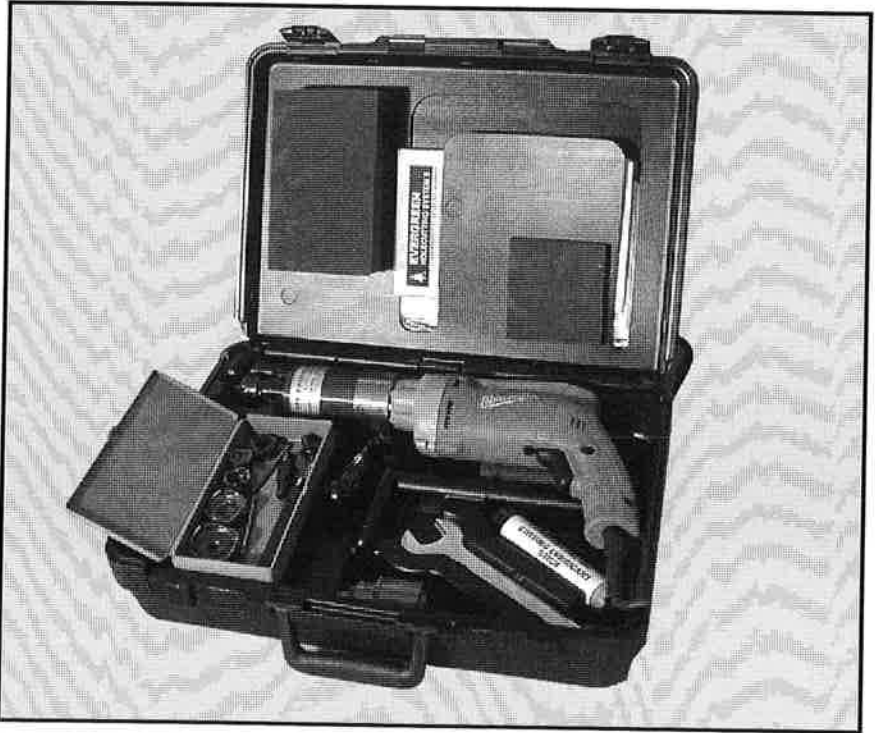




# EVERGREEN HOLECUTTING SYSTEM II

United States Patent Nos. 5,607,266 ; 5,639,193 ; 5,624,213



## Operating and Maintenance Manual

**Please Read These Instructions  
Completely Before Using  
This Equipment**

# Congratulations!

You are the owner of the all-new Evergreen Holecutting System II. This system provides a level of holecutting performance never before attained with lightweight hand-held tools. It has been specifically designed for holecutting in stainless steel but also provides exceptional performance in carbon steels and other materials up to 3/16" thick. Remarkable improvements in tool life and cutting efficiency have been achieved by focusing on optimizing cutting speed, tooth geometry, and pilot drill design. We are sure you'll agree that the Evergreen Holecutting System II is the best tool available for efficient and economical holecutting.

## IMPORTANT SAFETY INFORMATION



### **SAFETY –** **Read This Before Operating Tools**

Good safety habits are an important part of doing any job right. They are mostly common sense but a reminder is always helpful. Please refer to the safety section in the drill motor manual for a complete list of safety tips related to general drilling. There are some additional safety issues specifically related to holecutting with these tools that should always be practiced.

When using the Evergreen Holecutting System II, always remember that the system is capable of producing high torque and practice the following habits:

- **Always keep a firm grip on both handles when drilling**
- **Do not overreach or overextend while drilling; it is best to keep the tool close to your body**
- **Work from a stable stance**
- **Pay attention to your work**
- **Always wear safety glasses and gloves**

# EVERGREEN HOLECUTTING SYSTEM II

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## HOW and WHY IT WORKS

Stainless steel is difficult to drill because of its hardness, toughness and work-hardening properties. As a cutting edge shears away a chip, it causes the material at the cutting interface to work-harden, creating a work-affected zone that makes penetration by subsequent cutting edges more difficult. Rapid heat build-up and further hardening will follow if the cutter cannot penetrate this work-hardened surface.

Evergreen System II cutters overcome these problems in several ways. Recognizing that the applied cutting force is limited by the user's strength, Evergreen System II cutters concentrate that force on three cutting teeth to produce a higher cutting pressure per tooth than conventional hole saws. Along with this the cutting teeth are designed with an aggressive rake angle, high back clearance and minimal curf to get underneath the work-hardened surface to softer material. The depth of cut is limited by the raker teeth to provide smooth cutting performance and prevent stalling. The cutter body is tapered inside and out to minimize friction and heat build-up.

