1942

Study of defense training in Hartford, Connecticut.

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Knowlton - 1942

STUDY OF DEFENSE TRAINING IN HARTFORD CONNECTICUT

by

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A PROBLEM SUBMITTED AS PARTIAL FULFILLMENT FOR

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CHAPTER I

INTRODUCTION

In 1939 a group of manufacturers asked the State Government to help them find employable men and women. With the large group of unemployed people living in and around Connecticut it seemed impossible that employers were without workers.

Committees were set up to investigate the possibility of training groups to meet the needs of Industry. It was found a workable plan to use the State Trade Schools during their off hours, to train the needed workers. This plan was based upon 200 hours training for those who were found to have some mechanical ability. The training consisted of a General Machine Shop course.

Job Training has been under way in Connecticut since November 1939. Originally sponsored by Governor Raymond E. Baldwin as an effort to solve the state's unemployment problem, and the first program of it's sort to be launched not by the Government, but by public-spirited private business men and manufacturers with the State Government's cooperation, the present national defense emergency with it's crying need for trained workers has catapulted Job Training.

What is Job Training? This plan for training workers is not a Government Project. It is based upon the American principle of community thought and community action the three hundred year old tradition. Since earliest times, "The Armory of the Nation, Connecticut" has supplied arms, munitions and supplies to the country in times of need. Washington's armies were supplied with guns and ammunition from this state.

The Connecticut General Assembly, on March 30, 1939, adopted an act authorizing the Governor to appoint a commission to study employment. This commission, headed by Carl A. Gray, of Farmington Connecticut, through whose efforts and under whose sponsorship "Job Training" has been evolved. Mr. Gray serves without pay.

The local situation must be taken into consideration in every phase of this work. It's for the localized, specialized industries that this plan was inaugurated.

The shortage of skilled help in the local plants and our large unemployment lists made this plan possible.

The State Commission set up a state employment agency, which registered all unemployed people in the state. If an actual head count is impractical, this survey may be made on a statistical basis, using commonly employed and accepted cross-sectional methods. This has been the proceedure used by the commission.

To obtain the complete picture, this survey is broken down into occupational groups, first for the State as a whole, then by individual localities.

While registrations at State employment offices do not necessarily reflect accurately the total unemployment, nevertheless they supply a valuable cross section. From this cross section as a base, additional statistics, as highly localized as may be necessary, may be built up.

The Connecticut survey shows the problem of "Youth" and the "Skill-Rusty" older worker. It was found that of the employable unemployed, approximately one-third are young men and young women between the ages of 16 and 25; untrained and inexperienced, few of whom, indeed, have ever held a "real" job in their lives.

The Owen D. Young Commission made public a report confirming Connecticut's findings and stating the figure to be 33 1/3% of unemployed youth.

Another 33 1/3% were found to be the "Skill-Rusty"

workers, older people formerly employed, but now without work.

Each local committee, then makes a local survey. This is a group of diversified citizens from all types of business including manufacturing, industrial and commercial fields, members of civic groups, members of the American Legion, members of labor organizations, members of educational boards and members of the State Employment Services. As many sub-committees of this committee as are necessary for the community are made up. Because the needs of one community vary from the needs of another, no set plan is insisted upon other than this general outline.

The chairman of the local committees serve on a State Advisory Council which also includes the Commissioner of the State Board of Education, the Director of the State Employment Service, the Commissioner of the Department of Labor, the president of the State Manufacturers' Assoc. representatives of labor, the chairman of the State Development Commission, executive vice-president of the State Chamber of Commerce, Commissioner of State Welfare and the chairman of the State Apprenticeship Council.

Figures as to local employables, as compiled by the local committee in each locality, include age, sex, occupation and previous experience of each individual. Employables are grouped by major industrial classifications such as manufacturing, construction and trade. The

industrial group shows the number of skilled, semi-skilled, unskilled, inexperienced youth, professional, technical, supervisory, sales persons, clerical, rehabilitation and retraining cases and unemployables. The breakdown in classification shows that employables are of all types and not from one group. We are too inclined to the premise all employables can be absorbed by the manufacturers and that all have had manufacturing experience, which is not true. In Connecticut less than 42% of the unemployed have had some previous manufacturing experience - the balance come from other fields. Therefore, the responsibility for re-employment should not rest entirely on the shoulders of the manufacturers.

The formation of a Fact Finding Committee, Job Analysis Committee, Public Relations Committee, Finance Committee, and Job-Training Committee may be of assistance to the local committee. The administration of the various committees can be carried out through the existing facilities and personnel of local organizations - industrial, commercial, charitable, municipal, civic, the State Employment Service, American Legion or whatever the local community has in the way of organizations.

After receiving the general breakdown of employables for their locality the Fact Finding Committee makes a further analysis of individual aptitudes. In this way they know what the abilities and backgrounds of the

individuals are.

The Job Analysis Committee makes a study of the employment requirements of the community. It analyses the needs of local industry, dovetailing industrial, agricultural and general business requirements, thus obtaining a complete and detailed picture of current and anticipated demands for workers. Public relations committee carries the responsibility for utilizing every appropriate media of publicity and for interpreting the work of the local committee to employer, employees and the unemployed rests upon this committee. It is their function to interpret the value of jobs in industry, to show parents the value of preparation for useful jobs. For example, the interpretation of the white collar job versus the job in the shop; the fact that the management selects its foremen, superintendents, plant managers, etc., from the men who know tools who are trained to work with hands as well as head. Too often parents and particularly those who have worked in shops themselves are ambitious to have sons and daughters, who have completed high school and even college, immediately jump into a white collar job in preference to jobs that will give fundamentals and a basic training.

The Job-Training Committee is a sub-committee that sets up the course of study job-training. In many instances, the local committee as a whole may wish to take over this

function. However, it will be found practical to set up a sub-committee of a few qualified members that will be able to work directly with local industry and the local and State school authorities in setting up and administering a curriculum.

A sub-committee also on finance may be set up where local conditions are such as to necessitate community efforts to raise funds.

"Job-Training", by which is meant, in its broad sense, vocational training, is no new thing, although, by many educators it perhaps too long has been considered the step-child, the ugly duckling of our educational system.

The secondary schools have recognized in a small way the need for vocational education in the development of commercial courses but these commercial courses have been in one or two specific fields. For example, anyone who hires a secretary expects that she already knows how to take shorthand and knows how to type. By the same reasoning, training in other vocations should be given in the schools which would allow students to have sufficient knowledge and ability to qualify them as beginners in various industrial and commercial pursuits. This has been recognized in Connecticut in its State Trade School system. The need, however, continues greater than the provision. Eighty per cent of our high school graduates go directly

to jobs (if they can find them); only 20 per cent continue on into college.

Jobs of educators and jobs of industrialists are quite similar in several important respects. The educators and industrialists are required to take certain raw material with which to work, according to prescribed formula. They both produce a product which must have a market or there will be no sale. However, the industrialist as a rule analyze their market for his product before he goes into production. By the same reasoning those in the educational field should analyze their markets (job-analysis, job turn-over) in order so to shape their curricula that students upon graduation can be sold. If a community is made up of industrial concerns, industrial jobs will predominate; if it is a farming community, farm jobs predominate; if it is a combination of manufacturing, commercial, merchandising and farms, banks and insurance companies, all the fields must be carefully studied to meet the community requirements.

Both manufacturers and educators use raw material supplied by others over whom they have no control. But there is one important difference, namely, that the manufacturer can reject the raw material supplies if it fails to meet rigid specifications. Having accepted the raw material, the educator, like the manufacturer, processes it: the educator according to a prescribed curriculum, the manufacturer according to prescribed operation sheets

or engineering specifications. In this phase of the process the experience and problems of the manufacturer are in some measure simpler and more definite than those of the educator. The manufacturer is using raw material of his own selection, with machines and appliances of known and standardized effect; the educator is dealing with the infinite variety of human material, using books and theories, always with a wide margin for speculation as to their probable effectiveness.

A possible weakness in the tools used by the schools is the lack of sharpening them to meet current conditions in a changing world. (The dies used in the Model T Ford are perhaps now on the junk pile or in the Smithsonian Institute). Having passed through the early stages in education and manufacturing the same finished product is now ready for the final touches or, to use a manufacturing term, the assembly line. In the education field then comes the final line of progression, the final examinations and graduation; in the manufacturing field the final inspection and testing. The product is then ready for market or for a life work of usefulness and service. The next problem is to get the product into the hands of the ultimate users and here is where the paths of the educator and industrialist diverge.

The educator then declares to the world, "Here they are" and on a given day in June turns out hundreds or

or thousands of a finished human product, stating that all has been done that can be done for them. The educators then say to the world, "They are yours now to do with as you will, to take and use and develop and make into leaders of men if you can. If they don't fit, if they are not prepared for the American way of life, that is their misfortune, but we must carry on with a new class, so the community, the parents, the employers, the taxpayers must worry about this class from now on". If the educator's product is not acceptable, still he carries on, producing more misfits. In manufacturing if one does not sell the product successfully the manufacturer is wrong and is eventually forced out of business unless he revamps the product to meet the demand.

It is necessary for those in the educational field to work in close harmony with business and industrial leaders in their communities. The educator should know the needs of the users of his product; thereby he is enabled to plan his educational program, the processing of the product, to meet those requirements.

This, the planning of an educational program exactly to meet the specific requirements of a known demand for workers, is the heart of Job-Training.

JOB-TRAINING is based upon specific training, highly intensified, upon specific machines in connection with which a known local demand, current or expected for workers

exists. Such training may apply all the way from the heavy machine tool worker to the girl being trained for needle-work. In Connecticut, job training classes have been set up in Bridgeport for airplane riveters, in Hartford for filers on machine guns, in Manchester for sewing machine operators, in Meriden and Hartford, Bridgeport and New London, Manchester, Ansonia, Bristol, Willimantic and other centers for general training on machines in use in common machine shop practice.

In each community, the local committee organizes the job training school. In this it has the cooperation of the State Department of Education, the local Board of Education, and other State and local authorities.

The objectives of training are to familiarize the trainee with measuring tools, simple blueprint reading, and to furnish some experience on machines, the idea being not to develop skills so much as to develop an appreciation of the necessity for accuracy.

The selection of the trainees is placed in the hands of the State Employment Service. All applicants are interviewed by this service and tests are given in addition to surveying the trainee's previous school and employment record.

When the trainee enters the school, he is given a sheet of instructions, This sheet specifically advises

the trainee that the completion of this course does not guarantee him a job.*

THE HARTFORD SCHOOLS**

In setting up a job-training school, all one needs is the will to act. The first job-training school was set up in Hartford in four days. The first step was to call upon the manufacturers who are members of the local committee to donate instructors, which they willingly did and paid for. These men were practical men right from shop floors. The second step was to get in touch with Dr. Alonzo Grace, State Commissioner of Education, and Mr. A. S. Boynton, the State Vocational Director in charge of Trade Schools. The third step was to call a meeting of the instructors loaned by industry and to work out a curriculum which would give prospective students the basic training for the job openings which were known definitely to exist through job analysis.

The curriculum was set up and the next question was where to locate the school. The manufacturers offered a building and some machinery. However, because it seemed the more practical thing to do, the State Trade School in Hartford finally was decided upon. Funds were made available for this first school by Governor Baldwin from his contingent fund.

*See release application

**Hartford Public High School with 3 shops -capacity 80 trainees
Bulkeley High School 1 shop - " 40 "
Weaver High School 1 shop - " 40 "
One instructor is allowed for every ten trainees.

In order not to interfere in any way with the regular Trade School day and evening classes, the hours of the job-training school were set from 11:30 o'clock at night to 7:30 o'clock in the morning.

In the Hartford Job-training school, a 200-hour course of intensive training was set up, eight hours a night, forty hours a week. This as a basic course proved so successful that all of the other job-training schools since established in the State to give general machine shop training have patterned their curricula upon it.

The curriculum follows:

Power Saw	1 hour (s)	Bench	16 hours
Lathe	72	Cy'l. Grinder	8
Bench Lathe	4	Shaper	24
Surface Grinder	24	Miller	24
Drill Press	8	Tool Grinder	4
Internal Grinder	8		

All industries were asked to fill out the following questionnaire for the purpose of informing the committees of their status.

JOB-TRAINING SURVEY

Are you at the present time training regular apprentices in your plant? YES.....NO.....

If so, how many? .....

Are they part time trade school? YES.....NO.....

When will they have completed training? (How many in each?) 3 months.....; 6 months.....; 9 months.....; 12 months.....(etc.)

If you have not established such a plan, do you contemplate doing so? YES.....NO.....

If so, how many can you accommodate?.....

Irrespective of your answer above, have you established any course for learners or for specialized training on certain types of machines? YES.....NO.....

What are they, and how many in each?.....
.....

If you are not training a surplus for future demand, how many men could you train for the anticipated increase caused by the defense program?.....

Are you giving supplemental training to men released from the special night shift at the trade school? How many?..... Can you absorb any more?.....

Have you any space available in your factory that could be used for training purposes by the manufacturers as a group project under a group expense burden?.....

If so, have you any machinery available for this training? YES.....NO.....

What machinery?.....

If you have not the space but can lend the machinery, please indicate what types, and how many machines.
.....
.....

If you anticipate being called upon to manufacture something that will be needed in the defense program and have no physical capacity for training, what kind and how many workers do you anticipate you will need in the twelve months?.....
.....

Do you know of men available and desirable for training who have made application to your plant and whom you are not now able to accommodate? YES.....NO.....

Have you any men on your staff with instructional ability who could be spared and used under a group project of training? YES.....NO..... How Many?.....

SELECTION OF TRAINEES - DEFENSE TRAINING PROGRAM

HARTFORD, CONNECTICUT

This statement outlines the procedure by which men are selected in Hartford for defense training in a beginning machine operator's course of approximately two hundred hours. A similar procedure is in operation in most of the Connecticut cities in which defense training is conducted.

The schools operating as defense training centers do not consider direct applications for training. All trainees are selected and placed by the State Employment Service.

The selective procedure includes the following three phases:

1. Preliminary screening of applicants by the State Employment Service.

2. Mechanical aptitude testing of applicants by the Employment Service interviewers.

3. Approval of applicants for training by prospective employers.

Preliminary Screening

From all applicants for defense training, the State Employment Service chooses for their further consideration those who apparently meet the known but varying requirements of the local employers in defense industries. Such requirements may include citizenship, age, height, weight,

education, experience in related occupations, apparent mental alertness, probable physical vitality or stamina, personality traits, and so forth.

Mechanical Aptitude Testing

The men accepted for further consideration are scheduled by the State Employment Service for mechanical aptitude testing. In Hartford, and three other Connecticut cities, the tests are given by the Adult Guidance Service. (Some branch offices of the State Employment Service, in cities which do not have Adult Guidance Services, administer their own mechanical aptitude testing programs.)

All men referred to the Adult Guidance Service, to be tested for enrollment in defense training schools, are given a battery of three mechanical aptitude tests. These are the Detroit Mechanical Aptitude Examination, the MacQuarrie Test for Mechanical Ability, and the Revised Minnesota Paper Form Board Test. In computing the examinee's composite percentile rank in mechanical aptitude, the above tests are given weights of 5, 3, and 3 in the order named.

The results of the tests are reported to the State Employment Service. The report on each individual gives his percentile rank on each test, and the quartile in which he ranks as shown by his composite percentile rank. Men who stand in the two upper quartiles, (or above the median composite percentile rank) are considered to have "passed".

For those who may not be familiar with the tests used, perhaps it should be stated that they are presumed to measure primarily the individual's innate mechanical aptitude or capacity (sometimes defined as general mechanical intelligence), and not mechanical ability based on experience. In other words, trade tests measuring the degree of acquired mechanical ability are not used in this program, as men having such skills do not need the "pre-employment" type of beginning training with which this selective procedure is concerned.

Incidentally, the Adult Guidance Service is jointly sponsored by the Works Progress Administration, the State Department of Education, and the Hartford Board of Education. The W. P. A. pays the salaries of the staff, but has delegated supervision of the staff and program to the State Department of Education. The Hartford Board of Education provides housing and supplies.

Such of the mechanical aptitude tests given by the Adult Guidance Service as are used for selecting men for defense training, are purchased from Federal Defense Training funds allocated to the Hartford Board of Education. The Hartford Board also supplements the W. P. A. staff with three test scorers and clerks paid from federal defense training funds.

Approval of Applicants by Prospective Employers

Applicants for defense training who have been screened

by the Employment Service as probably acceptable, and who have then "passed" the mechanical aptitude tests, are next sent to one or more employment managers of local defense industries for approval. Only one approval is required. If necessary, an applicant will be sent to as many as four different employment managers, in search of one who will approve him, before he is rejected for training. When an applicant favorably impresses an employment manager, the company gives him a physical examination.

It is understood that a company's approval for training does not constitute a promise to hire the individual when he has completed the training. In practice most "graduates" are employed by the companies which approved them. However, if the original approving company does not happen to need a man when he completes his training, placement in another local company is assured.

The names of applicants who have been approved by an employment manager are placed on a waiting list for training. Whenever a trainee completes his training he is certified for placement to the Employment Service which then fills the vacancy in the training center from its waiting list of approved applicants.

CHAPTER II

Course of Study - Training Center

This is the application all trainees fill out upon arrival at a training center.

(Last name) (First name) (Middle name)

(1) PRINT YOUR NAME AND ADDRESS

(2) Where do you live now? (Check one)
(a) On a farm or in a place of less than 2,500 .
(b) In a place of 2,500 or more . . . . .
(c) In a CCC camp . . . . . .

(3) Local address

(4) Telephone No.

(5) Race and sex — *Male* / *Female*
White / Negro / Other

(6) Marital status
Single / Married / Other

(7) Home address, if different from (3)

(8) Name and address of public employment office with which registered

Where were you born?
(9) City or town | (10) State or country

(11) How old were you on your last birthday?

Nationality of
(12) Father | (13) Mother

(14) Social Security number

If of foreign birth, answer the following: (15) How long have you lived in the United States? ____ years
(16) Are you a naturalized citizen? ____ (17) If naturalized, what is your certificate number? ____
(18) What is the date of your certificate? ____ (19) What court issued your certificate? ____
(20) If not naturalized, have you received your first papers? ____ (21) If so, give date on which issued ____
(22) Give name and address of court ____

EDUCATIONAL RECORD

(23) Circle highest grade completed

In elementary and secondary school: 1 2 3 4 5 6 7 8 9 10 11 12
In college: 1 2 3 4
Graduate work: 1 2 3 4

(24) Name of last elementary school, secondary school, or college attended ____
(25) What course did you take? ____
(26) Have you attended a trade or vocational school? ____ (27) If so, number of months in attendance ____
(28) Name and address of trade or vocational school attended ____
(29) Name of trade or vocation for which trained ____ (30) Date of leaving ____

EMPLOYMENT RECORD

PRESENT EMPLOYMENT

If now employed, check and give details below
(31) WPA ____ NYA resident project ____ NYA nonresident project ____ CCC ____ Other employer ____
(32) Name of employer or project [1]

(33) Date employed

(34) Wages or salary
$____ per ____

(35) Address of employer

(36) Your duties and specialties

(37) Kind of employment

[1] If employed by WPA, NYA, or CCC, give title of project.

PREVIOUS EMPLOYMENT

List most important

(38) Name of employer

(39) Dates
From ____ to ____

(40) Wages or salary
$____ per ____

(41) Address of employer

(42) Your duties and specialties

(43) Kind of employment

(44) Name of employer

(45) Dates
From ____ to ____

(46) Wages or salary
$____ per ____

(47) Address of employer

(48) Your duties and specialties

(49) Kind of employment

16—18599

VE-ND Form 1
(Revised Nov. 1, 1940)
FEDERAL SECURITY AGENCY
U. S. OFFICE OF EDUCATION
Washington

RECORD OF DEFENSE TRAINING

(50) Date enrolled	(51) Program symbol [1]	(52) Name of course taken	(53) Code symbol [2]	(54) Date completed

COURSES DISCONTINUED BEFORE COMPLETION:

(55) Date discontinued	(56) Course symbol [2]	(57) Name of course	(58) Code symbol [2]	(59) Reason for discontinuing

(60) Instructor's appraisal of trainee _____

[1] 1A Preemployment refresher (VE–ND)
1B Supplementary (VE–ND)
4A General preemployment (OSY)
4B Specific preemployment-preparatory (OSY)
5 NYA program
[2] Use code symbol adopted locally for identifying course for reporting purposes. (See Misc. 2400 ND, Misc. 2600, and Misc. 2700.)

PLACEMENT AND FOLLOW-UP RECORD

DATE	OCCUPATION (61)	EMPLOYER (62)	ADDRESS OF EMPLOYER (63)	DUTIES OF EMPLOYEE (64)	WAGES OR SALARY (65)

(66) If trainee was not placed, give details of placement efforts:

_____ Referred to placement office.
_____ Referred to WPA.
_____ Additional training recommended.
_____ Other (Describe efforts) _____

FOLLOW-UP INFORMATION

Each trainee must sign the following release before starting work in any shop.

CONNECTICUT STATE DEPARTMENT OF EDUCATION

_____194

REGULATIONS FOR NATIONAL DEFENSE TRAINING COURSES

NOTICE TO TRAINEES.

