SET-UP and OPERATION
of
Brown & Sharpe
Automatic Screw Machines

No. 1

Of a Series of Booklets
for Training Operators

A General Explanation of the
Operation of B & S Screw Machines

Brown & Sharpe Mfg. Co.
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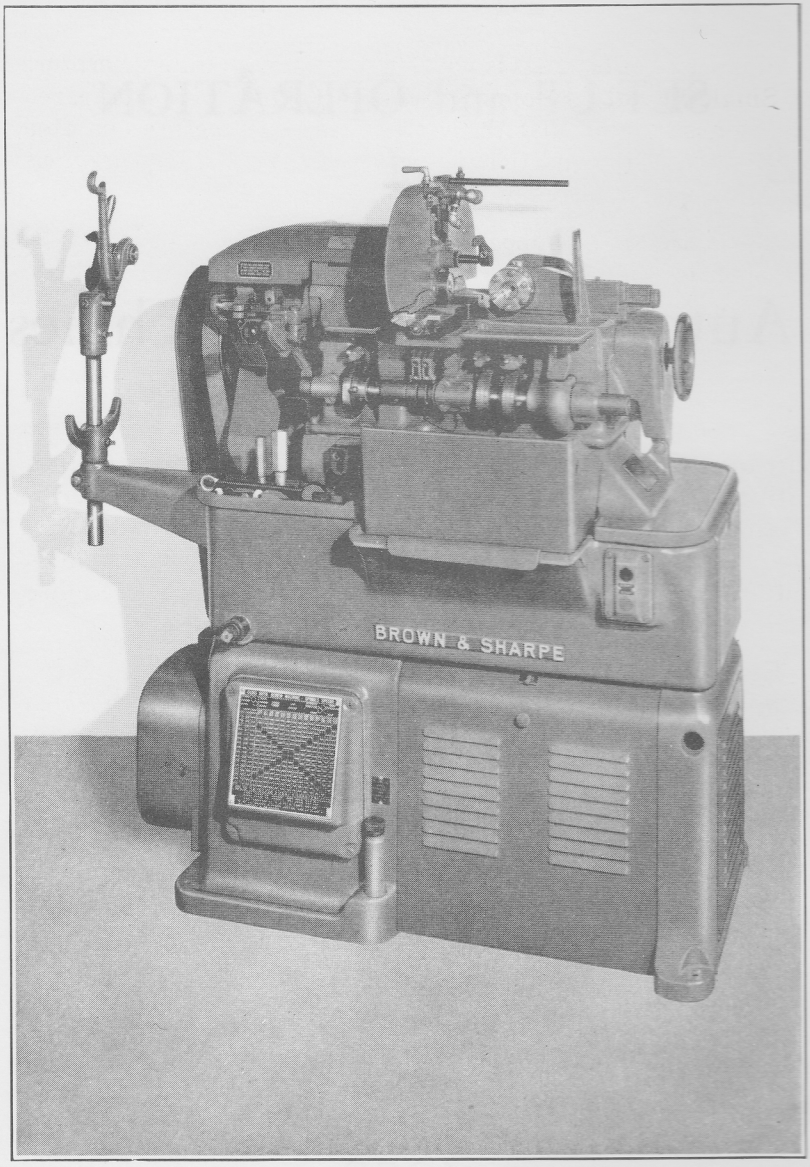


No. 00G Automatic Screw Machine—High Speed

INTRODUCTION

This series of booklets is written to help in training operators of Single Spindle Automatic Screw Machines. It is prepared on the assumption that the reader has never before operated a Screw Machine and that he may not have had any previous experience with machine tools.

It is the practice in most shops to start a new man under the guidance of an experienced operator. His first work may be to help keep machines running by restocking them, changing feed fingers and collets and making minor adjustments. Very soon, however, he is given an actual job to set up and run off. It will probably be the simplest piece being produced in the department, and will have a minimum number of operations, perhaps only those of forming and cutting off. Having become familiar with this job and the "feel" of the machine, the operator is given a piece which requires one more operation in its production. From this he goes to a little more difficult job and so on until he has used most of the screw machine tools and is familiar with the common machine attachments.

These booklets follow this old shop method of training. First, there is described in great detail one of the simplest jobs which can be done in a Screw Machine. From this is developed a three-operation job and from there jobs which require more turret tools and the operation of attachments.

Such a treatment should help a learner to better understand the things which are explained to him by other operators or by his foreman. By studying during spare time or during study periods set aside by his employer, an operator can make more rapid progress and will sooner qualify himself for advanced classes of work.

