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

No. 13

Of a Series of Booklets for Training Operators

Centering, Drilling, Turret Tapping, Cross Drilling, Forming, and Cutting Off

Brown & Sharpe Mfg. Co.
North Kingstown, R. I., U. S. A.

1968

PRINTED IN U.S.A. 1M-12-68

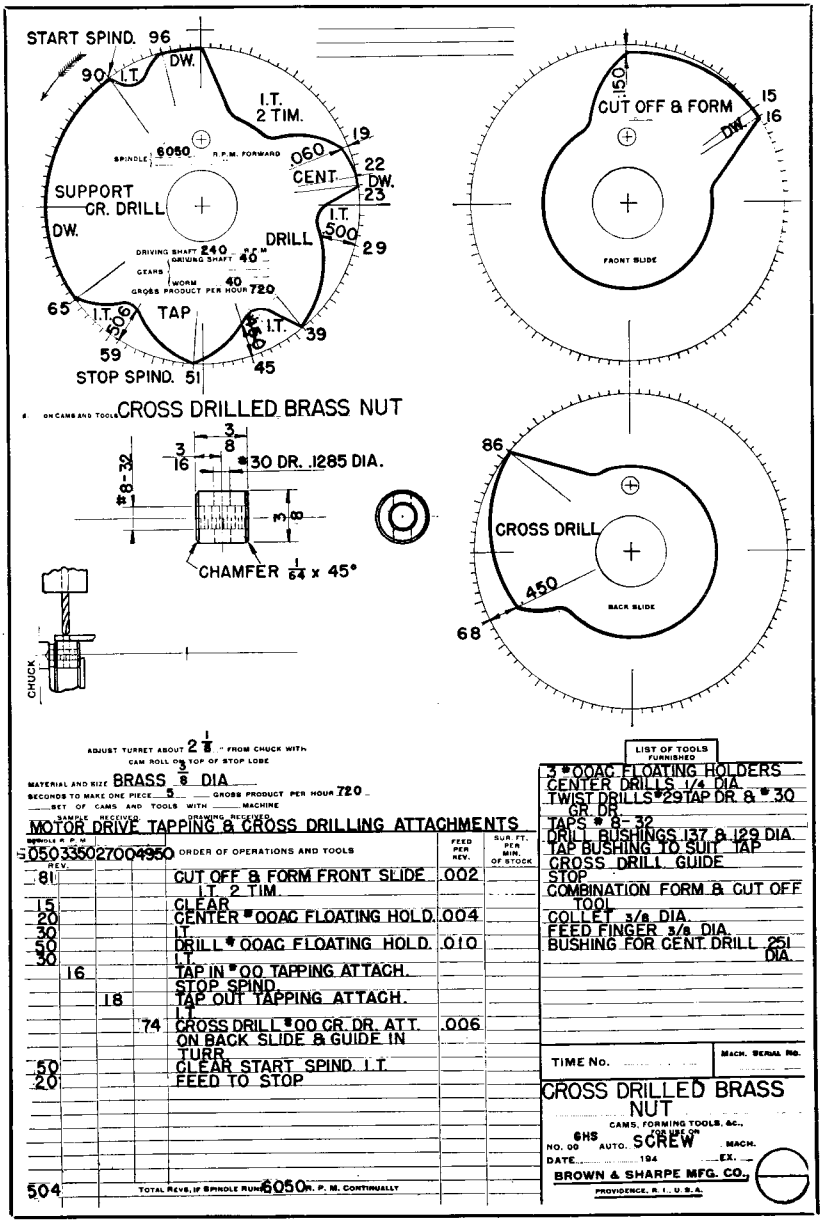

Fig. 1. Work Sheet for Job No. 12

NO. 13 OF A SERIES OF BOOKLETS FOR TRAINING OPERATORS

JOB NO. 12

Centering, Drilling, Turret Tapping, Cross Drilling, Forming, and Cutting Off

The field of screw machine work is broadened by the use of attachments, for with them the total number of operations on the work can be increased, new operations become possible, and second operation work on other machines may be eliminated. This Job No. 12, (Fig. 1) employs two useful attachments, the Cross Drilling and Tap or Die Revolving Attachments.

