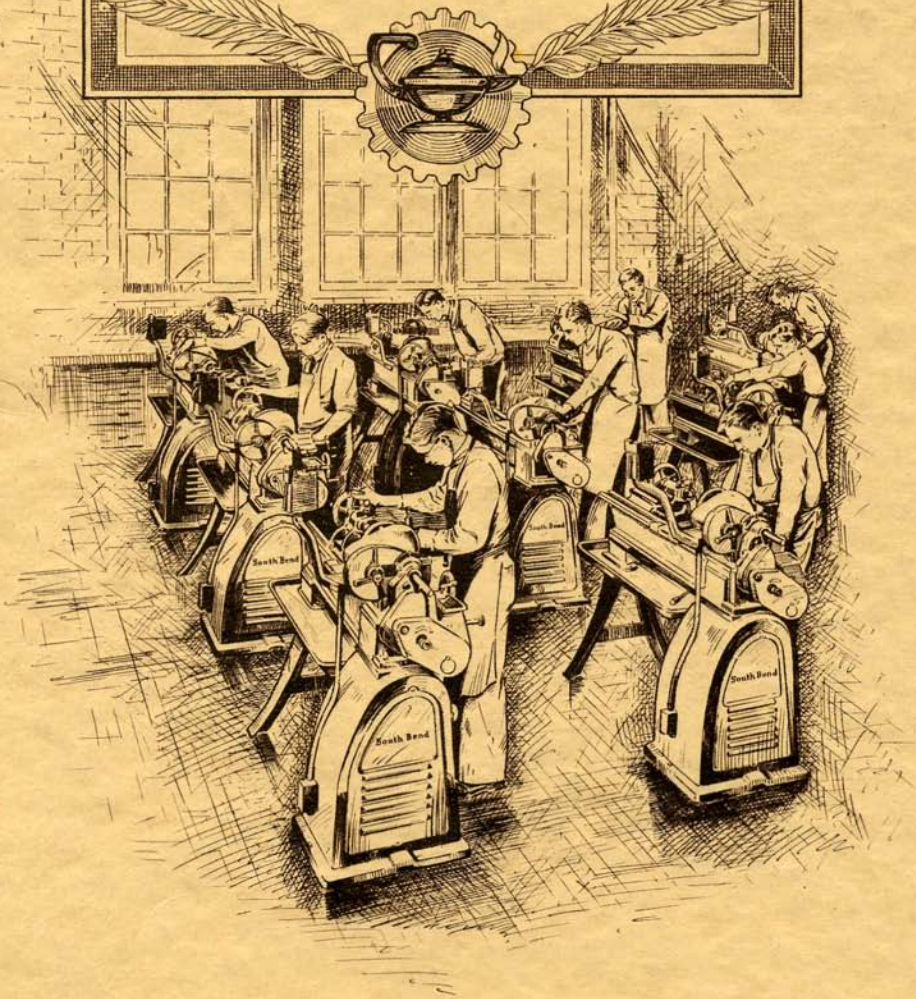
THE SCHOOL SHOP



Vocational Bulletin No. 57

SOUTH BEND LATHE WORKS
SOUTH BEND, INDIANA

Co-operation Between Industry and Vocational Schools

The Employment of Vocational and Trade School Graduates

Before the development of the vocational and trade school it was customary for manufacturers to employ as apprentices boys who were relatives or friends of their employees, boys picked up on street corners, or almost any boy picked at random.

In 1932 the Superintendent of the South Bend Lathe Works came to the conclusion that a better way of selecting apprentices for shop work would be to go to the vocational and trade schools and interview boys in the graduating classes. Obviously, boys with four years of training in wood work, machine shop, mechanical drawing and related subjects would make ideal apprentices.

A representative was sent to talk to boys in the senior classes who had taken vocational work in high school. The school records of about twenty boys who stood in the first 25% of their class were studied, and these boys were interviewed. From this number six boys were selected and put to work as apprentices.

First, the boys were placed in a department where they could do general but varied work in order to determine their individual ability and find out if possible the class of work each boy could do best. This was a sort of "clearing house" or "proving ground". The wage was 30c per hour for the first three months.

After spending a short time in the "clearing house", most of the apprentices were transferred to the machine shop, tool room, pattern shop, engineering department, cost department and other departments where there was plenty of opportunity to acquire skill and knowledge. Advancement was made entirely on the ability and the effort of the individual. This was not a final adjustment as there is a gradual development, more rapid in some boys than in others, and changes are made whenever it seems advisable. This plan proved unusually successful and was adopted as a permanent company policy.

SOUTH BEND LATHE WORKS

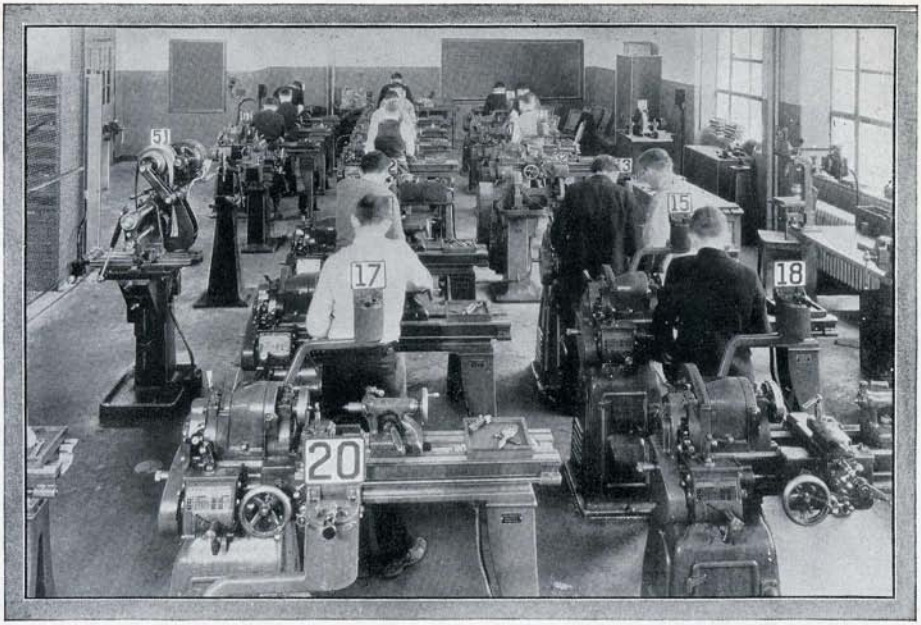


Fig. 1. Rindge Technical High School, Cambridge, Massachusetts

Mechanical Training in Modern Schools

Engineering Shops in the universities of the United States are essential to the training of young men for responsible technical positions in Industry. Only by actually using modern machine tools in the shop, can the engineering student receive a thorough practical foundation and acquire the experience essential to success.

Vocational and Trade School Machine Shops all over the United States are performing a valuable service to boys and young men in preparing them to enter industry as skilled or semi-skilled mechanics. The practical training these boys receive paves the way for advancement to the jobs of foreman, superintendent, engineer, executive and factory owner. See pages 2 and 3.

Senior High School Machine Shops are doing much the same work as in the Vocational and Trade School. The object is to provide a fundamental knowledge of machine shop practice which the student can use as a basis, should he become a tradesman, or if he takes up a technical course at college. See pages 4 and 5.

Junior High School Machine Shops and General Metal Shops start the boy off in the right direction. After a year of Junior High School Shop work, he can advance to the Senior High School or the Vocational Shop and finish an excellent training, ready to enter industry when he leaves school. See pages 6 and 7.

Auto Mechanics and Aeronautics Shops give the student in every community the chance to learn something about the automobile, truck and tractor. Over 25,000,000 of these vehicles are in use in the United States alone, with an average service and repair bill annually of more than $500,000,000 making it one of the biggest industries in the country. Aeronautics is rapidly following Auto Mechanics on a smaller scale. See pages 10 and 11.

The Small General Shop, as shown in this bulletin, has been a development in the small community to serve the same purpose as the large independent shops in the larger cities. Several different subjects in the same room, taught by one instructor, give the students practical shop training at a minimum cost. See pages 12 and 13.

The Large General Shop, as shown in this bulletin, combines a group of technical activities into one shop, giving the student a training in each activity to bring out his natural abilities and tendencies. Subjects have been selected according to their greatest importance to the majority of the cities in the United States. See pages 14 and 15.

Farm Mechanics Shops are springing up everywhere because of the demand for shop work in agricultural sections of the country. Farmers are frequently careless and neglectful of costly equipment, because of a lack of knowledge and appreciation of machinery generally. The Farm Shop supplies this knowledge. See pages 16 and 17.

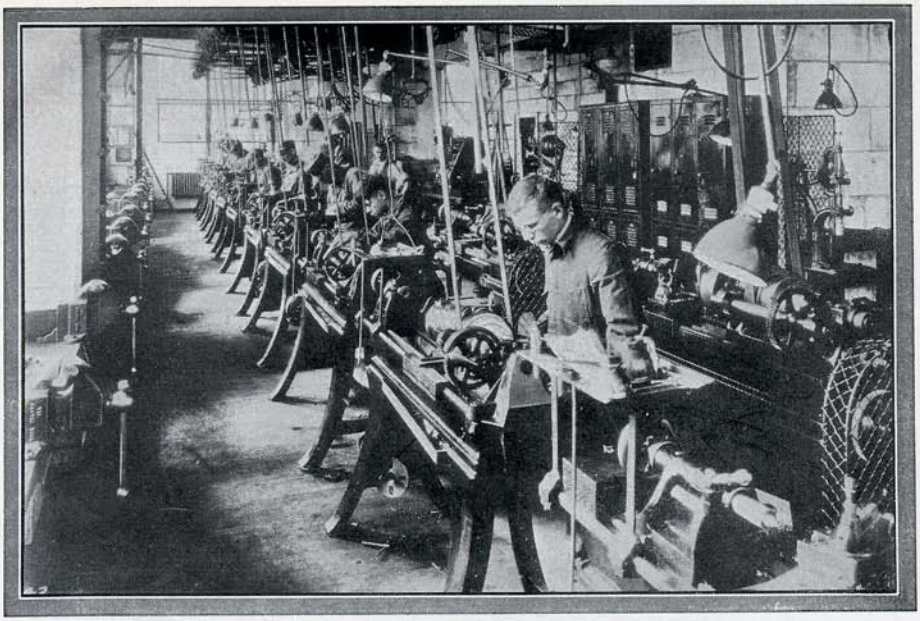


Fig. 2. Machine Shop of Madison Vocational School, St. Paul, Minn.

Vocational and Trade School Machine Shop

Training in Machine Shop Practice in the Vocational and Trade Schools has as its object the development of skilled tradesmen such as machinists and toolmakers. The shop should provide the type of training that formerly was given to the apprentice in the industrial plant by the foreman of the shop. The practice of developing apprentices has been dropped by many plants and they look to the public schools to provide the necessary workmen who have "learned their trade."

The Instructor is a Foreman in the school machine shop. He should guide the student in much the same way that a foreman guides the apprentice under him. It should not be the purpose of the shop to make a machine hand out of the boy, but to teach the fundamentals so he can go further on his own initiative.

Shop Work should be a combination of projects and exercises. Building projects in large quantities on a production basis is not good practice as the student fails to get the rounded-out experience required by a skilled machinist or toolmaker. Several projects, having some practical value requiring a variety of operations to complete, combined with exercises that bring out the important fundamental points, make an excellent type of shop training.

Related Work is just as necessary to the Vocational and Trade School student as it is to the apprentice. Industrial plants having their own apprentice departments combine actual shop work with classes in related subjects. The success of several of these modern apprentice departments is shown on pages 34 and 35 where apprentice training is described.

Type of Work Done in the Vocational Machine Shop

Plain Turning
Facing
Cutting to a Shoulder
Taper Turning
Knurling
Cutting Screw Threads
Sharpening Lathe Tools
Hardening and Tempering
Making Jigs and Fixtures
Drilling and Tapping
Sharpening Drills
Planing Jobs
Shaping Jobs
Milling Jobs
Dividing Head Work
Making Spur Gears
Sharpening Cutters
Layout Work

The Extent of the Course can be almost unlimited as each of the jobs listed above can be broken down into a varied assortment of operations that will bring out the fundamental shop practice. The student will become familiar with the processes and will be able to handle any job of similar character he runs into later in actual shop work. Every phase of Machine Shop Practice should be covered to some extent in the Vocational Machine Shop.

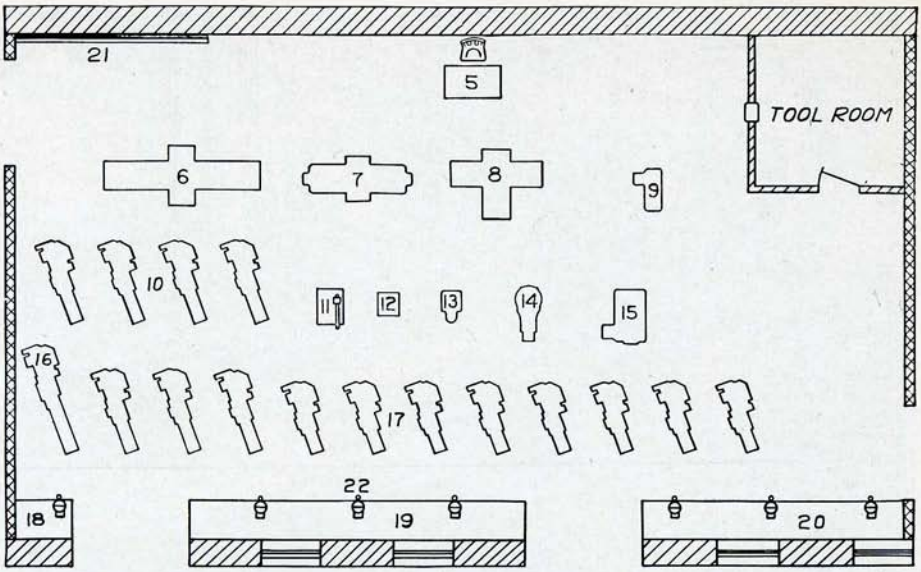


Fig. 3. Practical Vocational Machine Shop Floor Plan Layout

Organizing the Vocational and Trade School Shop

A Practical Vocational Machine Shop is shown in the floor plan layout above. This shop has been designed to provide the maximum amount of machine training for every student that takes the course. About 35 boys can be taken care of with one instructor in the shop.

Equipment Recommended has been selected to provide the necessary foundation training that every machinist or toolmaker should have. Machines are the correct size for the students to use most conveniently and efficiently. Some shops have the mistaken idea that large heavy machines, suitable for only 5% of the industrial work in the United States, should be used in the school shop. This equipment is expensive and the designs of the machines are usually too specialized for training purposes in a school shop.

Size of the Room shown is 38′x68′ providing 2584 square feet. Lathes forming the major part of the shop equipment are individual motor drive, each having its own motor and control equipment. Machines are set at an angle to secure best lighting on the work. A room slightly longer in one direction is preferred to a square room because of better light facilities and for convenience of the instructor.

Cost of the Equipment for a complete machine shop, as shown above, will vary, depending on the exact selection of machines and small tools. The list below shows the recommended size and type machines with reference numbers applying to the layout above. An itemized quotation covering cost of the entire shop equipment will be sent on request to any interested instructor, supervisor or school official.

Vocational and Trade School Machine Shop Equipment

No.	Name	Quan.
5.	Instructor's Desk	1
6.	24″x6′ Planer, Motor Driven	1
7.	No. 2 Universal Grinder, Motor Driven	1
8.	No. 2 Universal Milling Machine, Motor Driven	1
9.	4″x4″ Power Hack Saw	1
10.	15″x6′ Quick Change Gear Back-Geared, Screw Cutting Motor Driven Lathes	7
11.	Arbor Press	1
12.	10″ Emery Grinder, Motor Driven	1
13.	12″ Sensitive Floor Drill, Motor Driven	1
14.	24″ Back-Geared Drill Press, Motor Driven	1
15.	16″ Shaper, Motor Driven	1
16.	16″x6′ Quick Change Gear Back-Geared, Screw Cutting Motor Driven Lathe	1
17.	13″x6′ Quick Change Gear Back-Geared, Screw Cutting Motor Driven Lathes	8
18, 19 and 20.	Work Benches	3
21.	Blackboard	1
22.	4″ Machinist Vises	7
	Assortment of small tools and accessories, drills, Hack Saws and miscellaneous special tools	1

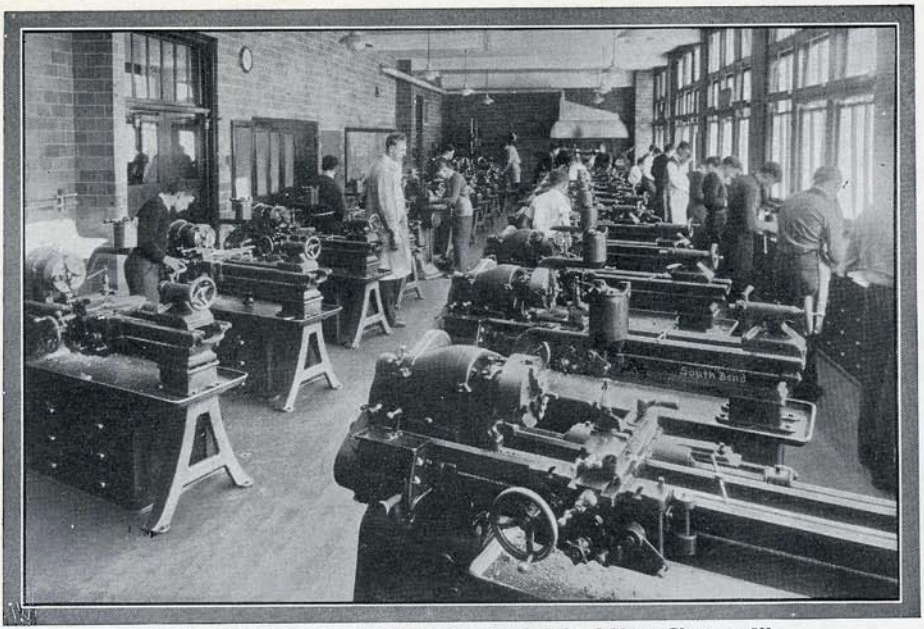


Fig. 4. South Bend Lathes in Austin High School Shop, Chicago, Ill.

The Senior High School Machine Shop

Machine Shop Practice in the Senior High School and Technical High School should be similar to that in the Vocational and Trade School. The work must be practical and cover the actual shop practice and methods in accepted use in the industrial plants, commercial machine shops and engineering laboratories. Thus the boy has secured a valuable training that will help him if he enters industry or if he takes up a technical course in college.

Shop Processes of a complicated nature and jobs that are a rarity in the average shop or plant should be avoided. Only about 2% of the manufacturing done in the United States is in large organizations with highly specialized processes and large employment rolls. The average manufacturing plant and shop employing the vast majority of workers, employs about 200 people. Thousands of shops and plants employ less than 20 men. The school should train the student for the average shop.

Projects and Exercises. Making projects having practical value combined with a few fundamental shop exercises should be the extent of the course. Instructional value, should be the determining factor in choosing machine shop jobs. Production of parts in quantity is rarely a part of the High School machine shop course because it is not the object to make machine operators out of students. Several practical projects for the machine shop are shown and described on pages 20 to 23.

Effects of Shop Training. Several of the greatest mechanical geniuses and leaders of industry owe their successes to shop training in early life. Henry Ford, Wilbur and Orville Wright, Geo. Westinghouse, McCormick and many others got their start on a small lathe. Henry Ford has his first lathe set up in Dearborn, Michigan, among his museum exhibits and attributes the founding of his vast enterprise to the training he received on it.

Type of Work done in the Senior High Machine Shop

Plain Turning
Facing
Cutting to a Shoulder
Taper Turning
Knurling
Cutting Screw Threads
Sharpening Lathe Tools
Hardening and Tempering
Making Jigs and Fixtures
Drilling and Tapping
Sharpening Drills
Planing Jobs
Shaping Jobs
Milling Jobs
Dividing Head Work
Making Spur Gears
Sharpening Cutters
Layout Work

Over 80 Per Cent of machine shop work is lathe work. For that reason the majority of the time should be spent on lathe jobs. The lathe is the basic machine and a thorough knowledge of its operation is of greatest importance to the average boy who is mechanically inclined.

Two or three years of shop training will provide a good fundamental knowledge of machine shop practice, however, in the limited time available for shop in the high school, it is impossible to turn out skilled mechanics. Skill can be acquired later if the boy follows a trade.

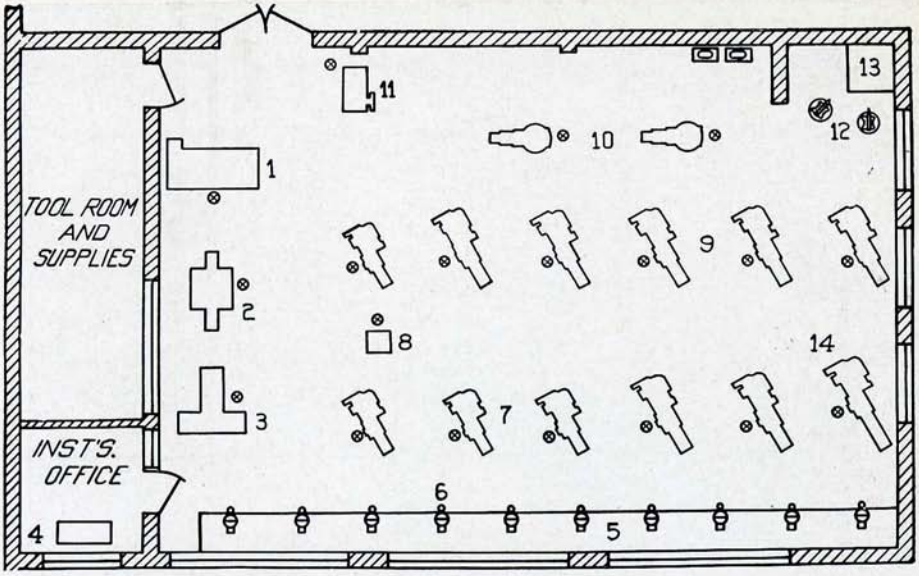


Fig. 5. Floor Plan for Senior High School Machine Shop

Organizing the Senior High School Machine Shop

Layout of the Shop. The floor plan shown above contains some good practical suggestions that can be followed in the Senior High School Machine Shop. Equipment shown is sufficient to give every student the right proportion of hand and machine training. With the above equipment about 30 boys can be taken care of to advantage with one instructor in the shop.

Equipment Recommended in this layout has been selected after years of experience in dealing with several hundred successful school shops. Heavy, massive machines and special purpose tools have been avoided as they have no place in this type of shop. All machines are of the individual motor driven type, of the correct size to give best results from the teaching standpoint and to keep the shop cost reasonable. The result is a shop that will be appreciated in any High School.

Size of Room shown is 38′x60′ providing 2280 square feet including stock room and instructor's office. A room oblong in shape instead of square is generally preferred as it offers better lighting facilities and is more convenient for the instructor. Ground floor or basement are preferred for the shop to prevent vibration throughout the building.

Cost of the Equipment will vary depending on the individual selection and make of machines and tools. Listed below are the machines and equipment for the complete machine shop shown in the layout above. Numbers refer to the location numbers on the layout; quantities refer to the quantity of each machine required. The entire shop equipment need not be purchased at one time but a start can be made with a few machines and the remainder added as funds are available.

Senior High School Machine Shop Equipment Recommendations

No.	Name	Quan.
1.	No. 2 Universal Milling Machine	1
2.	No. 2 Universal Grinder	1
3.	16″ Motor Driven Shaper	1
4.	Instructor's Desk	1
5.	Work Bench	1
6.	4″ Machinist Vises	10
7.	11″x4′ Quick Change Gear Back-Geared, Screw Cutting Lathes	4
8.	10″ Emery Grinder, Motor Driven	1
9.	13″x5′ Quick Change Gear Back-Geared, Screw Cutting Lathes	7
10.	20″ Drill Press, Back-Geared	2
11.	4″x4″ Power Hack Saw	1
12.	100 lb. Blacksmith Anvils	2
13.	Hand Power Forge	1
14.	16″x6′ Quick Change Gear, Back-Geared, Screw Cutting Lathe	1
	Equipment of tools for general shop use consisting of calipers, micrometers, scales, hammers, chisels, wrenches, files, scribers, etc.	1
	Equipment of tools for lathes	1
	Equipment of tools for shaper	1
	Equipment of tools for milling machine	1

A complete itemized quotation of prices of the above equipment, if desired for estimating purposes, will be sent on request, without obligation.

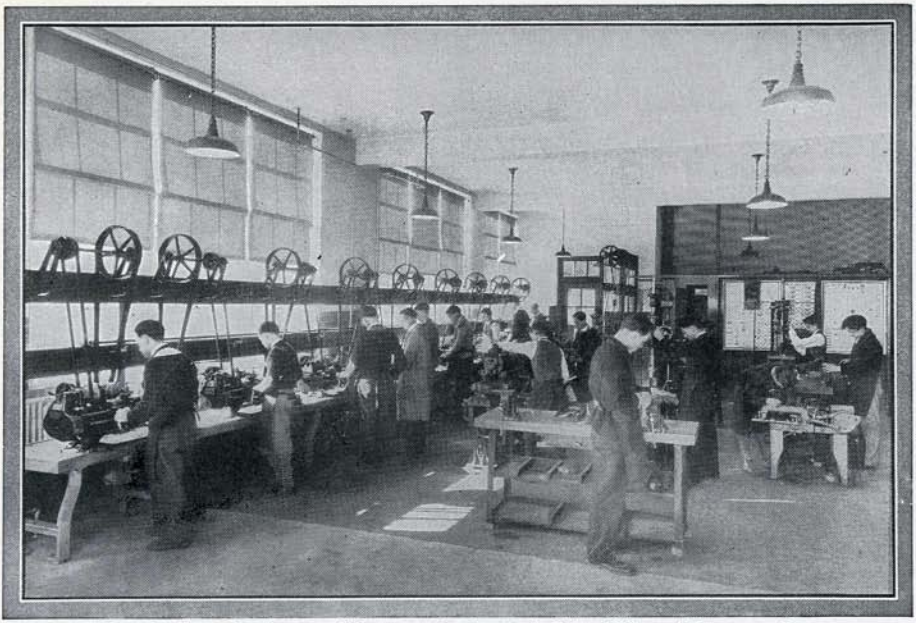


Fig. 6. Boys Working in Allentown Junior High School Shop, Allentown, Pa.

Junior High School Machine Shop

Machine Shop Practice in the Junior High School has been handled in several different ways in various parts of the United States. Some schools confine Junior High Shop Work to the General Shop; others have set up general metal shops and combine machine shop practice with other metal work. The method of giving shop training shown here requires the complete machine shop expressly developed for Junior High School classes. This is the type of shop best suited to the subject of shop training, if space, facilities and budget will permit.

Projects and Exercises. Listed below is a brief outline of the scope of Junior High School Shop work. Simple operations covering elemental parts of shop work should be adhered to. Most of the operations will necessarily be confined to lathes, drill press and to bench work. Simple projects that have some practical value should be made. A few exercises covering fundamental shop operations make a good foundation for a complete shop training to come later. See pages 20 to 23.

Metal Work has become of major importance in technical and vocational education, because of the extensive use of metals everywhere. Metal is displacing wood and other materials in hundreds of every day uses. Fabrication of metal, repair and service of metal parts have grown to positions second to none in the United States. This is true not only in heavy industrial sections of the United States, but in every community both large and small, making a knowledge of metal work of value to every individual regardless of vocation or profession.

