilators to close automatically by gravity at the approach of fire or excessive heat.

PUSH BAR SASH ADJUSTERS

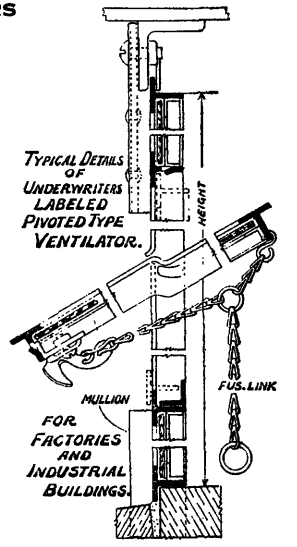
Without the fusible links are permitted in some localities, but is subject to the approval of the local Fire Rating Bureau.

MULLIONS

The Mesker (**PATENTED**) tongue and groove mullions are employed to combine labeled sash units in wide openings. A special type mullion is furnished in connection with labeled sash for openings more than eight feet in height.

GLAZING

The glazing is accomplished by small steel glazing angles, held in place by tap screws or split rivets. Special installation and glazing instructions accompany each shipment of Underwriters' Sash.



COMMENT

The weather side of our sash have a very neat finish, clear cut muntin lines, symmetry in appearance, and free from projections or flanges to catch dust, snow or other objectionable matter to hasten rusting.

These steel windows are lower in price than wood and far more desirable, considering volume of light area and ventilation, they are incomparably superior.

Customers are given the benefit of our very low prices, attained by purchasing material in large quantities at advantageous market quotations, by manufacturing sash at a ratio of 95% machine labor to 5% hand labor, and by the 33⅓% less freight charges than obtain in other sash.

PRICE LISTS AND TERMS OF SALE

Mesker Bros. Iron Co. are publishers of the first steel sash catalogue in the United States giving prices of steel window sash. See page 10 for price list in this issue.

Customers will please write for price lists and avail themselves of the prevailing discount and estimate the cost of their requirements.

All prices in this Catalog are F. O. B. cars, St. Louis, Mo. Subject to discount. **NET CASH** upon receipt of goods. ALL prices are subject to change without notice. Those desiring credit must have good commercial rating or furnish references from whom satisfactory information must be obtained before shipment will be made.

NO GOODS will be shipped C. O. D. or to our order with draft attached to Bill of Lading, unless one-half payment is made in advance, to insure acceptance, or unless guaranteed by your bank or banker. No extension allowed nor more than thirty days credit given except by special agreement.

CLAIMS against invoice must be made upon receipt of goods. **REMITTANCES** must be made by draft or its equivalent, Express or P. O. Money Order, not by personal check unless exchange is added. ALL contracts or agreements are contingent upon Strikes, Accidents, Delays or Damages by carriers and other delays unavoidable or beyond our control. ALL orders sent us without previous quotations will be shipped at our regular prices, which will be as low as if quoted before receiving the order.

As questions constantly arise as to the responsibility of shippers, for loss of and damage to goods, etc., in transit, we call the special attention of our customers to the following: Our responsibility ceases as soon as goods are delivered in good order and condition at shipping point, and a receipt taken for same, we as senders, having no legal claim after the goods are delivered to the carriers properly consigned, as the ownership has passed from us to consignee.

No goods returned will be received by us unless we have been corresponded with and have given our permission that same may be returned, and customer returning must in all cases pay freight and expense. After orders are entered the cancellation of same must be subject to our acceptance. It is expressly understood that all orders imply an acceptance of above terms of payment and conditions of shipment.

All contracts and agreements received by our sales representatives are subject to the approval of the home office, and such approval must be signed by an officer of the company to be valid; and unless so signed the responsibility rests with the representative and not with the company.

MESKER BROTHERS IRON COMPANY

Publishers of THE FIRST STEEL SASH PRICE LIST in the United States

Follow Heavy Face Type for 12" x 18" Glass and Light Face Typef or 14" x 20" Glass.

HEIGHT OF WINDOW OPENINGS. 3'-0⅞" / 3'-4⅞"	 32	 42	 52	 32-161	 42-141	 42-181	 52-161
WIDTH OF OPENINGS.	3'-1¼" 3'-7¼"	4'-1⅝" 4'-9⅝"	5'-2" 6'-0"	3'-1¼" 3'-7¼"	4'-1⅝" 4'-9⅝"	4'-1⅝" 4'-9⅝"	5'-2" 6'-0"
PRICE OF SASH	$2.26 2.42	$2.79 3.17	$3.48 3.86	$5.53 6.05	$5.53 6.02	$6.54 7.04	$6.86 7.23
HEIGHT OF WINDOW OPENINGS. 4'-7¼" / 5'-1¼"	 33	 43	 53	 33-161	 43-141	 43-181	 53-161
WIDTH OF OPENINGS.	3'-1¼" 3'-7¼"	4'-1⅝" 4'-9⅝"	5'-2" 6'-0"	3'-1¼" 3'-7¼"	4'-1⅝" 4'-9⅝"	4'-1⅝" 4'-9⅝"	5'-2" 6'-0
PRICE OF SASH	$3.10 3.48	$4.01 4.54	$4.85 5.53	$6.32 6.63	$6.76 7.17	$7.79 8.18	$8.26 8.57
HEIGHT OF WINDOW OPENINGS. 6'-1⅝" / 6'-9⅝"	 34	 44	 54	 34-161	 44-141	 44-181	 54-161
WIDTH OF OPENINGS	3'-1¼" 3'-7¼"	4'-1⅝" 4'-9⅝"	5'-2" 6'-0"	3'-1¼" 3'-7¼"	4'-1⅝" 4'-9⅝"	4'-1⅝" 4'-9⅝"	5'-2" 6'-0"
PRICE OF SASH	$4.01 4.54	$5.30 5.83	$6.36 7.13	$7.24 7.93	$7.93 8.69	$8.93 9.70	$9.65 10.54
HEIGHT OF WINDOW OPENINGS. 7'-8" / 8'-6"	 35	 45	 55	 35-161	 45-141	 45-181	 55-161
WIDTH OF OPENINGS	3'-1¼" 3'-7¼"	4'-1⅝" 4'-9⅝"	5'-2" 6'-0"	3'-1¼" 3'-7¼"	4'-1⅝" 4'-9⅝"	4'-1⅝" 4'-9⅝"	5'-2" 6'-0"
PRICE OF SASH	$5.07 5.61	$6.36 7.13	$7.73 8.71	$8.33 8.86	$9.11 9.90	$10.13 10.92	$10.95 11.81
HEIGHT OF WINDOW OPENINGS. 9'-2⅜" / 10'-2⅜"	 36	 46	 56	 36-161	 46-141	 46-181	 56-161
WIDTH OF OPENINGS.	3'-1¼" 3'-7¼"	4'-1⅝" 4'-9⅝"	5'-2" 6'-0"	3'-1¼" 3'-7¼"	4'-1⅝" 4'-9⅝"	4'-1⅝" 4'-9⅝"	5'-2" 6'-0"
PRICE OF SASH	$5.90 6.58	$7.39 8.48	$9.17 10.49	$9.40 10.08	$10.34 11.04	$11.36 12.05	$12.68 14.09

STANDARD OPENING SIZES FOR CENTER PIVOTED AND EXTENDING VENTILATOR SASH

Eight light ventilators not recommended for side arm extending type.

Prices are F. O. B. cars St. Louis, not including glass and putty. Glass is always kept in stock for prompt delivery and is quoted on application.

SIZES FOR 12" x 18" GLASS

Width of Window Opening	Total No. of Lights Wide	No. of Units	Number of Lights Wide: 1st Unit	2nd Unit	3rd Unit	4th Unit	5th Unit
3'-1¼"	3	1	3	....	....	....	....
4'-1⅝"	4	1	4	....	....	....	....
5'-2"	5	1	5	....	....	....	....
6'-6"	6	2	3	3	....	....	....
8'-6¾"	8	2	4	4	....	....	....
10'-7½"	10	2	5	5	....	....	....
9'-10"	9	3	3	3	3	....	....
10'-10⅜"	10	3	3	4	3	....	....
11'-10¾"	11	3	3	5	3	....	....
11'-10¾"	11	3	4	3	4	....	....
12'-11⅛"	12	3	4	4	4	....	....
13'-11½"	13	3	4	5	4	....	....
13'-11½"	13	3	5	3	5	....	....
14'-11⅞"	14	3	5	4	5	....	....
16'-0¼"	15	3	5	5	5	....	....
13'-2"	12	4	3	3	3	3	....
15'-2¾"	14	4	3	4	3	4	....
15'-2¾"	14	4	3	4	4	3	....
17'-3½"	16	4	4	4	4	4	....
17'-3½"	16	4	5	3	3	5	....
17'-3½"	16	4	3	5	5	3	....
19'-4¼"	18	4	4	5	5	4	....
19'-4¼"	18	4	5	4	4	5	....
21'-5"	20	4	5	5	5	5	....
16'-6"	15	5	3	3	3	3	3
17'-6⅝"	16	5	3	3	4	3	3
18'-6¾"	17	5	3	3	5	3	3
18'-6¾"	17	5	3	4	3	4	3
19'-7⅛"	18	5	3	4	4	4	3
19'-7⅛"	18	5	4	3	4	3	4
20'-7½"	19	5	5	3	3	3	5
21'-7⅛"	20	5	4	4	4	4	4
21'-7⅛"	20	5	5	3	4	3	5
21'-7⅛"	20	5	3	5	4	5	3
22'-8¼"	21	5	5	4	3	4	5
22'-8¼"	21	5	4	5	3	5	4
22'-8¼"	21	5	4	4	5	4	4
22'-8¼"	21	5	5	3	5	3	5
23'-8⅝"	22	5	4	5	4	5	4
23'-8⅝"	22	5	5	4	4	4	5
24'-9"	23	5	5	4	5	4	5
24'-9"	23	5	4	5	5	5	4
25'-9⅜"	24	5	5	5	4	5	5
26'-9¾"	25	5	5	5	5	5	5

Our patented tongue and groove mullions should be used with two or more standard units for large openings.

WAREHOUSE STOCK

Large quantities of the above sizes in Center Pivoted Type are in stock and immediate deliveries can be made if desired.

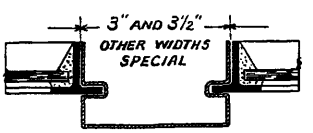
WRITE FOR DISCOUNTS

SIZES FOR 12"x18" GLASS

Height of Window Opening	No. of Lights High
3'-0⅞"	2
4'-7¼"	3
6'-1⅝"	4
7'-8"	5
9'-2⅜"	6

SIZES FOR 14"x20" GLASS

Height of Window Opening	No. of Lights High
3'-4⅞"	2
5'-1¼"	3
6'-9⅝"	4
8'-6"	5
10'-2⅜"	6



Detail of Standard Mullion and Sash Bar.

Mullions for 2 units are 3½" wide.
Mullions for 3 units are 3⅛" wide.
Mullions for 4 units are 3 " wide.
Mullions for 5 units are 2 15/16" wide.

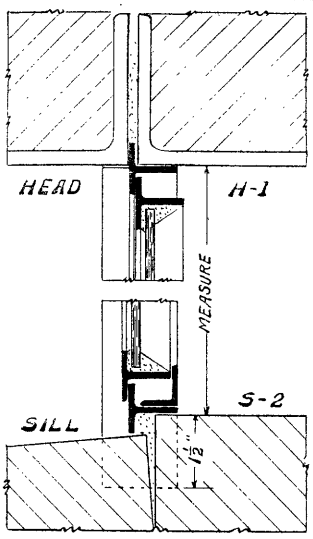
UNDERWRITERS' LABELED SASH

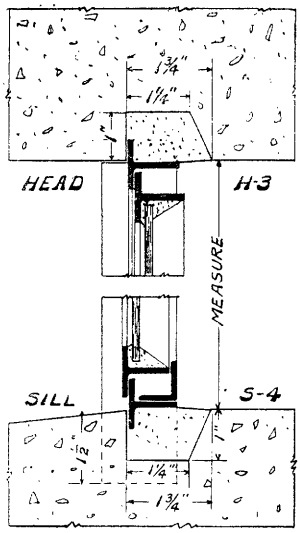
are also carried in stock and are of the same construction as our Standard Sash, plus the small steel glazing angles. The sash are subject to the rigid requirements and inspection of the National Board of Fire Underwriters, bearing their labels of approval and adopted by rating bureaus everywhere in the United States and Canada as standard Underwriters' sash.

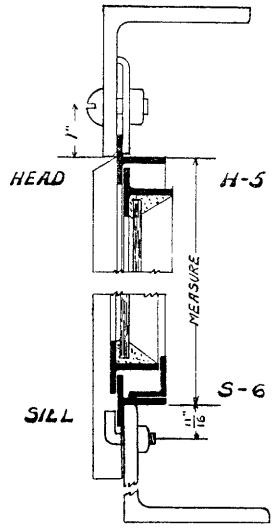
SIZES FOR 14" x 20" GLASS

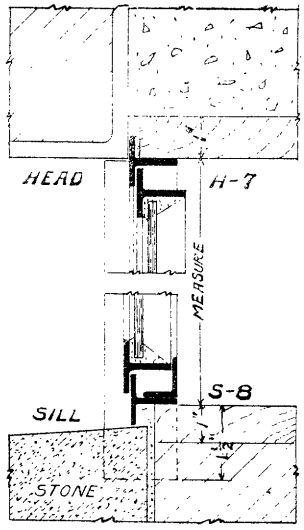
Width of Window Opening	Total No. of Lights Wide	No. of Units	Number of Lights Wide: 1st Unit	2nd Unit	3rd Unit	4th Unit	5th Unit
3'-7¼"	3	1	3	....	....	....	....
4'-9⅝"	4	1	4	....	....	....	....
6'-0"	5	1	5	....	....	....	....
7'-6"	6	2	3	3	....	....	....
9'-10¾"	8	2	4	4	....	....	....
12'-3½"	10	2	5	5	....	....	....
11'-4"	9	3	3	3	3	....	....
12'-6¾"	10	3	3	4	3	....	....
13'-8¾"	11	3	3	5	3	....	....
13'-8¾"	11	3	4	3	4	....	....
14'-11⅛"	12	3	4	4	4	....	....
16'-1½"	13	3	4	5	4	....	....
16'-1½"	13	3	5	3	5	....	....
17'-3⅞"	14	3	5	4	5	....	....
18'-6¼"	15	3	5	5	5	....	....
15'-2"	12	4	3	3	3	3	....
17'-6¾"	14	4	4	3	3	4	....
17'-6¾"	14	4	3	4	4	3	....
19'-11½"	16	4	4	4	4	4	....
19'-11½"	16	4	5	3	3	5	....
19'-11½"	16	4	3	5	5	3	....
22'-4¼"	18	4	4	5	5	4	....
22'-4¼"	18	4	5	4	4	5	....
24'-9"	20	4	5	5	5	5	....
19'-0"	15	5	3	3	3	3	3
20'-2⅜"	16	5	3	3	4	3	3
21'-4¾"	17	5	3	3	5	3	3
21'-4¾"	17	5	3	4	3	4	3
22'-7⅛"	18	5	3	4	4	4	3
22'-7⅛"	18	5	4	3	4	3	4
23'-9½"	19	5	5	3	3	3	5
24'-11⅞"	20	5	4	4	4	4	4
24'-11⅞"	20	5	5	3	4	3	5
24'-11⅞"	20	5	3	5	4	5	3
26'-2¼"	21	5	5	4	3	4	5
26'-2¼"	21	5	4	4	5	4	4
26'-2¼"	21	5	5	3	5	3	5
26'-2¼"	21	5	4	5	3	5	4
27'-4⅝"	22	5	4	5	4	5	4
27'-4⅝"	22	5	5	4	4	4	5
28'-7"	23	5	5	4	5	4	5
28'-7"	23	5	4	5	5	5	4
29'-9⅜"	24	5	5	5	4	5	5
30'-11¾"	25	5	5	5	5	5	5

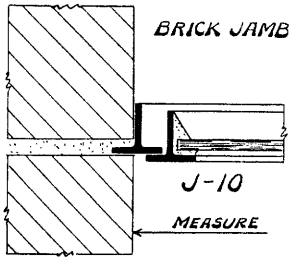
STANDARD INSTALLATION DETAILS OF THE MESKER CENTER PIVOTED AND EXTENDING VENTILATOR WINDOWS

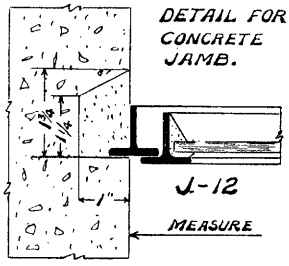


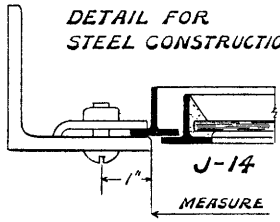


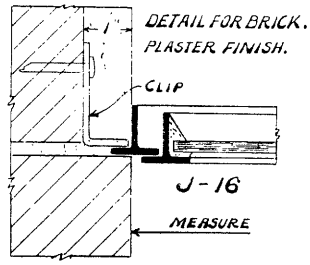


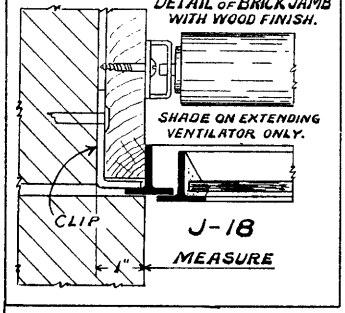


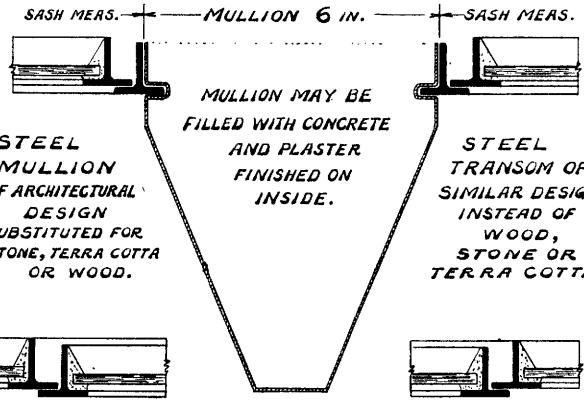


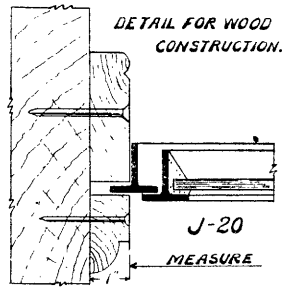


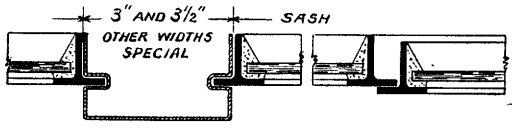










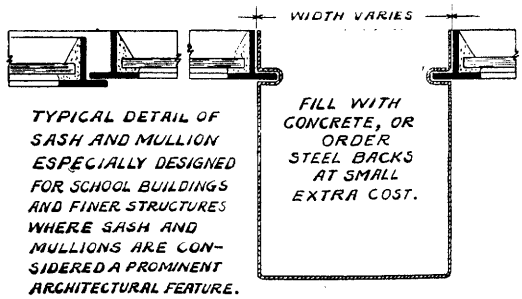


TYPICAL DETAIL OF STANDARD MULLION AND SASH BARS.

THE ABOVE DETAILS ARE STANDARD INSTALLATIONS, AND ARE USED IN CONNECTION WITH CENTER PIVOTED, AND SIDE ARM EXTENDING VENTILATOR SASH.

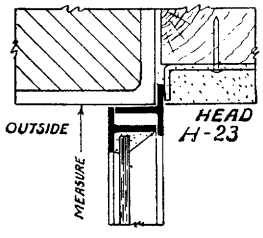
STEEL BACKS ARE FURNISHED FOR MULLIONS AT ADDITIONAL COST WHEN ORDERED.