In connection with the course you are now starting, the following items are specifically called to your attention.

1. The completion of the course DOES NOT guarantee that you will secure a job.

   Every effort will be made, however to secure work for you.

2. The first week is to be considered a probationary period. If at the end of this period you have not shown sufficient progress, you will be dropped from class and another called to fill your place. For this reason it becomes necessary for you to give us your best effort right from the start.

3. It is to be understood that this course does not aim to produce skilled tool-makers and machinists, nor should you expect to secure the type of work done by these tradesmen when entering industry. Its purpose is to give such training as will enable a person to have some small understanding of shop processes and an appreciation of the accuracy required in machining operations.

4. The _____School is not responsible for any injuries which may occur to members of the class.

Date _____

I have read the foregoing items and I hereby release the _____School from any responsibility in case of an accident to my person.

Signed _____

Upon entrance, time is taken to explain all rules and regulations being sure each trainee fully understands them.

RULES FOR TRAINEES
at
Hartford Public High School, Defense Training Program

1. Eating will be permitted in Room M-6 only between 7:30 and 8:00 P. M. (3:30 and 4:00 A. M.), (Lunch period.) Smoking allowed in basement, 7:30 to 8:00 P. M. (3:30 to 4:00 A. M.). Absolutely no smoking allowed anywhere else in the building or at any other time.
2. Start work at 3:30 P. M. (11:30 P. M.) and work until 7:25 P. M. (3:25 A. M.), at which time all persons having micrometers return them to the tool crib and get your check. All micrometers must be turned in at this time.
3. Start work again at 8:00 P. M. (4:00 A. M.). Those that turned micrometers in at 7:25 P. M. (3:25 A. M.) and will need them for the remainder of the period will get them out on checks again.
   Work until 11:10 P. M. (7:10 A. M.). Turn in all tools. Make sure that you have 10 checks, then turn them in to tool crib boy.
   You must then return to the room in which you were working and clean the machines you were operating.
4. Washing will not be permitted before 7:25 P. M. and 11:20 P. M. (3:25 A. M. and 7:20 A. M.). You must wash in the room in which you have been working.

5. No whistling or loud talking permitted.
6. Do not sit on benches during working hours.
7. The reading of newspapers or magazines is not allowed.
8. The reading of textbooks will be allowed if permission is first obtained.
9. Anyone staying out 2 days without informing the chief instructor will automatically be dropped. You must call us each day you are out or notify us in some way. The telephone number is 2-5053.
10. Insubordination is cause for immediate dismissal from the course.
11. You are to work on the machine that has been assigned to you and on no other unless the instructor so directs.
12. You will not leave the building before 11:30 P. M. (7:30 A. M.) without permission.
13. All trainees must be ready to go to work at 3:30 P. M. and 8:00 P. M. (11:30 P. M. and 4:00 A. M.).
14. Each trainee will be assigned a check number. The tool crib boy keeps 10 brass checks on a ring to correspond to your number. Ask him for your checks, count them to make sure you have 10. Before leaving for home, count your checks to make sure you have 10, then turn them in to the tool crib boy, as the next shift uses these same checks. You are responsible for all tools out on your checks.
15. Report to instructor before starting to work. Do not start any machine without instructor's permission.

16. The odor of alcoholic breath is not permitted. The first time you will be sent home. The second time you will be dismissed.
17. Trainees are not to leave the room they are assigned to without the permission of the instructor.

SAFETY RULES FOR TRAINEES

1. Never wear rings or wrist watches when running a machine.
2. Do not oil any machine while it is running.
3. Keep hands off all moving parts of a machine.
4. Never put your hands on a moving belt. The belt hooks may tear your hands; or you may get your hand caught between the belt and the pulley.
5. Avoid reaching over a machine while it is running.
6. Do not wear loose garments around a machine. They may get caught.
7. Do not leave machine while it is running;-shut it off.
8. Roll your sleeves up when working on machines. Take loose clothing off.
9. Never start a machine until told to do so by the instructor, even though you have run the machine previously.
10. When drilling or reaming have a firm grip on the drill jig or part.
11. Wear goggles where specified. Especially on operation B-1 and B-2.

12. Remove chuck key from chuck before starting machine.
13. Keep cloth or waste away from moving parts.

Ten small steel objects are measured by the trainee with a 6" scale and his figures recorded in the following table. With the use of a decimal chart the fractional measurements are changed to decimal measurements. This gives him the use of charts.*

The reading of a micrometer is now taught and the student preceedes to measure the steel objects with his micrometer, recording the measurements in the proper space on this table.

Reading the Micrometer

The Commercial micrometer consists of a frame, the anvil or fixed measuring point, the spindle which has a thread cut 40 to the inch on the portion inside the sleeve or barrel and the thimble which goes outside the sleeve and turns the spindle. One turn of the screw moves the spindle 1/40 or .025 of an inch and the marks on the sleeve show the number of turns the screw is moved. Every fourth graduation is marked 1, 2, 3, etc., representing tenths of an inch or as each mark is .025 the first four means .025 x 4 = .100, the third means .025 x 4 x 3 = .300.

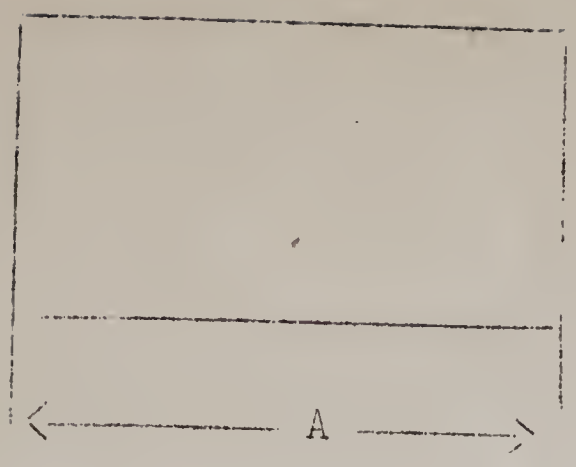
The thimble has a beveled edge divided into 25 parts and numbered 0, 5, 10, 15, 20 and to 0 again. Each of these mean 1/25 of a turn or 1/25 of 1/40 =1/000 of an inch.

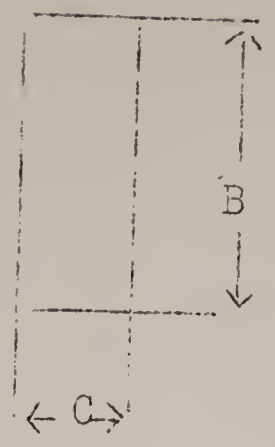
*See chart page 27.

To read, multiply the marks on the barrel by 25 and add the graduations on the edge of the thimble. In the cut there are 7 marks on the sleeve and 3 on the thimble so we say 7 x 25 = 175, plus 3 = 178 or .178.

In shop practice it is common to read them without any multiplying by using mental addition. Beginning at the largest number shown on the sleeve and calling it hundreds and add 25 for each mark, we say in the case show 100 and 25, 50, 75 and then add the numbers shown on the thimble 3, making .178 in all. If it showed 4 and one mark, with the thimble showing 8 marks, the reading would be 400 + 25 + 8 = 433 thousandths or .433.*

*Taken from: American Machinists' Handbook
Pages 356 - 7





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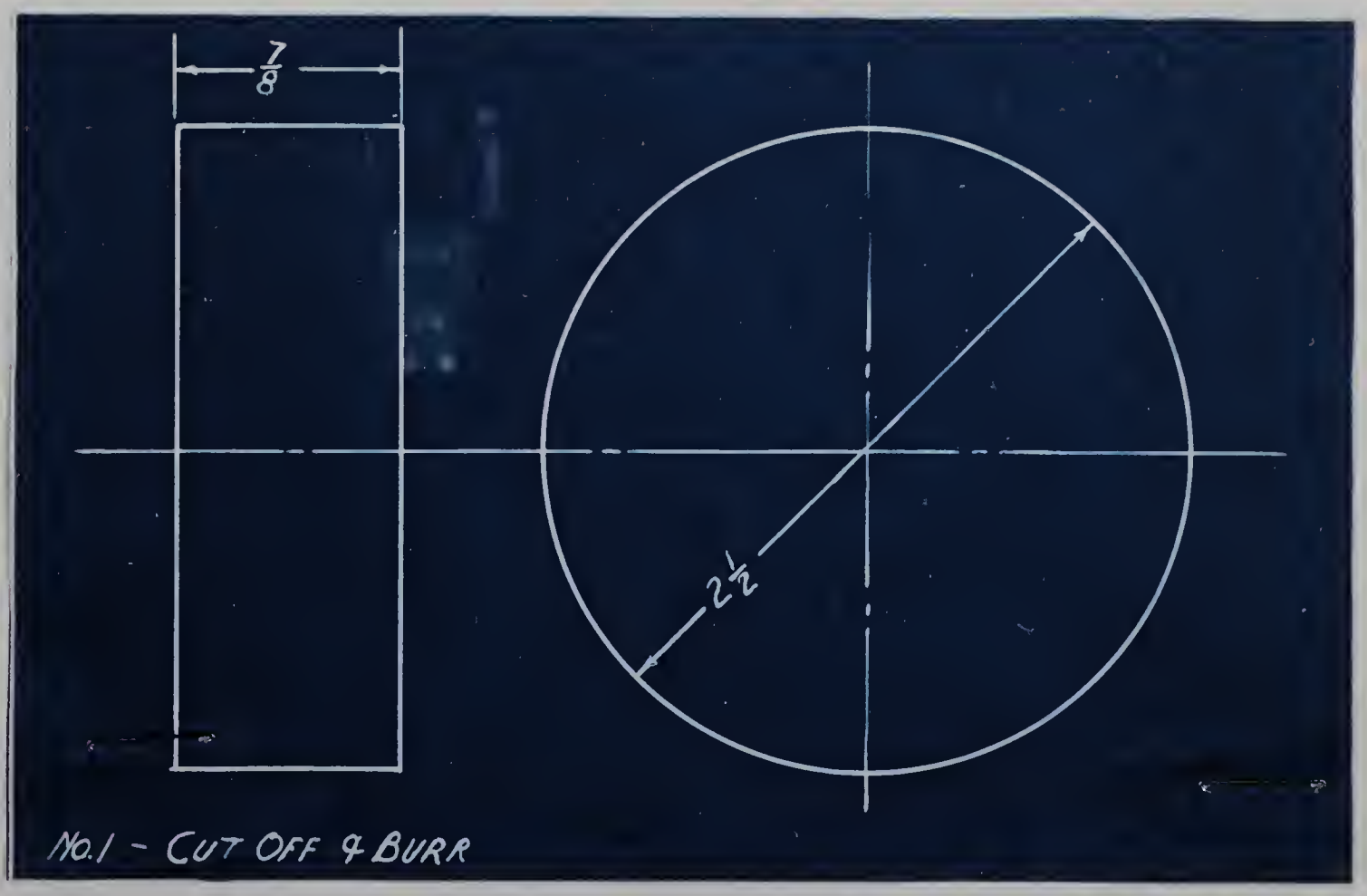
PART NO. 2001 PART NAME Adapter DEPT.NO. S. T. S.

MATERIAL Cutting off stock OPER.NO. 1 SHEET NO. 1 NO.SHEETS 24

TYPE OF MACHINE Power Saw

DESCRIPTION OF OPERATION	NAME OF TOOL
Place bar stock 2½" diameter in jaws of vise allowing the stock to project beyond saw blade 7/8"	6" scale
Tighten vise and throw in clutch of the machine. Make sure that compound flows on saw blade while it is cutting off the stock.	
Hold the stock that is sawed off in a bench vise and with course file remove burrs from the work.	



NO.1 - CUT OFF & BURR

PART NO. 2001 PART NAME Adapter DEPT.NO. H.S.T.S.
Boring reaming
MATERIAL drilling facing OPER.NO. 2 SHEET NO. 1 NO.SHEETS 24

TYPE OF MACHINE Lathe

DESCRIPTION OF OPERATION	NAME OF TOOL
Hold the work in a three jawed chuck	Tool holder Adjustable wrench
Place drill chuck in the tail stock and center drill the work.	Tail stock drill chuck Center drill
Grab a 9/32 drill in tail stock chuck and drill hole thru the work.	9/32 drill
Remove the tail stock chuck and place center in the tail stock.	
Place a 15/16 drill in a taper shank drill holder Keep drill holder against center with the tool post and drill hole in work.	15/16 drill Taper shank drill holder or dog.
With boring tool bore hole to fit the .990 - .996 plug gage.	Plug gage Op. #2
Hold 1" reamer with a dog keeping the r the t	1" reamer
With work	
With the h	
Remov	

PART NO. 2001 PART NAME Adapter DEPT.NO. H.S.T.S.

MATERIAL _____ OPER.NO. 3 SHEET NO. 1 NO.SHEETS 24

TYPE OF MACHINE Lathe

DESCRIPTION OF OPERATION	NAME OF TOOL
Place the work on an arbor, entering the small end of the arbor in the machined side of the work.	1" arbor
Make the work tight on the arbor in an arbor press.	
Place the dog on the large end of the arbor and suspend the arbor between centers on the lathe.	
Rough turn the work to 2 27/64", caliper measurement, using a diamond point tool.	
Finish turning to 2.390 - 2.392	3" micrometer
Remove diamond point tool insert facing tool.	
Have the tool slightly below the center with the end square to the arbor.	
Face clean the side of the work.	
Reverse the arbor and face work to	
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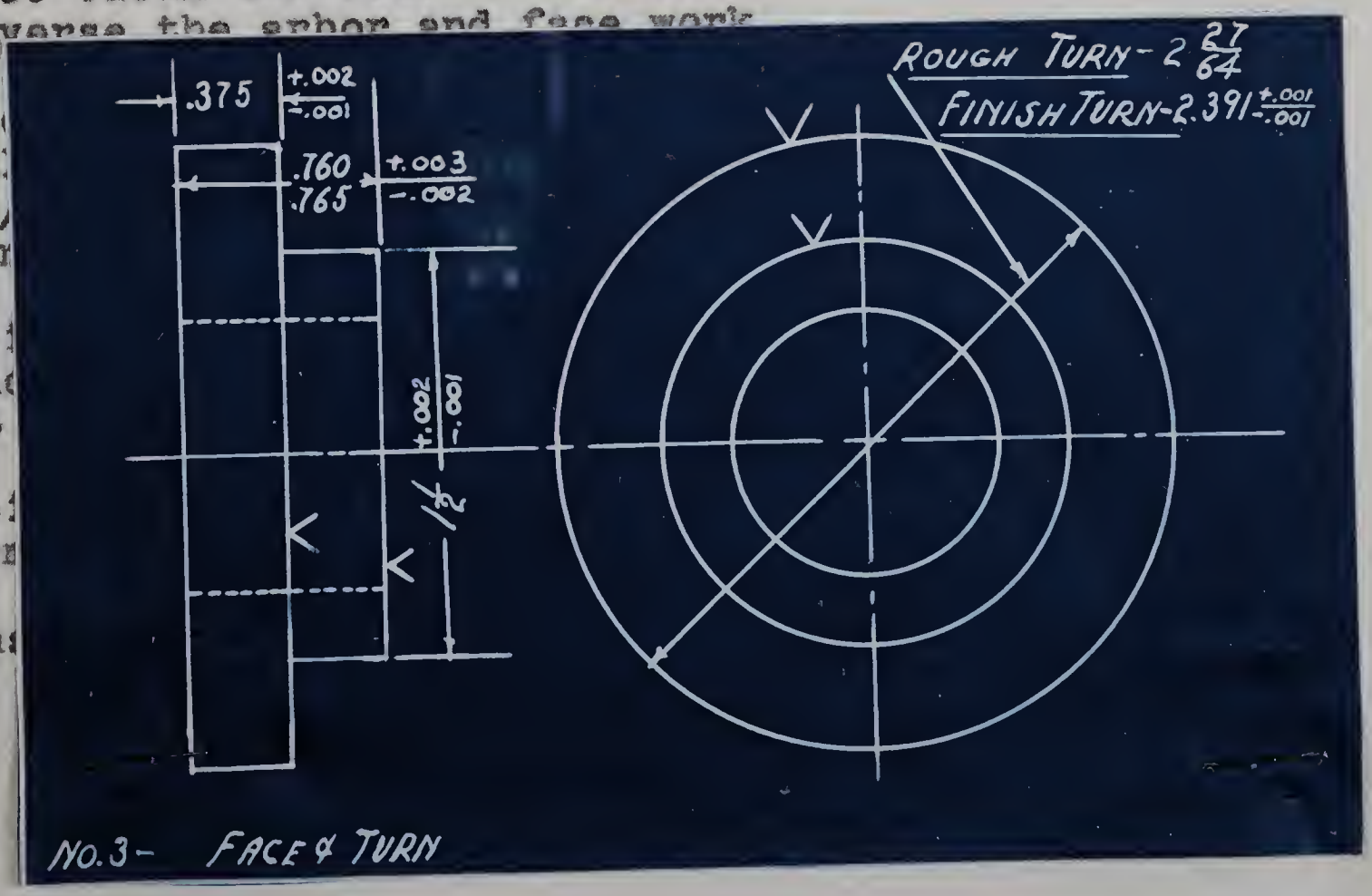


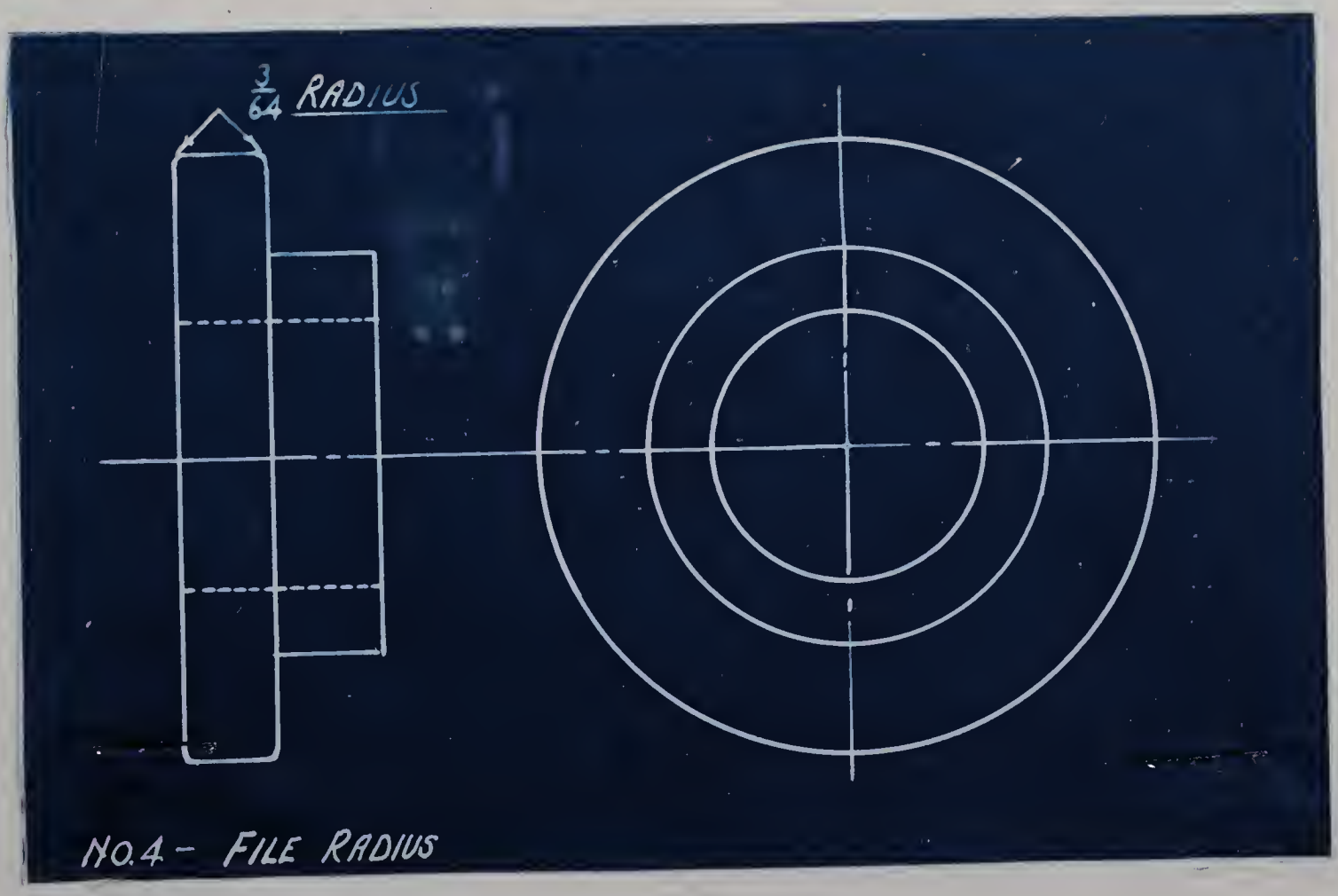
NO. 3 - FACE & TURN

PART NO. 2001 PART NAME Adapter DEPT NO. H.S.T.S.

