# The Hamilton Varimatic Precision Drilling Machine

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This paper documents research regarding the restoration of a "precision" drilling machine, the *Hamilton Varimatic Drill Press*, which was manufactured in 1962/63 by The Hamilton Tool Company of Hamilton, Ohio. It was initially sold in January 1963 to The Triplex Machine Tool Corporation of Long Island City, New York who sold it to the Adler Electronics Corporation of Pelham, New York. The Hamilton Tool Company drill press product line was eventually purchased by the Precision Drilling Machine Company of Yadkinville, North Carolina who produced them well into the 1980s under the eventual name of REBB Industries Corporation of Yadkinville, North Carolina.

*This "variable speed drill press" was unique for its time.* It was a first generation variable speed drill press patented and produced in the United States. Its capability utilized a <u>mechanical device</u> that allowed for an operator controlled variable speed (non-reversing rotation) of the chuck/spindle over multiple speed ranges (thus the Model name Varimatic). The speed ranges (low and high rpm, 880-2700 and 2850-9350 rpm respectively) required the placement of the drive belt on two sets of pulleys, the belt being driven by an electric motor having a constant output of 1725 rpm. It was a precision drill in that it was initially built to serve the watch-making industry, later to also serve the aircraft industry during WW II. The basic drill mechanisms were initially patented in 1920, followed by a variable speed mechanism patent in 1942, and overall improvements patented in 1960. *This drill press was unique in that it was the first capable of drilling/boring very precise, very small holes in metals at low to very high spindle speeds; the speed of the spindle being operator controlled over continuously adjustable multiple speed ranges.*

I purchased this drill press around 1994. *The restoration process was both started and completed in 2013.* The restored drill press has been tested and found satisfactory relative to its published initial operating specifications. *My purpose for pursuing this restoration was to preserve some little part of our American manufacturing history and heritage.*

It should be noted that the only documentation available at the time restoration began was a single set of patent drawings (Frederick. W. Schlichter, 1942). No published drawings, specifications, or marketing materials were available during the restoration process. All of the companies involved in the initial production of this machine no longer exist; the result being that no documentation that may exist has been found to date. There is one exception in that Mr. David Brown of REBB Industries Incorporated has provided a copy of an original Varimatic Parts List which is reproduced in this paper. He also provided a copy of the original sales slip (purchase order receipt) from Hamilton Tool Company to Triplex Machine Tool Corporation for this particular drill press (Serial Number 23427V).

Some of the information contained in this paper was gathered from documents available in the public domain, or the development of summary information from such public information. All other information was developed by the author.

# The Hamilton Varimatic Drill Press

"Sensitive" Precision Drilling Machine

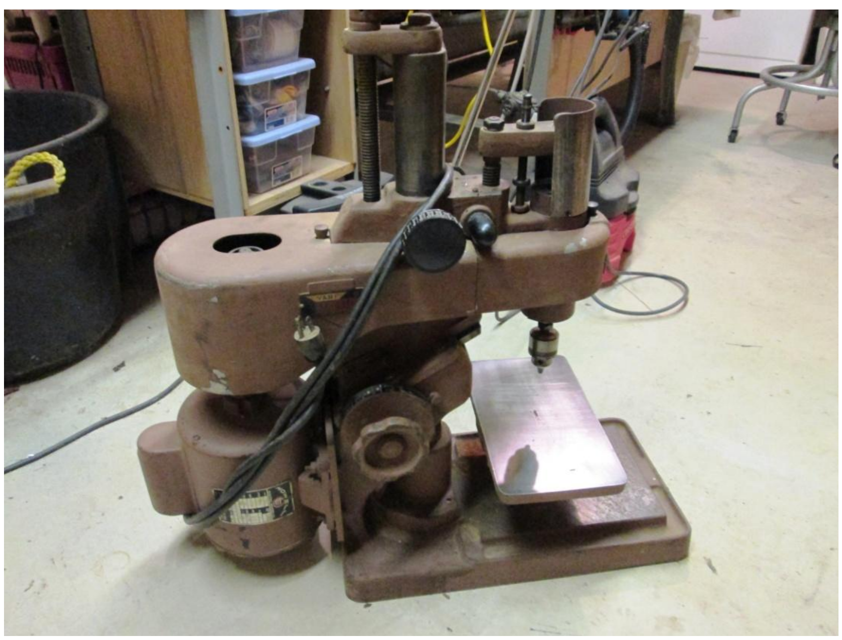

*This is a picture of a bulletin published by the Hamilton Tool Company, Hamilton, Ohio. A copy of the bulletin or an original version has not been found to date. This bulletin contains a Version Number of "V-53" in the upper right hand corner. It also has a hand-written notation of "1956" in the center. The printed information in the bottom right hand corner is unreadable. Note the logo on the bottom left of the bulletin.*

# Contents

# Introduction

Hamilton Varimatic - Prior to Restoration

The following pictures indicate the condition of the Hamilton Varimatic Drill Press when acquired in 1995. This machine remained out of service until 2013 when restoration occurred.



# Hamilton Tool Company, Varimatic Precision Drill Press

(Serial Number: 23427V, Mfg. 1962-1963)






The following pages document the initial build and sale of Serial Number: 23427V.

BY SOLD TO: Triplex Machine Tool Corp.
25-20 43rd Ave.
Long Island City 1, N.Y.

SHIP TO: Adler Electronics Inc.
Pelham, New York

12719-A

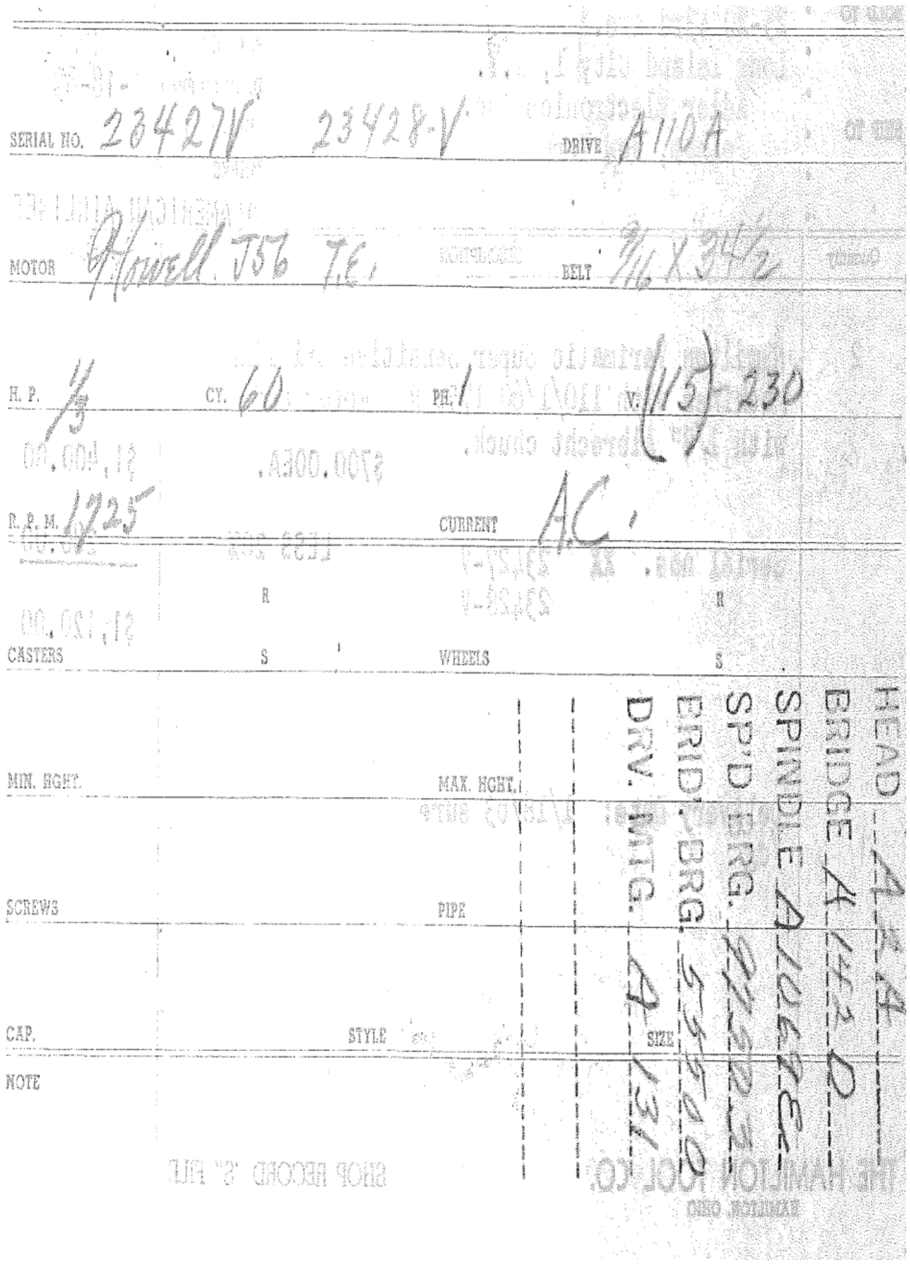
S. F. M. 12719 A
DATE 1/18/63
P. O. NO. TM-9224
DATE SHIPPED 1-18-63
THEIR P. O. NO. 2018-706
MARKS
VIA AMERICAN AIRLINES

| Quantity | DESCRIPTION | Price |
|---|---|---|
| 2 | Hamilton Varimatic Super Sensitive Drilling Machines with 110/1/60 1750 RPM motor and with 1/8" Albrecht chuck. $700.00EA. | $1,400.00 |
| | Serial nos. ZA 23427-V 23428-V LESS 20% | 280.00 |
| | | $1,120.00 |
| | Delivery Date: 1/18/63 sure /dg | |

THE HAMILTON TOOL CO.
HAMILTON, OHIO

SHOP RECORD "S" FILE

*Original purchase order and shop routing slip.*



SERIAL NO. 23427V 23428-V DRIVE A110A

MOTOR Howell J56 T.E. BELT 9/16 X 34 1/2

H. P. 1/3 CY. 60 PH. 1 V. (115)-230

R. P. M. 1725 CURRENT A.C.

CASTERS R S WHEELS R S

MIN. HGHT. MAX. HGHT.

SCREWS PIPE

CAP. STYLE SIZE

NOTE

HEAD A-4-4

BRIDGE A 1422 D

SPINDLE A1062E

SP'D BRG. [illegible]

ERID. BRG. 55502

DRV. MTG. A 131

THE HAMILTON TOOL CO.
HAMILTON, OHIO

*The numbers noted on the back of the shop slip represent part numbers and motor specifications.*

## Current Ownership

This Varimatic (SN: 23427V) was purchased in about 1994/95 from Litton Industries, AMECOM Division located in College Park, Maryland. I bought the Varimatic at auction (surplus sale) as the result of Litton's "Prototype Build Shop" being relocated prior to the sale of Litton Industries - AMECOM Division to North American-Grumman DENRO, in Gaithersburg, Maryland (2000/2001 final). Prior to this sale this Drill Press was in storage for some period of time due to the advent of CNC type machinery which had replaced many of the manually operated equipments utilized in the shop. This Shop's mission was to support the Engineering Department with custom builds of engineering prototype systems and equipment related to Aerospace instrumentation developed under government contract.

## Prior Ownership

It cannot be definitely determined at this point who owned this particular drill press immediately prior to it being acquired by Litton-AMECOM Division. It is possible that this machine was transferred from Adler Electronics to Litton-AMECOM. At one time, Litton Industries had acquired Adler which became a part of Litton's Business Systems Division. Litton Industries later divested itself of its business systems product line to concentrate on their shipbuilding and aerospace and electronics business segments. It is highly probable that some of Adler's physical assets were transferred throughout other Litton divisions as the need dictated when Litton Industries divested itself of their business systems product line.

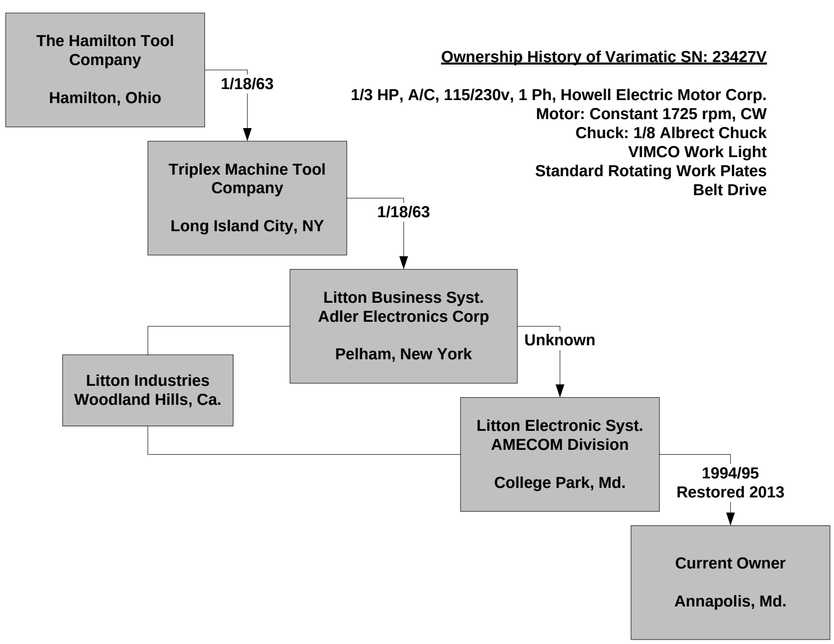
## Original Manufacture and Ownership

This drill press was originally manufactured and assembled by the Hamilton Tool Company located in Hamilton, Ohio (Shop # 12719A). It was subsequently sold (in a lot of two) on January 18, 1963 to the Triplex Machine Tool Corporation in Long Island City, New York (their Purchase Order Number being TM-9224). It was shipped via American Airlines directly to Adler Electronics Corporation in Pelham, New York on the sales date. Adler (the ultimate customer) purchased the lot of two drill presses from Triplex (the retailer/distributer) via Adler Purchase Order Number 2013-707. The price from Hamilton to Triplex was $700 per each unit further discounted by 20% ($140) per unit. The lot contained two presses with serial numbers: 23427V (mine) and 23428V. Both units had the same model of drive motor: a Howell Electronic Motors Corporation, Kingston-Conley Division in Plainfield, New Jersey. Both motors were rated at 1/3 hp, 1725 rpm, 115/120 volt, single phase 60 Cycle alternating current. The mechanicals and configuration of both presses were identical. Each press was fitted with a 1/8 inch Albrecht chuck. It is noted that the drill chuck installed on my press was a 3/8 inch Jacobs #1 Morse taper, when I purchased it.

No further documentation regarding the existence or operations of Triplex Machine Tool Corporation or Adler Electronics Corporation has been found to date specific to this particular drill press. Consequently, it cannot be determined conclusively at this time who owned this drill press during the period of time of ownership between Adler Electronics and Litton-Amecom.

It is known that Adler Electronics primarily manufactured both non-electric and electric typewriters.

According to the New York Dept of State, Triplex was established on July 8, 1958 and subsequently dissolved on March 25, 1987. It appears that Triplex operated as an industrial machine and tool supplier to the domestic manufacturing market.



# Basic Restoration Plan

**Background**

I decided to restore this drill press to as close to original condition as is possible. Hamilton Tool Company who holds the patents and manufactured the Varimatic is no longer in business. The drive motor, a Howell Electric Motors Company, Kingston-Conley Division is also no longer in business. This particular drill press was patented in 1942, an improvement being patented in 1960. Patent drawings have been acquired, but any other documentation such as "as-built" drawings, shop drawings/sketches, manufacturer's drawings/sketches, operators manual, parts list/manual, etc. seem to be non-existent although a document search continues. The same is true for literature relative to the manufacturers of either the drill press itself or the drive motor. A parts list does exist that I have acquired thanks to Mr. David Brown, REBB Industries, located in Yadkinville, North Carolina.

The purpose of this paper is to document my activities to restore this particular drill press to as near original operating condition as possible, and preserve the history of the machine's development.

**Naming Conventions**

For the purpose of this paper the following conventions are utilized:

1. *Front* is the end of the machine where the spindle and work piece is normally positioned.
2. The *Rear or Back* is obviously the opposite end from the Front.
3. The *Top* is the uppermost portion of the machine when positioned in normal operation.
4. The *Base Plate* is the casted and machined rectangular base to which the Support Column is attached via a forged collar and supports a *"mushroom" working plate* via a Seat Cylinder.
5. The *Rotating Working Plate* is the rectangular casted and machined plate that contains a machined circular indentation on the bottom of the plate that rides on top of the "mushroom" plate.
6. *The Frame* rides on the *Support Column* and contains the drill mechanisms such as the spindle, spindle elevation adjusting mechanism, and the variable speed mechanism (cone, drive belt, speed adjustment mechanism, frame elevation adjustment mechanism (jacking screw, spindle elevation adjustment lever mechanism, etc.)
7. The *Upper Frame* is that portion of the frame above the Guide Plates as installed.
8. The *Lower Frame* is that portion of the frame below the Guide Plates as installed.
9. *The Drive Motor* contains the motor itself, the mounting plates, and the "cup" portion of the "cup/cone" variable speed mechanism. The cup portion is directly attached to the drive motor output shaft via a split/roll pin.
10. *A Casting Mark*: any marking that appears to be a part of the metal casting process prior to machining of the casting.
11. *A Stamp or Stamping*: any marking that appears to be pressure stamped or "struck" into the metal of a component or part.
12. *A Machinists Etching*: any marking that appears to be hand scribed into a metal component or part by a "virtual" machinist to identify a particular component or part unique to a particular machine.