Intricate work requiring unusual operations or special attachments are not described in these booklets. Delicate spindle and clutch adjustments are not discussed and repair and reassembly work is omitted. These are beyond the elementary purpose of this series and must be obtained from the treatise "Construction & Use of Automatic Screw Machines," a more advanced text on Brown & Sharpe Automatics.

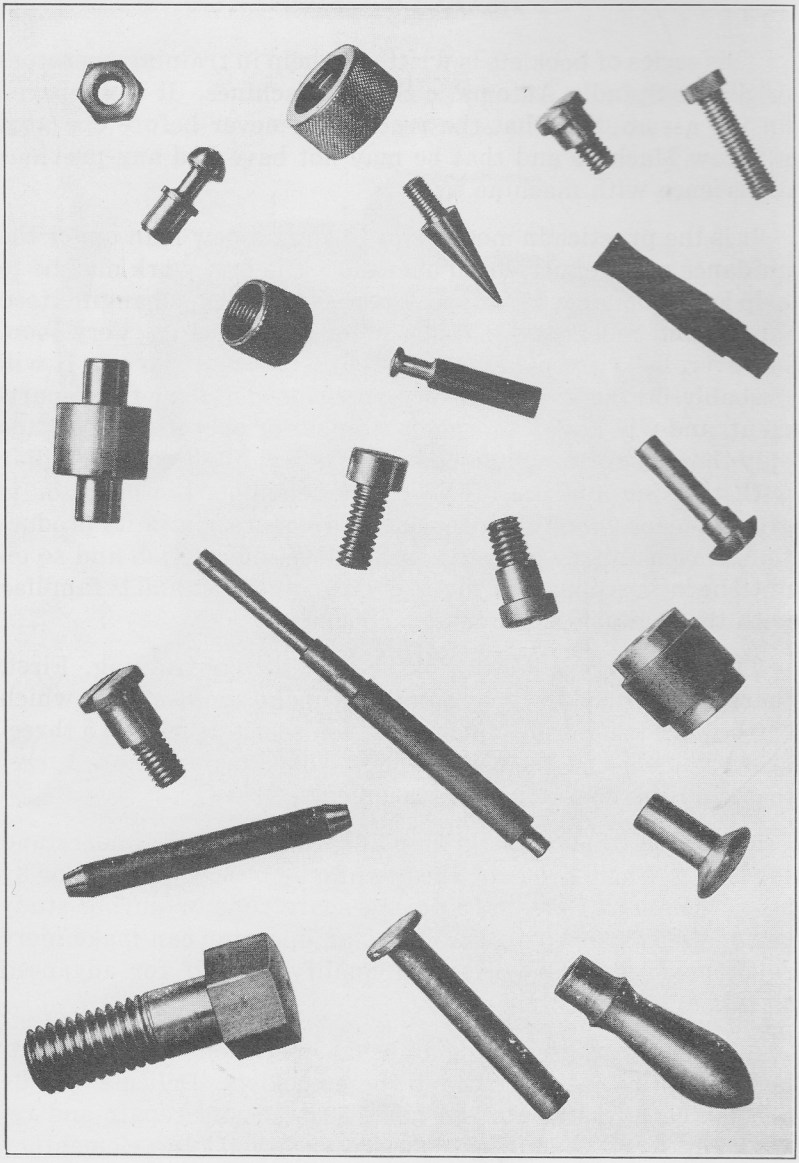


Fig. 1. Work Finished on Automatic Screw Machines

NO. 1 OF A SERIES OF BOOKLETS FOR TRAINING OPERATORS

A General Explanation of the Operation of B & S Screw Machines

An Automatic Screw Machine is a machine tool which can cut a bar of stock (Fig. 2) into small duplicate parts similar to any one of the pieces shown in Fig. 1. The outstanding characteristic of a Screw Machine is its automatic operation; for once started, the bar is automatically fed through the machine and finished pieces keep dropping into the work pan.

Although as you stand and watch a machine operate there seems to be some magic in the steady regularity and perfect timing of its parts, the basic controls of the machine are simple. The word automatic is not a symbol for complexity, and by picturing and describing the important members of a machine, we hope to show the few fundamental actions which control its operation.

To get a simplified picture of a Screw Machine, consider it in three sections, as shown in Fig. 3. In the upper section mounted on top of the bed are the members which make contact with the work and do the actual cutting or machining.