MATERIAL Filing radius OPER.NO.4 SHEET NO. 1 NO.SHEETS 24

TYPE OF MACHINE Bench lathe

DESCRIPTION OF OPERATION	NAME OF TOOL
Hold shoulder arbor in a ½" spring collar in spindle of the lathe	½" collar Draw back Special arbor Op.#4
Place the work on the arbor making it tight with the nut.	
With a file, file a 3/64" radius on the flange of the work to fit the 3/64" radius gage.	3/64" radius gage
Reverse the work and file a 3/64" radius on the opposite side of the flange to fit the 3/64" radius gage.	
With emery cloth polish radius	Emery cloth
Remove the work from the arbor.	



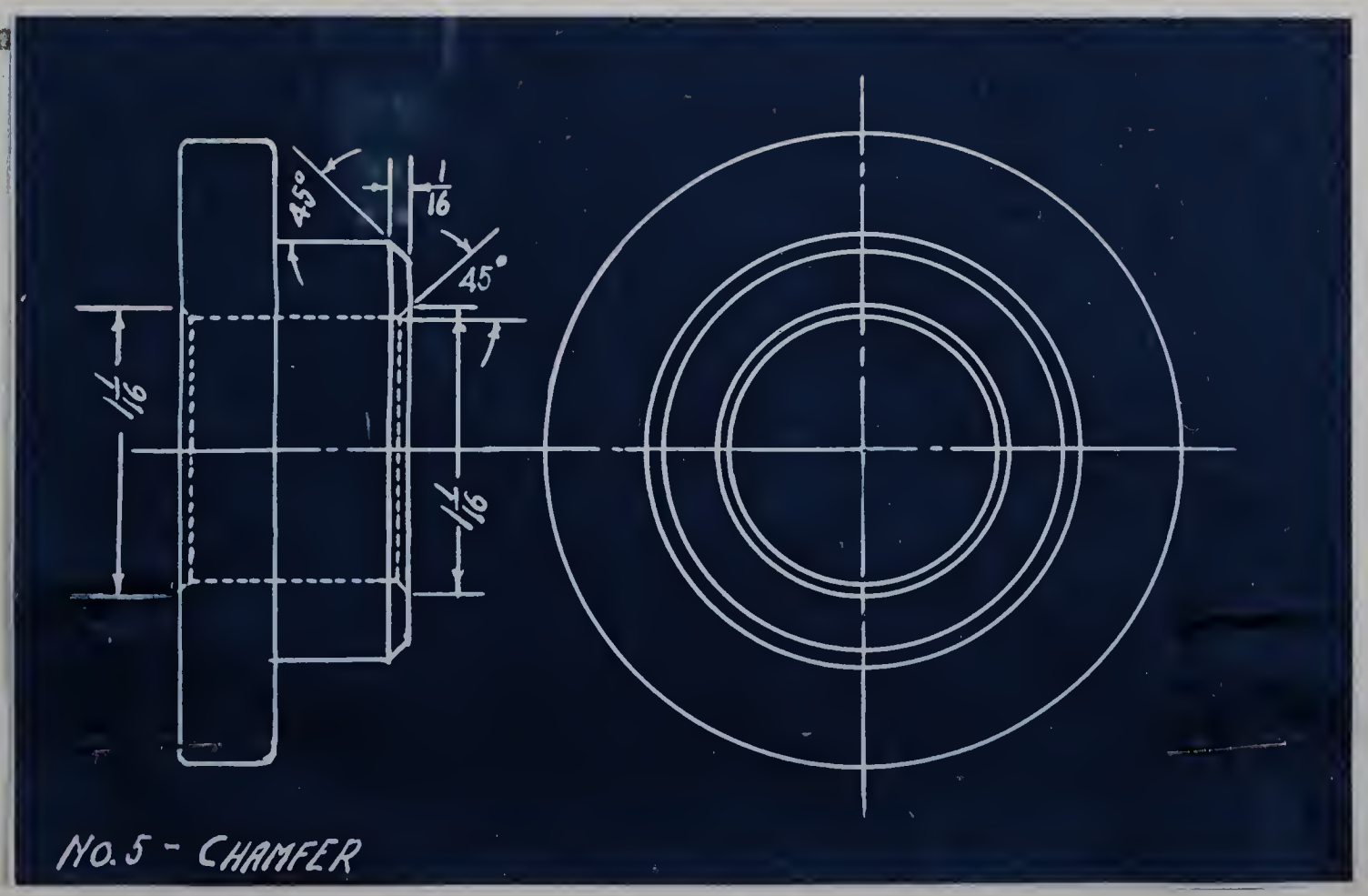
NO.4 - FILE RADIUS

PART NO. 2001 PART NAME Adapter DEPT.NO. H.S.T.S.

MATERIAL Chamfering OPER.NO. 5 SHEET NO. 1 NO.SHEETS 24

TYPE OF MACHINE Bench lathe

DESCRIPTION OF OPERATION	NAME OF TOOL
Grab the work by the flange in a three jawed chuck.	3 jawed chuck Draw back
Set the compound to the right at 45 degrees	Tool post Tool holder
Turn a chamfer in the 1" hole leaving the mouth of the work measuring 1 1/16" remove burrs with a scraper.	Screw driver (medium)
Set the compound 45 degrees to the left and turn a 1/16" chamfer on the hub.	
Reverse work in the chuck holding it by the hub. Set compound 45 degrees to the right and turn a chamfer in the 1" hole leaving the mouth of the work 1 1/16".	
Rem	

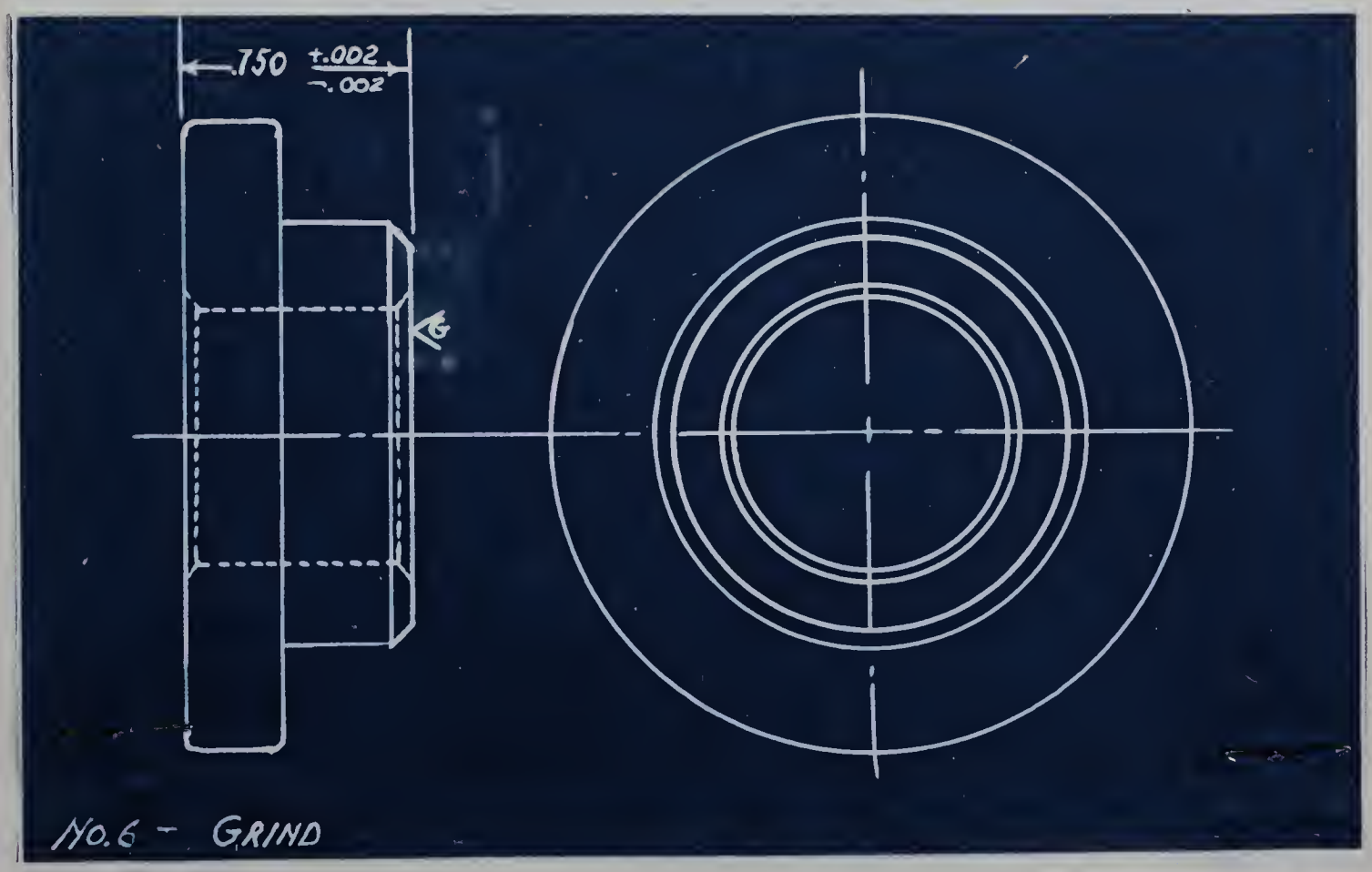


NO. 5 - CHAMFER

PART NO. 2001 PART NAME Adapter DEPT NO. H.S.T.S.
Grinding end
MATERIAL of hub OPER.NO. 6 SHEET NO. 1 NO.SHEETS 24

TYPE OF MACHINE Surface grinder

DESCRIPTION OF OPERATION	NAME OF TOOL
Measure the work with a micrometer and then place the work upon the magnetic chuck, having the flange on the work on the surface of the chuck.	1" micrometer
Turn on chuck switch. Make certain that the work is held on the chuck. Start wheel.	
Bring wheel down until it touches the work and grind off the face of the hub until it measures .750" ± .002	

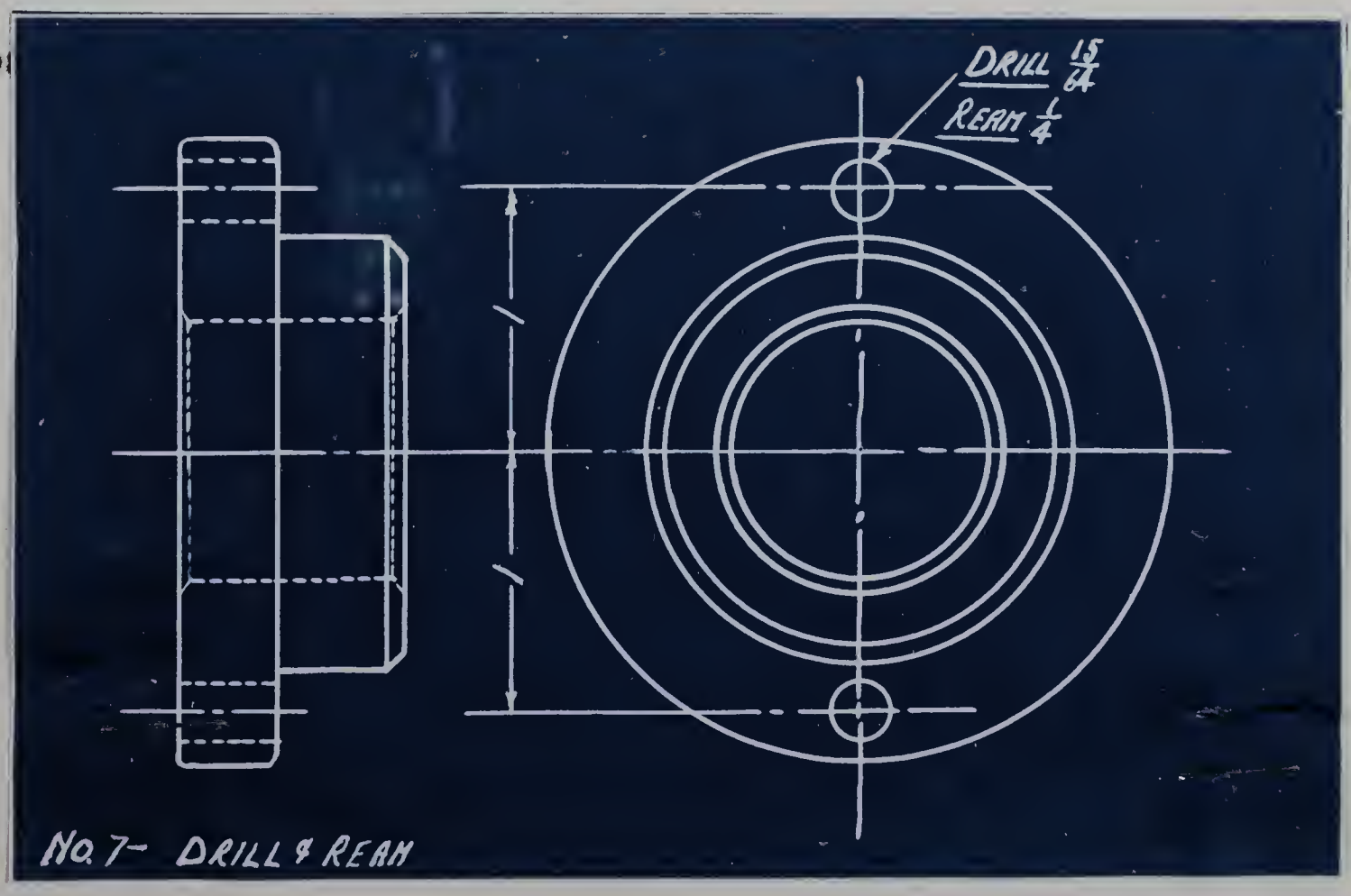


PART NO. 2001 PART NAME Adapter DEPT NO. H.S.T.S.
MATERIAL Drill and reaming OPER.NO. 7 SHEET NO. 1 NO.SHEETS 24

TYPE OF MACHINE Drill press

DESCRIPTION OF OPERATION	NAME OF TOOL
Place work on the drill jig stud flange first and make work tight with the screw.	Drill Jig Op. #7
Insert 15/64" drill bushings into the drill-jig holes.	15/64" drill
Grab 15/64" drill in drill chuck and drill the two holes. Lubricate drill with cutting oil.	Cutting oil can
Remove drill bushings and insert ¼" reamer bushings in drill jig.	
Grab ¼" reamer in drill chuck and ream the two holes. Lubricate the reamer with cutting oil.	¼" reamer

Loo

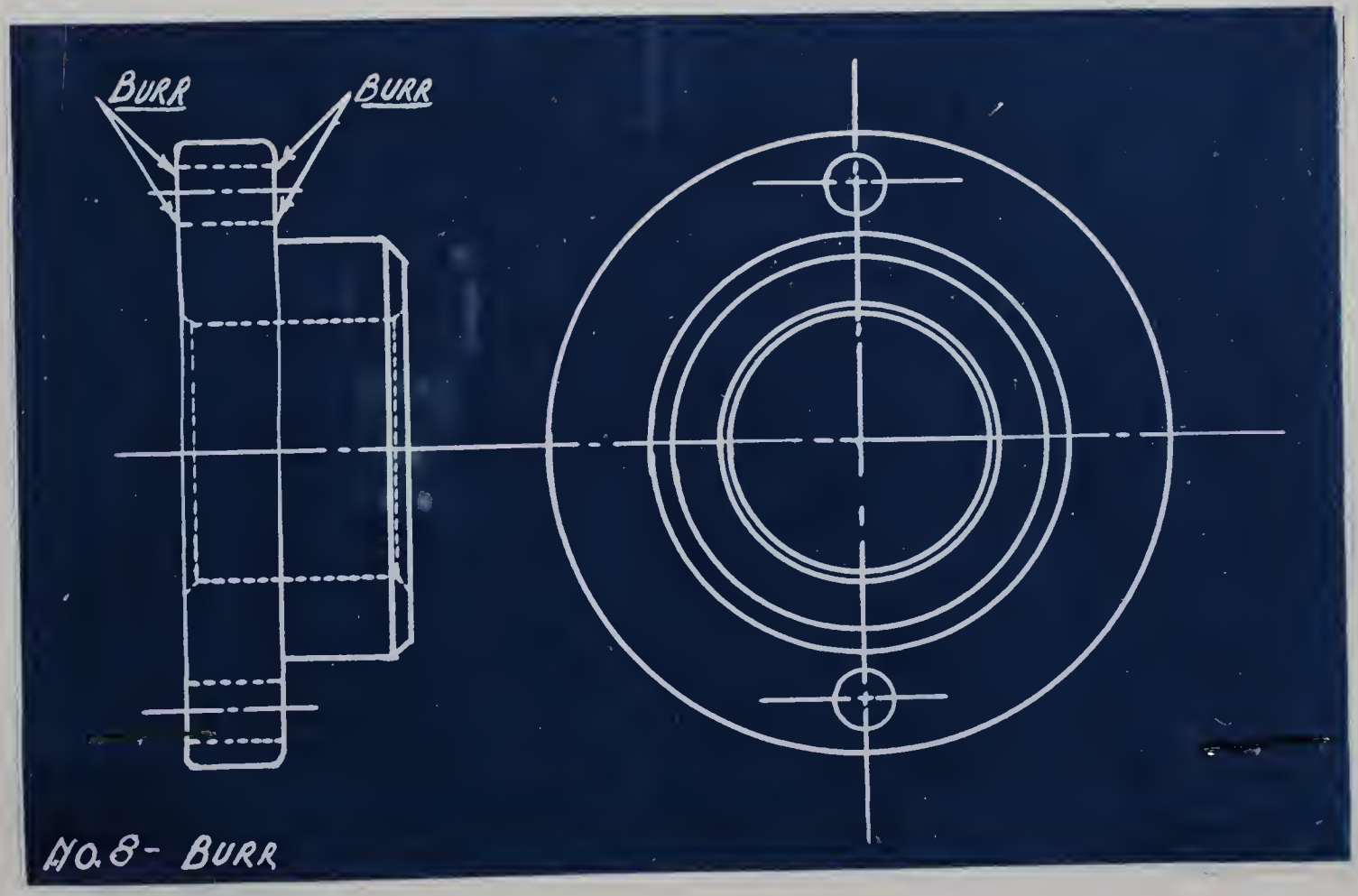


PART NO. 2001 PART NAME Adapter DEPT NO. H.S.T.S.