## Restoration Planning

1. **Initial Conditions, Objective(s), and Plan**
    - The drill press was covered in at least three coats of paint, the first coat appearing to be black or dark grey, the top coat being brown.
    - The operating mechanisms generally operated as intended and movement of mechanisms were for the most part free to travel in their intended direction and motion.
    - Most of the machined surfaces were subject to some level of rusting and pitting.
    - Original casted surfaces appeared to be “grey casted” and ground in some locations.
    - Many markings and stampings were unobservable because of paint coverage.
    - No literature (Specifications, Shop Drawings, Assembly Drawings, etc.) was available during the restoration effort.
    - All bearings appeared to operate freely in their races and appeared to be in good condition.
    - All parts and pieces appeared to be installed on the machine as originally manufactured with the exception of a rod used to secure one of the work surfaces to the base plate. I ended up manufacturing my own part as a replacement.
    - The Spindle Assembly and Cone Assembly appear to remain tight and exhibit no play in either the axial or transverse directions. As a result, other than cosmetic clean-up and lubrication, these assemblies were not completely torn down for maintenance or repairs.
    - The Cup Assembly also appeared tight and secure on the motor output shaft and was also not torn down.
    - The ***initial objective of this restoration effort*** was to return this drill press to as near original operating condition as possible, document and preserve the history of the evolution of the machine and its manufacturer, and place the machine back into limited service.

2. **Initial Known’s**
    - Three primary and three secondary patents were awarded relative to the evolution of the drill press.
    - All six patents have been acquired through the US Patent Office.
    - Based on the patent drawings, this drill press is currently considered a Grove/DeLano model.

3. **Initial Un-Known’s**
    - The Hamilton Tool Company, Hamilton, Ohio, the original manufacturer no longer exists.
    - The Howell Electric Motors Company, Plainfield, New Jersey, the manufacturer of the drive motor no longer exists.

4. **In Process**
    - After much researching Mr. David Brown of REBB Industries appears to be one of the most knowledgeable people, still in business. He has provided a Parts List that clearly identifies many of the markings and stampings as part numbers keyed to the Parts List. He has personally assembled many Varimatics in the 1060s for the Precision Drilling Machine Company of Yadkinville, North Carolina (currently REBB Industries).
    - The restoration and testing was considered completed in July 2013.

5. **Continuing Activities**
    - Search for Shop/Manufacturing Drawings and information continues.
    - Search for history of Hamilton Tool Company continues.
    - Search for history of Howell Electric Motors Company continues.
    - Search for history of Triplex Machine Tool Company continues.
    - Search for Copyright, Trademark, and Casting/Forging Symbols continue.

# Data Summary
## Hamilton Varimatic Precision Drill Press
(Prior to Restoration)

1. **Manufacturer's Name Plate:**
   Hamilton Tool Company
   Ninth Street and Hanover
   Hamilton, Ohio
   "It's a Hamilton"

2. **Distributor's Name Plate**
   Triplex Machine Corporation
   Long Island City, New York

3. **Separate Plate (Model)**
   Varimatic

4. **Drive Motor Manufacturers Plate**
   Howell Electric Motor Co.
   Kingston-Conley Div.
   Plainfield, N.J.

5. **Motor Data Plate**
   HP: 1/3
   Therm. Prot.: NONE
   RPM: 1725
   PH: 1
   Volt: 115/230
   Amp: 4.4/2.2
   Cycles: 60
   Rise: 55$^{o}$ C Cont.
   FR: J56
   S.F: 1
   No.: 40 J13 3117 1
   Ser. No.: WJ 6159
   Code: M

6. **Drive Belt:** 9/16 x 34 ½ printed in white on the belt by the manufacturer. This belt has been identified by David Brown of REBB Industries as a Panther # 400 Woven Belt.

7. **Total Weight:** is approximately 145 pounds with base plate and working plates in normal operating configuration.

8. **Spindle Operating Range (RPM):**
   The spindle can be operated through two speed ranges; a low range (880 to 2700 rpm as noted on the operator's adjustment knob), and a high range (2850 to 9350 rpm). This assumes a motor output shaft rotation of approximately 1725 rpm. The ranges are controlled by two different sized pulleys (step pulley) on both the cone and the spindle that are connected by the drive belt. Within these two speed ranges the rotational speed of the spindle can be varied by the operator from the low to the high end of each range by engaging the cup/cone drive mechanism through an adjustment knob. The spindle speed can be varied continuously by the Operator throughout the speed allowed for each range while the machine is operating. The adjustment knob is provided with a graduated scale showing the rpm settings for each speed range.

**9. Overall Dimensions (Approximate in inches):**

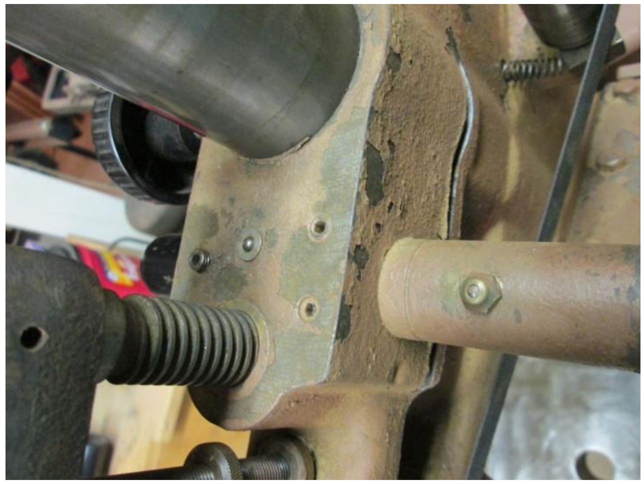
a. Height: 28", bottom of base plate to top of jacking screw handle.
b. Width: 11".
c. Depth (Front to Rear): 27".
d. Frame Elevation Travel (max frame travel): adjustable.
e. Spindle Travel: adjustable 0" to 2".
f. Base Plate: 10"width x 18"deep (front to back) x 2.5" tall (thick).
g. Mushroom (Circular) Work Plate: 4" above base plate when mounted x 5-3/8" diameter machined surface.
h. Rotating (Rectangular) Work Plate: (6" x 10.5") x 0.5" above mushroom plate when mounted. The rotating work plate cannot be mounted without first installing the mushroom plate.

**10. Lubrication Points:** In general, all lubricating points except one are located on the right side and top of the drill press. All points are standard depressible-ball type oiling points and easily accessed. There are five oiling points in total. The electric motor is a sealed unit with no oiling/lubricating points.

**a.** Two of the five points are located in the frame member that secures the upper and lower spindle bearings.

**b.** One of the five is located on the rear end of the frame jacking screw link.

**c.** One of the five is located on the spindle elevation lever bar holding the ratcheting mechanism (and services the front side of the ratchet).



**d.** The last of the five is located on the top of the frame member just to the rear of the spindle stop. This lubrication point appears to service the spindle elevation mechanism pinion. (See the previous picture.)

**11. Spindle Elevation Handle/Lever (Ratcheting Type):**
The spindle is lowered into the work piece via a handle (or lever) on the upper right side of the frame. The lever is attached to a ratcheting bar extending through a spring loaded channel through the upper frame member. The purpose of the ratchet is to position the lever in any location comfortable for the operator. A knob is provided in line with the bar that engages or disengages the ratcheting mechanism. The lever is threaded into a collar that surrounds the bar which secures the fixed side of the ratchet gear teeth.

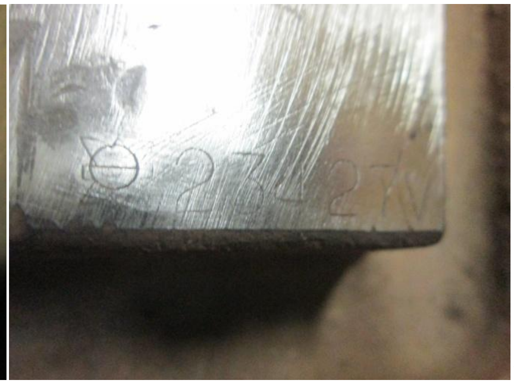
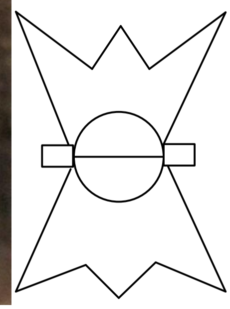
**12. Machine Finish:**
The Drill Press proper was originally finished in Black (or dark grey); the electric motor was coated in black enamel. This drill press had several coats of brown paint covering all originally painted surfaces and parts. Most all machined surfaces were left unpainted and covered with a light coat of oil. It has yet to be determined what factory finish was applied; whether the factory used a standard finish, or the finish was determined by the customer.

**13. Chuck:** The installed drill chuck is Jacobs “Multi-Craft Chuck”, Cap 1/16-3/8, MC4K01, Number 1 Morse Taper. It is known that a 1/8th Albrecht chuck was the manufacturer’s standard chuck provided with the original drill press. Possibly the chuck was installed/provided by the owner, the drill press being sold without a chuck installed. The type of chuck chosen would normally have been dependent on the intended use of the machine (milling, drilling, or tapping). In accordance with the technical staff at Jacobs, this model of chuck has not been manufactured by Jacobs for years and is not now replaceable. The installed chuck uses a Morse #1 taper to match the one-piece machined spindle on the drill press. Jacobs adopted their own taper standard (more acute angle) many years ago, which has become an industry standard over the years. Jacobs does make a Morse #1 Taper to Jacobs #1 Taper arbor in order to mount their chuck.

**14. Stampings and Markings**

Stampings generally represent part number designations, others are assumed to be casting markings of an unknown requirement or specification.

a. **Base Plate** (top front right hand corner stamped into machined surface): the marking is a symbol and the characters “23427V”. This alpha-numeric designates the machine serial number. The symbol (Hamilton Logo?) is replicated below.

b. **Mushroom Plate Threaded Seat Cylinder** (bottom of cylinder): “A 918”.

c. **Top Spindle Bearing/Alignment Block**: “A-981-U-A” on top

d. **Asset Tag** (Litton Industries, AMECOM Division): “09-30005”. This tag was painted over and was removed during restoration.


e. **Asset Logo**: This medallion was mounted to the drive motor switch plate, immediately above the switch. This logo badge was removed during restoration. This logo badge was probably used to identify a particular program effort (contract) called ATAC II or “Air Traffic Automated Communications” which was a common custom. That being the case, this particular drill press was likely procured (and funded) in support or the ATAC II Program. This was a 1960/70s FAA Program whose purpose was to integrate airfield communications.

f. **Frame Elevation Crank Link:** H-A-1032 plus a stamped design on the side.

g. **Left Upper Rear Frame Casting Mark:** The upper line is: “HA-2”. The bottom row of characters shows a set of symbols that are the same as found on the bottom of the Base Plate.


h. **Right Lower Rear Frame Casting Mark:** This mark appears to be a symbol similar to the number “12” or “R” in a circle. It could be an aberration of where the sprue waste was cut from the casting.

i. **Bottom of Base Plate Casting Mark:** The same Casting Mark symbols found on the Left Rear Frame plus “H-A 910” appear on the bottom of the base plate. It was also noted that in the following pictures there is no means of securing the support column into the base plate from the bottom of the plate, or that the support column extends through the entire base plate from above. In other Hamilton drill press models a pin or set screw was used to secure the support column to the base plate located above the base plate top surface.


*Punched metal tabs were attached against the sides of the sand mold prior to pouring in order to identify the casted piece once the mold was removed and the casted piece was cleaned of excess sand and the pouring sprue was removed (ground off).*

j. **Support Column Support Collar:** The Support column is connected to the base plate by being inserted into a casted and machined collar which is attached to the base plate by four large hex screws. This collar is stamped with the characters “H-A-913”. The collar has a flanged bottom where the four large hex screws are located. I found no key, roll pin, hex screw, or a bolt that was evident either in the collar proper or in the bottom of the base plate to secure the column to the collar.

k. **Ratchet Collar** in which the spindle elevation handle is inserted (threaded): “A-837”.

l. **Motor Mounting Plate** (part of the motor): This plate is a casting with marks on the interior surface (facing away from the motor). The marking appears on two lines and is; “5988D” on top and “L2” directly underneath. The motor is mounted directly to this plate by two bolts threaded directly into the motor case/housing. This plate then mounts to a mounting plate that is part of the frame. The motor mounting plate is attached to the frame mounting plate by four 7/8” bolts. It is not known whether this cast piece was part of the motor as supplied to Hamilton Tool Company or was cast by Hamilton as a motor mount, being a component of the drill press itself.


m. **Work Light Mounting Bracket:** A mounting plate for a work light is attached to the left rear frame (below the frame casting mark). This is an L-shaped steel bracket that appears to have originally been plated and then subsequently painted over when the frame was painted. When the paint was removed from the bracket it was stamped with the following: "VIMCO Mfg. Co., Buffalo NY". As a result, it appears this work light was provided as either an OEM option (manufactured by others) or it was separately installed subsequent to purchase by the owner.



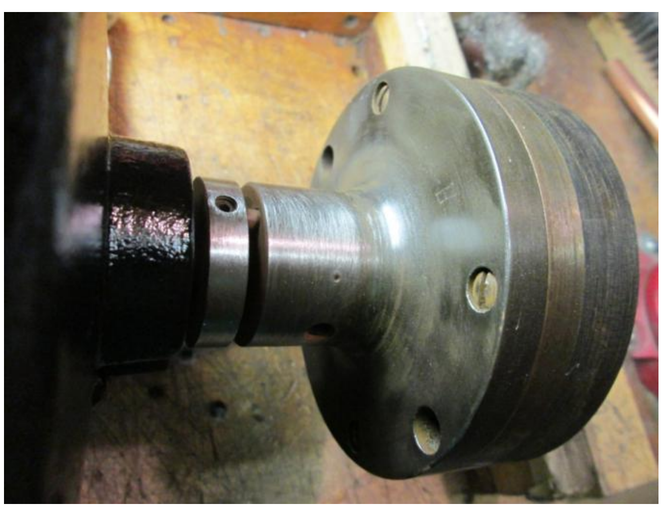
n. **Guide Plates:** The guide plates are the machined plates on each side of and bolted (three bolts per plate) to the lower frame that permits the movement of the drive cup on the motor relative to the cone. These are mounted to the lower frame and ride in Guide Ways machined directly into each side of the upper frame. The motion is initiated by a rack and pinion mechanism on the left of the internal frame and adjusted by the operator via a graduated rotational knob mounted in the same location except of being on the external side of the frame. These Guide Plates are both stamped on their top with: "A-178A". These Guide Plates are symmetrical in design but can only be mounted relative to the correct side of the frame (Guide Way). The stamped markings would always appear to the rear and on the outside edge of each plate when mounted properly.

*Right Guide Plate looking from rear to front.*

*Left Guide Plate looking from rear to front.*

**o. Cone Step Pulley:** stamped on top with “A-110A”. No markings were found on the cup portion of the cup/cone mechanism (attached to the motor output shaft) except for a machinist etching of “A-131” (see below).

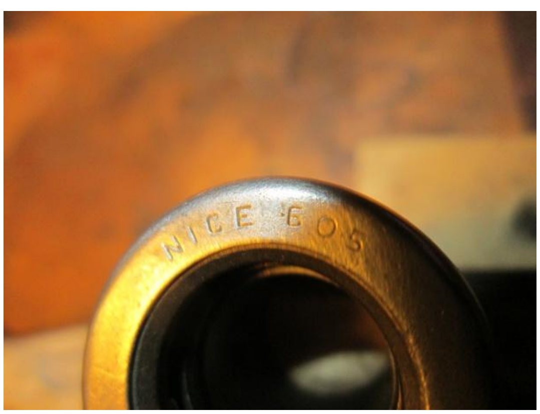
**p. Cup Machinist Marking:** etched is the marking “A131” on the bottom of the cup (facing the Motor).



**q. Jacking Screw Crank Handle:** stamped on the bottom of the handle is the marking "A927B".


**r. Jacking Screw Crank Handle Bearing:** The frame is elevated by a mechanical jacking screw that is turned in either direction by a handle fixed to the upper end via a roll pin. This handle rides on a bearing (ball type). This bearing was marked with a manufacturer's mark of "NICE 605 – Made in USA". The good condition of this bearing allowed for it to remain in place post restoration.


t

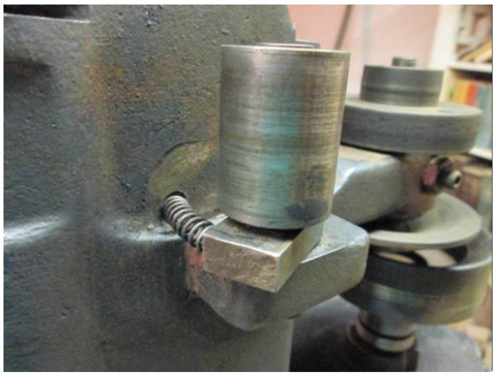


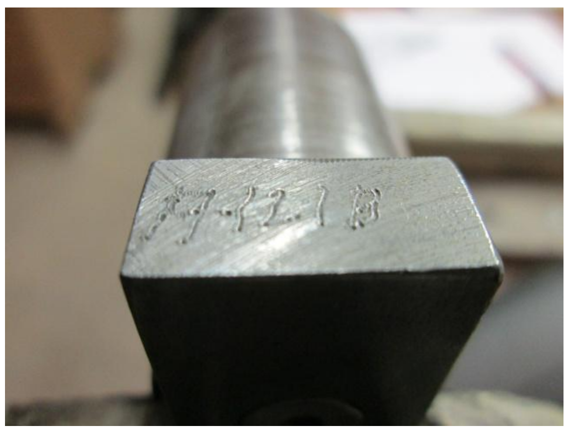

s. **Jacking Screw Link:** The jacking screw link is attached between the Support Column and the Jacking Screw, both ends of the link being fixed at their respective ends. The link is stamped on top with the marking “A1032A”.


**t. Jacking Screw Link Washer:** The end of the jacking screw link fixed to the support column is secured with a bolt (in a sleeve) and a washer. The washer is marked with a machinist mark of “A1038”. In the picture above this assembly is shown on the left.

**u. Belt Tension Bearing Assembly (Idler)**

The belt tensioning idler is a cylindrical bearing mounted on a swing arm that provides for tensioning the drive belt (the belt being run on the outside of the idler) via a spring located on the swing arm on one end and secured against the frame on the other. The end of the swing arm contains a machinist mark of “A-121B”.