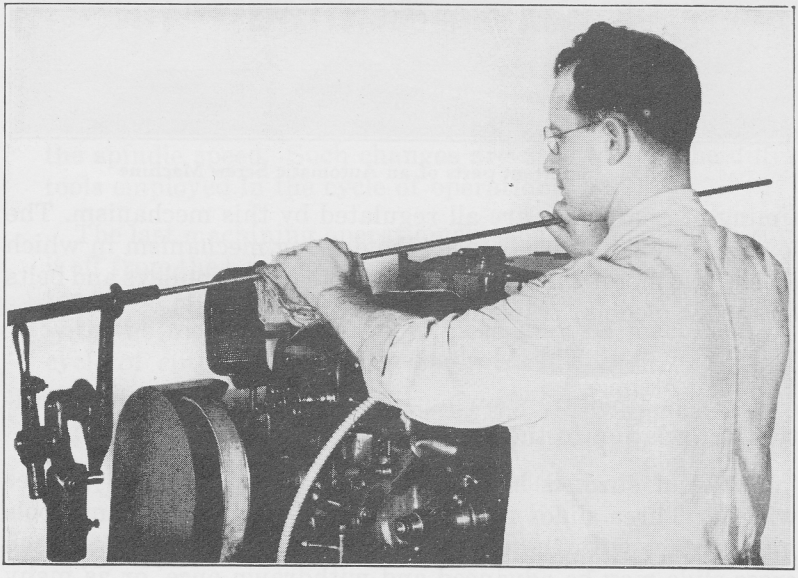


Fig. 2. Inserting bar stock into stock tube of the Automatic Screw Machine

In the middle section, called the bed, is the control mechanism. Here are the members which give the machine its automatic cycle. The movement of tools, the feeding of stock and the

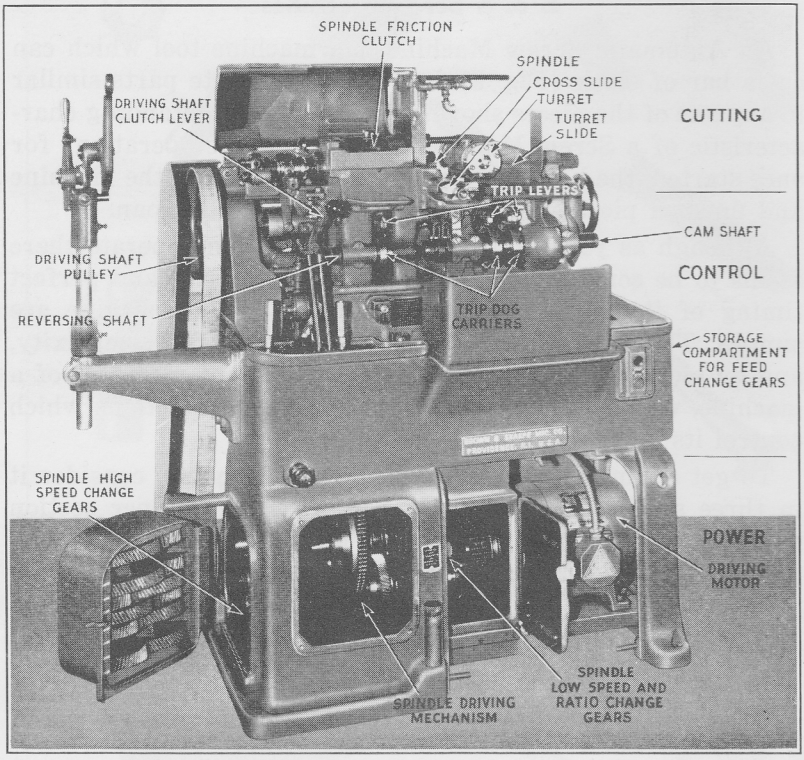


Fig. 3. Important parts of an Automatic Screw Machine

timing of operations are all regulated by this mechanism. The lower section, or base, houses the driving mechanism in which an electric motor through chains and gears (or pulleys and belts on earlier models) transmits power to the machine.

The Mechanism for Cutting

Fig. 4 is a picture showing the cutting tools and their positions in relation to the work or stock.

A bar of stock is held securely in the spindle and rotates with it. Three slides may be advanced to bring cutting tools into contact with the exposed end of the bar of stock. Each cross slide may be advanced and withdrawn once, or as many times as the work requires, in the production of a piece. The