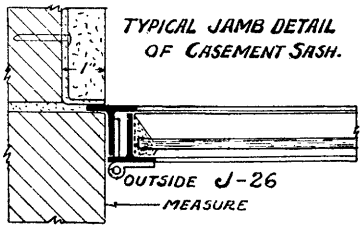
MULLIONS ARE PATENTED

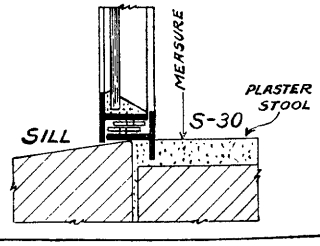


TYPICAL DETAIL OF SASH AND MULLION ESPECIALLY DESIGNED FOR SCHOOL BUILDINGS AND FINER STRUCTURES WHERE SASH AND MULLIONS ARE CONSIDERED A PROMINENT ARCHITECTURAL FEATURE.

TYPICAL CASEMENT SASH DETAILS.

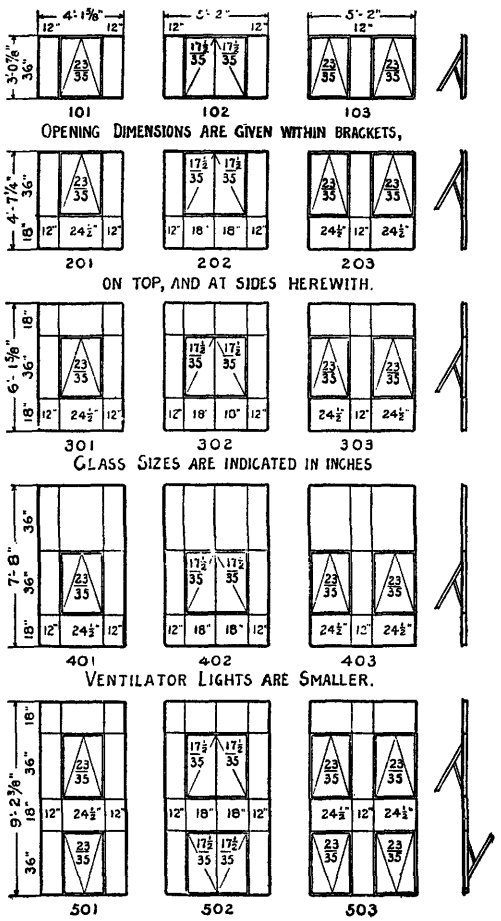




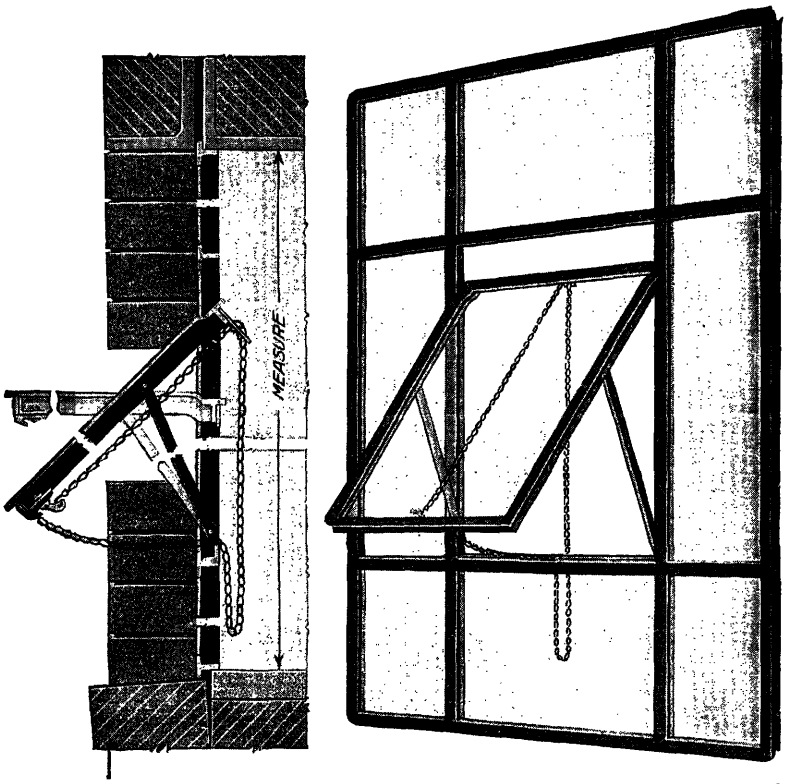


THE MESKER SIDE ARM EXTENDING VENTILATOR SASH

The Mesker Solid Section rolled open hearth Steel Sash with improved Side Arm Extending Ventilators are especially adapted, and are being extensively used in Schools, Industrial and Office Buildings, or wherever a superior window with maximum ventilation is desired. They are readily adopted by Architects and School Boards for the most perfectly operating windows without projecting the sash into the rooms. When open, the ventilator serves either as a rain shield or as an awning as well as for ventilation.



STANDARD SIZES



TYPE

The Extending Ventilator opens out at the bottom, causing the top to slide down vertically. This is accomplished by means of a pull chain fastened at the top, which projects the ventilator outwardly at the bottom. The slam, heretofore experienced when closing other types of sash is entirely eliminated in the extending type.

The necessary friction for the successful operation of this type of sash is developed by our special construction of sash bar. Has no springs or bolts to be adjusted, but a vertical slide arrangement of utmost simplicity, requiring the least effort to operate.

The self balancing ventilator automatically adjusts itself to any angle, from the vertical to the horizontal plane, giving window cleaners full access to the outside of the glass.

Another distinguishing feature of the Extending Ventilator is that it admits the attachment of window screens, on the interior as well as window shades and draperies.

CONSTRUCTION

The sash and ventilator is constructed of solid rolled open hearth steel section. The outer frame consists of **ONE PIECE CONTINUOUS STEEL BAR**, bent round at the four corners and welded at the splicing of the two ends. The muntins, also of solid steel section are tenoned at the ends and mortised into the frame members. And when caulked by heavy machinery makes the sash of greatest possible strength, and perfectly square and true, so that they cannot be racked out of shape by careless or rough handling. No other sash manufactured has this superior **ONE-PIECE FRAME BAR FEATURE.**

MULLIONS

The Mesker **PATENT** Mullions are designed to be used to join a multiple of units in large openings for lighting class rooms, auditoriums, hospital wards, etc.

They are constructed of **No. 14 or No. 16 gauge steel**, and formed into the distinctive feature of matched tongue and groove boards, and are rainproof, windproof, and dustproof.

They have no unsightly bolts, nuts or expansion slots to mar their appearance or cause time or trouble in erection. And no seams to spread open and admit dust and water. The tongue and groove feature provides for expansion and contraction and also for the most rapid installation at a reduction of 20% in cost. See page 11 for special types of mullions designed to substitute stone, terra cotta or wood. These mullions may be concrete filled and plaster finished on the interior and they present an architectural finish on the exterior.

STANDARD SIZES

The sizes of units for this type of sash are the same as for the standard center pivoted type.

Customers sending inquiries regarding this type of sash should refer to unit numbers given.

For high windows where an upper and lower ventilator is desired as in Nos. 501-502-503 it is recommended that the lower one extend in at the top and the upper one extend out at the bottom.

One hundred percent ventilation is obtainable with the extending ventilator, but maybe opened to any desired angle without the use of push bar or any other fasteners.

GLAZING

Our glazing clips, of special design, are devised to hold the glass firmly in place. Holes are provided in the muntin bars for the clips—four or more to each light. The clips take up the variation in thickness of the glass. Special steel sash putty should be spread on the glazing rabbet and the glass forced into same, completely filling the entire space between the glass and the steel. Do not use ordinary putty, it dries out and breaks away. Excess putty should be struck off and glass face puttied.

HARDWARE

The extending ventilator is operated by an endless chain. One end fastened to the cam lock, and the other passing through a wheeless pulley is secured to the bottom of ventilator.

Chains, pulleys, locks, etc., are included in our quotations.

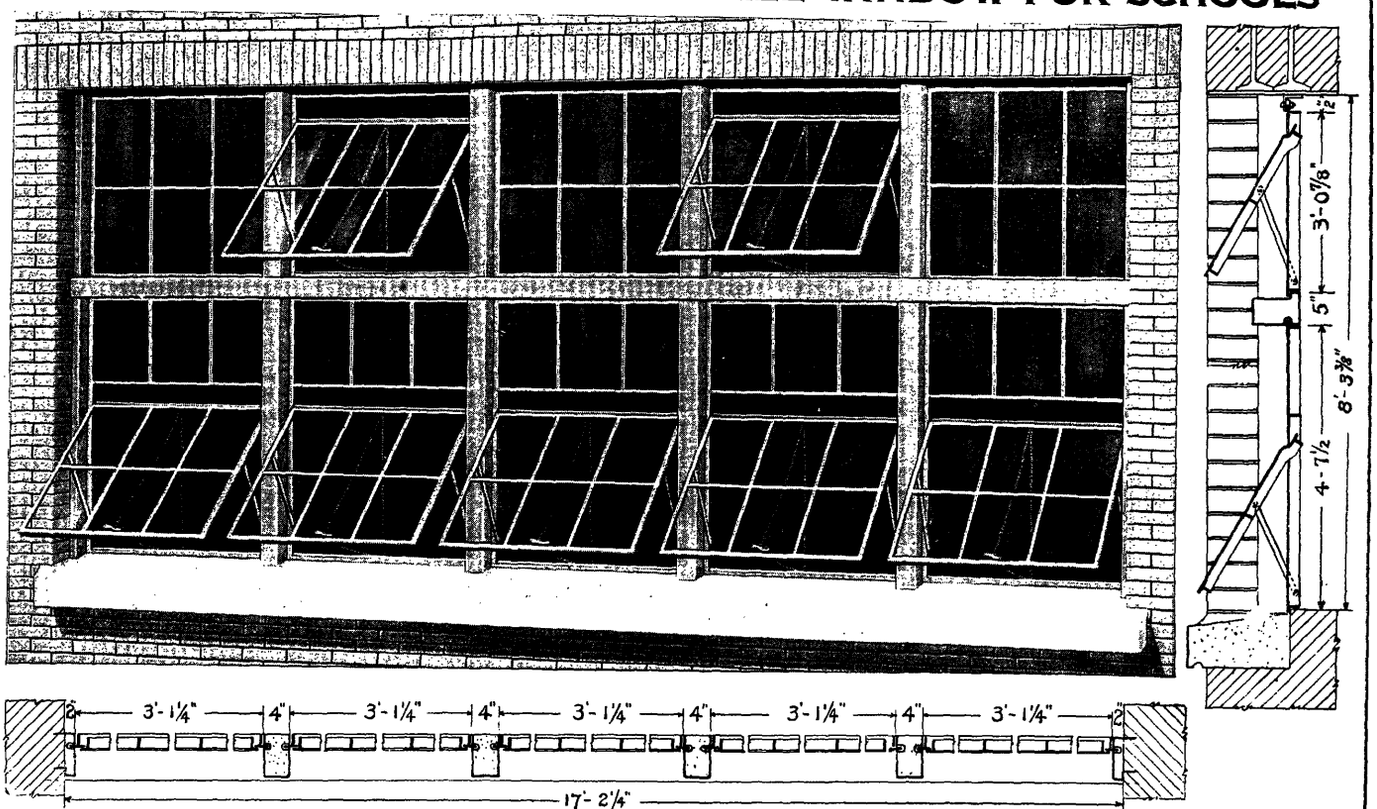
PAINTING

These sash receive a priming coat of paint before leaving the factory.

PRICES ON APPLICATION

Special prices quoted for large quantities or carload lots. Glass kept in stock for prompt delivery and is quoted on application.

THE MESKER SOLID SECTION STEEL WINDOW FOR SCHOOLS



Showing Typical large area window for School Buildings; with the Mesker Patent Mullions combining several sash units. The heavy Steel Mullions have the appearance of stone or terra cotta and add to the Architectural beauty of the structure. In the Mesker Solid Section School Window is found a most desirable means for day lighting large Halls, Class Rooms, and Auditoriums, and is being largely adopted by Architects for this purpose. The Mesker Patent Mullion may be plain or moulded into artistic design to represent cut stone and to carry into effect the general appearance of the building.

SPECIFICATION FOR STEEL SASH MESKER PIVOTED WINDOWS

All sash throughout shall be **MESKER PIVOTED SASH** manufactured by Mesker Brothers Iron Company, St. Louis, Mo. All muntin bars shall consist of one continuous piece of solid section rolled open hearth steel. Intersecting joints shall be formed by a dovetail wedge and mitre which is to be locked into place by powerful presses. The joints at the frame bars shall consist of a double two-way **INTERLOCKING MORTISE AND TENON** (special feature). The iron in the frame bar to be pressed hard against said tenon. Frame bars of both sash and ventilators shall be of **ONE CONTINUOUS SOLID SECTION STEEL BAR** bent round at corners and where the two ends come together they shall be solidly spliced and welded. All sash to be furnished with standard angle brackets for attaching hardware. All ventilators to be furnished with standard push bars, unless otherwise specified. All ventilators inaccessible to the floor are to be operated by chain and cam lock, except when mechanical operators shall be specified. Vertical mullions are to be Mesker Patent tongue and groove type made of No. 16 gauge open hearth steel plates. Horizontal mullions to be either Mesker tongue and groove mullions or built up mullions of angles and channels.

To erect Mesker sash one unit to the opening, the walls should be bricked up to about ⅛ the height of the sash leaving a slot or rebate in the wall ½" x ½" so that the sash can be slid down into place, wedged and trued up to the proper position. Then the sash is securely bricked in. Do not crowd the sash at the ventilators. To erect sash of more than one unit to the opening, the opening should be built the full height, leaving a ½" x ½" opening on both jambs, having a single angle lintel construction, and omitting one course of bricks at the bottom. The units should then be placed in the opening and loosely bolted to the lintel. See that the jambs of the sash are in the rebate at the side of the opening. Then spring the sash out to a bowed position and insert mullion between units, putting the flanges of sash in the slots of mullion, then forcing the mullion up against the lintel and spring the sash back into line and then block same in place, and securely bolt. Then the sill course may be laid and sash grouted in place. All sash shall receive one priming coat of paint before leaving our factory. The above specifications apply also to the Mesker Side Arm Extending Sash on page 12, in all respects pertaining to construction, steel sections, **ONE PIECE ROUND CORNER** feature, general method of manufacture and installation.

SPECIFICATIONS FOR STEEL CASEMENT WINDOWS

All Casement Windows shall be the Solid Section Steel Casements as manufactured by the Mesker Bros. Iron Co., St. Louis, Mo. The frame and sash shall consist of solid section rolled open hearth steel. The steel bars at the four corners shall have a special offset mortise and tenon joint solidly welded, making the sash perfectly rigid. The Casements shall be of the Mesker double contact construction. The vertical muntins shall consist of solid section steel bars. The horizontal muntins shall be of heavy lead muntin strip. The Casement sash shall be side hinged on strong bronze plated butts neatly riveted to face of sash bar and firmly secured to the stem of the frame member. All sash shall swing outwardly from the inside except where otherwise noted. The adjuster arm shall be of machine steel. It shall be jointed at about midway of its length with a special friction joint, designed to hold the sash open at any desired angle. Each sash shall be furnished with a bronze plated, cam acting lock of artistic design, firmly attached to suitable angle bracket riveted to the sash. The vertical and horizontal mullions shall be constructed of No. 16 gauge steel. They shall be the Mesker patent tongue and groove type, strong but narrow, neat and smooth. Where transom sash are required they shall be side hinged to swing out, and shall have butts, adjusters and locks as described for casement sash unless otherwise herein specified. Unless otherwise specified all casement sash shall be equipped throughout with the Mesker (patent applied for) weatherstripping. Weatherstrips shall be of No. 11 zinc, or No. 32 gauge spring bronze, and shall be secured by tubular or split rivets according to shop practice of Mesker Bros. Iron Co. The Mesker Casement Windows must be set true and straight in the openings. Leave the window sill out until casement is installed. A recess of one inch must be provided on the inside of each window jamb and at the head. The windows must be set into this recess from the inside. Secure the windows in place with steel anchors provided for same, not less than two to each side. Do not install the Mesker Casement Windows until the building is under roof. Steel glazing clips are provided to hold the glass in the sash. Glass must be back puttied, and face puttied completely covering the clips. Use special steel sash putty. Smooth the putty neatly around the glass and strike off all excess putty. Glazing to be done from the inside. Stationary Casement Windows glazed from the outside. All casement windows shall receive one coat shop paint before leaving the factory.

Continued from Page 20

MULLIONS—Underwriters approved mullions are used, when needed to combined two or more units for large openings in Auditoriums, Classrooms, Hospital Wards, etc. They are heavily built up of plate steel and they present a very neat and trim appearance, both on the inside as well as outside.

LIGHTING SURFACE—About 15% more lighting surface is obtained by the steel window than by wood window, and they are fire proof.

STANDARD SIZES—Standard dimensions of the Combination Window are given on page 20. By ordering these sizes a more prompt shipment is assured, and at a lower cost.

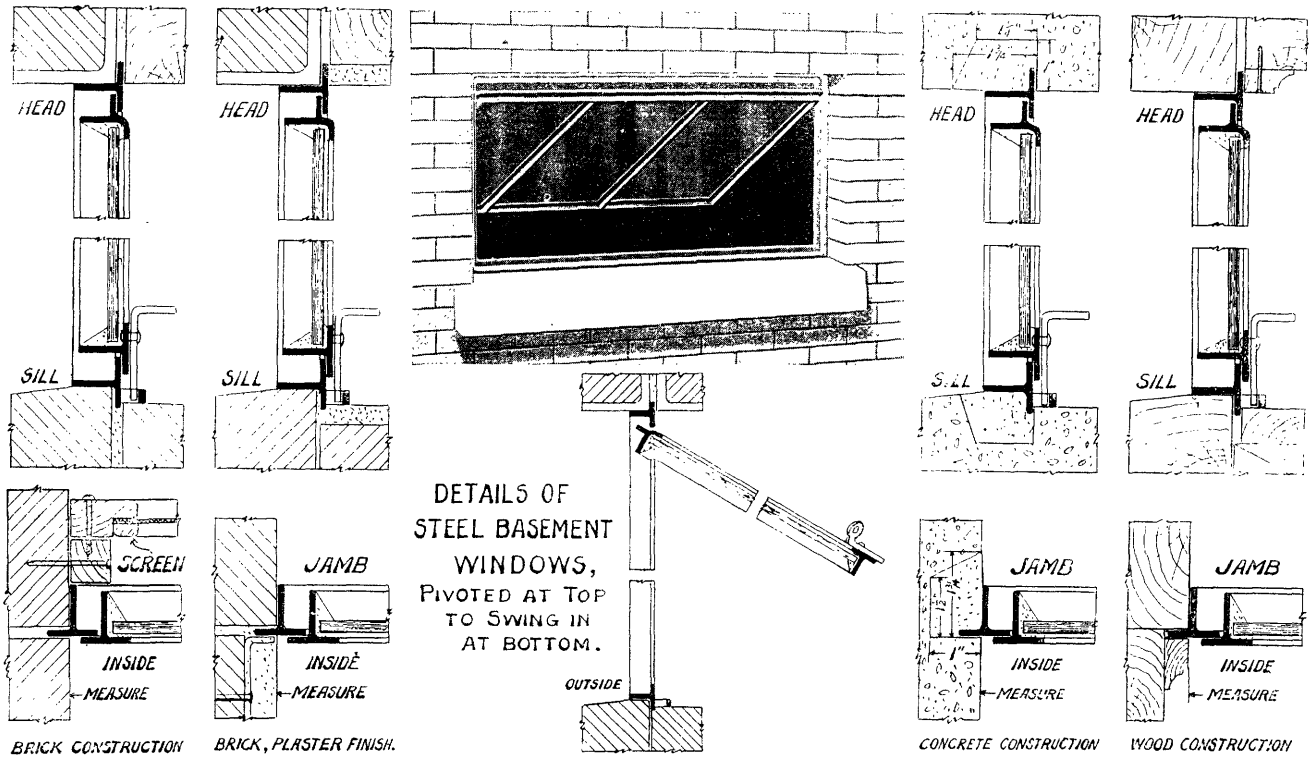
GLAZING—The sash are glazed from the inside. For the non-labeled windows, steel glazing clips and special steel sash putty should be used. Ordinary putty dries out and breaks away. For labeled windows, steel glazing angles are furnished and should be back puttied.