MATERIAL Burring holes OPER.NO. 8 SHEET NO. 1 NO.SHEETS 24

TYPE OF MACHINE Bench

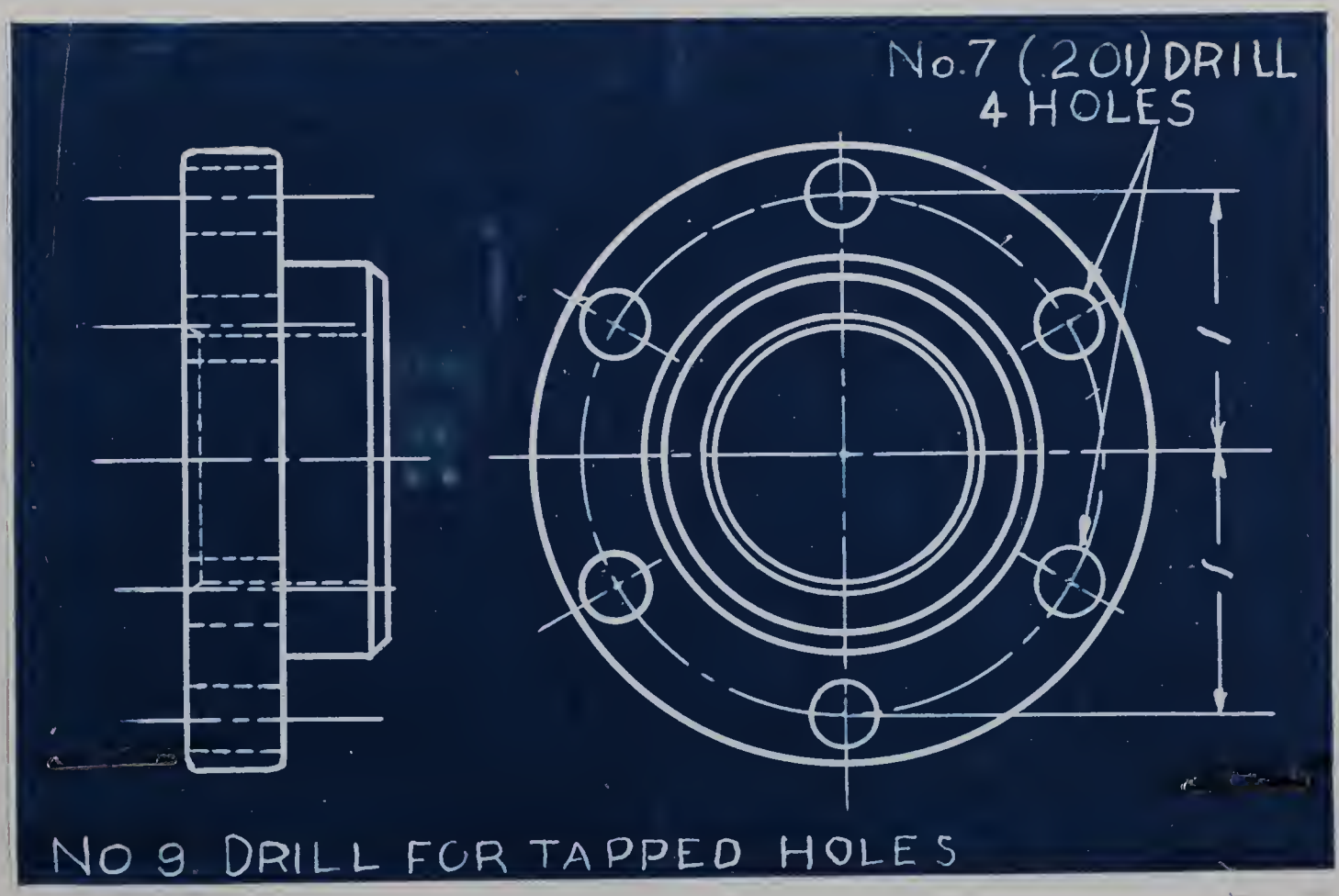
DESCRIPTION OF OPERATION	NAME OF TOOL
With a file and a three cornered scraper remove the burrs on the two holes and try the holes with a $\frac{1}{4}$" plug gage.	#8 plug gage



PART NO. 2001 PART NAME Adapter DEPT NO. H.S.T.S.
MATERIAL Drilling for tapped holes OPER. NO. 9 SHEET NO. 1 NO. SHEETS 24

TYPE OF MACHINE Drill press

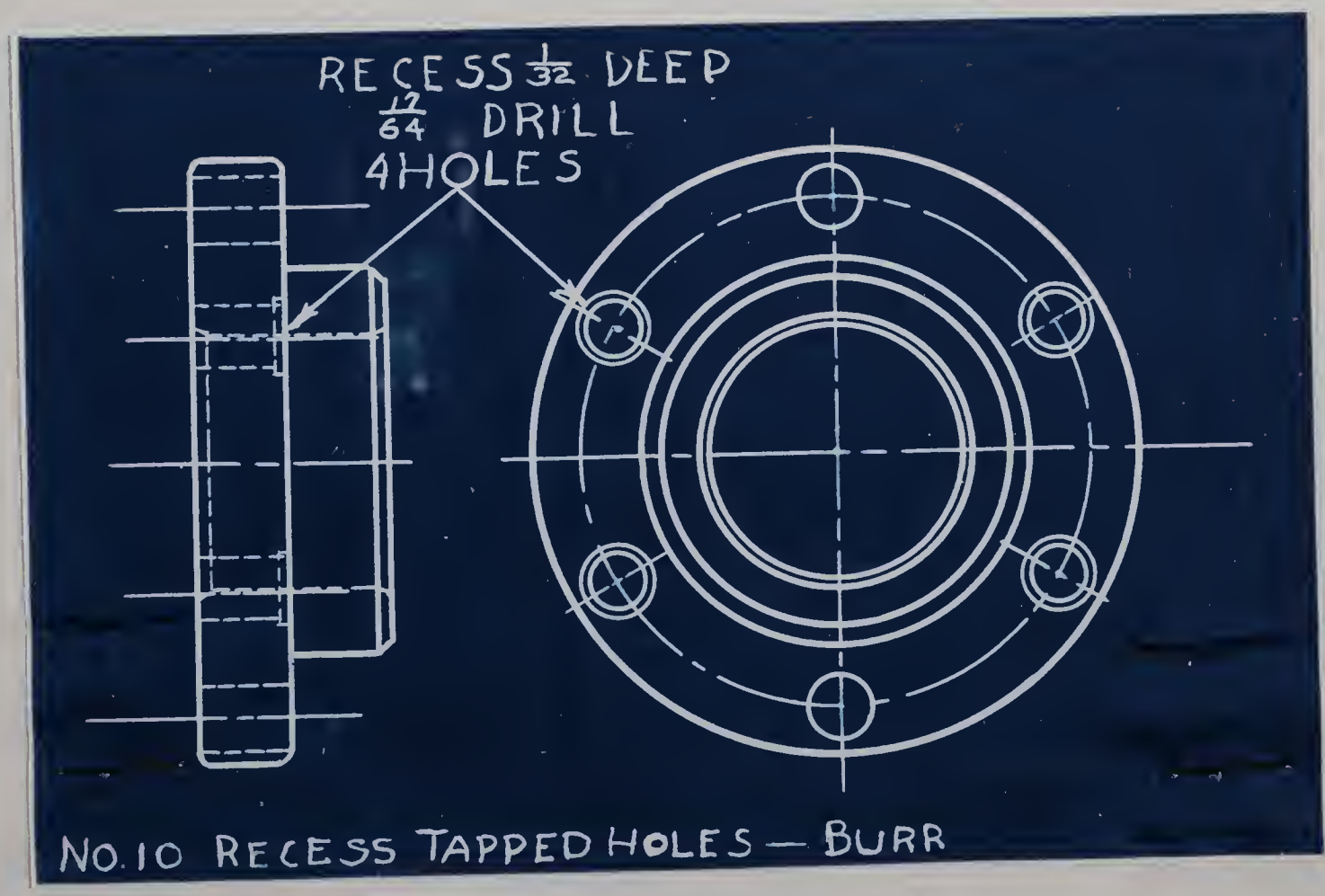
DESCRIPTION OF OPERATION	NAME OF TOOL
Place work on the drill jig stud flange first. Line the holes in the work with the pin on the jig and tighten with the screw.	Drill jig Op. #9
Grab a No. 7 drill in the drill chuck and drill four holes through the flange. Lubricate the drill with cutting oil.	Cutting oil can #7 (.201) drill
Loosen screw and remove the work.	



PART NO. 2001 PART NAME Adapter DEPT NO. H.S.T.S.
Recessing and
MATERIAL burring OPER.NO. 10 SHEET NO. 1 NO.SHEETS 24

TYPE OF MACHINE Drill press

DESCRIPTION OF OPERATION	NAME OF TOOL
Place work in the C' sink fixture flange first, tighten work in the fixture with the set screw.	C' Sink Fixture #10
Grab a 17/64" drill in the drill chuck and recess the four No. 7 holes to a depth of 1/32"	17/64" drill
Loosen screw, remove work and repeat operation on opposite side of the flange.	
With a file and a scraper remove the burrs.	



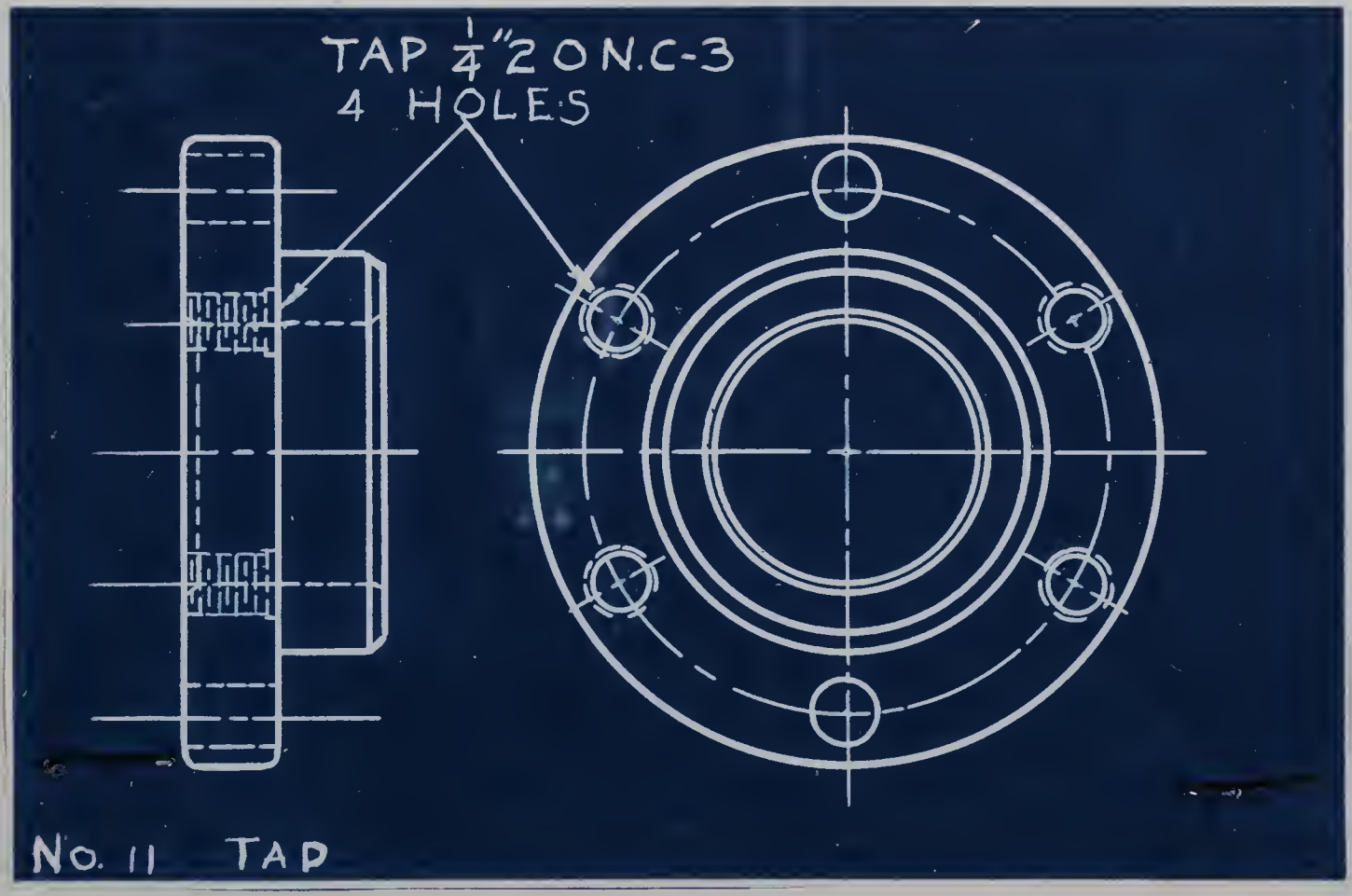
NO. 10 RECESS TAPPED HOLES — BURR

PART NO. 2001 PART NAME Adapter DEPT. NO. H.S.T.S.

MATERIAL Hand tapping OPER.NO.11 SHEET NO.1 NO.SHEETS 24

TYPE OF MACHINE Bench

DESCRIPTION OF OPERATION	NAME OF TOOL
Grab the work in a bench vise by the flange.	
Enter a ¼" - 20 tap Check the tap for straightness with square.	Can of cutting oil ¼" - 20 tap 9" tap wrench
Tap out the hole	
Repeat the operation on the other No. 7 tapped holes.	



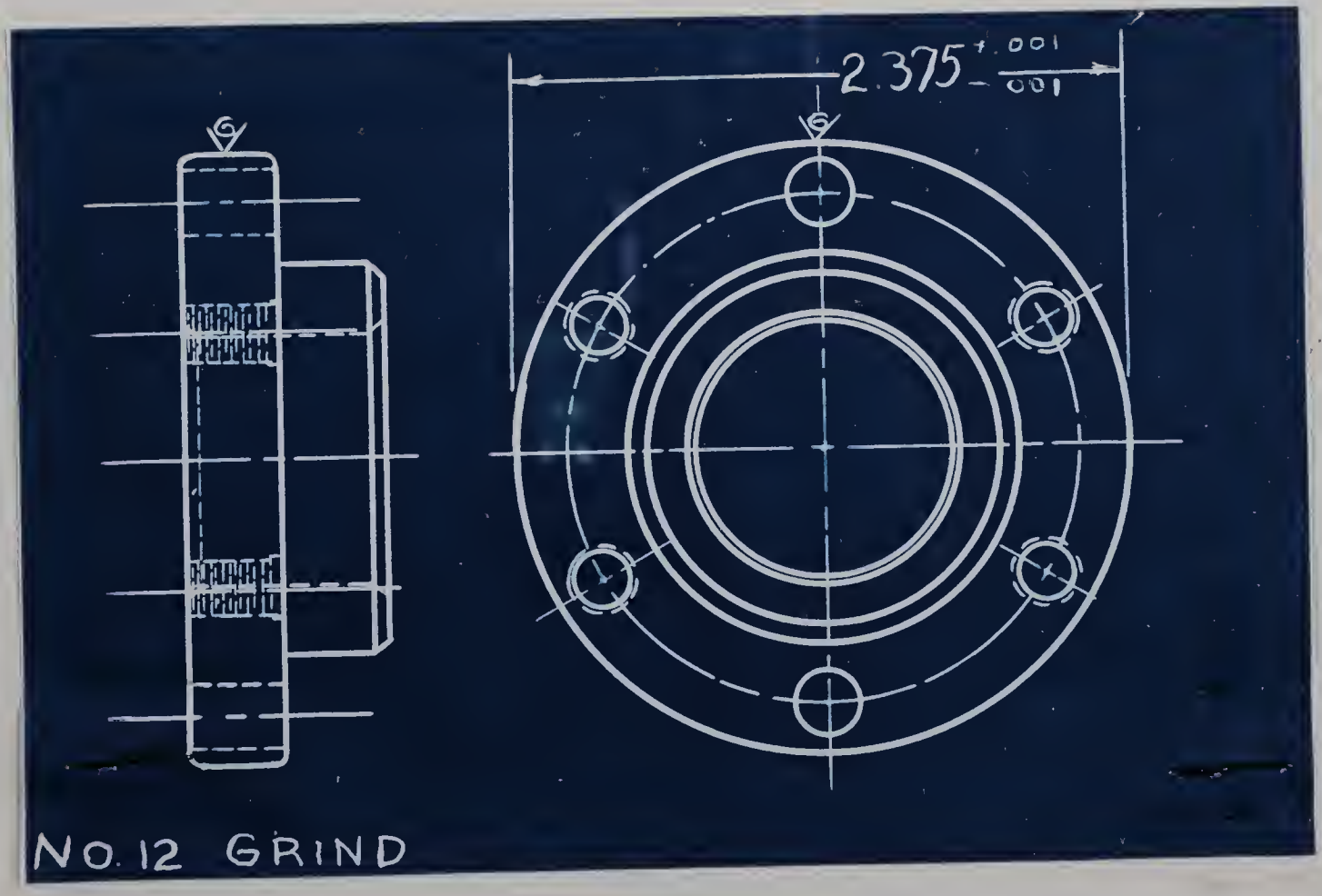
No. 11 TAP

PART NO. 2001 PART NAME Adapter DEPT NO. H.S.T.S.

MATERIAL Grinding O.D. OPER. NO. 12 SHEET NO. 1 NO. SHEETS 24

TYPE OF MACHINE Cylindrical grinder

DESCRIPTION OF OPERATION	NAME OF TOOL
Place the work on a 1" arbor and suspend it between the centers on the grinder.	1" Arbor and dog
Start the work and grinding wheel turning and bring the wheel up to the flange of the work.	Use Vitrified Aluminum Oxide. Wheel
Grind the flange of the work to a diameter of 2.375 $^{+.001}_{-.001}$	3" micrometers
Stop the machine and remove the work.	

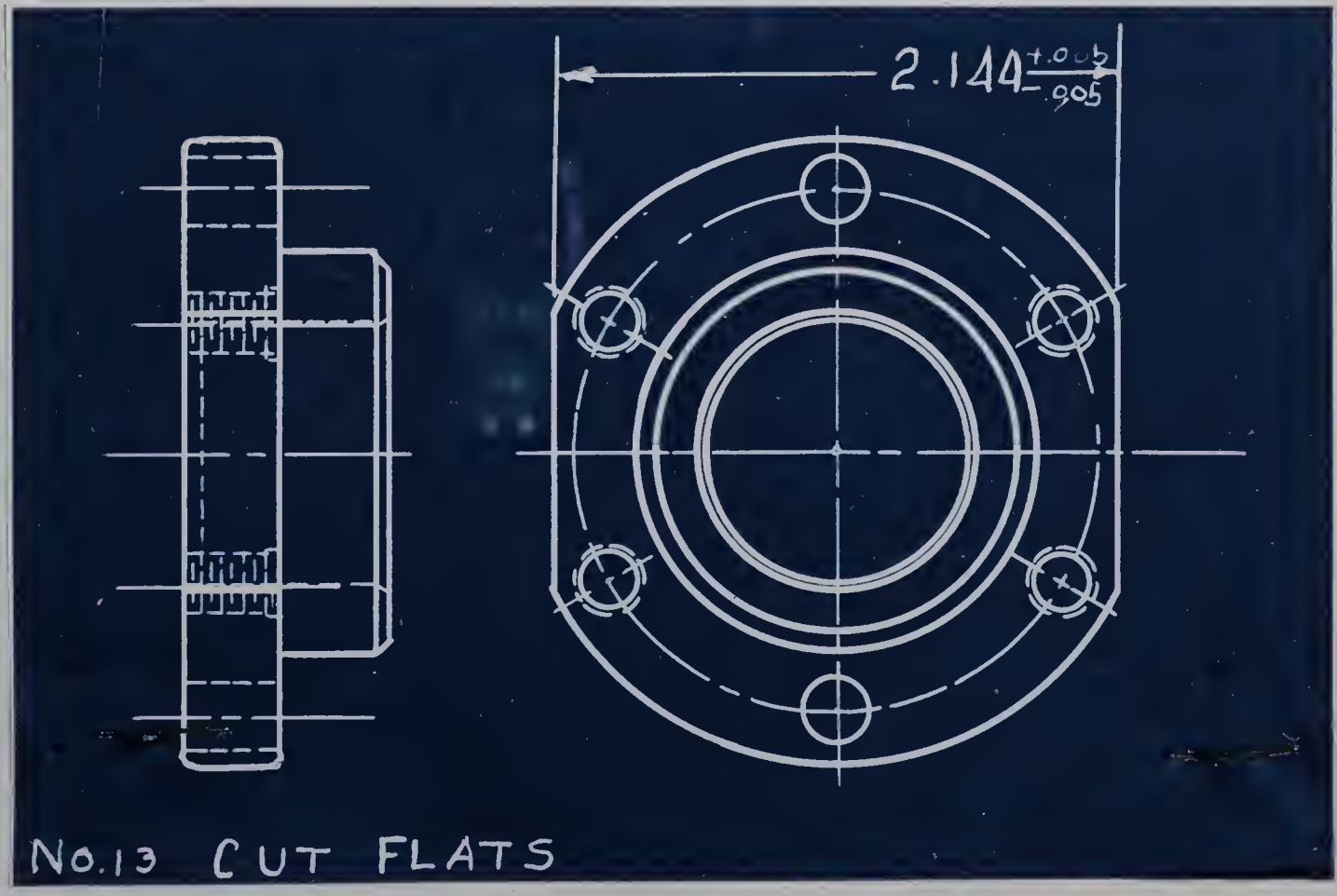


PART NO. 2001 PART NAME Adapter DEPT.NO. H.S.T.S.

MATERIAL Shaping the flat OPER.NO.13 SHEET NO. 1 NO.SHEETS 24

TYPE OF MACHINE Shaper

DESCRIPTION OF OPERATION	NAME OF TOOL
Place the work on the fixture stud, flange first.	Shaping and grinding
Line the $\frac{1}{4}$" reamed hole with the pin and tighten the nut.	Fixture #13
Throw in clutch on the shaper and remove the stock on the flange to fit the flush gage.	#13 Flush gage
Loosen nut and remove the work. With a file remove the burr.	
Repeat the operation on the other side of the flange.	