The idler is fitted internally with a bearing; that bearing being marked as a “FAFNIR 38PP C1 USA”. This bearing was left in place post restoration as it was in excellent condition.



In the underside of the swing arm is located a pin/screw that secures the idler to the swing arm and is marked “A122A”.

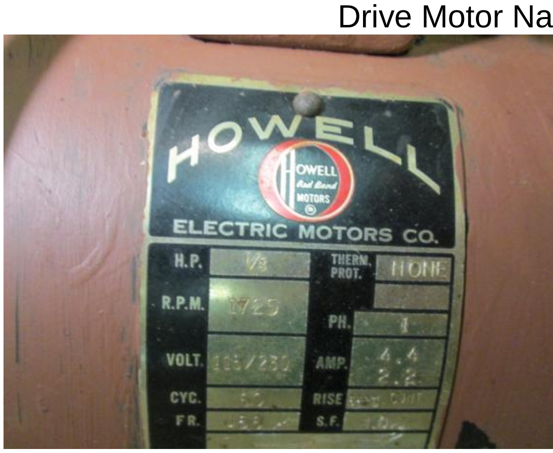
### v. Manufacturers Plates (prior to restoration)

Left Side Model Plate & Asset Tag


Right Side Distributor Name Plate


Front Maker/Manufacturer's Name Plate

Drive Motor Name / Data Plate




**w. Asset Tag Summary**

This Varimatic was owned by the AMECOM Division of Litton Industries Incorporated. It along with several other items of equipment were being salvaged in anticipation of the Machine Shop (Prototype Build) being relocated to another building and ultimately along with the entire AMECOM Division being sold to another company. AMECOM was then located on what is now known as Paint Branch Parkway in College Park, Maryland and operated as a government contractor for high technology aviation/aerospace related products. When and from whom the Varimatic was purchased by AMECOM is not known at this time. See additional information on page 16 (subparagraph "Asset Logo").


**x. Drive Belt Summary**


The drive belt (9/16" x 34-1/2" Panther #400) on this drill press appears to be relatively new because of two reasons: (1) the belt did not appear to have significant wear on either the inside or outside surfaces or edges; and (2) the belt size marking appeared to be relatively new. In addition, the belt was installed with the markings in an upside down position. The conclusion is that the original belt had been replaced at some point. In the absence of an Operator's Manual, it is not known what the original belt Make and Type were specified: however, Mr. David Brown of REBB Industries indicated this belt to be a Panther #400 woven belt and is still available on the current commercial market.

**y. Frame Elevation (Jacking Screw) Crank Link Marking (on top of link “H-A-1032 plus stamped design)**

The marking stamped into the Frame Crank Elevation Link (from the jacking screw to the support column) was upside-down on my drill press. The stamping is located on the right hand side of the Link when facing the front of the drill press. This indicates that the link was originally installed in that manner, or was reinstalled erroneously as a result of a previous machine tear down or maintenance procedure over the years the drill press was in use. It is noted that the link and the drilled holes on both ends of the link is symmetrical in all axes which would lead one to surmise that no matter the circumstance the link can be installed in either direction (i.e., flipped over in this case) without adverse effect. Therefore, I personally attach no particular significance to the position of the stamping.

This picture shows the support column and the jacking screw (with crank handle) and the link between them (jacking screw link). The frame jacking screw and crank are located to the rear of the support column. This jacking bolt raises and lowers the entire frame on the support column. The weight of the frame is directly supported by the jacking bolt. The crank rests on a bearing (ball bearing in a circular race surrounding the top of the jacking bolt), the crank itself being secured to the top of the jacking bolt with a roll pin.

## z. Base Plate & Working Plates

The only significant missing part that I found was a rod with a black plastic knob (consistent with all other knobs) that extended through a channel from the front of the base plate to the centering lug in the bottom of the "mushroom" plate seat cylinder. This rod was inserted into a machined hole in the (right hand) threaded "mushroom" plate for the purpose of securing the rotation of the "mushroom" plate to the base plate. This was accomplished by turning the "mushroom" plate onto the threaded seat cylinder, the rod being for the purpose of keeping the seat cylinder from turning. In this fashion the "mushroom" plate was tightened down onto the base plate by rotating the "mushroom" plate (clockwise) onto the seat cylinder. This type of arrangement is specifically shown on the patent drawings for the Grove/Delano model.

In the absence of any "as built" drawings or other documentation, only the patent drawings could be utilized as a reference. In the Grove/Delano patent drawings this rod appeared to have a threaded end with either a thread cut in the base plate channel just ahead of the seat cylinder, the rod intended to extend into the seat cylinder (non threaded) for the purpose of securing the seat cylinder from rotating. In my drill press no threads are cut into the base plate channel. The rod is held into the seat cylinder by a spring inserted permanently into a transverse hole/channel cut perpendicular to the seat cylinder hole and extending slightly across the bottom of the hole. This in effect provided a friction fit "retains the spring in the transverse hole" for the rod in the seat cylinder hole.

*<- The knob for the rod can be seen in this picture at the front and center of the base plate. This picture was found in an advertisement on the internet. It also shows the work plate and the "Mushroom" plate installed in the base plate.*

*<- The picture on the left shows the bottom of the cylindrical "mushroom plate" with the seat cylinder installed in the bottom. It also shows the rotating rectangular work plate (bottom) that slides over the "mushroom plate". The work plate can be secured from rotating on the "mushroom plate" with two ¼-20 set screws (note the two screw holes machined in the bottom of the work plate).*

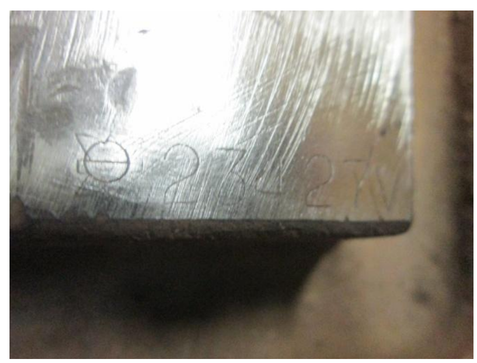
The following picture (left) shows the spring at the bottom of the hole in the seat cylinder. The picture in the center shows the end of the transverse hole in which the "retaining" spring is mounted. The opposite end of the transverse hole looks the same. The far right picture shows the seat cylinder separately.

The rod is approximately 3/8" x 7 ¼" fully seated in the seat cylinder to the surface of the base plate hole. It probably was another ¾" in length to accommodate the knob. My Drill Press was missing the original rod. I made a replacement stainless steel rod with a similar knob that mimics the original.

*<- Shown in the picture on the left is the Base Plate hole in my Drill Press for accommodating the rod. The rod runs in a channel from the front of the base plate to the hole in the base plate in which the seat cylinder is inserted.*

The Base Plate front right hand corner is also stamped in the machined surface with: some kind of design plus the numerals "23427V". The Base Plates in both the patent drawings show two types of base plate designs. My base plate follows the Grove/DeLano drawing; however, the Schlichter drawing may be the same or a different type, or the Schlichter patent drawing just did not show the specifics of the base plate in his patent application. I have seen pictures of Varimatic Drill Presses that had different types of base plates, possibly an aftermarket modification. The few pictures of the Varimatic that I have seen also showed that many were modified with a Cross Vise or X-Y Table.



23427V

In discussion with Mr. David Brown of REBB Industries, the alpha-numeric stamped in the base plate is the actual serial number assigned to the drill press by the Hamilton Tool Company and later producers (the Precision Drilling Machine Company of Yadkinville, North Carolina). The symbol on to the Muehlmatt produced name plate appears very similar. (see Appendix B)

# Restored Hamilton Precision Varimatic Drill Press

(Restored Condition)

The following pictures visually describe my Varimatic Drill Press after restoration. This particular drill press was manufactured by the Hamilton Tool Company in Hamilton, Ohio in the December-January time frame of 1962-1963. This machine is currently fully operational within the original specifications and contains all original parts (with the exception of part # 1022C, a base plate rod which was remanufactured as a replacement for the original).


*These two pictures and those that follow show the Varimatic with the work plates installed but without the spindle and drive (frame) covers installed. These covers are shown installed in the last pictures of this series.*


TRIPLEX
MACHINE TOOL CORP.
LONG ISLAND CITY, N. Y.

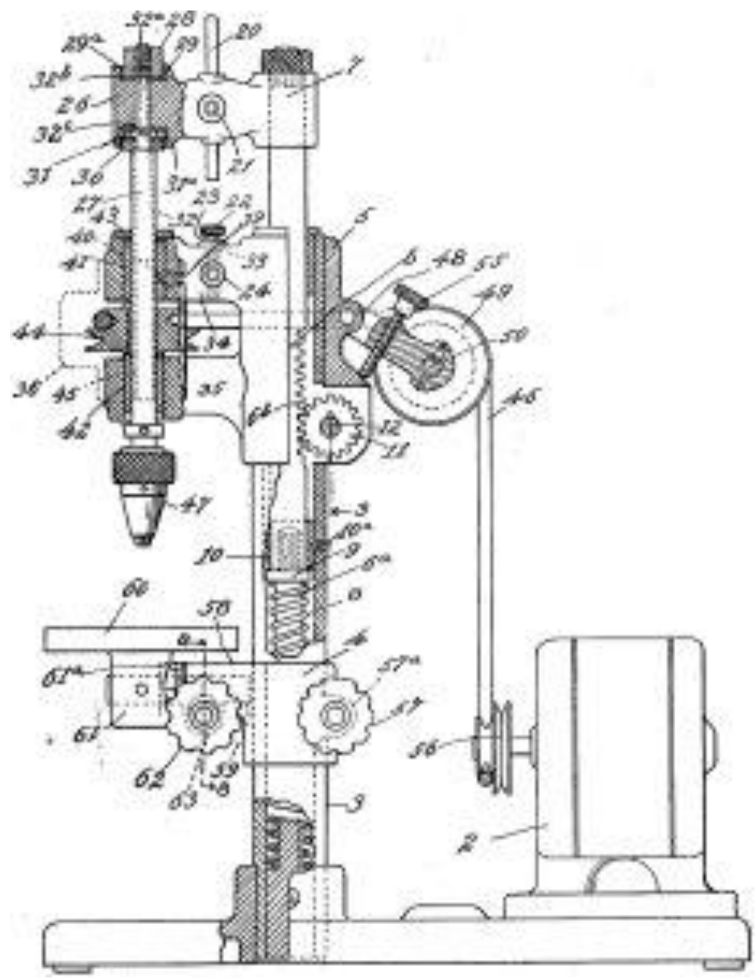

VARI


MATIC


TRIPLEX

# The Development and Evolution of the Hamilton Varimatic

## -Patent Summary-



**The First "Sensitive Bench Drill" Drill Press**

Patent: US Patent: 1,497,579
Title: Precision ("Sensitive") Drill Press
Patentee: Adolph Muehlmatt, Newport Ky.
Applied: Apr. 23, 1920
Granted: Jun. 10, 1924
Assignees:

- Hamilton Tool Company, Hamilton, Ohio.
- Adolph Muehlmatt, Cincinnati, Ohio.

The Muehlmatt drive system consisted of a round belt that traveled over a 90 degree path for providing power to the drill spindle (drill head). The speed control on this model was fixed by the pulley size. His patent provided for an electric motor driven bench drill that provided for the accuracy and precision needed in the jewelers industry. It also provided for a sensed feedback (of the drill into the work piece) to the operator during drilling operations through a spindle travel lever. In addition it provided for a mechanism to stop the depth of drill bit travel with pre-determined accuracy. This initial invention provided only for two fixed drive speeds of the spindle. See Appendix C for a detailed discussion of the original Adolph Muehlmatt model.

This Drill Press (US 1,497,579 – Adolph Muehlmatt - 1924) was the first in its line followed by (US 2,297,078 – F. Schlichter - 1942) that improved on the original Muehlmatt by adding a variable speed drive ("cup and cone"). In 1960 the Schlichter model was further improved by J E Grove and W W DeLano (US 2,961,899 – Grove/DeLano – 1960). Concurrently, a similar machine used for tapping operations was patented in 1963 by K. J. Yost and W. W. DeLano (US 3,105,982). See Appendix B for details relative to the Tapping Machine.

Both later models, the Schlichter and the Grove/DeLano provided a wide ranging variable speed to the spindle through a unique application of a "mechanical cup and cone" arrangement. This mechanism allowed for changing spindle speed via the engagement of a cone attached to a step pulley, and a cup shaped ring fixed to the motor output shaft. The amount of operator engagement/adjustment either increased or decreased the speed of the spindle through two different speed ranges (determined by the positioning of a drive belt on a set of front and rear step pulleys. Connecting (the transmission of drive speed to spindle speed) the "cone pulley" and the spindle pulley was provided by a thin flat belt sized at approximately 34-1/2" x 9/16"). This allowed for a quiet smooth transmission of power that also reduced noise and vibrations inherent in geared drive mechanisms of that era, as well as for higher spindle speeds. From an engineering perspective, this mechanism was also unique (to the "cone/cup" mechanism) in that it also acted as a continuous clutch mechanism through mechanical operator adjustment while the spindle was engaged– a first of its kind. See Appendix A for a discussion of the Cup / Cone design concept.

As stated above, the 1942 Schlichter model utilized the basic Muehlmatt head mechanism and improved it with a variable speed cup and cone drive mechanism. According to the Schlichter patent, improvements to the Muehlmatt design were intended to accomplish the following:

- "His invention related to drill presses, and particularly to drill presses with an infinite range of ratio of speed between the driving member and the chuck spindle, having special value in those devices in which an electric motor is utilized to drive the chuck spindle.
- A further important aim was to present an unusually compact construction in such a device enabling the attainment of a full range of speed between wide limits of minimum and maximum, and enabling the variation of the ratio of speed between the drive and the chuck spindle with great (operator) ease and certainty.
- It was also an aim to coordinate in a novel way a chuck spindle and cone driving device to the end that the area of frictional contact between the elements will increase progressively from high speed to low speed position, this having particular value in such machines because of the fact that a minimum of power is required with high speed operations where small drills are employed, but low speeds are necessary where large drills are required and where a greater amount of power must be transmitted to the drill.
- Another object was to present a novel and very compact means for attaining the combined function of maintaining the two cone elements in contact in such a device as disclosed in this submittal, and also absorbing shocks and vibrations tending to be transmitted from the motor, so that they are not manifest at the contact between the cone elements and is not likely to cause excessive wear of the cone elements or detrimentally affect actions of the drills. This is important because of the tendency in some work for drills to chatter or jam, such tendency being increased by any vibrations transmitted through the driving conditions.
- An aim of this submittal is to present a drill press of this kind of combined variable transmission which may be constructed at a very low cost, not exceeding that of ordinary belt transmissions and pulleys adapted to attain the same range of ratio variation, while at the same attaining improves results in greater rapidity of adjustment and speed, greater safety, less effort to drive on the part of the operator, obviating the necessity for the operator to leave the front of the drill press when changes of drive ratio are to be made ordinarily".

The 1960 Grove/DeLano model improved on the Schlichter model by providing for the following improvements according to his patent approval:

- Increasing the accuracy of the drill press and prolonging the useful life of the machinery.
- Simplify and expedite assembly and servicing of the spindle structure, thus minimizing down time.
- Incorporated improvements in the variable speed drive for the drill spindle, resulting in advantages with respect to lubrication, servicing and vibration-less operation.

The Grove/DeLano model referenced not only the Schlichter model patent (US 2297078, September 1942), but also those of Orville H. Ensign (US 1530819, March 1925), Charles F. Schenck (US 1830679, November 1931), and J. Beier (US 2253750, August 1941).

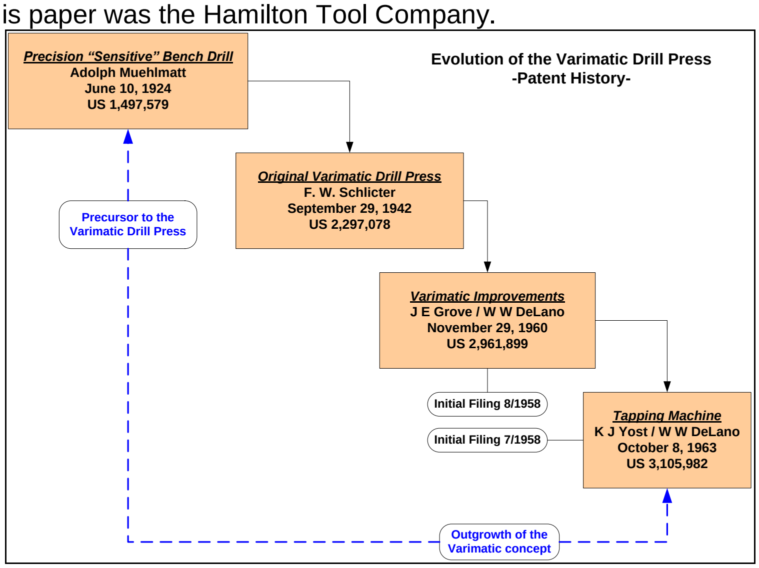
- The *Ensign* patent addressed a gang drill arrangement; however, the spindle thrust bearing design was of particular interest and was incorporated into the Schlichter design. This design reduced the build and maintenance cost in multi-press production operations.