HARDWARE—Chains, Pulley, Locks, Lifts and Counterweights for double hung windows are included in our quotations, unless otherwise specified.

PAINTING—These windows receive a priming coat of paint before leaving the factory.

WRITE FOR PRICES—Prompt quotations are furnished on any schedule of requirements, especially low prices are given for large quantities.

SOLID SECTION STEEL BASEMENT WINDOWS



The Mesker Steel Basement Windows are made in two sizes and are constructed of solid rolled open hearth steel sections throughout, 1/8" thick. The outer frame bars of the sash and ventilator are made of **ONE CONTINUOUS PIECE OF SOLID ROLLED STEEL SECTION** welded together at the ends. This makes the sash of greatest possible strength, and perfectly square and true, so that they cannot be racked out of shape by careless or rough handling. No other sash manufactured has this superior **ONE-PIECE FRAME BAR FEATURE.**

To install Basement Windows the mason lays four or five courses of brick, leaving a half inch groove in the brick jamb on each side. Slide the sash down into these grooves, the projecting flanges of the sash extending into the grooves. Then build up the walls encasing the sash flanges into the brick work, and neatly point up with cement mortar all around. In concrete walls a rebate should be formed in each jamb and the sash is slipped down from the top into the rebate and grouted securely.

The Mesker pivot is patented. It is not a hinge or an attachment of any kind, therefore no plates, bolts, nuts, pins or other loose parts are required in its make up. It cannot rust tight when not in use. Its superiority lies in the simplicity of its formation. The Mesker Pivot permits the ventilator to be removed by window cleaners without the use of tools, and to be replaced without readjustment or refitting.

The lock is of heavy steel securely riveted to ventilator. A slotted seat is pressed into the frame for latching and insures absolute weathering. There are no springs, bolts or nuts to rust or get out of order.

Steel glazing clips to hold the glass in position are furnished. A good grade of steel sash putty should be used. Putty should be spread upon the glazing rabbet and the glass forced into same, completely filling the entire space between the glass and the steel. Face putty the glass and neatly strike off excess putty.

Our basement windows come complete ready to install in brick, stone, concrete or wood walls. They are serviceable, economical, easy to operate. The ventilator is pivoted at the top and swings in at the bottom and can be fastened to ceiling. When open 100% ventilation is obtained.

They have more lighting capacity than wooden windows, better in appearance, they are fireproof, they cost less and they last longer.

The Mesker Basement Windows are easily installed, the flanges of the frame extend into the masonry, and they are built in as the walls go up. The steel flange along the top rail extends up into the lintel construction, and the lower rail is grouted into the window sill on the inside. These windows have a priming coat of paint before leaving the factory.

Standard wooden screens may be used with basement sash from the outside. See detail above.

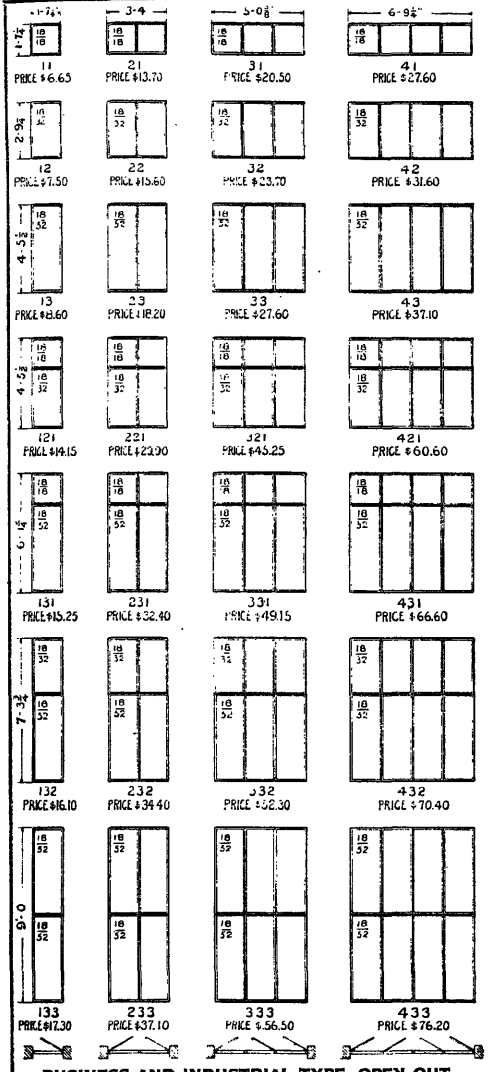
STANDARD SIZES AND PRICES

3′–2¾″ x 1′ 8″, 3 lights glass 12″ x 18″	$3.54
3′–8¾″ x 1′ 10″, 3 lights glass 14″ x 20″	3.82

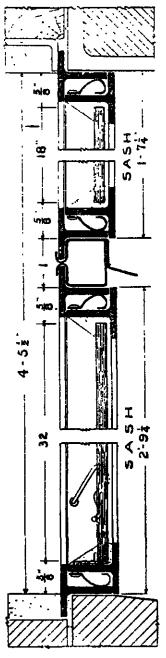
Write for discounts.

Large quantities of standard sizes are carried in stock.

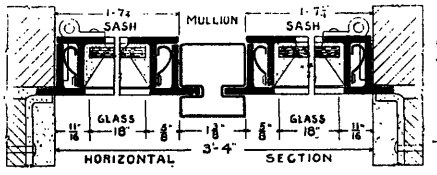
THE MESKER STANDARD SOLID SECTION STEEL CASEMENT WINDOWS



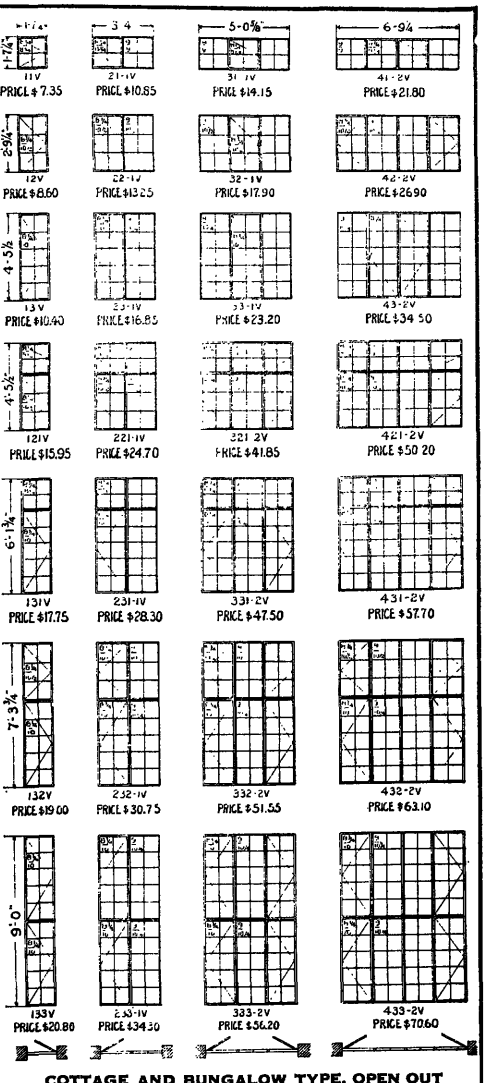
COSTS LESS THAN WOOD-EN WIN-DOWS



VERTICAL SECTION



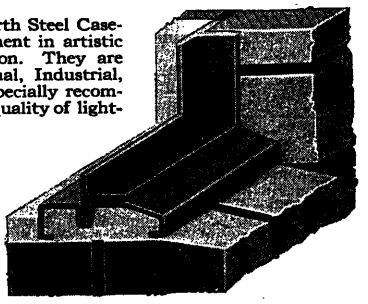
WRITE FOR DIS-COUNTS



BUSINESS AND INDUSTRIAL TYPE, OPEN OUT

The Mesker Improved Solid Section Rolled Open Hearth Steel Casement Windows represent the most advanced development in artistic beauty and symmetry and for economical construction. They are adapted chiefly for Business, Educational, Institutional, Industrial, Public, as well as for all Residential Buildings, but especially recommended for Cottages and Bungalows for their superior quality of lighting and ventilating and for their reasonably low cost.

COTTAGE CASEMENTS—The Cottage Casement Windows are designed to meet a growing need for a low price steel window, for which the suburban cottage and residence is so much in demand in modern times. Owners of Apartments as well as Bungalows are also seeking the more convenient and artistic style of window which is to be found in th Mesker Steel Casements. They are convenient for the reason that they do not project into the room, permits screens to be attached, and shades or draperies may decorate the window on the inside without being disturbed when window is operated. If so desired, when grouped, the upper or transom portion of the windows may be hinged at top to swing out at bottom. This serves as an awning, and the window may remain open during light rains without damage to the interior of rooms, and yet admitting ventilation into the room. The adjusters for both the casement and transom sash, made of spring brass or machine steel, contain the necessary friction for holding the sash at any desired angle, and requires only the slightest push of the hand to operate same after releasing the lock.



SPECIAL SILL FOR CASEMENT WINDOW

COTTAGE AND BUNGALOW TYPE, OPEN OUT

CONSTRUCTION—The Casement Windows are constructed of solid rolled open hearth steel sections. The vertical muntin is double tenoned at the ends and mortised into the frame bars. An extra sill member made of No. 16 gauge steel is furnished when desired for special installations (see illustration above) but it is not at all a necessary part of the Casement Window. This is not included in above prices but is included when requested in inquiries.

STANDARD SIZES—Standard opening dimensions of the Mesker Steel Casement Windows are given above. More prompt delivery as well as lower prices is assured when ordering these sizes, and owing to large quantity production minimum cost is attained and low prices are quoted.

LIGHTING CAPACITY—One hundred per cent ventilation is obtainable by this type of window, and at least 50% more lighting area than with the ordinary wooden window, and they cost less. The Standard Steel Casement Windows are fireproof when glazed with rough ribbed or polished wire glass, and glazing angles are used.

MULLIONS—The 1⅜" wide mullion is of the tongue and groove type and is protected by United States patent. They are slender, yet very strong, and are used when two or more single units are combined to fill large openings.

INSTALLATION—The Mesker Steel Casement Windows are easily installed. Having all hardware attached no further fitting is necessary. They must be set true and straight in the openings. (See page 11 for details.) Build openings according to sizes given. Leave brick or stone sill out until window is set. Set window from the inside. Block up to proper height, see illustration (page 8). See that sash line up with adjoining sash. and nail two lugs on each side into masonry. All casements swing out right or left as desired. Do not install casements until building is under roof.

GLAZING—The Mesker Casement Sash are glazed from the inside and steel glazing clips are furnished for holding the glass firmly in place. The glass should be back puttied, and neatly face puttied covering the clips entirely and leaving a neat smooth finish. Use special steel Sash putty, as ordinary putty dries out and breaks away. Steel glazing angles are furnished at extra cost.

HARDWARE—Lock of the cam acting type and handle of artistic design, in brass finish, is attached to bracket of each sash. Sturdy Steel hinges of brass finish and removable pins connects the sash to the frame. A jointed friction adjuster restrains the sash when open and holds it in the desired position.

LEADED ART GLASS CASEMENTS—When Cottage Casements with small lights are required as shown in right hand corner above, a vertical ¾" solid section T bar muntin is furnished with heavy leaden horizontal sash bars, shipped separately. They are to be attached to sash when glazing is being done. Clear, colored or translucent glass may be used for such artistic effect as may be adapted to carry out the desired design.

INTERIOR FINISH—Since wood interior trim is not considered a necessity in modern homes, and as sanitation is being more carefully observed in building construction, plaster finish is preferably recommended for sides, head and sill of the interior where the Mesker Casement Windows are used.

WEATHERSTRIPPING— Our (patent applied for) metal weatherstripping attachment to solid section steel sash is of the utmost simplicity and cost less than weather stripping wooden windows and much neater in appearance, and prevents rattle, and is rainproof, windproof, and dustproof. The cost is only a trifle extra. Weather strips may be preferred for their neat appearance, softness of closure and air tight qualities. They are made of No. 11 gauge zinc, or No. 32 gauge spring bronze and furnished only when ordered. Weather strips may be attached to our casements by owners subsequent to receiving the windows, and may be attached without the assistance of a skilled mechanic before glazing. No practical method has been previously designed for fastening metal weather strips to steel sash. The means employed in the Mesker method is of utmost simplicity and practicability. With this latest achievement in weather stripping no triple contact is necessary since the weather strips are secured to the sash. The Mesker metal weather stripped, air tight, casement windows have no rival for their artistic beauty and superior qualities. Weatherstripping not included in above prices.

MESKER MONITOR STEEL SASH

TYPE 1—*See details.*

Shows a top hinged continuous vertical sash in any length. For heights 2′–10½″, 3′–10½″ and 4′–10½″ clear openings between structural angles. Glass sizes 20″ x 35″, 20″ x 37″ and 20″ x 59″ respectively.

Heights over 4′-10½″ a heavier and more costly construction must be used.

Units or Sections made in lengths 10′–0″ and not exceeding 12′–0″.

The end lights adjoining each operating run are fixed as shown.

Weathering caps G and H are of No. 18 steel, one side riveted, the other not attached, for expansion and contraction.

Sash bars are of solid rolled open hearth steel sections, joined by mortise and tenon interlocking joint and pressed by heavy machinery, making a rigid joint.

A continuous angle 1¼″ x 1¼″ x $\frac{3}{16}$″ is riveted to vertical bars for attaching arms of mechanical operating devices.

Glazing is done from the outside. Glazing clips are supplied for holding glass in place. Glass $\frac{3}{16}$″ or ¼″ in thickness is recommended.

We furnish no structural steel nor flashing at heads, sills or ends.

TYPE 2—*See details.*

Represents a horizontal pivoted row of sash and can be used in vertical plane only. Fixed units may be combined alternately with ventilated units.

Standard units of sash described on opposite page may be used, either fixed or ventilated. Combined with our tongue and grooved mullion, they make up a continuous run of monitor sash at a great saving in cost over special sizes and give most satisfactory service.

Monitor mullions C are of No. 16 steel and their construction provides for expansion and contraction without bolts or slotted holes.

Swing sash or ventilators must clear all trusses, vertical supports, diagonal bracing or other framing.

Glazing is done from inside and any thickness of glass may be adopted in sizes of 12″ x 18″ and 14″ x 20″.

Continuous mechanical operators for operating the ventilators are suggested, although long chains may be used or they may be operated individually from runways.

We furnish no structural steel nor flashing at heads, sills or ends.

TYPE 3—*See details.*

Illustrates a combination of continuous top hinged in upper, and continuous fixed sash in lower portion.

The clear openings between structural angles to be 2′–10½″, 3′–10½″ and 4′–10½″ in height for both upper and lower runs of sash, making overall clear opening height 5′–9″, 7′–9″ and 9′–9″.

Glass sizes for the top hung sash are 20″ x 34½″, 20″ x 46½″ and 20″ x 58½″ and for the lower portion, or fixed sash are 20″ x 35″, 20″ x 47″ and 20″ x 59″ respectively, for the 2′–10½″, 3′–10½″ and 4′–10½″ heights.

For heights over 4′–10½″ a special, heavier and more costly construction is designed but not illustrated in this catalogue.

The sections are made in lengths approximately 10′–0″ and not exceeding 12′–0″.

The end lights adjoining each operating run are fixed.

Weathering caps T are of No. 18 steel.

Sash bars and muntins are of solid rolled open hearth steel sections and jointed as in type 1.

A continuous angle 1¼″ x 1¼″ x $\frac{3}{16}$″ is riveted to vertical bars for attaching arms of mechanical operators.

The lower run of fixed sash is held in place by means of hook bolts and by anchor clips, see detail.

Glazing must be done from the outside and our special glazing clips are furnished. Glass $\frac{3}{16}$″ or ¼″ in thickness is recommended and should be puttied and back puttied.

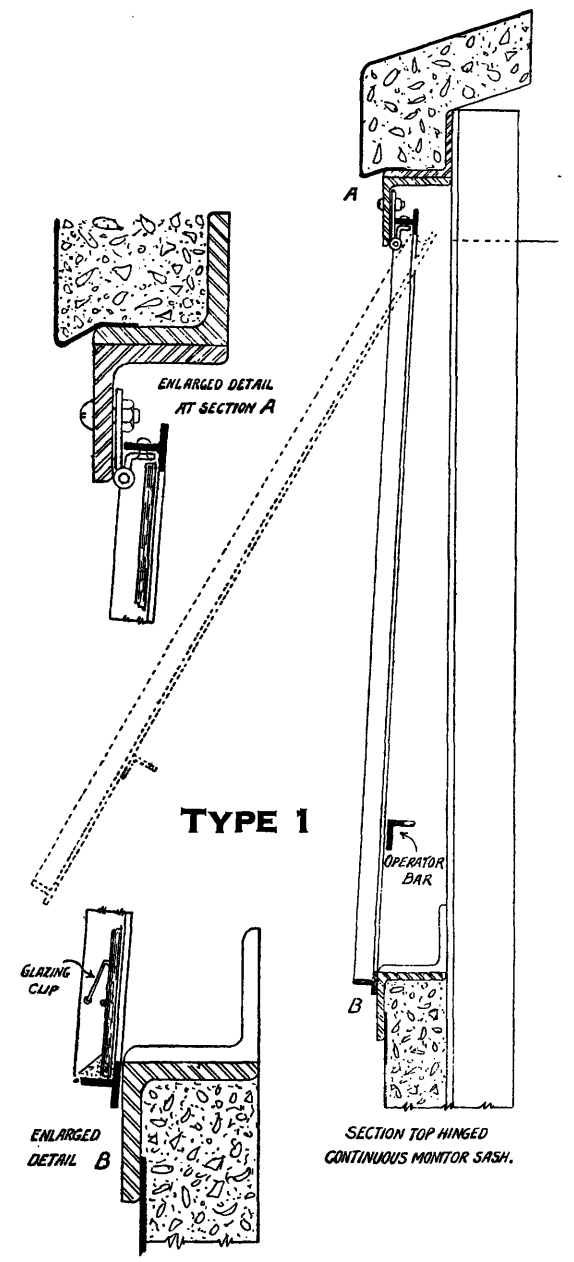
We furnish no structural steel nor flashing at heads, sills or ends.