Stainless steel requires a low cutting speed of about 60 surface feet per minute (SFPM), roughly half that of low carbon steel, to minimize friction and heat build-up. Though a variable speed hand drill can rotate slowly, there is insufficient torque at low speeds to drive a holecutter, particularly those of larger diameter. This led to our development of a coaxial speed reducer that provides a 4 to 1 gear reduction for the cutter and no reduction for the pilot drill. A commonly available 1/2" drill motor of 0-850 RPM with the System II speed reducer will produce an optimal speed of 0-210 RPM for the holecutter and 0-850 RPM for the pilot drill. At the same time, sufficient torque is provided to drive larger holecutters at less than full speed conditions. This reduction in speed greatly improves the cutting performance and tool life.

The System II pilot drill is also optimized for this application. An aggressive edge geometry with a thin-webbed 135 degree split point design greatly improves the ease of starting and the drilling speed.

# OPERATING INSTRUCTIONS

Operation of the Evergreen Holecutting System II is very similar to conventional hand drills. A primary difference is the addition of the System II speed reducer. Our speed reducer is a planetary gear reduction system; therefore, when operating the drill motor it is necessary to prevent the ring gear (speed reducer housing) from turning to achieve the desired gear reduction. This is the purpose of the clamp and handle. Three clamping options are illustrated below. To achieve the proper cutting speed it is best to use a drill motor with a variable speed of 0-850 RPM.

The System II speed reducer has a gear ratio of 4 to 1. While the speed of the drill motor is reduced by 1/4, the available torque is multiplied by 4 times. It is therefore **important to maintain a firm grip** on the drill motor and speed reducer handles at all times. During drilling, stay square to the work and apply steady pressure; the Evergreen System II cutters work most efficiently with firm, strong pressure on the cutting edges. The system can be operated at full speed (i.e. 210 RPM output speed) or a slower speed depending on the size of the hole and prevailing conditions. Remember that larger holes are best cut at lower RPM.

*Following are instructions for set-ups, tool changes, and other operational details.*



## **IMPORTANT:**

**Always unplug the drill before making any set-up or tool changes.**

## ATTACHMENT OF THE SYSTEM II SPEED REDUCER TO THE DRILL MOTOR

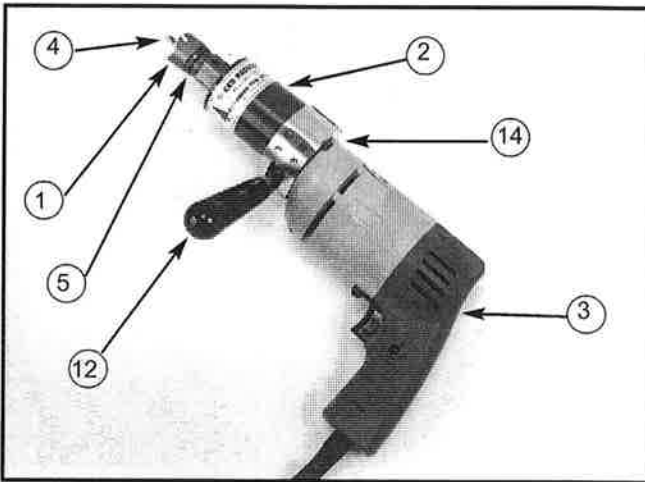
### Method 1

This method is used for drill motors with a fixed circular boss, such as the Milwaukee Holeshooter, 1/2" variable-speed 0-850 RPM drill. With this method the drill chuck is removed from the preferred drill motor and the System II speed reducer is threaded directly onto the drill chuck spindle. The tightened clamp bridges the gap between the speed reducer housing and the drill motor, thereby transferring the torque of the speed reducer to the drill motor causing them to act as a single unit. **This is our recommendation** for best control, least weight and size. This package is available as Evergreen Tool Co. Standard Kit II.

### To set up this configuration:

1. Remove chuck from drill motor leaving washer on drill motor shaft (See page 13).
2. Slide the drill adapter ring onto the circular boss.
3. Thread the speed reducer on the drill chuck spindle. Tighten by hand. Speed reducer input shaft has a 1/2" - 20 UNF female thread.
4. Slide the clamp/handle over the speed reducer up to the drill motor housing such that the clamp grips both the speed reducer and the drill adapter ring.
5. Rotate clamp and handle until the handle is in the desired position. Tighten clamp by twisting handle in a clockwise direction until hand tight.
6. Install pilot drill, loosening hex washer, and cutter to complete preparation for holecutting (See page 15).