The Introduction of Machine Shop Practice in the Junior High School, is, for these reasons, to be encouraged and developed. Hundreds of Junior High Schools are already well advanced in this work, many of them carrying the work still further than described herein. The plan has been successful, because it has made the student more self-reliant, increased his practical knowledge and fitted him better to meet conditions outside of school.

Type of Work Done in the Junior High Machine Shop

Plain Turning Operations
Facing Operations
Taper Turning
Knurling
Cutting a Screw Thread
Drilling and Tapping
Milling Operations
Shaping Operations
Properties of Metals
Sharpening Tools
Sharpening Drills
Machining to Accurate Dimensions

Limiting the Work. Generally the age of the students demands that simple, introductory operations be given in this shop. Several small projects such as shop tools, objects which the boy can take home and use, metal parts of equipment around the school building provide excellent training in the Junior High School.

The Operations Required in building a variety of projects will include all of those listed above and teach the boy how to operate all the machines in the Shop. After learning how to operate the lathe, milling machine, shaper, drill press, etc., he will be able to use any size, type or make of machine when he gets out of school.

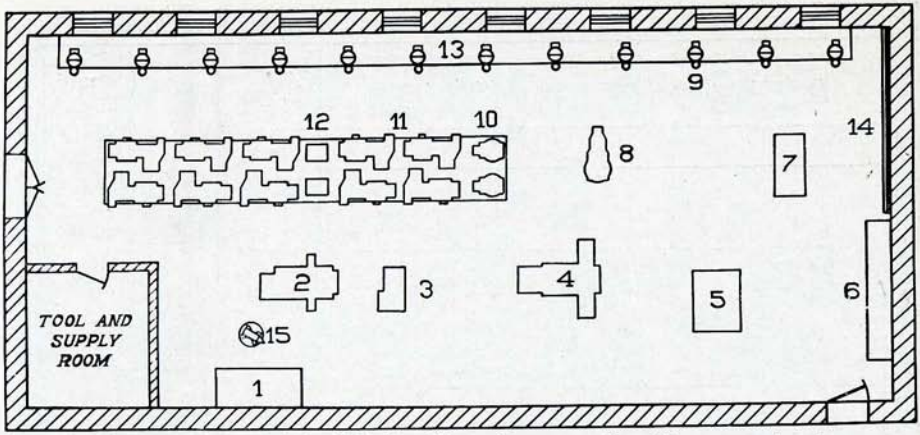


Fig. 7. Junior High School Machine Shop with groups of machines on one bench

Organizing the Junior High School Machine Shop

Layout of the Shop. The floor plan shown above is a very satisfactory arrangement for a complete Junior High School Machine Shop. Equipment shown is sufficient to give every student both hand work and machine training. About 25 to 30 boys can be taken care of to advantage with one instructor.

Equipment Recommended in this layout is small in size, suitable for the small work taken care of in the Junior High School. Heavy tools of large size are entirely unsuited to the young boys that make up the Junior High classes. All the lathes, two grinders and two sensitive drills are individual motor driven, grouped on a large bench near the center of the room. This has three distinct advantages. The bench type machines are lower in cost, take up less floor space and the bench provides necessary storage space for tools and accessories.

Size of Room shown is 25′x60′ providing 1500 square feet of floor space. This is about average size and provides sufficient working areas around each machine. An oblong shaped room is preferred to a room that is square as the lighting facilities are usually better in a shop of this shape. In planning a shop, have it large enough so that a supply room and tool room of generous proportions may be available for safeguarding school property.

Cost of the Equipment for the machine shop will vary according to the individual selection of sizes, types and makes of machines. Reference numbers in the tabulation below apply to the numbers shown in layout above. Many items of equipment such as benches, cabinets, etc., will be built at the school, or may be secured, separately, from local mills or from firms specializing in this type of furniture.

Shop Equipment Recommendations for the Junior High School

No.	Name	Quan.
1.	Hand Power Forge	1
2.	14″ Motor Driven Shaper	1
3.	4″x4″ Power Hack Saw, Motor Driven	1
4.	No. 1 Milling Machine, Motor Driven	1
5.	Tool and Cutter Grinder	1
6.	Display Cabinet	1
7.	Instructor's Desk	1
8.	20″ Back-Geared Drill Press	1
9.	4″ Machinist's Vises	12
10.	10″ Sensitive Bench Drills	2
11.	9″x3′ Back-Geared, Screw Cutting Bench Lathes, Motor Driven	10
12.	8″ Bench Emery Grinder, Motor Driven	2
13.	Work Bench	1
14.	Blackboard	1
15.	100 lb. Anvil	1
	Equipment of tools for entire shop consisting of calipers, scales, dividers, micrometers, hammers, chisels, tongs, pliers, files, punches, etc.	1
	Equipment of tools for lathes	1
	Equipment of tools for shaper	1
	Equipment of tools for milling machine	1

A complete itemized quotation on the above equipment will be supplied on request, without obligation.

Other Shop Layout Drawings in addition to the shop recommended above have been prepared in response to requests from school officials. The shops were placed in use and have been successful under actual working condition in various parts of the country. Some of these shops are smaller than the above with about half the quantity of equipment. Others are larger than the above and are shown with a greater variety of machines. Blueprints 12″x18″ of these drawings will be sent free to any instructor or supervisor. A special layout will also be made, if desired. See engineering service described on page 31 of this bulletin.

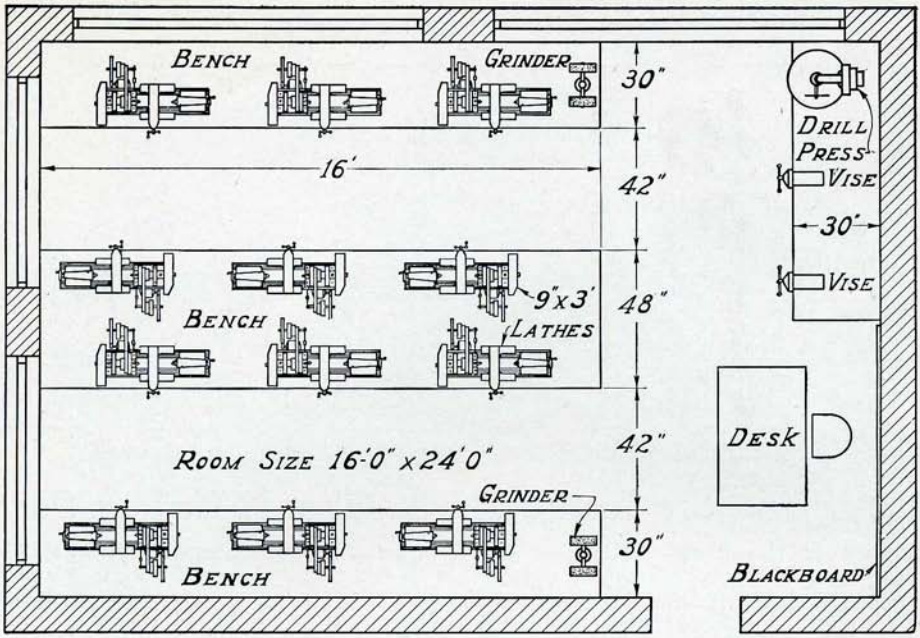


Fig. 8. Floor Plan of School Shop 16'x24' with Twelve Motor Driven Lathes

Complete Machine Shop—12 Bench Lathes

Capacity 48 Boys Each Day of 4 Periods

Bench Lathes May Be Used Exclusively for the school machine shop and are sometimes preferable to the larger sizes of lathes. The illustration above shows the floor plan of a well arranged shop 16'x24', equipped with twelve motor driven bench lathes, a bench drill press, two bench grinders and two vises.

A Considerable Saving of Floor Space in using bench lathes exclusively is accomplished. Cabinet type benches are used, so there is ample storage space in the benches for stock, tools, accessories, supplies, etc. No wall space is required for tool cabinets, and there is ample room above the benches for charts and blueprints.

The Investment is Less than for other equipment that would accommodate an equal number of boys, since the bench lathes are less expensive than the larger sizes of lathes which have floor legs. There is an additional saving in that the room does not need to be so large because of the economical arrangement that may be made with bench lathes.

Bench Lathes Are Exactly the Same as the large floor type lathes except that they are smaller in size. They are just as satisfactory for teaching machine shop practice, and they cost less to operate because less power is required.

The Shop Is Easy to Keep Clean and Neat when bench lathes are used as there is little room under the lathes for chips and dirt to accumulate. The lathes and benches should be cleaned after each class period. If the benches are of the cabinet type, extending to the floor, there is no chance for chips to accumulate under them. Therefore only the aisles are left for the janitor to sweep.

This Shop will accommodate at least 12 boys each period, or 48 boys in a day divided into 4 periods. Each of these boys has his own lathe and may use the grinders, drill press, vise and bench. The entire shop can be equipped for approximately only $1500.00.

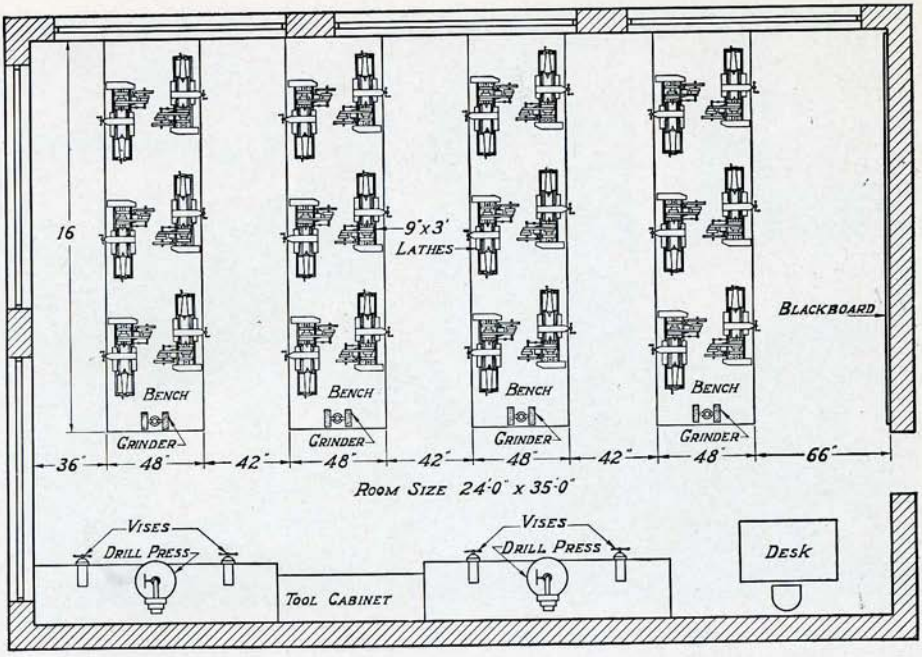


Fig. 9. Floor Plan of School Shop 24'x35' with Twenty-four Motor Driven Bench Lathes

Complete Machine Shop—24 Bench Lathes

Capacity 96 Boys Each Day of 4 Periods

The Floor Plan above shows an excellent arrangement for a bench machine shop to accommodate twenty-four boys each period or ninety-six boys each day of four periods. In addition to twenty-four bench lathes there are several bench emery grinders, bench drill presses and vises.

Arrangement of the Machinery and equipment in this shop is quite economical of floor space, as well as convenient. The teacher's desk is located in the corner next to the door, which permits checking students in and out of the shop, if desired. The blackboard is conveniently located near the teacher's desk and on a well lighted wall.

Bench Lathes are mounted in groups of six on large benches 16 feet long and 48 inches wide. These benches are cabinet type construction which provides ample space for storing tools and accessories for the lathes. Lockers may also be provided in the benches for each individual boy, in which he may keep the projects on which he is working, supplies, instruction sheets, etc.

Equipment Costs for this shop are reduced to a minimum by using bench equipment exclusively. Moreover, bench lathes are just as satisfactory for teaching machine shop practice as are larger lathes because all of the operations involved are identical and the fundamental principles are the same, regardless of whether a bench lathe or floor leg lathe is used.

Floor Space Is Saved by the use of bench lathes because there is no necessity of providing locker or cabinet space other than that which is in the benches on which the lathes are mounted. The shop that is equipped with bench lathes mounted on cabinet type benches is easy to keep clean and neat, because there is very little space where chips and dirt may accumulate.

The Total Cost of the Equipment shown in this shop is approximately $3,500.00, although this amount may vary considerably, depending on the type of equipment installed, accessories included, etc.

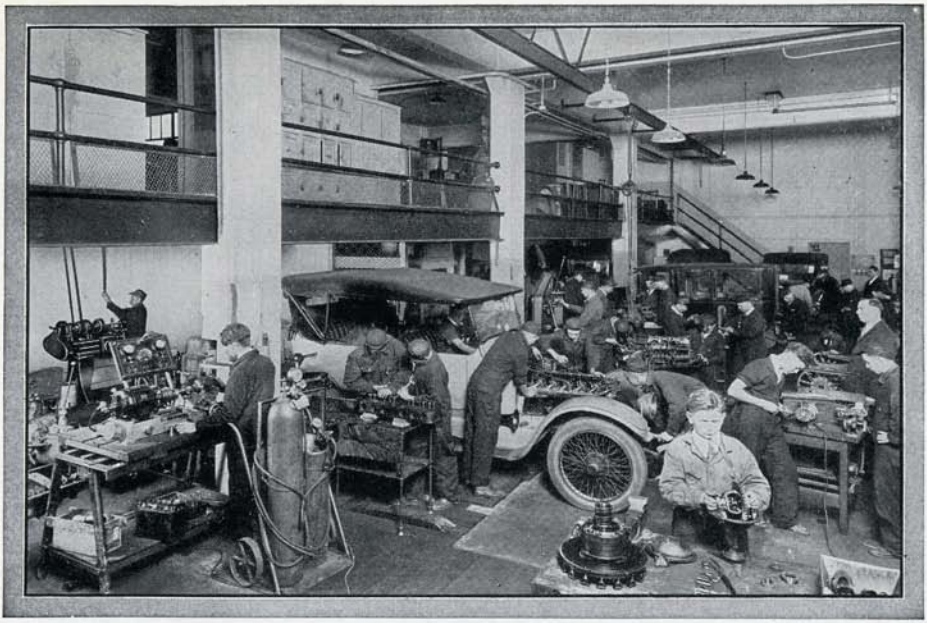


Fig. 10. An Exceptionally Well-Equipped and Efficient School Motor Mechanics Shop.

Motor Mechanics School Shop

The Study of Motor Mechanics has become increasingly important in all parts of the world because of the universal use of motor cars trucks, buses, tractors and other gasoline driven equipment.

In Thousands of Cities and Towns the Automobile, Truck and Tractor repair business is the largest industry in the community. The repair shops, service shops, and machine shops are about the only industries in these towns to absorb the graduating boys. If the boy cares nothing for agriculture and has had no training in shop work, especially motor mechanics, he may leave town "to get a job."

One Instructor can take care of the Motor Mechanics Shop. Motor cars, Trucks and Tractors may be brought in and repaired at a nominal charge. This provides modern practical training for the students and also appeals to the community as a whole.

Machine Work in the motor mechanics shop is of great importance because the mechanical units of the modern automobile, truck and tractor operate with precision. These units include the engine, differential, brakes, etc. Modern machine methods that meet the most exacting standards of accuracy, must be used in servicing these parts.

A Separate Building for the motor mechanics shop is built by many schools, as the present school buildings are unable to provide the required space. Blue prints and photographs of suggested shops will be sent to any school instructor or supervisor who is interested.

Aero Mechanics is rapidly becoming an essential study also because of the widespread use of aircraft in passenger, mail, express and freight handling. Many schools have expanded the Auto Mechanics Shop to include Aeronautics.

Type of Work Done in the Motor Mechanics Shop

Refacing Valves
Finishing Pistons
Starter and Generator Service
Ignition Work
Making Bushings
Brake Drum Work
Wheel Aligning
Boring Connecting Rods
Testing and Truing Axles
Replacing Differential Ring Gears
Fitting Ring Gears to Flywheels
Truing Commutators
Undercutting Mica Insulation
Reboring Cylinders
Sharpening Reamers
Miscellaneous Hand Work

Most Motor Mechanics Shops devote 95% of the time to shop operations in Motor Mechanics. The related knowledge and theory are picked up as the practical jobs are handled, or are obtained by outside preparation. The shop equipment is therefore in constant use and the students derive full benefit from practical experience on actual jobs.

Practical Aero Mechanics must largely be confined to construction of gliders, rigging damaged ships for personal use, and the study of aircraft engines by tearing down laboratory engines and reassembling. Actual work of overhauling aircraft engines for commercial use is impractical under present Department of Commerce regulations of aircraft.

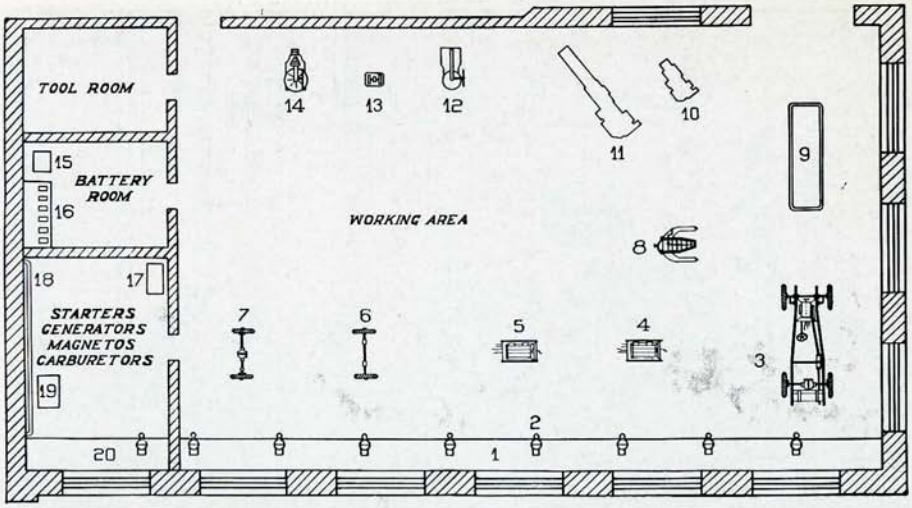


Fig. 11. Motor Mechanics Shop Floor Plan Layout.

Organizing the Motor Mechanics Shop

The Floor Plan Layout illustrated above shows a practical arrangement of a shop suitable for Motor Mechanics alone, or with Aero Mechanics in conjunction with it. Sufficient space must be provided as a working area for vehicles which are driven into the shop, the same as in a commercial garage or repair shop.

Laboratory Engines on permanent stands should be set up to show the general construction and theory of operation. Most school auto shops provide batteries, ignition systems, cooling systems and permanent exhaust outlets to the laboratory engines so that they may be operated and studied.

Instruction Manuals made up in blue print form showing how to handle several important motor service jobs are described on pages 40 and 41.

The Size of the Room should be 50'x50' for the average Motor Mechanics Shop taking care of 20 to 30 boys with one instructor. The shape of the room should be nearly square. Equipment is best arranged near the walls of the shop so the working area is in the center of the room. Ground floor with ramp and double doors for vehicles is necessary.

Additional Equipment not shown in the layout but which has been found practical in successful Motor Mechanics and Aero Mechanics shops include: Wind tunnel for aerodynamic tests; permanent stands; permanent water, gas and exhaust lines; brake testing and drum truing equipment; chain hoists, etc. This equipment adds to the utility of the shop but a good fundamental training can be given without it.

Motor Mechanics Shop Equipment

Minimum Equipment Cost, Approximately $1500

Name	Quan.
—9"x4' Quick Change Gear Motor Driven Back-Geared, Screw Cutting Lathe	1
—Motor Stands	2
—Rear Axle Stands	2
—Front Axle Stands	2
—Vises, Machinist	6
—Battery Testing Equipment	1
—Heavy Duty Jack	1
—Arbor Press	1
—Drill Press	1
—Bench Emery Grinder	1
—Small equipment consisting of wrenches, screw drivers, micrometers, hack saws, scales, torch, taps, dies, reamers, pliers, chisels, hammers, punches, hydrometers, oilers, grease guns, lathe tools, lathe dogs, etc.	

Standard Equipment Cost, Approximately $3500

No.	Name	Quan.
2.	Machinist Vises	9
4, 5.	Motor Stands	2
6, 7.	Axle Stands, Front and Rear	6
8.	Heavy Duty Roller Crane	1
10.	9"x4' Quick Change Gear Lathe	1
11.	16"x8' Quick Change Gear Lathe	1
12.	Arbor Press	1
13.	8" Emery Bench Grinder	1
14.	Drill Press	1
15, 16.	Battery Testing Equipment	1
17.	Air Compressor	1
19.	Electric Test Bench	1
	Electric Drill	1
	Battery Charger	1
	Small tool equipment same as listed in the equipment at left.	

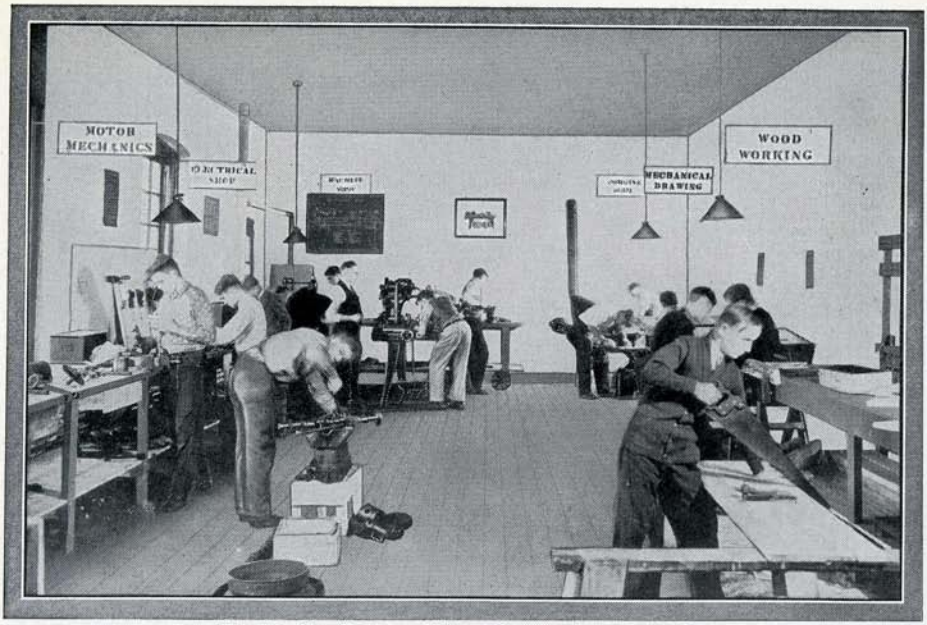


Fig. 12. Small General Shop Showing Boys at Work.

The Small General Shop

The Small General Shop is one of the most important departments of the Junior High School in the large city and of the small town or township High School in a rural community. The demand on the part of the students and parents has shown this to be the most popular department and the one that proved the most beneficial to the student after leaving school.

In the Extensive School System of large cities, the small general shop is used for "exploratory" or "tryout" work with the purpose in mind of letting the student specialize later on in a chosen trade or vocation.

In the Rural School or small town high school which has no other shop activities, the student is taught the fundamentals of several practical subjects in the Small General Shop. This permits him to use tools and equipment just the same as if he were in a trade school.

Several Practical Subjects are taught in the Small General Shop. These subjects offer the greatest opportunities to the greatest number of students, although the needs of any single community may best be served by substituting other subjects if desired. Some communities may prefer to add alloy or brass foundry work, sheet metal, Carpentry, Concrete work, etc. The shop shown here represents the average community in the United States.

Schools Already Equipped with a manual training or woodworking department may build up the Small General Shop by adding the various units to that department. If there is no available room in the present school building, it is advisable to erect a separate shop building. Some schools have built their own shops at a very small cost as a project in carpentry.

Type of Work Done in the Small General Shop

Machine Shop: Make screw driver, punches, nail sets, make bolt and nut.
Electrical Work: Make splices, hook up door bells, buzzers, repair auto generator.
Auto Mechanics: Reface valves, hand repairing on chassis, adjust tappets, etc.
Wood Work: Home carpentry jobs, make small wood projects.
Mechanical Drawing: Draw projects made in other departments of shop.
Forging: Make cold chisel, punches, harden and temper commonly used tools.

Actual Operations are Performed by the student on the equipment in the shop by making projects, or by doing exercise work. This teaches him manipulative skill, use of tools and how to do things. For example, in Machine Work the student may make, as a project, a small screw driver or punch. In connection with this practical work he studies on related subjects so as to get a rounded-out idea of each subject and each operation.

Related to the Actual Shop Work involved, the boy learns the properties and the uses of various metals; how to cut them; how to shape them; how they will react under various conditions of heat, cold, stress and strain; the chemical properties of metals; why various metals have various uses and so forth, as far as his natural ability and time available for shop work will permit. This same plan is carried out in the other units in the General Shop.

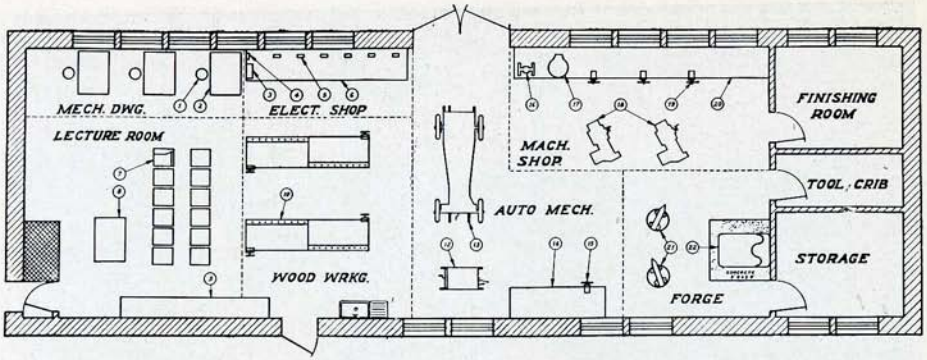


Fig. 13. Practical Layout for a Small General Shop.

Organizing the Small General Shop

The Illustration Above shows a practical floor plan arrangement for a Small General Shop that will accommodate 15 to 25 boys at one time, in the six different activities or subjects discussed on the preceding page.

Size of the Room should be at least 30 x 60 or 30 x 70 feet—around 2000 square feet of floor space, preferably rectangular in shape for most efficient arrangement. Most schools will find that after the shop has been in use for two or three semesters, they will want to increase the scope of the work and take in more students. Therefore, the room should be sufficiently large.

One Instructor can take care of 15 to 25 boys in the General Shop. One-sixth of the class will devote one-sixth of the school year to each department of the shop. Advanced students can spend all their time on the activity elected at the beginning of each year. The demand from the students will determine if one or more units in the shop should be expanded.

The Cost of the Equipment for Small General Shop will vary from $750.00 upwards depending on the requirements of the individual school. The shop shown at the top of the preceding page has equipment that cost $877.50. This equipment is listed in the tabulation below under No. 1 G. S. The fully equipped shop, shown on the floor plan layout above, cost approximately $1650.00. The list of machines and equipment is shown under No. 2 G. S. in the tabulation below.

The Principal Machine Equipment of the General Shop consists of a Back-Geared, Screw Cutting Lathe, a bench drill press, bench grinder and forge. These machines, as well as a number of small tools and other general equipment are used in common by all units of the General Shop as the occasion requires. The average life of this equipment is 25 years.