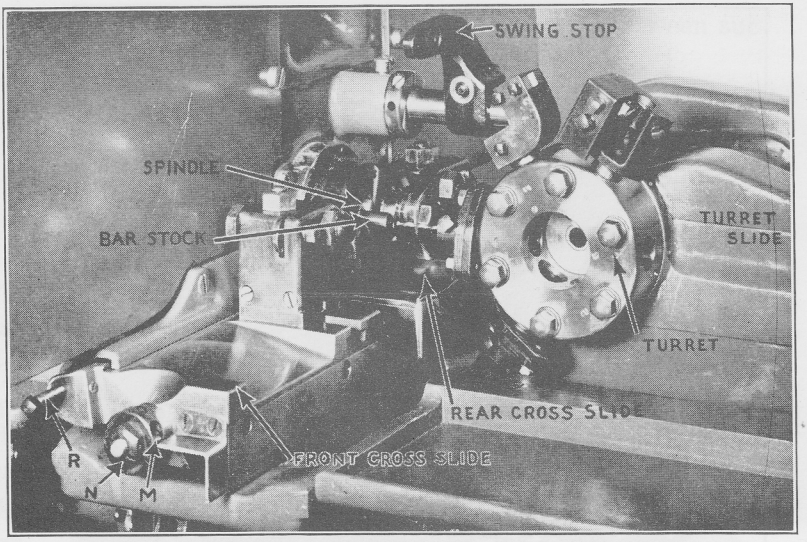


Fig. 4. Spindle, Stock and Cutting Tools

turret slide may go forward as many as six times, each time presenting a new tool to the work. This is possible because a six-position turret is mounted on the turret slide. After each turret operation, the turret slide is withdrawn and the turret is indexed or rotated 1/6th of a turn, bringing a new tool into working position.

A friction clutch on the spindle, Fig. 3, makes it possible to reverse the direction of spindle rotation or to instantly change the spindle speed. Such changes are used to suit the different tools employed in the cycle of operations.

The last machining operation on each piece is that of cutting it off from the bar. As soon as the cutting-off tool is withdrawn, the bar of stock is automatically fed forward to correct location with the tools, so that a new piece may be machined as the cycle of cutting operations is repeated.

To machine a complete piece, the following controls will be necessary to actuate the members shown in Fig. 4:

(1) The turret must be indexed at the proper points in the work cycle.

(2) The stock must be advanced through the spindle as a piece is completed and cut off.