### Method 1



Item	Part No.	Description
4	435	System II Pilot Drill 3/16" Double End
1	610-642	System II Holecutter
5	651	Loosening Hex Washer 3/16" Thick
2	673	System II Speed Reducer
12	656	Clamp and Handle Assembly
14	675	Drill Adapter Ring 43 for Milwaukee Drill Motor No. 0299-20 0-850 RPM, 120V
3	907	Drill Motor: Milwaukee No. 0299-20 1/2" 0-850 RPM, 120V 60 Hz VSR

Fig. 1

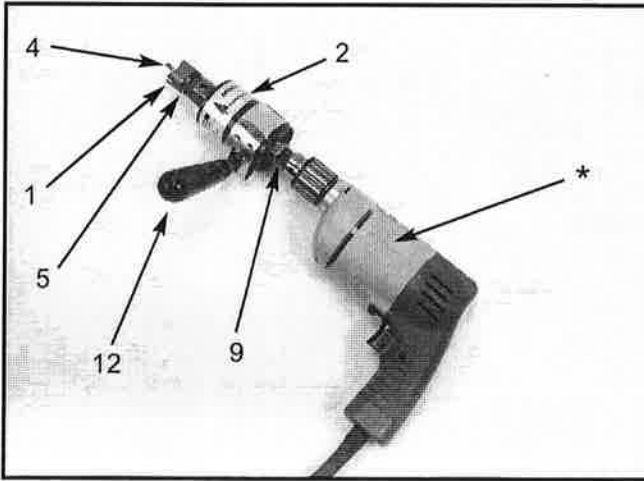
## METHOD 2:

With this method the System II speed reducer is installed in the drill chuck of any drill motor of appropriate speed (0-1000 RPM). The advantage of this option is that the drill motor is not dedicated to holecutting. The speed reducer can be quickly removed from the drill chuck like an ordinary drill bit. The drill motor can then be used for other drilling purposes. The disadvantage is that the hole drilling system is a little heavier and a little longer and the operator must restrain the torque of the speed reducer housing with the clamp and handle. Its rotation is not fixed to the drill motor housing. Refer to our Evergreen Holecutting System II price list for necessary items.

### To set up this configuration:

1. Screw the stem adapter (Part No. 674) into the 1/2-20 UNF thread in the input shaft of the speed reducer.
2. Tighten the other end of the stem adapter into the chuck of the drill motor.
3. Place the clamp over the rear portion of the speed reducer. Twist the handle clockwise to tighten the clamp hand-tight.
4. Install the pilot drill, loosening hex washer, and cutter to complete preparation for holecutting. (See page 15).

## Method 2



Item	Part No.	Description
4	435	System II Pilot Drill 3/16" Double End
1	610-642	System II Holecutter
5	651	Loosening Hex Washer 3/16" Thick
2	673	System II Speed Reducer
12	656	Clamp and Handle Assembly
9	674	Stem Adapter
*	***	Drill Motor (by others)

Fig. 2



# OPERATION OF ACCESSORIES

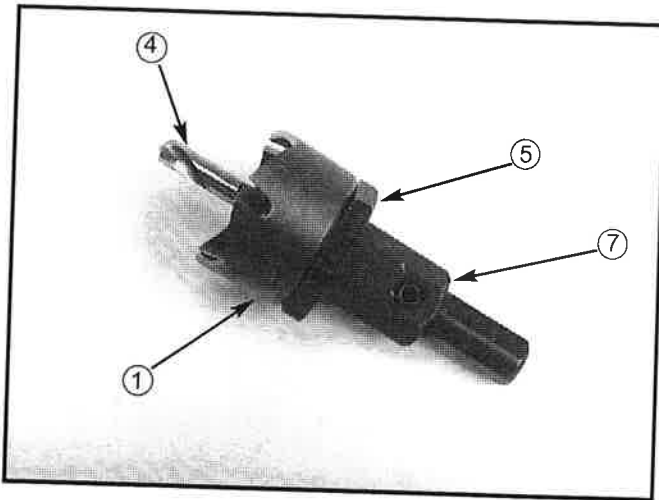
## Option 1: Arbor

The arbor (**Part No. 600**) is used to drive the System II holecutter and pilot drill. The arbor is intended to be chucked into any ordinary drill motor. It is important to remember, however, when operating the System II cutter in stainless steel, it should not be run faster than 210 RPM and slower for holecutters larger than 1 1/8".

### To set up this configuration:

1. Insert the pilot drill into the arbor such that the set screw will engage the first flat on the pilot drill.
2. Tighten set screw with hex key wrench.
3. Install loosening hex washer.
4. Screw cutter on arbor threads finger-tight.