At one point in the work cycle, the spindle is stopped and held stationary by a brake while a motor-driven drill is brought forward by the back cross slide to drill a radial cross hole. To stop the spindle, the low-speed spindle pulley is held stationary instead of being driven by a belt. When the spindle reverse clutch is thrown to the low-speed side, clutch friction slows down the spindle and locks it to the stationary pulley. After cross drilling, the clutch is shifted to the high speed side and the cycle continues.

Since with this arrangement, the spindle has one direction of rotation (high speed) and cannot be reversed during operation, the usual method of tapping cannot be used, for a non-rotating tap must be backed out of the work by reversing the spindle. To get around this limitation, a tap revolving attachment is used. With this arrangement, the tap held in the turret is rotated at 2700 r.p.m., in the same direction as the spindle. Since the spindle is rotated at 6050 r.p.m., the spindle treads the work on to the tap at a speed of 3350 r.p.m., just as it would if the tap was stationary and the spindle had a speed of 3350 r.p.m. As soon as the spindle is stopped, however, the tap speed of 2700 r.p.m., threads the tap out of the work just as effectively as though the tap was held stationary and the spindle was reversed to a speed of 2700 r.p.m.

Strip the Machine.

Back off cross slide stop screws.
Insert feed finger, collet and stock.
Adjust length of feed and collet pressure.
Put on feed change gears.
Put on cross slide and turret lead cams.
Engage coupling driving spindle reverse trip dog carrier.

Adjust Turret Position. This is a No. 00G Machine. To obtain the 2⅛" setting between the turret and chuck, the turret rack must be disengaged from the gear segment and the slide and rack moved back about ¼". This adjustment was described in Booklet No. 7.

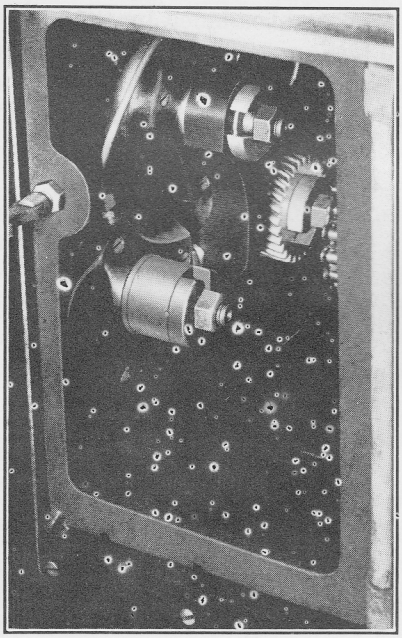

Fig. 2. Spindle brake for use on chain drive machines

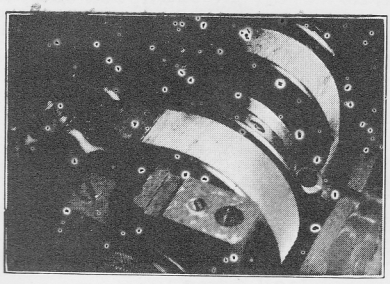

Fig. 3. Spindle brake for use on belt drive machines

Make Spindle Speed Changes. The low-speed sprocket is to be held stationary. The spindle brake (furnished at extra cost) holds the low-speed driving sprocket stationary, permitting the spindle to be stopped for cross drilling and similar operations.

The brake is installed in the right-hand change gear compartment in the base as shown in Fig. 2. The large end has a splined hole, and is slipped onto the upper change gear shaft in place of a gear; and the other end fits between the two lower shaft bearing retainers where it is clamped motionless by means of a screw and lock nut in the brake. Thus the upper shaft is held stationary; and since the low-speed spindle drive is from a sprocket on this shaft, the spindle too is held stationary when the clutch engages the low-speed sprocket.

After installing or removing the brake, be sure that each of the lower change gear shafts has either the spacer or a small change gear on it before starting the machine.