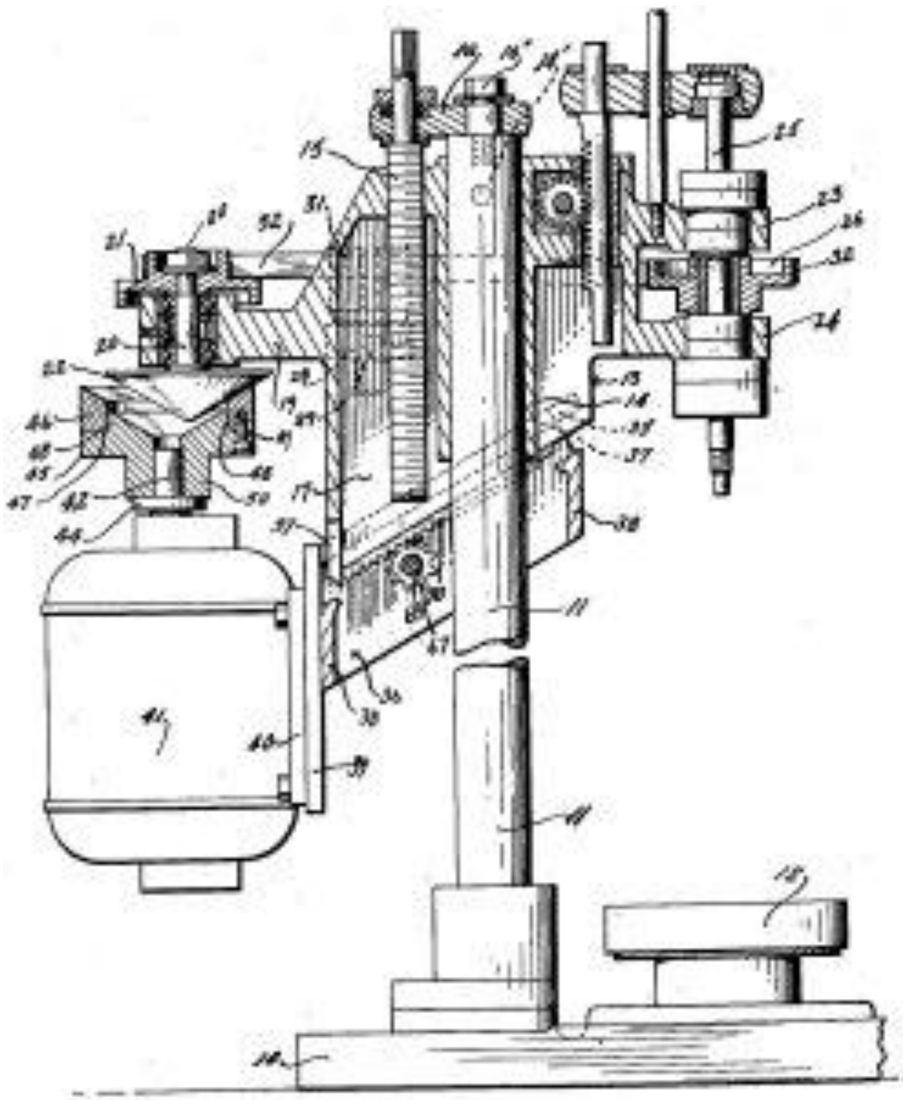
- The *Schenck* patent improved the life and adjustability of the ball bearing type thrust bearings in the spindle bearing arrangement, thus improving maintainability, reducing vibration of the spindle at high speeds, reducing machine time set-up, and reducing bit breakage caused by bit chatter (caused by vibration feedback between the work piece and the bit).

- The *Beier* patent, in essence addressed the friction pressure between the cup and cone mechanism relative to the force/power transmission ratios. In general it provided for an improvement in cup/cone design resulting in improved transmission of power between the cup and the cone.

It should be noted that patent drawings are conceptual in nature and cannot supplant any type of "as-built" type drawing. The actual structures, mechanisms, parts, and dimensions can only be determined by actual measurement in the absence of any type of "as-built". An "as built" is usually a complete set of manufacturer's drawings, "marked-up" shop drawings, or final assembly drawings. None have been found thus far.

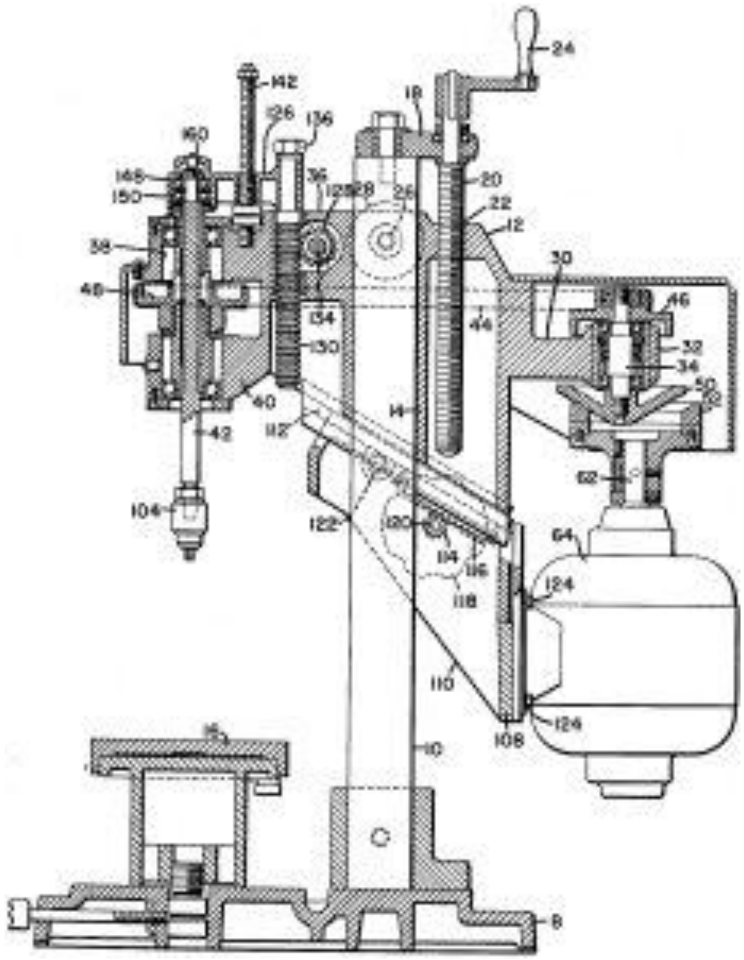
As a sidebar: it is interesting to note that in 1963 the Hamilton Tool Company was also the assignee of a patent (US 3105982, October 8, 1963) granted to K.J. Yost and W. W. DeLano for a Tapping Machine that was eventually produced by the Hamilton Tool Company. This machine appeared highly similar to the drill presses then produced by Hamilton. It is not surprising when considering that W. W. DeLano was also granted a previous patent for the improvement of the original Varimatic. The assignee for all of the machines noted in this paper was the Hamilton Tool Company.





Schlichter Version/Model
US 2,297,078 – Sept 1942

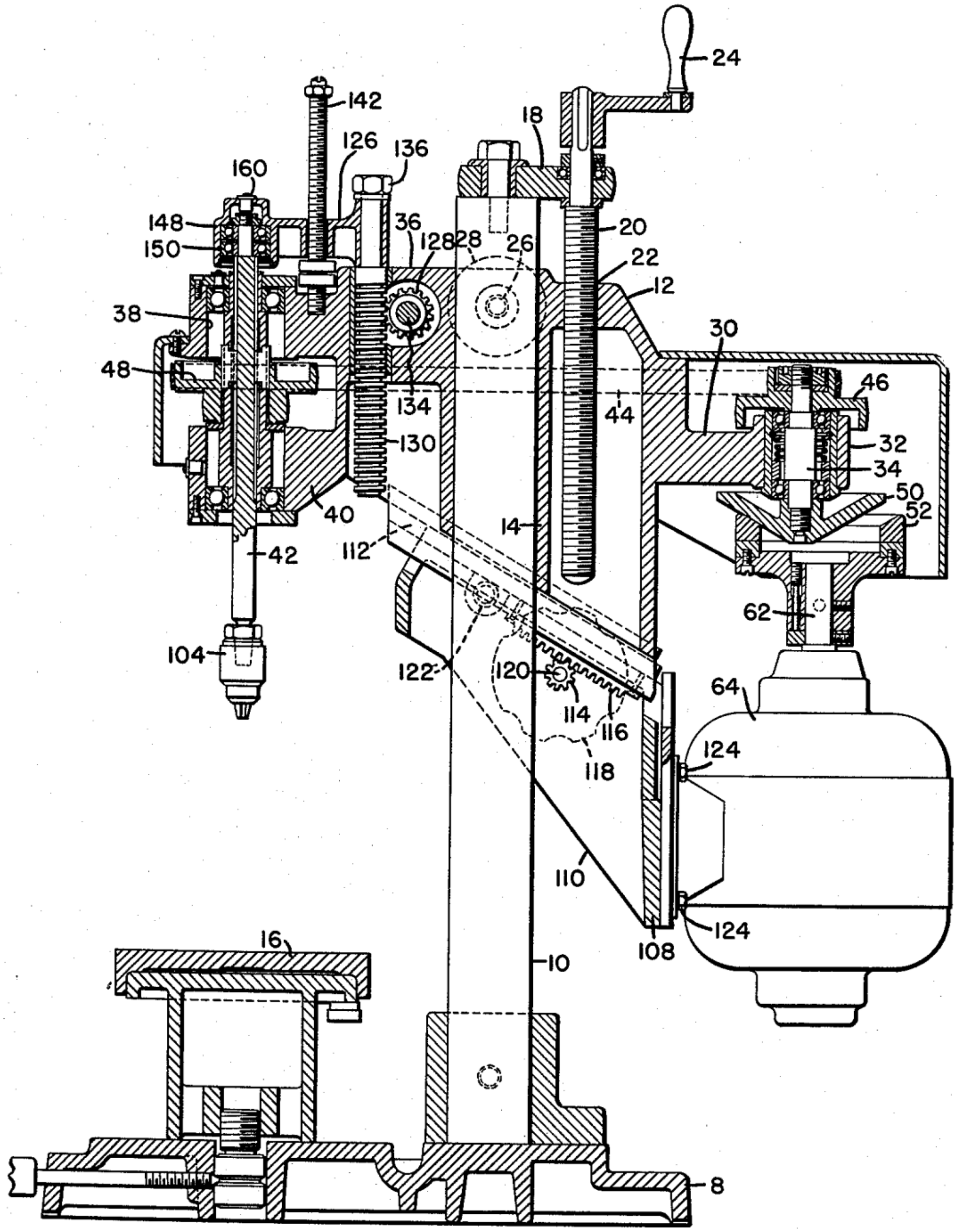
| | |
|---|---|
| Patent: | US Patent: 2,297,078 |
| Title: | Variable Speed Drill Press |
| Patentee: | Fredrick W. Schlichter, Hamilton, Ohio |
| Applied: | June 15, 1940 |
| Granted: | September 29, 1942 |
| Assignees: | Hamilton Tool Company, Hamilton, Ohio. |

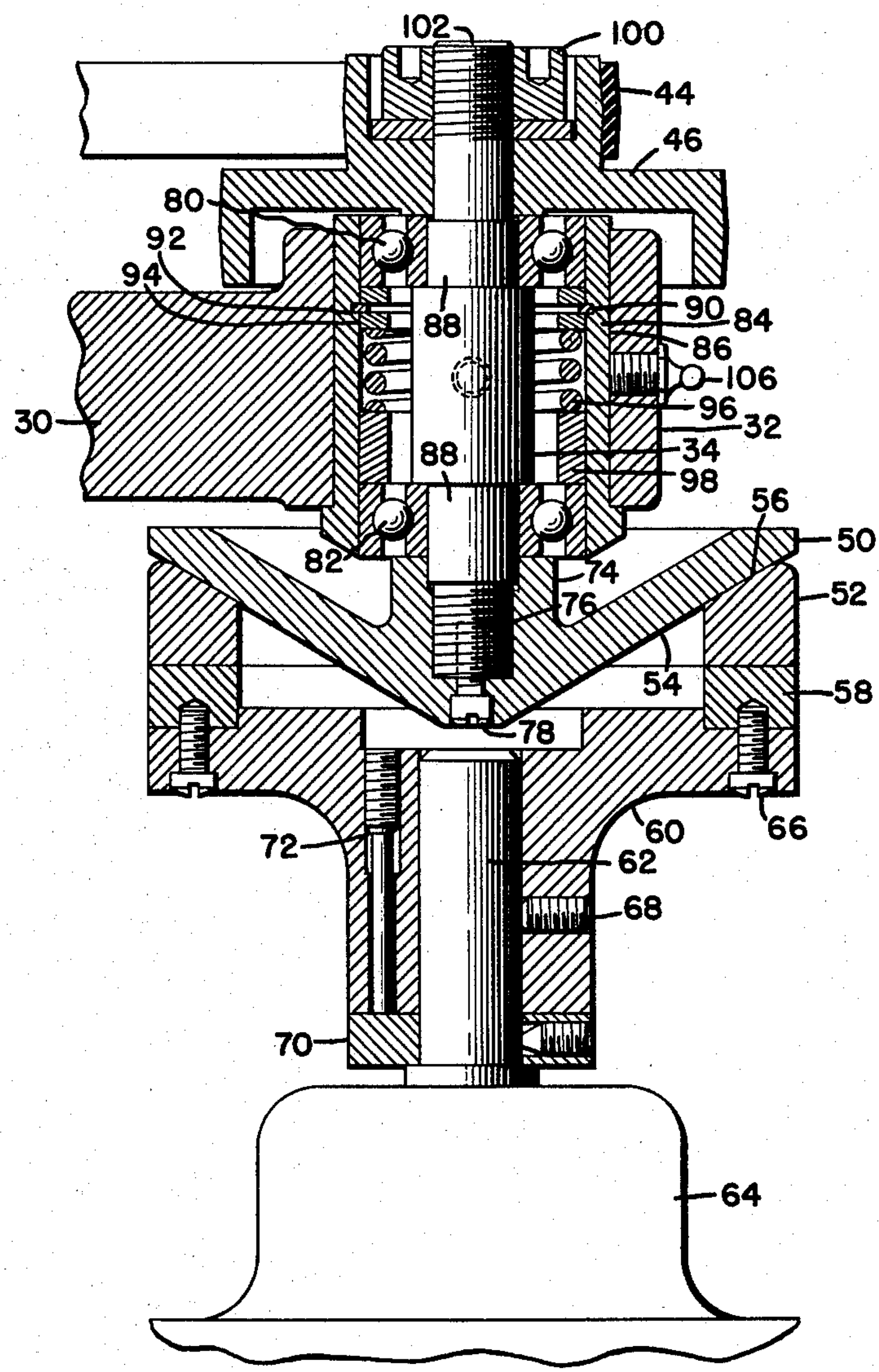



Grove / De Lano Version/Model
US 2,961,899 – Nov 1960

| | |
|---|---|
| Patent: | US Patent: 2,961,899 |
| Title: | Variable Speed Drill Press |
| Patentees: | Walter W. De Lano, Fairfield, Ohio |
| | James E. Grove, Hamilton, Ohio |
| Applied: | August 20, 1958 |
| Granted: | November, 1960 |
| Assignees: | Hamilton Tool Company, Hamilton, Ohio. |

# Basic Assembly





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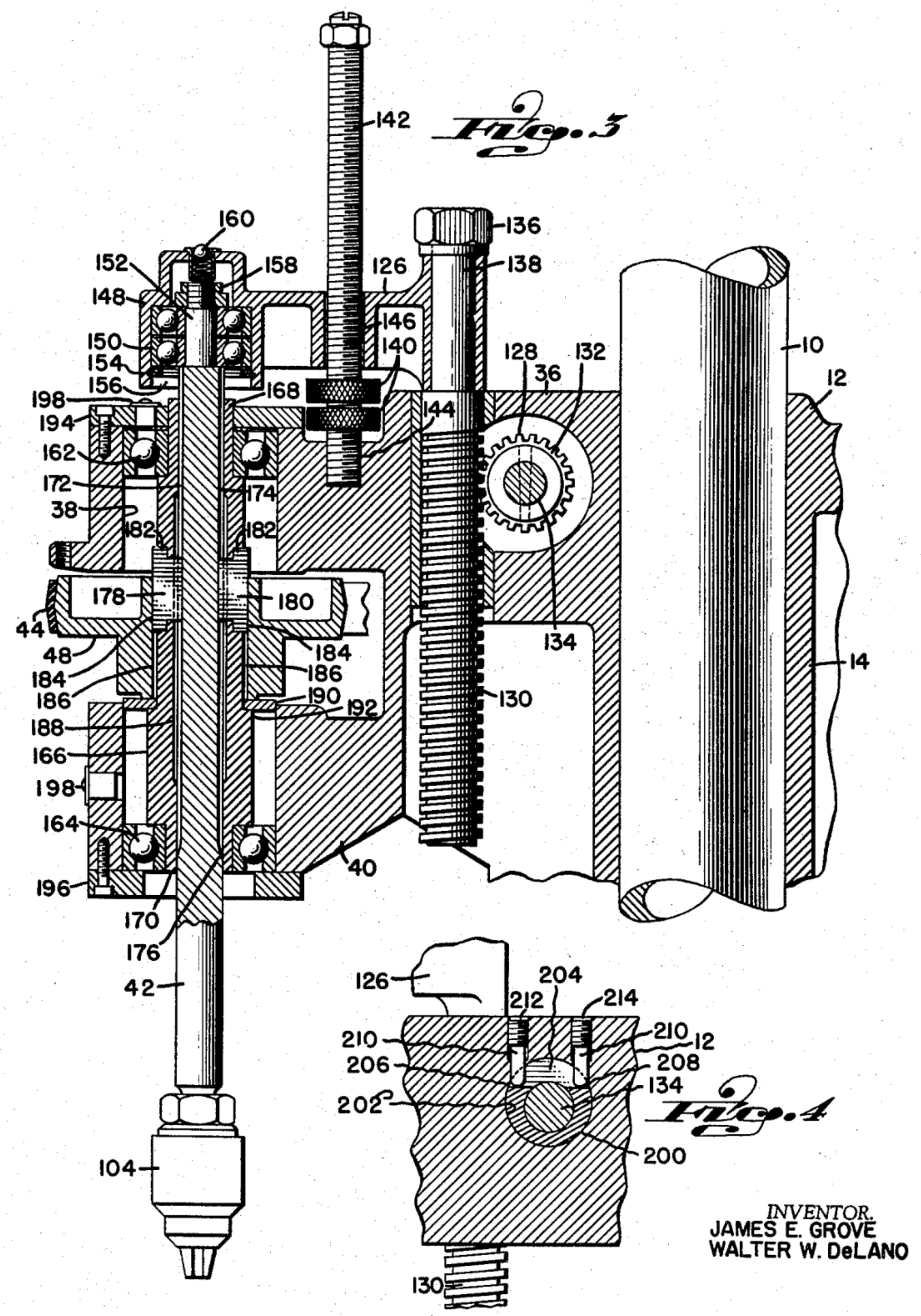