### Option 1



Item	Part No.	Description
4	435	System II Pilot Drill 3/16" Double End
1	610-642	System II Holecutter
5	651	Loosening Hex Washer 3/16" Thick
7	600	Arbor

Fig. 4

## Option 2: Arbor Extension

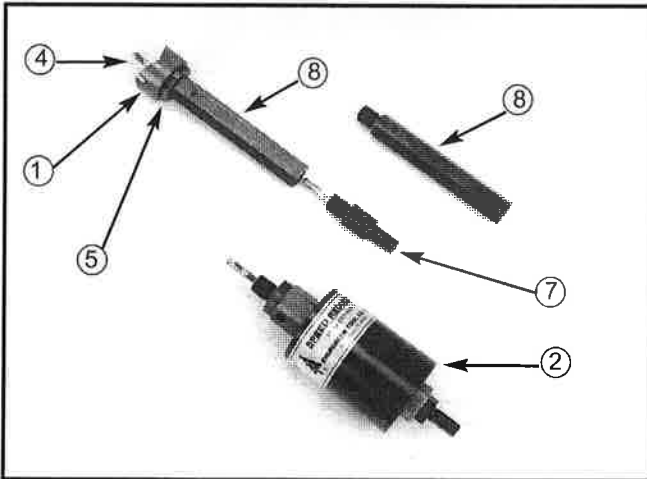
The arbor extension (**Part No. 437**) is used to extend the reach of the System II holecutter. The arbor extension can be used with the arbor (**Part No. 600**) or with the speed reducer (**Part No. 673**). Additional extensions can also be added to the first one to achieve an even longer reach.

**Note:** *When the arbor extension is used with the speed reducer, the pilot drill in the arbor extension will turn at the same speed as the holecutter.*

### To set up this configuration:

1. Insert the pilot drill into the arbor extension such that the set screw will engage the first flat on the pilot drill.
2. Tighten set screw with hex key wrench.
3. Install loosening hex washer.
4. Screw cutter on arbor extension threads finger-tight.
5. Screw arbor extension onto arbor (Part No. 600) or speed reducer output adapter or additional arbor extension. *Note: Pilot drills that are in the arbor or speed reducer need not be removed in order to add the arbor extension.*

### Option 2



Item	Part No.	Description
4	435	System II Pilot Drill 3/16" Double End
1	610-642	System II Holecutter
5	651	Loosening Hex Washer 3/16" Thick
8	437	Arbor Extension
7/2/8	600/673/437	Arbor, Speed Reducer or Arbor Extension

Fig. 5

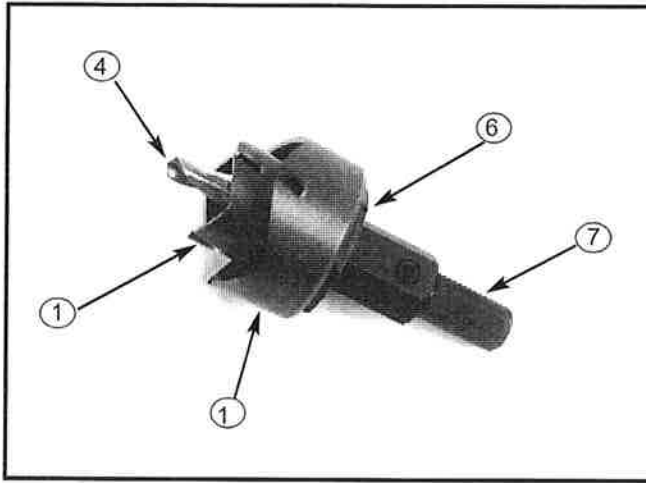
### Option 3: Method to Enlarge An Existing Hole

This option illustrates a method used to enlarge existing holes. Two System II cutters are used, one acting as a pilot. The thin loosening hex washer should be used as it allows sufficient threads for installation of the pilot cutter.

#### To set up this configuration:

1. Install on the arbor or speed reducer output adapter the thin 3/32" loosening hex washer (Part No. 652).
2. Select a holecutter sized for the new hole and screw it on the arbor or speed reducer output adapter.
3. Select a holecutter to match the diameter of the existing hole and screw it onto the remaining threads of the arbor or speed reducer output adapter.
4. If the pilot drill is in place, it may not need to be removed from the arbor or speed reducer to proceed with this option.

### Option 3



Item	Part No.	Description
4	435	System II Pilot Drill 3/16" Double End
1	610-642	System II Holecutter
1	610-642	Pilot System II Holecutter
6	652	Loosening Hex Washer 3/32" Thin
7/2	600 or 673	Arbor or System II Speed Reducer

Fig. 6

## TOOL CHANGES

### Chuck Removal

1. Open the chuck jaws.
2. Remove the bolt at the base of the jaws inside the chuck.  
**Important:** This bolt has a left hand thread - turn clockwise to loosen.
3. Clamp a large hex wrench into the chuck and with the drill held firmly in a vise or on a bench, turn the wrench or strike its edge with a hammer to loosen and remove the chuck counterclockwise. Leave the washer found behind the drill chuck on the drill output shaft.

## System II Speed Reducer Removal and

### Installation on Drill Motor

This section applies only to the System II speed reducer attached without the drill chuck:

#### Removal:

1. Loosen the clamping handle and slide the clamp forward.
2. Place the special 7/8" thin wrench provided in the kit on the hex between the speed reducer and the drill body.
3. With the drill body held firmly in a vise or on a bench, strike the edge of the wrench with a hammer to loosen threads (**FIG. 7**). Turn in a counterclockwise direction.
4. Turn the speed reducer off by hand.