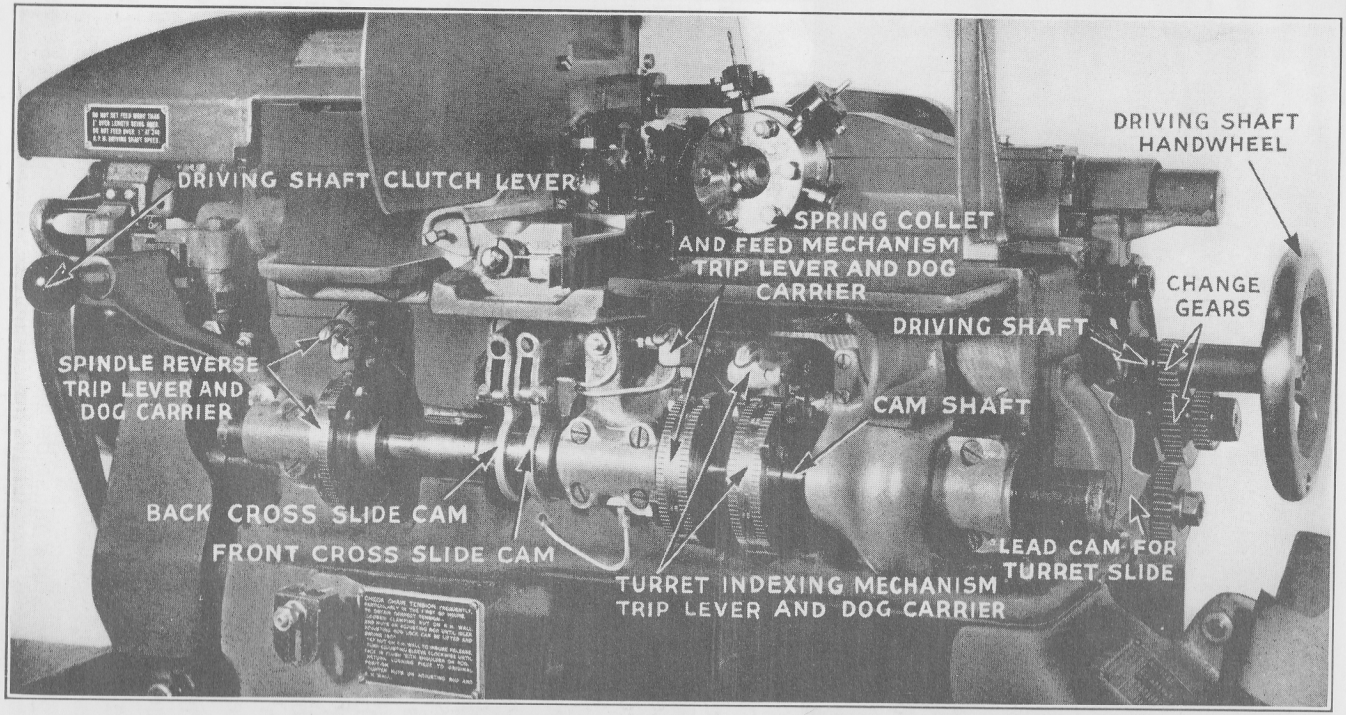


Fig. 5. The Control Mechanism governing the automatic movements

(3) The spindle must change speed or reverse between successive tool actions if the part requires this.

(4) The front and back cross slides must be advanced to and withdrawn from the work as required.

(5) The turret slide must advance the proper amount for each of its turret tools.

The Control Mechanism

The members shown in the picture, Fig. 5, and in the diagram, Fig. 6, control the movements just listed.

The driving shaft rotates at constant speed and upon clutch engagement supplies the power for automatic feed, turret indexing or spindle reverse. The hand-lever operated clutch close to the driving pulley starts and stops the driving shaft and cam shafts.

The cam shaft is driven from the driving shaft by a set of change gears. The cam shaft speed depends on the change gears used and is selected to give one revolution for each piece of work produced. If the operations on a piece are planned to be completed in two seconds, the cam shaft will make one turn in two seconds. If the operations on another piece require 14 seconds, then change gears are selected to give a cam shaft speed of one turn in 14 seconds.

On the cam shaft, are trip lever dog carriers to which are bolted trip dogs. See Fig. 7. These dogs lift the trip lever and release for engagement a jaw clutch on the driving shaft. When released, the clutch will snap into engagement for exactly one

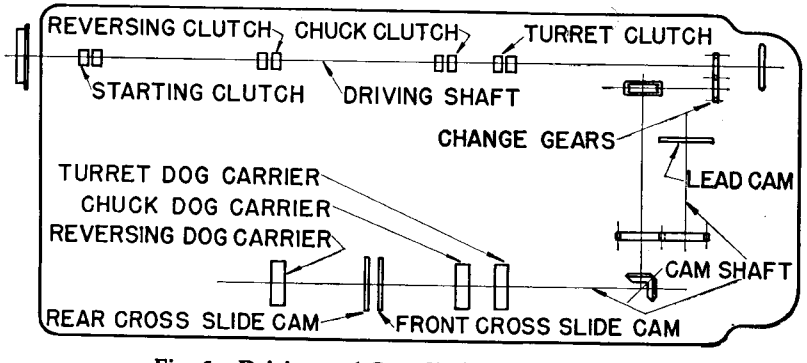


Fig. 6. Driving and Cam Shafts and their parts

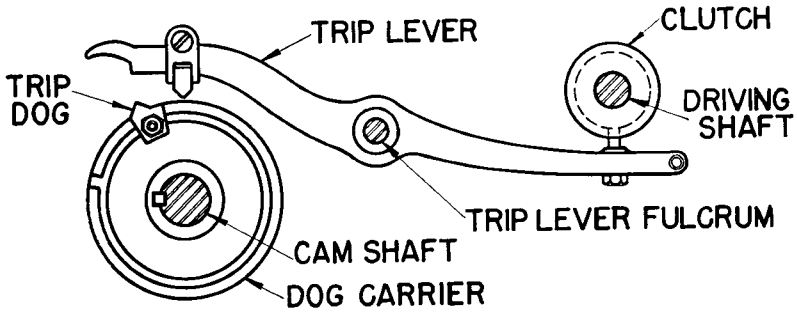


Fig. 7. Trip Lever and Dog Carrier

revolution or just long enough to complete one turret index, one feed of the stock, or a spindle reversal. There are three dog carriers and trip lever mechanisms on the machine to control these three functions. All three mechanisms are similar in construction and are described by Fig. 7. By setting dogs in the proper positions on the carriers, the machine may be made to index, feed stock or change spindle speed at desired points in the cycle of operations.

Notice that the trip levers have finger hooks for hand operation when setting up a machine.

Turret Indexing. When the turret trip lever is lifted and the turret clutch on the driving shaft is engaged, there is a direct gear drive to the indexing mechanism. This mechanism first withdraws the turret slide from its working position, then indexes the turret 1/6th of a turn and finally returns the turret slide to its original position. Just how the turret mechanism is designed is unimportant here so long as it is understood that tripping the turret trip lever by hand or dog will give one complete index.