Benches, Mechanical Drawing Tables, and other wood cabinets and accessories can be made in the shop after it is organized. These items make excellent projects in the wood working subject. Considerable savings can be effected in this manner as well as giving useful instruction to the students. Blue prints giving working details of suitable benches and mechanical drawing tables will be supplied at nominal cost to any school interested. See list of blue prints on page 26.

General Shop Equipments

No. 1 G. S. Total Cost $877.50

1—9″ x 3′ Back-Geared, Screw Cutting Motor Driven Lathe	$300.00
1—10″ Bench Drill Press	47.00
1—8″ Bench Emery Grinder	35.00
1—Hand Power Forge	37.50
1—Set of Tools for Electric Shop	58.00
1—Tools for Machine Work	100.00
1—Tools for Auto Mechanics	50.00
1—Tools for Electrical Work	60.00
1—Equipment for Mech. Drawing	50.00
1—Tools for Wood Working	100.00
1—Tools for Forging	40.00
Total Cost of Shop Equipment	$877.50

No. 2 G. S. Total Cost $1637.00

2—9″ x 3′ Back-Geared, Screw Cutting Motor Driven Lathes (18)	$ 600.00
1—10″ Bench Drill Press (17)	47.00
1—8″ Bench Emery Grinder (16)	35.00
1—Hand Power Forge (22)	45.00
4—Wood Working Benches (10)	200.00
1—Tools for Entire Shop	75.00
1—Tools for Machine Shop	175.00
1—Tools for Auto Mechanics	85.00
1—Tools for Electrical Work	120.00
1—Equipment for Mech. Drawing	75.00
1—Tools for Wood Working	125.00
1—Tools for Forging	55.00
Total Cost of Shop Equipment	$1637.00

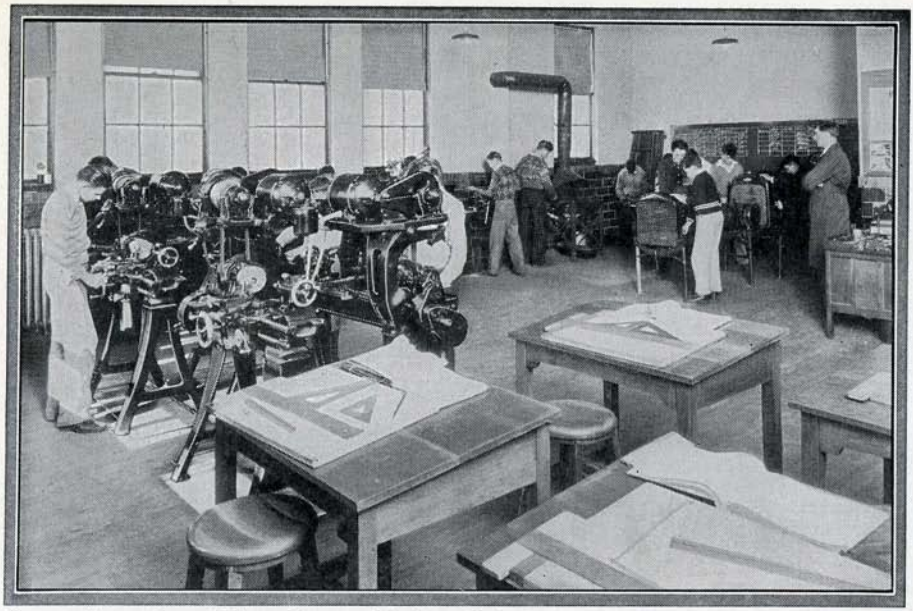


Fig. 14. Large General Shop Showing Machine Work, Drafting, Forging and Auto Mechanics

The Large General Shop

The Large General Shop is similar to the Small General Shop except it is larger. Many Junior High Schools and Senior High Schools in cities and large towns give the first year of fundamental shop work in the Large General Shop, passing the student on to the complete shops for specializing. For example, preliminary training in machine shop work is given in the General Shop, after which the student enters the High School Machine Shop. Also preliminary training is given in the General Shop on Electricity after which the student enters High School or Vocational Electric Shop.

Two Instructors or more are often required in the Large General Shop. This is true when eight or ten different subjects are provided for in the same shop. One man finds it difficult to handle so large a class and seldom is any one instructor capable of teaching more than four or five subjects in the General Shop.

In Many Schools the practice has been to make the General Shops much larger than those shown here and eliminate the separate shops in the Junior High and Senior High grades. The equipment placed in the shop is thus very extensive and the shop is arranged to take care of large classes of 50 to 60 boys at one time. For example, the machine shop units in the intermediate schools of one of the large cities in the Middle West have from 12 to 18 lathes. Other shop equipment is relatively extensive.

The Student gets much value from his training in the General Shop. If he expects to become a tradesman he has laid the foundation for his work later on. If he intends going to college for an engineering course he has practical information of great value in his college studies. Nearly every profession, trade or vocation requires some practical training.

Type of Work Done in the Large General Shop

Machine Work: Plain turning, taper turning, thread cutting, making small projects.
Electrical Work: Bell and buzzer circuits, splices, drycell connections, 6-8 volt work.
Wood Working: Small wood projects, simple turning jobs, use of hand tools.
Mechanical Drawing: Making plans for other projects made in shop.
Auto Mechanics: Taking down and reassembling automobile engines.
Forging: Making simple chisels, punches, hardened tools, heating various metals.
Sheet Metal: Making scoops, cookie cutters, funnels, spouts and similar projects.

The Extent to which the subjects outlined above are used will be determined by the community itself. A city surrounded by agricultural interests would have greater demand for Automotive, Electrical and Machine Shop, because the Automotive, Electrical and Machine Shop lines offer the only openings for technical jobs in the agricultural sections of the country.

In Some Communities it may be desirable to institute an entirely different subject if the community itself is the center of a large industry of unusual character. For example, in a textile center, attention would be given to textile and related subjects. Chemical, mining or other similar trade centers would lay stress on trades relating to their industry.

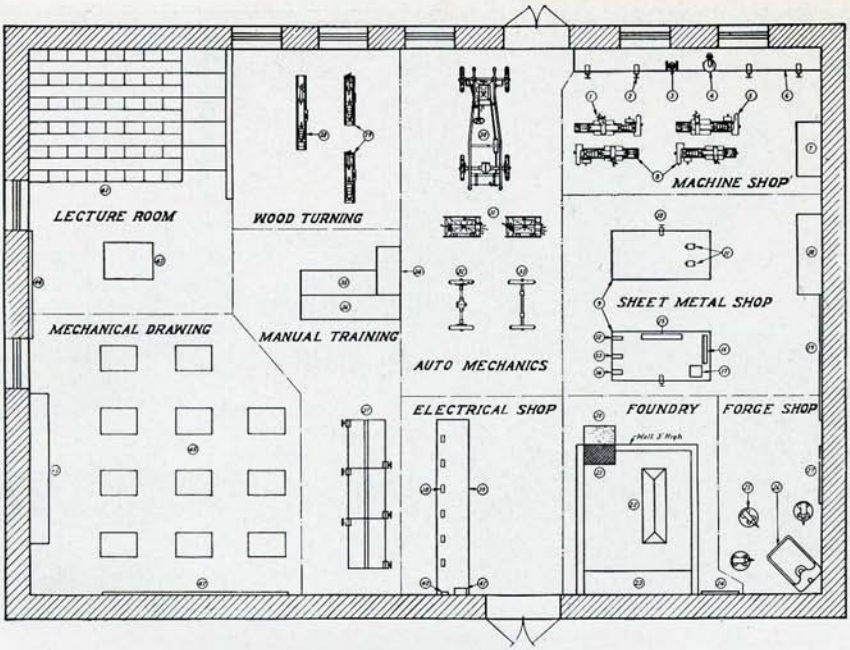


Fig. 15. Popular Layout for the Large General Shop.

Organizing the Large General Shop

The Illustration above shows a practical floor plan arrangement for a General Shop that will accommodate 40 to 45 boys at one time in nine different activities. No partitions are erected, nor is each unit separated from the rest, except by the arrangement of equipment.

The Size of the Room shown here is a practical size for a Large General Shop and is 63'x-40' or 2520 square feet of floor space which is divided as shown at right.

The Cost of the Equipment for the shop shown at the top of the page is approximately $4000.00 including the various hand tools and accessories required. The equipment items are listed below in detail and itemized quotations covering the entire shop equipment will be furnished on request.

Department	Size	Capacity
Machine Shop	258 sq. ft.	6 boys
Electrical Work	205 sq. ft.	5 "
Auto Mechanics	357 sq. ft.	5 "
Wood Working	152 sq. ft.	6 "
Wood Turning	189 sq. ft.	3 "
Forging	135 sq. ft.	3 "
Foundry	200 sq. ft.	4 "
Sheet Metal	328 sq. ft.	4 "
Mechanical Drawing	456 sq. ft.	11 "

This Arrangement has worked out very successfully in actual use. It is practical, efficient and inexpensive. Relatively a small amount of space is required and a large number of students can be taken care of at one time by one or two instructors.

Large General Shop Equipment Recommendations

No.	Name	Quan.
1.	11"x4' Motor Driven Back-Geared, Screw Cutting Lathe	1
3.	8" Emery Grinder	1
4.	16" Sensitive Bench Drill	1
5.	9" x 3' Motor Driven Back-Geared, Screw Cutting Lathe	1
8.	11" x 5' Motor Driven Back-Geared, Screw Cutting Lathes	2
11.	Gas Furnaces	2
12.	Wiring Tool	1
13.	Turning Tool	1
14.	Burring Tool	1
15.	Folder	1
16.	Bender	1
17.	Blowhorne Stake	1
23.	Moulders Bench	1
28.	12"x6' Wood Turning Lathe	1
29.	10"x4' Wood Turning Lathe	2
30.	Chassis	1
31.	Motor Stands	2
32.	Rear Axle Stand	1
33.	Front Axle Stand	1
37.	Wood Working Benches	6
38.	6-8 volt Outlets	6
39.	Wiring Bench	1
40.	110-volt Outlet	1
41.	6-8 volt Transformer	1
45.	Drafting Tables	11

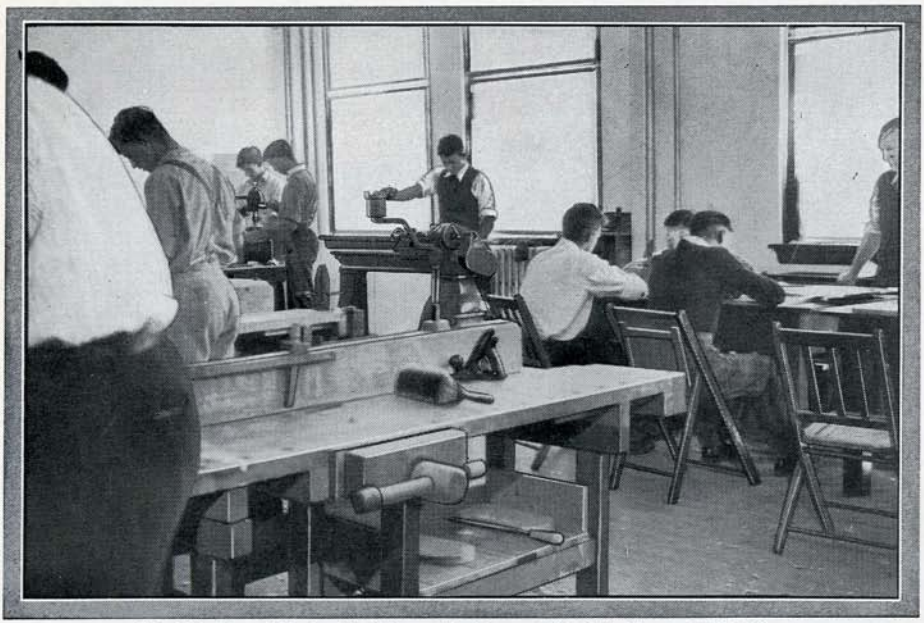


Fig. 16 Farm Mechanics Shop with Boys at Work in Several Activities

The Farm Mechanics Shop

Farm Mechanics offers the greatest opportunity to the Rural School student to learn something about the construction, operation, service and repair of the automobile, truck, tractor, farm implements and other devices used in every home and farm. Several hundred of these shops are now in operation and have proved very valuable in training the boy along useful lines so that he may improve his living conditions after leaving school.

The Object of the Farm Mechanics Shop is to give the boy a fundamental knowledge of the mechanical equipment he uses in everyday life. The farm of today uses a great variety of mechanical devices such as electric motors, cream separators, milking machines, pumping equipment, power saws, tractors, combines, harvesters and other standard farm implements, all of which must be kept in good condition and repair. The Farm Mechanics shop in the school is the logical place to acquaint the rural school students with this necessary knowledge.

Several Practical Subjects are taught in the Farm Mechanics Shop much the same as in the Small General Shop. Each subject is covered from the farm angle, for example, in wood work, the jobs done are those especially applicable to the farm; Mechanical Drawing jobs should apply especially to Farm equipment; Electrical jobs should apply especially to House wiring jobs, ignition on a tractor, farm light plant wiring, etc.

The Advantage to the community of having a Farm Mechanics shop in the school are unlimited. The boy is kept at home after leaving school because he has learned something useful. His shop work has better equipped him to earn a living and he becomes satisfied to remain in the community and do work that he is familiar with. Where the Farm Shop has been introduced, it has become the most popular department of the school.

Scope of the Farm Mechanics Shop

Subjects Given

Mechanical Drawing
Motor Mechanics
Electricity and House Wiring
Forging and Blacksmithing
Machine Shop
Woodwork and Carpentry
Farm Machinery Repair

Jobs Done

Repairing Tractors and Implements, Servicing light plants, stationary engines, making repair parts, fitting pistons, truing commutators, Farm carpentry jobs, Forging Implement parts, Heat treating tools, cutting screw threads, making bolts etc.

The Time Given to Farm Mechanics can be as long as the facilities of the shop permit. Two years can profitably be spent by the High School student in getting fundamentals of all shop practice. Three would be better. It will be found that shop expansion is necessary after the first year or two of operation.

Farm Equipment used by the farmers in the community offers the best material for the shop to work on. Farm Tractors, Combines and implements can be brought to the school and repaired. These projects will be found very valuable and give evidence of the worth of the Farm Mechanics Shop.

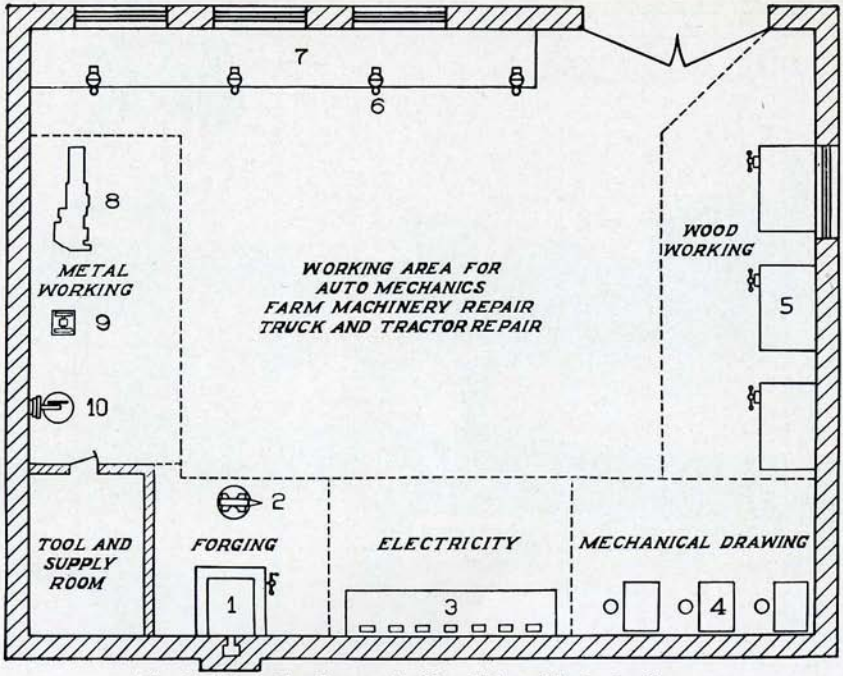


Fig. 17. Floor Plan Layout for School Farm Mechanics Shop.

Organizing the School Farm Mechanics Shop

Laying Out the Shop. The illustration above shows a practical layout of a Farm Mechanics Shop serving a community of 2000 to 3000 population. The shop will accommodate a class of 15 to 25 boys at one time and give them all training in each subject.

Size of the Room should be 50′ square or more, depending on the amount of farm machinery and vehicles that will be brought into the shop. A large area in the center of the room is very necessary. Double doors for vehicles are also essential.

Separate Building for Farm Shop. Several schools have found it desirable to erect a separate building especially for Farm Mechanics. The building can be of frame construction, with concrete floor and be built at very reasonable cost. Part of the work can be done by the students and become a part of their practical shop work for that year.

Plan of Work. It is customary to give each student an opportunity to learn something in each unit of the Farm Shop. For example, while boys of one group are working on machine work, others are doing electrical work, another group wood work. See Small General Shop described on pages 12 and 13.

Cost of Equipment for the Farm Mechanics Shop is listed below. These amounts are approximate only. For accurate quotations write to us and we will supply detailed prices on the machines and tool assortments.

Farm Mechanics Shop Equipment Recommendations

No. 1 F. S. Approximately $950

1—9″ x 4′ Back-Geared, Screw Cutting Motor Driven Lathe	$300.00
1—10″ Bench Drill Press	47.00
1—8″ Bench Emery Grinder	35.00
1—Hand Power Forge	37.50
1—Tools for Entire Shop	58.00
1—Tools for Farm Machinery Repair	60.00
1—Tools for Machine Work	100.00
1—Tools for Auto Mechanics	50.00
1—Tools for Electrical Work	60.00
1—Equipment for Mec. Drawing	50.00
1—Tools for Woodworking	100.00
1—Tools for Forging	40.00
Total Cost of Shop Equipment	$937.50

No. 2 F. S. Approximately $2500*

1—9″ x 4′ Back-Geared, Screw Cutting Motor Driven Lathe.
1—16″ x 8′ Back-Geared, Screw Cutting Motor Driven Lathe.
1—16″ Bench Sensitive Drill, Motor Drive.
1—10″ Bench Motor Drive Emery Grinder.
1—Hand Power Blacksmith Forge.
3—Wood Working or Manual Training Benches.
1—Hand Tool Equipment for Entire Shop.
1—Each Tool Equipments for Machine Work, Farm Machinery Repair, Auto Mechanics, Electrical Work, Mechanical Drawing, Wood Working, Forging.

***Itemized prices on this shop equipment will be supplied on request, no charge.**

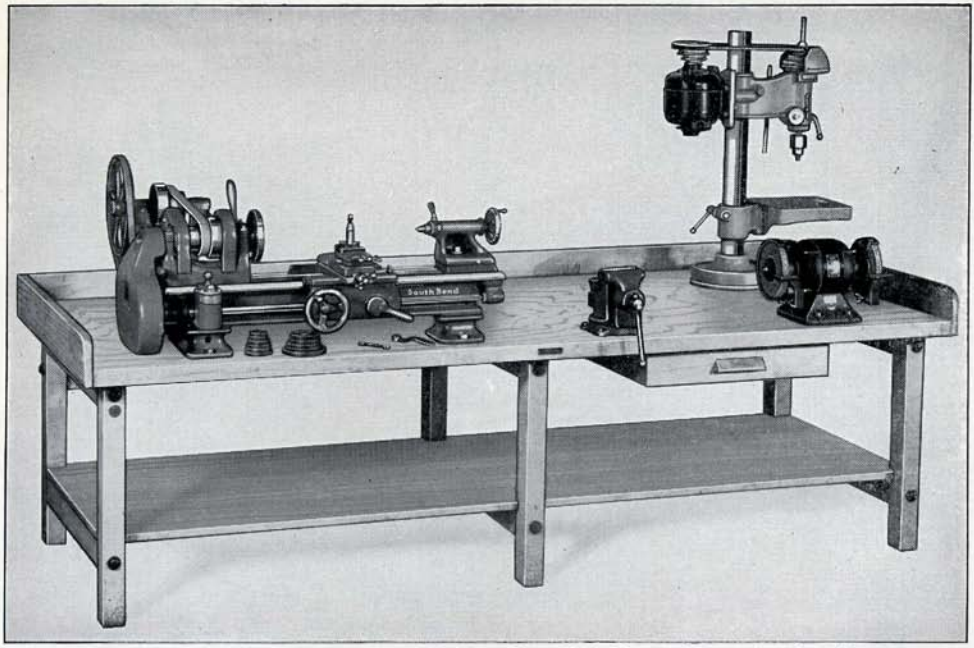


Fig. 18. A Complete Motor Driven Machine Shop Unit Mounted on a Bench 40"x96"

Bench Machine Shop Equipment

For the Small General Shop

A Complete Bench Machine Shop Unit, consisting of a 9" x 3' South Bend "Workshop" Horizontal Motor Driven Bench Lathe, bench drill press, bench emery grinder, and a 4-inch swivel vise is shown in the illustration above. This equipment is all mounted on a frame bench 40 inches wide and 96 inches long. A cabinet type bench could be used if preferred to provide storage space for supplies, hand tools, etc. Locker space could also be provided for each individual boy, if desired.

For the Small General Shop, the bench machine shop unit is very practical, as it represents the minimum investment and is very economical of floor space. This unit is also practical for use in the electrical shop, the auto mechanic's shop, etc.

A Great Variety of Work can be done with the equipment included in this unit. The lathe can be used for machining steel, cast iron, brass, bronze, aluminum, copper and all kinds of metals. It can also be used for turning wood, fibre, bakelite, catalin, cast resin plastics, etc. Many practical attachments such as milling attachment, wood turning hand rest, grinding attachment, etc. can be used with the lathe for special classes of work.

The Drill Press and Grinder are of course necessary in any shop. These tools are used for so many different kinds of jobs that it is impossible to list them here. The vise is also quite necessary, and if desired, two more vises may be added by placing the bench in the center of the floor so that all four sides may be used.

The Approximate Cost of the bench and the equipment shown in the illustration above is listed below. We shall be glad to submit itemized quotations to any instructor or official who is interested.

COST OF BENCH MACHINE SHOP UNIT

1—9"x3' South Bend "Workshop" Bench Lathe with Adjustable Horizontal Motor Drive	$116.00
1—10" Bench Drill Press	41.00
1—8" Bench Emery Grinder	20.00
1—4" Machinist's Vise	6.00
1—40" x 96" Frame Bench	75.00
Total	$258.00

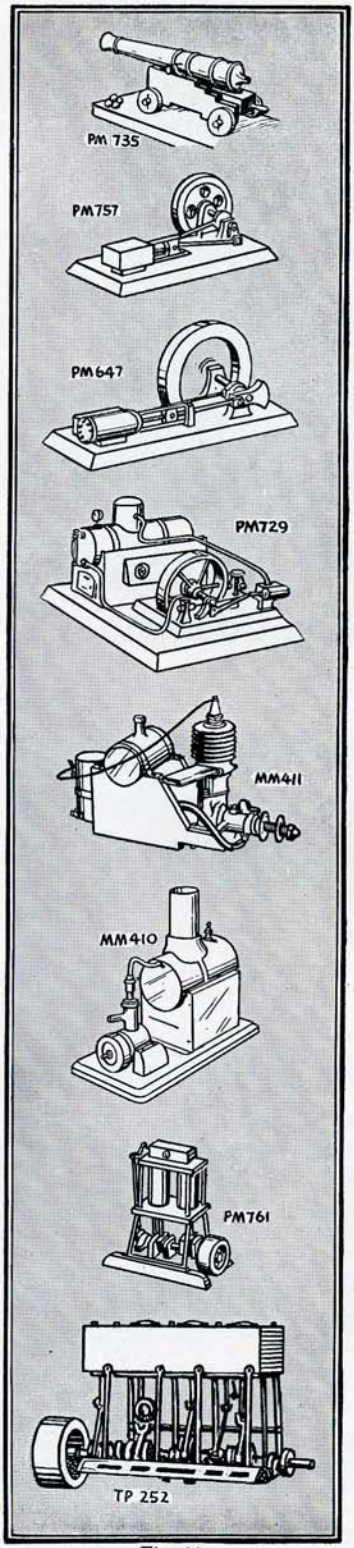


Fig. 19

General Shop Projects

For The Beginner

Listed below are a number of excellent working models which make ideal projects for the general shop. The construction of these models will provide experience in bench woodwork, machine shop practice, pattern making, moulding, sheet metal work, soldering, etc. Castings and supplies are available for some of the models, while others may be constructed entirely of lead castings, brass and steel stock.

Model Colonial Cannon No. PM735

This is a perfect 10" miniature of an American naval gun used about 1776. The barrel is made of turned brass and the mounting constructed of wood. The design of the barrel is very attractive, and if well finished this model will make a beautiful mantelpiece.

No. PM735. One Blueprint Model Colonial Cannon.....**$0.25**

Simplified Steam Engine Model No. PM757

This one-cylinder horizontal type steam engine is an excellent model for the beginner. It has a 4" flywheel which may be cast from die metal, lead, babbitt or type metal.

No. PM757. Set of two Blueprints of Simplified Steam Engine **$0.50**

Model Horizontal Steam Engine No. PM647

This engine has a 1" bore and 1¼" stroke. The flywheel is 6" in diameter. This is a good project for the amateur machinist. No castings are required.

No. PM647. One Blueprint Horizontal Steam Engine..**$0.25**

Horizontal Steam Engine and Boiler No. PM729

This model horizontal steam engine and boiler develops 1/30th H.P. at 15 lbs. pressure. The flywheel is 5¾" in diameter and the cylinder has ⅜" bore and ⅞" stroke.

No. PM729. Set of six Blueprints of Horizontal Steam Engine and Boiler **$1.00**

Miniature Air-Cooled Gasoline Engine No. MM411

This is a two-cycle gasoline engine suitable for operating a 4 ft. airplane or small motor boat. Cylinder bore, $\frac{13}{32}$ inch; stroke, ¼ inch; weight complete 12 oz.

No. MM411. One Blueprint of a Miniature Air-cooled Gasoline Engine. Price **$1.00**

Single Cylinder Model Steam Engine No. MM410

This engine is suitable for operating model boats. Has ½ inch bore, ¾ inch stroke; has a tubular type boiler; no castings are required.

No. MM410. One Blueprint of Single Cylinder Model Steam Engine. Price **$1.50**

Twin Cylinder Marine Engine No. PM761

This model is of an upright steam operated marine engine with two cylinders. The flywheel is 1¼" in diameter, and the cylinders have 17/32" bore. No castings are required. This is an excellent engine for operating a 30" model boat.

No. PM761. One Blueprint Twin Cylinder Marine Engine **$0.25**

Vertical Marine Engine Models

No. TP250. Single cylinder Marine Engine, ⅜" bore, ⅜" stroke. Castings, blueprint and sundries **$4.50**

No. TP251. Twin cylinder single expansion Marine Engine, 1" bore, ⅞" stroke. Castings and blueprint **$9.00**

No. TP252. Triple expansion Marine Engine, ¾", 1¼" and 1¾" bore by 1" stroke. Castings and blueprint **$27.00**

South Bend Machine Shop Course

Consisting of Job Sheets and Drawings for 56 Projects

The South Bend Machine Shop Course was developed several years ago as a course of apprentice training for teaching the fundamentals of modern machine shop practice. The course, which is outlined on pages 20 to 23 of this bulletin, is based on production methods used in the building of modern machinery in industry. The instruction material, consisting of drawings and job sheets, is outlined and so arranged that the apprentice or student will become familiar with the best methods employed in modern industrial plants.