#### Installation:

1. Leave the washer on drill motor output shaft.
2. Install the drill adapter ring if not already in place.
3. Turn the speed reducer on by hand - no further tightening is required
4. Install the clamping handle and tighten the clamp by twisting the handle in a clockwise direction until hand tight.

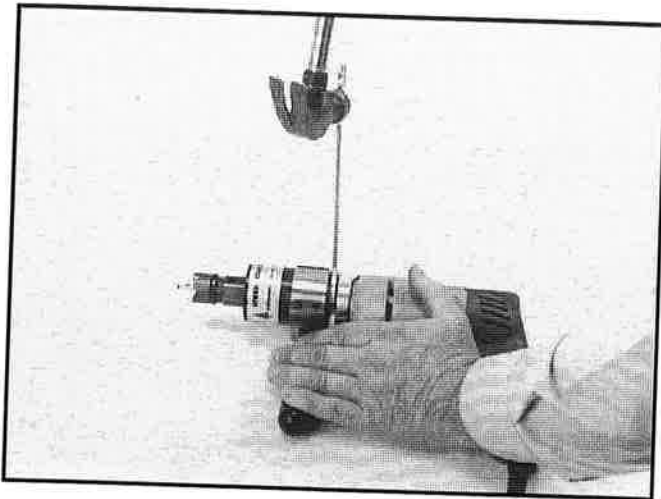


Fig. 7

## System II Pilot Drill Removal and Installation

### Removal:

1. Loosen clamping handle slightly.
2. Rotate ring gear housing with handle until set screw aligns with an access hole on the output adapter (**FIG. 8**).
3. Loosen set screw about 1-1/2 turns and remove pilot drill

### Installation:

1. Align set screw with access hole as in steps 1 and 2 above.
2. Loosen set screw sufficiently to allow pilot drill to slide past.
3. Spread a thin coating of grease on pilot drill between the flats to lubricate the piloting hole in the output adapter.
4. Install pilot drill into hole until the leading edge of the 2nd flat is flush with the nose and the flat is perpendicular to the set screw (**FIG. 9**).
5. Wiggle the pilot drill slightly as the set screw is tightened to ensure that the set screw engages the flat on the pilot drill.
6. Rotate clamping handle to desired position and tighten.