Fig. 3
Fig. 4
INVENTOR.
JAMES E. GROVE
WALTER W. DeLANO

Below is listed an abbreviated “parts key” to the basic components of the Hamilton Varimatic Drill Press. The key references the patent drawings shown above. These drawings were extracted from the Grove/DeLano Patent (1960) application because they represented the most complete set of concept drawings when compared to those contained in the Schlichter (1942) patent application. It is highly suspected that between the two patent applications, improvements were made to the Varimatic as a normal course of events in the manufacturing process over the 18 years between patents. The Grove/DeLano patent admittedly incorporated these improvements and the purpose of their patent was to codify the manufacturing changes. This is a logical conclusion in that Schlichter, Grove, and DeLano all were employed by the Hamilton Tool Company (it being the assignee in all the referenced patents). Key to the Spindle and Cone Bearing Assemblies are not specifically addressed in detail in the following key list in that it is assumed the bearings changed over the years as bearing technology improved. Since the Varimatic was considered one of the best precision drills of its time, it is assumed it was outfitted with the most up-to-date bearing assemblies that permitted ease of assembly, lubrication, maintainability, and cost. It is highly probable these assemblies varied between machines manufactured over the years.

| **Assembly Nomenclature Key** | | |
|---|---|---|
| **Key #** | **Name** | **Note / Remark** |
| | | |
| 50 | Cone | Upper Friction Drive Assembly |
| 52 | Cup | Lower Friction Drive Assembly |
| 34 | Cone Shaft | When Cup and Cone are axially aligned the rpm = 1:1. Assuming a motor output shaft rated rpm of 1725 rpm, then the cup and cone will rotate at a corresponding rpm. As the cone is relocated to the edge of the cup, an increase in rpm will occur at the spindle. The specific rpm will ultimately be determined by the cone pulley size and the connected (by the drive belt) pulley size of the spindle. |
| 62 | Motor Output Shaft | |
| 46 | Cone Pulley | 2 Step Upper Drive Pulley |
| 42 | Spindle | |
| 150 | Upper Spindle Bearing Assembly | |
| 10 | Frame Support Column | |
| 8 | Base Plate | |
| 12 | Upper Frame Assembly | |
| 110 | Lower Frame Assembly | |
| 16 | Rotating Work Table | |
| 16A | Mushroom Plate | Supports the Rotating Work Plate |
| 16B | Mushroom Plate Seat Cylinder | Secures the Mushroom Plate to the Base Plate |
| 18 | Jacking Link | Fixed to the Frame Support Column |
| 20 | Jacking Screw | Elevates Frame on the Frame Support Column |
| 24 | Jacking Handle | Fixed to the Jacking Screw |
| 44 | Drive Belt | Connects Cone Step Pulley to the Spindle Step Pulley |
| 26 | Frame Clamping Screw | Clamps Frame to the Frame Support Column (#28 = Knob). Restricts Frame movement in both the vertical and rotational directions. |

| | | |
|---|---|---|
| 40 | Spindle Housing | Area of the Upper Frame holding the Spindle Assembly |
| 48 | Spindle Step Pulley | 2 Step Pulley fixed to spindle via mechanical fastening |
| 64 | Drive Motor | |
| 22 | Jacking Screw Threads | Cut into frame to secure jacking screw |
| 30 | Cone Arm | Part of Upper Frame to hold Cone Assembly |
| 36 | Spindle Arm | Part of Upper Frame to hold Spindle Assembly |
| 54 | Cone Friction Face | Provides Friction surface interfacing with Cup friction surface. |
| 56 | Cup Friction Face | Provides Friction surface interfacing with Cone friction surface. |
| 60 | Cup Hub | Mechanically fixed to Motor Output Shaft |
| 74 | Cone Hub | Mechanically fixed to Cone Drive Assembly (bearings and Cone Arm) |
| 80 | Upper Cone Shaft Bearing Assembly | Maintains Cone axial Alignment |
| 82 | Lower Cone Shaft Bearing Assembly | Maintains Cone axial Alignment |
| 88 | Cone Shaft | Reduced portion of main Cone Shaft |
| 84 | Cone Bearing Sleeve | Maintains alignment of Compression Spring |
| 96 | Cone Compression Spring Bushing | Maintains Cone axial contact with the Cup |
| 98 | Cone Compression Spring Bushing | Limits Compression Spring location |
| 100 | Cone Step Pulley Security Nut | Secures Step Pulley to Cone Shaft |
| 104 | Spindle Chuck | #1 Morse Taper, 1/4 to 1/2 inch chuck |
| 106 | Lube Point | |
| 108 | Lower Frame Mounting Plate | For mounting drive motor to the Frame |
| 112 | Guide Way | Consists of matching machined Guide Plates mounted to each side of the lower frame that ride into machined slots in the frame which permit the forward and rearward movement of the lower frame via a rack and pinion mechanism. This movement allows for the same movement of the cone relative to the cup, thus permitting a change in rotational ratios. |
| 114 | Guide Way Pinion | Interfaces with Guide Way Rack |
| 116 | Guide Way Rack | see Guide Way remark |
| 120 | Guide Way Pinion Shaft | Permits interface between the rack and the pinion |
| 122 | Guide Way Locking Knob | Permits locking/clamping the guide ways to limit further movement |
| 124 | Frame Plate Bolts | Secures Frame Plate to lower Frame |
| 126 | Spindle Arm | That portion of the upper Frame that holds the Spindle Assembly |
| 128 | Spindle Elevation Mechanism | Permits positioning of the Spindle in the vertical direction |
| 140 | Spindle Elevation Stop Nuts | limits movement of spindle in the uppermost and lowermost vertical positions |
| 142 | Spindle Elevation Anchor Screw | Provides an anchoring point for the movement of the spindle assembly |

# Hamilton Tool Company, Hamilton, Ohio

## Company Background

**Hamilton Machine Tool Co.** was formed in the 1890's to make upright drills. In the late 1890's they began to make engine lathes. The firm was formed as the **Hamilton Tool Co.** in 1903 and incorporated in the state of Ohio in 1926. During the World War II era this company made sensitive (precision) drills. The drill was patented by **Adolph Muehlmatt** in 1924 (patented applied for in 1920) and improved upon in Frederick Schlichter's patent of 1942 (patent applied for in 1940). The drill was first manufactured by Mr. Muehlmatt himself from about 1920; Muehlmatt had already been in business for about 20 years, making ball vises and engravers' supplies. Following Mr. Muehlmatt's death, in 1937 Hamilton Tool Co. acquired the assets of his business and organized it as the "A. Muehlmatt Division of Hamilton Tool Co.", and continued manufacture of his line of precision drill presses. That is not to say that Muehlmatt's own company and Hamilton did not merge at some point prior to his death; it just has not been conclusively verified to date.

Over the years, the Hamilton Tool Company appears to have developed three basic product lines: Drilling & Tapping Machines, Material Handling Equipment, and Printing & Packaging Industry Machinery. Eventually all three product lines were sold off to various separate companies and the Hamilton Tool Company ceased to exist although their patents remained in effect.

*The Machine Company* (later incorporated in Ohio) on Hastings Avenue in Hamilton, Ohio purchased the two material handling product lines, at auction in November of 1999. The Portelvator and Die-Part, both registered material handling product lines, were originally sold by Hamilton Tool in 1977 to the *Machine Tool Corporation* also of Hamilton.

The Printing & Packaging product line of the Hamilton Tool Company was eventually acquired by *Stevens Graphics* in 1986, which appears to have subsequently moved production to Dallas/Fort Worth, Texas after a Union dispute. At one time prior to the eventual relocation to Texas and after the sale of the Printing & Packaging product lines, the company's name was changed to Hamilton-Stevens while it was located in Hamilton, Ohio.

Research relative to tracking the organizational relationships regarding the Hamilton Tool Company was difficult at best. Basic company records were either destroyed or passed on as each product line was sold. A graphical representation of establishment and eventual demise of the Hamilton Tool Company are provided below. This "Org Chart" below is the best that could be reconstructed with the current information available that could be found through public records and word of mouth.

## The Hamilton Tool Company Incorporation History

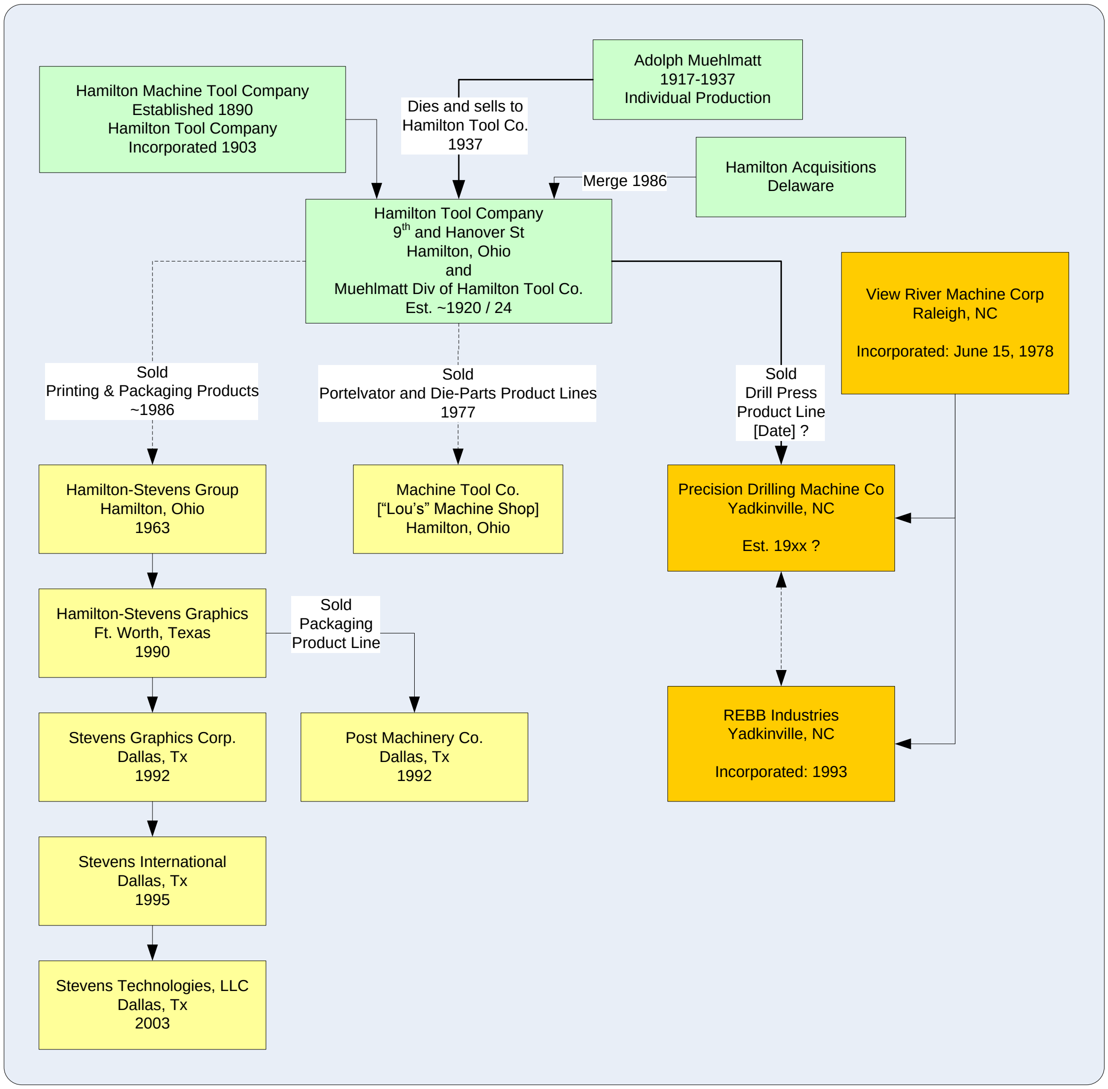
Class: Corporation for profit
Number: 123086
Hamilton, Butler County, Ohio
Incorporated: 9/16/1926
Status: Dissolved 5/31/1990

| Filing | Date | Number | Remarks |
|---|---|---|---|
| Incorporation | 09/16/1926 | A421_0141 | Charles M Lyle, Charles A Cammerer, Oscar A Koogler, Pearl Koogler, May W Lyle, Martha M Cammerer: Initial Capital= $50,000, 500 Shares @ $100/share. |
| Amendment | 12/28/1942 | A421_0147 | FW Schlichter, Pres; JE Grove, Secty; 2000 Shares @$100/share |
| Amendment | 01/04/1955 | A421_0149 | FW Schlichter, Pres; William Franzmann, Asst. Secty, 4000 Shares @$100/share; Oscar Schlichter appointed Secty. As of 1930 |

| | | | |
|---|---|---|---|
| Amendment | 01/02/1958 | B028_0972 | FW Schlichter, Pres; JE Grove, Secty; 10,000 Shares @$100/share |
| Amendment | 12/31/1962 | B288_1538 | Calvin W Jung, Pres; JE Grove, Secty; 30,000 Shares @$100/share |
| Amendment | 04/29/1965 | B405_0345 | Calvin W Jung, Pres; Eleanor Grove, Secty; increases powers of the Board and restates articles of incorporation regarding operations and capital investments |
| Amendment | 12/31/1969 | B655_0077 | Harold Huffman, Pres; J B Grove,Secty: handling of shares Class A and B; rights a values of classes of shares; 80,000 Shares @$30/share. Huffman served as vice-president of Hamilton Tool Company from 1960-1967, was named president in 1967, serving until 1974, and served as a consultant until his retirement in 1991. |
| Amendment | 11/29/1973 | B842_0476 | Harold Huffman, Pres; J B Grove, Secty: handling of shares |
| Merger Agreement | 12/31/1986 | G078_0085 | Fredrick H Harding, Pres; J B Grove, Secty: Hamilton<br>Fredrick H Harding, Pres; Richard I Stevens, Secty: Acquisition<br>Paul and Richard Stevens; Stevens Graphics<br><br>Merger of Hamilton Acquisition Inc, a Delaware corporation with the Hamilton Tool Company, the Hamilton Tool Company being the lone survivor.<br><br>Hamilton then merges with Stevens Graphics Corp a Delaware Corporation + $18.6 M + good will and considerations +$1.0M for Acquisition. |
| Domestic Merger | 03/30/1990 | G834_0937 | Merger executed between Hamilton and Stevens with Hamilton being the Survivor |
| Merger out of Existence | 05/31/1990 | G879_0480 | Final filing with Ohio Sec of State to dissolve the company |
| | | | |

The table above was developed from the corporate filings database maintained by the Ohio Secretary of State which is open to the public at no cost via their web site. In most states this is not true (ex. Delaware, New York, etc.).

Although the company existed prior to 1926 it incorporated in that year with an initial capitalization of $50,000 by three families of investors. Although not an initial investor, the Grove family also served the company throughout its history. The filings indicate a continuous growth while the company existed. Several different people acted as President; however, members of the Grove family also served as the company Secretary which added continuity and consistency in the overall management of the firm. In the 1985/86 time frame it appears the board was in the mood to sell the company. It also appears that at some point prior, the board had established another company in Delaware (the Hamilton Acquisition Corporation) for the purpose of acquiring assets for the Hamilton Tool Company. This was common in that era because of the favorable tax treatment Delaware provided to corporations compared to many other states. In 1986 the Hamilton Tool Company and Hamilton Acquisitions merged, Hamilton Tool Company being the lone survivor in order to facilitate a potential sale. At that time Hamilton was in discussions with Stevens Graphics of Fort Worth, Texas for a potential buy-out. As a result both reached agreement in 1986 which was filed with the Ohio Secretary of State and the Agreement was executed in final form in 1990. A condition of the sale was that Hamilton Tool Company and Hamilton Acquisition Corporation would merge in order to simplify the sell-out process. Additionally, a second filing was submitted within 60 days that dissolved the Hamilton Tool Company which was another condition of the Agreement. By this time the two other product lines (material handling and drill/tapping machines) had been sold. In essence, the assets owned by Hamilton that were sold to Stevens consisted only of the printing/packaging product lines. The surviving entity after the sale was named Hamilton-Stevens Group which remained in Hamilton, Ohio. Later, as a result of a Union dispute in 1994 Hamilton-Stevens Group co-located their Hamilton, Ohio assets in total to Ft. Worth, Texas, and became a true subsidiary of Stevens Graphics Corporation. This signaled the final demise of the Hamilton Tool Company in Hamilton, Ohio if in name only.