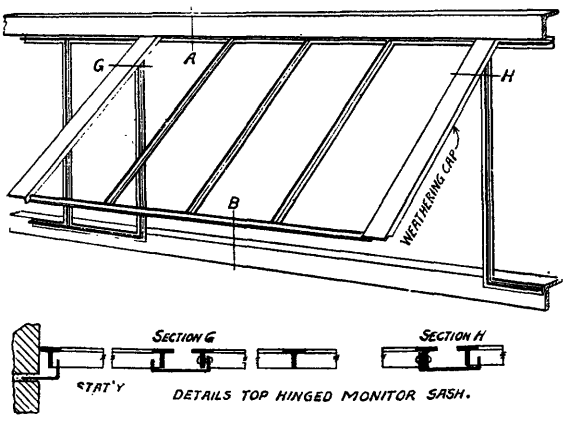
MECHANICAL OPERATING DEVICES

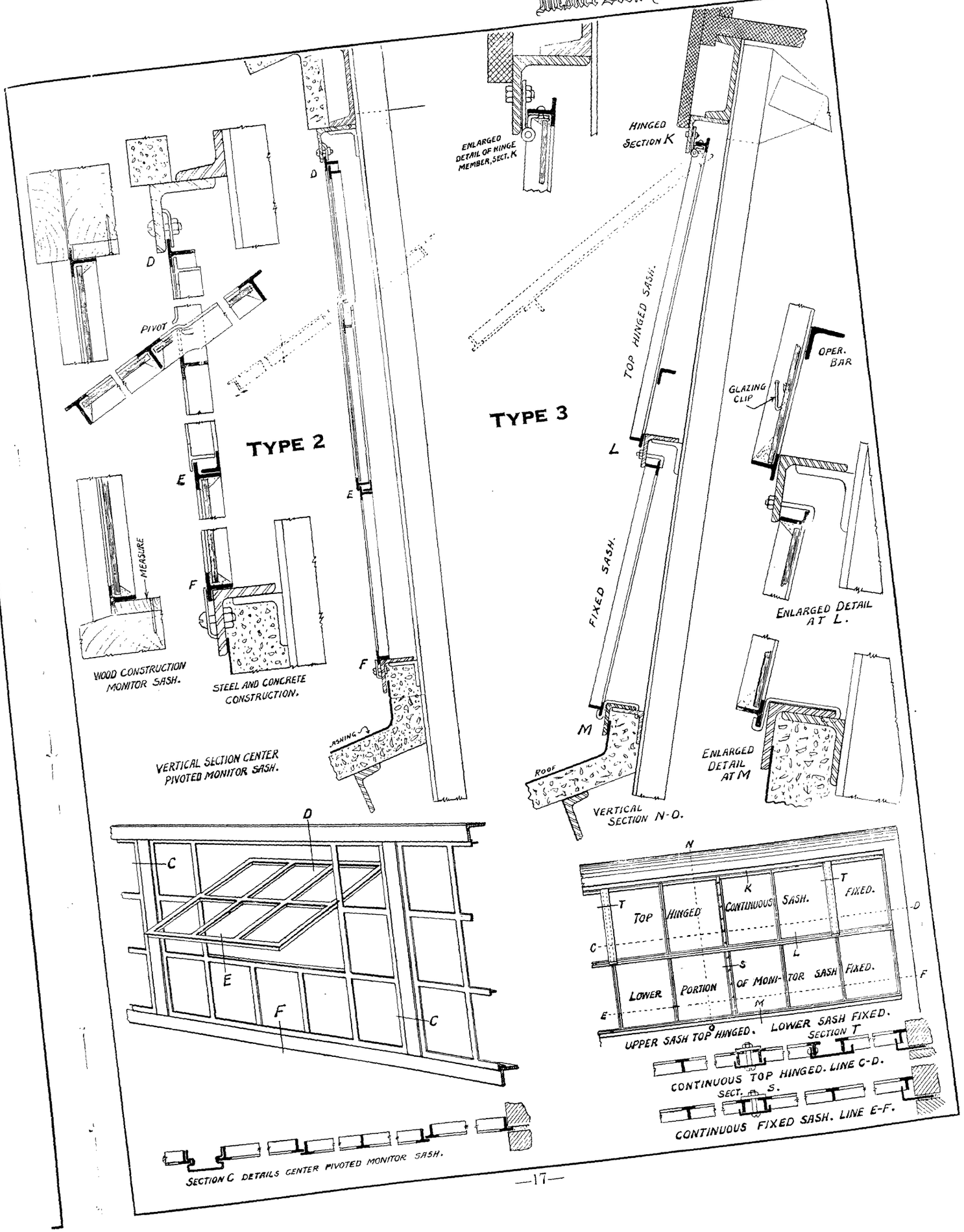
Continuous Operators (at extra cost) will be supplied. Maximum lengths operated by one controlling station are as follows:

Type 1—Vertical, any height	120′ 0″
Type 2—Vertical, any height	80′ 0″
Type 3—Vertical, 30°—3′ 0″	70′ 0″
Type 3—Vertical, 30°—4′ 0″	60′ 0″
Type 3—Vertical, 30°—5′ 0″	50′ 0″

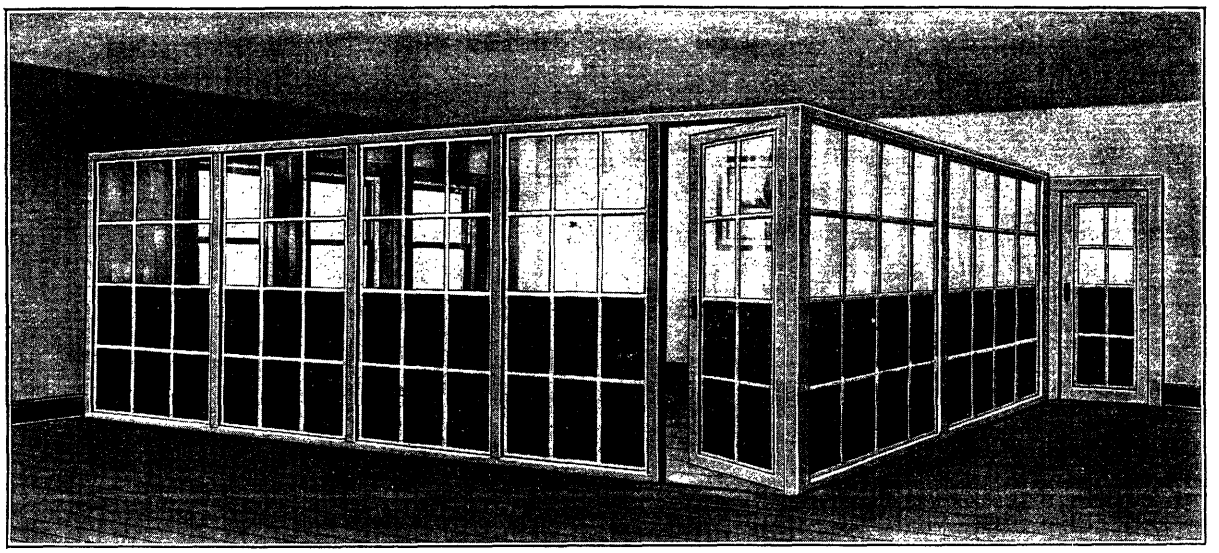
When requesting quotations give total run of feet of each monitor, number of ventilators, distance from floor to bottom of ventilators and state if operating chains can hang perpendicularly or if they must be operated off the vertical place of sash—give distance.



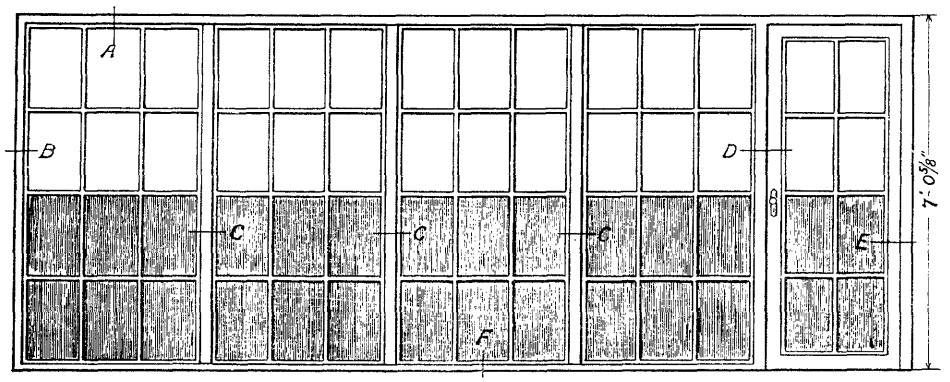



TYPE 2
TYPE 3
D
E
F
PIVOT
MEASURE
WOOD CONSTRUCTION MONITOR SASH.
STEEL AND CONCRETE CONSTRUCTION.
VERTICAL SECTION CENTER PIVOTED MONITOR SASH.
ENLARGED DETAIL OF HINGE MEMBER, SECT. K
HINGED SECTION K
TOP HINGED SASH.
FIXED SASH.
L
M
ROOF
VERTICAL SECTION N-O.
OPER. BAR
GLAZING CLIP
ENLARGED DETAIL AT L.
ENLARGED DETAIL AT M
C
N
T
K
S
TOP HINGED CONTINUOUS SASH.
FIXED.
LOWER PORTION OF MONITOR SASH
UPPER SASH TOP HINGED. LOWER SASH FIXED.
SECTION T
CONTINUOUS TOP HINGED. LINE C-D.
SECT. S.
CONTINUOUS FIXED SASH. LINE E-F.
SECTION C DETAILS CENTER PIVOTED MONITOR SASH.

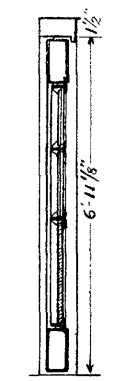
STEEL AND GLASS STANDARD PARTITIONS



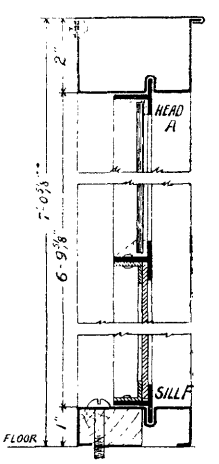
THE MESKER SOLID ROLLED SECTION STEEL AND GLASS PARTITION.

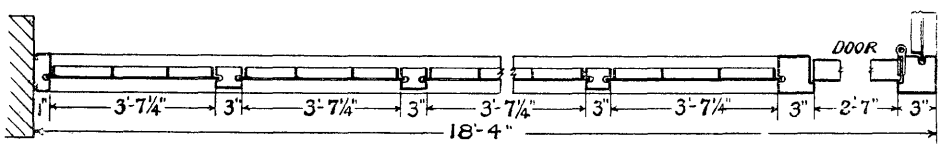


TYPICAL ELEVATION OF STEEL AND GLASS PARTITION.

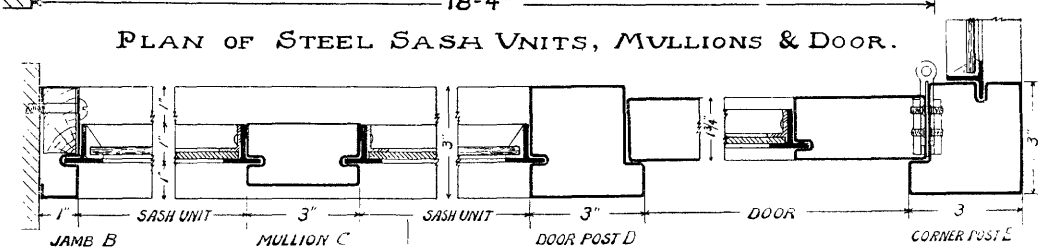


DOOR SECTION





PLAN OF STEEL SASH UNITS, MULLIONS & DOOR.



The Mesker Steel and Glass Partitions are intended for office enclosures on the interior of mills, factories, garages, warehouses, machine shops, office buildings, department stores, balconies, banks, etc. They are fireproof, durable, easy of erection, inexpensive and they present a fine appearance.

These partitions are made up of standard units of solid rolled section steel sash, designed to be artistically grouped with the Mesker tongue and groove mullions for any condition, dimension, or arrangement of plan. Partitions designed from our standard sizes, given on page 10, can be delivered from stock and at much lower prices than when specially designed.

The wainscoting portion of these partitions are paneled with heavy steel plate, and the upper panels are glazed with ribbed, florentine, wire, plate or window glass.

When arranging for steel partitions, it is advisable to avoid coming in direct line between existing columns. Partitions should be, as far as possible, run clear of any obstruction.

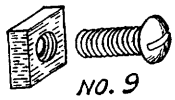
The partition illustrated above is approximately 7 feet high, leaving ample space for the circulation of air and heat. Where it is desired, the entire enclosure may extend up to the ceiling by filling the space between the sash and ceiling with metal lath and plaster, or with steel plates. In such construction the mullions should run from the floor to the ceiling. In most cases, it would be impractical to extend sash to ceiling and fit around sprinkling systems, steam pipes, beams, girders, and other obstructions contiguous to the ceiling. Ventilators may be placed in the sash at any desired location.

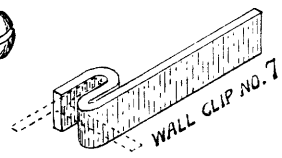
The Mesker design of mullions makes it possible to readily remove partitions, which so often is required, and permits them to be taken apart No bolts, nuts or pins to be removed. Any or all units may be re-erected without removing the glass.

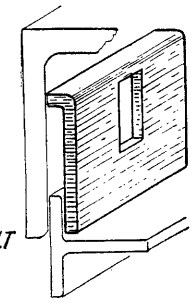
Doors are manufactured from heavy rolled open hearth steel, welded at joints. Latches or locks and bolts are provided where needed. Doors and door frames are not drilled for hinges or door checks. This should be done by the contractor erecting doors to insure correct fit.

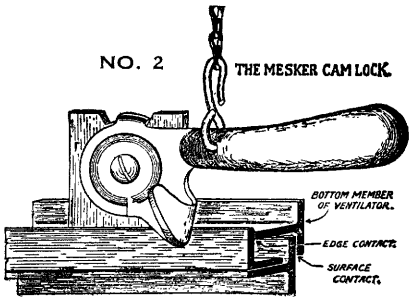
Any ordinary mechanic may install the Mesker Partitions with utmost simplicity, they fit like matched tongue and groove flooring after starters are bolted to wall and floor. Send sketch or plan of your requirement, showing existing walls and outline of partition needed, with full dimensions. Designate position of doors, height of partition from floor and location of ventilators, if any.

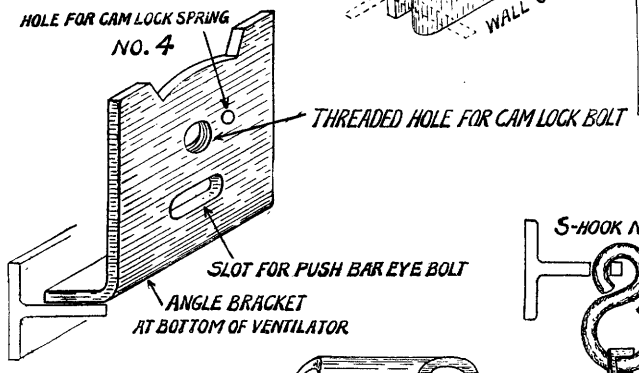
THE MESKER STEEL SASH HARDWARE AND ATTACHMENTS

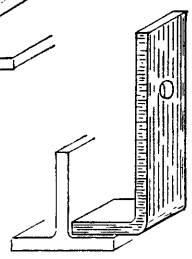


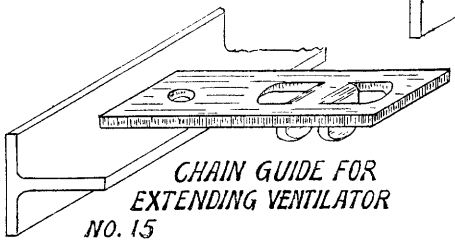


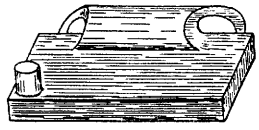


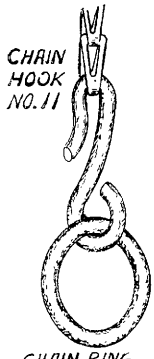


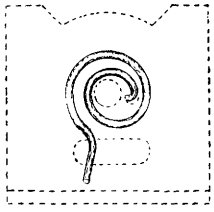


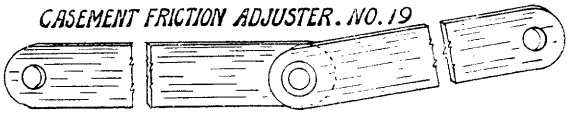


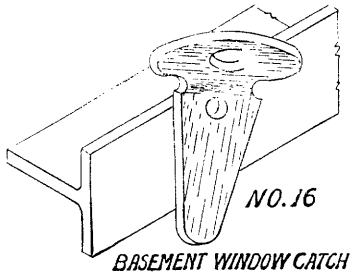


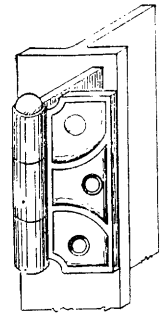


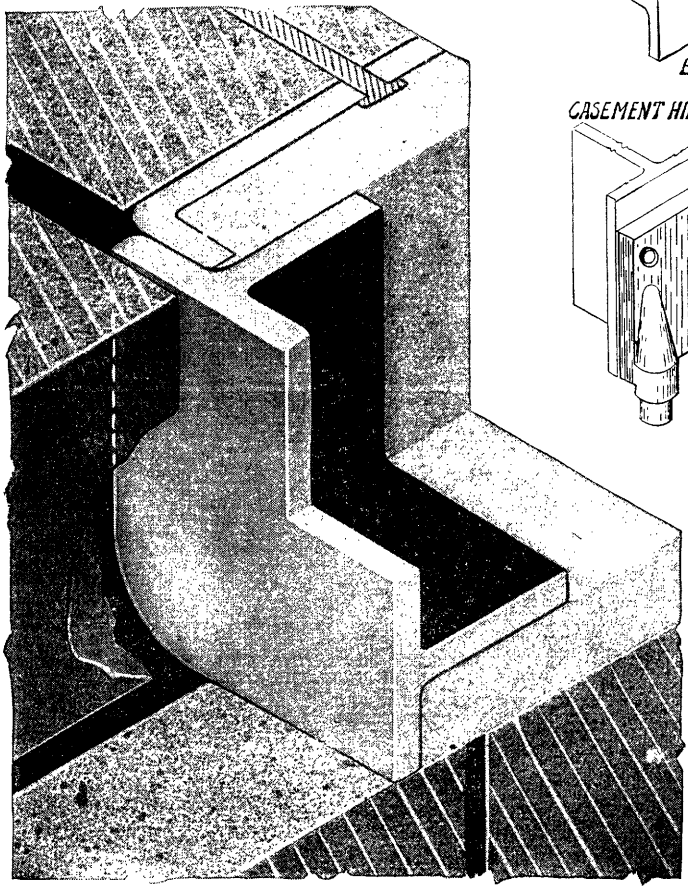




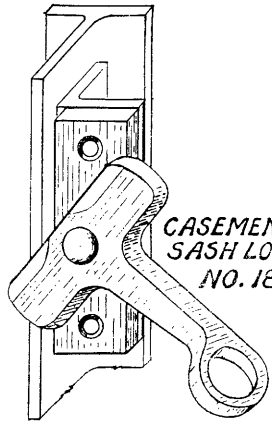








SHOWING ROUND CORNER FEATURE OF SASH INSTALLED IN WALL. FULL SIZE.



USED FOR GLAZING LABELED SASH

1 PUSH BAR ADJUSTER
2 CAM LOCK
3 EYE BOLT FOR PUSH BAR
4 ANGLE BRACKET
5 ANCHOR CLIP
6 WALL ANCHOR
7 WALL CLIP
8 CAM LOCK SPRING
9 CAM LOCK BOLT AND NUT
10 S-HOOK
11 CHAIN HOOK
12 CHAIN RING
13 GLAZING CLIP
14 BRONZE FRICTION SHOE
15 CHAIN GUIDE
16 BASEMENT WINDOW CATCH
17 CASEMENT SASH HINGE
18 CASE. SASH LOCK
19 CASE. FRICTION ADJUSTER
20 CASE. HINGE PIVOT
21 WALL HOOK

HARDWARE HALF FULL SIZE

THE MESKER COMBINATION SHEET STEEL AND SOLID ROLLED SECTION STEEL WINDOWS

STANDARD SIZES, COUNTER-BALANCED WINDOWS — **WRITE FOR DISCOUNTS** — **STANDARD SIZES, COUNTER-WEIGHTED WINDOWS**

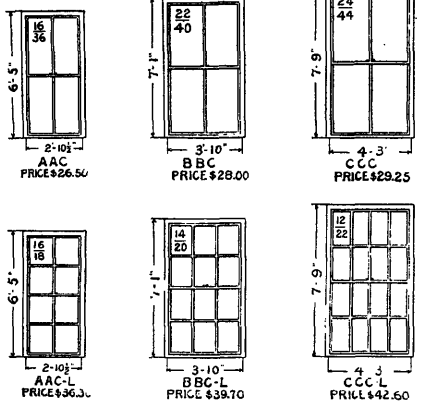
Widths Heights

$3'\text{-}1\frac{1}{2}''$ x { 6'-5" / 7'-1" / 7'-9" }

$4'\text{-}1\frac{1}{2}''$ x { 6'-5" / 7'-1" / 7'-9" }

$4'\text{-}6''$ x { 6'-5" / 7'-1" / 7'-9" }

L—Indicates Labeled Windows, others non-labeled.