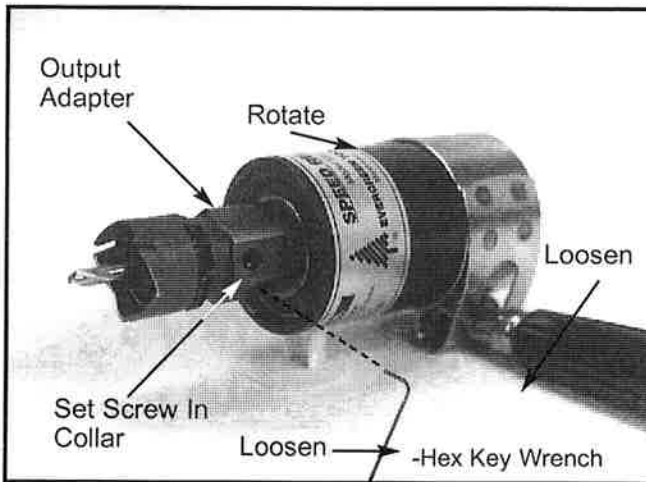


Fig. 8

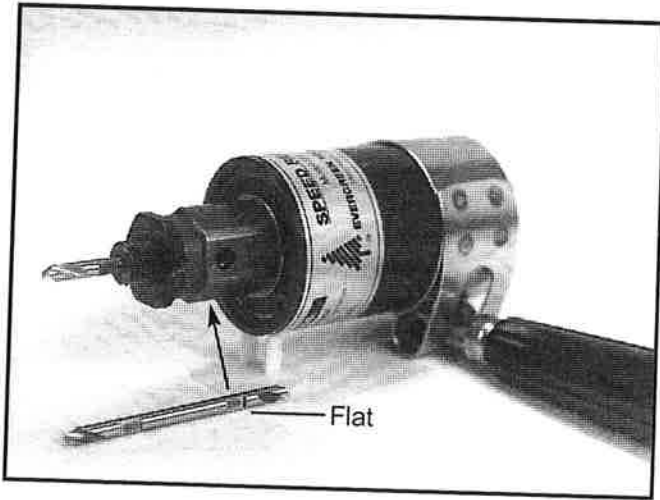


Fig. 9

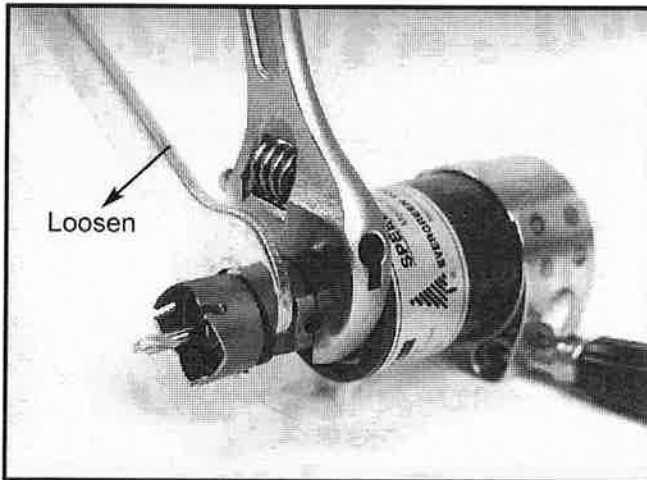
## System II Cutter Removal and Installation

### Removal:

The System II speed reducer has been equipped with a loosening hex washer and a special 4-start thread which provide for easy cutter removal by either of the following two methods:

**Method 1:** Two 1" wrenches can be used (**FIG. 10**); one to hold the output adapter and a second to turn the loosening hex washer counterclockwise. Once broken loose, the cutter is removed with your fingers.

**Method 2:** Place a wrench on the loosening hex washer and strike the edge of the wrench with a hammer. A light blow will loosen the cutter.



**Fig. 10**

### **Installation:**

1. Install the loosening hex washer if not already in place.
2. Install the cutter finger tight.

## **MAINTENANCE and LUBRICATION**

The System II speed reducer has been designed to be relatively maintenance-free and is thoroughly lubricated at the factory; however, periodic lubrication will increase life of the tool. There are four important points of lubrication - these are: 1) pilot drill, 2) planetary gearing, 3) planet gear shafts, and 4) input shaft bushing. The latter three are internal and require partial disassembly of the System II speed reducer. Disassembly is not difficult and will be described in the following section.

### **SYSTEM II PILOT DRILL LUBRICATION**

Each time the System II pilot drill is removed, a thin coating of grease should be applied between the two flats before being reinserted. This grease provides lubrication for the piloting hole in the output adapter which guides the pilot drill. After installation, wipe away all the excess grease from around the hole to prevent machining chips from sticking to this area.



## INTERNAL LUBRICATION AND INSPECTION

The System II speed reducer should be disassembled periodically for lubrication and inspection. The lubrication interval depends on the type of use; for sheet metal drilling where heat build-up does not occur, it should be regreased approximately every year. For heavier drilling applications involving heat build-up, the interval should be more frequent.

### Disassembly For Lubrication:

1. Remove speed reducer assembly from drill motor.
2. Remove stem adapter, cutter and loosening hex washer.
3. Remove output adapter - the input shaft and ring gear must both be held stationary to remove the output adapter. This is done by gripping with one hand both the clamping handle and a wrench on the input shaft while turning the output adapter with a wrench in the other hand (**Figure 11**).

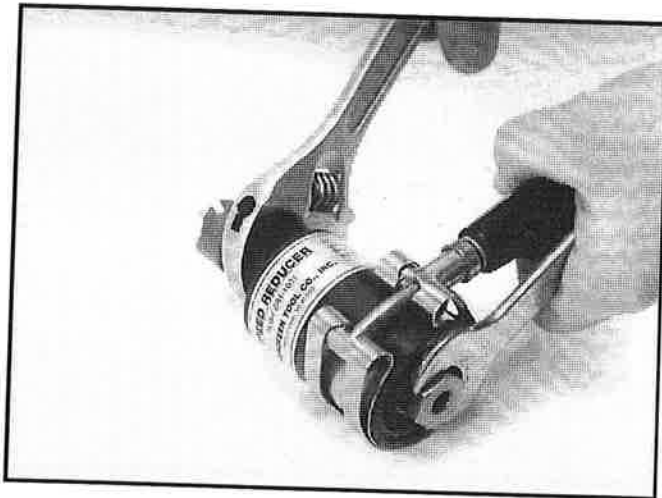


Fig. 11

4. Remove output adapter washer.
5. Loosen the set screw and remove the collar.
6. Remove the pilot drill.
7. On the input end, remove the retaining ring.

(cont.)