Over 5,000 Schools are using the South Bend Machine Shop Course. Nearly as many industrial plants and railroad shops are using it for teaching apprentices. Thirty-one years' experience in machine shop practice and industrial manufacturing have gone into the development of the course. It represents an investment of more than $25,000.00 and includes carefully selected contributions of leading engineers, educators, and manufacturers.

Elementary Training in Machine Shop Practice is essential, because so many mechanical devices are now a part of our daily life. The ever increasing use of machinery in all branches of industry and in rural districts makes machine shop training one of the most important in the modern school.

School Machine Shops, in the Vocational and Trade Schools, Senior and Junior High Schools, Teacher Training Schools and Engineering Colleges find this course practical and valuable. General Shops, Auto Mechanics Shops, and Farm Mechanics Shops use the projects in the Machine Shop work. Projects are selected that are suitable in each individual shop. Some shops use nearly all 56 projects.

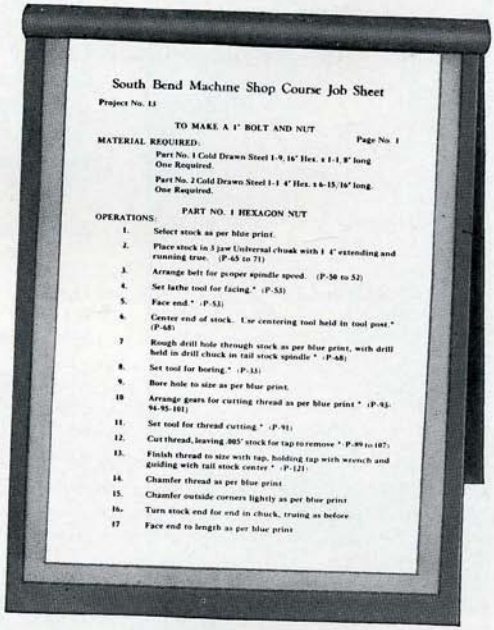
Job Sheets for Machine Shop Course

Explain the Work Step by Step

Job Instruction Sheets, size 8½" x 14", are furnished for each project giving specific instructions covering the proper procedure for doing the work. The job sheets have been worked out with the thought of acquainting the boys with the best methods employed in actual shop practice in industrial plants. One or more job sheets, depending on the number required, are furnished and give complete working details for each project.

A Job Instruction Sheet for Project No. 13, 1-inch Bolt and Nut, is shown at right. The entire set consists of four pages which explain the work, step by step, from start to finish. The project is handled in two parts. The first and second pages show the material required for producing both parts. The necessary operations for completing Part I, the Nut, follow in proper sequence. The operations for completing Part II, the Bolt, appear on pages 3 and 4 of the Manual.

56 Practical Projects, covering the fundamental operations in machine shop practice, make up the South Bend Machine Shop Course. These projects are illustrated and priced on pages 22 and 23. They cover a wide range of machine work beginning with simple elementary jobs and gradually advancing so that the more advanced projects require skill equal to that of the expert mechanic.



South Bend Machine Shop Course Job Sheet

Project No. 13

TO MAKE A 1" BOLT AND NUT

MATERIAL REQUIRED. Page No. 1

Part No. 1 Cold Drawn Steel 1-9, 16" Hex. x 1-1, 8" long
One Required.

Part No. 2 Cold Drawn Steel 1-1 4" Hex. x 6-15, 16" long.
One Required.

PART NO. 1 HEXAGON NUT

OPERATIONS:

1. Select stock as per blue print.
2. Place stock in 3 jaw Universal chuck with 1 4" extending and running true. (P-65 to 71)
3. Arrange belt for proper spindle speed. (P-50 to 52)
4. Set lathe tool for facing.* (P-53)
5. Face end.* (P-53)
6. Center end of stock. Use centering tool held in tool post.* (P-68)
7. Rough drill hole through stock as per blue print, with drill held in drill chuck in tail stock spindle.* (P-68)
8. Set tool for boring.* (P-13)
9. Bore hole to size as per blue print.
10. Arrange gears for cutting thread as per blue print.* (P-93-94-95-101)
11. Set tool for thread cutting.* (P-91)
12. Cut thread, leaving .005" stock for tap to remove.* (P-89 to 107)
13. Finish thread to size with tap, holding tap with wrench and guiding with tail stock center.* (P-121)
14. Chamfer thread as per blue print
15. Chamfer outside corners lightly as per blue print
16. Turn stock end for end in chuck, truing as before
17. Face end to length as per blue print

Fig. No. 20. Job Sheet for Project No. 13. "1" Bolt and Nut" Actual Size of Job Sheet (8½"x14").

"There is a tremendous waste in the world due to the fact that many of the workers have not found the vocation for which they are adapted and are not trained in the work they are doing."—HARRIS

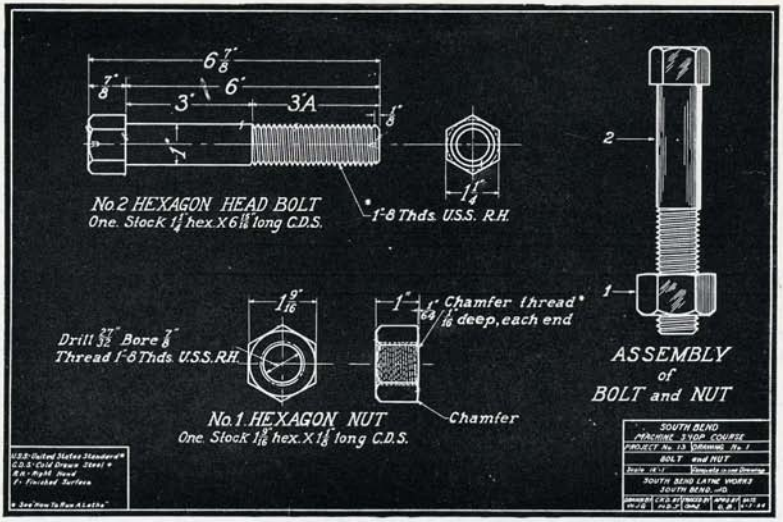


Fig. 21. Drawing (Actual Size 12″ x 18″) for Project No. 13, "1-inch Bolt and Nut"

Drawings for Machine Shop Course

Give Complete Working Details

Drawings, 12″ x 18″, similar to the reproduction above, are furnished as a part of the South Bend Machine Shop Course. They show working details, dimensions of various parts and assembly drawings of the finished project. These drawings are carefully drawn to scale and show each part of the project in detail. Some projects require one drawing, others require three or four, while the largest project in the list, No. 68, 8″ Bench Lathe, comes complete with seventeen drawings. The number of drawings furnished with each project is indicated in the tabulation on page 23, where prices will also be found.

Drawing for Project No. 13, "1-inch Bolt and Nut," illustrated above, presents the work in two parts. Part I, the Hexagon Nut; Part II, the Hexagon Head Bolt. Detailed drawings of each part are shown, also an assembly drawing showing the completed Bolt and Nut. The job sheet for this project is illustrated on page 20.

Standard Size Drawings and Job Sheets as used in industry, are furnished for use in the South Bend Machine Shop Course. The drawings are 12″ x 18″. The job instruction sheets are 8½″ x 14″. The drawings are similar in every respect to the working drawings used in the large manufacturing plants and represent the best methods employed in modern shop practice.

Rough Castings for many of the projects can be supplied at the prices listed on page 23. Some schools prefer to copy the drawings, develop their own patterns and secure castings from a local foundry.

Steel and Hardware Parts. We can supply these parts at the prices listed on page 23. Most schools carry a quantity of steel bars and will find it cheaper to cut their own stock.

Shop Instructors find the drawings and job sheets very practical in explaining operations of all kinds to the class by the lecture method. Each student should have a copy of the project and the instructor can explain step by step the various operations as they should be performed. Direct procedure is then followed in the shop.

Copies of the Drawings and Job Sheets used in the South Bend Machine Shop Course may be made by your Business Department and Mechanical Drawing Department in order to provide copies for shop class use—especially desirable for giving lectures. If you desire one or more projects in quantity, special prices will be quoted upon application.

"How to Run a Lathe" is an authoritative manual covering the fundamental operations of the back-geared, screw cutting lathe, containing 160 pages, 5¼″ x 8″, and more than 300 illustrations. This popular book is used as a text with the South Bend Machine Shop Course. Over one and one-half million copies are in use in the United States and ninety-six other countries. This book is illustrated, described and priced on page 32.

South Bend Machine Shop Course Projects

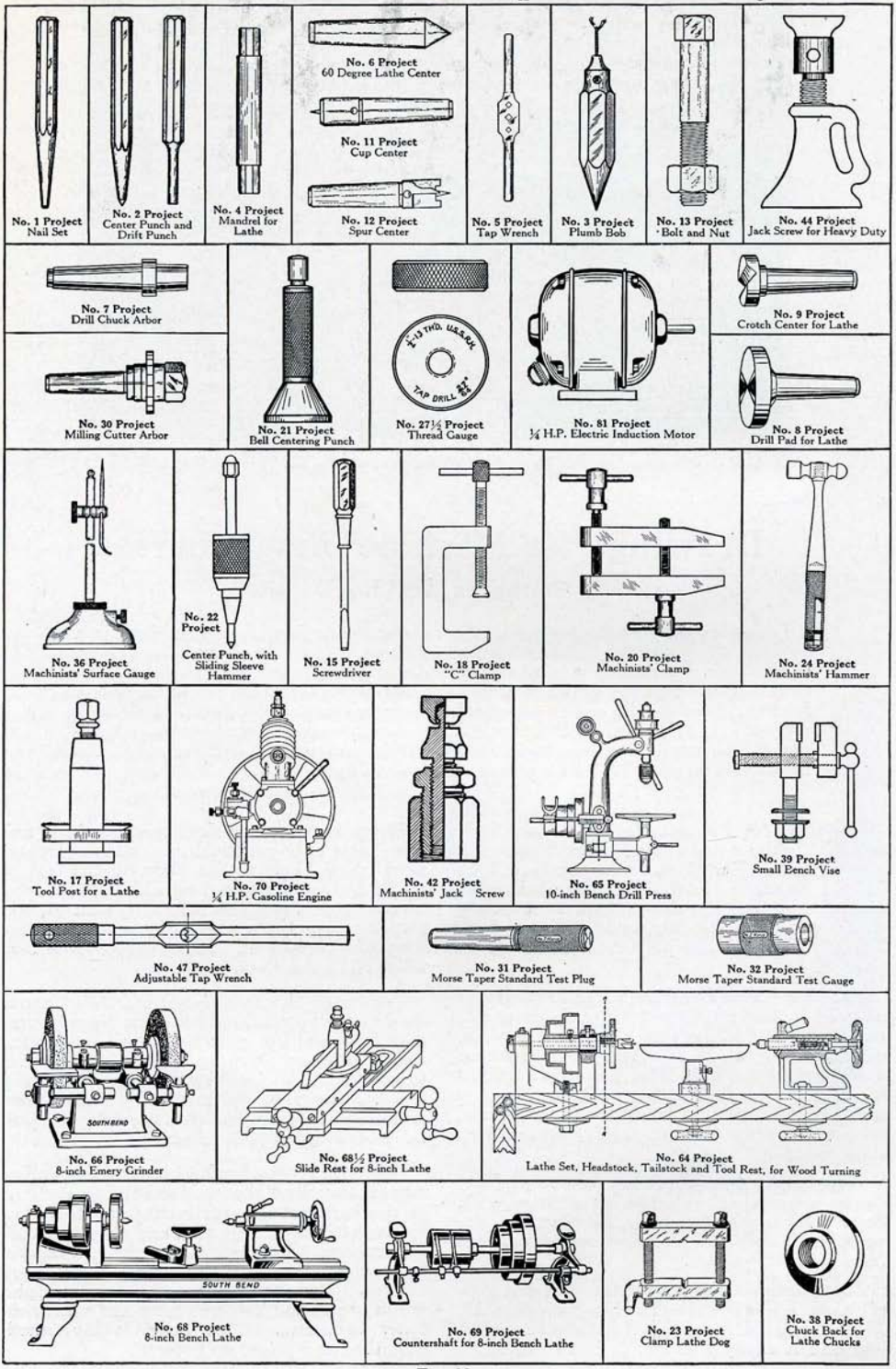


Fig. 22

Prices of South Bend Machine Shop Projects

The tabulation below shows the complete list of South Bend Machine Shop Course Projects. You may order individual projects complete or in part to meet your own shop requirements.

The prices of drawings and job sheets include postage to any point in the world. Prices for rough castings, steel and hardware are f.o.b. South Bend, Ind.

56 Practical Machine Shop Projects for the Student and Apprentice

Project Number	Name of Project	No. of Drawings	No. of Job Sheets	Approx. Weight of Finished Projects	PRICES		
					Drawings and Job Sheets Postpaid	Rough Castings F. O. B. South Bend	Steel and Hardware F. O. B. South Bend
1	Nail Set	1	2	¼ lb.	$0.20		$0.05
2	Center Punch and Drift Punch	1	2	½ lb.	.20		.10
3	Plumb Bob	1	2	1 lb.	.20		.10
4	Steel Mandrel, or Arbor, for Lathe	1	3	2 lbs.	.25		.30
5	Tap Wrench, for ⅜-in., 7/16-in. and ½-in. Taps	1	2	2 lbs.	.20		.25
6	60° Lathe Centers, Head and Tail	1	2	2½ lbs.	.20		.75
7	Drill Chuck Arbor	1	2	2 lbs.	.20		.25
8	Drill Pad for Lathe	1	2	3 lbs.	.20	$0.40	
9	Crotch Center for Lathes	1	2	2½ lbs.	.20	.35	
10	Blacksmith's Drill Chuck	1	3	2½ lbs.	.25	.40	
11	Cup Center, for Wood Turning	1	4	1½ lbs.	.30		.25
12	Spur Center, for Wood Turning	1	3	1½ lbs.	.25		.25
13	1-in. Bolt and Nut	1	4	5 lbs.	.30		.50
14	Pipe Center and Shank	1	5	10 lbs.	.35	1.00	1.10
15	Screwdriver, Steel	1	4	1 lb.	.30		.15
17	Tool Post for a Lathe	1	8	6 lbs.	.50		.75
18	"C" Clamp	1	6	2 lbs.	.40		.30
20	Machinist's Clamp	1	4	1½ lbs.	.30		.30
21	Bell Centering Punch	1	4	2 lbs.	.30	.25	.10
22	Center Punch, with Sliding Sleeve Hammer	1	5	2 lbs.	.35		.30
23	Clamp Lathe Dog	1	5	3 lbs.	.35		.60
24	Machinist Hammer Kit	1	4	7 lbs.	.60		1.20
26	Taper Mandrel with Expansion Sleeve	1	6	20 lbs.	.40		3.00
27	Cast-Iron Pulley	1	2	12 lbs.	.20	1.75	
27½	Thread Gauge	1	‡	½ lb.	.10		.15
29	Boring Bars for the Lathe	1	3	8 lbs.	.25	.50	.75
30	Milling Cutter Arbor for Milling in Lathe	1	5	5 lbs.	.35		.75
31	Morse Taper Standard Test Plug	1	4	2 lbs.	.20		.25
32	Morse Taper Standard Test Gauge	1	4	2 lbs.	.25		.40
36	Machinist's Surface Gauge	1	9	5 lbs.	.55	.40	.40
38	Chuck Back for Lathe Chucks	1	2	10 lbs.	.20	1.50	
39	Small Bench Vise, 2¾-in. Jaws	1	9	18 lbs.	.55		2.00
41	Mercury Plumb Bob	1	3	1 lb.	.25		.15
42	Machinist Jack Screw	1	4	1½ lbs.	.30		.25
44	Jack Screw for Heavy Duty	1	2	21 lbs.	.20	1.75	1.40
46	Cabinetmaker's Vise	1	6	25 lbs.	.40	2.00	1.50
47	Adjustable Tap Wrench	1	4	1½ lbs.	.30		.40
48	Tap Wrench	1	3	2 lbs.	.25		.30
54	Polishing Head for Bench	3	7	30 lbs.	.65	3.00	1.15
55	6-inch Improved Water Motor	3	6	12 lbs.	.60	1.85	.15
58	Arbor Press	3	5	115 lbs.	.55	15.00	1.00
61½	Surface Plate	1	‡	110 lbs.	.10	16.00	
62	Hand Power Emery Grinder	6	10	22 lbs.	1.10	2.10	.75
64	Lathe Set, Headstock, Tailstock, and Tool Rest for Wood Turning	5	10	58 lbs.	1.00	7.00	1.40
64½	Countershaft for Lathe Set	3	3	43 lbs.	.50	5.50	1.00
65	10-inch Bench Drill Press	6	15	88 lbs.	1.35	18.00*	
66	8-inch Emery Grinder	5	4	50 lbs.	.70	6.75	1.00
66½	Floor Column, Pan & Waterpot for 8" Grinder	7	2	80 lbs.	.35	12.00	.15
67	Countershaft for 8-inch Emery Grinder	4	4	45 lbs.	.60	5.50	1.00
68	8-inch Bench Lathe	11	17	120 lbs.	1.95	16.50	3.00
68½	Slide Rest for 8-inch Bench Lathe	4	8	16 lbs.	.80	2.10	.50
69	Countershaft for 8-inch Bench Lathe	3	4	43 lbs.	.50	5.75	1.00
70	¼ H. P. Gasoline Engine, Vertical, Air Cooled	9	15	35 lbs.	1.65	8.00*	
71	¼ H. P. Gasoline Engine, Horizontal	6	‡	20 lbs.	.60	20.00*	
80	Model Airplane Engine ⅛ H. P.	1	‡	1½ lbs.	2.00	8.00*	
81	Electric Motor—¼ H. P.	Complete Information and Prices on Request.					

*Prices include both Castings and Steel Parts. Prices of Engines do not include ignition coils or spark plugs

‡Cannot furnish.

Group Action Reduces Cost of Equipment
For Lane Technical High School

In the development of a project of such magnitude as the new Lane Technical High School, comprising as it does the entire field of technical training, and taking cognizance of the rapid growth of new industrial methods and discoveries, it was realized that one of the greatest problems to be successfully met was the one of equipping this great institution.

Early estimates had placed the cost of this equipment in excess of one million dollars, admittedly a prohibitive sum, even considering that such equipment would administer to the needs and requirements of approximately 7,000 pupils.

Accordingly, the Board of Education decided to invite the co-operation of a group of men known to be leaders in the commercial and industrial life of Chicago, and to seek the benefit of their experience in coping with problems of this nature, and more particularly as it applied to the question of machinery installation.

The following men responded to the invitation, were known as the Advisory Committee, and served as a group assisting the school administration in the selection of the equipment:

J. D. McGann, International Harvester Co.
D. C. Robertson, Illinois Bell Telephone Co.
F. V. Carroll, Inland Steel Company
M. M. McChesney, Acme Steel Company
Victor E. Flodin, Crane Company
George P. Wardley, Illinois Steel Company
Capt. Wm. A. Hayward, U. S. Army Air Corps
Craig R. Spicher, Miehle Printing Press Co.
F. L. Tubbs, Miehle Printing Press Co.
A. D. Dailey, Commonwealth Edison Co.
C. R. Hoyt, American Foundrymen's Ass'n.
T. J. Sullivan, Inland Steel Company
A. P. Cottle, International Harvester Co.
Wm. J. McDonald, Central States Engineering Co.
E. Piehl, Illinois Bell Telephone Co.
R. L. Sonneborn, Illinois Bell Telephone Co.
A. J. Bemis, Day & Zimmerman, Inc.—Engineers
A. C. Zwengal, Kimble Electric Co.—connected with Miehle Printing Press Co.

As a result of their efforts and investigations the cost of equipment was reduced approximately $500,000 below previous estimate. This saving is a tribute to the wisdom of the Board in the adoption of such a policy and to the Members of the Committee, who at great sacrifice freely donated their services.

Reprinted with permission from Official program issued by Board of Education on Dedication day, Sept. 17, 1934.

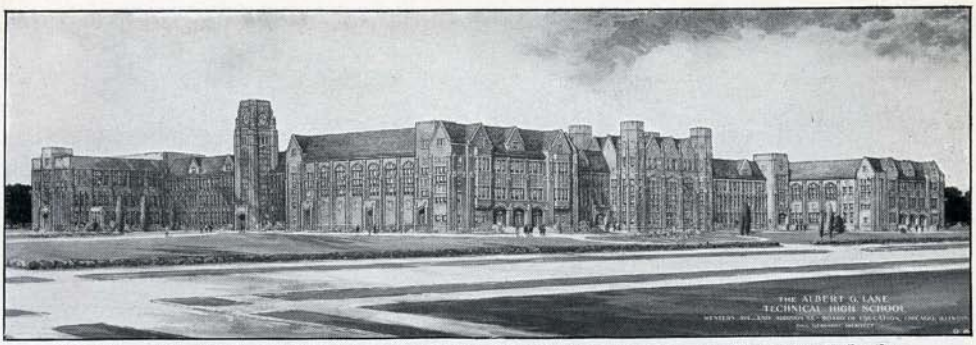


Fig. 23. The Albert G. Lane Technical High School, Chicago, Ill.—92 South Bend Lathes

Lane Technical High School
92 South Bend Lathes

"The equipment of the new Lane Technical High School is on a par with that of any school building in the country. The ideas incorporated in this design were built on a foundation made by years of experience in school plant construction and operation in Chicago and with the thought that it shall never be impossible to use the building for the purposes for which it was erected because of any failure of the mechanical plant."—Excerpt from Dedication Program 8-17-34.

A Few General Features

Floor Area, 700,000 Sq. Ft.; Ground Area, 30 Acres; Materials, Cement, Brick; Stories, 3 and 4; Auditorium, 2,200 Seats; Athletic Field; Class Rooms, 60; Shops, 54; Teachers, 272; Students, 8,865.

Building Cost, $6,000,000; Equipment Cost, $500,000; Two-way Public Address System; Automatic House Telephone System.

A Few Shop Features

Machine Shops	Air Conditioning
Heat Treating	Refrigeration
Aviation	Heating
Electricity	Auto Mechanics
Forge Shops	Foundry (with Cupola)
Woodworking	Metal Pattern-making
Welding Shops	Linotype, Hand Composing

Fig. 24. Shop Room No. 129, Lane Tech. High School—23 South Bend Lathes

Fig. 25. Shop Room No. 232, Lane Tech. High School—23 South Bend Lathes

Fig. 26. Shop Room No. 235, Lane Tech. High School—23 South Bend Lathes

Fig. 27. Shop Room No. 230, Lane Tech. High School—23 South Bend Lathes

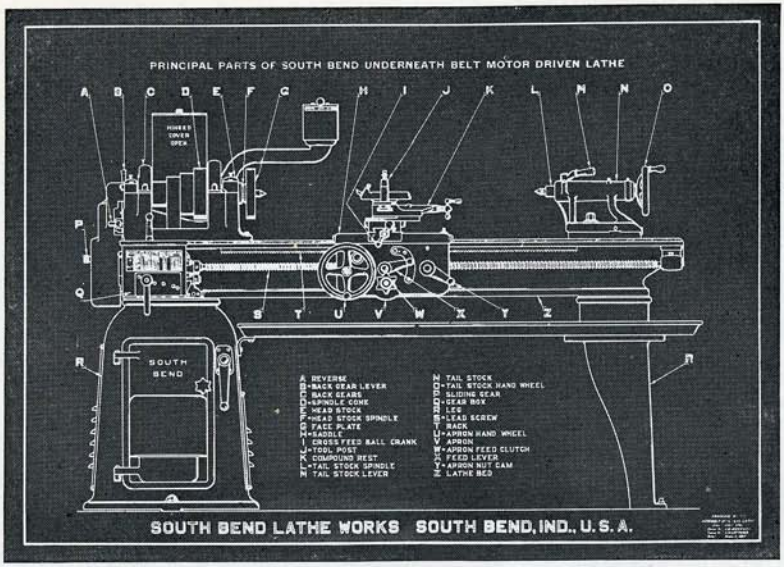


Fig. 28. Blueprint No. 175 "Principal Parts of a Lathe."

Blueprints and Charts for School Shop Use

For instruction purposes in the school shop, we have prepared drawings on practical subjects, and can furnish blueprints. Drawings are intended for mounting on the wall.

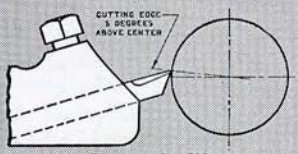
All drawings conform to modern engineering practice. They provide modern practical information that perhaps could not be obtained in any other way.

List of Blueprints and Charts for School Shop Use

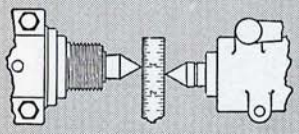
No.	Description	Size, Inches	Price Postpaid
SP-1	Drill Sizes by Letter and Number	8½ x 11	$0.10
SP-2	Tap Drill Sizes, S.A.E. and U.S.S.	8½ x 11	.10
SP-3	Tap Drill Sizes—Machine Screw Taps	8½ x 11	.10
SP-14	Pitch Diameter of Screws	8½ x 11	.10
SP-15	Standard Tolerances for Press Fit	8½ x 11	.10
SP-16	Standard Tolerances for Running Fit	8½ x 11	.10
175	Principal Parts of Underneath Belt Motor Drive Lathe	18 x 22	.10
2500	Assembly Drawing of Underneath Belt Motor Drive Unit	18 x 22	.10
175-A	Principal Parts of a Lathe—Quick Change Gear	28 x 40	.25
175-C	Principal Parts of a Lathe—Quick Change Gear	18 x 22	.15
250	How to Become a Machinist—Chart of Rules	12 x 18	.10
264	Correct and Incorrect Method for Pointing Screw Drivers	8⅝ x 13¼	.10
524	Using Large Drill in Lathe	12 x 18	.10
533	Reaming in the Lathe	12 x 18	.10
540	Knock-out Bar for Lathe Center	12 x 18	.10
551	Measuring with Outside Calipers	12 x 18	.10
558	Shifting Cone Pulley Belt (at top)	12 x 18	.10
559	Shifting Cone Pulley Belt (at bottom)	12 x 18	.10
561	Application of Steady Rest	12 x 18	.10
562	Correct Height of Cutter Bit	12 x 18	.10
568	Setting Inside and Outside Calipers	12 x 18	.10
570	Chuck-Back Thread Cleaner	12 x 18	.10
590	Setting Outside Calipers to Scale	12 x 18	.10
591	Measuring With Inside Calipers	12 x 18	.10
593	Setting Inside Calipers to Scale	12 x 18	.10
596	Incorrect Use of Lathe Dog	12 x 18	.10
597	How to Remove a Face Plate or Chuck	12 x 18	.10
600	Checking Alignment of Lathe Centers	12 x 18	.10
606	Chart Showing How to Lace a Belt	12 x 18	.10
626	How to Measure Tailstock Setover	12 x 18	.10
629	Application of Follower Rest	8½ x 11	.10
636	Center Indicator	12 x 18	.10
638	Correct and Incorrect Setting of Tool Holder	12 x 18	.10
639	Correct Set-up for Cutting Screw Threads	12 x 18	.10
640	Standard Screw Thread Formulae	12 x 18	.10
672	Application of Lathe Tools	11 x 14	.10
677	Morse Taper Dimension Chart	11 x 13	.10
742	Emery Wheels for Different Classes of Work	12 x 18	.10
765	Practical Work Bench—Working Drawing	12 x 18	.10
766	Practical Mechanical Drawing Table—Working Drawing	12 x 18	.10
770	How to Level a Lathe	12 x 18	.10
777	Decimal Equivalent Fractions of an Inch	13 x 19	.10

Blueprints Show Correct Shop Methods

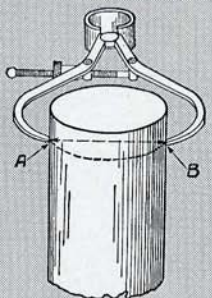
On This Page Are Shown Illustrations of a Few of the Blueprints Listed on Page 26. Instructors Find Them Valuable for Student Training.