*The above graphic represents my research to date regarding the genealogy of the companies associated with the original manufacturer, the Hamilton Tool Company*

## Patents held by the Hamilton Tool Company - Summary Table

A review of the Patent submittal history of the Hamilton Tool Company indicates that the primary market of the company was in the design and manufacture of Printing industry equipment during the post WWII era. They also produced a drill press product line, and a material handling product line (Portlevator and Die-Parts). At this point, little history of the company's operations has been found.

| Number | Date Granted | Patentee | Title | Type |
|---|---|---|---|---|
| 1,497,579 | Jun. 10, 1924 | A. Muehlmatt | Sensitive drill | drill presses |
| 2,297,078 | Sep. 29, 1942 | F.W. Schlichter | Drill press | drill presses |
| 2,632,510 | Mar. 24, 1953 | H.A. Doppleb | Cutoff cylinder | paper cutting |

| | | | | |
|---|---|---|---|---|
| | | | | machines |
| 2,643,827 | Jun. 30, 1953 | W.H. Franzmann | Winding apparatus | printing |
| 2,659,306 | Nov. 17, 1953 | W.W. De Lano | Means for varying the circumference of printing cylinders | printing |
| 2,664,821 | Jan. 05, 1954 | H.W. Huffman | Method of and means for varying the circumference of printing cylinders | printing |
| 2,729,982 | Jan. 10, 1956 | H.W. Huffman | Governor-drum drive for printing presses | printing |
| 2,736,380 | Feb. 28, 1956 | R.A. Dillenburger | Rotary cut-off assembly with a pull-out roll | printing |
| 2,761,631 | Sep. 04, 1956 | W.H. Franzemann | Roll supporting member for manifold machine | printing |
| 2,766,984 | Oct. 16, 1956 | W.H. Franzemann | Method of making manifold forms | printing |
| 2,829,886 | Apr. 08, 1958 | W.H. Franzemann | Selective gathering and collating machine | printing |
| 2,829,887 | Apr. 08, 1958 | W.H. Franzemann | Machine for making manifold forms | printing |
| 2,859,035 | Nov. 04, 1958 | W.H. Franzemann | Machine for making manifold forms | printing |
| 2,863,387 | Dec. 09, 1958 | H.W. Huffman | Means for varying the phase relationship of the cylinders of a printing press | printing |
| 2,961,899 | Nov. 29, 1960 | J.E. Grove,<br>W.W. De Lano | Drilling machine | **drill presses** |
| 2,990,171 | Jun. 27, 1961 | J.E. Grove,<br>J.E. Chamberlain | Mobile, separable work holder | printing |

| | | | | |
|---|---|---|---|---|
| 3,067,893 | Dec. 11, 1962 | J.E. Grove | Portable, elevatable work handling and locating table | material handling |
| 3,084,449 | Apr. 09, 1963 | H.W. Huffman | Method and apparatus for producing air-cooled carbon-coated paper | printing |
| 3,096,949 | Jul. 09, 1963 | H.W. Huffman | Air expandable core shaft | printing |
| 3,105,982 | Oct. 08, 1963 | K.J. Yost (Oxford Oh.), W.W. De Lano (Fairfield Oh.) | Tapping machine having tapping head and drive means adjustably mounted on a support post | tapping machines |
| 3,124,349 | Mar. 10, 1964 | H.W. Huffman | Cammed tucker-blade folder | |
| 3,124,350 | Mar. 10, 1964 | H.W. Huffman | Screw folder for continuous forms | printing |
| 3,219,202 | Nov. 23, 1965 | H.W. Huffman | Screw pile and batch delivery | printing |
| 3,228,273 | Jan. 11, 1966 | H.W. Huffman | Sheet delivery mechanism | printing |
| 3,231,261 | Jan. 25, 1966 | H.W. Huffman | Method of and means for fabricating booklets from continuous webs | printing |
| 3,237,556 | Mar. 01, 1966 | H.W. Huffman | Printing press mechanism | printing |
| 3,241,411 | Mar. 22, 1966 | H.W. Huffman | Method of and means for dampening transmission of shock and vibration impulses along continuously moving web | printing |
| 3,268,136 | Aug. 23, 1966 | H.W. Huffman | Data card and method of making same | printing |
| 3,280,679 | Oct. 25, 1966 | H.W. Huffman | Screw pile and batch delivery | printing |
| 3,298,353 | Jan. 17, 1967 | H.W. Huffman | Multiple orifice glue applicator | printing |
| 3,298,684 | Jan. 17, 1967 | C.P. Crampton | Sheet end stabilizer and method of use | printing |

| | | | | |
|---|---|---|---|---|
| 3,304,102 | Feb. 14, 1967 | H.W. Huffman | Data card | printing |
| 3,373,666 | Mar. 19, 1968 | C.P. Crompton | Batch delivery mechanism | printing |
| 3,391,863 | Jul. 09, 1968 | H.W. Huffman, R.W. Morner | Data card punching device | printing |
| 3,476,631 | Nov. 04, 1969 | H.W. Huffman | Method of and means for distributing glue to a moving web | printing |
| 3,555,767 | Jan. 19, 1971 | H.W. Huffman | Boxing method and apparatus | printing |
| 3,651,724 | Mar. 28, 1972 | H.W. Huffman | Method and apparatus for producing card sets | printing |
| 3,761,300 | Sep. 25, 1973 | J.A. Wilmer, H.W. Huffman | Method of disintegrating a glue string attached to a glue head by means of a heated wire of the like and after said bead is applied to a web | printing |
| 3,841,216 | Oct. 15, 1974 | H.W. Huffman, H.W. Huffman | Method of and apparatus for correcting deviations in length and registration in a continuous strip of material | printing |
| 3,977,621 | Aug. 31, 1976 | H.W. Huffman | Differential driven rewinder-unwinder | printing |
| 4,270,743 | Jun. 02, 1981 | C.P. Crompton | Forward numbering or underlap sheet delivery | printing |
| 4,848,202 | Jul. 18, 1989 | C.P. Crampton | Cut off or cross perforator or scoring cylinder with quick blade release | printing |
| 4,934,838 | Jun. 19, 1990 | R.W. Morner | Frame member for supporting multiple bearings with heat barrier slot | |
| 4,991,503 | Feb. 12, 1991 | R.W. Morner | High pressure intaglio cantilever press | |

## Publications of Hamilton Tool Company

The Hamilton Tool Company, like many business of their day, produced and published their own Manuals and other various publications regarding the products they either made or sold. Some produced instruction or technical reference information as well. The following summarizes the known materials published by the Hamilton Tool Company that I have been able to verify to date.

- **Book / Manuals**

| | |
|---|---|
| Trade Catalogs on Portable Elevating Tables, Portelvator, Drills | 193? |
| Hamilton Super Sensitive - Small Hole Precision Tapping Machine | 1955 |
| Hamilton No 1 Gear Hobber | 1965 |
| Hamilton Precision Super Sensitive Drilling and Tapping Machines | 1962 |

- **Advertisement / Pamphlet**

| | |
|---|---|
| The Hamilton Varimatic Pamphlet (V-53) | 1953? |
| Varimatic Parts List (VPL 23) | 1960 |
| Tapping Machine Parts List (VPL 55) | ???? |
| Bulletin T-54 - Tapping Machine | ???? |
| Bulletin A-M-54 – AM Drilling Machine | ???? |

Note: A-M Drilling Machine was the product abbreviation of the drill presses and tapping machines produced under Hamilton's marketing segment known as "A Muehlmatt Division of the Hamiltion Tool Company".

# Adolph Muehlmatt and the Hamilton Tool Company

“The Hamilton Tool Company was initially formed in the 1891 as the **Hamilton Machine Tool Co.** to make upright drills. In the late 1890's they began to make engine lathes. The firm incorporated as the **Hamilton Tool Co.** in 1903.

During the World War II era this company made precision “sensitive” drill presses. The drill was patented by **Adolph Muehlmatt** in 1924 (patented applied for in 1920) and was improved upon in Frederick Schlichter's patent of 1942 (patent applied for in 1940), and further improved by the Grove/DeLano patent of 1960. The drill was first manufactured by Mr. Muehlmatt himself from about 1920; Muehlmatt had already been in business for about 20 years, making ball vises and engravers' supplies. Following Mr. Muehlmatt's death, in 1937 Hamilton Tool Co. acquired the assets of his business and organized it as the "A. Muehlmatt Division of Hamilton Tool Co.", and continued manufacture of his line of drill presses.

Adolph Muehlmatt arrived in New York after emigrating from Switzerland on 16 June 1881, and eventually settled in Newport, Kentucky. He was granted US citizenship on July 10, 1887 in Newport, Kentucky at the age of 24 which was about six years after coming to the US.  He was born around 27 June 1863 in Soliton, Switzerland and died in 1937.  He was married to Ella (or Ellen) Wright on 24 June 1885 at the St. Paul’s Church of Christ in Newport. They had a daughter Mary born March 15, 1886 and died on July 20, 1969 in Clearwater, Florida.  She was married to one Alfred Voige.

**Muehlmatt Patent Summary**

| Number | Date | Patentee | Title | Type |
|---|---|---|---|---|
| 481,238 | Aug. 23, 1892 | A. Muehlmatt | Engraver's block | |
| 497,809 | May 23, 1893 | A. Muehlmatt | Machine for bending stud-spirals | |
| 911,667 | Feb. 09, 1909 | A. Muehlmatt | Engraver's block | |
| 973,542 | Oct. 25, 1910 | A. Muehlmatt | Boring-head for lathes, milling-machines, and the like | metal lathe accessories |
| 985,536 | Feb. 28, 1911 | A. Muehlmatt | Mechanical opening and closing spring-chuck | metal lathe accessories |
| D42,397 | Apr. 09, 1912 | A. Muehlmatt | Design for an engraver’s block | |
| 1,057,762 | Apr. 01, 1913 | A. Muehlmatt | Holder for engraving-blocks | |
| 1,064,759 | Jun. 17, 1913 | A. Muehlmatt | Self-filling fountain-pen | |
| 1,497,579 | Jun. 10, 1924 | A. Muehlmatt | Sensitive Precision bench drill | drill presses |

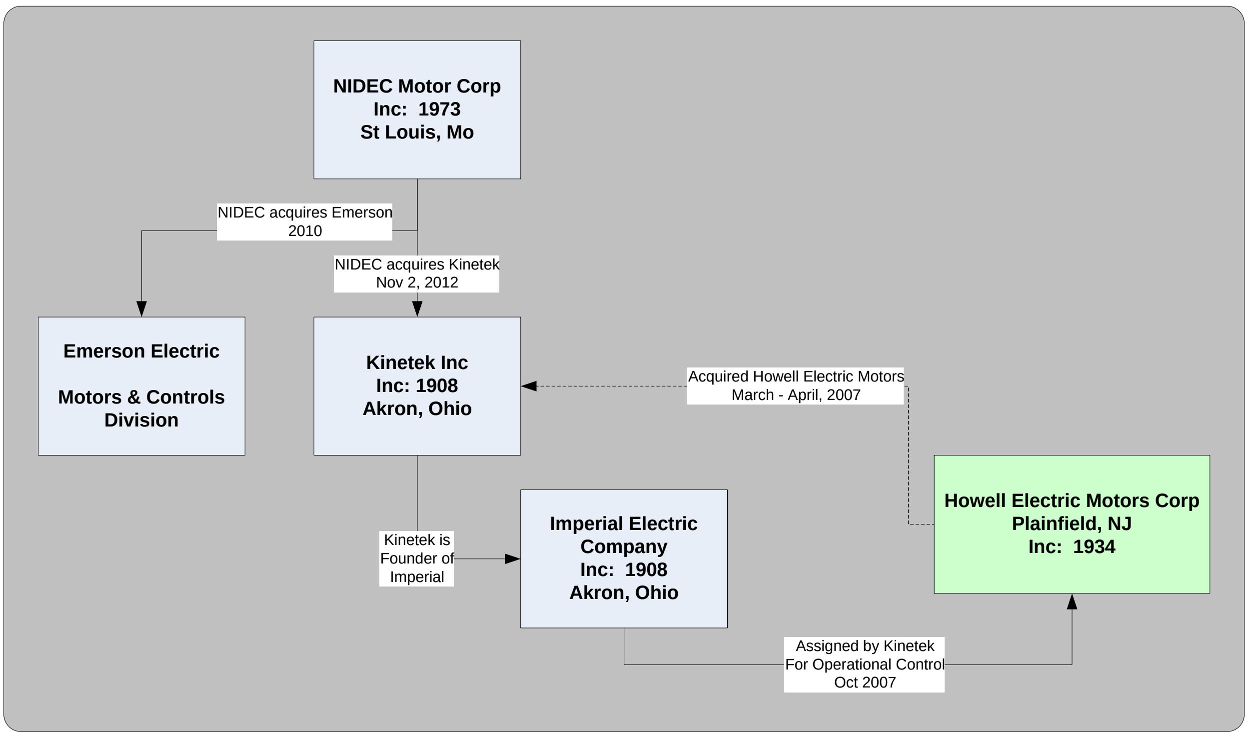
In accordance with one of Muehlmatt patent submittals, he resided at 807 Maple Avenue, Newport, Kentucky, in 1909, but maintained a post office mailing address of Fifth and Elm Streets, Cincinnati, Ohio. Hamilton, Ohio is located almost due west from and not far from Cincinnati.

# Howell Electric Motors Company

The Hamilton Varimatic Electric Drive Motor

The drive motor on my drill press is a 1/3 hp, 1725 rpm CW rotating AC motor manufactured by the Howell Electric Motors Company, Kingston-Conley Division, of Plainfield, New Jersey.

The Howell Electric Motors Company was purchased by Imperial Electric [A Kinetek Company].




**Research results regarding "Howell Electric Motors"**

Howell Electric Motors Inc.
900 North Avenue , Plainfield , NJ , 07061 , United States
Phone: +1 908 756 8800
Industry: Motors & Generators
SIC: Motors & Generators (3621)
NAICS: Motor and Generator Manufacturing (335312)
Description: As of March 31, 2007, Howell Electric Motors Inc. was acquired by Imperial Electric Company. Howell Electric Motors Inc. produces AC motors and gear motors for the commercial floor care and restaurant kitchen equipment industries. The company offers custom designed commercial convection fan motors, pump motors, and specialty motors primarily for original equipment manufacturers. Its products are used for food machinery, air handling, commercial cleaning equipment, industrial machinery, and custom applications. The company was founded in 1934 and is based in Plainfield, New Jersey.

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**Press release date: April 30, 2007**

Deerfield, IL, April 30, 2007 Kinetek, a global leader in the design and manufacture of motors and controls for a variety of industrial and commercial applications, has announced the acquisition of Howell Electric Motors, a leading producer of AC motors and gear motors for the commercial floor care and restaurant kitchen equipment industries.

In announcing the acquisition, Kinetek CEO, Randy Bays, noted that the highly regarded Howell product line will improve Kinetek's already market leading positions in commercial floor care and restaurant kitchen equipment. "Over the past two decades Kinetek has built a $400 million global manufacturing enterprise by acquiring and growing quality brands like Imperial Electric, Euclid Universal, and Scott DC Power Products. The addition of Howell Electric will further strengthen our company, improve Howell's competitive position, and benefit our customers. I am very excited about the future."

Kinetek formally acquired the assets of Plainfield, New Jersey-based, Howell Electric on March 31 of this year. Founded in 1934, Howell produces custom designed commercial convection fan motors, pump motors and specialty motors primarily for original equipment manufacturers.

Kinetek provides its global customer base with customized solutions for their motor and motion control system needs. Kinetek's comprehensive range of product lines includes AC and DC electric motors (sub-fractional, fractional and integral), electronic controls, motion control products, gearboxes, gears, transaxles and related systems solutions.

Kinetek companies operate 24 facilities in North America, Europe and Asia and hold market leading positions in the elevator/escalator, commercial floor care, material handling, golf and utility vehicle and appliance/vending market segments. Kinetek companies include Imperial Electric Company (Akron, Ohio), Advanced Motors and Drives (Syracuse, New York), Kinetek De Sheng/KDS (Guandong Province, China), Scott DC Power Products (Alamogordo, New Mexico), Euclid Universal (Solon, Ohio), FIR Group (Casalmaggiore, Italy), Kinetek Controls (Perry, Ohio), Merkle-Korff Industries (Des Plaines, Illinois) and Motion Control Engineering (Rancho Cordova, CA). Learn more about Kinetek by visiting www.kinetekinc.com

Contact: Randy Bays 317-471-1094 baysr@imperialelectric.com

**News Release October 10, 2007**
**Howell Electric Motor's Customer Service through Imperial Electric**

Howell Electric Motors, recently acquired by Kinetek Inc., is now being operated by Imperial Electric. All inquiries and order processing information for Howell Electric products should be directed through Imperial Electric at 330 734-3600 or e-mail sales@imperialelectric.com.

Gary Ward, VP of Sales & Marketing for Imperial Electric stated, "The acquisition was a natural fit because the Howell Electric Motors will compliment Imperial Electric's existing product lines and expand its presence in the commercial food machinery market."

"The Howell name stands for reliable performance, superb workmanship and product durability, the same standards as those practiced at Imperial Electric" says Mr. Ward. Howell customers may now call Imperial Electric directly for fast and courteous customer service.

In addition to food machinery, Howell Motors are used for air handling, commercial cleaning equipment, industrial machinery and custom applications.

Imperial Electric, an operating unit of Kinetek, also manufactures a complete line of motors including; AC & DC Gearless Machines, AC & DC Hoists, Flange Mounts, Gear Motors, Transaxles, Motor Generator Sets and Hydraulic Submersibles. Typical applications include elevators, floor care machines, material handling equipment, appliances, all-terrain vehicles and golf carts.

## Press Release November 12, 2012

## Nidec Completes Acquisition of Kinetek

Deerfield, IL., November 2, 2012 – Nidec Corporation (NYSE: NJ), a multi-billion dollar global manufacturer of small and medium sized motors, and Kinetek, Inc., a leader in the development of custom engineered control, motor and drive system solutions, jointly announced today that Nidec has completed the acquisition of Kinetek. The companies had previously announced the acquisition agreement on September 20, 2012. Kinetek's leadership in elevator, floor care, commercial food/refrigeration, material handling, aerial lift and golf car market segments will expand and strengthen the commercial segment of St. Louis-based Nidec Motor Corporation, a Nidec Group company.

"Kinetek is truly a leader in the design of innovative, custom-engineered product solutions for world class customers," said Patrick Murphy, president of the Appliance, Commercial and Industrial Motors (ACIM) business of Nidec Corporation. "Their global engineering talent and manufacturing capabilities will enhance our engineered motor and control solutions capability, and provide access to important markets and growth opportunities. We are very excited to have the Kinetek team join Nidec."