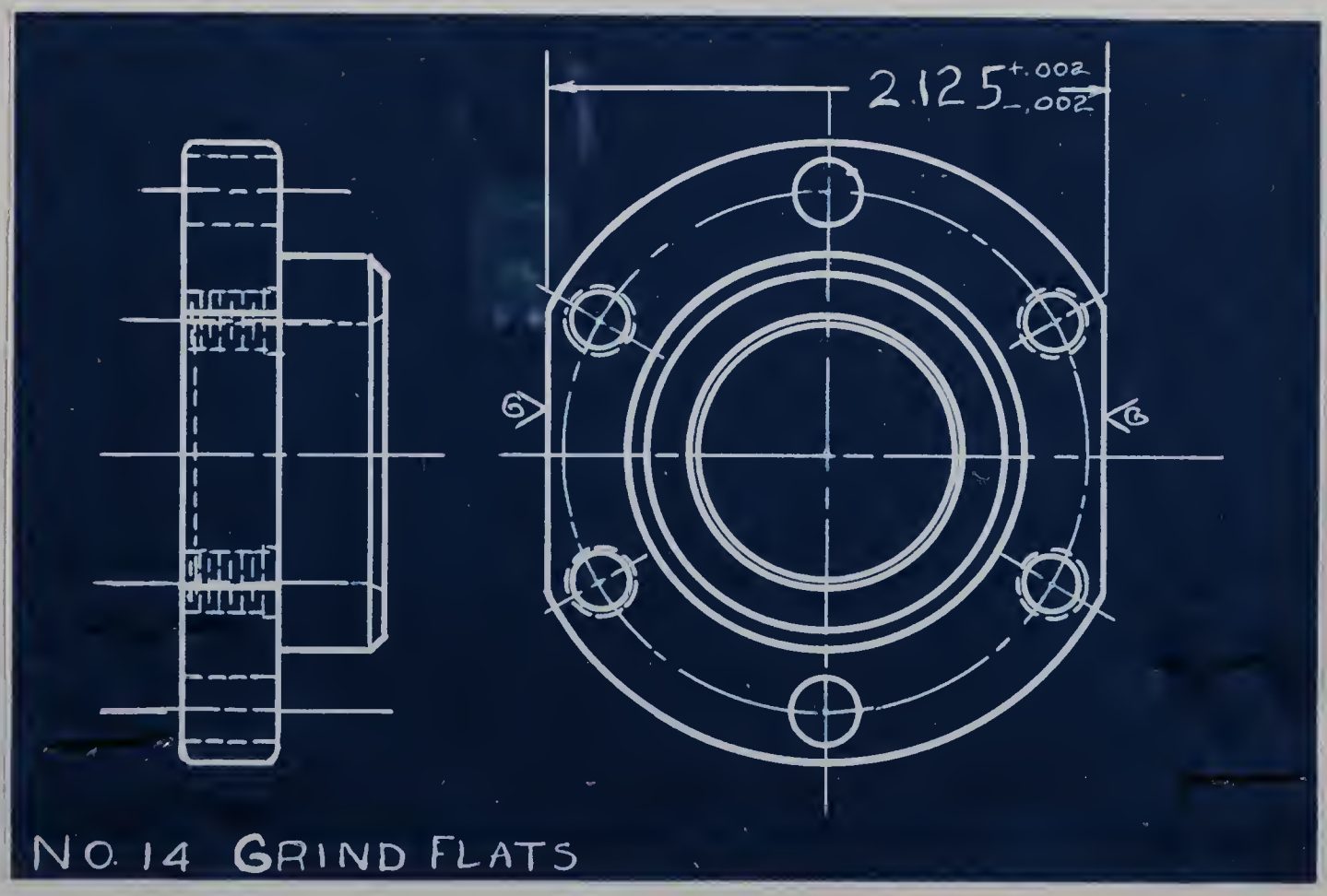


PART NO. 2001 PART NAME Adapter DEPT NO. H.S.T.S.

MATERIAL Grinding flats OPER.NO.14 SHEET NO.1 NO.SHEETS 24

TYPE OF MACHINE Surface grinder

DESCRIPTION OF OPERATION	NAME OF TOOL
Place the work on the stud of the fixture, flange first.	Shape and grinding
Line the ¼" reamed hole in the work with the pin on the fixture tighten the work with the nut.	Fixture 14
Start the machine and lower the wheel until it touches the work.	Use Vitrified Aluminum Oxide wheel
Grind the flat on the flange until it fits the flush gage.	#14 flush gage
Loosen nut remove work and with a file remove the burr.	
Repeat the operation on the other side of the flange.	

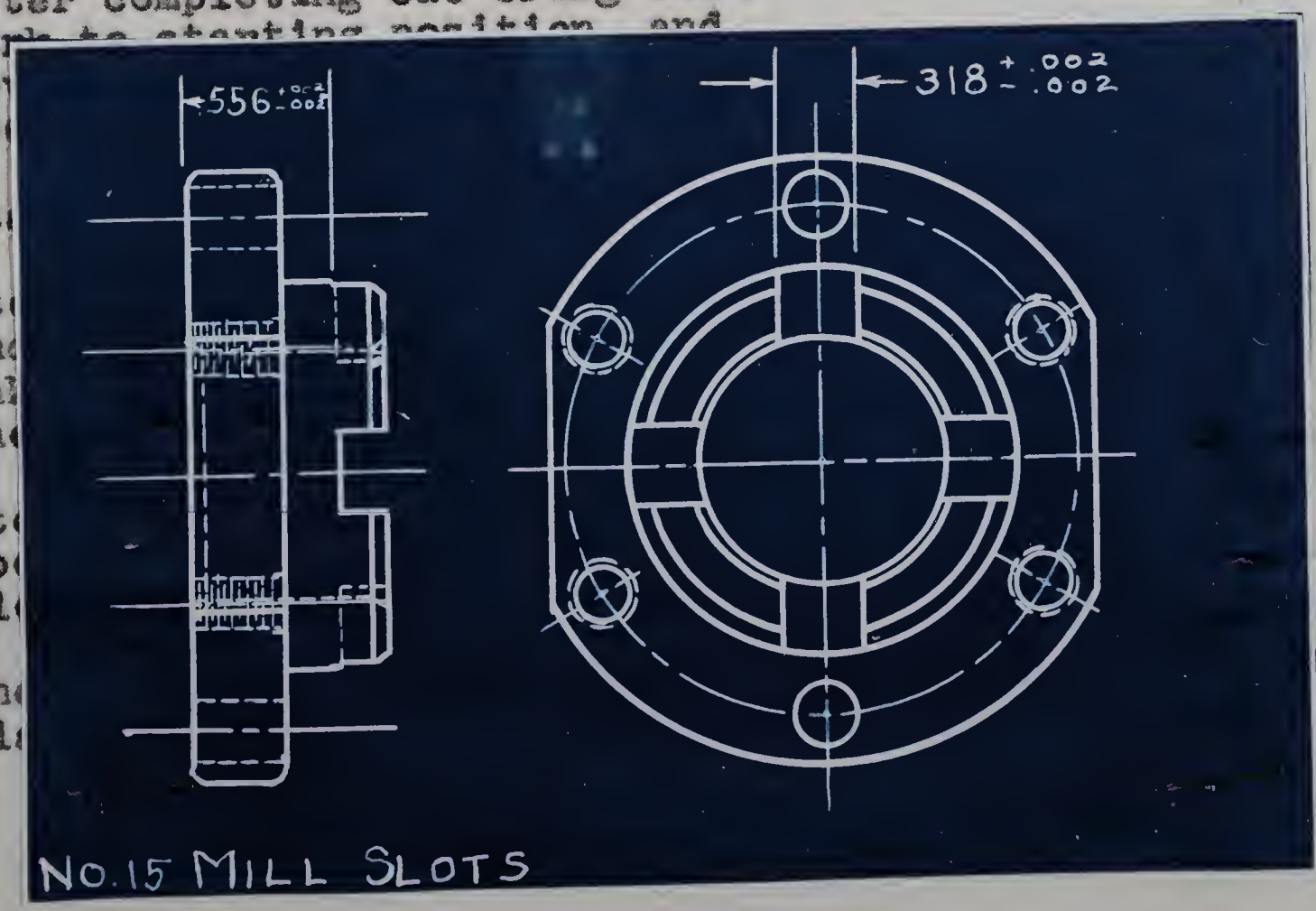


PART NO. 2001 PART NAME Adapter DEPT NO. H.S.T.S.

MATERIAL Milling the slot OPER.NO.15 SHEET NO.1 NO.SHEETS 24

TYPE OF MACHINE Milling machine

DESCRIPTION OF OPERATION	NAME OF TOOL
Remove chips from the fixture Place the work on the stud flange first. Line the ½" hole with pin on the fixture.	Milling fixture #15 ¼ side milling cutter
Adjust the clamps and tighten the set screws.	
Take out back lash on the cross feed and line the 0 on the dial with the 0 on the machine, then lock the table.	
Start the machine, bring the work to the cutter and throw in the feed.	
After making the cut, stop the machine, bring the table back, loosen the table lock, and move table in .033 with cross feed handle using set up gage.	#15 set up gage
After completing cut bring back work to starting position and mo .O	
St	
St an Ma th	Op.#15
St lo cl	
Ch fl	Op.#15

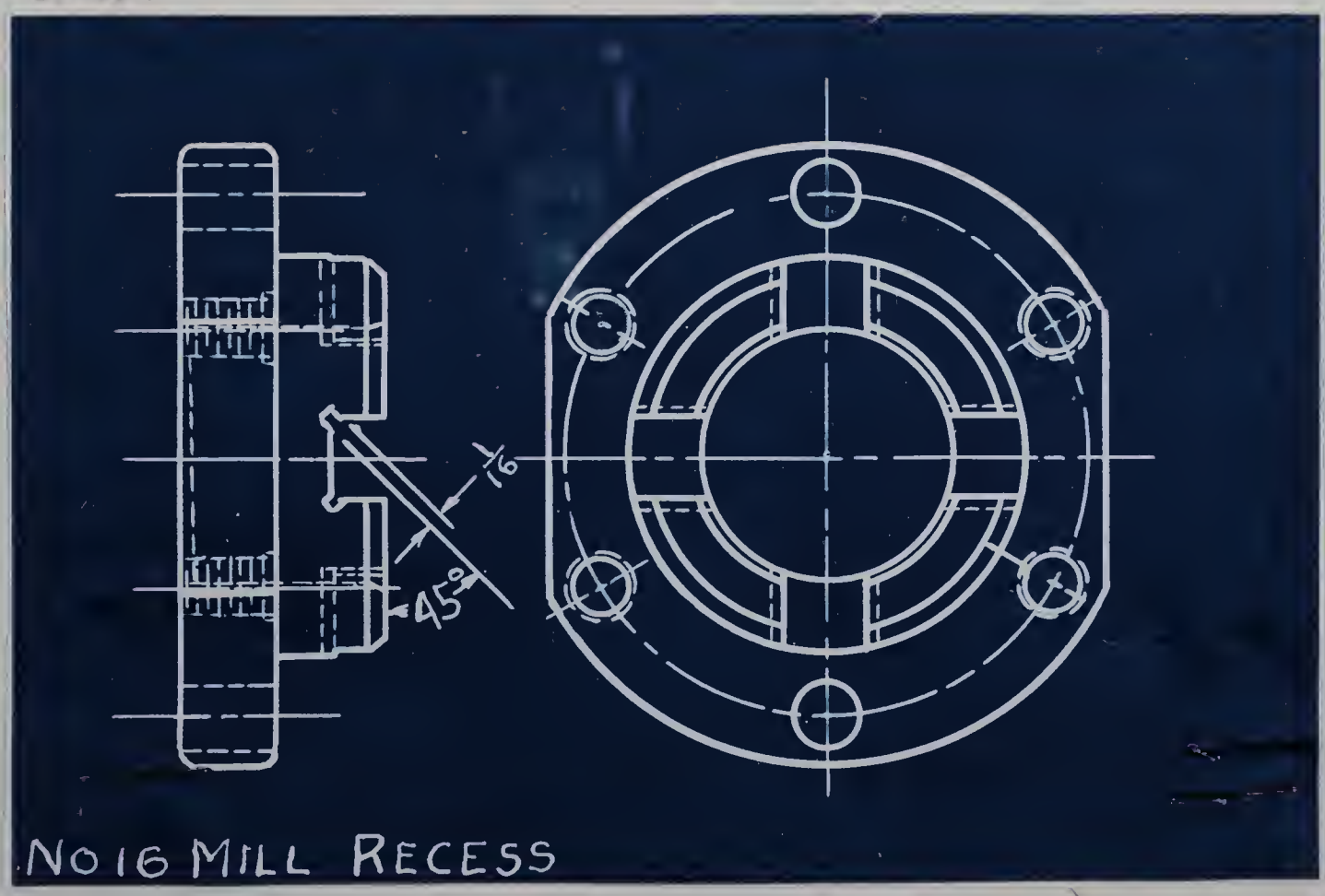


PART NO. 2001 PART NAME Adapter DEPT NO. M.S.T.S.

MATERIAL Milling recess OPER. NO. 16 SHEET NO. 1 NO. SHEETS 24

TYPE OF MACHINE Miller

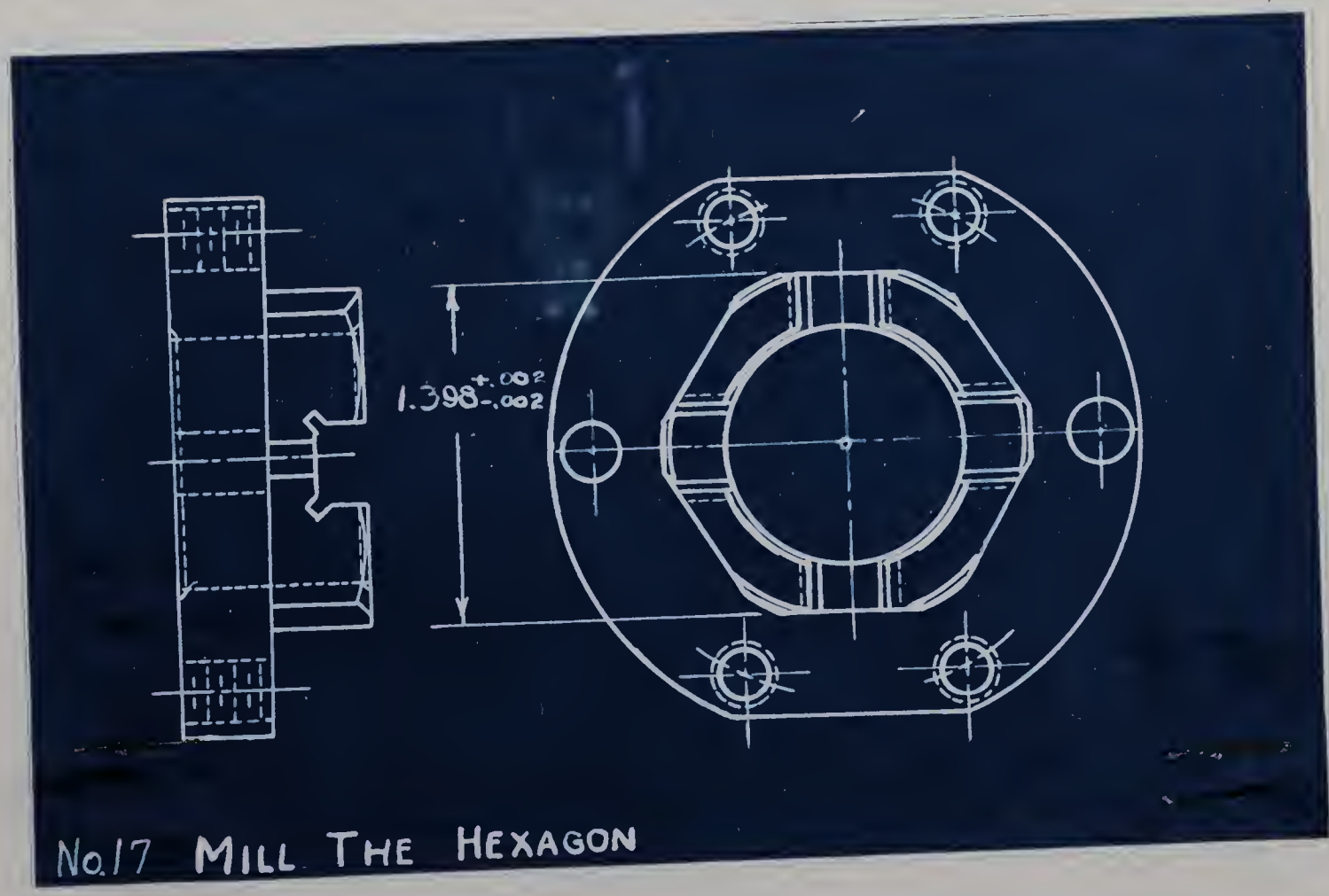
DESCRIPTION OF OPERATION	NAME OF TOOL
Clean the chips from the fixture place the work on the fixture stud flange first. Line the $\frac{1}{4}$" reamed hole in the flange with the pin on the fixture.	Milling fixture Op.15 and 16
Adjust and tighten the clamps.	1/16" Plain milling cutter
Start the machine, bring work up to the cutter, throw in the feed and mill the recess.	
Stop the machine, bring the work back, loosen the clamps and turn the work halfway around in the stud.	
Repeat milling operation on the other side.	



PART NO. 2001 PART NAME Adapter DEPT.NO. H.S.T.S.
MATERIAL Milling the hex OPER.NO.17 SHEET NO.1 NO.SHEETS 24

TYPE OF MACHINE Miller

DESCRIPTION OF OPERATION	NAME OF TOOL
Remove all chips from the fixture and place work on the fixture stud flange first. Line the $\frac{1}{4}$" reamed hole on the flange with the pin on the fixture and tighten the screw.	#17 snap gage Milling fixture Op.#17
Start the machine, bring the work up to the cutter, throw the feed and mill the side of the hub.	
Stop the machine, bring the table back, index the dividing head 6 turns 9 holes on the 18 circle index plate and repeat the milling operation.	Gage #17
Continue operation until six sides have been milled on the hub.	

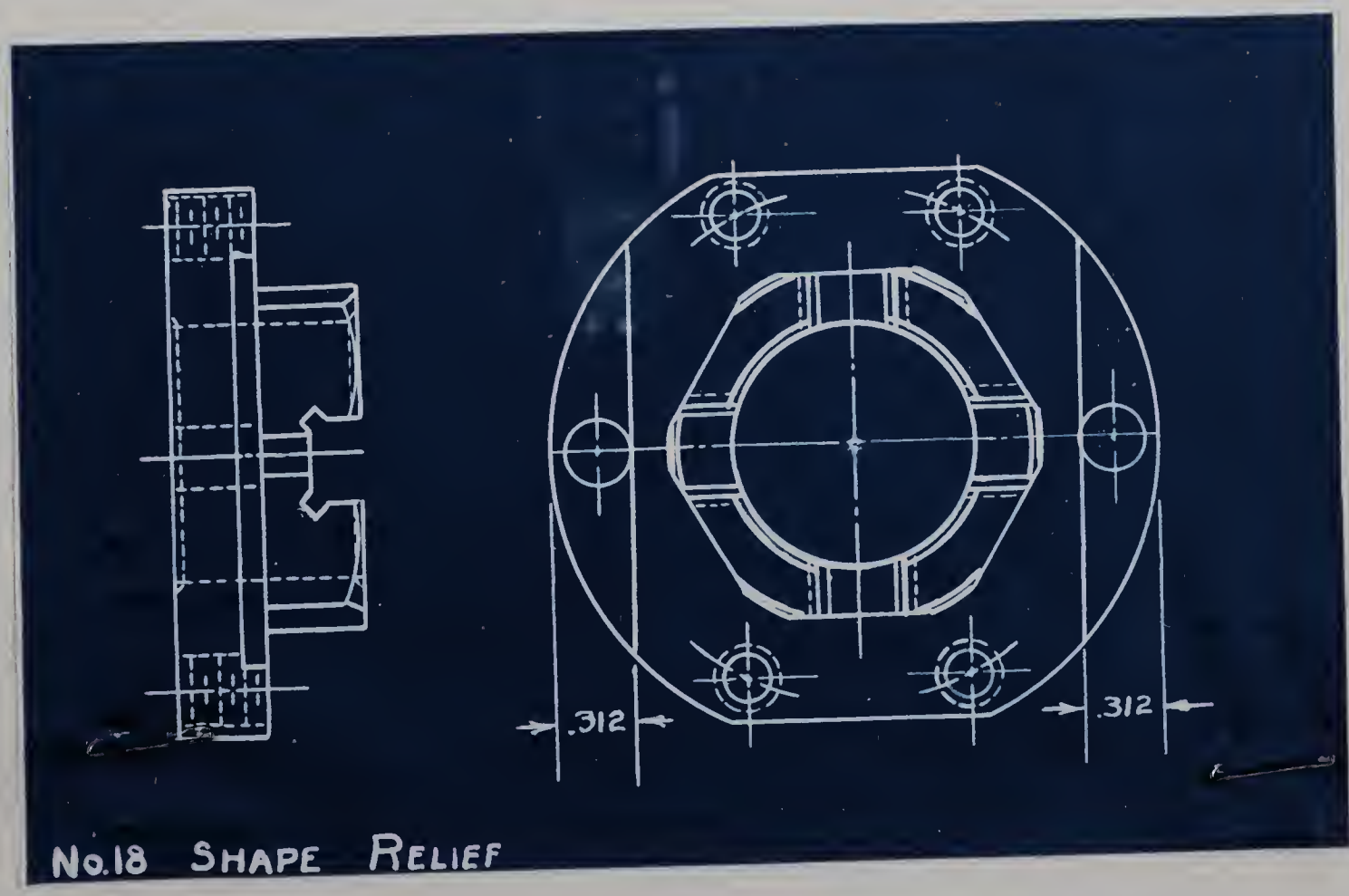


No.17 MILL THE HEXAGON

PART NO. 2001 PART NAME Adapter DEPT.NO. H.S.T.S.
MATERIAL Shaping the relief OPER.NO. 18 SHEET NO.1 NO.SHEETS 24