Spindle Reverse. The spindle friction clutch can lock the spindle to either of two sprockets which rotate on the spindle. These sprockets have different speeds, with fast and slow sprocket speeds in 13 ratios of 1.6:1 to 11:1. The sprockets may rotate in the same or opposite directions. When the spindle reverse trip lever is lifted either by hand or dog, a fork is actuated that shifts the friction clutch from engagement with one sprocket to engagement with the other. The next tripping of the lever would shift the clutch back again.

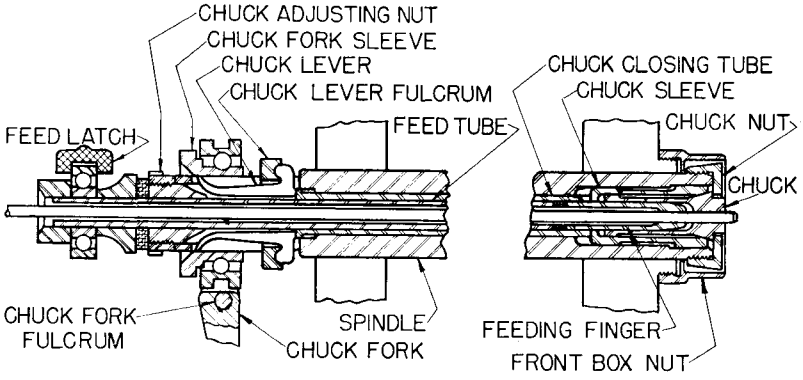


Fig. 8. Section through Spindle

Feeding Stock. The last of the three trip dog carriers controls the automatic feeding of stock and as the feed trip lever is lifted, a sequence of several movements is started. The swing stop (See Fig. 4) moves down and gets directly in front of the stock. When the bar is fed forward, it will butt against this stop and an accurate length of feed will be obtained. At the same time, the chuck or collet is opened, releasing its grip on the stock. Fig. 8 is a section of the spindle and shows the chuck and the members which operate it. The chuck has a tapered or conical shoulder and when the chuck sleeve is pushed

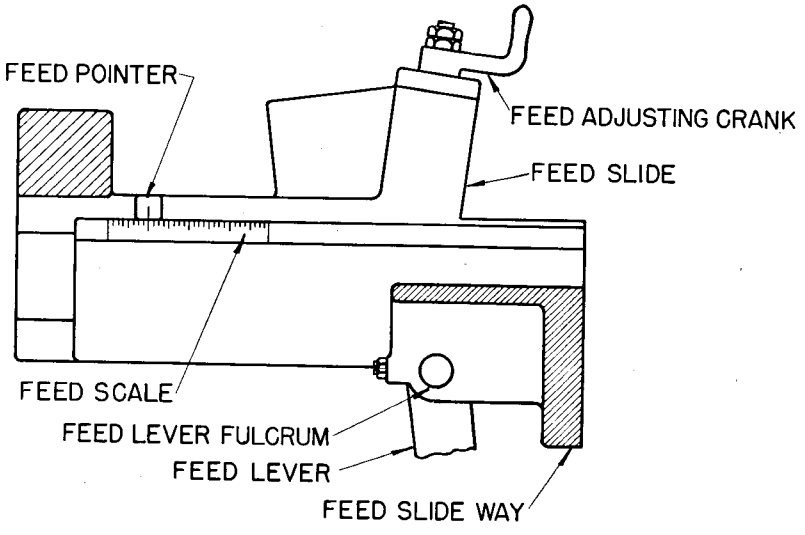


Fig. 9. Feed Slide

forward against this shoulder, the chuck is closed lightly on the work. Chuck levers force the sleeve forward. These levers are put under tension or released by the chuck fork sleeve which is operated by a shifting fork. The chuck adjusting nuts permit the chuck pressure or grip to be varied.

As soon as the chuck is open, stock is fed forward by the feed tube and feed finger which are advanced with the feed slide. At the maximum forward position, the chuck closes, gripping the stock securely. The feed finger is pulled back, sliding over the stock to its initial position, and the swing stop is moved back to its "at rest" position.