Kinetek will operate as part of Nidec Motor Corporation (NMC), a leading manufacturer of commercial, industrial, and appliance motors and controls. NMC was formed in 2010 when Nidec purchased the motors and controls business of Emerson Electric. It is anticipated that Kinetek operating companies will continue to operate as independent business units as they did prior to the acquisition â€" with limited business practice changes visible to its customer base.

"We are impressed with the vision, commitment and people of Nidec, and are excited to be part of Nidec moving forward," said Randy Bays, Kinetek president and CEO. "This new relationship provides a terrific opportunity to continue to build on the strengths and values we've developed at Kinetek and our operating companies. We look forward to continued success with Nidec."

**About Kinetek**
Kinetek traces its roots to 1908 with the founding of the Imperial Electric Company in Akron, Ohio and 1911 with the founding of Merkle-Korff Industries in Chicago. Today, Kinetek manufacturing and design centers are located on three continents and employ about 3,000 worldwide. Kinetek product lines include AC, DC, and brushless DC electric motors, pumps, gearing, gearboxes, fans, transaxles, human machine interface products (membrane switch assemblies, graphic overlays), electronic controls/systems and end products. www.kinetekinc.com

**About Nidec**
Founded in 1973, Nidec is a manufacturer and distributor of electric motors and related components and equipment with headquarters in Kyoto, Japan. The company provides discrete and variable speed motors and pumps, electronic motor controls and other electronic components. Nidec comprises over 170 consolidated and affiliated subsidiaries, with over 100 manufacturing and sales locations in 25 countries with more than 107,000 employees. www.nidec.co.jp/english/index.html

**About Nidec Motor Corporation**
Nidec Motor Corporation (NMC) is a leading manufacturer of commercial, industrial, and appliance motors and controls. The NMC product line features a full line of high efficiency motors, large and small, which serve Industrial, residential and commercial markets in applications ranging from water treatment, mining, oil and gas and power generation to pool and spa motors, air conditioning condensers, rooftop cooling towers and commercial refrigeration. It also makes motors, controls and switches for automotive and commercial markets. www.nidec-motor.com/

No records were made available regarding the Howell Electric Motors Company to the author after contacting Imperial Electric.

## Kingston-Conley Electric Company

The Kingston-Conley Electric Co. was founded by Frederick S. Kingston and Brooks L. Conley, in 1934. In 1936 Kingston and Conley established their own manufacturing facility in North Plainfield, New Jersey. In the late 1920s through to the late 1930s the two men (both separately and together) patented various electric motor improvements and switching mechanisms. In 1937 Conley patented an electric motor (CA 369,408) in Canada.

In 1948 the Kingston-Conley company had been acquired by the Hoover Co. of North Canton, OH, and operated as the "Kingston-Conley Division of The Hoover Co." Hoover was then bought by Howell Electric Motor Company in 1958. Although Kingston-Conley Electric Company was fully absorbed as a separate Division of Howell Electric Motor Company by 1963 their motors were marketed under the separate names of Hoover, Atlas, and Howell Electric Company.

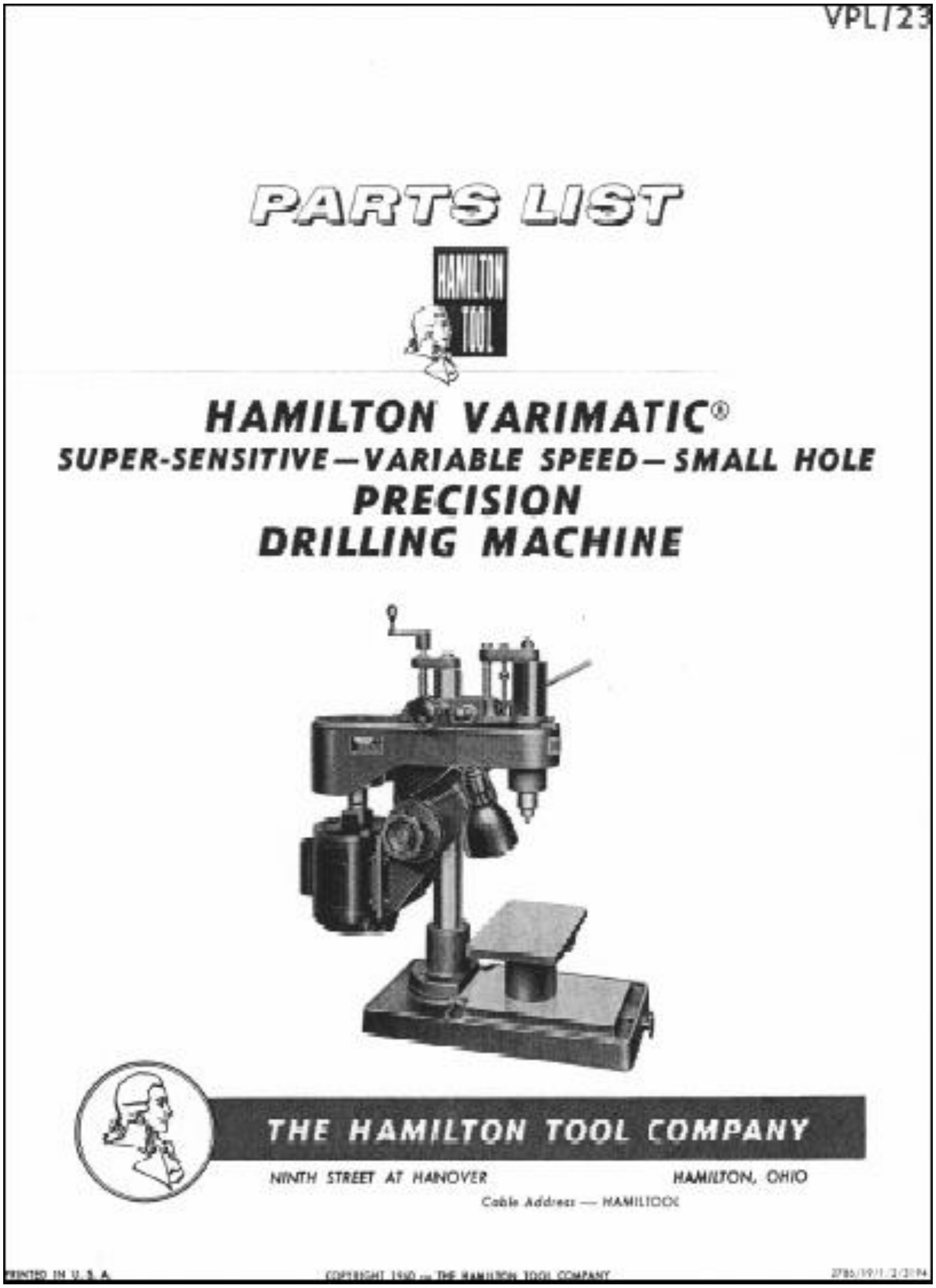
Kingston-Conley motors displaying only a K-C logo and data plate have been seen factory installed on Hamilton (Muehlmatt produced) drill presses.

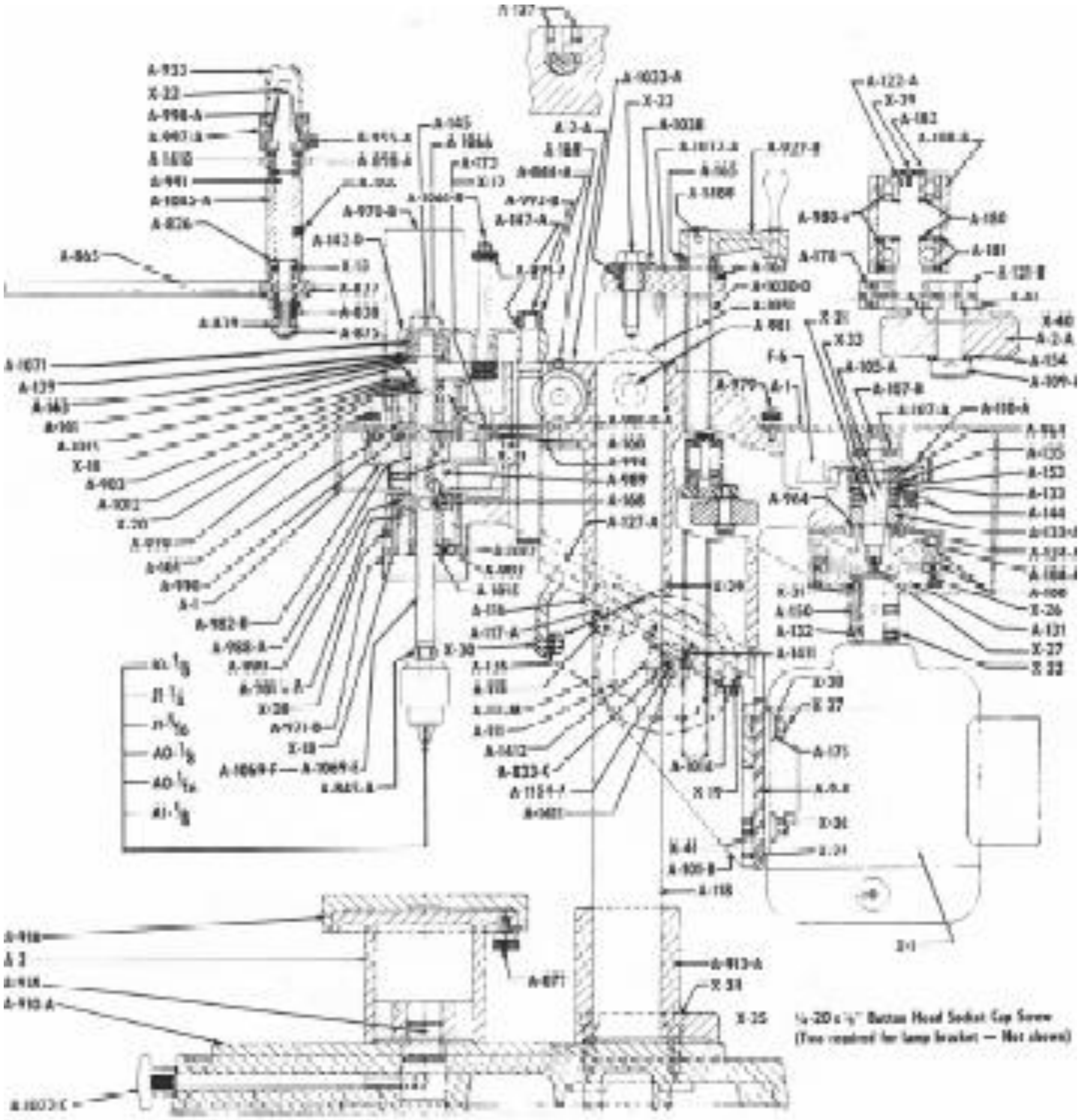
## Emerson Electric Company

Howell Electric motors were not the exclusive factory installed drive motor by The Hamilton Tool Company. Hamilton did install Emerson Electric motors on some of their machines; those motors having the same operating specifications as Howell motors.

# Original Varimatic Parts List

The following copy of an original Parts List was provided by Mr. David Brown, REBB Industries; Yadkinville, NC. Note the marking of “VPL 23”. Other parts lists produced by the Hamilton Tool Company contained different VPL numbers. As an example see page 68 for a picture of another Varimatic Parts List that is numbered 55.






Each machine has a serial number stamped in the front right corner on the top surface of base. Mention of this serial number when ordering parts for your machine will lessen the chances for error and hasten delivery of your order.

Apply light-bodied spindle oil where required at frequent intervals.

# VARIMATIC DRILLING MACHINE

VPL / 23

## PARTS LIST

| PART NO. | PART NAME | PART NO. | PART NAME | PART NO. | PART NAME |
|---|---|---|---|---|---|
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |

## THESE ITEMS AVAILABLE LOCALLY OR DIRECT

| | | | | | |
|---|---|---|---|---|---|
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |

## FOOTNOTES

(1) [illegible]

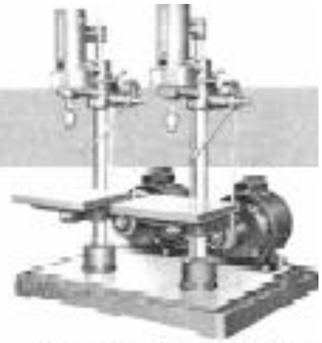
## THE HAMILTON TOOL COMPANY

NINTH STREET AT HANOVER — HAMILTON, OHIO

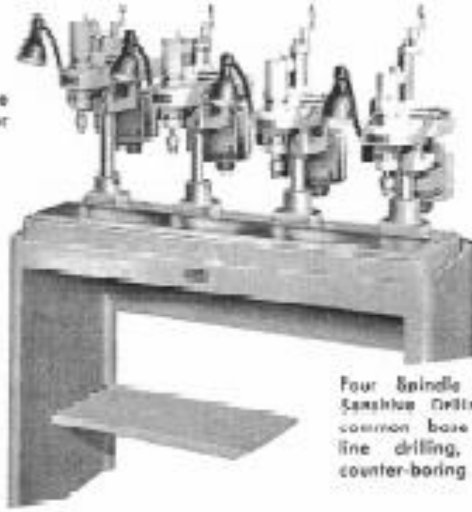
. . . and

## FOR SPECIALIZED DRILLING OF SMALL PRECISION HOLES

Two spindle Maxi-Jr. Super Sensitive Drilling Machine on common base for jig multiple drilling operation.



Two spindle "A-M" Super Sensitive Drilling Machine with common base for production drilling with one spindle, and reaming with the second spindle.



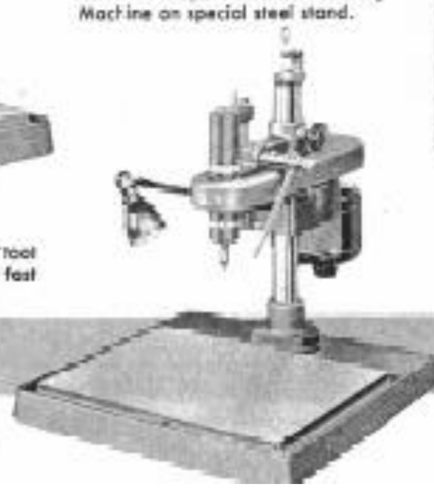
Four Spindle Maxi-Jr. Super Sensitive Drilling Machine on common base for production line drilling, reaming, and counter-boring

**Often, we are asked to supply our high precision drilling machines mounted and equipped for specialized work. We illustrate here a few of the thousands of special arrangements which we have provided.**

**If your operation is of a "special" nature, be sure to investigate the advantages which a special arrangement of spindles, bases, or accessories could bring to your work. We will welcome your communication.**

Hamilton Super Sensitive Drilling Machine on special steel stand.

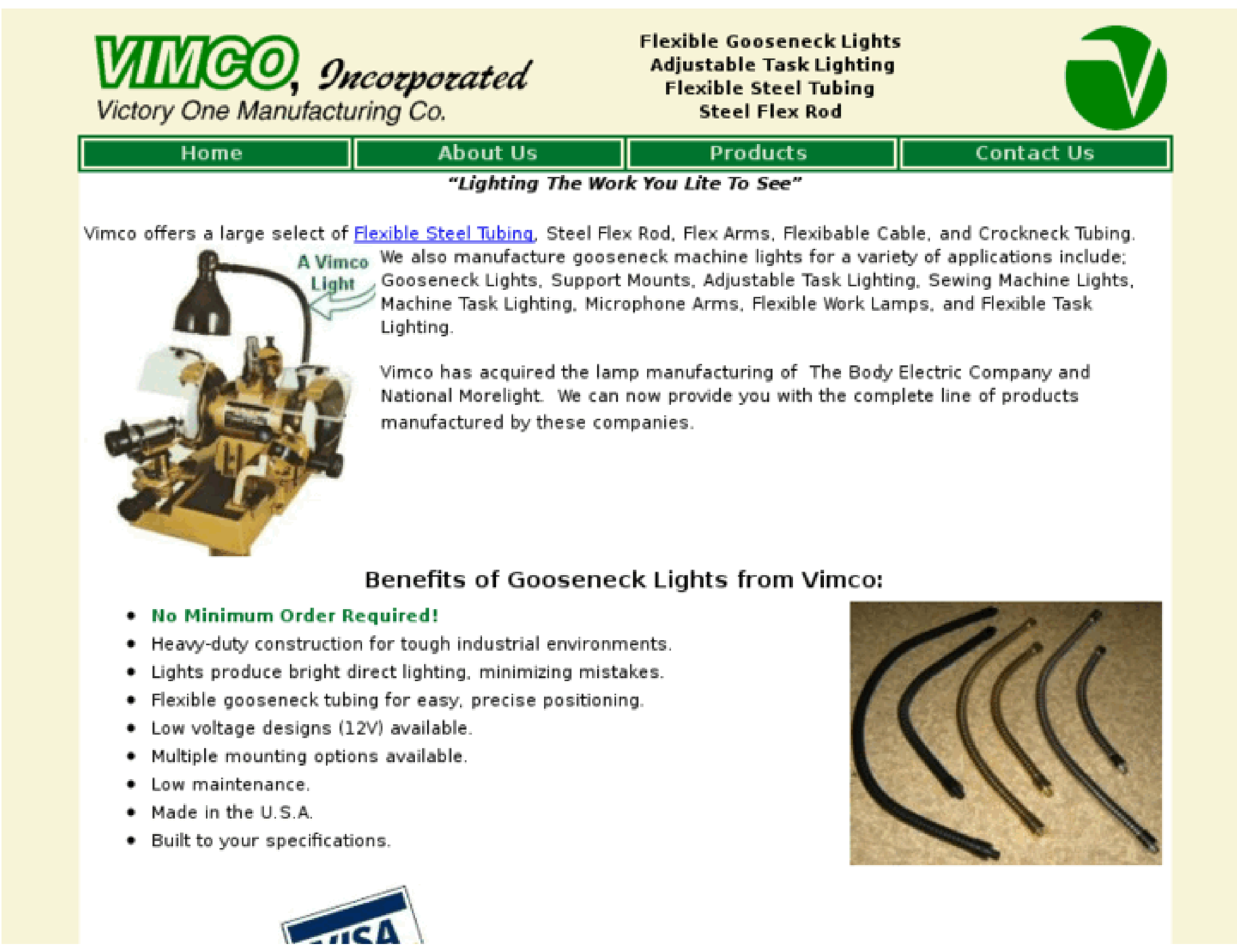
Maxi-Jr. Super Sensitive Drilling Machine on "tool room" base equipped with compound table for fast and accurate production line drilling.