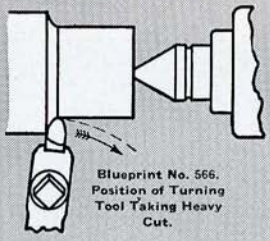
Blueprint No. 562.
Correct Height of Cutter Bit.



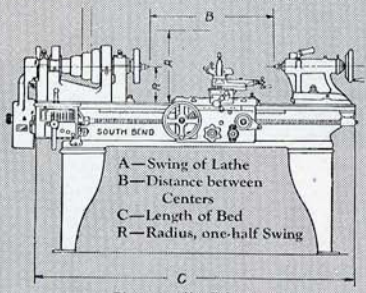
Blueprint No. 626.
How to Measure Tailstock Setover.



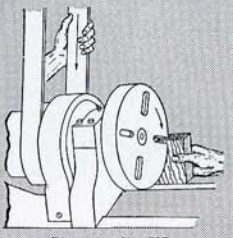
Blueprint No. 551.
Measuring With Outside Calipers



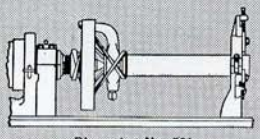
Blueprint No. 566.
Position of Turning Tool Taking Heavy Cut.



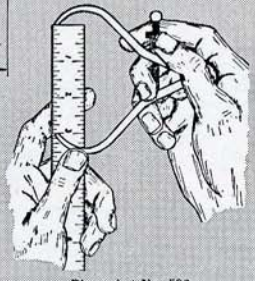
Blueprint No. 703.
How to Determine the Size of a Lathe.



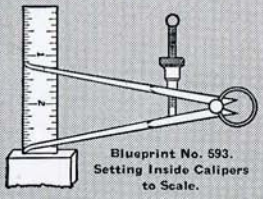
Blueprint No. 597.
How to Remove a Face Plate or Chuck.



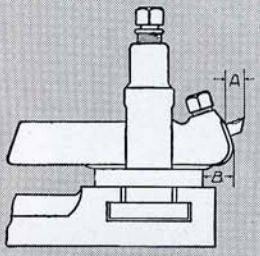
Blueprint No. 561.
Fastening the Work to the Head Spindle.



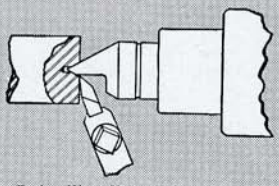
Blueprint No. 590.
Setting Outside Calipers to Scale.



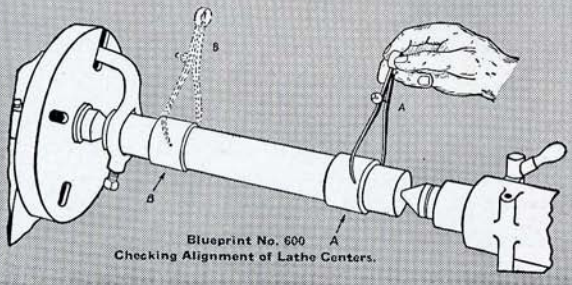
Blueprint No. 593.
Setting Inside Calipers to Scale.



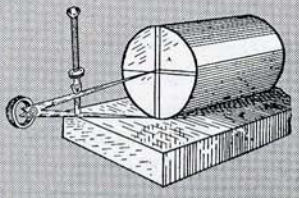
Blueprint No. 638.
Correct Setting of Tool Holder.



Facing Work Using Relieved Center



Blueprint No. 600
Checking Alignment of Lathe Centers.



Blueprint No. 669.
Locating Center With Surface Plate and Dividers.

South Bend Lathe Works

U. S. Government Uses South Bend Lathes

Fig. 42

Over 400 South Bend Lathes in Government Shops

The United States Government has been a steady customer of the South Bend Lathe Works for many years. The illustration at the left shows two South Bend Lathes in the U. S. Airway Radio Laboratory, Chicago, Illinois.

S.K.F. Industries

A 9-inch South Bend Underneath Belt Motor Drive Bench Lathe used by S.K.F. Industries, one of the largest manufacturers of ball and roller bearings in the world.

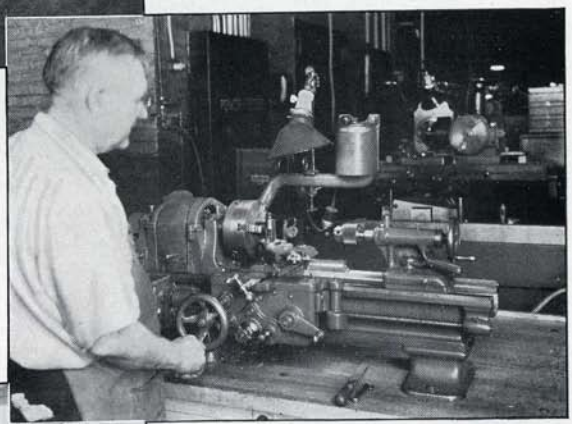


Fig. 43

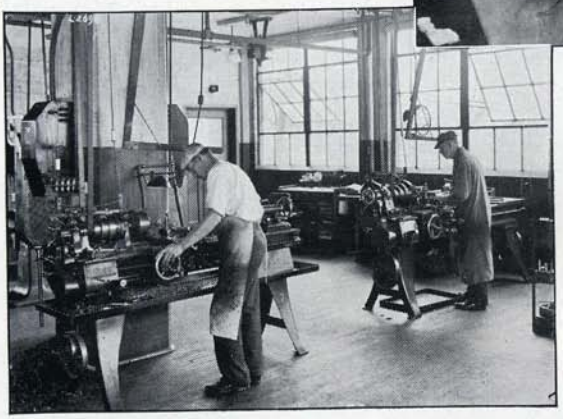


Fig. 44

Allen Bradley Company

Two of nine South Bend Lathes in the shops of the Allen Bradley Company, one of the leading manufacturers of electrical controllers, starters and radio devices.

South Bend Lathes in Industry

For thirty years the South Bend Lathe Works has furnished back-geared, screw cutting precision lathes to manufacturing plants, tool and die shops, etc. Pictures above and on the following page show a few representative installations. More than 80,000 South Bend Lathes are used in the United States and 96 other foreign countries.

Educators, recognizing the need for industrial type equipment for trades, vocational and technical training, have installed more than 5,000 South Bend Lathes in their school shops.

South Bend Lathes Popular in Industry

Bendix Products Corporation

This group of South Bend Lathes is used for manufacturing small parts in the Bendix-Stromberg Carburetor Division of the Bendix Products Corporation at South Bend, Indiana. More than 40 South Bend Lathes are used by this organization.

Fig. 46

Scintilla Magneto Company

Sixteen South Bend Tool Room Lathes ranging in size from 9-inch swing to 18-inch swing are in use in the plant of the Scintilla Magneto Company at Sidney, New York, manufacturers of Scintilla Aircraft Magnetos.

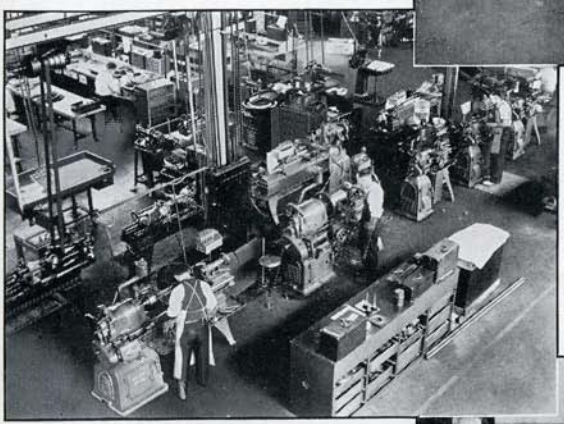


Fig. 47

Western Electric Company

Three of twenty-seven South Bend Lathes in use at Western Electric, Hawthorne Works. The Western Electric Company manufacture the famous Western Electric sound system for sound motion pictures.

Fig. 49

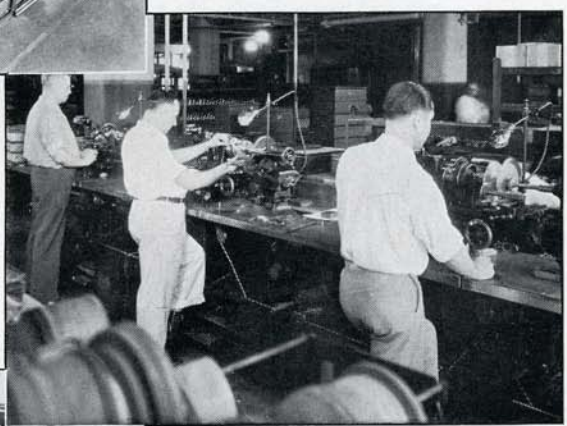


Fig. 48

Westinghouse Electric & Manufacturing Co.

One of a number of South Bend Lathes used at the East Pittsburgh Plants of the Westinghouse Electric and Manufacturing Company, one of the largest industrial organizations in the world.

Suggestions on Selecting Shop Equipment

Sizes and Types of Machine Tools for the School Shop

Selecting Correct Equipment for the school shop is important because of the relatively high cost of machinery and the great variety of sizes, types and drives available. A proper selection of shop equipment will save considerable money and will improve the facilities of the shop.

How to Drive the Shop Machinery

Two Accepted Methods of driving the shop machinery are in general use,—Countershaft Drive and Motor Drive. Over 50% of the machines in use in the industrial plants and machine shops are driven from a lineshaft and countershaft. Countershaft drive is practical and economical because as many as 10 or 20 machines can be driven from one lineshaft.

Individual Motor Drive for each machine in the shop has been growing in popularity, because visibility in the shop is improved. The disadvantages are higher first cost of machines, and increased operating expense. Safety factors need not be considered since metal working machinery does not operate at high speeds.

The Most Widely Used Tool in the school shop as well as the commercial shop and plant is the Back-Geared, Screw Cutting Lathe, therefore the suggestions listed below apply specifically to the lathe. The same general rules apply also to the other machines and tools in the shop.

Value of the Small Lathe

The modern tendency of the school in the purchase of equipment is toward smaller machine units, for example, the 9″ and 11″ back geared screw cutting lathes are taking the place of large machines in many shops.

In one city of over 250,000 using over 300 lathes in the public school machine shops, 60% are 9″ swing, 20% are 11″ swing and the remaining 20% are 13″, 15″ and 16″ swing sizes. Of course, the smaller the unit of equipment, the lower the price, the less space it occupies, and the greater the number of students that can be taken care of. The same plan is being followed in many other cities and has been found practical for educational purposes.

Recommended Sizes of Lathes for School Shops

Listed in the table below are recommendations on the sizes of lathes that have been found best suited to the several school shops outlined in this bulletin.

Type of Shop	Size of Lathe				
	9-in.	11-in.	13-in.	15-in.	16-in.
Farm Mechanics Shop	9″x4′	.....	.....	.....	16″x8′
Small General Shop	9″x3′	11″x4′	.....	.....	16″x8′
Large General Shop	9″x3′	11″x4′	13″x5′	.....	16″x8′
Junior High School Machine Shop	9″x3′	11″x4′	13″x5′	.....	.....
Senior High School Machine Shop	.....	11″x4′	13″x5′	15″x5′	16″x6′
Vocational School Machine Shop	.....	.....	13″x6′	15″x6′	16″x6′
Electrical Shop	9″x3′	11″x4′	.....	.....	.....
Auto and Aero Mechanics Shop	9″x4′	.....	13″x6′	.....	16″x8′

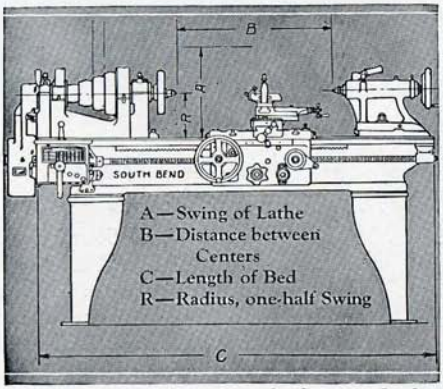


Fig. 50. How to Determine the Size of a Lathe

How to Determine the Size of a Lathe

When selecting the size of lathe for your work, take into consideration the largest diameter and the greatest length of the work to be handled as at "A" and "B" in the illustration at left. Then select the lathe that has a swing-over bed and distance between centers at least 10% greater than the dimensions of the largest work to be handled.

The size of a Screw Cutting Lathe is determined by the swing over bed "A", and the length of bed "C". European tool manufacturers determine the size of a lathe by its radius or center distance "R". What the European terms an 8-inch center lathe, United States manufacturers term a 16-inch swing lathe.

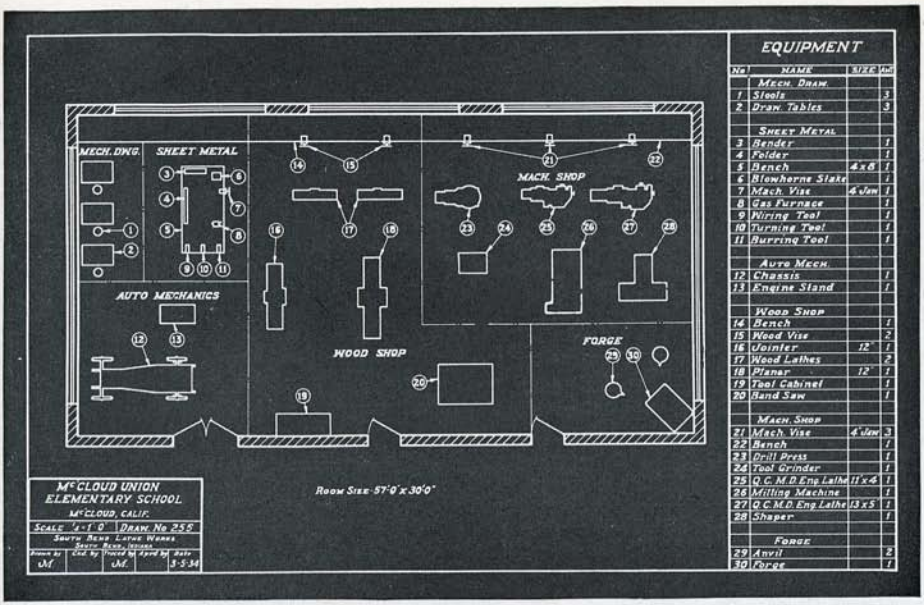


Fig. 51. Floor Plan Layout Made for McCloud Elementary School, McCloud, California

Layouts for School Shops

The Layout above is reproduced from the original tracing which was made for the McCloud Elementary School, McCloud, California. Over 1,000 school layouts have been prepared in a similar manner. These schools are located in the United States, Canada, Mexico, Cuba, Panama, Salvador, Siam, Brazil, Chile, Argentine, India, Hawaii, Puerto Rico, Philippine Islands, China, and all parts of the world.

Planning a New Shop. Should you desire the services of our engineering department in planning a shop, they are available without cost or obligation. The suggestions of this department on the most efficient plan of shop arrangement, lighting facilities, power application, location of electric conduit outlets, floor construction, and other pertinent details, will be found helpful and valuable.

Send Us a Sketch of your shop room giving length and width of room, height of ceiling, location of pillars, steam radiators, location of electrical line and details of any other conditions that affect the shop. Also let us know the type of shop you are planning and number of boys in the classes.

We will Prepare a Drawing of the suggested layout showing (1) locations of machines, (2) size of equipment suggested, (3) quantity of equipment required. An estimate of the cost will be made and sent to you along with blue prints made from this drawing.

Service is Free. There is no cost or obligation for this service to any instructor, supervisor, director or other school official. We invite you to take advantage of it when planning a shop or when re-arranging an old shop.

The Engineering Department, shown in the illustration at right, is maintained in our factory at all times for the development and improvement of the Back-Geared, Screw Cutting Lathe and for the designing of tools, jigs and fixtures for the production and manufacture of lathes.

Our entire facilities are concentrated on the development and production of the lathe so that these engineers are specialists in machine design and construction. Their suggestions on shop layouts and equipment will be found practical and valuable to anyone planning a shop.

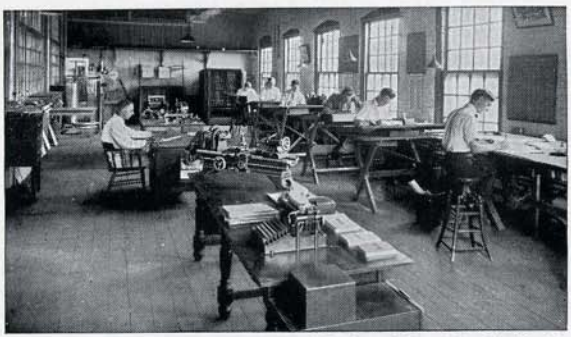


Fig. 52. Engineering Department of the South Bend Lathe Works.

"How to Run a Lathe"—32nd Edition

A Valuable Text and Reference Book on Lathe Operations

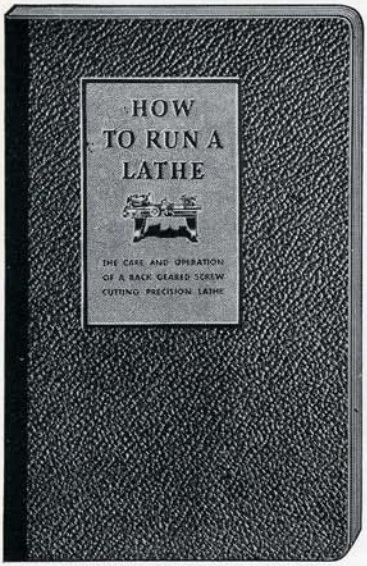


Fig. 53. Paper Bound.....price 25c
Leatherette (as shown).....price 75c

Competent Authorities say that this is one of the most complete books written on the care and operation of the Back-Geared, Screw Cutting Lathe. The book is 5¼" x 8", contains 160 pages and more than 300 illustrations.

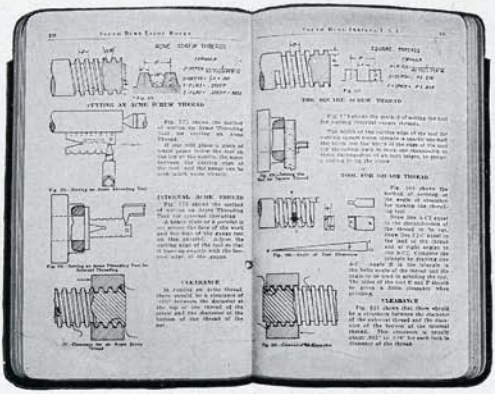


Fig. 54. Two Sample Pages in "How to Run a Lathe"

400 Different Types of Lathe Jobs in modern machine shop practice are illustrated and described in this book. Over one and one-half million copies have been published in the last 30 years. The book is now in the thirty-second revised edition.

Used with Machine Shop Course. The Machine Shop Course, described on pages 20 to 23, refers to operations which are fully described in the book, "How to Run a Lathe". This book can also be used in the Auto Mechanics Shop, General Shop, Farm Shop, and Electric Shop for reference and instruction purposes.

Printed in Several Languages. English, Spanish, Portuguese and Chinese editions of "How to Run a Lathe" have been published. The Spanish edition is known as "Manual del Tornero". The Portuguese edition is known as "Como Se Deve Manejar Um Torno."

Large Industries such as Ford Motor Co., Bethlehem Steel Co., New York Central Railroad, etc., use "How to Run a Lathe" for apprentice school training. Schools and colleges all over the world accept it as a text and reference book in machine shop practice.

Paper Binding or Leatherette. Prices are quoted below for books with paper binding and with de luxe leatherette cover. Coin or stamps of any country accepted on orders for single copies.

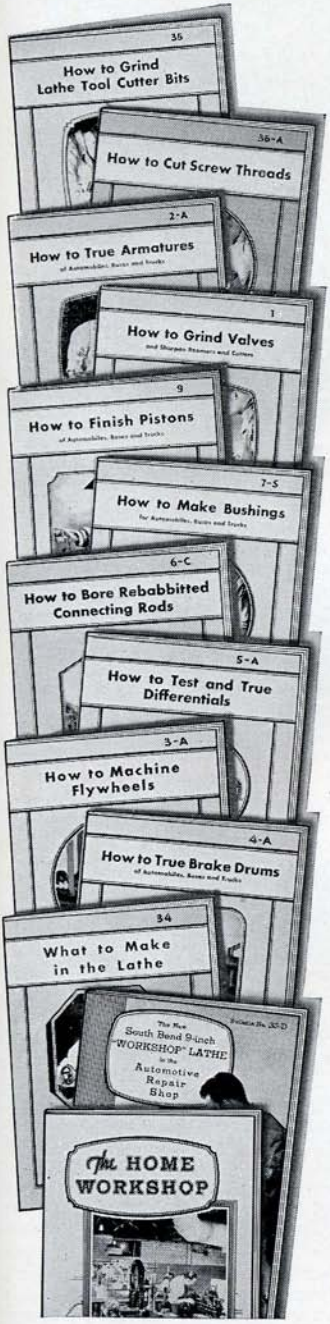
Partial List of Contents

PRICES FOR BOOK "HOW TO RUN A LATHE"

Single Copy and Quantity Prices	Paper Bound	Leatherette Bound
Single copies, postpaid, each	$0.25	$0.75
Quantities up to 25 copies, postpaid, each	.25	.75
Quantities 26 to 100 copies, f.o.b. South Bend, each	.20	.65
Quantities 101 to 1000 copies, f.o.b. South Bend, each	.19	...

Reference Books on Lathe Work

The bulletins listed below illustrate and describe how to handle general lathe work and seven major auto service jobs according to the latest shop practice followed in successful shops and plants in the United States. Thousands of mechanics use these bulletins in their work. Bulletins are 6″ x 9″ in size and contain from 8 to 28 pages each. When ordering specify the titles of the bulletins wanted and they will be mailed postpaid on receipt of price indicated. Coin or stamps of any country accepted.



"How to Grind Lathe Tool Cutter Bits" Bulletin No. 35. Explains in detail how to sharpen various types of cutter bits for lathe work. 16 pages, size 6″x9″, 50 illustrations. Price postpaid 10c

"How to Cut Screw Threads" Bulletin No. 36-A. Explains various screw thread forms and how to cut screw threads in the lathe. 24 pages, size 6″x9″, 65 illustrations. Price postpaid..10c

"How to True Armature Commutators and Undercut Mica" Bulletin No. 2-A. (Automotive.) Contains information on truing armature commutators and undercutting mica in the lathe. 12 pages, size 6″x9″, 35 illustrations. Price postpaid.....10c

"How to Grind Valves and Sharpen Reamers" Bulletin No. 1. (Automotive.) Contains information on refacing automobile engine valves, sharpening valve seat reamers, cutters, etc. 12 pages, size 6″x9″, 23 illustrations. Price postpaid.....10c

"How to Finish Pistons" Bulletin No. 9. (Automotive.) Contains detailed information on finishing semi-machined pistons in the lathe, reaming and honing wrist pin holes, etc. 12 pages, size 6″x9″, 31 illustrations. Price postpaid.....10c

"How to Make Bushings" Bulletin No. 7-S. Contains information on making bushings, lathe mandrels, press fits and running fits. 12 pages, size 6″x9″, 28 illustrations. Price postpaid...10c

"How to Bore Rebabbitted Connecting Rods" Bulletin No. 6-C. (Automotive.) Illustrates and describes the latest shop practice for boring, facing, and finishing rebabbitted connecting rods. 8 pages, size 6″x9″, 25 illustrations. Price postpaid.....10c

"How to Test and True Differentials" Bulletin No. 5-A. (Automotive.) Contains information on removing the old ring gear, testing and truing the ring gear seat, testing bearings of drive pinions, etc. 8 pages, size 6″x9″, 20 illustrations. Price postpaid 10c

"How to Machine Flywheels" Bulletin No. 3-A. (Automotive.) Contains information on turning down flywheels for new starter ring gears. 8 pages, size 6″x9″, 24 illustrations. Price postpaid 10c

"How to True Brake Drums" Bulletin No. 4-A. (Automotive.) Shows how to mount various types of brake drums in the lathe for truing the drum so that it will be concentric, round and true. 16 pages, size 6″x9″, 40 illustrations. Price postpaid.....10c

"What to Make in the Lathe" Bulletin No. 34. Illustrates and describes over 65 useful projects for the home and shop including tools, grinders, and other useful objects, also various models such as steam and gas engines, locomotives, airplanes, etc. 28 pages, size 6″x9″, 75 illustrations. Price postpaid.....10c

"Motor Mechanics Handbook No. 33-D." (Automotive.) Illustrates the use of the lathe in automotive service work. 24 pages, size 6″x9″, 70 illustrations. Mailed postpaid, no charge.

"The Home Workshop" Handbook No. 11-W. Shows a number of illustrations of excellent home workshops, hobby shops, etc. Also contains many good shop kinks, rules and tables, etc. 24 pages, size 6″x9″, 70 illustrations. Mailed postpaid, no charge.

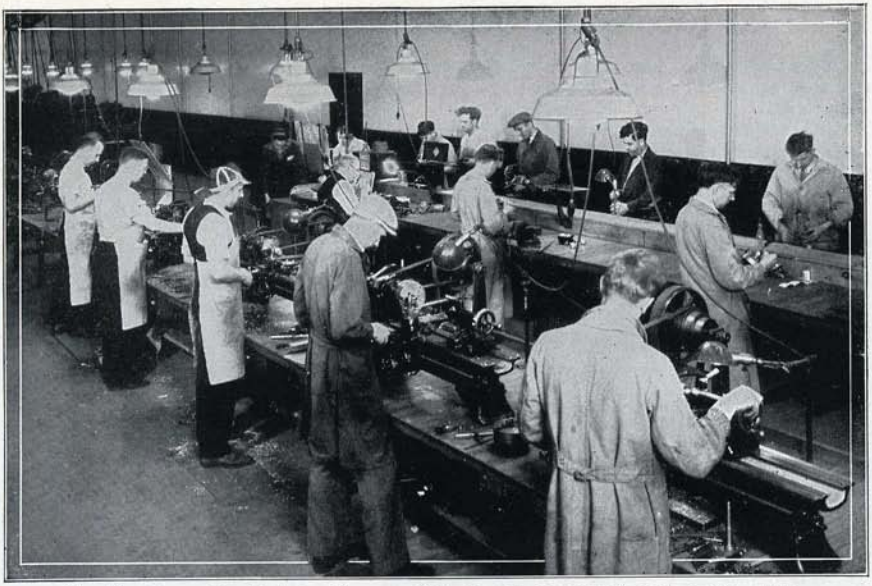


Fig. 56. Apprentice Training Group at Work in the Bendix-Stromberg Co. Plant

Industrial Apprentice Training

Most machinists and toolmakers in American industry today received their early training as apprentices, working under shop foremen in the production departments and tool rooms by agreement with the plant or shop owners and executives. Industry has been compelled for many years to train its own men in order to be assured of a sufficient supply of skilled help in later years. A few firms having their own apprentice departments are listed below. Brief descriptions show how these departments are operated.