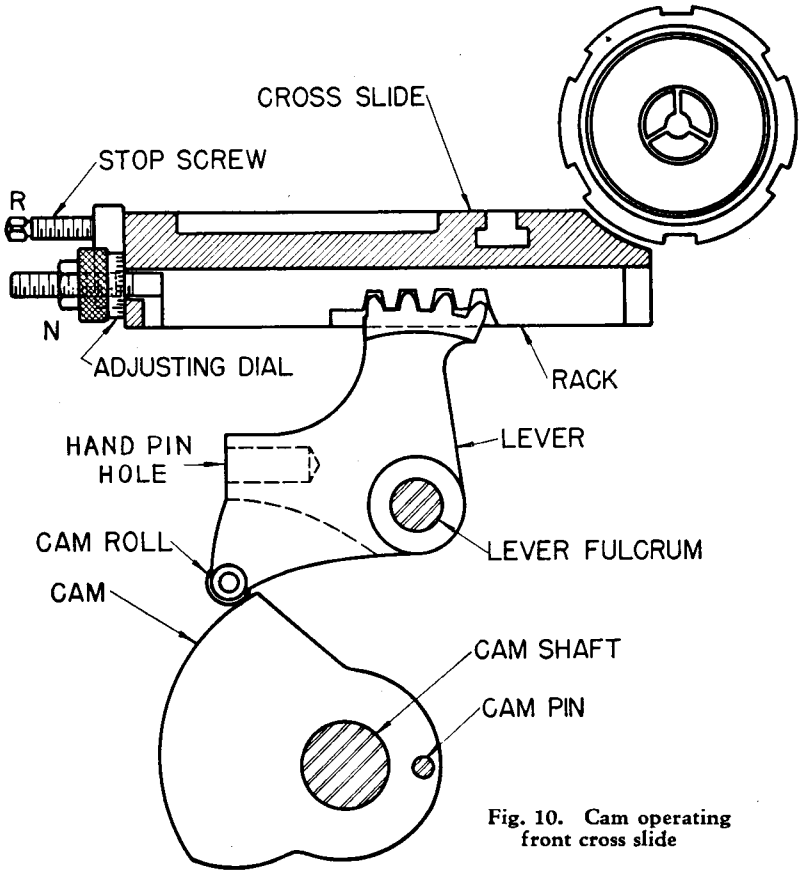


Fig. 10. Cam operating front cross slide

The amount of the feed slide movement is adjusted by the Feed Adjusting Crank, (See Fig. 9). The feed setting is indicated by the position of a pointer on the feed scale.

Tool Slides. The front cross slide, back cross slide and turret slide are all advanced by disc cams on the cam shaft and withdrawn by spring or crank action. The cam shaft is always in motion while the machine is running and the positions of the slides depend solely on the forms of the cams. Fig. 10 is a representative section, showing how a cam actuates a slide. Notice that there is a pin hole in the cam lever. This is for a hand pin lever, which may be used to advance the slide when testing tool settings or making set-up adjustments. All three cam levers may be operated by hand.

Power Transmission

A motor mounted under the right-hand side of the base supplies power to the machine. Spindle speeds may be selected by changing the gears in the mechanism which is located in the machine base.

196 two speed combinations are obtainable by change gears as shown on the chart on the front of the base. The gears for high speed drive are mounted in the compartment at the left-hand side of the machine as shown in Fig. 11. The ratio change gears which determine ratio between high and low spindle speeds, that is, selection of any one of 12 low speeds available for use with each high speed, are mounted in the compartment at the right-hand side of the base.

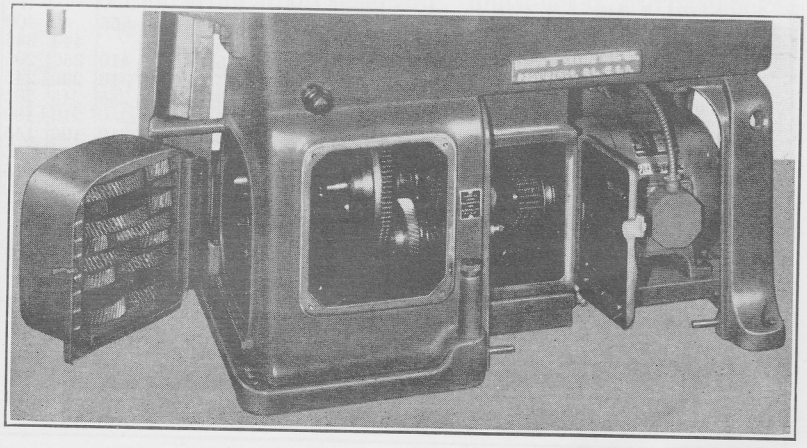
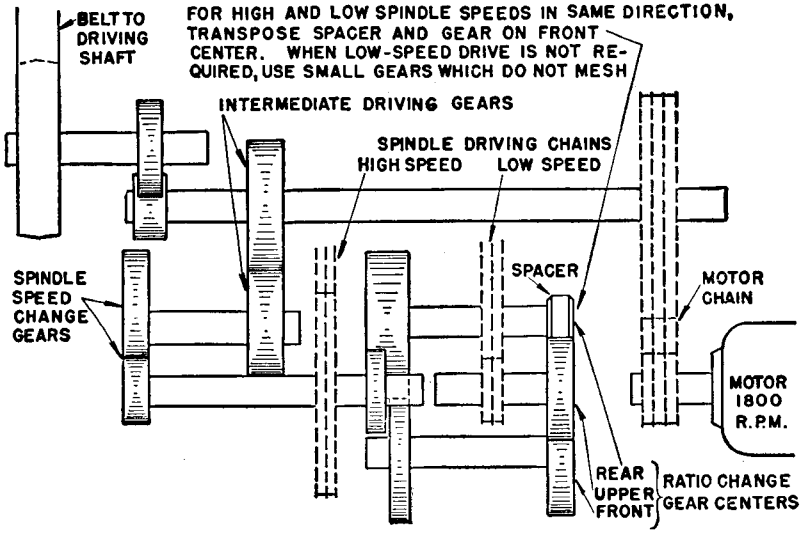