The driving chains are not disturbed in using the spindle brake. It is well, however, to make sure that the low-speed chain has the proper tension when the brake is added.

Fig. 3 shows the type of spindle brake, which is for use on machines using belt drive.

Put on the proper change gears to get a forward direction 6050 r.p.m. high spindle speed.

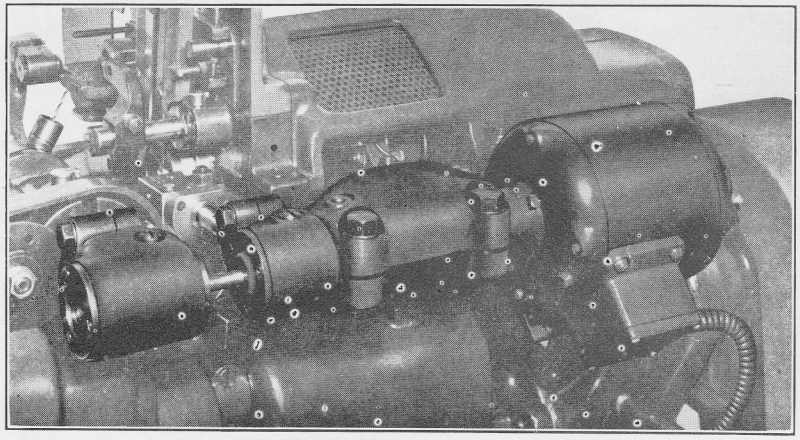

Fig. 4. Motor Drive for Cross Drilling and Turret Drilling Attachments

Mount the Attachments. The members which stand out in Fig. 4 are already in position on the machine. The cross drilling and tap revolving heads may be removed as the machine is

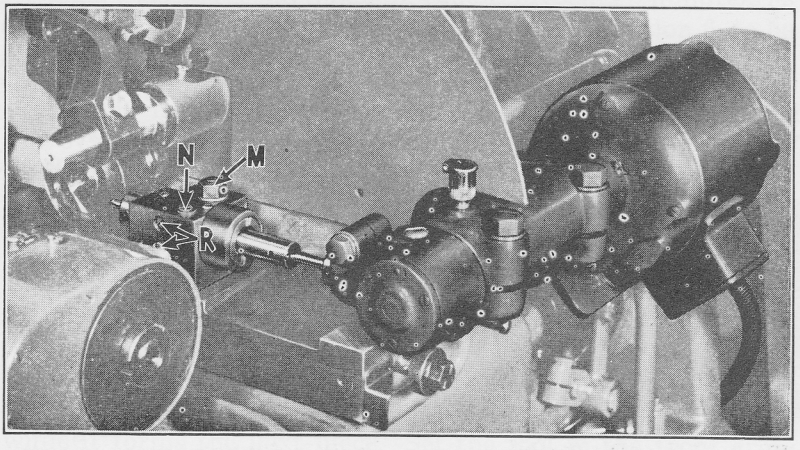

Fig. 5. Cross Drilling Attachment with its motor drive

changed from job to job, but the driving motor and these members in the gear drive, are usually left permanently on the machine. Connect the motor by plugging it in to the receptacle provided.

The cross drilling head, Fig. 5, is mounted on the back cross slide as though it were a tool post and is connected to the motor-driven gear case by a universal or tongued shaft. Engage the tongue of the shaft with the splined hole in the gear case driving shaft, and set the head in temporary position on the cross slide.