8. Press out the input shaft assembly on an arbor press as follows:
  - A) On the arbor press base, support the speed reducer housing such that the bearing can pass through a hole in the support as it is pressed out. A steel plate with a 1-7/8" hole in it works or use bearing press sleeve (Part No. 442) **(Figure 12)**.
  - B) Place the speed reducer with the input end down on the support structure and center it under the arbor press
  - C) Press downward on the nose of the input shaft. Increase the force slowly until it moves and continue to press until the input shaft and bearing are removed. If it doesn't move easily, do not force it or bang on it because you may bend or distort the end of the input shaft. Instead, heat the ring gear around the input bearing and try it again. If you can't press it out, consult the factory.
9. Remove the spacer from inside the speed reducer.
10. Inspect components for excessive wear or damage.
11. Remove the planet gears and lubricate them one at a time or mark the exposed planet gear face and planet pin to insure they are reinstalled on the same pin.
12. Use a lithium-based grease to lubricate the following points:
  - A) Coat the planet pins with grease.
  - B) Spread grease around the planet gear teeth and into the bores.
  - C) Apply a generous bead around the ring gear teeth.
  - D) On the input shaft subassembly, spread grease around the sun gear and leave a generous amount in the area adjacent the bearing. Next, grease the area near the nose of the shaft where it runs on the bushing and leave a generous amount on the shaft between this point and the sun gear.

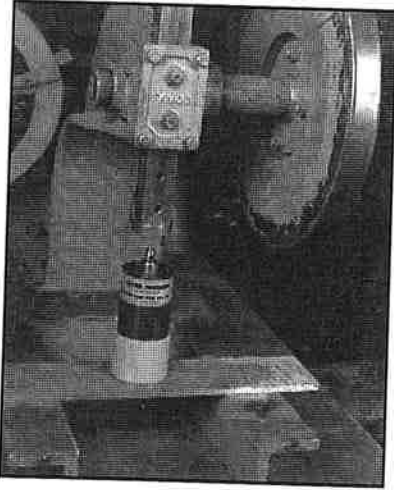


Fig. 12



Fig. 13

### System II Speed Reducer Reassembly:

13. Install the planet gears in the same orientation as they were removed.
14. Install the spacer.
15. Slide the input shaft subassembly down through the bushing on the planet carrier. Wiggle it back and forth to engage the gears - you should feel the engagement before the bearing begins to press.
16. Place the assembly in the arbor press on the steel plate, centered over the 1 7/8" hole or on the bearing press sleeve with the output end down (**Figure 13**).
17. Press the input shaft back in place and install the retaining ring.
18. Install the collar.
19. Install the pilot drill and tighten the set screw.
20. Spread a thin coat of grease on the pilot drill between the flats to lubricate the piloting hole in the output adapter.
21. Install the output adapter washer.
22. Install the output adapter finger tight.
23. Reassemble the loosening hex washer, cutter, and stem adapter (if used) and reassemble to drill motor.

# ORDERING REPLACEMENT PARTS,

## TOOLS and ACCESSORIES

Replacement System II holecutters, pilot drills, service parts, and accessory items are available directly from our factory. Following are the part numbers and descriptions. When ordering, please indicate quantity, part number, and part description.