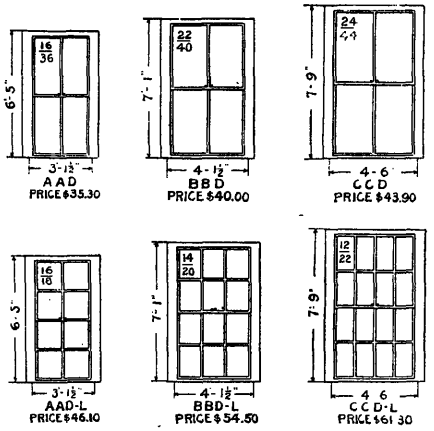
Widths Heights

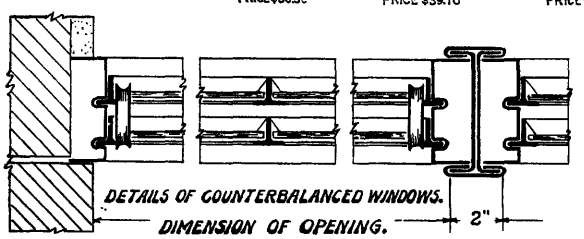
$2'\text{-}10\frac{1}{2}''$ x { 6'-5" / 7'-1" / 7'-9" }

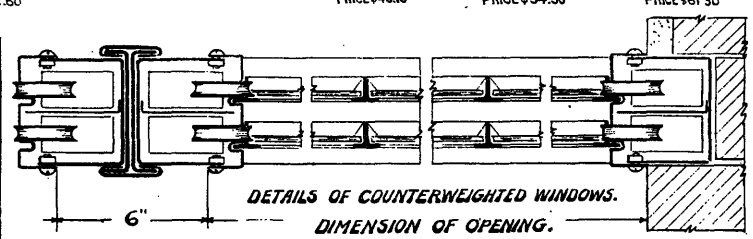
$3'\text{-}10''$ x { 6'-5" / 7'-1" / 7'-9" }

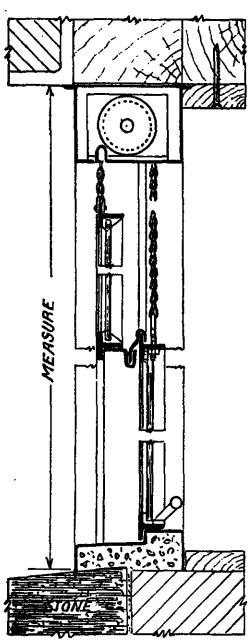
$4'\text{-}3''$ x { 6'-5" / 7'-1" / 7'-9" }

L—Indicates Labeled Windows, others non-labeled.

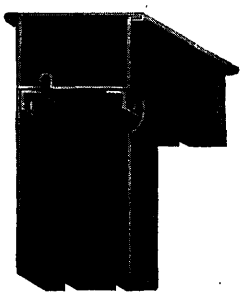




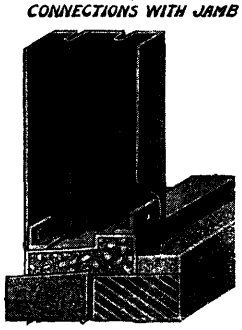


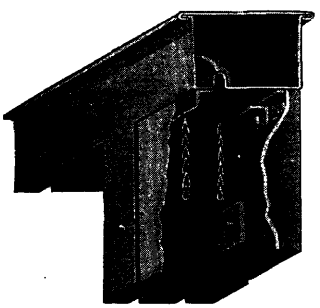


VERTICAL SECTION. COUNTERBALANCED.

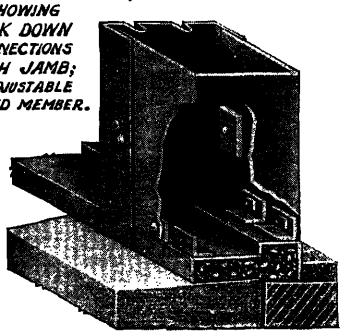


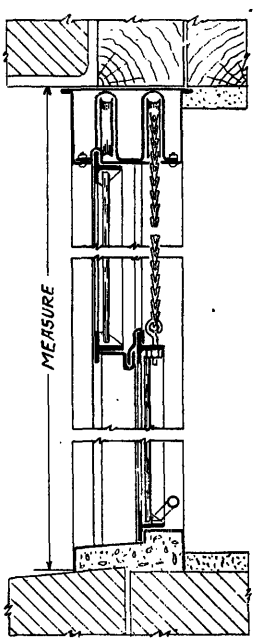
HEAD AND SILL OF COUNTERBALANCED WINDOW, SHOWING KNOCK DOWN CONNECTIONS WITH JAMB





HEAD AND SILL OF DOUBLE HUNG WINDOW, SHOWING KNOCK DOWN CONNECTIONS WITH JAMB; ALSO ADJUSTABLE GROOVED MEMBER.





VERTICAL SECTION. COUNTERWEIGHTED.

TYPES—The most desirable types in this class of window are the Double Hung (or counterweighted) and the Counterbalanced Windows. These are especially suited for Business, Educational, Institutional, Industrial, Public, Residential and Recreational Buildings.

UNDERWRITERS LABELED—These windows are subject to the rigid requirements and inspection of the National Board of Fire Underwriters, bearing their label of approval and accepted by rating bureaus everywhere in the United States and Canada as Standard Underwriters' Windows.

NON-LABELED—The non-labeled windows are of the same construction as the labeled, except that the glass in the non-labeled windows is held in place with steel glazing clips and putty, instead of steel glazing angles.

CONSTRUCTION—The heads, sills and jambs of the windows are made of No. 16 gauge steel, or No. 24 gauge galvanized steel. Grooves are formed in the frame to receive the projecting flanges of the sash members. The sash operates in the grooves with a vertical movement and insures easy operation and is perfectly weathertight.

ACCESS TO WEIGHTS, DOUBLE HUNG WINDOWS—The grooved members of the jamb in the Double Hung Window are adjustable for the double purpose of removing the sash should occasionr equire, and for giving access to counter-weights after the window is installed.

COUNTERBALANCED WINDOWS—This type is recommendedi n preference to the Double Hung type. The frames are constructed of No. 16 gauge steel with grooves formed to receive the flanges of the sash members. The grooves permit perfect weathering and easy operation of the sash. The two sash counter-balance each other being hung on chains which pass over pulleys in the head. When open, the window allows 50% ventilation, heated air escapes through the top, and fresh air is admitted through the opening at the bottom.

CONNECTION LUGS—The sill and head is secured to the jambs by a series of angle lugs riveted to the sill and head and fastened to the jambs by tap screws threaded into the lugs. (See illustrations.)

MAY BE KNOCK DOWN—These types of windows may be furnished **KNOCK DOWN** form, thereby saving a considerable amount in freight cost. When so ordered, they are shipped in parts and assembled on the job. The cost at the factory is less. The cost of assembling at building must be added. The subsills are filled with concrete at the building. Instructions for assembling accompanies each order.

SASH CONSTRUCTION—The sash is constructed of solid rolled open hearth steel section. The outer frame consists of **ONE PIECE CONTINUOUS STEEL BAR**, bent round at the corners and welded at the splicing of the two ends. The muntins are also of solid steel section, mortised at the ends and tenoned into the frame members, making the sash perfectly rigid and cannot warp out of square.—Continued on page 13.

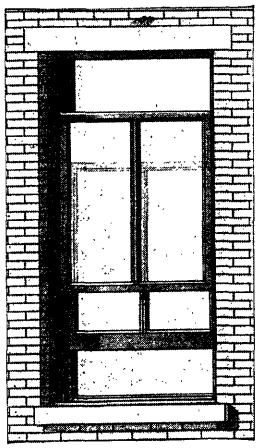
MESKER FIREPROOF HOLLOW METAL WINDOWS

Approved by the National Board of Fire Underwriters. Adapted to new and old buildings. Designed along the same lines and contain the same glass area as wood windows. **FRAMES AND SASH** of No. 24 gauge galvanized steel or 20 oz. copper. **CONCRETING** of subsill must be done at building.

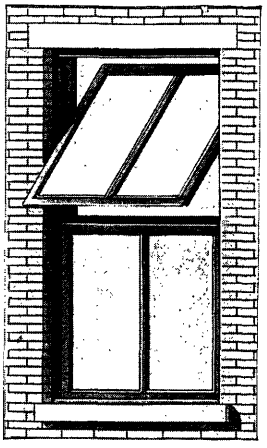
Type A.	Double Hung	5′ 0″ x 10′ 0″	Type D.	Double Casement	5′ 0″ x 10′ 0″
Type B.	Standard Pivoted	5′ 0″ x 10′ 0″	Type H.	Single Pivoted	5′ 0″ x 5′ 0″
Type C.	Double Pivoted	5′ 0″ x 10′ 0″	Type K.	Single Top Hinged	5′ 0″ x 5′ 0″

Maximum Openings

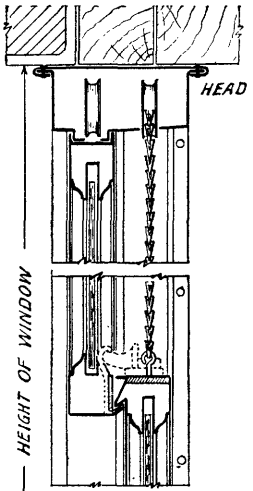
GLASS must not exceed 720 square inches, exposed area per light, and no light longer than 54 inches, except for windows in street elevations where such light is limited to 2916 square inches. **TRANSOMS** of hinged, pivoted or stationary types may be used over all windows or multiples. **TRANSOM BARS** for windows 10 feet high and under, are all sheet metal. **MULLIONS** are of a non-bearing character, made of No. 16 gauge galvanized steel, and limited to 12 feet high. They must extend 3 inches down into sills and same distance up into brick arches where segments are used. For square head windows mullions must be attached to lintels with knees and bolts. **HARDWARE.** We supply windows complete, inclusive of hardware, sash weights and chains, fusible links for pivoted windows; ¼-inch rough ribbed, maze, prism or polished wire glass, cut accurately to sizes and boxed separately. **UNDERWRITERS** label is a guarantee that windows comply with every requirement and are accepted everywhere by rating bureaus as standard. The removing and replacing of sash as easily accomplished as in wood-windows, an important factor of cost.

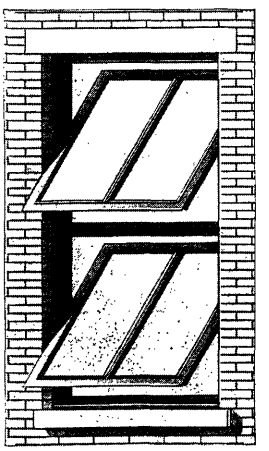


DOUBLE HUNG, TYPE A.

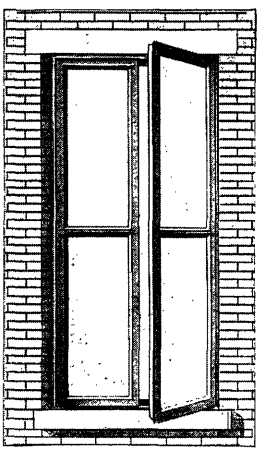


STANDAD PIVOTED, TYPE B.

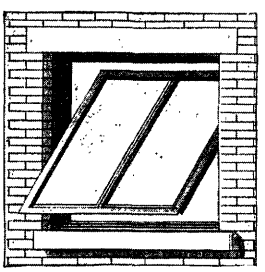




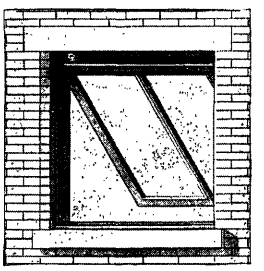
DOUBLE PIVOTED, TYPE C.



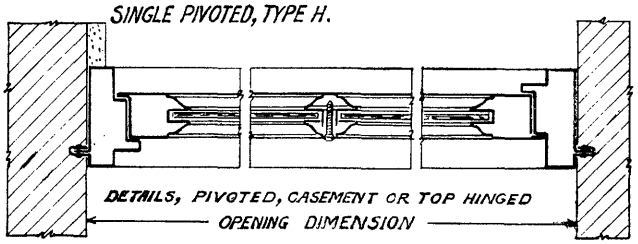
CASEMENT, TYPE D.

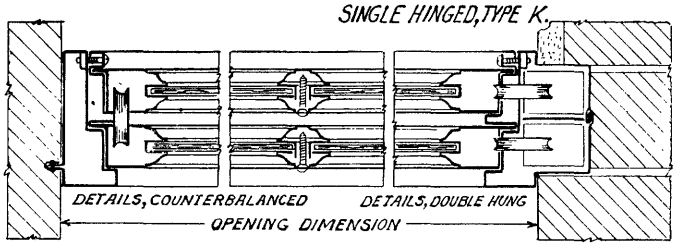


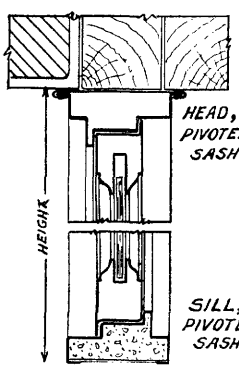
SINGLE PIVOTED, TYPE H.

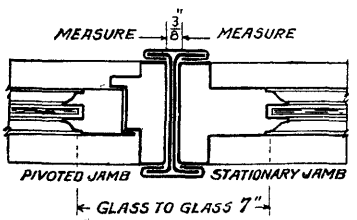


SINGLE HINGED, TYPE K.

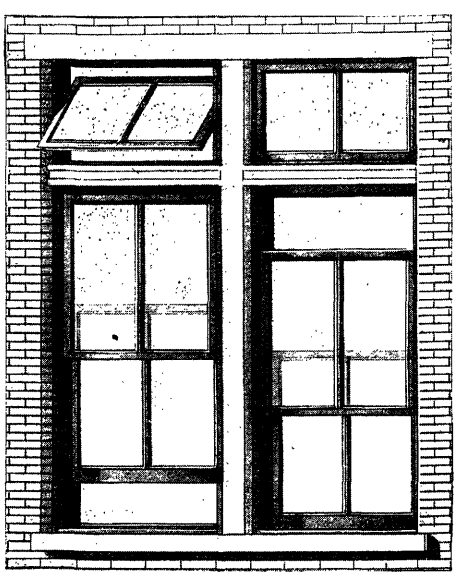




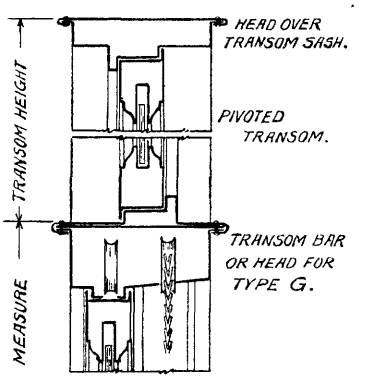


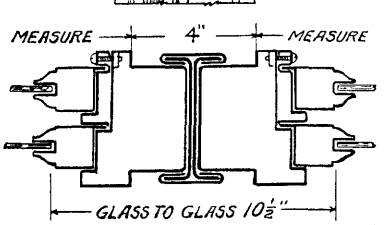


UNDERWRITERS' APPROVED MULLION FOR TYPES B.C.D.H.K.

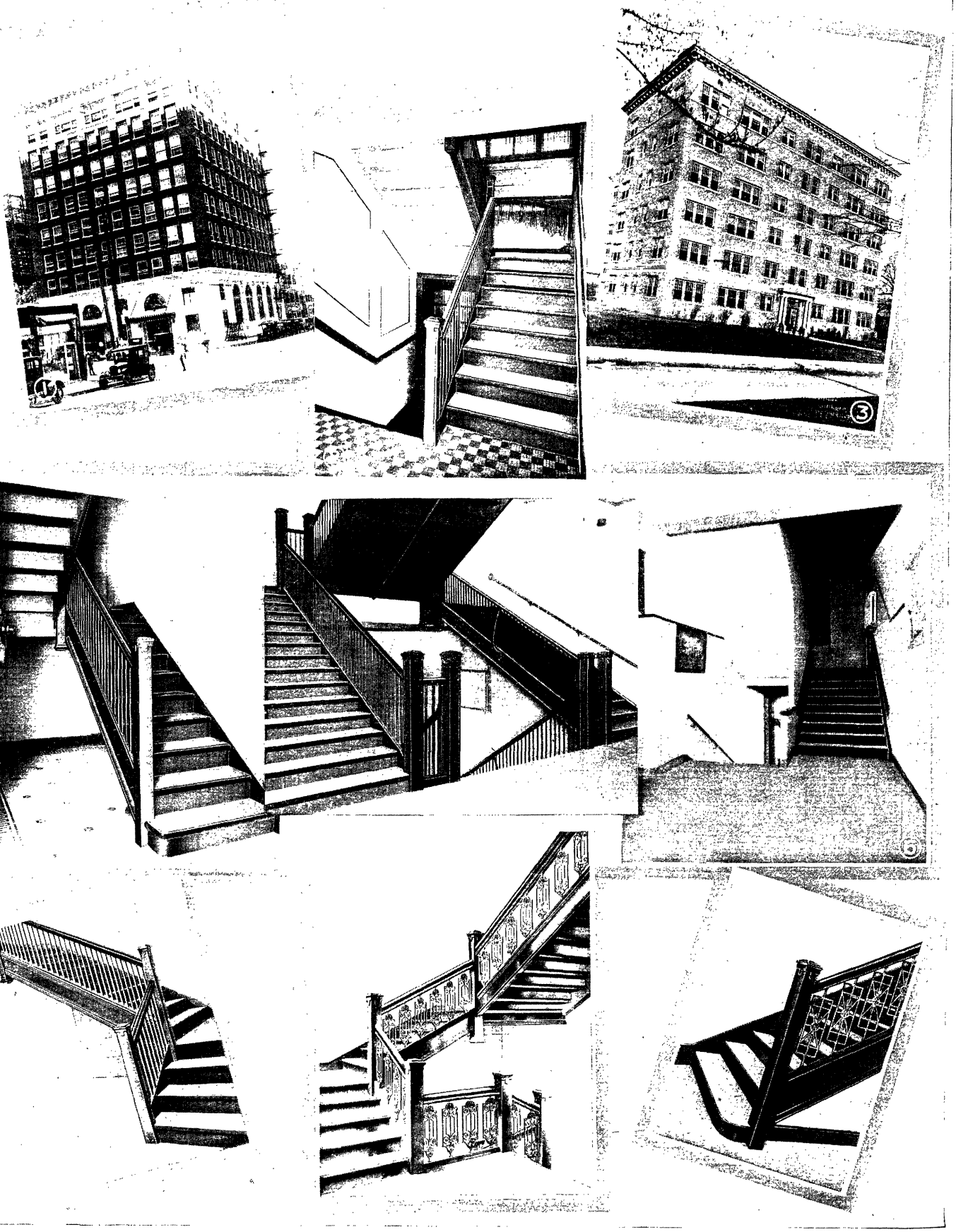


TWIN DOUBLE HUNG, TYPE G.





UNDERWRITERS' APPROVED MULLION, TYPE G.



Many hundreds of buildings have been equipped with the MESKER PATENT STEEL AND CONCRETE STAIRS

A GROUP OF A FEW TYPICAL INSTALLATIONS

1. Gillet-Kerr Building, Tulsa, Okla.
2. Brady Apartments, Des Moines, Iowa.
3. Alamadura Apartments, Memphis, Tenn.
4. Alamadura Apartments, Interior Stairs.
5. Linton-Stockton School, Linton, Ind.
6. Alamo Iron Works, San Antonio, Texas.
7. Typical Stair Installation.
8. Typical Stair Installation.
9. Typical Stair Installation.

MESKER PATENT COMBINATION STEEL AND CONCRETE INTERIOR STAIRS

THE MESKER STAIRS are specififfed as a "STANDARD" of construction throughout the country and are installed in some of the best buildings erected within the past 15 years.