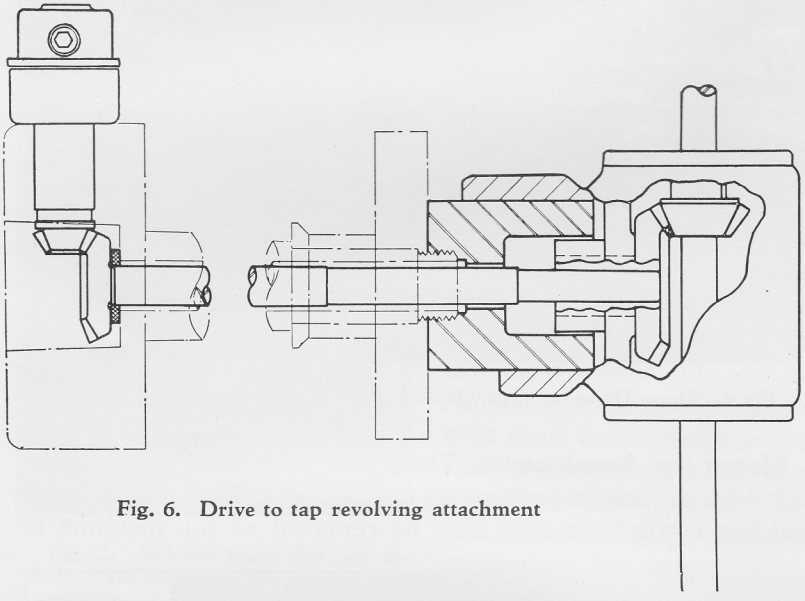

Fig. 6. Drive to tap revolving attachment

Insert through the axial center hole in the turret, the long bevel gear shaft shown in Fig. 6. The bronze thrust washer should be in position on the shaft next to the gear shoulder. Turn the gear, and push in at the same time, until the keys on the end of the shaft engage the keyways in the gear case and the shaft moves in to full depth.

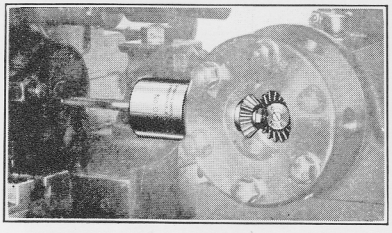

Fig. 7. Tap or Die Revolving Attachment

The tap spindle which is to be mounted in a turret station is shown in Figs. 6 and 7. Remove the rod pin and hex nut on the end of the spindle and slip off the small bevel gear. Insert the tap spindle in one of

the turret stations and then reassemble the gear, washer, nut and pin in position. Now move the spindle in until the bevel gears mesh properly. The gears should not be wedged so tight that you can feel the teeth bump as they rotate and yet there should not be excessive play or backlash between the teeth. Clamp the spindle in position. A moderate pressure will be ample. A heavy pressure will tend to distort the unit and may cramp the bearings inside the spindle shank. The driving torque of the tap which is to be mounted in the spindle, is taken directly by the bevel gears and there are no forces on the spindle shank which make heavy clamping pressures necessary.

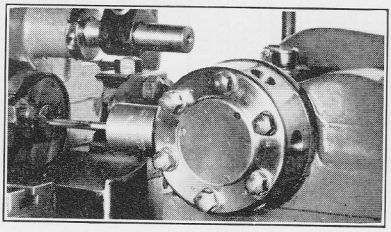

Fig. 8. Chip guard on face of turret

The bevel gears should be protected from chips and coolant. Coat the gears with grease and then put the circular guard (Fig. 8) over the center hole in the turret and clamp it down tightly with the three screws provided. The turret station holes which are not to be used for tools should be filled with cylindrical plugs. According to the work sheet, all turret stations are employed except No. 2 which is between the turret stock stop and the center drill. Put a plug in this hole to seal the gear chamber from chips.

Set All Carrier Trip Dogs. Fig. 9 shows approximate trip dog settings. The ¼ second indexing time represents 5 hundredths on the cam, thus the idle index has been set in position 6, to be certain the index after stock stop will have been completed before the idle index is tripped.

The fifth turret index does not occur until the spindle has stopped and the tap has threaded itself out of the work-piece while the sixth index is delayed until the cross drill is safely withdrawn.