Cleveland, Cincinnati, Chicago & St. Louis Ry. Co.
United Shoe Machinery Corp.
General Motors Corporation
Atchison, Topeka & Santa Fe Ry. Co.
Westinghouse Elec. & Mfg. Co.
National Cash Register Co.
Studebaker Corp.
International Harvester Co.
Ford Motor Car Co.
Bethlehem Steel Corp.
Delco Remy Electric Corp.
Bucyrus Erie Co.

General Electric Co. Apprentice Dept.

Supplied by Roy E. Ellis, Supt. of Apprentices

Apprentice Department was organized September 1901, has graduated over 1800 men in machinist, toolmaking, pattern making and other trades. The course offered to machinist apprentices is one that has proved the most popular and is most essential to the electrical industry. High School students required to spend three years on course; less than High School grade must spend four years. Theory of the trade combined with actual shop practice in the plant are the basis of each course.

Reo Motor Car Co. Apprentice Dept.

Furnished by Arthur F. Avis, Supt. of Apprentices

This company has had apprentice training since company was first organized in 1904. The length of the training period varies from 2½ to 3½ years according to age and previous education of the student. Actual shop work is carefully correlated with training theory. Graduated over 400 men since 1916 and still have most of these graduates in their employ, most of whom attained ranking positions in the company as superintendents, foremen, engineers, designers, and sales executives.

Cooper Bessemer Corp. Apprentice Dept.

Mt. Vernon, Ohio

A successful apprentice program has been in force with this firm for many years. Students must be 18 years old, physically fit, mechanically inclined and of good character. Course requires 7200 hours or about three years in the shop and classroom. Classroom work is given at the plant. Shop work is given separately from the regular production departments. Careful grading of all students shows their progress and permanent records are kept on hand for later classifying each graduate.

Warner & Swasey Co. Apprentice Dept.

Cleveland, Ohio

This department was organized in 1911 and has been an important factor in the company policy. Classroom instruction in subjects of immediate and practical value is given four hours each week, and for allied subjects and advanced studies the apprentice is urged to take outside courses in night schools. Graduate apprentices include Works Manager, Superintendent, Assistant Superintendent, Foremen, Draftsmen, Inspectors, Sales Executives, and Demonstrators in the employ of the company.

A Few Views of Industrial Apprenticeship Classes

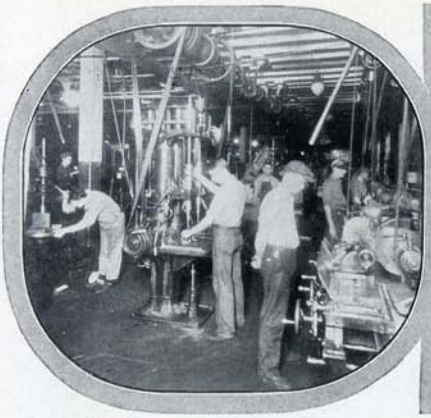


Fig. 57. Apprentices in Apprentice Training Machine Shop of the Reo Motor Company, Lansing, Michigan.

Fig. 58. Apprentices Working on Lathes in Machine Apprentice Training Room, General Electric Company, Schenectady, New York.

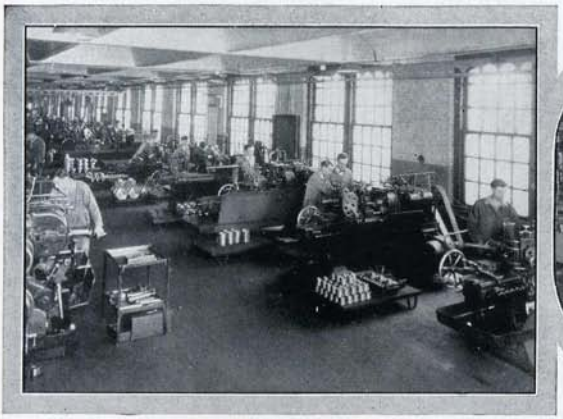


Fig. 59. Apprentices Getting Actual Shop Experience by Working in the Training Shop of the Warner Swasey Company, Cleveland, Ohio.

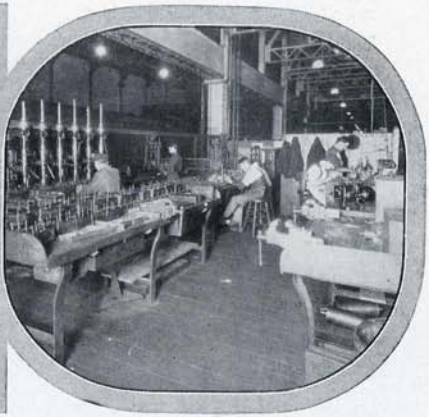


Fig. 60. View in One Corner of Training Department, Westinghouse, Pittsburgh, Pennsylvania.

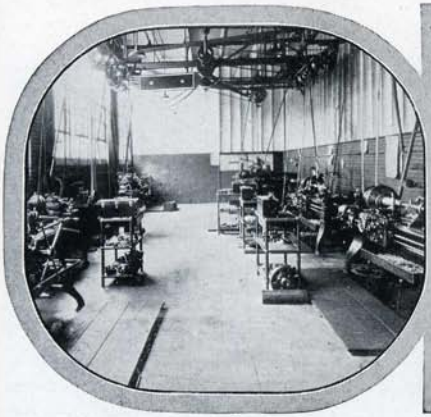


Fig. 61. Apprentice Training Department, Cooper-Bessemer Company, Mt. Vernon, Ohio.

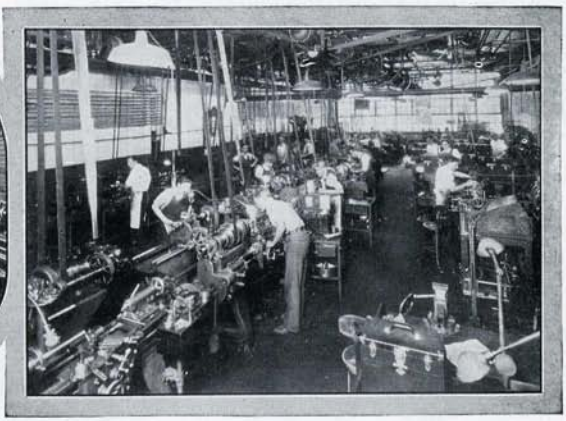


Fig. 62. Machine Apprentices Getting their Training in the Training Shop of Delco-Remy Corporation, Anderson, Indiana.

Some Well Equipped School Machine Shops

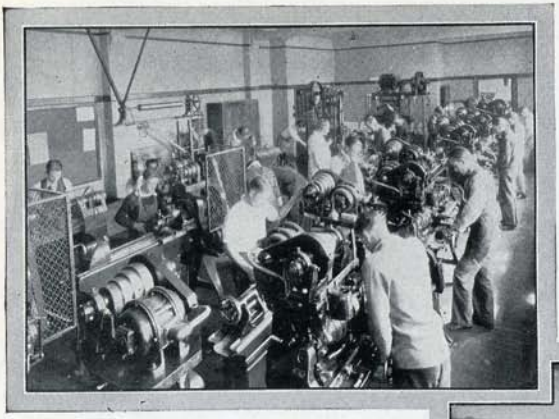
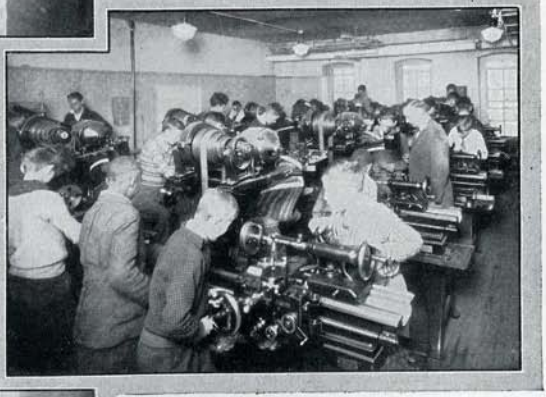


Fig. 63. Above—Mobile, Alabama, High School. 6 South Bend Lathes are used in Mobile Schools.

Fig. 64. Above—West Side High School, Denver, Colorado. 22 South Bend Lathes are used in Denver Schools.

Fig. 65. Right—Barret Jr. High School Shop, Columbus, Ohio. Columbus Schools use 87 South Bend Lathes.



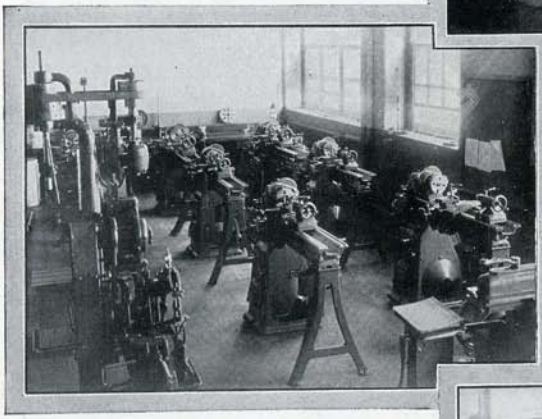


Fig. 66. Left—Goff Jr. High School, Pawtucket, R. I. Pawtucket School Shops use 9 South Bend Lathes.

Fig. 67. Below—Baltimore, Md., Polytechnic Inst. uses 14 South Bend Lathes in this Shop.

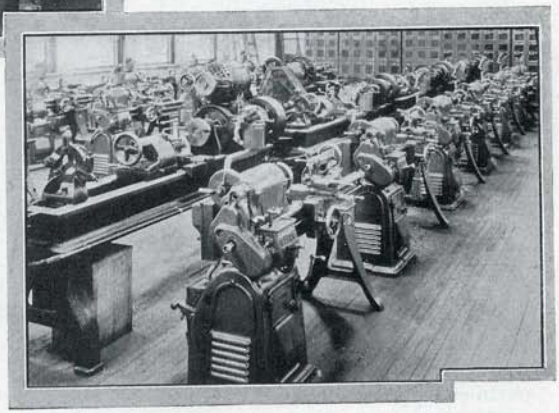
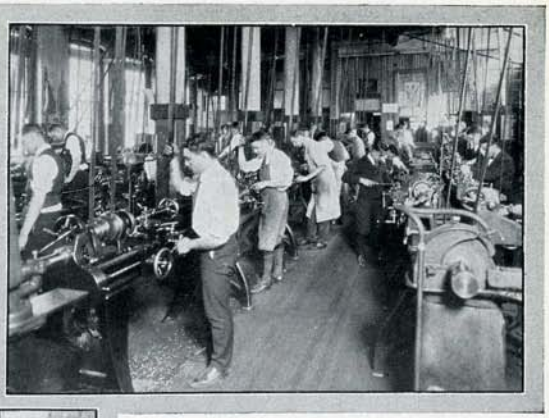


Fig. 68. Above—Reading, Pa., High School. 47 South Bend Lathes are used in Reading School Shops.

Fig. 69. Above—Jackson Intermediate School, Detroit, Mich. 359 South Bend Lathes in Detroit Schools.



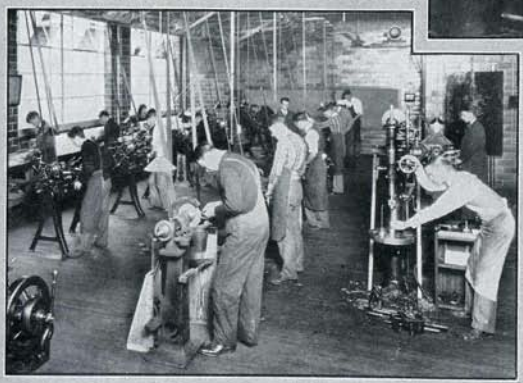


Fig. 70. Above—Springfield Tech. High School, Springfield, Mass. 55 South Bend Lathes in Springfield Schools.

Fig. 71. Left—Elkhart High School Machine Shop, Elkhart, Ind. Elkhart Schools use 10 South Bend Lathes.

Fig. 72. Right—Woodward Technical High School, Toledo, Ohio. 41 South Bend Lathes in Toledo Schools.

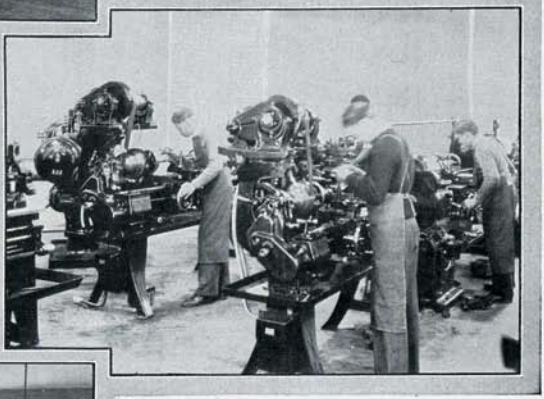
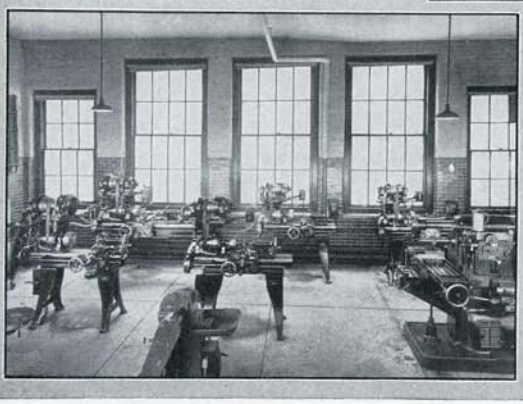


Fig. 73. Below—Washington High School, Boston, Mass. 34 South Bend Lathes are used in Boston Schools.



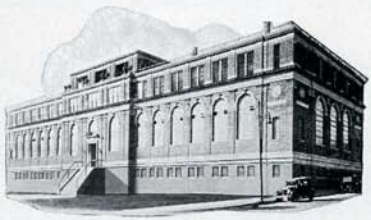


Fig. 74. Above—Omaha, Nebraska, Technical High School. 16 South Bend Lathes are used in Omaha Schools.

South Bend Lathes in Other Lands

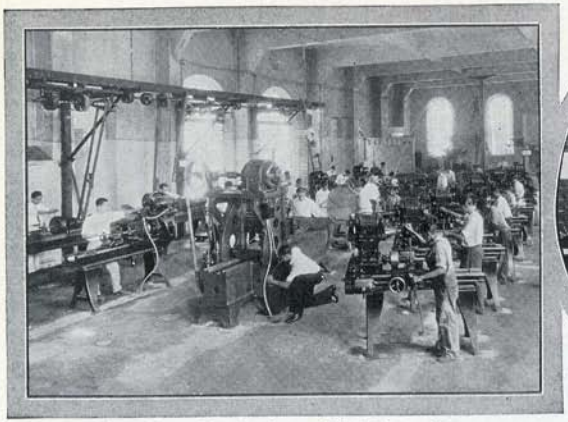


Fig. 75. Escuela de Artes Y Oficios, Panama, R. P. 17 South Bend Lathes are used in Panama School Machine Shops.

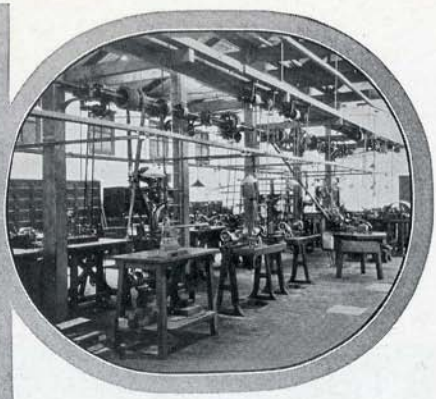


Fig. 76. Wanganui Tech. College, Wanganui, New Zealand. 3 South Bend Lathes in this College.

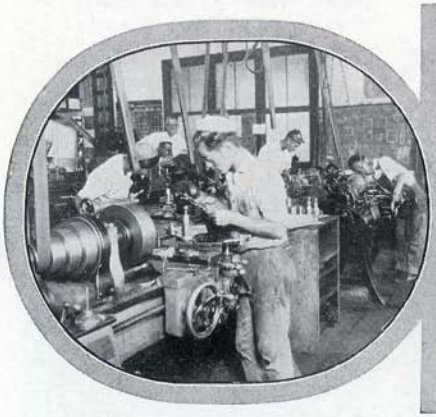


Fig. 77. Honolulu, Hawaii, Vocational School. 5 South Bend Lathes are used in Honolulu Schools.

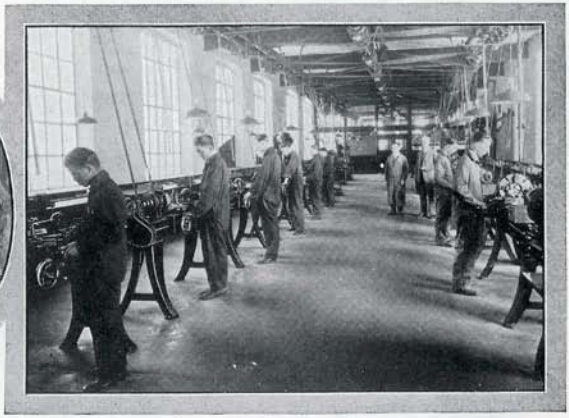


Fig. 78. Ecole Technique de Hull, Quebec, Canada. 6 South Bend Lathes are used in the Machine Shops of Hull Schools.

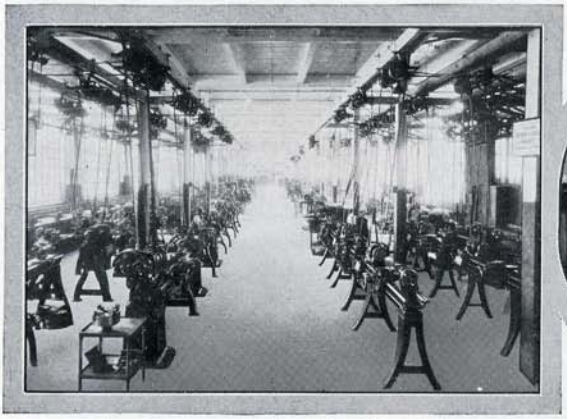


Fig. 79. Montreal Technical School, Montreal, Quebec, Canada. Montreal School Shops are using 22 South Bend Lathes.

Fig. 80. Escuela Central Agricola de Guanajuato, Celaya, Guanajuato, Mexico uses a South Bend Lathe.

The Story of the Lathe

The First Type of Lathe

The origin of the lathe is unknown. Old wood cuts and paintings dating back several hundred years show crude methods of fabricating various materials including the crude tree lathe shown at the right, for turning wood. The part to be turned was held between two trees "on centers" and rotated back and forth by an ingenious method. An overhanging tree was bent down over the job and a rope fastened to the tree tip. This rope was then wound around the work and looped to receive the operator's foot or a long stick. The spring tension of the tree trunk would cause the work to rotate in one direction while the operator's weight on the lower end of the rope rotated the work in the opposite direction.

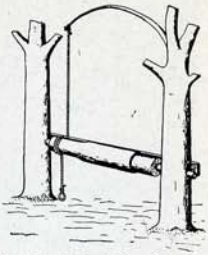


Fig. 81. The Tree Lathe

Fig. 82. Turning Wood by Hand and Foot Power in India 1933

Turning Lathe in India

Primitive methods of turning various materials are still in use in remote parts of the world. The illustration here shows two natives of the Punjab in India turning small spindles of wood by a very old method. One man holds the chisel and forms the work while a coolie furnishes the power for turning. As will be seen, a thong or rope is wound two or three times around the work and the ends grasped in the two hands. By a see-sawing motion the work is rotated for turning, first one way and then the other.

The First Screw Cutting Lathe

The early lathes were used mostly for wood turning and it was not until metals came into prominence that the screw cutting lathe was developed. The earliest known screw-cutting lathe was built in France about 1740. Then Henry Maudslay, an Englishman, built the lathe shown at right in 1797.

The Screw Cutting Lathe is the oldest, and most important of all machine tools. From it were developed all other modern machine tools. The lathe made possible the building of the steamboat, the locomotive, the electric motor, the automobile, the airplane, and all kinds of machinery used in industry. Without the lathe our great industrial progress of the past century would have been impossible.

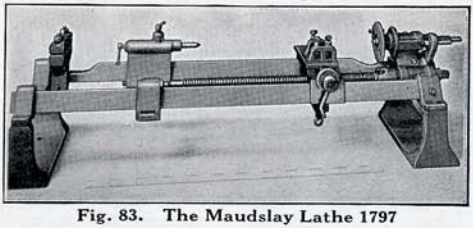


Fig. 83. The Maudslay Lathe 1797

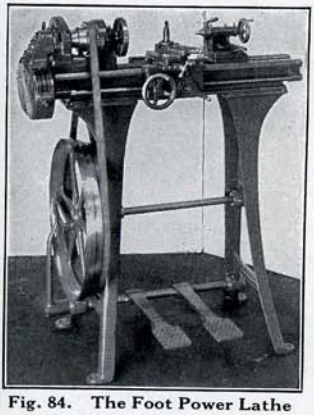


Fig. 84. The Foot Power Lathe

20th Century Lathes

The first screw cutting lathes were operated by a treadle arrangement similar to that shown at the left. The invention of the steam engine made it possible to operate the primitive machines of that time by "engine" power, hence the name of Engine Lathe.

Even today in remote parts of the world many foot power lathes with modern features in every way are being used. High costs of power and fuel cause the operators to cling to the old methods even in otherwise modern surroundings.

The lathes of today are no different in basic principle from the lathes of a hundred years ago. Improved design, better materials, better workmanship, and more skilled handling in manufacturing have made the 1937 models far superior to the older type lathes. Industry and modern development along mechanical lines are still dependent upon the basic back-geared screw cutting lathe.

Fig. 85. 9″ x 3′ "Workshop" South Bend Precision Bench Lathe, with Horizontal Motor Drive and Regular Lathe Equipment

9-inch "Workshop" South Bend Bench Lathe

A Back-Geared, Screw Cutting Metal Working Precision Lathe Practical for the Junior High School Shop

The 1937 Model 9-inch "Workshop" South Bend Lathe is the ideal tool for the Junior High School Shop because it is easy for boys of Junior High School age to operate, being small in size and of simple construction.

The "Workshop" Lathe is supplied in bench and floor leg models. The drives furnished include: countershaft drive, horizontal motor drive, and underneath motor drive. Any model can be supplied in bed lengths of 3, 3½, and 4 ft.

Standard screw threads from 4 to 40 per inch, right or left hand, including 11½ pipe thread, can be cut on this lathe. Precision thread gauges, taps, tools and dies may be made to the most exacting specifications.

Hundreds of machine operations, such as turning, threading, boring, facing, drilling, etc. can be done on this lathe. Special work such as milling, grinding, etc. can also be done when the lathe is equipped with attachments of which there are thirty-eight in the line.

Description, illustrations and prices of the "Workshop" Lathe will be found in Catalog No. 15-K, mailed on request.

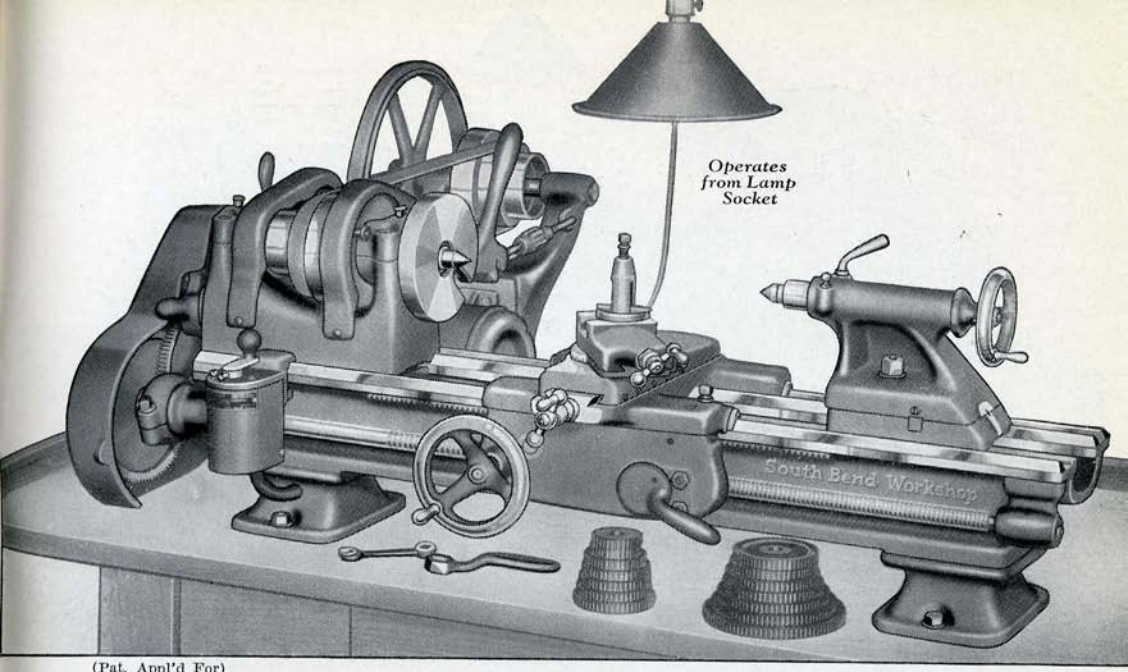
"Workshop" Lathe Features

Back-geared headstock, six spindle speeds
Twin gear reverse for threads and feeds
Compound rest graduated 180°
Tailstock has ⅝″ set-over for taper turning
Micrometer graduations on feed screws
Automatic longitudinal power feeds to carriage
Precision lead screw for screw thread cutting
Three V-ways and one flat-way on lathe bed

"Workshop" Lathe Specifications

Swing over bed	9¼″
Swing over carriage	5½″
Collet Capacity	1/16″ up to ½″
Hole Through Spindle	¾″
Screw thread cutting range	4 to 40 per in.
Spindle Speeds	39, 68, 122, 202, 353, 630, R.P.M.
Head and tail spindle centers	No. 2 Morse Taper
Size of motor used	¼ H.P.

Write for No. 15-K "Workshop" Catalog Describing the Above Lathe.



(Pat. Appl'd For)

Fig. 86. Cat. No. 415-YA, 9″ x 3′ "Workshop" Motor Driven Precision Bench Lathe, complete as shown, but less bench. (Ship. wt. crated 320 lbs.) $116.00

9″ "Workshop" Horizontal Motor Drive Lathe

For the Junior High School Shop

The 1937 Model 9-inch "Workshop" South Bend Bench Lathe is popular for use in Junior High School Shops and is also widely used in manufacturing plants, garages, laboratories, home workshops, and experimental shops where the finest type of back-geared, screw cutting precision lathe is required.

The Adjustable Horizontal Motor Drive, shown in Fig. 87, is practical, convenient and efficient. The countershaft has belt tension adjustment for both cone pulley belt and motor belt. A quick release for cone pulley belt tension permits easy shifting of the belt for changing spindle speeds.

Improved Features include back-geared headstock, ball thrust bearing for spindle, precision lead screw, compound rest, etc.

Regular Equipment included in price of lathe consists of: Graduated compound rest; face plate 5-inch dia.; forged steel tool post; two centers, headstock spindle sleeve; wrenches; set of change gears for screw thread cutting; compound gearing for automatic longitudinal power feeds; installation plan and book, "How to Run a Lathe."

For More Complete Information write for catalog No. 15-K, mailed on request.