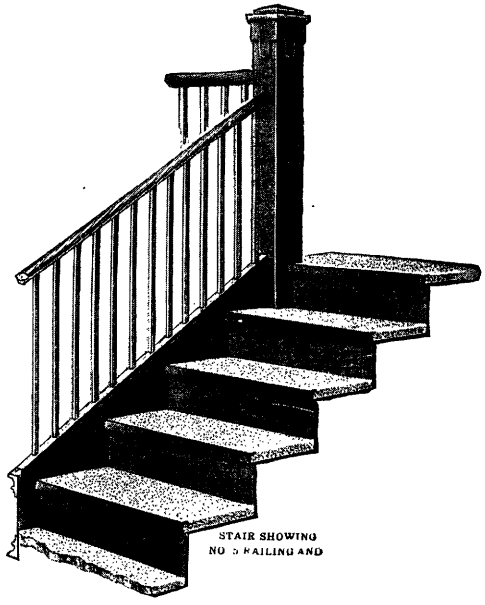
SPECIFICATIONS—Stringers shall be $\frac{1}{16}$-inch steel plate, bent in channel form and of width shown on plans.

Treads and risers shall be made of one continuous steel plate No. 12 or No. 13 gauge, bent to form as indicated. Treads shall be supported at ends by special clamps, securely bolted to stringers with acorn heads on face strings and shall be filled with concrete or other material by others. (Tread filling 1½ inches more or less in thickness.)

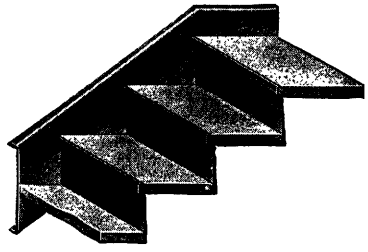
Platforms or landings, where required, shall be No. 12 or No. 13 gauge steel plates, with nosings same as treads and supported on a 2 by 2 by $\frac{1}{8}$-inch angle frame, riveted or bolted to stringers, and reinforced with tees not over 2 feet on centers.

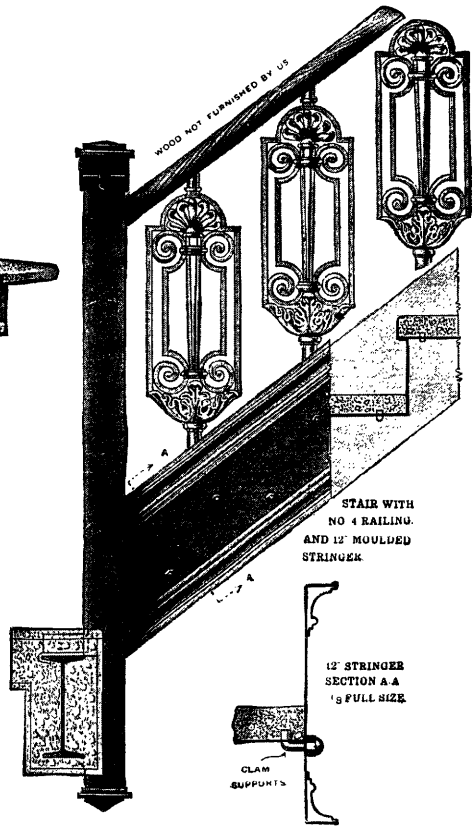
Newels shall be No. 12 gauge blue annealed steel with cast iron caps and pendants. Newels to be welded at corners, making a continuous one-piece seamless newel

Railings to be of design indicated on drawings. All to have a coat shop paint.



STAIR SHOWING NO 5 RAILING AND

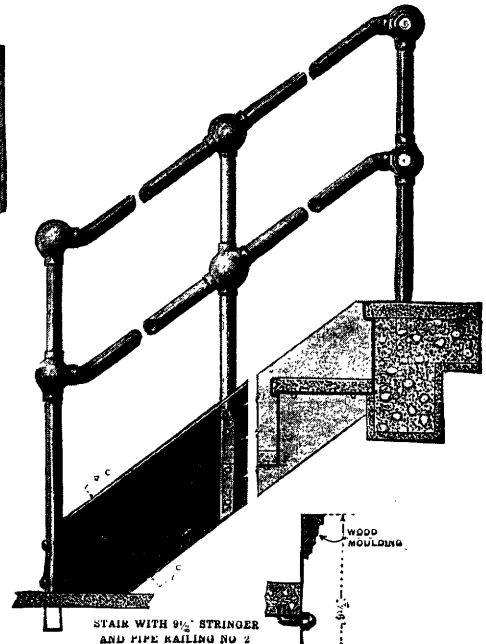




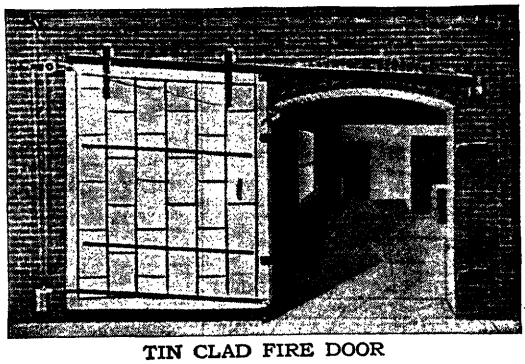
STAIR WITH NO 4 RAILING AND 12" MOULDED STRINGER

12" STRINGER SECTION A-A ½ FULL SIZE

CLAM SUPPORTS



STAIR WITH 9½" STRINGER AND PIPE RAILING NO 2

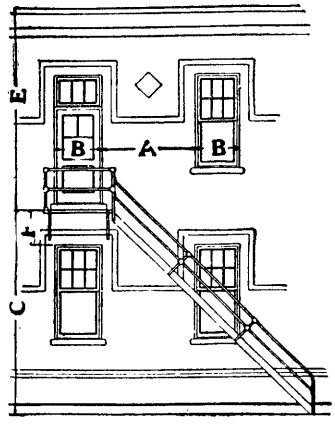


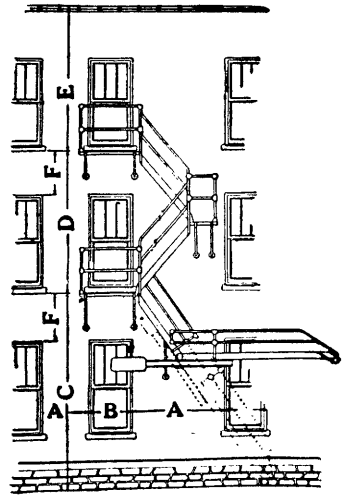
TIN CLAD FIRE DOOR

We supply standard tin clad fire doors, single and double hinged, horizontally and vertically sliding, with hardware and wall bolts complete, constructed to meet Underwriters' requirements and bearing their label of approval, which is a guarantee that the work has been subject to the most rigid inspection.

Angle or channel frames are furnished in connection with hinged doors, although they may be arranged to lap the openings 4 inches on each side and top, making frames unnecessary in bearing walls.

Doors are of two or three thicknesses of wood, tin clad, according to location in building and thickness of walls to which they are attached.





FIRE ESCAPES

We manufacture **FIRE ESCAPES** in conformity with the various State laws, with or without counter-balanced bottom section, with or without ladder to roof. They are shipped in complete sections prepared for easy erection by any mechanic.

For Schools, Colleges, Hospitals and Theaters the stair portion is usually 36 inches wide, while for other structures it is 24 inches wide with platforms to suit the conditions.

When inquiring for prices, give the following information:

A—Distance between windows.
B—Width of window openings.
C—Distance from grade to underside of second story window or door sills.
D—Distance between window sills.
E—Distance from upper window or door sills to top of fire walls or roof.
F—Distance from top of windows to underside of sills.
Mention the character of buildings and where unusual conditions exist, describe fully.

DEALERS GREAT OPPORTUNITY TO SELL THE MESKER COTTAGE AND BUNGALOW CASEMENT WINDOWS

Price of Casement Windows, 1′ 7¼″ x 1′ 7¼″, each	$ 7.35	Extra for weatherstripping	$0.80
Price of Casement Windows, 1′ 7¼″ x 2′ 9¼″, each	8.60	Extra for weatherstripping	1.10
Price of Casement Windows, 1′ 7¼″ x 4′ 5½″, each	10.40	Extra for weatherstripping	1.40

Price of Casement Windows in groups, see page 15.
Price of Casement Windows, Sills and Lintels, see page 15.

The above prices include adjustable friction stay, cam lock, hinges and glazing clips, complete ready for installation. No glass.

F. O. B. cars St. Louis, Mo.

SEND FOR DISCOUNTS

CLASSIFICATION OF PRODUCTS

Serial Number	Type of Product	Total No. of Lights	Lights in Ventil.	Height		Width	
				ft.	in.	ft.	in.
B 32	Solid Section Steel Sash Without ventilators	6	0	3	7/8	3	1¼
B 33	" "	9	0	4	7¼	3	1¼
B 34	" "	12	0	6	1¾	3	1¼
B 35	" "	15	0	7	8	3	1¼
B 36	" "	18	0	9	2½	3	1¼
B 42	" "	8	0	3	7/8	4	1¾
B 43	" "	12	0	4	7¼	4	1¾
B 44	" "	16	0	6	1¾	4	1¾
B 45	" "	20	0	7	8	4	1¾
B 46	" "	24	0	9	2½	4	1¾
B 52	" "	10	0	3	7/8	5	2
B 53	" "	15	0	4	7¼	5	2
B 54	" "	20	0	6	1¾	5	2
B 55	" "	25	0	7	8	5	2
B 56	" "	30	0	9	2½	5	2
B 32160	Solid Section Steel Sash With Center Pivoted Ventilators	6	6	3	7/8	3	1¼
B 33161	" "	9	6	4	7¼	3	1¼
B 34161	" "	12	6	6	1¾	3	1¼
B 35161	" "	15	6	7	8	3	1¼
B 36161	" "	18	6	9	2½	3	1¼
B 42140	" "	8	4	3	7/8	4	1¾
B 43141	" "	12	4	4	7¼	4	1¾
B 44141	" "	16	4	6	1¾	4	1¾
B 45141	" "	20	4	7	8	4	1¾

CLASSIFICATION OF PRODUCTS

Serial Number	Type of Product	Total No. of Lights	Lights in Ventil.	Height		Width	
				ft.	in.	ft.	in.
B 46147	Solid Section Steel Sash With Center Pivoted Ventilators	24	4	9	2½	4	1¾
B 42181	" "	8	8	3	7/8	4	1¾
B 43181	" "	12	8	4	7¼	4	1¾
B 44181	" "	16	8	6	1¾	4	1¾
B 45181	" "	20	8	7	8	4	1¾
B 46181	" "	24	8	9	2½	4	1¾
B 52160	" "	10	6	3	7/8	5	2
B 53161	" "	15	6	4	7¼	5	2
B 54161	" "	20	6	6	1¾	5	2
B 55161	" "	25	6	7	8	5	2
B 56161	" "	30	6	9	2½	5	2
C 32	Solid Section Steel Sash Without Ventilators	6	0	3	5	3	7¼
C 33	" "	9	0	5	1¼	3	7¼
C 34	" "	12	0	6	9¾	3	7¼
C 35	" "	15	0	8	6	3	7¼
C 36	" "	18	0	10	2½	3	7¼
C 42	" "	8	0	3	5	4	9¾
C 43	" "	12	0	5	1¼	4	9¾
C 44	" "	16	0	6	9¾	4	9¾
C 45	" "	20	0	8	6	4	9¾
C 46	" "	24	0	10	2½	4	9¾
C 52	" "	10	0	3	5	6	0
C 53	" "	15	0	5	1¼	6	0
C 54	" "	20	0	6	9¾	6	0
C 55	" "	25	0	8	6	6	0

CLASSIFICATION OF PRODUCTS

Serial Number	Type of Product	Total No. of Lights	Lights in Ventil.	Height		Width	
				ft.	in.	ft.	in.
C 56	Solid Section Steel Sash Without Ventilators	30	0	10	2½	6	0
C 32160	Solid Section Steel Sash With Center Pivoted Ventilators	6	6	3	5	3	7¼
C 33161	" "	9	6	5	1¼	3	7¼
C 34161	" "	12	6	6	9¾	3	7¼
C 35161	" "	15	6	8	6	3	7¼
C 36161	" "	18	6	10	2½	3	7¼
C 42140	" "	8	4	3	5	4	9¾
C 43141	" "	12	4	5	1¼	4	9¾
C 44141	" "	16	4	6	9¾	4	9¾
C 45141	" "	20	4	8	6	4	9¾
C 46141	" "	24	4	10	2½	4	9¾
C 42180	" "	8	8	3	5	4	9¾
C 43181	" "	12	8	5	1¼	4	9¾
C 44181	" "	16	8	6	9¾	4	9¾
C 45181	" "	20	8	8	6	4	9¾
C 46181	" "	24	8	10	2½	4	9¾
C 52160	" "	10	6	3	5	6	0
C 53161	" "	15	6	5	1¼	6	0
C 54161	" "	20	6	6	9¾	6	0
C 55161	" "	25	6	8	6	6	0
C 56161	" "	30	6	10	2½	6	0
C 22140	" "	4	4	3	5	2	5
101	Side Arm Extending Ventilator Sash	3	1	3	7/8	4	1¾
102	" "	4	2	3	7/8	5	2
103	" "	3	2	3	7/8	5	2

CLASSIFICATION OF PRODUCTS

Serial Number	Type of Product	Total No. of Lights	Lights in Ventil.	Height		Width	
				ft.	in.	ft.	in.
201	Side Arm Extending Ventilator Sash	6	1	4	7¼	4	1¾
202	" "	8	2	4	7¼	5	2
203	" "	6	2	4	7¼	5	2
301	" "	9	1	6	1¾	4	1¾
302	" "	12	2	6	1¾	5	2
303	" "	9	2	6	1¾	5	2
401	" "	9	1	7	8	4	1¾
402	" "	12	2	7	8	5	2
403	" "	9	2	7	8	5	2
501	" "	12	2	9	2½	4	1¾
502	" "	16	4	9	2½	5	2
503	" "	12	4	9	2½	5	2
11	Solid Section Steel Casement Windows	1	1	1	7¼	1	7¼
12	" "	1	1	2	9¼	1	7¼
13	" "	1	1	4	5½	1	7¼
21	" "	2	2	1	7¼	3	4
22	" "	2	2	2	9¼	3	4
23	" "	2	2	4	5½	3	4
31	" "	3	3	1	7¼	5	5/8
32	" "	3	3	2	9¼	5	5/8
33	" "	3	3	4	5½	5	5/8
41	" "	4	4	1	7¼	6	9¼
42	" "	4	4	2	9¼	6	9¼
43	" "	4	4	4	5½	6	9¼
11 V	" "	4	4	1	7¼	1	7¼
12 V	" "	6	6	2	9¼	1	7¼
13 V	" "	10	10	4	5½	1	7¼

CLASSIFICATION OF PRODUCTS

Serial Number	Type of Product	Total No. of Lights	Lights in Ventil.	Height		Width	
				ft.	in.	ft.	in.
21-1V	Solid Section Steel Casement Windows	8	4	1	7 1/4	3	4
22-1V	" "	12	6	2	9 1/4	3	4
23-1V	" "	20	10	4	5 1/2	3	4
31-1V	" "	12	4	1	7 1/4	5	5/8
32-1V	" "	18	6	2	9 1/4	5	5/8
33-1V	" "	30	10	4	5 1/2	5	5/8
41-2V	" "	16	8	1	7 1/4	6	9 1/4
42-2V	" "	24	12	2	9 1/4	6	9 1/4
43-2V	" "	40	20	4	5 1/2	6	9 1/4
121 V	" "	10	10	4	5 1/2	1	7 1/4
131 V	" "	14	14	6	1 3/4	1	7 1/4
132 V	" "	16	16	7	3 3/4	1	7 1/4
133 V	" "	20	20	9	0	1	7 1/4
221-1V	" "	20	10	4	5 1/2	3	4
231-1V	" "	28	14	6	1 3/4	3	4
232-1V	" "	32	16	7	3 3/4	3	4
233-1V	" "	40	20	9	0	3	4
321-2V	" "	30	20	4	5 1/2	5	5/8
331-2V	" "	42	28	6	1 3/4	5	5/8
332-2V	" "	48	32	7	3 3/4	5	5/8
333-2V	" "	60	40	9	0	5	5/8
421-2V	" "	40	20	4	5 1/2	6	9 1/4
431-2V	" "	56	28	6	1 3/4	6	9 1/4
432-2V	" "	64	32	7	3 3/4	6	9 1/4
433-2V	" "	80	40	9	0	6	9 1/4

CLASSIFICATION OF PRODUCTS

Serial Number	Type of Product	Total No. of Lights	Lights in Ventil.	Height		Width	
				ft.	in.	ft.	in.
AAC	Combination Sheet Steel and Solid Rolled Section Steel Windows	4	same	6	5	2	10½
AAC	" "	4	"	7	1	2	10½
AAC	" "	4	"	7	9	2	10½
BBC	" "	4	"	6	5	3	10
BBC	" "	4	"	7	1	3	10
BBC	" "	4	"	7	9	3	10
CCC	" "	4	"	6	5	4	3
CCC	" "	4	"	7	1	4	3
CCC	" "	4	"	7	9	4	3
AAD	" "	4	"	6	5	3	1½
AAD	" "	4	"	7	1	3	1½
AAD	" "	4	"	7	9	3	1½
BBD	" "	4	"	6	5	4	1½
BBD	" "	4	"	7	1	4	1½
BBD	" "	4	"	7	9	4	1½
CCD	" "	4	"	6	5	4	6
CCD	" "	4	"	7	1	4	6
CCD	" "	4	"	7	9	4	6
AAC-L	" "	8	"	6	5	2	10½
AAC-L	" "	8	"	7	1	2	10½
AAC-L	" "	8	"	7	9	2	10½
BBC-L	" "	12	"	6	5	3	10
BBC-L	" "	12	"	7	1	3	10
BBC-L	" "	12	"	7	9	3	10
CCC-L	" "	16	"	6	5	4	3

CLASSIFICATION OF PRODUCTS

Serial Number	Type of Product	Total No. of Lights	Lights in Ventil.	Height		Width	
				ft.	in.	ft.	in.
CCC-L	Combination Sheet Steel and Solid Rolled Section Steel Windows (counterbalanced)	16	same	7	1	4	3
CCC-L	" "	16	"	7	9	4	3
AAD-L	" "	8	"	6	5	3	1½
AAD-L	" "	8	"	7	1	3	1½
AAD-L	" "	8	"	7	9	3	1½
BBD-L	" "	12	"	6	5	4	1½
BBD-L	" "	12	"	7	1	4	1½
BBD-L	" "	12	"	7	9	4	1½
CCD-L	" "	16	"	6	5	4	6
CCD-L	" "	16	"	7	1	4	6
CCD-L	" "	16	"	7	9	4	6
A	Fireproof Hollow Metal Windows - Double Hung	4	"	10	0	5	0
B	Same - Standard Pivoted	4	2	10	0	5	0
C	Same - Double Pivoted	4	same	10	0	5	0
D	Same - Double Casement	4	"	10	0	5	0
H	Same - Single Pivoted	2	"	5	0	5	0
K	Same - Single Top Pivoted	2	"	5	0	5	0

The Mesker Combination Steel and Concrete Interior Stairs are made to order so that there are no standard sizes. The same applies to fire escapes and fire doors.

CLASSIFICATION OF PRODUCTS

Serial Number	Type of Product	Total No. of Lights	Lights in Ventil.	Height		Width	
				ft.	in.	ft.	in.
90	Coal Window	2	2	1	5¼	2	1¾
90 H	" " (hopper	2	2	1	5¼	2	1¾
120	" "	2	2	1	5¼	2	1¾
120 H	" " (hopper	2	2	1	5¼	2	1¾
120 L	" "	2	2	1	9¾	2	5¾
170	" "	2	2	1	9¾	2	5¾
170 H	" " (hopper	2	2	1	9¾	2	5¾
1	Basement Sash (pivoted)	2	2	1	10	2	6½
2	" "	3	3	1	2	3	8¾
3	" "	3	3	1	4	3	8¾
4	" "	3	3	1	10	3	8¾
5	" "	3	3	1	8	3	2¾
6	Basement Sash (casement)	3	3	1	4	3	8¾
7	" "	3	3	1	10	3	8¾
8	" "	3	3	1	8	3	2¾

EXPLANATION OF CLASSIFICATION OF SERIAL NUMBERS ON PRODUCTS AND PARTS.