Sharpen, Mount and Adjust the Circular Form Tool. This tool has the double duty of cutting off the first work-piece while it is forming the second. All the operations of forming, drilling, and tapping, are done close to the chuck. Then the stock is fed forward and the circular form tool cuts off the completed piece while it forms the next piece. Set the tool in the front cross

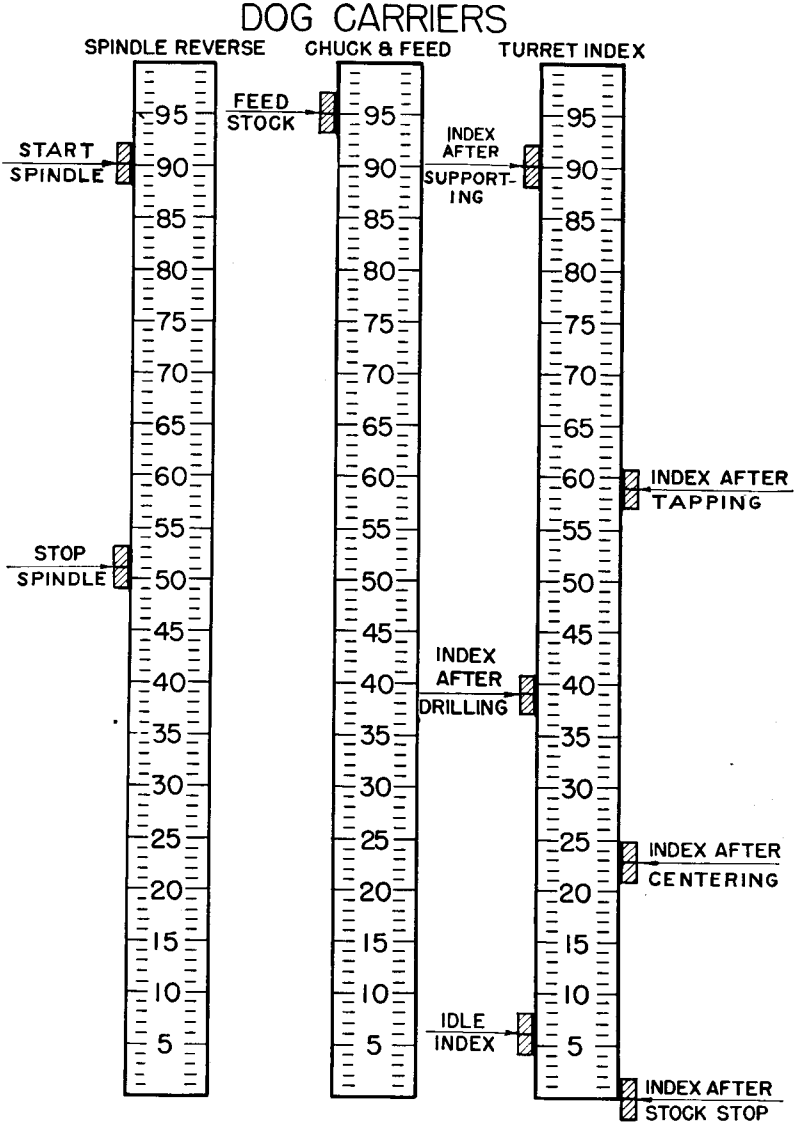

Fig. 9. Dog Settings for Job No. 12

slide on a raising block and get it close to the chuck to reduce overhang of the work.

Set Turret Stock Stop. Put the stop in the first turret station and set it 3/8" from the cutting-off lip of the form tool when the turret lead cam lever is on the cam dwell between positions 96 and 100.

Sharpen, Mount and Adjust Center Drill. Use a 1/4" drill for centering and mount it in the third turret station using the familiar floating holder.

Sharpen, Mount and Adjust the No. 8 Drill. The drill, mounted in a floating holder, goes in the fourth turret station. Adjust the drill to just clear the work when the turret lead cam lever is at the beginning of the drilling lobe, position 29. Having drilled a hole, let the machine run until the stock is fed forward and the piece is cut off. The drill setting is correct when the stock shows a full diameter (.164") spot or center on the exposed end of the stock. If the form tool does not completely cut off the work piece, the drill is not feeding to proper depth.