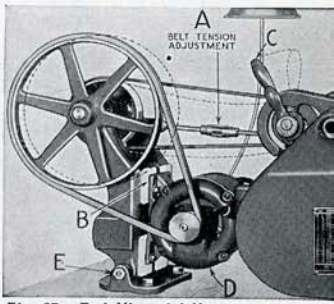


Fig. 87. End View of Adjustable Horizontal Motor Drive Countershaft

Prices of 9-inch "Workshop" Adjustable Horizontal Motor Drive Lathes

	9″ x 3′	9″ x 3½′	9″ x 4′	9″ x 4½′
9-inch "Workshop" South Bend Bench Lathe with Graduated Compound Rest and Lathe Equipment, but less Motor Drive Equipment and Bench*	$85.00	$97.00	$109.00	$126.00
MOTOR DRIVE EQUIPMENT				
Motor Drive Equipment consists of: Adjustable Type Horizontal Countershaft; ¼ H.P. Start-Stop Reversing Split-Phase Motor, 1725 R.P.M. (1-ph. 60 cy., A.C. 110-V.); V-Groove Pulley for Motor; Drum Reversing Switch (Style R-12); Bracket for attaching Switch to Lathe; V-Belt, Motor to Drive Unit; Flat Leather Belt and Lacing	31.00	31.00	31.00	31.00
Net Factory Price, Lathe with Motor Drive Equipment	$116.00	$128.00	$140.00	$157.00
Catalog Number, Lathe with Motor Drive Equipment	No. 415-YA	No. 415-ZA	No. 415-AA	No. 415-RA
Code Word, Lathe with Motor Drive Equipment	Magla	Mahlk	Manaf	Mandl
Distance Between Spindle Centers of Lathe	17 inches	23 inches	29 inches	35 inches
Shipping Wt., Lathe and Motor Drive Complete	320 lbs.	345 lbs.	370 lbs.	420 lbs.

*Blue prints of frame and cabinet benches furnished free on request.
Prices of lathes with instant reversing ¼ H.P., A.C. or D.C. motors on request.

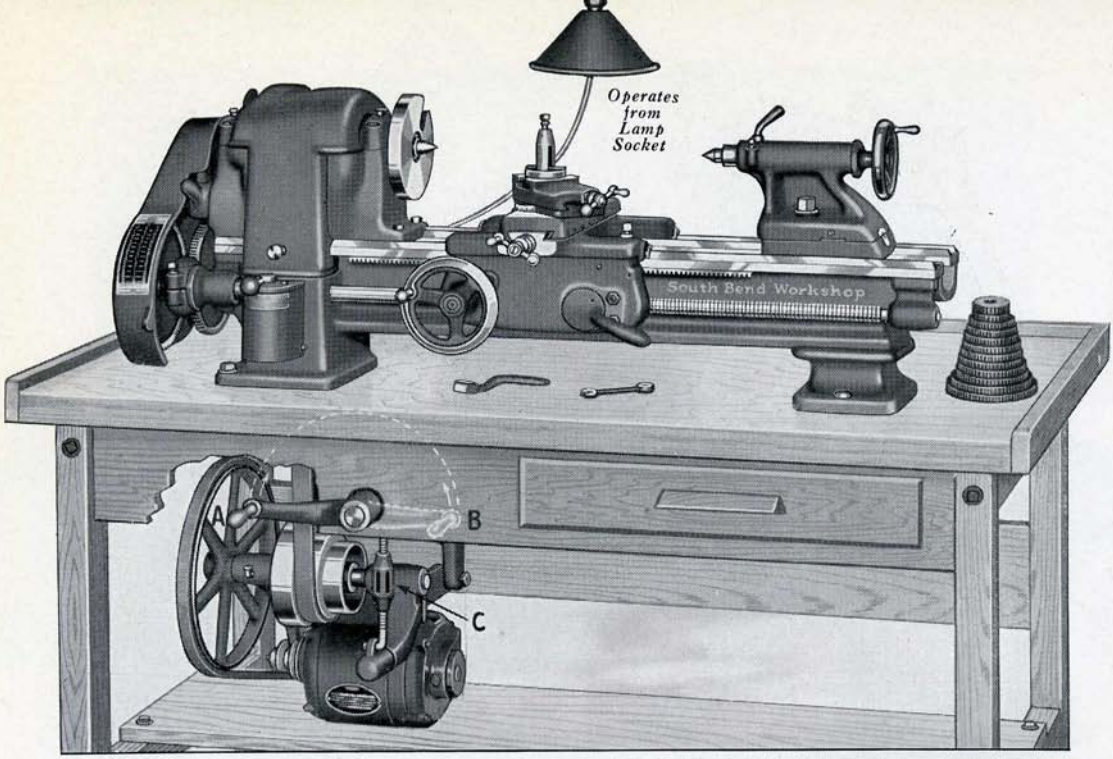


Fig. 88. Cat. No. 115-YB, 9″ x 3′ "Workshop" Underneath Belt Motor Drive Bench Lathe. . . .$155.00

9″ "Workshop" Underneath Motor Drive Lathe

A Very Popular Motor Drive Bench Lathe for the School Shop

The 1937 Model 9-inch "Workshop" Bench Lathe illustrated above is the same as lathes shown on preceding pages, except for necessary alterations in the headstock and bed to accommodate the underneath motor drive. The hinged cone pulley cover may be raised for belt shifting.

Junior High School Shops use this lathe in batteries of 4, 8, 12 and more on a single large bench. The lathes are placed back to back, making a compact, smooth running unit. This lathe is also recommended for General Shop, Farm Shop, Electrical Shop and Laboratory.

Motor Drive Unit is bolted under the bench top. The cone pulley belt tension is released for shifting the belt by moving the crank handle "A" to position "B." Any desired belt tension can be obtained by adjusting the turnbuckle "C."

Hardened Headstock Spindle is regular equipment on Underneath Motor Drive Lathes.

Regular Equipment included in price of lathe consists of: Graduated compound rest; face plate 5-inch dia.; forged steel tool post; two 60-degree tool steel lathe centers, No. 2 Morse Taper; hardened and ground headstock spindle; headstock spindle sleeve; wrenches, set of change gears for screw thread cutting; compound gearing for automatic longitudinal power feeds; installation plan and book, "How to Run a Lathe." Bench is not included in price.*

Electrical Equipment included in price consists of: Underneath belt motor drive countershaft complete with ¼ H.P., 1725 R.P.M. 1 ph. 60 cycle, A.C. 110-volt start-stop reversing motor, reversing switch, motor pulley, belting, and wire for connecting motor to switch.

Prices of 9-inch "Workshop" Adjustable Underneath Belt Motor Drive Precision Bench Lathe

Swing Over Bed Inches	Length of Bed Feet	Distance Between Centers Inches	Hole Through Spindle Inches	Collet Capacity 1/16″ up by 64ths to	Swing Over Carriage Inches	Size of Motor H.P.	Approx. Ship. Wt. Crated Pounds	Cat. No.	Code Word	Price F.O.B. Factory
9¼	3	17	¾	½″	5½	¼	340	115-YB	Edhar	**$155.00**
9¼	3½	23	¾	½″	5½	¼	365	115-ZB	Edhiz	**167.00**
9¼	4	29	¾	½″	5½	¼	390	115-AB	Edhof	**179.00**

*Blue prints of frame and cabinet benches furnished free with lathe on request.
Prices of lathes with instant reversing ¼ H.P., A.C. or D.C. motors on request.

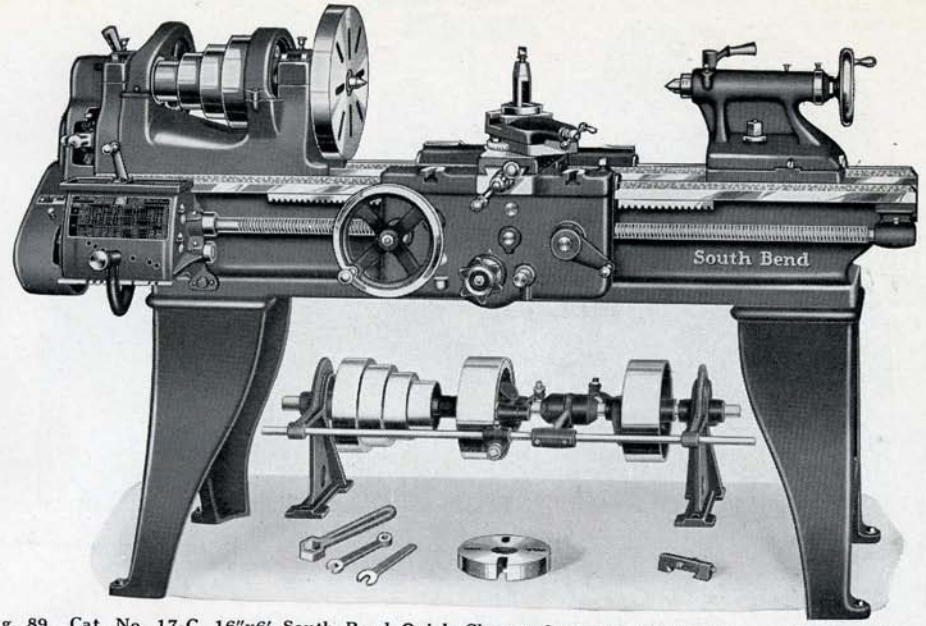


Fig. 89. Cat. No. 17-C, 16″x6′ South Bend Quick Change Gear Countershaft Driven Lathe. . $657.00

9″ to 16″ South Bend Countershaft Driven Lathes

Quick and Standard Change—Back-Geared Screw Cutting Lathes

The South Bend Back-Geared, Screw Cutting Precision Lathe has tool room accuracy, power for heavy cuts and the latest mechanical features. It can be supplied in either the Quick Change Gear type, or in the Standard Change Gear type. For lathe specifications see page 46. Features described below do not apply to 9″ Junior and 9″ "Workshop" Lathes.

Back-Geared Headstock is hand-scraped to lathe bed; has three-step cone pulley on 9″ and 11″ lathes, providing six spindle speeds, three direct and three back-geared. A four-step cone on 13″ to 16″ lathes provides eight spindle speeds, four direct and four back-geared; has wrenchless bull gear lock; spring latch reverse.

Phosphor Bronze Bearings for headstock spindle are line-bored and lapped to a perfect bearing, and are adjustable for wear.

Headstock Spindle is made of high carbon steel, finish ground. Has a hole its entire length for machining rods and bars.

Apron has automatic cross feeds and automatic longitudinal feeds. Half-nuts and lead screw are used only for screw thread cutting. An automatic safety device prevents engaging half-nuts and automatic feeds at the same time. (9-inch Junior and 9-inch "Workshop" Lathes have hand operated cross feed and half-nut longitudinal feed to carriage.)

Tailstock has set-over for taper turning; graduated spindle; double plug spindle lock, Morse taper center, hardened, ground and self-ejecting.

Compound Rest is graduated 180° and swivels to any angle. Compound rest screw and cross feed screw have micrometer graduated collars.

Precision Lead Screw is made of special carbon steel and has coarse pitch Acme thread.

Lathe Bed is 50% steel, heavily constructed and reinforced by box braces its entire length.

The Gear Box on Quick Change Gear Lathes provides 48 changes for cutting standard screw threads, right or left-hand, from 2 to 112 per inch, including 11½ pipe thread.

Standard Change Gear Lathes have independent change gears instead of the quick change gear box for operating the automatic feeds and for cutting screw threads, right or left-hand, from 4 to 40 per inch on 9″ and 11″ lathes and from 2 to 40 per inch on 13″ and 16″ lathes.

Regular Equipment consists of: Double friction countershaft; large* and small face plates; tool post; thread cutting stop*; two 60° lathe centers; spindle sleeve; wrenches; change gears with Standard Change Gear Lathes; installation plan and book, "How to Run a Lathe."

*Not supplied for 9-inch "Workshop" and Junior Lathes; prices on request.

Popular Sizes of Countershaft Drive Lathes

Size of Lathe	Distance Between Centers Inches	Approx. Weight Crated Pounds	Quick Change		Standard Change	
			Cat. No.	Net Price	Cat. No.	Net Price
*9″x3′ W.S.	17	300	Not Made		15-YBW	$ 97.00
*9″x4′ W.S.	29	350	Not Made		15-ABW	121.00
*9″x3′ Jr.	16⅜	427	Not Made		22-Y	215.00
*9″x4′ Jr.	27⅜	477	Not Made		22-A	235.00
*9″x3′	16⅜	482	9-Y	$320.00	7-Y	280.00
*9″x4′	27⅜	532	9-A	340.00	7-A	300.00
11″x4′	24	725	11-A	398.00	10-A	353.00
13″x5′	28	1110	13-B	478.00	12-B	423.00
13″x6′	40	1160	13-C	495.00	12-C	440.00
15″x5′	24½	1575	14-B	559.00	21-B	494.00
15″x6′	36½	1650	14-C	579.00	21-C	514.00
16″x6′	34	1875	17-C	657.00	23-C	582.00
16″x8′	58	2035	17-E	701.00	23-E	626.00

*If floor legs are not wanted deduct $10.00 from price of Junior and 9-inch Lathes. "Workshop" Lathe has bench legs.
Prices of lathes in other bed lengths on request.

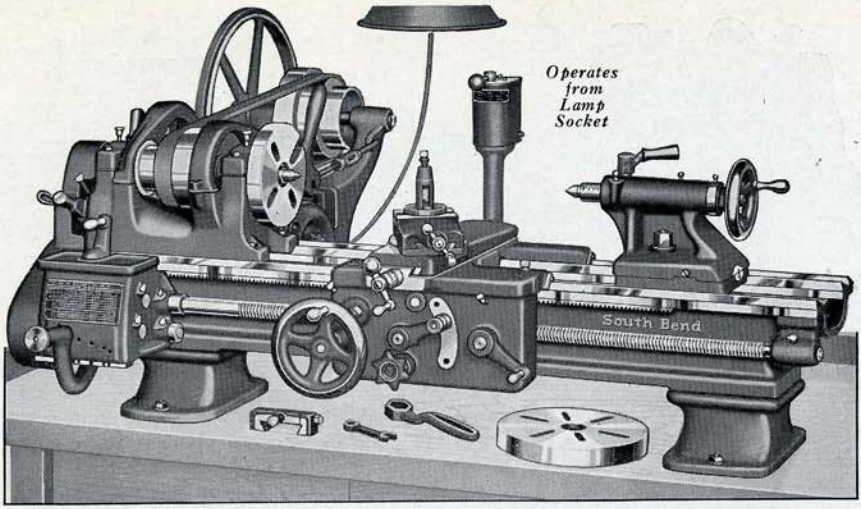


Fig. 90. Cat. No. 409-YN, 9″x3′ Horizontal Motor Drive Quick Change Gear Bench Lathe complete as shown, but less bench.....$333.00

9-inch South Bend Bench Lathes

With Adjustable Horizontal Motor Drive

South Bend 9-inch Swing Bench Lathes are made in Quick Change Gear, Standard Change Gear and Junior Types, in addition to the 9-inch "Workshop" Lathes shown on the preceding pages. Catalogs giving complete information on the various models of lathes will be mailed on request.

The Quick Change Gear 9-inch Bench Lathes have full quick change mechanism, providing 48 changes for cutting right and left hand screw threads from 2 to 112 per inch, and also a wide range of power longitudinal carriage and power cross feeds. Apron has worm drive and friction clutch for operating power carriage feeds.

The 9-inch Junior Bench Lathes have the same headstock, tailstock and bed as the Standard and Quick Change Gear Lathes, but the apron design is similar to that of the 9-inch "Workshop" Lathes shown on preceding pages. Change gears included in price of lathe permit cutting right and left hand screw threads from 4 to 40 per inch. Lead screw and half-nuts are used for power longitudinal carriage feeds.

Hardened and Ground Headstock Spindle is included as regular equipment in the price of these lathes as shown below.

The Standard Change Gear Lathes are exactly the same as the Quick Change Gear Lathes except that instead of quick change mechanism, change gears furnished permit cutting right and left hand screw threads from 4 to 40 per inch. Gearing is supplied for automatic power feeds.

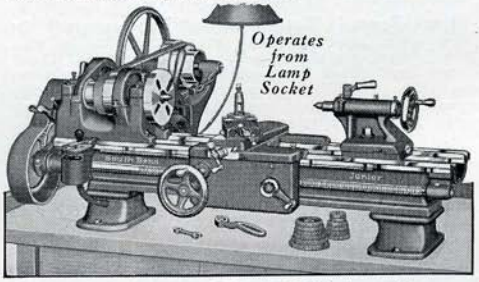


Fig. 91. Cat. No. 422-YN, 9″x3′ Horizontal Motor Drive Bench Lathe, less bench..$227.00

Net Factory Prices of 9-inch Adjustable Horizontal Motor Drive Bench Lathes

Size of Lathe	Distance Between Centers Inches	Weight Crated Pounds		9″ Junior Lathes		9″ Quick Change		9″ Standard Change	
		9″ Jr.	9″ Std. and Quick	Cat. No.	Price	Cat. No.	Price	Cat. No.	Price
9″x3′	16⅜	416	471	422-YN	$227.00	409-YN	$333.00	407-YN	$292.00
9″x3½′	21⅜	441	496	422-ZN	237.00	409-ZN	343.00	407-ZN	302.00
9″x4′	27⅜	466	521	422-AN	247.00	409-AN	353.00	407-AN	312.00
9″x4½′	34⅜	491	546	422-RN	257.00	409-RN	363.00	407-RN	322.00

Prices above are for lathes equipped with ¼ H.P., 1-phase, 60 cycle, 110 v. start-stop type reversing motor. Prices of lathes with instant reversing A.C. or D.C. motors available upon request.

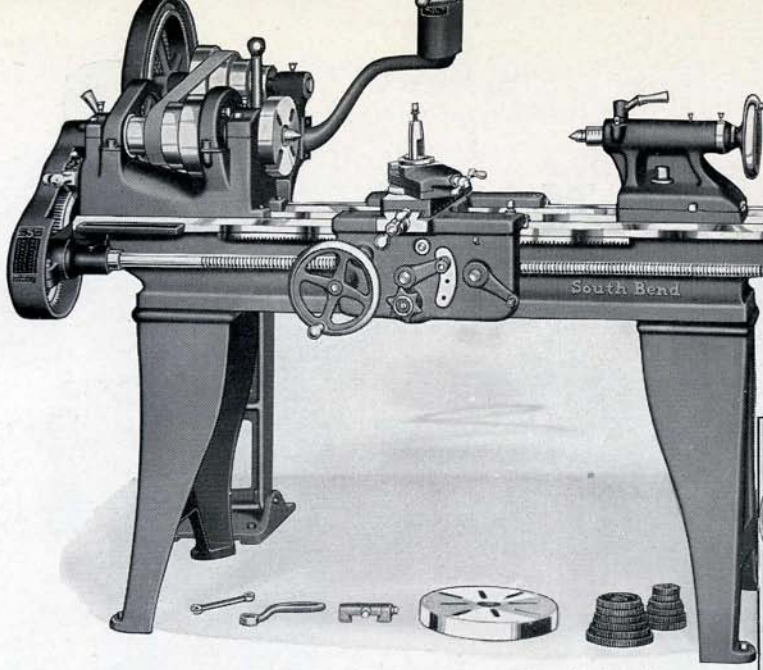


Fig. 92. Cat. No. 912-B, 13"x5' Standard Change Gear Pedestal Adjustable Motor Drive Lathe, complete as shown.....$515.00

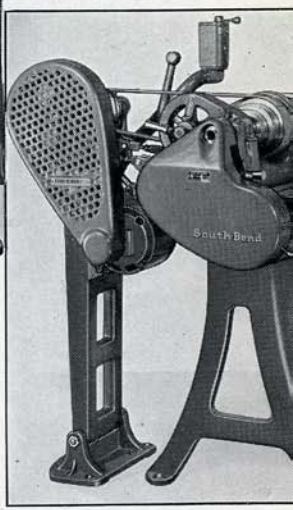


Fig. 93. End View of Pedestal Adjustable Motor Drive

9-Inch to 16-Inch Pedestal Adjustable Motor Drive Lathes

A Popular Priced Lathe for the School Shop

Pedestal Adjustable Motor Drive Lathes in standard and quick change gear types are recommended for shops requiring an efficient motor driven lathe at a moderate price. All sizes of lathes, 9-inch swing to 16-inch swing inclusive, can be supplied with this new drive. Write for a catalog.

The Pedestal Motor Drive permits placing the lathe in any position in the shop. Adjustment is provided for taking up belt stretch. V-belts enclosed in a guard transmit power from motor to countershaft. A belt tension release lever permits easy shifting of cone pulley belt.

Electrical Equipment included in price of lathe consists of: Pedestal Adjustable Motor Drive, reversing motor, reversing switch, wiring and belting.

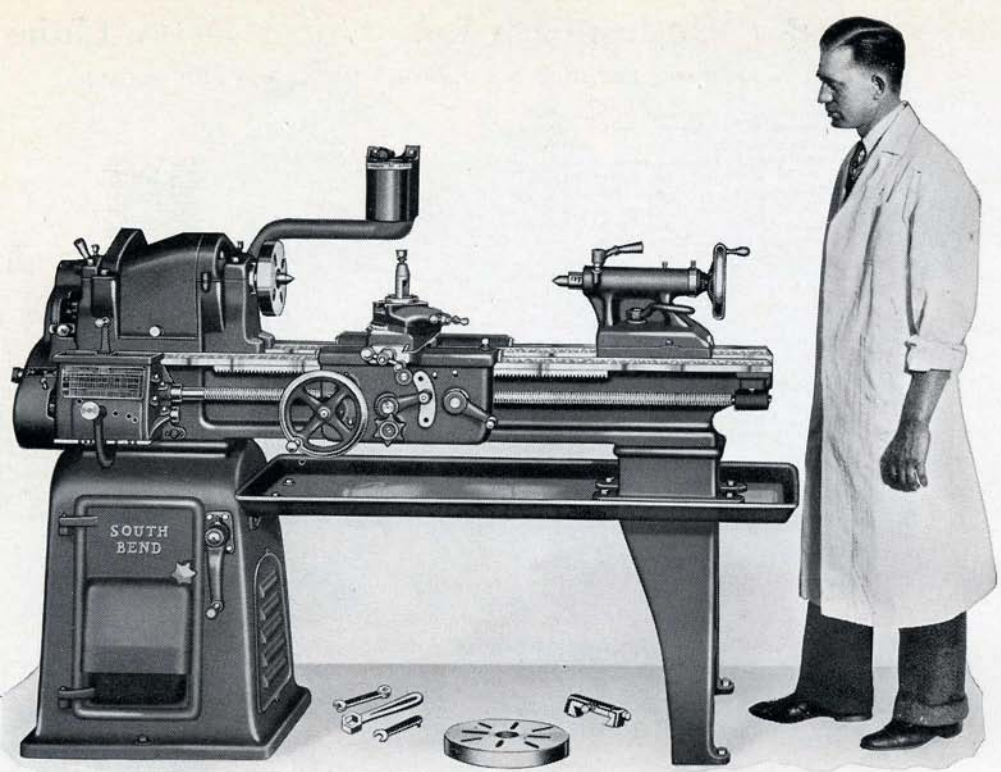
Regular Equipment consists of large* and small face plates, tool post, thread cutting stop,* spindle sleeve, wrenches, gear box or loose change gears, installation plan and book, "How to Run a Lathe."

*Not supplied with 9-inch "Workshop" or Junior Lathes.

Net Prices of Popular Size Pedestal Adjustable Motor Drive Lathes

Swing Over Bed Inches	Length of Bed Feet	Distance Between Centers Inches	Size Motor Used H.P.	Approx. Weight Crated Pounds	Quick Change Gear Lathes					Standard Change Gear Lathes				
					Catalog Number	Code Word for Lathe	3-Phase 60-Cycle A.C. Motor	1-Phase 60-Cycle A.C. Motor	Direct Current Motor	Catalog Number	Code Word for Lathe	3-Phase 60-Cycle A.C. Motor	1-Phase 60-Cycle A.C. Motor	Direct Current Motor
9¼ W.S.	3	17	¼	440			Not Made			915-Y	Harob		$141.00‡	
9¼ W.S.	4	29	¼	490			Not Made			915-A	Hemir		165.00‡	
*9¼ Jr.	3	16⅜	¼	505			Not Made			922-Y	Mahac	$273.00	288.00	$280.00
*9¼ Jr.	4	27⅜	¼	555			Not Made			922-A	Majad	293.00	308.00	300.00
*9¼	3	16⅜	¼	560	909-Y	Cegek	$378.00	$393.00	$385.00	907-Y	Birol	338.00	353.00	345.00
*9¼	4	27⅜	¼	610	909-A	Cerul	398.00	413.00	405.00	907-A	Bivil	358.00	373.00	365.00
11⅜	4	24	½	863	911-A	Melon	469.00	486.00	477.00	910-A	Hebos	424.00	441.00	432.00
13¼	5	28	¾	1255	913-B	Ravel	570.00	589.00	583.00	912-B	Rolex	515.00	534.00	528.00
13¼	6	40	¾	1305	913-C	Roser	587.00	606.00	600.00	912-C	Rezob	532.00	551.00	545.00
15¼	5	24½	1	1735	914-B	Tinuk	661.00	673.00	738.00	921-B	Tanat	596.00	608.00	673.00
15¼	6	36½	1	1810	914-C	Tixap	681.00	693.00	758.00	921-C	Tapom	616.00	628.00	693.00
16¼	6	34	1	2165	917-C	Lapin	763.00	775.00	840.00	923-C	Pirel	688.00	700.00	765.00
16¼	8	58	1	2325	917-E	Larag	807.00	819.00	884.00	923-E	Pabit	732.00	744.00	809.00

‡"Workshop" Lathes supplied with Start-Stop Reversing A.C. Motor (1-Ph., 60-Cy., 110 V.).
*If Start-Stop Reversing Motor is desired, deduct $12.00 from price of 3-Phase, 60-Cycle Motor Driven Lathe.



(Patented)
Fig. 94. Cat. No. 113-B, 13″x5′ Underneath Belt Motor Driven Quick Change Gear Lathe, With Chip Pan, $682.00 Less Chip Pan.....$651.00

South Bend Underneath Belt Motor Driven Lathes

Quick Change Gear and Standard Change Gear Precision Lathes

The South Bend Underneath Belt Motor Driven Lathe is a compact, self-contained unit with a powerful and efficient motor drive fully enclosed within the cabinet leg under the headstock. It has the accuracy and precision for general machine work, screw thread cutting and for doing the finest class of tool work.

Regular Equipment consists of: Large face plate*; small face plate; tool post; thread cutting stop*; two 60° lathe centers; spindle sleeve; change gears with Standard Change Gear Lathes; wrenches; lag screws; washers; installation plan and book, "How to Run a Lathe." *Not supplied for 9-inch Junior Lathes, prices on request.

Electrical Equipment consists of: Motor drive mechanism mounted in cabinet leg under headstock; instant reversing motor; drum reversing switch; wiring enclosed in metal conduit; V-belts, motor to drive pulley; double ply flat leather belt and wiring diagram blue print.

LATHE FEATURES

Back-geared headstock:
Gives 6 spindle speeds on 9″ and 11″ Lathes.
Gives 8 spindle speeds on 13″ to 16″ Lathes.
Automatic cross feed, automatic longitudinal feed.
Hollow spindle made of special carbon steel.
Phosphor bronze bearings for headstock spindle.
Graduated compound rest swivels to any angle.
Tailstock has set-over for taper turning.
Micrometer graduated collar on cross feed and compound rest feed screws.