Fig. 11. Motor and driving pulleys



Spindle Speeds—R.P.M.

Spindle Change Gears — Ratio Change Gears: Upper / Lower — Opposite Direction / Same Direction — Low Speeds — Front / Rear

L.H. Centers Low. | Up.	High Speed	28/67	31/64	35/60	39/56	42/53	46/49	49/46	53/42	56/39	60/35	64/31	67/28	70/25	73/22
73–22	6050	3780†	3255†	2700†	2265	1990	1680†	1480†	1240	1100	920	765	660	565	
70–25	5110	3180†	2745†	2280†	2015	1680	1420	1250	1055	930	775	645	555		400
67–28	4365		2345	1950	1630	1435	1210	1065	900	790	665	550		440	345
64–31	3770	2345		1680	1410	1225	1045	920	780	685	575		410	350	295
60–35	3130	1950	1680		1170	1030	870	765	645	565		395	340	290	245
56–39	2620	1630	1410	1170		860	725	640	540		400	330	285	245	205
53–42	2305	1435	1240	1030	860		640	565		420	350	290	250	215	180
49–46	1945	1210	1045	865	725	640			400	350	295	245	210	190	155
46–49	1715	1065	920	765	640	560			355	310	260	220	185	160	135
42–53	1450	900	780	645	540		400	355		260	220	185	160	135	115
39–56	1270	790	680	565		415	350	310	260		195	160	125	120	100
35–60	1065	660	570		395	350	295	260	220	195		135	115	100	85
31–64	885	550		395	330	290	245	215	185	160	135		100	85	70
28–67	765		410	340	285	250	210	185	155	140	115	95		70	60
25–70	650	405	350	290	245	215	180	160	135	120	100	80	70		50
22–73	550	345	295	245	205	180	155	135	115	100	85	70	60	50	
Ratio of High to Low Speed		1.6	1.8	2.2	2.6	3	3.6	4.1	5	5.5	6.5	7.9	9.1	11	13

Spindle Running Fast Backward — Cross Driving Shaft Belt.
Spindle Running Fast Forward — Open Driving Shaft Belt.

† These combinations not to be used in opposite directions.

Fig. 12. Spindle Speed Diagram for No. 00G Automatic Screw Machine

Selection of the direction of low speed relative to high speed is made by placing the lower of the two change gears on the proper one of two centers.

Spindle driving chains run continuously often at high speeds and undergo frequent sudden application of load as the spindle clutch changes from high speed to low speed and vice versa. Maximum chain life will be obtained by following the instructions on the plate attached to the front of the machine.

Do not run sprockets in opposite directions when spindle is used continuously in one direction. If a one-speed job is to be run off, take off one of the ratio change gears and mount a small ratio change gear, so that gears will not mesh, or else put on the proper ratio change gears so that both sprockets will turn in the same direction.

Lubricating the Machine

Go over the machine thoroughly to be sure that all bearings are well supplied with oil. Most of the mechanisms in the machine are lubricated by means of a mechanical oiler located on the back of the tank table. This should be regularly filled with clean oil and the oil feed regulation checked from time to time and adjusted to allow two drops of oil per cycle.

The entire driving mechanism in the base is lubricated by a splash system from an oil reservoir. The level should be checked frequently.

The spindle sprocket bearings, clutch sleeve, turret slide, swing stop shaft, cam lever rolls and the various attachments (when in use) should be oiled daily.

Booklet No. 1 has given a very general outline of a Screw Machine and has named most of the important parts or units. Actual details of operation and adjustment will be found in the booklets to follow.