Sharpen, Mount and Adjust the Tap. The No. 8 tap should be sharpened on the chamferred end as was the tap in Job No. 10. A two-thread, 20 degree chamfer will give easy cutting action in brass. The tap must be mounted in the tap spindle using the same type of shoe bushing employed for drills and reamers. Turn the driving shaft handwheel until the turret lead cam lever is at the beginning of the tapping lobe, position 45. Then bring the tap forward in the tap spindle until it clears the end of the work by 1/8". Clamp the tap in this position. Start the machine and produce a piece. The threaded length will be short but this will give you a chance to test the trip dog setting for spindle stop position. If the tap goes in without excessive pull-out and threads off without crowding (see pages 14 and 15 of Booklet No. 4) the trip dog setting is satisfactory.

Inspect the cut-off piece to see how much farther out the tap must be set to produce a full depth thread throughout the length of the nut. Reset the tap but keep on the safe side even if you have to make one or two more trial settings. Overshooting the mark means a broken tap, undershooting simply means one more adjustment.

There is a small amount of float or play in the tap spindle and if the tap bushing is concentric and true, the tap will center itself without any difficulty.

Sharpen, Mount and Adjust the No. 30 Cross Drill. This is a regular drill and should be sharpened in the standard manner. Since however, the drill must create its own center hole you should be particularly careful in grinding the drill point to get it central and sharp.

It is more difficult to start a drill on a cylindrical surface than it is on a flat surface. To aid the cross drill to start a hole on the round bar without the aid of a center hole, a turret support is used. Such a support is shown in Fig. 10. It is held in a floating holder in the turret and is in position at the side of the work during cross drilling. Having a .130" hole, it guides the drill and prevents it from springing off-center as the hole is started.

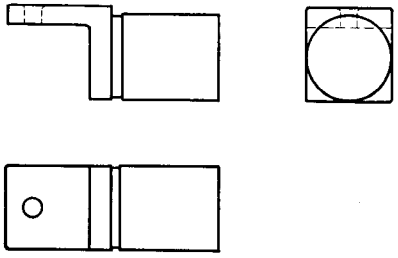

Fig. 10. Support for drill during cross drilling.

Mount the drill in the cross drilling head using a shoe type drill bushing. Now move the head along the cross slide T-slot until the drill is central with or at the mid point along the length of the work-piece. Clamp the drilling head in this position with the T bolt nut M, Fig. 5. As the drilling head is moved, the gear case on the motor shaft extension must also be moved to keep the two units in line. To adjust the gear case, release the clamp bolt on the supporting bracket and pull or push the case the small amount necessary to get the universal or driving shaft in line with the drill. Clamp the case in this position.

The next move is to adjust the drill up or down so that its axis will be in the same horizontal plane as that of the work, or so that the drill will be on center with the work. This adjustment may be made by turning the eccentric bushing in which the drill spindle is mounted. To do this, release the clamp screw N, Fig. 5, on the top surface of the head. Then screw in on one of the screws R located on the side of the head and back off on the other until the drill is lifted or lowered to a central position. Having made the setting, clamp the eccentric bushing again.

Loosen the set screw clamping the cross drill bushing, enough so that the drill can be pushed back. Also loosen the turret clamp on the floating holder and the holder screws which permit it to float. Now turn the driving shaft handwheel until the turret lead cam lever and the back cross slide lever have reached

position 68 on their cams. Holding the turret guide for the cross drill in position at the side of the work, bring the cross drill forward with your fingers until it enters the supporting hole in the guide and just clears the surface of the work-piece. Clamp the drill in this position.

For the next step, clamp the floating holder in its turret station. Then float the guide so that it is close to the work (within $\frac{1}{64}$") and is free on the cross drill. Tighten the float controlling bolts. Start the machine spindle (the cross drilling attachment motor will also start) and bring the back cross slide forward by hand. Observe whether or not the drill tends to bind in the guiding hole at any position of feed. If it does, re-adjust the guide position.

Produce a trial piece, watching the tools carefully as they perform. Check the dimensions and finish of the work and let your foreman see a sample piece.