TYPE OF MACHINE Shaper

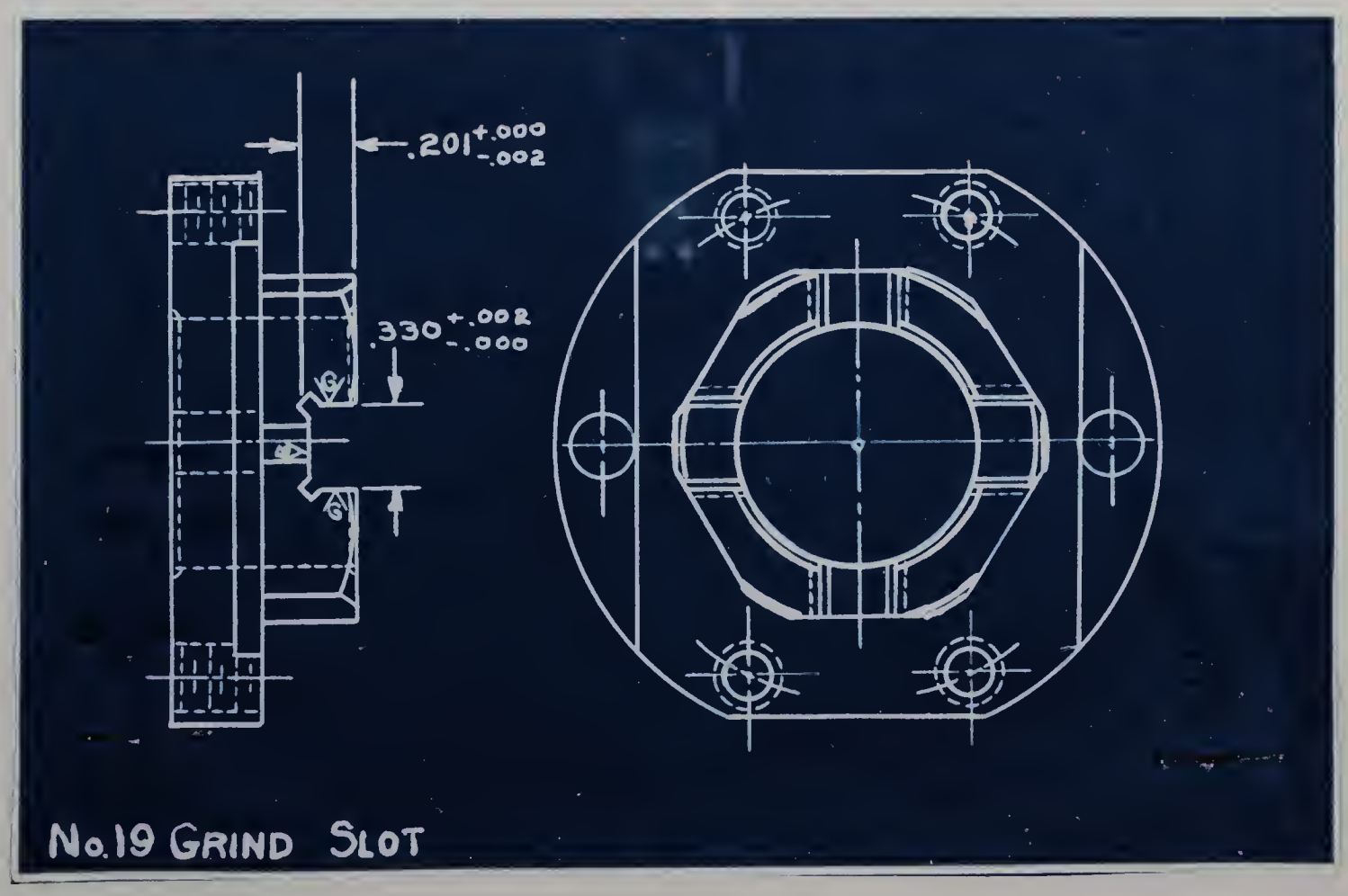
DESCRIPTION OF OPERATION	NAME OF TOOL
Place work on the fixture stud flange first.	Shaping relief
Line the ¼" reamed hole with the pin on the fixture, tighten fixture screw.	Fixture Op.#18
Start the shaper and shape the ¼ - 5/16 relief on the flange.	
Scale measurement	6" scale
Loosen the screw and turn the work half way around lining the ¼" reamed hole on the flange with the pin and tighten the screw.	
Repeat operation on this side.	



PART NO. 2001 PART NAME Adapter DEPT.NO. H.S.T.S.
Grind the
MATERIAL slot OPER.NO.19 SHEET NO.1 NO.SHEETS 24

TYPE OF MACHINE Surface grinder

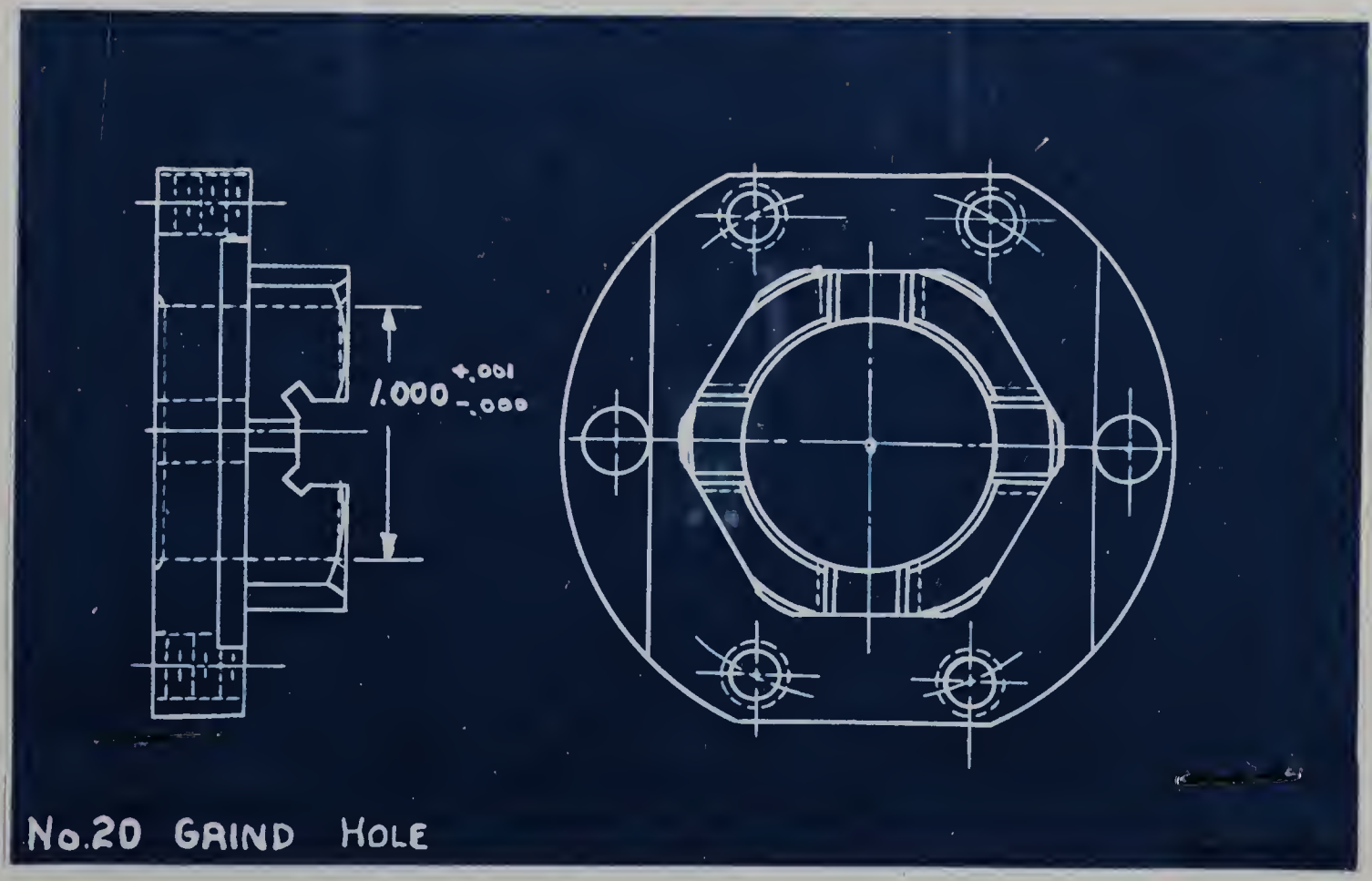
DESCRIPTION OF OPERATION	NAME OF TOOL
Place work on the magnetic chuck with flange resting on the surface of the chuck and the ground flat of the flange tight against the straight edge.	
Throw in switch and make certain that the work is secure.	#19 snap gage
Start machine bring the wheel down until it touches the b ottom of the slot. Move table of machine out until it touches the work.	#19 flush gage
Grind one side of slot clean then grind bottom of slot to fit the flush gage. Grind the other side of the slot to fit the Go gage.	
Remove the work.	



PART NO. 2001 PART NAME Adapter DEPT.NO.H.S.T.S.
MATERIAL Grinding the 1" hole OPER.NO.20 SHEET NO.1 NO.SHEETS 24

TYPE OF MACHINE

DESCRIPTION OF OPERATION	NAME OF TOOL
Hold the work in the fixture and make it tight with the set screws.	Internal Grinding fixture Op. 20
Start the machine and enter the wheel in the hole. Bring the table of machine back until it touches the work.	#20 plug gage
Grind the hole to fit the Go plug gage.	

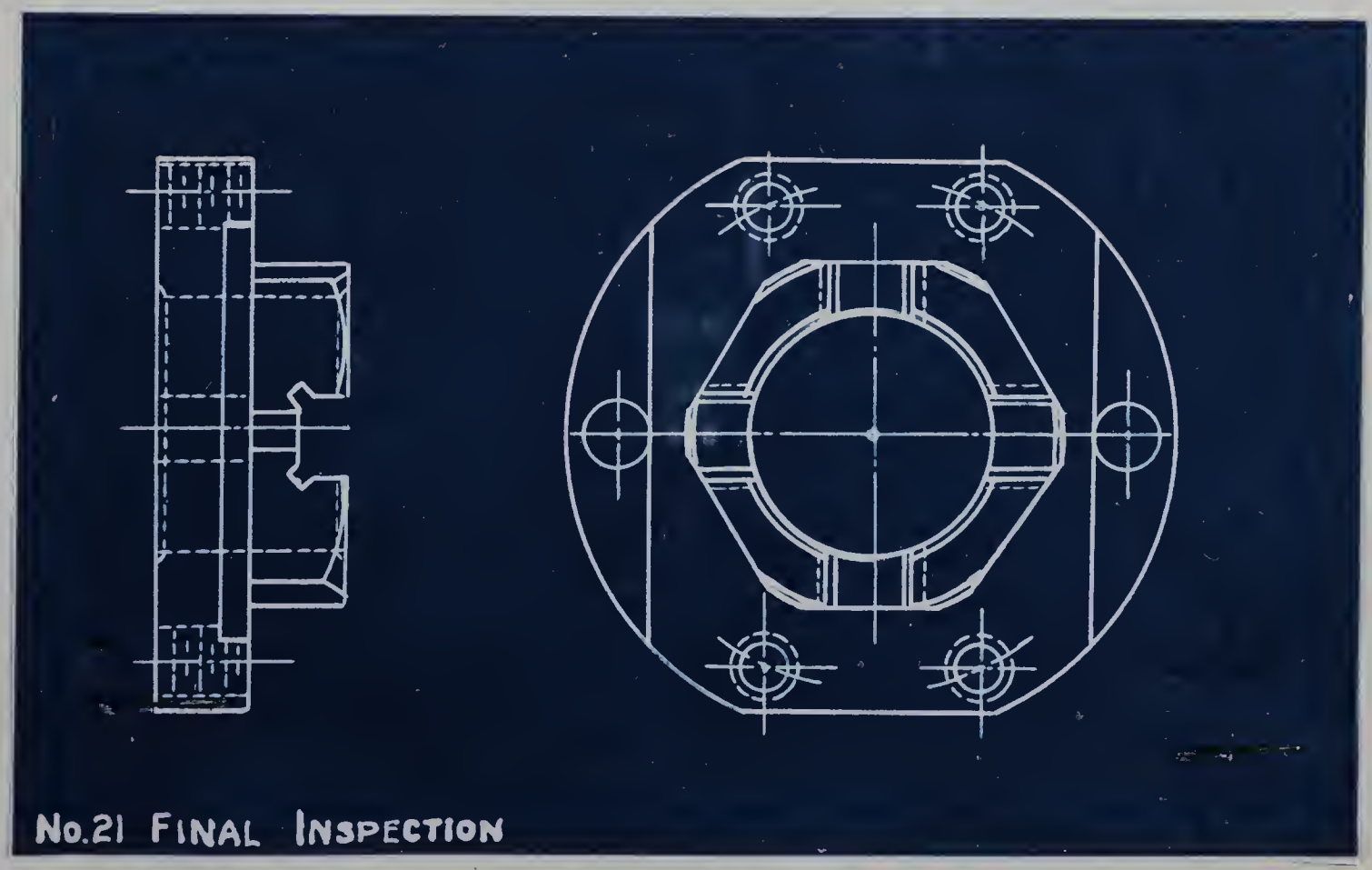


PART NO. 2001 PART NAME Adapter DEPT NO. H.S.T.S.

MATERIAL Inspection OPER.NO.21 SHEET NO.1 NO.SHEETS 24

TYPE OF MACHINE Bench

DESCRIPTION OF OPERATION	NAME OF TOOL
With the blue print check	
O D on flange	3" micrometers
O D on hub	2" micrometers
Width across the flats on the flange	
" " " " " " hub	
Thickness of the adapter	1" micrometer
" " " flange	
Width of the slot	#19 snap gage
Depth of the slot	#19 flush gage
Thickness of the relief	
Length of the relief	
Diameter of the hole	#20 plug gage
Tapped holes	
Reamed holes	#8 plug gage



No.21 FINAL INSPECTION

OPERATION B-1

Special operation on Grinding Drills

Using for text "Handbook for drillers" published by the Cleveland Twist Drill Company.

In this operation we try to acquaint the trainee with the names of various parts and types of drills. The grinding of simple drills, speeds and feeds and angles of clearance, etc.

OPERATION B-2

Special operation on grinding tool bits

Using for text, "How to Grind Lathe Tool Cutter Bits" published by South Bend Lathe Works. Illustrations shown to trainee of various types of cutter bits.

OPERATION A-1

Special shaper work

Shaping to a shoulder

OPERATION A-2

Special shaper work

Shaping dove tails

HARTFORD PUBLIC DEFENSE TRAINING CENTER

General Machine Course

Outline of Trade Information

1st-4 hour session

1. Scale reading
2. Measuring sample blocks
3. Using outside calipers
4. Using and reading the micrometer
5. Grinding tool bits (information)
6. Arbors and mandrels (information)
7. Setting tool for lathe operation (information)
8. Reading Assignment - Burghardt - Pgs. 102-109 (Revised edition)

2nd-4 hour session

1. Shop Sketching
   (a) Alphabet of lines
   (b) 3-view projection
   (c) Methods of dimensioning
   (d) Making working sketches from models
2. Read Burghardt - Pgs. 74-95 and answer questions listed on attached question sheet #1 or question sheet #2 Pgs. 96-125 inclusive.
3. Discussion of answers to questions
4. Read "How to Run a Lathe" - South Bend Lathe Works

3rd-4 hour session

1. Sketching
   (a) Further application of sketching principles

2. Reading Assignment - Burghardt - Pgs. 160-176 inclusive. (Revised edition).

3. Answer questions listed on attached question sheet #3 (Written)

4. Discussion of answers to questions.

4th-4 hour session

1. Sketching or blueprint reading

(a) Answering questions about various blueprints

2. Reading Assignment and answering questions Burghardt Pgs. 120-126 Question sheet #4

3. Discussion of answers.

4. Threaded parts -- information about taps and dies.

5th-4 hour session

1. Blueprint reading, asking and answering questions- Question sheet #6

2. Summary of facts presented up to this time.

3. Visual knowledge of tools used in the machine and tool industry - using Starrett Catalog #26

Vernier Height Gage
Vernier Caliper
Surface Gage
Planer Gage
Indicators

Thread gages
Depth mikes
Combination sets of stock, center head
Bevel protractors
Combination squares
Etc., Etc., Etc.

MILLING MACHINE WORK

References: "Shop Theory" - Henry Ford Trade School

Important Information	Section	Pages
1. Name of important parts Type of milling machines	Milling Mch.	1 to 5
2. Special attachments for milling machines	Milling Mch.	5 to 8
3. Type of cutters used and their speeds	Milling Mch. Small Tools	9, 10, 32 22, 23
4. Arbors and collets	Small Tools Milling Mch.	22 8
5. Operations - Face Milling Straddle Milling Circular " Plain Milling Gang "	Milling Mch.	10, 11, 12
6. Setting cutters central " vise jaws parallet	Milling Mch.	11, 12, 13
7. Dividing head (name of parts)	Milling Mch.	13
8. Direct or rapid indexing	Milling Mch.	14
9. Plain indexing	Milling Mch.	14, 15, 16
10. Angular indexing	Milling Mch.	20, 21
11. Spacing slots (using)dial on cross-feed screw	Milling Mch.	27

SHAPER WORK

References: "Shop Theory" - Henry Ford Trade School

1. Name of principal parts Type of shapers	Shaper	1, 2, 3
2. Common type of tool bits Clearance and rakes	Shaper	4, 5
3. Accessories	Small Tool	12

Important Information	Section	Pages
4. Combination set application	Small Tool	11
5. Height gage and surface gage	Small Tool	16, 17
6. Faults in operation - correct methods	Shaper	5, 6
7. Machining rectangular work	Shaper	5
8. Clapper box settings for vertical and angular cuts	Shaper	6
9. Methods of machining dovetails and measuring for size	Shaper	6, 7, 8
10. Cutting a "v" and splining a keyway in a shaft	Shaper	9
11. Correct methods of clamping work	Shaper	15, 16

LATHE WORK

References: Book 1 - "How to Run a Lathe"-South Bend Lathe Co.
Book 5 - "Shop Theory" - Henry Ford Trade School

Important Information	Book	Section	Pages
1. Name and purpose of principal parts of a lathe	1		6, 22, 23
General lathe information	1		16 to 24
Names of principal parts (purpose and description)	5	Lathe	1 to 7
2. Lathe centers, their care and alignment	1		42, 43, 44, and 50
3. Belts, their care and how to shift them.	1		16, 17
4. Steel	1		144
5. Methods of centering work	1		35 to 40
Combination center drill-	5	Lathe	9
Mounting work on centers.			

	Important Information	Book	Section	Pages
6.	Grinding lathe tools - their rake and clearance.	1		25 to 30
	Cutting tools and holders	5	Lathe	7, 8
		5	Small Tool	13
	Rakes and clearances	5	Cutting Tool	1, 2, 3
7.	How to measure with steel rule	5	Rule	1, 2, 3
8.	How to measure with calipers	1		31, 32, 33
		5	Small Tool	15
9.	Fractions- Decimal equivalent	5	Front of Bk.	1, 2
10.	How to read micrometers	1		34
	How to read and use micrometers	5	Micrometer	1 to 4
11.	Files and filing	5	Files	1 to 8
12.	Table of cutting speeds	5	Lathe	13
	Cutting speeds and lubricants for various metals.	1		47
13.	Knurling in lathe	1		52
		5	Lathe	15
14.	Machining work on mandrels	1		53, 54
15.	Taper turning (methods)	5	Lathe	13
	Application-calculations for compound rest and taper attachment	5	Taper	1 to 8
	Taper turning and boring (how to figure tailstock set-over and comp. rest and taper attachment settings.	1		75 to 84
16.	Mounting work in chuck (instructor should explain difference between independent, universal, combination chucks)	1		66
	Special lathe set-ups. Description and precautions.	5	Lathe	10, 11, 12
17.	Drilling, reaming, tapping in the lathe. Allowances for reaming cutting compounds. Tap			

	Important Information	Book	Section	Pages
	and drill sizes. How to figure size to bore before threading. Use of lead.	1		73, 74
18.	Draw-in collets and their uses	1		118, 119
	" " " " "	5		7
19.	Center gauge - its uses	5	Lathe	14
20.	Screw threads-National Series			
	Class of fits	5	Thread	1 to 4
	Dies and tap drill sizes	5		6, 7
	Standard thread forms	5		5 to 9
	Screw threads-terms, measurements, fits, change gears, use of thread dial. Left hand threads.	1		86 to 104
21.	Rules to observe when operating and performing various operations in the lathe	1		145, 146
	Safety rules	5		15

DRILL PRESS WORK

References: Book 3- "Handbook for Drillers"- Cleveland Twist Drill Company
Book 5- "Shop Theory"- Henry Ford Trade School

1.	Type of drill presses used	5	Drill & drilling	13, 14
2.	Parts of a twist drill necessary to know, so as to intelligently discuss their rake, clearances, cutting angles	5	"	1, 2, 3
		3		4 to 8
3.	Stock drill sizes - with table of cutting speed	3		8,28,28,30
		5	Drill & drilling	15, 16
4.	Types of drill shanks	5	"	3
		3		8
5.	Points on grinding (why and how)	3		9 to 16
		5	"	3, 4, 5

	Important Information	Book	Section	Pages
6.	Grinding drill for different materials	3 5	Drill & drilling	20, 21, 22 6, 7
7.	Purpose of thinning web on large drills	5 3	" "	6 23, 24
8.	Sockets, sleeves, drifts and tools you will use.	3 5	 Small Tool	36 to 45 8, 9, 10
9.	Common errors in practice and their results	3 5	 Drill & drilling	24 to 27 3, 4
10.	Drilling small holes	3		21, 22
11.	Meaning of common operations done in drill press	5	Drill & drilling	10, 11, 12
12.	Lubricants and their functions	3		21, 22
13.	Speeds and feeds- Calculations	5 3	Drill & drilling	9, 10 16 to 19
14.	Layout instructions and use of gouge or round nosechisel	5 5	" Small Tool	8, 9 12 fig. 103
15.	Use of surface gauge, dividers & hermaphrodites in layout	5 5	" " Drill & drilling	16, 18, 19 8
16.	Table of cutting speeds Top drill sizes Decimal equivalent of drill sizes	5	"	15, 16

Use and Care of Tools and Equipment

Keep tools clean and free from moisture.