1. Standard Steel Sash Without Ventilators.

Example:- B 32

Letter B signifies that window is designed for 12" x 18" glass panes.

Letter C signifies that window is designed for 14" x 20" glass panes.

First digit signifies how many lights wide window is - in this case 3.

Second digit signifies how many lights high window is - in this case 2.

2. Standard Steel Sash with Center Pivoted or Top Pivoted Ventilators.

Example:- B 32.160

Letter - same as above.

First digit - same as above.

Second digit - same as above.

Third digit signifies number of ventilators in window - in this case 1.

Fourth digit signifies number of lights in ventilator - in this case 6.

Fifth digit signifies how many lights above sill ventilator is located - in this case o.

3. Side Arm Extending Ventilator Sash.

Note: Numbers signify type construction rather than actual specifications.

Example:- 302

First digit signifies type of vertical construction.

Second digit is common to this entire class of sash.

Third digit signifies type of horizontal construction.

There are five different types of vertical construction to each of the three different types of horizontal construction, making fifteen different styles in this class of sash.

4. Steel Casement Windows - Industrial Type - Each vertical row of lights pivoted to open outward as ventilator.

Note: This type sash classification is based on building of various sizes out of a series of twelve standard units.

These units are classified by numbers of two digits, as for example 32.

First digit signifies how many lights wide unit is - in this case 3.

Second digit signifies to which of the three different vertical measurements the unit is constructed - in this case the second vertical measurement or 2' 9¼".

In addition to the twelve units, the sash made up of combinations of these units are classified with numbers of three digits as for example - 132.

Combination of first and third digits gives number 12 showing that top section of sash is made up of unit #12.

Combination of first and second digits gives number 13 showing that bottom section of sash is made up of unit #13.

Therefore sash is made up of unit #12 on top of unit #13.

5. Steel Casement Windows - Cottage Type - each vertical row does not open as ventilator.

Example:- 132-2V

Numbers to left of hyphen are construed in exactly the same manner as those for class. #4 immediately above.

Digit to right of hyphen together with letter V signifies number of vertical rows used as ventilators - in this case 2.

(2V - 2 Ventilators)

5. Steel Casement Windows - Cottage Type (cont.)

Note: 1. Where letter V appears alone following numbers, it signifies that the sash is composed of only one vertical unit, which is used as a ventilator.

2. In all sash of type 2V, the ventilator units, or vertical opening units, are the extreme right and left hand units.

6. Combination Sheet Steel and Solid Rolled Section Steel Windows.

Example: - BBC-L

First two letters are always alike and indicate which of the three standard widths of each type the window has. (AA, BB, or CC)

Third letter signifies which of the two types the window belongs to:

Type C - means counterbalanced.
Type D - means counterweighted.

Presence or absence of the letter L signifies whether or not the window is labeled. Non-labeled windows all have four lights. Labeled windows are further subdivided according to width.

Each separate width (BB, CC, etc.) has three different standard heighths.

7. Cut Tee Bars.

Example:- B 23

Letter indicates size of glass as in class. #1.

First digit indicates type of bar.

Second digit indicates number of lights covered by length of bar.

The following types of bars are made:

Type #1 - Horizontal Frame Bar.
Type #2 - Vertical Frame Bar.
Type #3 - Horizontal Field Bar.
Type #4 - Vertical Field Bar.
Type #6 - Vertical Frame Bar if next to vent.
Type #8 - Vertical Field Bar if next to vent.
Type #9 - Horizontal Bar above or below ventilator.

8. Mullions.

Example:- B 4

Letter indicates size of glass to be used as in class. #1.

Figure indicates how many lights high mullion is.

There is no classification as to width of mullion itself. The width varies from $2\frac{3}{4}$ to $3\frac{1}{2}$ inches.

9. Water Angles.

Example:- BX 4

First letter indicates size of glass to be used as in class. #1.

Second letter is common to all water angles.

Figure indicates how many lights wide water angle is.

10. Ventilators.

Example:- B 4

Letter indicates size of glass to be used as in class. #1.

Figure indicates how many lights there are in the ventilator.

11. Coal Windows.

Example:- 120 H

Digits to left of cipher indicate depth of window - in this case 12".

Cipher common to entire class.

Letter H following figures indicates that window is equipped with a hopper.

Letter L following figures indicates that window is large size.

OPERATIONS IN MAKING HOLLOW METAL WINDOWS.

Piece #1. Sill.

1. Cut width and length on Niagara shear.
2. Notch four corners in foot press #85.
3. Punch four slots in Little Wonder foot press.
4. Prick off. (Set gauge for lots over 50)
5. Form in Henderson Brake.
6. Rivet 3 to 4 stays in each by hand.
7. Solder in labels.

Piece #2. Head.

1. Cut width and length on Niagara shear.
2. Cut 2 miters in Fowler press.
3. Prick off by hand. (Set gauge for lots over 50)
4. Form on Henderson Brake.

Piece #3. Cover.

1. Cut width and length on Niagara shear.
2. Notch four corners in foot press #85.
3. Prick off by hand.
4. Form on Henderson brake.

Piece #4. Separators.

1. Cut width and length on Niagara shear.
2. Notch one end in foot press #85.
3. Prick off by hand.
4. Form on Henderson Brake.

Piece #5. Jambs.

1. Cut width and length on Niagara shear.
2. Miter sill end on Bliss (38))press.
3. Punch 3 notches on Little Wonder foot press.
4. Prick off by hand.
5. Form on Henderson Brake.
6. Punch pockets in Swaine press.
7. Punch pulley slots in Swaine press.
8. Punch and rivet jamb nuts in foot press #222.
9. Paint inside of jambs.
10. Back to Henderson Brake for two more breaks.
11. Double seam edge on Henderson Brake.
12. Assemble two pulleys in each jamb.

Ready for soldering.

Piece #6. Bottom Sash Rail.

1. Cut width and length on Niagara shear.
2. Miter two ends in Ferracute (124) press.
3. Punch four holes for lift plate in foot press #222.
4. Prick off by hand.
5. Form in Henderson Brake. (Four breaks)
6. Squeeze two breaks in Henderson Brake.
7. Form pocket on #1 Ohl.
8. Form mould on #1 Ohl.
9. Draw through former frame by hand.
10. Close up by hand.
11. Squeeze on Henderson Brake.

Piece #6. Bottom Sash Rail. (cont.)

12. Punch holes through fin with hand punch.
13. Rivet fin on Bliss (38) press. (3 to 6 rivets per rail)
14. Rivet lift plat on Fowler press. (2 rivets)
15. Squeeze pocket ends.
16. Spread rail.

Piece #7. Bottom Meeting Sash Rail.

1. Cut width and length on Niagara shear.
2. Miter two ends on foot press #222.
3. Notch four corners on foot press #85.
4. Punch for lock plate.
5. Prick off by hand.
6. Form on Henderson Brake.
7. Squeeze one break on Henderson Brake.
8. Form pocket on #1 Ohl.
9. Form mould on #1 Ohl.
10. Draw through former frame by hand.
11. Close up rail by hand.
12. Squeeze on Henderson Brake.
13. Punch holes through fins for rivets by hand.
14. Rivet fin in Bliss (38) press.
15. Rivet lock plate on Fowler press.
16. Squeeze end.
17. Spread rail.

Piece #8. Top Meeting Rail.

1. Cut width and length on Niagara shear.
2. Notch on foot press #85 (4 cuts).
3. Punch holes for plate on foot press #222.
4. Prick off by hand.
5. Form on Henderson Brake.
6. Form pocket on #1 Ohl.
7. Form mould on #1 Ohl.
8. Draw through former frame by hand.
9. Close up by hand.
10. Squeeze on Henderson Brake.
11. Form fin lick.
12. Rivet plates on Fowler press.
13. Rivet in studs on Ferracute press #2.

Piece #9. Top Sash Rail.

1. Cut width and length on Niagara shear.
2. Notch in foot press #85. (2 cuts)
3. Prick off by hand.
4. Form on Henderson Brake.
5. Form pocket on #1 Ohl.
6. Form mould on #1 Ohl.
7. Draw through former frame by hand.
8. Close up by hand.
9. Squeeze in Henderson Brake.
10. Punch rivet holes by hand.
11. Rivet fins on Bliss press (#38).
12. Rivet in studs on Ferracute press (#2).

Piece #10. Side Sash Rail.

1. Cut width and length on Niagara shear.
2. Cut miters on Ferracute press #124.
3. Prick off by hand.
4. Form on Henderson Brake.
5. Form pocket on #1 Ohl.
6. Form mould on #1 Ohl.
7. Draw through former frame by hand.
8. Close up by hand.
9. Squeeze on Henderson Brake.
10. Punch rivet holes by hand.
11. Rivet fins on Bliss #38.
12. Rivet in studs on Ferracute press #2.
13. Squeeze pockets.

Assembly Process: (frame)

1. Rivet sill - 4 corners. (6 rivets)
2. Rivet head - 4 corners. (8 rivets)
3. Square up and solder all round.
4. Attach separators with bolts.
5. Slip in pulley covers.
6. Slip in Head cover.
7. Punch and rivet cover and solder ends.

Assembly Process: (sash)

1. Lay on bench, rivet, tack, and solder all rails.

Piece #11. Stops.

1. Cut width on Niagara shear.
2. Form 1/8 edge on Henderson Brake.
3. Form on #1 Ohl.
4. Paint (dip).
5. Saw to size of window.
6. Punch holes with prick punch.
7. Bolt to frame.

Piece #12. Muntins.

1. Cut width on Niagara shear.
2. Form on 7E Bliss. (each piece goes through die twice)
3. Saw by power saw to length needed.
4. Put in plates by hand.
5. Punch inside muntin with foot press #222.
6. Solder outside muntin to sash.
7. Bolt inside muntin to sash.
8. Weigh sash and fit in frame.
9. Paint sash and frame by hand.

OPERATIONS IN MAKING STAIRS.

Piece #1. Treads and Risers.

1. Cut to size on 12 ft. shear. (ST1)
2. Gang punch on #1 Ohl (H1) for bolting pan tread to underside of nosing.
3. Punch on Long & Alstetter punch (ST4) to receive tread angles and for bolting to stringers.
4. Form on #1 Ohl. (H1)
5. Rough treads on Long & Alstetter (SA11).

Piece #2. Stringers.

1. Lay out stringers and mark for punching.
2. Cut and notch ends on hand press. (ST10)
3. Punch on Long & Alstetter punch. (ST4)
4. Form on Totten press. (ST3) (also on big Ohl for small jobs)

Piece #3. Balustrades.

1. Mortise channel bars on Long & Alstetter punch. (ST4)
2. Tenon and cut baluster to bevel and to proper length on Long and Alstetter #1. (ST2)
3. Assemble railings on assembly bench.
4. Rivet balusters with pneumatic hammer.

Piece #4. Newels.

1. Cut to size on 12 ft. shear. (ST1)
2. Slot to receive stringers on Long & Alstetter punch. (ST4)
3. Form on #1 Ohl. (H1)
4. Weld at welding bench.
5. Cut to fit platform by hand.

Piece #5. Fittings.

1. Cut moulding to size on 12 ft. shear. (ST1)
2. Form on 7E Bliss. (H4)
3. Punch and cut tread angles to size on Long and Alstetter punch. (ST4)

Piece #6. Platforms.

1. Cut to size on 12 ft. shear. (ST1)
2. Punch on Long and Alstetter punch. (ST4)
3. Form platform stiffeners and supports at forge. (ST7)

Finally assemble and place in position as they will be in building.

Assembly Process:

1. Rivet tread angles to stringers. (by hand)
2. Attach moulding to stringers. (by hand)
3. Bolt treads to stringers.
4. Place stairs in position with platforms as they will exist in the building for which they are designed so that dimensions may be checked.

APPENDIX B

Contents:

LIST OF RAW MATERIALS USED

EXCLUSIVE OF HARDWARE, FITTINGS, ETC.

Article	Cross Section Dimen. Width	Depth	Thick.	Length	Approx Am't
	in.	in.	in.	ft.	
Bars of soft wrought iron	1¼		¼	25	25
" " "	1½		¼	25	25
" " "	2		¼	25	25
" " "	1¼		3/8	25	25
" " "	1½		3/8	25	25
" " "	2		3/8	25	25
" " "	3		3/8	25	25
Angles of soft wrought iron	1	1	1/8	25	50
" " "	1¼	1¼	3/16	25	200
" " "	1½	1½	3/16	25	200
" " "	1½	1½	1/4	25	100
" " "	1¾	1¾	1/4	25	25
" " "	2	2	1/4	25	50
" " "	2	2	5/16	25	25
" " "	2½	2½	1/4	25	50
Tees of soft wrought iron	1¼	1¼	3/16	25	50
" " "	1½	1½	3/16	25	50
" " "	1½	1½	1/4	25	50
" " "	2	2	1/4	25	25
" " "	2	2	5/16	25	25
" " "	2¼	2¼	1/4	25	25
" " "	2½	2½	5/16	25	25
Square bars of soft wrought iron	1/2		1/2	25	1000
" " " "	5/8		5/8	25	500
Round bars of soft wrought iron			1/4	25	5000
Channel bars of soft wr't iron	1	1/2	1/8	25	50
" " " "	1¼	1/2	1/8	25	100
" " " "	1¼	1/2	3/16	25	50
" " " "	1½	1/2	3/16	25	50
Black pipe			1	25	100
" "			1¼	25	200
" "			1½	25	100
" "			2	25	50
Railing fittings (20 sizes) (bin for each measures:	2	2		25	50
Miscellaneous fittings (20 sizes) (bin for each measures:	2	2		25	50
Cast iron caps for newels	3	3	3		200
" " " "	3	6	3		50
" " " "	4	4	4		200
" " " "	4	8	4		200
" " " "	5	5	4		50
" " " "	5	8	4		25

LIST OF RAW MATERIALS USED

EXCLUSIVE OF HARDWARE, FITTINGS, ETC.

Article	Cross Section Dimen.			Length	Approx. Am't
	Width	Depth	Thick.		
	in.	in.	in.	ft.	
Cast iron drops for newels	3	3	3		200
" " " "	3	6	3		50
" " " "	4	4	4		200
" " " "	4	8	4		200
" " " "	5	5	4		50
" " " "	5	8	4		25
3/16" rolled steel plates	14		3/16	8	
" " " "	14		3/16	10	
" " " "	14		3/16	12	
" " " "	14		3/16	14	One
" " " "	14		3/16	16	Carload
" " " "	14		3/16	18	
" " " "	14		3/16	20	
#13 rolled steel sheets	40		13 gage	12	
" " " "	40		"	15	
" " " "	42		"	12	One
" " " "	42		"	15	Carload
" " " "	44		"	12	
" " " "	44		"	15	
Galvanized iron sheets	24			8	
" " "	24			10	One
" " "	30			8	Carload
" " "	30			10	

MONTHLY FIGURES ON SEMI-FINISHED STOCK USED IN THE MANUFACTURE OF STANDARD STEEL SASH.

Description	Serial No.	Length of Bar	On Hand 1/1/26	Manufactured for stock - 1926:						
				Jan.	Feb.	Mar.	Apr.	May	June	July
Horizontal Frame Bar	B 12	25								
" " "	B 13	37½								
" " "	B 14	49¾								
" " "	B 15	62				100			100	
" " "	B 16	74½	50			50				
Vertical " "	B 22	37				65	100			
" " "	B 23	55½	20			50	50			
" " "	B 24	73¾	30			50	100			
" " "	B 25	92					100			
" " "	B 26	110.1					100			
Horizontal Field Bar	B 31	12¾	2000	325	680				5158	
" " "	B 32	25			200					
" " "	B 33	37½	30	550	315	1350				
" " "	B 34	49¾	450		847		200			450
" " "	B 35	62	450		500		600		50	
" " "	B 36	74½				75	200			
Vertical " "	B 41	18¾	600	1145	2680	4271	1950	700	987	
" " "	B 42	37	900		1897	1400			892	
" " "	B 43	55½	200	400		310				
" " "	B 44	73¾	250			500	400	636		
" " "	B 45	92	500				500			
" " "	B 46	110½								
Vertical Frame Bar Next	B 62	37								
" " to Vent.	B 63	55½								
" " "	B 64	73¾								
" " "	B 65	92								
" " "	B 66	110½								
" Field "	B 82	37	875							
" " "	B 83	55½	500		600					
" " "	B 84	73¾	600	160		385	500			1000
" " "	B 85	92	400	865						
" " "	B 86	110½								

MONTHLY FIGURES ON SEMI-FINISHED STOCK USED IN THE MANUFACTURE OF STANDARD STEEL SASH.

Description	Serial No.	Length of Bar	On Hand 1/1/26	Manufactured for Stock - 1926: Jan.	Feb.	Mar.	Apr.	May	June	July
Horizontal Bar Above or Below Ventilator	B 92	25								
" " "	B 93	37 1/2	500	1000	475		990		1364	
" " "	B 94	49 3/4	1000	500			990			
" " "	B 95	62	990				510	400		
" " "	B 96	74 1/2	4		300	18				
" " "	B 194	49 3/4				410				
Horizontal Frame Bar	C 12	29					50			
" " "	C 13	43 1/2								
" " "	C 14	57 3/4								
" " "	C 15	72							100	
" " "	C 16	86 1/2	20		100					25
Vertical " "	C 22	41	30		25					
" " "	C 23	61 1/2	8						110	
" " "	C 24	81 3/4				100				190
" " "	C 25	102	10							
" " "	C 26	122 1/2	25					50		
Horizontal Field Bar	C 31	14 1/2	1500	1400	3096				676	
" " "	C 32	29								
" " "	C 33	43 1/2	250	350			800			
" " "	C 34	57 3/4	450				400		193	350
" " "	C 35	72	200				200			
" " "	C 36	86 1/2								
Vertical " "	C 41	20 3/4	1200	1885	1570	1388	3410	1352	3357	1075
" " "	C 42	41	1200		690		700		200	405
" " "	C 43	61 1/2	525	100			650			
" " "	C 44	81 3/4	35	500			100	400		
" " "	C 45	102	500				400			
" " "	C 46	122 1/2								
Vertical Frame Bar Next " " to Vent.	C 62	41								
	C 63	61 1/2								

MONTHLY FIGURES ON SEMI-FINISHED STOCK USED IN THE MANUFACTURE OF STANDARD STEEL SASH.

Description	Serial No.	Length of Bar	On Hand 1/1/26	Manufactured for stock - 1926: Jan.	Feb.	Mar.	Apr.	May	June	July
Horizontal Frame Bar if next to Vent	C 64	81¾								100
" " "	C 65	102								
" " "	C 66	122½								
" Field "	C 82	41	1000						1280	
" " "	C 83	61½	500		500		500			
" " "	C 84	81¾	140	1490						
" " "	C 85	102	500			600				
" " "	C 86	122½								
Horizontal Bar Above or Below Ventilator	C 92	29		150					160	
" " "	C 93	43½	1000		785	1890			1011	
" " "	C 94	57¾	200	100			819		1264	
" " "	C 95	72		500					1201	
" " "	C 96	86½	110				500			
" " "	C 194	57¾	60	540			1000			
Mullion (3 in.)	B 2	39	27						204	
" "	B 3	57½	110						204	
" "	B 4	75½	101						150	
" "	B 5	94	7						186	
" "	B 6	112½	27						203	
" "	C 2	43	31						191	
" "	C 3	63¼	20						345	
" "	C 4	83¾	1						347	
" "	C 5	104	4						238	
" "	C 6	124½	9						204	
Mullion (3½ in.)	B 2	39	120						197	
" "	B 3	57½	285							
" "	B 4	75½	110						204	
" "	B 5	94	57						120	
" "	B 6	112½	91							

MONTHLY FIGURES ON SEMI-FINISHED STOCK USED IN THE MANUFACTURE OF STANDARD STEEL SASH.