Specifications of South Bend Lathes, 9-inch to 16-inch Swing, inclusive

Specifications of Lathes	9-in. Lathe	11-in. Lathe	13-in. Lathe	15-in. Lathe	16-in. Lathe
Swing over bed	9 1/4 in.	11 1/8 in.	13 1/4 in.	15 1/4 in.	16 1/4 in.
Swing over carriage	5 11/16 in.	7 in.	8 1/4 in.	10 7/8 in.	11 1/8 in.
Hole through spindle	3/4 in.	7/8 in.	1 in.	1 1/8 in.	1 3/8 in.
Spindle speed range R.P.M. (Motor Driven)	41-638	36-548	29-646	20-574	18-592
Spindle nose diam. and threads	1 1/2″—8	1 5/8″—8	1 7/8″—8	2 1/4″—6	2 3/8″—6
Lathe centers, Morse taper	No. 2	No. 2	No. 3	No. 3	No. 3
Lead screw Acme thread, diam. and threads	3/4″—8	7/8″—8	1″—6	1 1/8″—6	1 1/8″—6
Screw thread cutting range (Standard Change)	4 to 40	4 to 40	2 to 40	2 to 40	2 to 40
Screw thread cutting range (Quick Change)	2 to 112	2 to 112	2 to 112	2 to 112	2 to 112
Angular travel compound rest top	2 in.	2 5/8 in.	3 1/4 in.	3 1/2 in.	4 3/8 in.
Tool cross slide travel	7 in.	8 in.	9 in.	8 5/8 in.	10 in.
Size of motor used	1/4 H.P.	1/2 H.P.	3/4 H.P.	1 H.P.	1 H.P.
Power to reduce steel shaft in one cut	3/8 in.	1/2 in.	5/8 in.	11/16 in.	3/4 in.

Features of Underneath Belt Motor Drive Lathe

Applying to All Sizes of South Bend Underneath Belt Motor Drive Lathes

Drive Mechanism enclosed within cabinet leg.
Spindle cone pulley completely enclosed.
Underneath belt drive to lathe spindle.
"V" driving belts from motor.
No overhead obstructions—clear vision.
No exposed belts, pulleys or gears.
Silent, powerful and efficient in operation.
Independent adjustments for belt tension.
Safety devices on working units.
Increased Power and efficiency.

The Underneath Belt Motor Drive Lathe is new in design, modern in appearance, powerful and noiseless in operation. Motor and drive mechanism are completely enclosed within the cabinet leg under the headstock. A cover on the headstock encloses the spindle cone pulley.

The General Construction and Design of the Underneath Belt Motor Drive is the same for all sizes of South Bend Lathes, 9-inch to 16-inch swing, inclusive, varying only in dimensions, etc., for each size lathe.

Powerful and Efficient in Operation. Smooth, even power is transmitted by direct belt drive to the headstock cone pulley. Multiple V-belts supply the power from motor to the lower drive cone pulley. There are no exposed belts, pulleys or gears. This modern method of driving the lathe spindle is quiet, efficient and powerful.

Permits Clear Vision. The absence of overhead obstructions provides clear vision over the entire room and permits the most efficient lighting.

The Motor and Drive Unit are mounted on a cradle which is pivoted within the cabinet leg so that the entire mechanism may be raised or lowered by means of the belt release crank on the front of the cabinet leg. The lower cone pulley shaft bearings are equipped with ring oilers with large oil wells, providing thorough lubrication.

Belt Easy to Shift. The belt release crank on the front of the cabinet leg permits shifting the belt from one step of the cone pulley to another for changing spindle speeds.

Belt Tension Adjustments are provided both for V-belts and flat leather belt.

Fig. 95. Drum Type Reversing Switch

Reversing Motor and Switch

The Underneath Belt Motor Drive Lathe is equipped with an instant reversing motor and drum reversing switch which provide for instant starting, stopping and reversing of the lathe spindle.

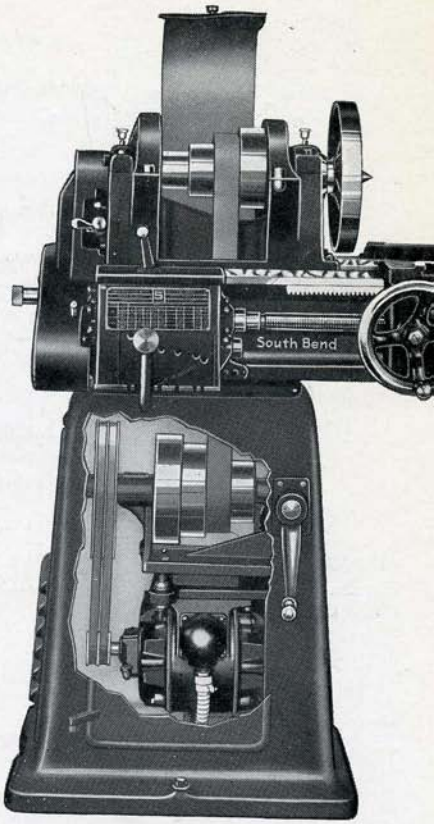


Fig. 96. Front View of Lathe with Door Cut Away. Showing Arrangement of Driving Mechanism

Net Prices of South Bend Underneath Belt Motor Drive Lathes

Prices Include Lathe Equipment, Instant Reversing Motor, Reversing Switch and Belting

Swing Over Bed Inches	Length of Bed Feet	Distance Between Centers Inches	Size of Motor H.P.	Approx. Weight Crated Pounds	Quick Change Gear Lathes					Standard Change Gear Lathes				
					Catalog Number	Code Word	3-Phase 60-Cycle A.C. Motor	1-Phase 60-Cycle A.C. Motor	Direct Current Motor	Catalog Number	Code Word	3-Phase 60-Cycle A.C. Motor	1-Phase 60-Cycle A.C. Motor	Direct Current Motor
9¼ W.S.							Not Made					Not Made		
9¼ W.S							Not Made					Not Made		
‡9¼ Jr.	3	16⅜	¼	740			Not Made			122-Y	Facir	$310.00	$325.00	$317.00
‡9¼ Jr.	4	27⅜	¼	790			Not Made			122-A	Facut	330.00	345.00	337.00
‡9¼	3	16⅜	¼	795	109-Y	Binug	$415.00	$430.00	$422.00	107-Y	Bagim	375.00	390.00	382.00
‡9¼	4	27⅜	¼	845	109-A	Bipgo	435.00	450.00	442.00	107-A	Bagos	395.00	410.00	402.00
11⅛	4	24	½	965	111-A	Bimuf	532.00	549.00	540.00	110-A	Badti	487.00	504.00	495.00
13¼	5	28	¾	1510	113-B	Becno	651.00	670.00	664.00	112-B	Bacik	596.00	615.00	609.00
13¼	6	40	¾	1560	113-C	Bedme	668.00	687 00	681.00	112-C	Bacmo	613.00	632.00	626.00
15¼	5	24½	1	1995	114-B	Bayba	769.00	809.00	851.00	121-B	Babsf	704.00	744.00	786.00
15¼	6	36½	1	2070	114-C	Bayce	789.00	829.00	871.00	121-C	Babuh	724.00	764.00	806.00
16¼	6	34	1	2300	117-C	Bapvo	869.00	909 00	951.00	123-C	Babes	794.00	834.00	876.00
16¼	8	58	1	2460	117-E	Baryo	913.00	953.00	995.00	123-E	Babiw	838.00	878.00	920.00

‡If Start-Stop Single Phase 60 cy., 110 v., Reversing Motor is desired, deduct $16.00 from price of 3-phase 60 cy. motor.

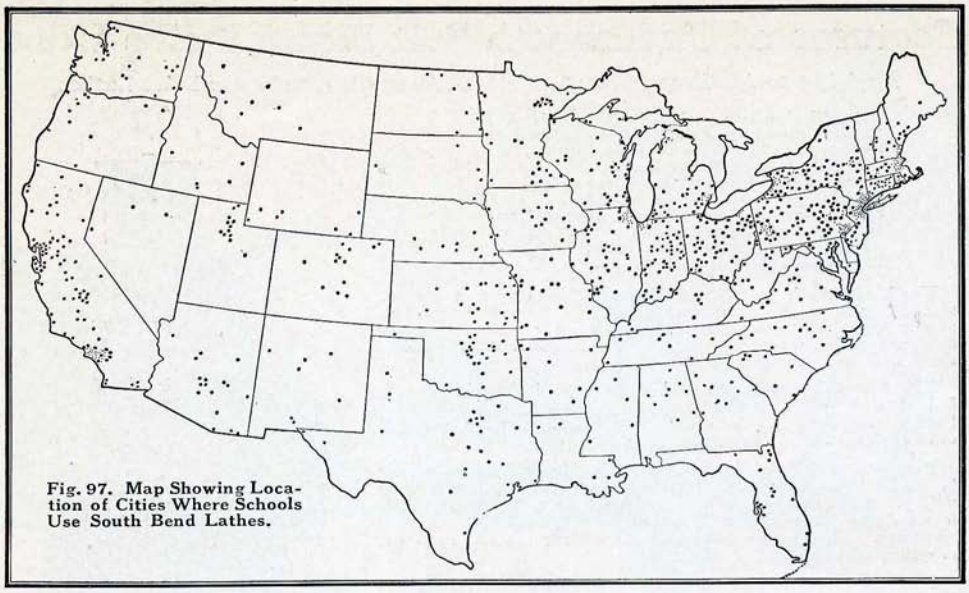


Fig. 97. Map Showing Location of Cities Where Schools Use South Bend Lathes.

Partial List of Cities Where Schools Are Using South Bend Lathes

ALABAMA
Alburn
Anniston
Auburn
Birmingham
East Lake
Gadsden
Huntsville
Mobile
Tuscaloosa
University

ARIZONA
Bisbee
Casagrande
Clarksdale
Douglas
Florence
Glendale
Globe
Holbrook
Mesa
Miami
Morenci
Nogales
Prescott
Scottsdale
Tempe
Tucson
Valentine

ARKANSAS
Arkadelphia
Fayetteville
Fort Smith
Jonesboro
Monticello
Russellville
Siloam Springs

CALIFORNIA
Alameda
Anaheim
Angwin
Alhambra
Bakersfield
Benicia
Berkeley
Beverly Hills
Bishop
Brentwood
Burbank
Calexico
Carmel
Centerville
Ceres
Chico
Claremont
Coalinga
Compton
Corning
Coronado
Covelo
Covina
Crescent City
Crockett
Daly City
Davis
Deep Spring
Delano
Downey
Dunsmuir
Eagle Rock
El Centro
El Monte
Eureka
Exeter
Fairfield
Ferndale
Fortuna
Fresno
Fullerton
Gardena
Glendale
Gridley
Hanford
Hemet
Hilmar
Hollywood
Holtville
Huntington Beach
Huntington Park
Inglewood
Kentfield
Lancaster
Laverne
Lawndale
LeGrand
Lindsay
Lodi
Long Beach
Los Angeles
Los Gatos
Madera
Martinez
Marysville
Merced
Mill Valley
Miranda
Modesto
Monrovia
Moor Park
North Hollywood
North Long Beach
Norwalk
Oakland
Oceanside
Ontario
Orange
Orosi
Oroville
Pacific Grove
Palo Alto
Pasadena
Pittsburg
Placerville
Pomona
Porterville
Portola
Puente
Red Bluff
Redondo Beach
Redding
Reedley
Richmond
Riverside
Roseville
Sacramento
San Andreas
San Bernardino
San Diego
San Dimas
San Francisco
Sanger
San Jose
San Luis Obispo
San Mateo
San Rafael
Santa Ana
Santa Barbara
Santa Clara
Santa Cruz
Santa Maria
Santa Monica
Santa Paula
Sebastopol
Sonoma
South Pasadena
Stanford University
Stockton
Strathmore
Sutter
Taft
Tehachapi
Torrance
Tracy
Tranquillity
Tulare
Vallejo
Venice
Visalia
Wasco
Whittier
Winnemucca
Woodland

COLORADO
Boulder
Colorado Springs
Denver
Fleming
Florence
Fort Collins
Greeley
Gypsum
Louisville
Pueblo
Salida
Sterling

CONNECTICUT
Ansonia
Bridgeport
Danbury
Bristol
Greenwich
Hamden
Hartford
Manchester
Mansfield
Meriden
Middletown
New Britain
New Haven
Newington
New London
Norwalk
Norwich
Putnam
Rockville
South Manchester
Stamford
Torrington
Waterbury
West Haven
Willimantic

DELAWARE
Claymont
Newark
Smyrna
Wilmington

DISTRICT OF COLUMBIA
Georgetown, University
Washington, D.C.
Takoma Park, Washington, D.C.

FLORIDA
Clearwater
Duval
Ft. Lauderdale
Gainesville
Jacksonville
Longwood
Melbourne
Miami
Orange Park
Orlando
Palmetto
Punta Gorda
St. Petersburg
Tampa
Winter Park

GEORGIA
Atlanta
Athens
Augusta
Columbus
Macon
Crawfordville
Monroe
Rome

IDAHO
Boise
Hazelton
Moscow
Pocatello
Rexburg
Twin Falls

ILLINOIS
Alton
Argo
Bloomington
Blue Island
Calumet City
Centralia
Champaign
Charleston
Chicago
Chicago Heights
Cicero
Collinsville
Danville
Decatur
DeKalb
Des Plaines
Dundee
East Moline
East Peoria
East St. Louis
Elgin
Elmhurst
Elsah
Evanston
Freeport
Galesburg
Geneva
Gillespie
Granite City
Henry
Highland Park
Jacksonville
Joliet
LaGrange
Lake Forest
Litchfield
Lockport
Macomb
Martinsville
Maywood
Moline
Mt. Pulaski
Normal
Northbrook
Oak Park
Ottawa
Pekin
Peoria
Quincy
Rock Island
Sherrard
Springfield
St. Charles
Sterling
Streator
Taylorville
Urbana
Waukegan
Wheaton
Winnetka
Woodstock

INDIANA
Alexandria
Anderson
Angola
Bloomington
Brazil
Cambridge City
Columbus
Crawfordsville
Culver
Danville
East Chicago
Elkhart
Elwood
Evansville
Fort Wayne
Frankfort
Franklin
Gary
Gas City
Greencastle
Griffith
Hagerstown
Indianapolis
Kokomo
Lafayette
Lakeville
LaPorte
Logansport
Marion
Michigan City
Mishawaka
Mitchell
Muncie
New Albany
Notre Dame
North Manchester
Oakland City
Orleans
Petersburg
Peru
Plainfield
Portland
Roseland
Richmond
Rushville
St. Meinrad
Shelbyville
Shelburn
South Bend
Southport
Terre Haute
Valparaiso
Wabash
Whiting
Winona Lake

IOWA
Altoona
Ames
Cedar Falls
Cedar Rapids
Charles City
Council Bluffs
Davenport
Eldora
Fort Dodge
Iowa City
Marshalltown
Mt. Pleasant
Newton
Sioux City

KANSAS
Altamont
Chanute
Dodge City
El Dorado
Emporia
Fort Leavenworth
Fort Riley
Hays
Hutchinson
Independence
Kansas City
Lawrence
Manhattan
Newton
Ottawa
Parsons
Pittsburg
Salina
Topeka
Wichita
Winfield

KENTUCKY
Berea
Lexington
Louisville
Murray
Paducah
Richmond
Somerset
Winchester

LOUISIANA
Bogalusa
Convent
New Orleans
Ruston
Shreveport

MAINE
Brunswick
Gorham
Lewiston
Livermore Falls
Northeast Harbor
Orono
Portland
Westbrook

MARYLAND
Annapolis
Baltimore
Catonsville
College Park
Cresaptown
Cumberland
Frederick
Frostburg
Glenburnie
Hagerstown
Loch Raven
Reisterstown
Salisbury

MASSACHUSETTS
Amherst
Andover
Belmont
Beverly
Boston
Brighton
Brockton
Cambridge
Charlestown
Chicopee
Concord

Partial List of Cities Where Schools Are Using South Bend Lathes—Continued

Danvers
East Boston
Falmouth
Fall River
Fitchburg
Harvard
Haverhill
Hyannis
Hyde Park
Lawrence
Lexington
Lowell
Lynn
Medford
Methuen
Milton
New Bedford
New Salem
Northampton
Pittsfield
Reading
Quincy
Salem
Somerville
Springfield
Watertown
Waltham
Wellseley
Westfield
Weston
Williamstown
Whitinsville
Worcester

MICHIGAN
Ann Arbor
Adrian
Albion
Battle Creek
Bay City
Benton Harbor
Berrien Springs
Birmingham
Buchanan
Dearborn
Detroit
East Jordan
Ferndale
East Lansing
Flint
Grand Rapids
Grosse Pointe
Hamtramck
Highland Park
Houghton
Imlay City
Ironwood
Ishpeming
Jackson
Kalamazoo
Lake Linden
Lansing
Manistee
Manistique
Muskegon
Marquette
Mt. Clemens
Negaunee
Niles
Northville
Olivet
Owosso
Paw Paw
Petoskey
Pontiac
Port Huron
Quinnesec
Royal Oak
Saginaw
St. Joseph
Sturgis
Three Rivers
Traverse City
Wakefield
Ypsilanti

MINNESOTA
Albert Lea
Austin
Biwabik
Breckenridge
Buhl
Chisholm
Collegeville
Crookston
Detroit Lakes
Duluth
Ely
Eveleth
Faribault
Gilbert
Hibbing
Keewatin
Kenyon
Minneapolis
Moorhead
Morris
Mountain Iron
Mountain Lake
Nashwauk
Northfield
Owatonna
Pipestone
Rochester
St. Cloud
St. Paul
Steelton
Virginia
Winona

MISSISSIPPI
A. & M. College
Agricultural College
Cleveland
Institute
Lorman
Meridian
Oxford
State College
University

MISSOURI
Boonville
Carthage
Columbia
Crystal City
Flat River
Hollister
Joplin
Kansas City
Kirksville
Mexico
North Kansas City
Parkville
Rolla
St. Louis
Sedalia
University City
Warrensburg

MONTANA
Billings
Butte
Great Falls
Harlowton
Helena
Kalispell
Missoula
Phillipsburg
Polytechnic

NEBRASKA
Beatrice
Columbus
Curtis
Gibbon
Grand Island
Hastings
Lincoln
North Platte
Omaha
Peru

NEVADA
Elko
Reno
Stewart
Winnemucca

NEW HAMPSHIRE
Berlin
Claremont
Concord
Dover
Durham
Exeter
Hanover
Keene
Laconia
Lebanon
Penacook
Portsmouth
Somersworth

NEW JERSEY
Atlantic City
Audubon
Bayonne
Bernardsville
Bloomfield
Bordentown
Bridgeton
Dumont
East Orange
East Rutherford
Elizabeth
Englewood
Glassboro
Glen Ridge
Hawthorne
High Bridge
Hoboken
Irvington
Jersey City
Kearny
Linden
Lyndhurst
Montclair
Morristown
Mountain Lakes
Newark
New Brunswick
Ocean City
Passaic
Paterson
Perth Amboy
Plainfield
Pompton Lakes
Point Pleasant Beach
Princeton
Rahway
Red Bank
Salem
Somerville
South Orange & Maplewood
Summit
Tenafly
Trenton
Unionbury
Ventuor City
Verona
Westfield
Westwood
Wilwood Crest

NEW MEXICO
Albuquerque
Fort Wingate
Las Cruces
Las Vegas
Los Lunas
Mesilla Park
Roswell
State College

NEW YORK
Akron
Albany
Albion
Alfred
Amsterdam
Attica
Auburn
Baldwin
Ballston Spa
Batavia
Bay Shore
Bayside
Bergen
Binghamton
Blasdall
Brockport
Bronx, NYC
Bronxville
Brooklyn
Buffalo
Canandaigua
Canton
Chappaqua
Cheektowaga
Clarence
Clinton
Cobleskill
Cold Spring Harbor, L. I.
College Point, L. I.
Cooperstown
Corning
Cornwall
Croton-on-Hudson
Dansville
Delmar
Depew
Dobbs Ferry
Dunkirk
East Buffalo
Endicott
Fairport
Farmingdale, L. I.
Far Rockaway, L. I.
Floral Park
Freeport, L. I.
Fulton
Garden City, L. I.
Geneseo
Glen Cove
Glenville-Scotia
Great Neck
Gowanda
Greene
Green Island
Hancock
Hastings-upon-Hudson
Houghton
Hudson
Hudson Falls
Islip
Ilion
Ithaca
Jamestown
Kenmore
Kingston
Lackawanna
Lawrence
Little Falls
Lockport
Long Island City
Malverne
Manhassett, L. I.
Manhattan
Marathon
Massena
Mechanicsville
Medina
Mount Vernon
Newark
Newburgh
New Rochelle
New York City
Niagara Falls
Oakfield
Oceanside
Olean
Oneonta
Ossinning
Oswego
Oyster Bay
Painted Post
Palmyra
Patchogue
Pearl River
Pelham
Penn Yan
Perry
Plattsburgh
Pleasantville
Port Jervis
Port Washington
Potsdam
Poughkeepsie
Randolph
Richmond Hill
Rochester
Rockville Centre
Rome, N. Y.
Rye
Salamanca
Saratoga Springs
Scarsdale
Schenectady
Scotia
Silver Creek
Solvay
Southampton
Sparkill
Spring Valley
Suffern
Syracuse
Tarrytown
Tonawanda
Troy
Tuckahoe
Utica
Valley Stream
Verbank
Warsaw
Waterford
Watertown
Waverly
West Coxsackie
Westfield
Westhampton Beach
West Point
Whitehall
White Plains
Woodlawn
Woodstock
Yonkers

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Chapel Hill
Charlotte
Durham
Greensboro
Greenville
Kenansville
Lenoir
Morganton
Raleigh
Roanoke Rapids
Rocky Mount
Smithfield
Waynesville
Winston-Salem

NORTH DAKOTA
Belcourt
Bottineau
Devils Lake
Ellendale
Fargo
Grand Forks
Park River
Valley City
Walpeton

OHIO
Akron
Alliance
Athens
Bellefontaine
Bellevue
Bexley
Bowling Green
Bucyrus
Canton
Chillicothe
Cincinnati
Cleveland
Columbus
Dayton
Defiance
Delaware
East Cleveland
Fairport Harbor
Fremont
Gambier
Glouster
Grove City
Hamilton
Hiram
Ironton
Lakewood
Leavittsburg
Lima
Lorain
Loudonville
Lowellville
Mansfield
Middletown
Newark
Oberlin
Oxford
Perrysburg
Piqua
Portsmouth
Rittman
St. Clairsville
Sandusky
S. Euclid
Struthers
Springfield
Sidney
Sylvania
Toledo
Van Wert
Wapakoneta
Warren
Wilberforce
Wyoming
Yellow Springs
Youngstown

OKLAHOMA
Ada
Bristow
Claremore
Coyle
Edmond
Enid
Fort Sill
Goodwell
Guthrie
Jenks
Langston
Muskogee
Norman
Oklahoma City
Okmulgee
Ponca City
Sand Springs
Shawnee
Stillwater
Tishomingo
Tonkawa
Tulsa
Wilburton

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Bend
Corvallis
Eugene
Klamath Falls
Lostine
Marshfield
Pendleton
Portland
Salem
Tillamook
West Linn

PENNSYLVANIA
Aliquippa
Alexandria
Allentown
Altoona
Ambridge
Ardmore
Arnold
Avondale
Bangor
Beaver Falls
Bethlehem
Bloomsburg
Brackenridge
Braddock
Bradford
Butler
California
Castle Shannon
Carlisle Barracks
Chambersburg
Chester
Cheyney
Clifton Heights
Conemaugh
Corry
Donora
DuBois
Duke Center
Economy
Eddystone
Edgewood
Elizabethtown
Elkins Park
Ellsworth
Ellwood City
Erie
Essington
Folsom
Frankford
Greensburg
Greenville
Grove City
Harrisburg
Hazleton
Haverford
Hershey
Heckscherville
Homestead
Huntingdon
Johnstown
Kennett Square
Kingston
Lancaster
Lansdale
Lebanon
Lehighton
Lemont
Lewisburg
Lewistown
Lock Haven
Locust Gap
Mansfield
McKeesport
Mechanicsburg
Midland
Millersburg
Millersville
Minersville
Monessen
Mt. Union
Naomi Pines
New Castle
NewKensington
Norristown
North Braddock
North East
Overbrook
Philadelphia
Phoenixville
Pocono Summit
Polk
Pottstown
Pottsville
Reading
Reinerton
Ridgway
St. Mary's
Scotland
Scranton
Sharon Hill
Sharpsburg
South Williamsport
State College
Stroudsburg
Sunbury
Summit Hill
Swarthmore
Tamaqua
Tarentum
Temple
Tower City
Trevorton
Turtle Creek
Upper Darby
Villanova
Wayne
West Chester
Wilkes-Barre
Wilkinsburg
Williamsport
Woodlawn
York

SOUTH DAKOTA
Aberdeen
Brookings
Deadwood
Flandreau
Lead
Yankton

TENNESSEE
Chattanooga
Cookeville
Knoxville
Madison
Martin
Memphis
Murfreesboro
Nashville

TEXAS
Alpine
Arlington
Austin
Borger
Canyon
College Sta.
Commerce
Dallas
Danbury
Denton
El Paso
Forsan
Fort Worth
Galveston
Gatesville
Georgetown
Gladewater
Houston
Huntsville
Kingsville
Lubbock
Marlin
Port Arthur
Prairie View
San Antonio
Stephenville
Victoria
Waxahachie

UTAH
Bingham Canyon
Brigham City
Kaysville
Logan
Morgan
Murray
Ogden
Price
Provo
Richmond
Salt Lake City
Sandy
Tooele

VERMONT
Norwich

VIRGINIA
Alexandria
Blacksburg
Bristol
Charlottesville
Covington
Crozet
East Radford
Farmville
Fort Monroe
Hampton
Harrisonburg
Hopewell
Lexington
Norfolk
Richmond
Salem
Schoolfield
Staunton
Sweet Briar

WASHINGTON
Aberdeen
Altonville
Bellingham
Cheney
Ellensburg
Demming
Everett
Friday Harbor
Kent
Longview
Medical Lake
Pullman
Puyallup
Seattle
Spokane
Tacoma
Vancouver
Walla Walla
Wenatchee
Winslow
Yakima

WEST VIRGINIA
Buckhannon
Charleston
Fairmont
Grafton
Huntington
Institute
Lost Creek
Montgomery
Morgantown
Parkersburg
Stoesbury
Warwood
Wheeling

WISCONSIN
Appleton
Beaver Dam
Beloit
Chippewa Falls
Cudahy
Eau Claire
Fondulac
Green Bay
Janesville
Kaukauna
LaCrosse
Madison
Manitowoc
Marinette
Menasha
Menomonie
Merrill
Milwaukee
Oshkosh
Plymouth
Platteville
Racine
Rhinelander
Sheboygan
South Milwaukee
Stevens Point
Stoughton
Superior
Two Rivers
Waukesha
West Allis
Wisconsin Dells
Wisconsin Rapids

WYOMING
Cheyenne
Kemmerer
Evanston
Laramie
Rock Springs
Superior
Torrington

SOUTH BEND LATHE WORKS
460 Niles Avenue, SOUTH BEND, INDIANA, U. S. A.

RXOM—1-4-37—C5443

Printed in U.S.A.

SOUTH BEND LATHE WORKS

460 Niles Avenue

SOUTH BEND, INDIANA, U. S. A.