Remove chucks and faceplates with proper tools.

Keep milling machine arbor support well lubricated. If using center at end of arbor adjust with small amount of end play to allow for expansion of arbor when heated and to minimize friction at this point.

When assembling taper parts of machines, be sure they are free of chips.

Before putting measuring instruments away, wipe with oily rag to protect from moisture.

Do not run drills into table of drill press.

Do not permit wheel on surface grinder to touch angle iron, vise or other piece of equipment used to support work.

Do not file into bench vise jaws.

Use soft metal hammer where possible to prevent marring work and damaging machines.

Shut off furnaces, forges, torches, etc., as it not only wastes fuel to let them run, but shortens the life of the furnace lining.

Do not force calipers over work or use on work while it is turning.

Keep tools sharp. After sharpening on tool grinder be sure to remove burrs with small oil or carborundum stone as this will make tools produce better work and last longer.

Before putting calipers and dividers away open them part way to relieve the spring.

Keep precision measuring instruments from dropping on the floor.

Do not force drills, files, emery wheel, etc., beyond their capacity to cut.

Clean all threaded parts thoroughly before assembling.

Place lathe chuck, faceplate and miscellaneous tools where they will not collect dirt and chips when not in use.

Adjust machine radial and thrust bearing and work between centers to allow for expansion and contraction due to temperature changes.

Do not lay files or other tools on lathe ways between carriage and head or tailstock.

Do not place tools where they will be jammed by moving tables.

Do not use hammers or wrenches with split or broken handles.

Keep oil holes clean.

Keep belts tight and well laced.

Lubricate the lathe dead center often especially when taking long, heavy cuts.

Clean centers and center holes before placing work between centers.

Loosen the toolpost and do not hammer the toolholder when making adjustments.

Do not permit tool or holder to run into lathe dog.
Stop machine before shifting or changing gears.
Do not remove chips from file by rapping on lathe ways.
Do not run cutting tools into mandrels.
Take light cuts on work supported on small mandrels.
Fasten dog on turned down end of mandrel, not on working surface.
Lubricate mandrels before driving into work.
When using an oil brush to lubricate and clean a milling machine cutter, apply the brush to the top of the cutter and do not permit it to get caught between the cutter and the work.
Use wrenches, screwdrivers, pliers, etc., of adequate size so as not to spring out of shape or break.
Do not use screwdrivers for chisels.
Learn to tighten screws and clamps enough to hold but no more as excessive tightening throws an unnecessary strain on the parts tightened.
Keep cutting tools cool when sharpening, as excessive heat will draw the temper enough to destroy their cutting qualities.
Use solid wrenches where possible, and wrenches of correct size.
Do not attempt to use collets for holding work larger or smaller than the size for which the collet was intended, as they will break or spring out of shape.

Use proper cutting speeds so as not to overheat or over-strain tools.

Do not permit milling machine cutters to run backwards.

When tapping deep holes, remove tap now and then to lubricate it and to remove chips.

Do not run cutters into dividing head or tailstock center, vises or dogs used to drive work.

Tighten drills securely so they will not slip and chew up shank.

Do not hold drills against work without feeding as this dulls them rapidly.

Keep emery wheels clean and true.

Do not use files as prybars.

Fasten file handles securely, but do not split.

Oil machines thoroughly before using.

Keep measuring tools away from ordinary tools when using and when put away.

Keep hacksaw blade from twisting or buckling to prevent breakage.

Do not use scales as screwdrivers.

Use proper size wrench for tapping-- if too large wrench is used the feel of the tap will be lost increasing the possibility of breakage.

Grind tools with correct rakes and clearances.

When lacing belts, cross lacings on outside of belt, not on pulley side.

SAFETY RULES FOR THE MACHINE SHOP - General safety -

Remove chuck key from chuck before starting machine.

Keep waste away from moving parts.

Remove chips from machine with brush (never use your hands).

Keep fingers away from all moving parts.

Stop machine before attempting to measure job.

Stop tool-post grinder before trying center gauge or measuring work.

Turn machine by hand when taking off or putting on a chuck.

Remove tool from tool post before taking off or putting on a chuck.

A cold chisel with a mushroom head should not be used.

Be careful of wrench slipping.

Exercise extreme care in handling electric drill.

Never allow water to come in contact with hot babbitt, lead, oil, or cyanide of potassium.

MILLING MACHINE SAFETY

Stop machine before measuring work.

Stop cutter from rotating before removing the chips with a brush (Hands should never be used).

Be careful in handling cutters.

Fasten work securely in machine.

GRINDING SAFETY

Get proper instruction before attempting any grinding.

Wear your goggles.

Keep fingers clear of abrasive wheel.

Fasten wheel securely.

Keep wheel properly dressed.

Guard abrasive wheels properly.

Do not overload grinding wheel.

Wheel must be balanced.

Replace trip dogs after truing wheel or cylindrical grinder.

HEAT TREATMENT SAFETY

Be careful of flare-back when lighting furnace.

Do not allow a furnace to reach an excessive temperature.

Use care in quenching work.

Do not allow water to come in contact with hot oil, babbitt, lead, or cyanide of potassium (cyanide of potassium is a deadly poison).

Never allow oil bath to catch fire through excessive heat.

Know how to combat oil fire.

Keep hands away from hot iron, lead or cyanide.

Select proper tongs to hold work.

MISCELLANEOUS SAFETY

Loose clothing should not be worn in the shop.

Always use a belt stick in mounting belts.

Never allow metal belt lacing to protrude on the sides of overhead belt.

Ladders must be securely placed and of proper construction.
Do not attempt to oil revolving machinery of countershafting.
Do not wear any rings.
Never remove guards from machinery.
Sleeves are to be rolled up to the elbow.
Don't ignore scratches or slight cuts.
You cannot talk and run power machinery at the same time.
Do not leave anything in your eyes overnight - such as chips, emery etc.
No files should be used without a handle.
Do not fail to report if any part of your machine is out of order. "An ounce of prevention is worth a pound of cure."
Do not leave anything loose overhead where machinery is running.
Do not invite accidents by ignoring danger signs: carefulness pays.

SUGGESTED OUTLINE - BLUE PRINT READING COURSE

For

NATIONAL DEFENSE

Objective

To train machine operators or those employed in allied trades to read such blue prints as would be necessary in the performance of their daily tasks, and to acquire the necessary auxiliary information usually connected with blue print reading.

Elementary (To be covered in 200 hour machine courses)

Three view projection
Dimensioning systems
  Fractional, decimal
Scales; full, half, quarter, double etc.
Angular measurement
Mechanical abbreviations
Tolerances
  Fractional, decimal, angular
Methods of indicating finishes
Drilled, reamed, bored, c'bored, c'sunk, spot facing and cored holes
Tapers, chamfers, necking and grooving
Sections, full and half
Materials in section
Screw threads systems
  Nomenclature
  Conventional representation
  Class of fit
  Fine and coarse thread series
Tapping holes
  Tap drill sizes
  Conventional representation
Standard machine fastening
  Screws, bolts, nuts
  Keys
  Springs, pins, rivets
Knurling
Title block
Specifications (part lists)
  Quantities, materials, commercial parts

Change notes

Advanced (To be covered in supplementary courses)

Auxiliary views
Violations of true projections
Omission of invisible detail
Revolved sections
Violation of true projection as applied to sectional views.
Detached sections
Fits
Shrink, drive, running etc.
Splines
Parallel, radial and involute
S. A. E. numbering system for steel and other materials.
Heat treating
Hardening
Cyanide, pack, nitriding, gas
Tempering
Annealing
Normalizing
Methods of testing
Hardness
Brinell, Rockewell, the Scleroscope
Eccentricity
Magnetically
Surface finishes
By depositing, plating, etc.
By heat
By salts and liquids
By tooling
Assemblies
Center tie-ups
Omission of invisible detail
Fits (advanced)
Allowances, positive and negative
Dimensioning, adding and multiplying of error
T slots, dovetails, gibs

Special (General outline to be expanded for special trades)

Sheet metal drawings
Intersections and developments
Welding, brazing, conventions for same
Structural steel drawings
Shapes, fastenings; conventions for same
Welding, brazing; conventions for same

Shop layouts
Floor plans
Pipes and connections, conventions for same
Electric wiring and connections, conventions for same
Mechanical drives, conventions for same
Gearing
Gear tooth forms, involute, cycloydal
Gear tooth systems, full depth, stub, fellows, etc.
Types of gearing, spur, bevel, helical, worm etc.
Inspection methods and equipment.

Each instructor marks each trainee in his class each day.

Instructor ____________________

Date ____________________

Student's Name	Operation	Time	Grade	Remarks

When the trainee has finished his course the following card is filled out and sent to the State Employment Bureau for their files.

VE-ND Form TER

Federal Security Agency
U. S. OFFICE OF EDUCATION
Vocational Training for Defense Workers
Washington

TRAINEE EVALUATION REPORT

Name_____ Address_____

Social Security number_____ Training center_____

Title of course_____ Date enrolled_____ Date completed_____

Occupation trained for_____ Number of hours of training_____

	Above Average	Average	Below Average	Unsatisfactory
Quantity of work done				
Quality of work done				
Knowledge of job				
Ability to learn				
Dependability				

Machines used:_____

Tools and instruments used:_____

Materials used:_____

Remarks:_____

Reported by_____ Title_____ Date_____

CHAPTER III

Results of Two Training Centers

On the application blank each trainee is requested to answer questions relative to his nationality, birthplace, age, education, home address, employment and citizenship. Of these groups we are here classifying them as graduates or drop-outs, which may mean they found employment before their 200 hours were up, or left for various other reasons.

The following lists include General Machine Courses 104 and 105 only. They do not include any enrollments from the State Trade School.*

* Figures taken from Board of Education records on Job-Training in Public Schools, Hartford Connecticut.

Table I

NATIONALITY	General Machine 104 - 7/15/40 to 9/20/41			General Machine 105 - 7/29/40 to 6/28/41	
	Grad.	Dropped		Grad.	Dropped
American	129	24	Eng-Irish	9	1
Am-Armenian	1	0	Eng.-Swedish	1	0
Am-Bohemian	1	0	French	37	9
Am-Czech.	1	0	German	9	2
Am-French	9	0	Ger.-American	2	0
Am-Greek	1	0	Ger.-Dutch	1	0
Am-Norway	1	0	Ger.-English	2	0
Am-Swedish	1	0	Ger.-French	1	0
Am-Syrian	1	0	Ger.-Hungarian	1	0
Armenian	8	1	Ger.-Irish	5	1
Austrian	5	1	Greek	4	1
Austrian-Am.	2	0	Greek-Irish	1	0
Bohemian	1	0	Greek-Polish	2	0
Czech	1	1	Greek-Scotch	1	0
Danish	0	1	Hungarian	1	0
Danish-Eng.	1	1	Indian-Scot.-Irish	1	0
Danish-Irish	0	1	Irish	54	20
Dutch-Eng.	2	0	Irish-Am.	6	0
Dutch-Russian	1	0	Irish-Arabian	0	1
English	25	3	Irish-French	8	0
English-Scotch	1	0	Italian	173	20

	Grad.	Dropped
Ital.-Armenian	1	0
Ital.-English	1	0
Ital.-Irish	4	1
Ital.-Polish	0	1
Ital.-Scotch	1	0
Jewish	80	11
Lithuanian	26	3
Lith-Finn	1	0
Lith-Irish	1	0
Negro	7	3
Negro-Jewish	1	0
Polish	127	8
Pol-Irish	1	0
Pol-Scotch	1	0
Portuguese	2	0
Rumanian	1	0
Rum.-Russian	1	0
Russian	23	2
Russ.-Austrian	4	0
Russ.-English	1	0
Russ.-Polish	5	0
Scotch	4	1
Scot.-American	1	0
Scot.-French	1	0
Scot.-Irish	2	0
Scot.-Eng. Irish	2	0
Slovak	6	0
Spanish	1	1
Span.-Swiss	2	0
Swedish	6	2
Swiss	2	0
Syrian	1	0
Syr.-Polish	1	0
* TOTAL	829	121

* One graduate and 1 dropped did not give this information.

Table II

BIRTHPLACE	General Machine 104 - 7/15/40 to 9/20/41			General Machine 105 - 9/29/40 to 6/28/41	
	Grad.	Dropped		Grad.	Dropped
Armenia	1	0	Minnesota	2	0
California	1	0	Missouri	1	0
Canada	8	0	Montana	1	0
Colorado	1	0	New Hampshire	9	0
Connecticut	184	28	New Jersey	7	0
Czechoslovakia	1	0	New York	48	5
Denmark	0	1	No. Carolina	1	0
England	5	1	Palestine	1	0
Georgia	4	0	Pennsylvania	15	7
Germany	2	0	Poland	6	0
Greece	1	0	Portugal	1	0
Hartford	354	48	Rhode Island	4	1
Illinois	1	0	Rumania	2	0
Indiana	2	0	Russia	5	0
Iowa	2	1	Scotland	2	0
Ireland	2	3	Vermont	10	4
Italy	22	1	Virginia	0	1
Louisiana	1	0	W. Virginia	3	1
Maine	25	8	TOTAL	830	122
Massachusetts	93	12			
Michigan	1	0			

Table IV

EDUCATION	General Machine 104 - 7/15/40 to 9/20/41	General Machine 105 - 7/29/40 to 6/28/41
	Graduate	Dropped
1 to 5th Grade	7	2
6th Grade	8	1
7th Grade	16	8
8th Grade	112	19
9th Grade	69	13
10th Grade	106	19
11th Grade	92	16
12th Grade	363	35
College 1.	22	2
College 2.	14	1
College 3.	7	1
College 4.	6	5
Higher college work	3	0
* TOTAL	825	122

* Three graduates gave no educational information on cards.

Table V

HOME ADDRESS	General Machine 104 - 7/14/40 to 9/20/41	General Machine 105 - 7/29/40 to 6/28/41
	Graduate	Dropped
Connecticut	185	34
Hartford	619	85
Iowa	1	0
Maine	2	2
Massachusetts	9	1
New Hampshire	2	0
New York	5	0
North Carolina	1	0
Pennsylvania	3	0
Vermont	3	0
TOTAL	830	122

Table VI

CITIZENSHIP

	Graduates	Dropped
Born Citizens	773	115
Naturalized	50	6
Alien	5	0
* TOTAL	828	121

* Two graduates omitted this information - one from Canada and one from Poland.

Table VII

COLOR

	Graduate	Dropped
White	821	119
Negro	8	3
Red	1	0
TOTAL	830	122

Table VIII

	Graduate	Dropped
W P A	113	35

Table IX

REASONS FOR DROP-OUTS

Non-attendance	106
Found work	5
Physical condition	4
No mechanical aptitude	6
In United States Army	1
TOTAL	122

Table X

EMPLOYMENT	General Machine 104 - 7/15/40 to 9/20/41	General Machine 105 - 7/29/40 to 6/28/41	
Allen Mfg. Company	8	M. S. Little Co.	2
Arrow,Hart & Hegeman	1	N.Y.,N.H. & H. Railroad	1
Billings & Spencer	12	Oslund Tool & Die	1
Bond Bread	1	Pratt & Grady	2
Bush Mfg. Co.	1	Pratt & Whitney Aircraft	222
Capewell Mfg. Co.	1	Pratt & Whitney Small Tool	24
Colt's	163	Private Employment	13
Cushman Chuck	4	M. H. Rhodes, Inc.	2
Economy Elec. Co.	1	Royal Typewriter	7
Fenn Mfg. Co.	1	Spencer Turbine	1
Granby Mfg. Co.	3	Taylor & Fenn	12
Gray Mfg. Co.	1	Travelers Ins. Co.	1
Hamilton Propeller	32	Union Drawn Steel Co.	2
Hanson-Whitney	4	United States Army	5
Hfd. Machine Screw	11	United Tool & Die	5
Hfd. Pntg.& Decorating	1	Underwood Typewriter	9
Hfd. Pattern & Model	1	Veeder Root Corp.	6
Hfd. Spec. Machine	3	Victor Oil Burner	1
Hfd. Tool & Die	3	Walton Tap Co.	1
Henry & Wright	16	Whitlock Coil Pipe	4
Holo-Krome Screw Corp.	5	Whitney Chain	4
Jacobs Chuck Co.	2	Windsor Locks Airport (Carpenter)	1
		TOTAL	600
		Unemployed	230
		Graduates ---------	830

From July 15, 1940 to September 20, 1941 our total enrollment was 981 of which 143 dropped out, 683 graduated and 155 were transferred to Billings and Spencer plant for further training. 552 were placed in employment by August 31, 1941.

CHAPTER IV

Detail of a Proposed Course of Study for High School and Proposed State Program for Improving Industrial Arts.

To train a group for each need of industry and to present an opportunity to more of our students, we have three courses of study.

1. Pre-Apprentice: For the boy above average ability planning to enter aircraft apprentice school, technical college, or other apprentice training courses.

Required Subjects 1st year	Required Subjects 2nd year
English	English
Algebra	Algebra
Ancient History	Modern History
Elect one subject	Elect one subject
German, French or Italian	German, French or Italian
General Science	

3rd year	4th year
English	English (incl. report writing)
Plane Geometry	American History
Physics	Senior Mathematics (Trig. and Solid Geometry)
Mechanical Drawing 1, 2	Metal Shop 1, 2
Elect one subject	Elect one subject
German or French	(Chemistry preferred)
	German or French

2. Pre-Vocational or "Learner": For the boy of good ability but not the superior ability required for an apprentice. He would be employed by the factory in routine work but as he showed ability would be trained in various phases and could advance in some factories, probably to the position of foreman. The purpose of the "learner" or pre-vocational industrial arts curriculum is to give an introduction to machinery, to remove the fear of machines, and to give a background of shop mathematics which would make the boy preferable in initial employment to the untrained person who comes in from the candidate line.

Required Subjects 1st year	Required Subjects 2nd year
English	English
Applied Math. or Gen. Math.	Metal Shop and Blue Print reading.
Woodworking Shop and Mechanical Drawing	(Inc. Mech. Drawing)
An elective (General Science preferred)	Two electives

3rd year	4th year
English	English (incl. report writing)
Metal Shop (2 double periods)	Metals Shop
and Shop Math. & Theory of Mach.	Shop Math. & Theory of Mach.
American History	American Democracy
An elective (Physics preferred)	An elective (Chemistry preferred)

3. General Industrial Arts: For students who will be seeking employment in routine work as unskilled or individual machine operators. The opportunities at this level are greater and more desirable than is usually recognized for students who take industrial arts merely as a part of general education. Their interests are more largely avocational or "hobby" interests. They have no premeditated vocational intent.

Required Subjects 1st year	Required Subjects 2nd year
English	English
Applied Math. or Gen. Math.	Metal Shop and
Woodworking Shop and	Mechanical Drawing
Mechanical Drawing	Two electives
An elective	
(General Science preferred)	

3rd year	4th year
English	English
Metals Shop or	Metals Shop or
Woodworking Shop and	Woodworking Shop and
Mechanical Drawing	Mechanical Drawing
American History	American Democracy
An Elective	An Elective

II Objectives

1. To develop interests in and understanding of the place of industry, its materials and processes in social economic life.

2. To develop consumer's knowledge which involves ability to select wisely, care for and use properly various industrial products about the home.

3. To foster appreciation of good workmanship and good design in industrial products.

4. To develop safe working habits and attitudes of respect for hygiene and safe working practices in the preservation of human resources.

5. To further the growth of problem-solving attitudes as experienced in creating industrial products.

6. To inculcate ideals and attitudes of readiness to assist and to cooperate with others in industrial shop activities.

7. To foster the growth of effective individual work habits through cheerful, orderly and methodical performance of any chosen or assigned tasks.

8. To develop "common sense" in the handling of any task.

9. To show the use of drawing and our dependence upon good blue prints, as well as how they are made.

10. To develop wholesome leisure time habits in hobby interests.

11. To provide occupational training in aptitudes and interests.

12. To foster appreciation of the contributions of science to industrial progress.

The following course of study will show how the operations of machine work are presented in High School. They follow an order similar to our Job-Training.

It must be remembered that High School classes meet one period a day (45 minutes) five days a week for thirty six weeks, making a total of one hundred and thirty-five hours a year.

Job-Training covers 200 hours which amounts to sixty-five hours more than a complete high school year, but the high school pupil has three years in which to take machine courses, so benefits much more than the Job-Training pupil.

The following is a suggested course of study in Machine Shop Practice for Senior High Schools.

Machine Shop Practice for senior high schools is presented as a course of instruction in the nomenclature, operation, use and care of machine-tools and small-tools. Following the most elementary stages, emphasis upon the development of skills becomes progressively greater, until

upon completion of the full high school course, the student is well grounded in the essential principles of Machine Shop Practice.