Description	Serial No.	Length of Bar	On Hand 1/1/26	Manufactured for stock - 1926: Jan.	Feb.	Mar.	Apr.	May	June	July
Mullion (3½ in.)	C 2	43	339							
" " "	C 3	63¼	51						200	
" " "	C 4	83¾	82						207	
" " "	C 5	104	4						221	
" " "	C 6	124½	105							
Mullion (2¾ in.)	C 5	104								
Water Angle	BX 2	23½	900							
" "	BX 3	35¾	200	1000		600				
" "	BX 4	48	800			350		1500		
" "	CX 2	27½	350	500						
" "	CX 3	41¾	1000			950				875
" "	CX 4	56	800		300			1000		
Center Pivoted Ventilator	B 4		111				500			
" " "	B 6		816				1500			1035
" " "	B 8		217		500		1500			
" " "	C 4		100	200					500	
" " "	C 6		129	1500						1000
" " "	C 8		150	300					800	
Center Piv. Vent. Labeled	B 4		43							
" " " "	B 6		34						102	
" " " "	B 8		76							
" " " "	C 4		67							
" " " "	C 6		100							
" " " "	C 8		61							
Extending Arm Ventilator	B 4		74							
" " "	B 6		116							
" " "	B 8						100			
" " "	C 4									
" " "	C 6		134							
" " "	C 8		63							
Top Pivoted Ventilator	B 6		34							
" " "	C 6		49							
Garage Vent.			54							

MAXIMUM NECESSARY NUMBER IN STOCK OF

VARIOUS SIZES OF STANDARD STEEL SASH.

Serial No.	Maximum Number Carried In Stock	
	Size B (12x18 glass)	Size C (14x20 glass)
32	200	200
33	200	100
34	200	100
35	150	100
36	50	50
42	200	100
43	100	100
44	150	100
45	150	100
46	50	50
32160	300	300
33161	200	200
34161	200	200
35161	200	100
36161	50	50
42140	100	100
43141	100	200
44141	100	150
45141	150	200
46141	50	50
42180	200	200
43181	200	200
44181	200	200
45181	200	200
46181	100	100
52160	100	200
53161	200	200
54161	200	200
55161	150	100
56161	50	50
22140	100	100

APPENDIX C

Contents:

LIST OF MACHINERY - SASH DEPARTMENT

No.	Name of Machine	Make or Maker	Machine used for:	Drive	Men Req.	Approx. Dimens.	
						leng.	wid.
H1	Press	Geo. A. Ohl (#1)	Forming mullions	Indiv.	2	20	12
H4	Upsetting mach.	Bliss (7E)	Miscellaneous stamping.	Indiv.	2	12	9
H6	8 ft. Vulcan shear	Vulcan Machine Co.	Cutting mullions	Group	2	15	12
SA1	Press	Vulcan Machine Co.	Caulking frames and ventil.	Indiv.	2	18	15
SA2	Upsetting mach.	Bliss (7B)	Upsetting ventilators	Indiv.	2	15	9
SA3	Punch	Stiles-Parker (#4)	Special punching	Group	1	3	4
SA4	Punch	Fred J. Swaine	Punching out locks from T bar	Indiv. (geared)	1	3	4
SA5	Punch	Fred J. Swaine	" " " "	Indiv. (geared)	1	3	4
SA6	Punch	Fred J. Swaine	Punching out glazing angles	Indiv. (geared)	1	3	4
SA7	Press	Geo. A. Ohl (#2A)	Cutting and punching T bar	Indiv.	2	16	6
SA8	Press	Geo. A. Ohl (#2)	" " " "	Indiv. (geared)	2	18	6
SA9	Press	Geo. A. Ohl (#3)	" " " "	Indiv.	2	16	6
SA10	Press	Kappes- Verden	" " " "	Indiv.	1	12	5
SA11	Punch	Long & Alstetter (C2)	Blanking out & miscel. work	Group	2	15	6
SA12	Press	Ferracute Mach. Co.	not in use	Group	1	7	5
SA13	Electric Hoist	- - - - - - - - -	Moving painted sash	Indiv.	1	125	*

LIST OF MACHINERY - STAIR DEPARTMENT

No.	Name of Machine	Make or Maker	Machine used for:	Drive	Men Req.	Approx. Dimens. leng.	wid.
H1	Press	Geo. A. Ohl (#1)	Forming treads and risers and for multiple punching	Indiv.	2	20	12
ST1	12 ft. Shear	Long & Alstetter (#2)	Cutting treads, risers, and stringers	Group	2	19	13
ST2	Press (punch)	Long & Alstetter (#1)	Cutting and notching railing	Group	2	12	5
ST3	Drop Hammer	Totten	Forming stringers	Indiv.	2	6	10
	(This machine has a track for feeding purposes with dimensions as follows:					60	1)
ST4	Punch	Long & Alstetter (#6)	Punching treads, risers, and stringers	Indiv.	1	2½	8
	(This machine has a track for feeding purposes with dimensions as follows:					40	1
ST5	Drill Press	American Tool Works	Drilling	Indiv.	1	2	4
ST6	Drill Press	- - - - - - - - -	Drilling	Group	1	2	4
ST7	Forge	- - - - - - - - -	Forging platform supports		1	3	3
ST8	Press	Totten (#1)	Cutting heavy stock	Group	1	9	6
ST9	Travelling Crane	- - - - - - - - -	Assembling and transporting finished stairs	Hand	1		
ST10	Punch	- - - - - - - - -	Miscellaneous cutting and trimming	Hand	1	3	5
ST11	Emery Wheel	- - - - - - - - -	Grinding	Group	1	2	3
ST12	Air Compressor	- - - - - - - - -	Compressing air for pneumatic riveter	Indiv.	0	9	9
SA11	Punch	Long & Alstetter (C2)	Roughing treads	Group	2	15	6
H4	Upsetting mach.	Bliss (7E)	Forming moulding	Indiv.	2	12	9

LIST OF MACHINERY - HOLLOW METAL WINDOW DEPARTMENT.

No.	Name of Machine	Make or Maker	Machine used for:	Drive	Men Req.	Approx. Dimens.	
						leng.	wid.
H1	Press	Geo. A. Ohl (#1)	Forming pockets and moulds	Indiv.	2	20	12
H2	10 ft. shear	Niagara Stamping Co.	Cutting all pieces for forming.	Group	2	18	6
H3	Brake	Henderson	Forming all pieces	Group	2	18	6
H4	Upsetting mach.	Bliss (7E)	Bending frames for comb. wind. and forming muntins.	Indiv.	2	12	9
H5	Punch	Fred J. Swaine	Punching pockets & pulley slots	Group	1	3	4
H6	8 ft. shear	Vulcan Machine Co.	Cutting frame sheets for combination windows	Group	2	15	12
H7	Punch	Fowler	Cutting miters in head & rivetting lock & lift plates	Group	1	2½	5
H8	Punch	Bliss (38)	Rivetting fins and mitering sill ends	Group	1	3	2½
H9	Punch	- - - - - - - -	Not in use	Group	1	2½	3
H10	Drill press	- - - - - - - -	Drilling	Group	1	2	3½
H11	Brake	Robinson	Miscellaneous work	Hand	2	10	3
H12	Brake	Robinson	Not in use	Hand	1	4	2
H13	Brake	Robinson	Not in use	Hand	1	4	2
H14	Brake	Robinson	Not in use	Hand	1	6	3
H15	Shear	- - - - - - - -	Not in use	Hand	1	2½	7
H16	Emery wheel	- - - - - - - -	Grinding	Group	1	2	1

LIST OF MACHINERY - HOLLOW METAL WINDOW DEPARTMENT.

No.	Name of Machine	Make or Maker	Machine used for:	Drive	Men Req.	Approx. Dimens. leng	Approx. Dimens. wid.
H17	Press	Ferracute Machine Co. (#124)	Mitering ends of bottom rail	Group	1	3	5
H18	Press	Ferracute Machine Co. (#2)	Blanking frame sheets for combination windows	Group	1	2	3
H19	Buzz Saw	- - - - - - -	Miscellaneous cutting	Indiv.	1	8	4
H20	Roll	- - - - - - -	Not in use	Hand	1	4	2
H21	Punch	Ferracute Machine Co. (#222)	These foot presses are used for:	Foot	1	1½	1½
H22	"	" " " "	Punching & rivetting jamb nuts	"	1	1½	1½
H23	"	" " " "	Punching holes for lift and lock plates	"	1	1½	1½
H24	"	" " " (#212)	Mitering ends of bottom meeting rail	"	1	1½	1½
H25	"	" " " "	And other similar work	"	1	1½	1½
H26	"	" " " "	"	"	1	1½	1½
H27	"	" " " "	"	"	1	1½	1½
H28	"	" " " "	"	"	1	1½	1½
H29	"	" " " "	"	"	1	1½	1½
H30	"	- - - - - - - - (#85)	Nothing corners of pieces	"	1	2	3
H31	"	- - - - - - - - (#85)	Notching ends of separators	"	1	2	3
H32	"	- - - - - - - -	Same as above	"	1	2	3

LIST OF MACHINERY - HOLLOW METAL WINDOW DEPARTMENT.

No.	Name of Machine	Make or Maker	Machine used for:	Drive	Men Req.	Approx. Dimens. leng.	wid.
H33	Punch	- - - - - - - -	Same as #H32	Foot	1	2	3
H34	Punch	- - - - - (Little Wonder)	Punching slots in sill and notches in jamb	Foot	1	2	3
H35	Shear	Acme (#2)	Miscellaneous cutting	Hand	1	3	4
H36	Scales	- - - - - - - -	Weighing	Hand	1	2	3
H37	Scales	- - - - - - - -	Weighing	Hand	1	2	3

LIST OF MACHINERY - MACHINE SHOP

No.	Name of Machine	Make or Maker	Machine used for:	Drive	Men Req.	Approx. Dimens.	
						leng	wid
M1	Miller	Brainard Milling Mach. Co.	Milling	Group	1	3	2½
M2	Shaper	Davis & Egan Mach. Tool Co.	Shaping	"	1	4	8
M3	Emery Wheel	Greenfield Tap & Die Corp.	Grinding	"	1	1½	2½
M4	Lathe	- - - - - - - - - -	Turning etc.	"	1	11	2½
M5	Emery Wheel	- - - - - - - - - -	Grinding	"	1	2	4
M6	Shaper	Hendey Machine Co.	Shaping	"	1	3	5
M7	Drill Press	Bement, Miles & Co.	Drilling	"	1	3	4
M8	Drill Press	Wm. C. Johnson & Sons Co.	Drilling	"	1	2	4½
M9	Planer	Cove Machine Co.	Planing	"	1	30	6
M10	Pipe Cutter	Wm. C. Johnson & Sons Co.	Cutting pipe	"	1	2	3
M11	Pipe Threader	Bignall & Keeler Co.	Threading pipe	"	1	7	2½
M12	Pipe Threader	National Machine Co.	Threading pipe	"	1	6	2
M13	Drill	Canedy, Otto Mfg. Co.	Drilling	Indiv.	1	2	7

LIST OF MACHINERY - SPECIAL PURPOSE

No.	Name of Machine	Make or Maker	Machine used for:	Drive	Men Req.	Approx. Dimens.	
						leng.	wid.
A1	Scales	- - - - - - -	Weighing	- - -	1	3	6
A2	Shear	- - - - - - -	Cutting	Hand	1	3	2
A3	Buzz Saw	Yerke	" "	Group	1	5	6
A4	Buzz Saw	- - - - - - -	" "	Group	1	9	4
A5	Band Saw	- - - - - - -	" "	not in use	1	4	6
A6	Band Saw	- - - - - - -	" "	Group	1	4	6
A7	Punch	Long & Alstetter	Miscellaneous punching	Group	1	5	3
A8	Drill Press	W.E. & J. Barnes Co.	Drilling	Group	1	2	4
A9	Stencil Mach.	- - - - - - -	Cutting stencils	Hand	1	4	2

CLASSIFICATION OF BENCHES AND STORAGE SPACES.

No.	Used for:	Dep't.	Approx. Dimens. ft.	
			Length	Width
BSA 1	Bending frame bars	Sash	50	3½
BSA 2	Assembling sash	"	40	6
BSA 3	Fitting sash	"	20	4
BSA 4	Painting	"	19	15
BSA 5	Drying sash	"	106	15
BSA 6	Storing Tee Bar	"	40	30
BSA 7	Storing cut field bars	"	36	6
BSA 8	Storing cut field bars	"	27	10
BSA 9	Storing cut frame bars	"	30	4
BSA 10	Storing ventilators	"	20	20
BSA 11	Storing mullions	"	33	12
BSA 12	Storing ventilators	"	40	30
BST 1	Assembling railings	Stair	20	3
BST 2	Assembling stairs	"	25	25
BST 3	Storing sheet steel	"	28	20
BST 4	Welding stairs	"	3	3
BM 1	Lockers for machinists	Mach. Shop	10	3
BM 2	Workbench	"	6	3
BM 3	Workbench	"	20	3
BM 4	Workbench	"	25	3
BH 1	Storage in process	H.M.W.	30	3
BH 2	Workbench	"	9	4
BH 3	Workbench	"	42	3
BH 4	Workbench	"	33	3
BH 5	Workbench	"	45	3
BH 6	Workbench	"	70	3
BH 7	Workbench	"	64	3
BH 8	Workbench	"	27	5
BH 9	Foreman's bench	"	6	3
BH 10	Sash and frame assembly	"	7	4
BH 11	Sash and frame assembly	"	7	4
BH 12	Sash and frame assembly	"	7	4
BH 13	Sash and frame assembly	"	7	4
BH 14	Sash and frame assembly	"	7	4
BH 15	Soldering	"	8	8
BH 16	Miscellaneous storage	"	45	25
BH 17	Workbench and process stor.	"	9	4
BH 18	Workbench and process stor.	"	9	4
BH 19	Fitting windows	"	10	-
BT 1	Tool and stockroom	All	30	25
BSA 13	Assembling ventilators	Sash	15	4

MACHINERY GROUPINGS*

Under Present Layout.

Group #1 - H2, H3, H7, H8, H9, H10, H17, H18, H19, A8, A3, A4.

Group #2 - M1, M2, M3, M4, M5, M6, M7, M8, ST6, ST7, ST9.

Group #3 - A6, A7, M9, M10, M11, M12, ST5, SA3, H5, (SA16).

Group #4 - H6, ST1.

Group #5 - ST2, ST11.

Under Proposed Layout.

Group #1 - A3, A4, A6, A7, A8.

Group #2 - M1, M2, M3, M4, M5, M6, M7, M8, M9, M12, M13.

Group #3 - H5, H7, H8, H10, H16, H17, H18.

Group #4 - M10, M11.

Group #5 - ST6, ST8, ST11.

*Note - Each group driven by one motor through shafting arrangement. See Page for description of machines listed above.

Distribution of Motors.

Under the present layout a total of 23 motors is used of which 18 are used for individual drive.

Under the proposed layout a total of 25 motors is used of which 20 are used for individual drive.

APPENDIX D

Contents:

Letters

Payroll Analysis of Stair Department for February, 1927

DAVID HOUSTON, BOND & CO., INC.

REALTORS

Military Park Building
60 Park Place, Newark, N. J.

April 25, 1927.

Mr. George C. Houston
259 St. Paul Street
Brookline, Mass.

Dear Mr. Houston:

In answer to your inquiries regarding a new location for the plant of Mesker Brothers Iron Company, of St. Louis, Missouri, we beg to submit the following result of our inquiries for your consideration.

We find that this firm is operating a plant in the center of the down town section of St. Louis, which has changed entirely from a manufacturing area to a warehousing district. The land value of the present site is in the neighborhood of $3.00 per square ft., which is altogether too high a value for the purpose for which it is used. The property is not served with a railroad sidetrack, though in close proximity to freight stations where L.C.L. shipments are handled. We find that industrial sites well located from the labor point of view with railroad facilities from the Missouri Pacific Railroad in the southern part of St. Louis (about 30 hundreds south), can be acquired at a price of approximately $.50 per square ft.

The present factory buildings of Mesker Brothers are three stories and two stories in height, and are of obsolete construction, entailing high insurance, inefficient manufacturing facilities, and probably high turnover in labor.

We are of the opinion that a plot of ground containing about 80,000 square ft. with railroad siding would be sufficient to provide for the erection of a new plant, and also for future expansion, and should not cost more than $40,000. A building 120' x 300', semi-monitor roof (which need not be of heavy construction, in view of the fact that individual drives are used on the majority of machines), could be built complete with heating and plumbing for about $2.50 per square ft., so that the total cost of land and buildings

would be in the neighborhood of $115,000., which is about $3.00 per square ft. for plant and buildings. We are of the opinion that the cost of moving would be saved in a very short time through economies and savings on account of increased efficiency.

The advantages to be derived from a new plant would be the following:

1. Direct railroad facilities for incoming and outgoing freight.

2. Better labor conditions, including lessening of labor turnover.

3. Increased efficiency in manufacturing.

4. Reduced insurance rates.

We trust this information will be sufficient for your purposes, and are

Yours very truly,
DAVID HOUSTON, BOND & CO., INC.

(Signed) David Houston
President.

DH:B

DAVID HOUSTON, BOND & CO., INC.

REALTORS

Military Park Building
60 Park Place, Newark, N. J.

April 29, 1927.

Mr. George C. Houston
259 St. Paul Street
Brookline, Mass.

Dear Mr. Houston:

We are in receipt of yours of April 26th. We think we have covered all the points raised by you in our previous letter, with the exception of the cost of excavating for a new building and the cost of demolishing and removing the present buildings.

The cost of excavating depends entirely on the nature of the soil, and also varies according to the distance to which the soil has to be carted. In this vicinity the cost of excavating where the sub soil is ordinary dirt would be about $.90 to $1.00 per cubic yd. If hard shale were struck the cost would be about $6.00 to $7.00 per cubic yd., and if it should happen to be a rock foundation, it would run as high as $20.00 per cubic yd.

I think, however, that where Mesker Brothers' plant is located, you would have no trouble with the foundation, but it would be well in any event before definitely deciding to rebuild on the present site, to take soundings, as it might possible develop that piles would be required to be used, which would increase the cost of the whole operation.

With regard to the cost of demolishing the present buildings, our experience has been that the value of the building material in the old buildings which can be salvaged in the demolition, about pays for the cost of demolishing.

We are,

Yours very truly,
DAVID HOUSTON, BOND & CO., INC.

(Signed) David Houston
President.

DH:B

Schedule "C"

PRODUCTIVE LABOR IN STAIR DEPARTMENT
SEGREGATED ACCORDING TO OPERATIONS
For February 1927

Operation Numbers	Hours	Amount
1	34¼	23.78
2	49¼	23.55
3	415½	214.07
4	136	68.55
5	122¼	57.65
7	616¼	296.87
8	27½	18.01
1-4	8	6.60
2-3	6¼	3.28
2-3-4	10½	8.66
2-3-6-7	10½	5.51
2-3-7	78½	41.21
2-4-5-7	10½	5.51
2-5	5	2.63
2-7	4¼	2.23
3-4	10½	8.66
3-4-5-6	10½	5.51
3-4-5-7	10½	5.51
3-4-7	8	6.60
3-6-7	31½	17.34
3-7	19	10.27
4-5	10½	5.51
4-5-7	8	4.20
4-6	39½	24.08
4-6-7	38¼	21.06
4-7	20½	10.75
5-7	6¼	3.12
6-7	69¾	42.96
Fitting & Welding on Special Job	52¾	27.14
Grand Total	1870½	970.82
Its Weekly Equivalent	467½	242.71

APPENDIX E

Contents:

Drawings of Proposed Layout

BIBLIOGRAPHY

Notes on Plant Layout, pp.1 - 24.
By Professor Erwin H. Schell. M.I.T.

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