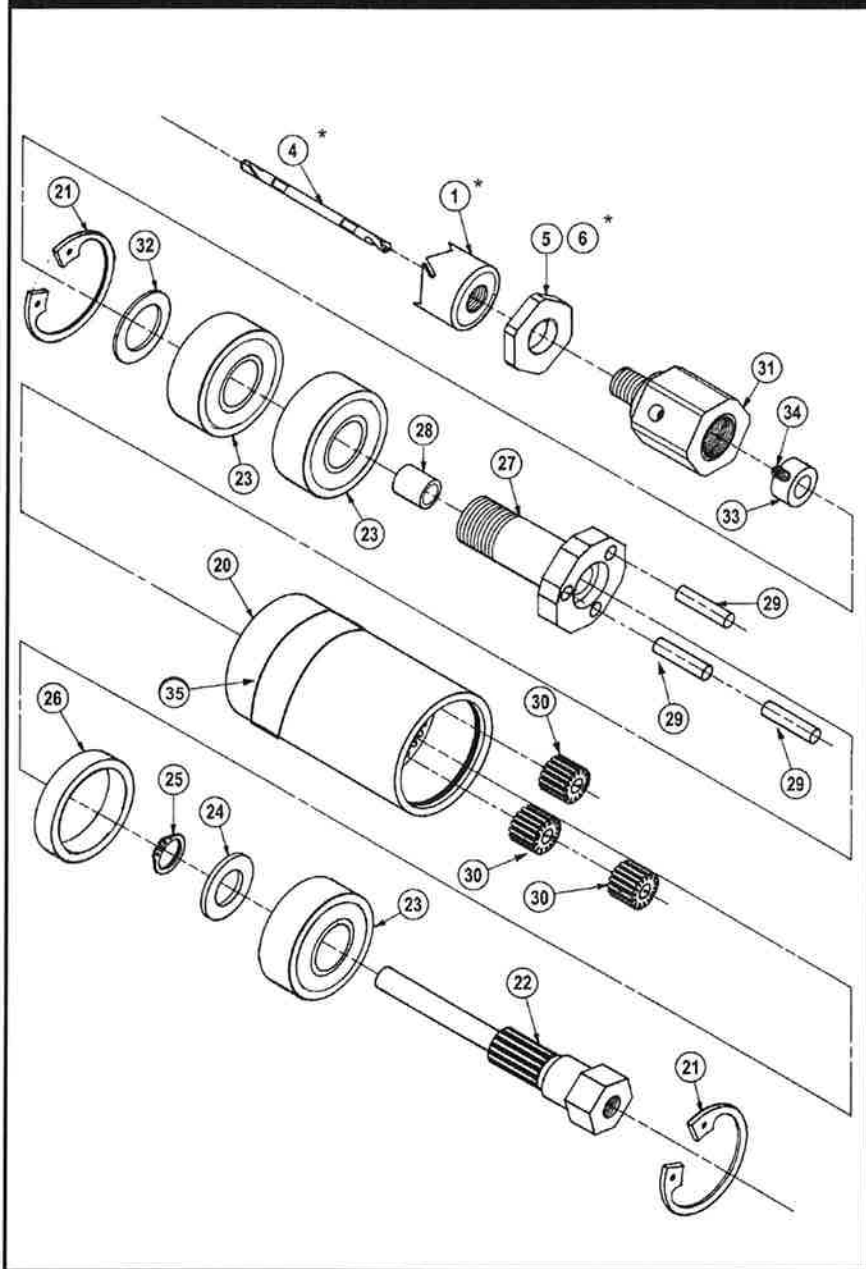
### SPEED REDUCER PARTS LIST

Item	Part Number	Description
20	460	Ring Gear (54T)
21	451	Retaining Rings
22	671	Input Shaft (18T) 1/2-20
22	484	Input Shaft (18T) 3/8-24
23	450	Bearing
24	493	Retaining Washer
25	452	Retaining Ring
26	492	Input Bearing Spacer
27	481	Planet Carrier
28	454	Bushing
29	453	Planet Pin 1/4"
30	483	Planet Gear (18T)
31	482	Output Adapter
32	491	Washer (M20)
33	490	Collar
34	455	Set Screw
35	474	Label

*\*Listed on pages 22 and 23*

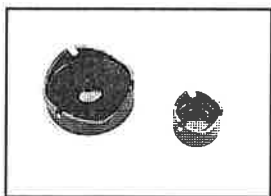
**Fig. 14A**

# EXPLODED VIEW of SYSTEM II SPEED REDUCER



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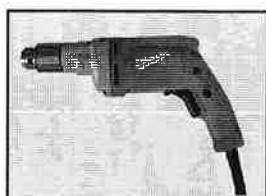
Fig. 14B



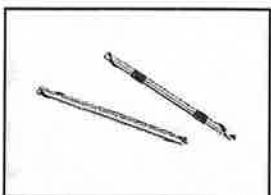
1



2



3



4



5/6



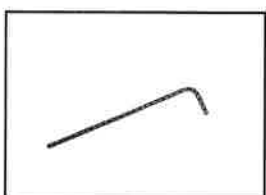
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8



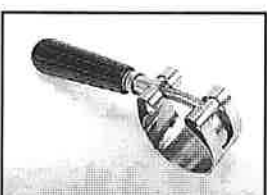
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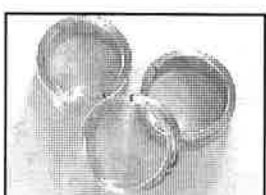
10



11



12



13



14



15



16



17



18



Fig. 15A

## EVERGREEN SYSTEM II HOLECUTTERS

PHOTO	PART NUMBER	DESCRIPTION
1	610	5/8" O.D. Holecutter
1	611	11/16" O.D. Holecutter
1	612	3/4" O.D. Holecutter
1	613	13/16" O.D. Holecutter
1	614	7/8" O.D. Holecutter
1	616	1" O.D. Holecutter
1	618	1 1/8" O.D. Holecutter
1	619	1 3/16" O.D. Holecutter
1	620	1 1/4" O.D. Holecutter
1	621	1 3/16" O.D. Holecutter
1	622	1 3/8" O.D. Holecutter
1	624	1 1/2" O.D. Holecutter
1	626	1 5/8" O.D. Holecutter
1	628	1 3/4" O.D. Holecutter
1	630	1 7/8" O.D. Holecutter
1	632	2" O.D. Holecutter
1	634	2 1/8" O.D. Holecutter
1	636	2 1/4" O.D. Holecutter
1	638	2 3/8" O.D. Holecutter
1	640	2 1/2" O.D. Holecutter
1	642	2 5/8" O.D. Holecutter
1	722.5	22.5 mm O.D. Holecutter
1	730.5	30.5 mm O.D. Holecutter
1	648	3" O.D. Holecutter
1	650	3 1/8" O.D. Holecutter

Fig. 15B

United States Patent Nos. 5,607,266 ; 5,639,193 ; 5,624,213