Good shop habits, including those directly affecting the safety of the workmen, as well as those habits involving common courtesy, certain unwritten laws of the shop, with respect to the rights and privileges of fellow workmen - in fact, those precepts which make for a happy harmonious life with one's fellow workmen - are taught and emphasized unceasingly throughout the course. The above statement of content might well be labelled a "Course in Good Citizenship"; for in truth it is precisely that.

From the beginning, an earnest effort is made to develop an intelligent respect for the equipment with which the workman must do this work. The instructor is often faced with the common, disturbing attitude of "What does it matter? It isn't mine. It belongs "to the city". "If I break it, they'll buy a new one." Despite frequent discouragement, the instructor must fight on, keeping doggedly at it, always striving to persuade the student that, indirectly, the equipment is in fact his own, and should be treated as carefully as if it had been purchased directly at his personal expense.

The instructor emphasizes, for example, the fundamental importance of a finished surface; and the basic reason for maintaining such surfaces in a condition as nearly perfect

as possible. Small-tools, such as files, wrenches, hammers, scribers, center-punches and the like, are presented for use only as intended - each for it's own purpose. Rigid insistence is placed upon such use. Attainment of the above objectives, obviously important to any who know machine tools and shop equipment, can be had only as the result of diligent, unceasing effort on the part of the instructor. It is difficult, but well worth the price.

In conjunction with the practical shopwork, a theory period is held during approximately ten class periods each semester. During the theory period, the student studies a textbook on machine-tool operation, or listens to a lecture by the instructor, or witnesses a demonstration relating to the construction, operation and care of some basic machine tool and incidental small tools. Besides gathering a store of valuable information which it is difficult to give individually, the student is furnished with material for a selfmade reference book, which may be used to excellent advantage both as the course progresses, and after the course has been completed, should the student elect to pursue some branch of industrial machine-tool or small-tool work.

It will be noted that no mention has been made of the time element, which is so important to production work. It should be borne in mind that, although the subject matter

deals directly with implements of industry, the course is a bona fide part of a public high school curriculum, and as such demands that the primary emphasis be upon the individual student, with due respect for varying aptitudes and interests. While all due importance is accorded the attainment of proficiency in the operation, use and care of shop equipment, there are many cultural values present, which are of even greater value to the young student than are the apparent facts of the course. Some of these cultural values have been mentioned in previous paragraphs. In so far as speed of operation is concerned provided that the graduate from this course finds work in a related field, it is of great importance to him as an individual that he know the "whys and wherefores" of the tools with which he may be called upon to perform. These "Whys and wherefores", the student absorbs gradually by virtue of persistent teaching, during which period he is given the all important privilege of taking sufficient time to learn. Here, of course, the emphasis is upon the development of the individual student, and not upon the product. The student who has diligently applied himself in pursuit of knowledge of the basic machine-tools and small-tools encountered in this course; and who has, incidentally, developed a sound "mechanical sense", will have little difficulty in learning the capacity of a production machine, and in adapting himself

thereto. Moreover (and here again, attention is directed to the pupil emphasis) such a person will, on the whole undoubtedly merit advancement in less time than will the unschooled workman who must learn each detail and "fine point", as so many do, "the hard way".

There follows a list of project and operations. These are listed by courses.

SHOPWORK 3

PROJECT: Turning Practice Piece

OPERATIONS:

Placing "dog" on work
Removing burrs with a file
Facing in a chuck
Spotting centers
Center-drilling
Setting up the lathe
  Mounting the faceplates
  Placing the centers
  Lining up centers
  Setting up the tool
  Placing stock between centers
Selection of reasonable spindle speed
Facing stock between centers
Measuring length with a scale
Straight turning
  Rough turning to a caliper measurement
  Finish turning to a micrometer measurement, using cross-feed dials
Turning to a shoulder
Necking with a cut-off tool
Knurling
Filing in the lathe
Tool-grinding

PROJECT: Drill Adapter

OPERATIONS:

Use of the power hack-saw, or shaping saw
All operations necessary to obtain the finish diameter to micrometer measurement

Turning to a shoulder
Necking
Setting up milling-machine index-head
Milling the tapered square tang
Drilling in a lathe
Drilling in a vise, in a drill-press
Tapping a hole
Making the set-screw
  Use of collets
  Use of compound rest
  Facing
  Turning
  Turning to a shoulder
  Milling flats on a square-head set screw
  Cutting a thread with a die
Polishing with emery cloth in a lathe

PROJECT: Special Jobs (lathe-rickers, tools, etc.) teaching the use of the shaper

PROJECT: "V"-belt Pulley

OPERATIONS:

Truing up stock in an independent chuck
All previous operations incident to center-drilling in a lathe
Mounting stock on an arbor
  Use of the arbor press
Facing and turning on an arbor
Use of a form-tool
Drilling a hole at an angle
Tapping a hole at an angle
Making a headless set-screw
  Turning
  Chamfering
  Threading with a die
  Cutting off with a hack-saw
  Hack-sawing a screw-driver slot
  Use of soft jaws for the vise

SHOPWORK 4

PROJECT: Thread-turning exercise

OPERATIONS:

All operations on Shopwork 3 incident to preparation for cutting a thread
Determining the correct pitch of the thread from a chart
Selection of the proper stud-gear and screw gear
Mounting the gears

Setting the thread-chasing lever on the apron
Setting the tool
  Use of the center-gauge
Setting the thread-stop
Use of the thread-chasing dial
Fitting the thread to a thread-gauge
  Use of the file to remove burrs

PROJECT: Clamp-dog Screw

OPERATIONS:

All previous operations incident to turning to size and length
Milling flats on the square head of the screw
Turning the thread
Fitting the thread
Finishing and polishing the screw

PROJECT: Milling-machine Jack

(Parts: base; screw; anvil; set-screw)

OPERATIONS:

All necessary previous operations
Use of a counter-bore
Use of a boring tool
Use of a round-nose form tool
Draw-filing

SHOPWORK 5

PROJECT: Hack-saw Frame

(Parts: frame-back; end-blocks; handle; nut; collar; screw; stud; handle-plug)

OPERATIONS:

Use of power hack-saw
Bending heated metal
Use of surface-plate and surface-gauge
Filing
Draw-filing
File-fitting
Removing burrs
Turning
Facing

Lay-out work
Center-drilling
Drilling
Milling slots
Use of hand hack-saw
Counter-sinking
Cold rieting
Setting up stock in a chuck
Reaming
Mounting work on an arbor
Scale measurement
Knurling
Filing in a lathe
Milling with the index-head
Tapping
Use of the arbor press
Setting up the lathe for thread-cutting
Cutting a thread in a lathe
Fitting a thread to a thread-gauge
Milling a shoulder
Drilling holes at an angle
Use of spring collets
Micrometer measurement
Turning a piece to a force-fit
Use of the precision collet lathe, with compound rest
Polishing work with emery-cloth
Care of all machines, machine-tools and small-tools involved in the above operations
Practice in the care and operation of the tool-crib

SHOPWORK 6

GENERAL: The care and operation of all machine-tools and small-tools involved in the following operations:

Instruction and work on the surface grinder and the cylindrical grinder
Care and operation of the tool-crib
Special jobs, involving the making of shop equipment.

PROJECT: Model Steam - or Air-powered Engine

OPERATIONS:

A very finely developed model steam-engine is at present serving as the working material for Shopwork 6,

and a part of the time for Shopwork 7. This clever little model has been developed from a very modest original. Over a period of several years, refinement has followed refinement, until the present model is a neat, compact assembly of finely designed parts. It may be appropriate to state that the model actually works. The multiplicity of operations involved includes work of a comparatively precise character, carried out on virtually every machine-tool in the shop. The standards of accuracy are appropriately more rigid than those imposed in previous courses; and are maintained as nearly as possible, in proportion to the previous experience and apparent capacity for development, of the individual student.

Work upon the component parts of the above model requires fine work with some of the more common precision instruments, such as the dial indicator and the "center wiggler".

As stated above, some few of the parts are finished by grinding on the surface grinder, and on the cylindrical grinder.

SHOPWORK 7

GENERAL:

Care and operation of all machine-tool and small-tools involved in the following operations

Special jobs involving the making of shop equipment.

Care and operation of the tool-crib

Work on the surface grinder

Work on the cylindrical grinder

PROJECT: Model Steam or Air-powered Engine

In the event that some students do not complete the making of the model engine described in Shopwork 6, sufficient time is now given for the completion of that job.

PROJECT: Indexing and gear problems

Attention is given to the solution of gear problems. Considerable time is spent studying the more common gear formulae. After a reasonable time, a problem is presented to the student, who works out the necessary data, using the above formulae. He then starts with raw stock, and puts his data into practice. This involves selection of the proper gear-cutter; indexing the teeth of the gear; layout of the correct center-distance, and the mounting of the gear and pinion in a working position.

An incidental to the solution of the above problems, of course, is the making of the gear and pinion blanks; turning and fitting of the studs; making and finishing of the base for mounting the gear and pinion.

The gear, the pinion and the base are ordinarily finished upon the surface grinder.

PROJECT: Spiral Milling Problems

In the remaining time, attention is given to study

and practice in the setting up of the universal milling machine for special indexing and milling. The student receives instruction in the principles of the operations, and is aided in setting up and operating the milling machine in solution of a problem of this nature.

SHOPWORK 8

This course is being developed in addition to the foregoing, which have been in operation for a period of many years. Shopwork 8 is a sort of apprentice course, designed to furnish the student with knowledge of and experience with common production devices.

The production devices involved are fixtures, jigs and gauges. Specially designed project necessitate the use of all these devices, to the end that the student who elects to enter the field of industrial production may leave high school knowing that such things are used; what they are; why they are used; and something of their construction and use.

The time element is an important factor in Shopwork 8.

The projects developed for this course call for considerable work on the surface grinder and the cylindrical grinder.

PRE-VOCATIONAL OR LEARNER GROUP

Grade X -- Some Blueprint Reading (including Mechanical Drawing)

I. Trends and II. Objectives

The study of Mechanical Drawing has long been recognized as the best method of learning to read drawings. Present industrial trends make it absolutely necessary that this universal language (mechanical drawing) be understood. Mechanical Drawing as we know it necessitates long and careful study. Some pupils will need only a working knowledge that permits them to understand a draftsman and perhaps to make rough drawings themselves upon occasion. Those who need an expert knowledge of drawing must secure it by taking a more thorough course in Mechanical Drawing. We believe shop sketching may be quicker and will fulfill the desired need adequately. It is essential that students have some method of expressing the principles discussed in the text, and shop sketching meets this need admirably.

In recognition of the principle that we learn by doing, a number of drawings have been included to give practice in reading. This course has been arranged to cover as wide a range as possible.

We believe the course to be well-suited to individual study, and when it is so used we urge that special attention be paid to shop sketching, and that the student seek criticism of his drawings by the instructor.

This course has been prepared for those who wish to acquire a working knowledge of the subject through reading. Into it the authors try to give an understanding of the fundamental principles of Mechanical Drawing, a knowledge of drafting conventions, practice in the interpretation of drawings, and some practice in expressing one's own ideas by "shop sketching".

The work in "shop sketching" is included to fill the student's need for some form of expression of the information imparted in the instructions. It is a well-known and sound principle of teaching that we do not really know a thing until we can give some expression to that information; or, in other words, make some use of it. In addition, the ability to "draw" is a very valuable acquisition to one who may be called upon to explain the meaning of a drawing, or to give constructive directions to others.

III. List of operations of activities

This course includes the use of instruments and drawing at the board. It would be much shorter than the present school course, and many problems concerning theories, inking, and technique would be dropped. The course would cover the use of instruments, detailing, and the making of blueprints.

IV. Suggested Projects

1. Drawings of sections of different types and symbols:-
   building, electrical, surfaces, rivets, screws and bolts.

2. Orthographic Projection
3. Drawings of Auxiliary views and actual sections
4. Revolutions
5. Drawings of Trade conventions of threads
6. Drawings of Trade conventions of bolts
7. Sketches of details from actual shop prints
8. Sketches of details from actual shop prints
9. Sketches of layout or assembly from shop details
10. Sketches of layout or assembly from shop details

V. Suggested Texts

1. Technical Drawing -- Giesecke, Mitchell, Spencer
2. Blueprint Reading -- Wyatt
3. Blueprint Reading -- Ford Trade School
4. Mechanical Drawing for High Schools -- Youngberg

SHOP THEORY

Trends

I. A segregated, compact and closely correlated theoretical course designed to aid in solving shop problems.

II. Definite goal formulated to meet needs as we know them.

III. Careful classification of pupils as to abilities in various classes.

IV. A more true and accurate means of evaluating the work of individuals, providing a true index of knowledge and abilities.

V. Provide a setting which will develop correct attitudes, interests and appreciation.

VI. Affording a place in our methods for the use of films, lectures, visits, trade periodicals and manufacturer's literature.

Objectives

I. A more technical background for students to approach and solve by industrial methods the shop problems.

II. Applying to known shop problems industries, methods, rules, formulae and principles.

III. Stimulate and encourage correct work habits; safe practices; ideals of workmanship and sane attitudes as to leisure.

IV. Provide a true perspective of one's part in the workings of a democracy.

Activities

I. Small Tools

a. By use of Shop Theory - Henry Ford Trade School

By use of Machine Tool Operation - H. D. Burghardt

1. Comprehensive treatment

a. kinds	f. sizes
b. use	g. operation
c. care	h. lubrication
d. parts	i. manufacture
e. choice	j. measurement

And any other necessary knowledge which will aid us in the utmost in knowledge and skill.

Aids

"Safety Code for Use of Abrasive Wheels"

"Centerless Grinding Bulletin"

"Tool and Cutter Grinding Wheel"-Abrasive Co., Philadelphia

"Aluminum and How to Solder It"

"Samples of Solder"- L. B. Allen Co., 6767 Mawr Ave., Chicago, Illinois

"What Metal Shall It Be?"- American Rolling Mill, Middletown, Ohio

Metal Working Abrasives - samples, lecture course, charts Behr-Mainning Co., Troy, N. Y.

Heat Range Chart - Chicago Flexible Sahft Co., Chicago

Heat Color Chart - Carpenter Steel Co., Reading, Pa. 10¢

Milling Machine Practice - Cincinnati Milling Machine Co. Cincinnati, Ohio

Metal Cutting With Hack Saw Blades - Clemson Bros., Inc. Middletown, N. Y.

Wall Chart of Machine Lathe - LeBlond Machine Tool, Cincinnati, Ohio

Micrometer Chart

Micrometer Adjustment - Lufkin Rule Co., Saginaw, Mich.

Screw Threads Chart

First Aid

Industrial Safety Education - Metropolitan Life Ins. Co. New York, N. Y.

Correct Pipe Threading Principles - National Tube Co., Chicago, Illinois

Wall Chart of Files - Nicholson File Co., Providence R.I.

Bolt, Nut and Rivet Tables - Russell, Bursdell & Wood
Port Chester, N. Y.

Saw Materials - Simonds Co., Fitchburg, Massachusetts

Measurement - Browne, Sharpe Co., Providence, R. I.

NOTE: Practically every concern dealing in Metal has charts, bulletins or folders we could use to advantage.

Museum

There is one outstanding in this field and that is the J. Higgins Museum at the Worcester Pressed Steel in Worcester, Massachusetts, where one may see the development through the ages to modern times supplemented by a vast library of information.

Proposed Teacher Training Program

for

Connecticut in Industrial Arts

Our state program is also progressing toward the same goal. In 1938, long before the present emergency, there was initiated under leadership of the State Board of Education, a long-range program of appraisal and evaluation seeking the development of the best possible educational experience for the boys and girls of Connecticut.

A fundamental principle governing this study is to secure progress through democratic action. That is the reason for the extensive and intensive committee organization - the development from the bottom up rather than from the top down procedure. It is a cooperative venture, the results emanating from the needs as seen in our communities and classrooms of the state.

Another fundamental principle basic to this development is a new concept of the relationship between a state department of education and the local school system. The trend in America toward centralized control and domination everywhere is apparent. General belief that local initiative and control must be strengthened, not only in the field of public education but also in all those services that effect people. For this reason, the purpose of the State Department of Education was defined as: (1) leadership, (2) service, (3) research and planning.

It had become evident through the first study and observation that there must be greater pre-vocational and vocational opportunity for boys and girls. This was substantiated by two years of cooperative study with the Manufacturers' Association, with labor, and from the observable deficiencies in our system. The war has aided in bringing to the attention of our people the need to train everyone for living and making a living in a technological society.

We desire to see broken down the concept of an aristrocracy of subjects; the idea that industrial arts is for the student who cannot get along in academic subjects; the feeling that there must be an intellectual aristocracy based on capacity to complete a particular curriculum preparatory to a higher educational opportunity. If we are to build a classless society these concepts must go.

We believe that every boy or girl should have an opportunity to learn to use his hands. We believe that the industrial arts should provide for broader possible specialization in vocational areas. We believe that according to the abilities of the student, the last two years of the secondary school, and to some extent the earlier years should provide for each, the desirable emphasis on vocational, pre-vocational, avocational, and consumer attitudes and skills.

We believe that there must be a greater correlation between the fine arts and industrial arts, without too many fine departmental lines. In a sense, the industrial arts, fine arts and many other areas of the school program are service areas in the development of a program. We cannot work separately and apart. No one department or area of learning or experience represents the American educational system.

A plan advanced under the leadership of the State Department of Education proposed the universal acceptance of Industrial Arts as part of a general education for all and vocationalization of Industrial Arts for a considerable number. It is my personal judgment that those in the industrial art's field are missing the opportunity if there be a continuance of the belief that industrial arts is solely general education or must not smack of vocational education.

We believe that vocational education for the skilled trades should be intensified and extended. The program of the State Board of Education includes three new trade schools and the expansion of existing facilities and programs.

We believe that candidates for teaching positions in the trade schools and the present teachers should include greater balance of professional educational preparation while maintaining present standards of skill in the given trade.

We believe that training for the semi-skilled trades and jobs generally may be accomplished by the secondary schools of the state and the trade schools working cooperatively. In many cases a breader and more effective program is possible.

Policy Leads to Program

The more expression of policy gives no benefit to the pupil. Action, if the state board of education is to provide its greatest service, starts with the reorganization of it's teacher training program to implement it's policy.

Thus, the State Board has created a division of Vocational Education in the Teachers College of Connecticut having three sections. Two of these are important in the field under discussion. The third is "Training for business." Following are the two departments dealing with the problem immediately under discussion:

A. Trade-Industrial - within the division of vocation education. This is a teacher training program for the faculty member either in or planning to enter the trade schools. It is designed not only to provide a general background, but also technical instruction. We have the trade schools of New Britain and Hartford adjacent to the teachers colleges, and these institutions will serve as laboratories.

B. Industrial Arts. Becuase the implication of industrial

arts in the area of pre-vocational training and the possible outright vocational possibility for many boys and girls, particularly in the semi-skilled areas, we have included, so far as teacher training is concerned, industrial arts within this division of vocational education.

This has nothing to do with the curriculum pursued by industrial art's teachers, but it does recognize that one of the greatest outlets and one of the greatest selling points for industrial arts is it's vocational effectiveness and its prevocational importance throughout every school system. More than that, the simplicity of administrative organization is immediately evident.

It must be clear that the industrial arts starts in the early elementary school and that for many it will only be a general education experience, but for all it at least will give the individual an opportunity to learn how to use his hands.

Such inclusion implies that the curriculum of industrial arts teachers will be modified toward the vocational only to include such emphasis as seems desirable toward pre-vocational and vocational effectiveness. The purpose, as indicated in the philosophy indicated earlier, will be to provide teachers who can in their classrooms give the whole range of emphasis necessary to meet the needs of the individual students in their classes.

This implies no let-down on the general, avocational,

consumer, and cultural aims of industrial arts. It is recognized that these features of industrial arts start very early in elementary school. Thus the industrial arts teacher must be prepared to assist the elementary school teacher in these activities. Far from being dismissed, this factor will be a subject of major attention.

The Staff at Teachers College

As policy leads to program, so an effective program must be implemented by a coordinated effective teaching staff so organized that each teacher has definite responsibilities, clear purpose, and is not overburdened. Thus the following teaching organization has been provided to make the program effective:

1. At the Connecticut Teachers College in New Britain, as head of the Division of Vocational Education will be Raymond Phipps. The responsibility of teacher training in the trade-industrial and the industrial arts section will be his. Associated with him will be five full-time professors in the industrial arts and vocational fields, and in addition six specialists from the central staff. In all, we will have a faculty of approximately fifteen in these areas. Dr. Grace will personally teach a course in the field of administration. We will offer not only the undergraduate program but shortly an opportunity for graduate study for a limited number of qualified candidates effective next year.

2. In addition, in the field there will be available

for advice to school systems a specialist in industrial arts. He will be closely associated with Mr. Phipps, for to be effective, training of teachers and service in the field must be closely allied. However, this field consultant will be a part of the Bureau of Youth Services and have the benefits of a special supervisor heading work with youth in industry and of the Director of Guidance. Thus, the direct teacher preparation and consultation service in industrial arts will be assisted by these important supplementing activities.

In conclusion,it is our expectation that proceeding from policy to program to teacher preparation carefully, step by step, building soundly, with due consideration for the interests of all concerned and ever with our eyes on the needs of the individual student in the schools, the evaluation and redirection of the program of industrial arts will lead to improvement and better acceptance by the communities served.

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