Hamilton Maxi-Jr. Super Sensitive Drilling Machine equipped with "tool-room" base only.

# The VIMCO Manufacturing Company


*The Varimatic Drill Press was fitted with a work light. The work light bracket was marked with the nomenclature shown above. Apparently this light was the standard supplied by the Hamilton Tool Company*




*The above is a picture of a VIMCO advertisement flyer.*

VIMCO stands for Victory One Manufacturing Company. Vimco Manufacturing Company was started in Buffalo, New York in 1919 by the Wood family and continued to produce lamps into the 1970's. Vimco is a subsidiary of Lutron Electronics Company (founded in 1961). [://www.privco.com/private-company/lutron-electronics-company-inc]

Apparently the VIMCO Manufacturing Company, located at 1354 Rt. 78. Java Center, New York no longer exists as a separate distinct business entity as of July 2012. An estate liquidation sale occurred at the place of business on July 16, 2012. All of the company physical assets of Richard J. Fisher, the apparent owner and president, were sold at auction upon his death on August 31, 2011. The company's web site was shut down in 2011.

Vimco manufactured adjustable Gooseneck Task and Machine Lights using Flexible Steel Tubing. VIMCO was also an industrial supplier of Flexible Steel Tubing and the complete line of products from *The Body Electric Company* and *National Morelight*.

# Appendix A:  The Varimatic Cup/Cone Design Concept

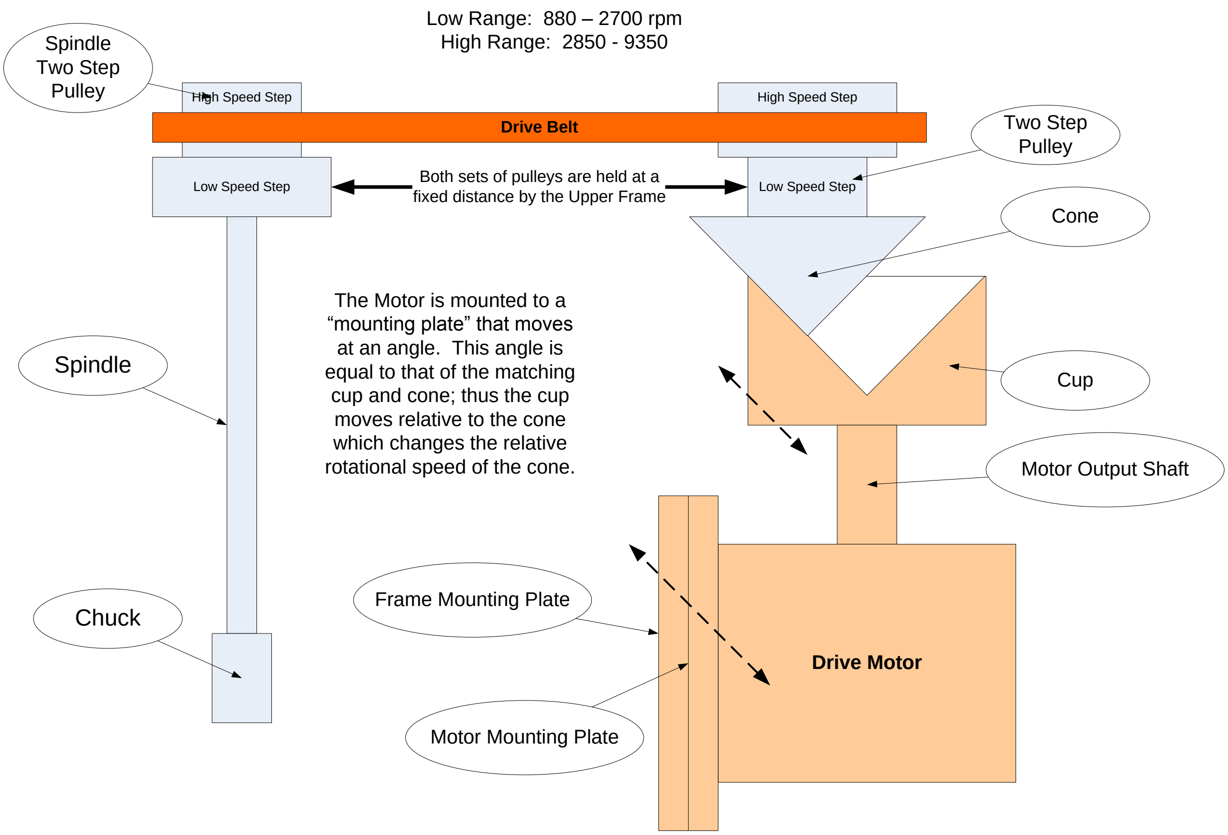
To achieve variable speed control of most medium or light duty electric motor driven machinery today, the prevalent method is to simply utilize variable speed motors. These motors may be Direct Current or Alternating Current. In general, the speed is controlled at the motor output shaft rather than within the machinery mechanical configuration to which the motor is physically connected. Simply, the speed of the driven machinery is determined by the speed of the electrical characteristics of the motor. This is a result of advances in electric motor technology over the years. However, there was a time when these motors did not exist, they were too expensive, or they were not reliable enough for continuous industrial use.

The Hamilton Tool Company Varimatic Drill Press achieved a variable speed spindle in a drill press application through mechanical means powered with a fixed rpm output of a non-reversing AC low horsepower electric motor. The drill mechanicals allowed for the spindle to operate at two speeds through a common step pulley system prevalent in those days. What the Varimatic provided that was unique at the time was an ability for the drill operator to vary the spindle rpm within a given pulley ratio. The spindle rpm could be varied above the fixed rpm provided by the motor pulley thus permitting very high speeds at the spindle. Not only could the spindle rpm be increased, but it could be positively and selectively controlled by the operator through a range of speeds limited only by the pulley ratios. By installing a set of two-step pulleys, Hamilton provided two speed ranges for the Varimatic.

Most all drill presses of the day were driven by a pulley fixed to the output shaft of a fixed speed (rpm) motor (the Drive Pulley). The drive pulley was generally connected by a belt to another pulley fixed to the spindle (the Driven Pulley). If the pulleys were the same size (same circumference, or pulley ratio of 1:1) one rpm of the drive pulley would result in one rpm of the driven pulley. Therefore, if the motor output rpm was 100 rpm, then the drive pulley would rotate at 100 rpm, resulting in 100 rpm at the driven pulley. In those days, to achieve a higher rpm at the spindle, different size pulleys were installed whereby the drive pulley was always smaller than the driven pulley. As an example, to double the speed of the spindle compared to the motor output shaft, the driven pulley need only to be twice the circumference of the driven pulley. Basically this situation requires a pulley ratio of 2:1. To change the speed of the spindle to triple the speed of the motor shaft rpm, a pulley ratio of 3:1 is required. Without getting into motor torque, horsepower, and current draws the size of the pulleys one can use are limited because of the weight of the pulleys being used. In addition the pulley size could not be varied to any significant extent therefore the speed ratio becomes fixed, or discreet. To get around this problem a range of fixed speeds was provided by simply stacking different size pulleys (both drive and driven) to obtain a set of discreet speeds and repositioning the belt between the drive pulley and driven pulley. When the pulleys were cut from the same block of material instead of stacking them, the pulley was called a step pulley; the number of steps being noted in the name of the pulley. As an example, a step pulley having three different circumferences was called a three-step pulley (the circumferences being separately specified). Most good drill presses today have generally a 4-step pulley that provides four speeds at the spindle ranging from 400 rpm to 4,000 rpm. In all cases the machine has to be stopped and the pulley needs to be reposition to change spindle speeds.

As shown in the following figure, the Varimatic solved these problems by installing a cone and cup “transmission” in between the motor output shaft and the drive pulley (i.e., the drive pulley is not directly attached to the output shaft). The cup acts as a drive pulley and the cone acts as a driven pulley with the ability to geometrically change diameters as the cup moves vertically up into the cone. This also has the effect of being able to change the position of the cone relative to the cup by the operator while the machine may be in operation. It also has the effect of providing a separate pulley system in front of the normal pulley assembly. That being the case, very low and very high speeds can be achieved at the spindle. In addition; being a non-geared transmission, very high speeds can be achieved with very little noise or vibration, a major achievement for precise drilling and boring especially for very small holes.

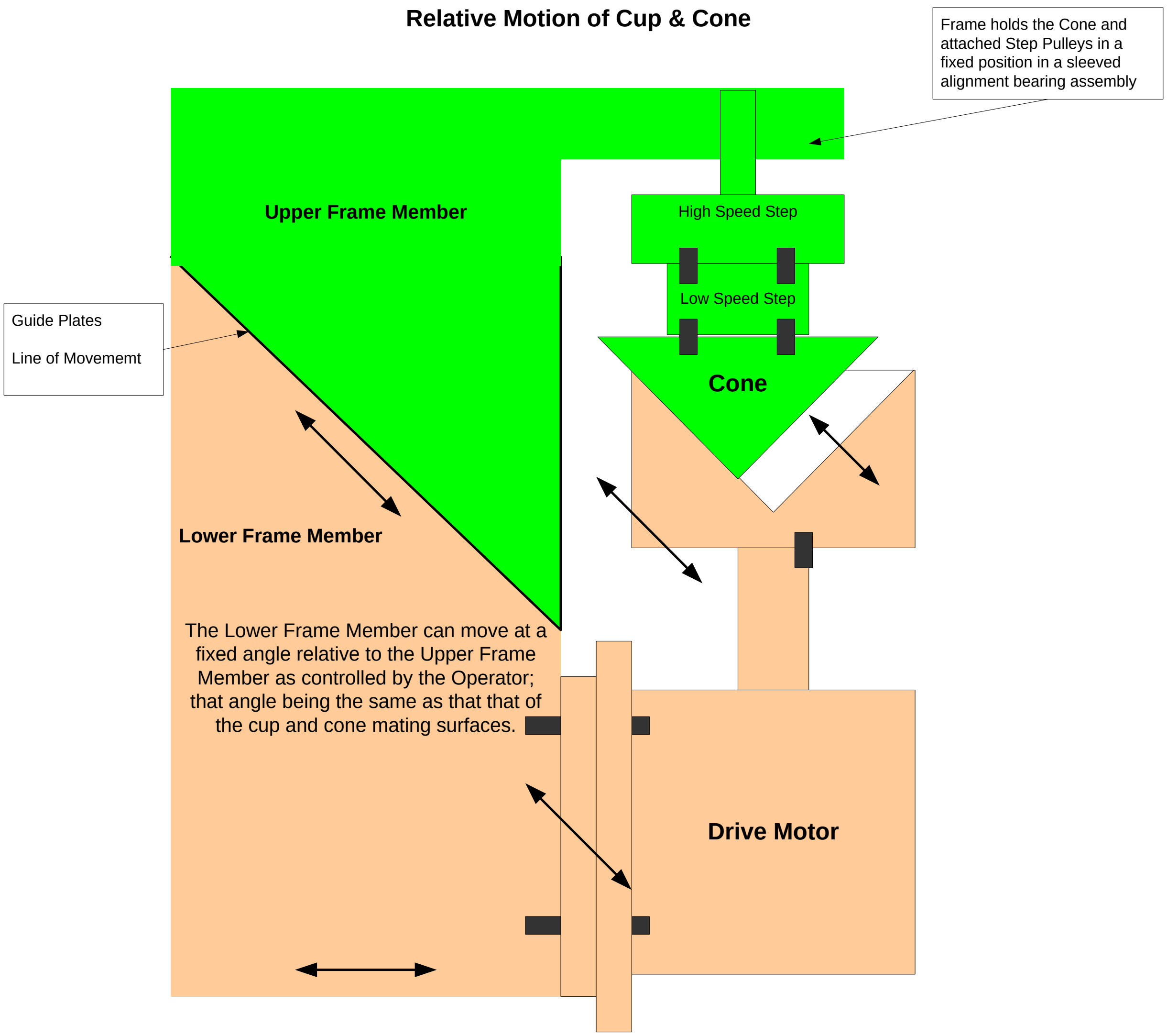
**The Varimatic Cup/Cone Concept**




As seen in the above graphic, the Varimatic provides for two separate speed ranges depending on which set of step pulleys are chosen on which to position the drive belt. As with any belt driven pulley system the step-up speed or a speed reduction relative to the motor output shaft rpm is a fixed ratio between the pulleys. What the Varimatic did was to provide an additional in-line variable pulley in front of the drive pulley. The speed of the drive pulley is determined by the position of the cone in the cup (constant full-time contact of the friction surfaces). The rpm of the motor shaft remains constant at 1725 rpm. As the cone slides up and down, the contact surfaces allow the cone to change speed relative to the cup by geometrically changing the diameter of both surfaces relative to each other (i.e., a virtual variable pulley system).

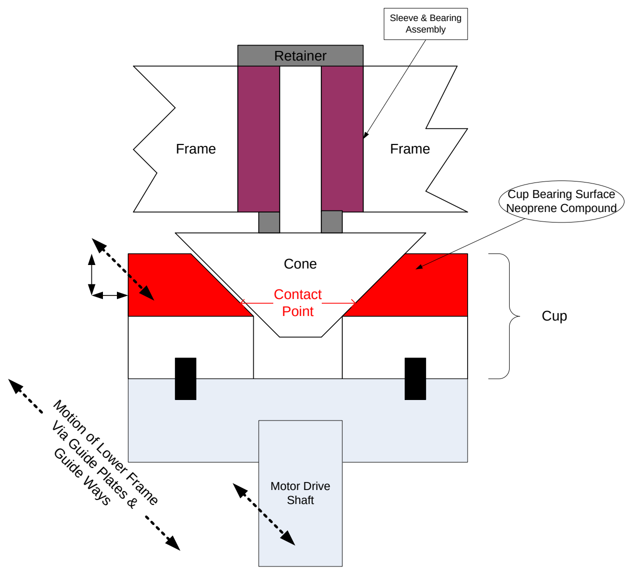
The mechanical configuration of the Varimatic allows the operator to position the cup relative to the cone at any time regardless of whether the motor is engaged or not. What it does not allow is the ability to reverse the rotation or to disengage the cup from the cone. The cone will always rotate in the same direction as the cup which rotates in the same direction as the motor output shaft. A reversing rotation is not permitted.

As also can be seen, the drill chuck on the spindle will assume the speed of the cone which drives a set of fixed ratio pulleys; thus the spindle speed varies with the position of the cone. If the belt is positioned on the upper step of the fixed pulleys the spindle will rotate at a higher speed than if positioned on the lower set. In effect, the fixed pulleys provide a fixed speed ratio that is varied by the position of the cone which then allows a range of speeds; that range being determined by the set of fixed pulleys chosen.

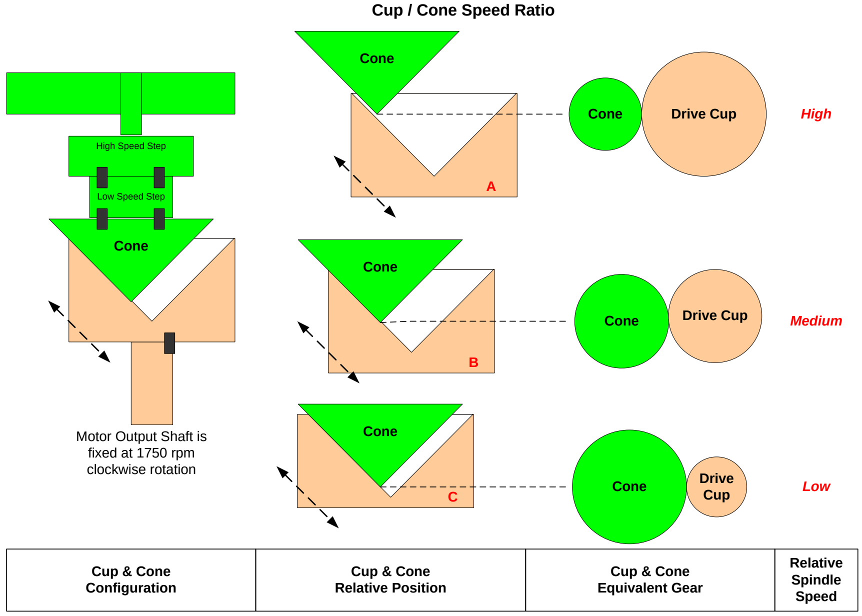



The position of the cup and cone relative to each other is controlled by the movement of the cup, the cone being in a fixed position held in alignment by the upper frame member. The lower frame member moves along a line determined by a set of guide plates attached to the lower frame. These plates ride in a grove, the guide ways, in the upper frame. These groves, or guide ways, are machined at the same angle as that of the cone angle. Therefore once the cup and cone are in contact they remain in contact in so far as the restriction of the movement of the guide plates in the guide ways allows. The lower frame, drive motor and cup are all fixed together as one unit or assembly. The Operator can control the movement of the lower frame relative to the upper frame via a rack and pinion assembly; the rack being on the lower frame and the pinion being on the upper frame. The Operator can rotate the pinion at any time causing the cup to move relative to the cone (thus effectively changing speed ratios between them). As the cup moves lower on the cone the speed of the cone increases (the ratio of the cup circumference increases relative to the cone circumference as shown below). Simply put, the cup has the effect of changing the gear ratio in a gear driven system as the cup moves up and down on the cone. Also note that the cone continuously contacts only one side of the cup.

**Equivalent Gear Ratio Concept**
**Of**
**Cup & Cone**



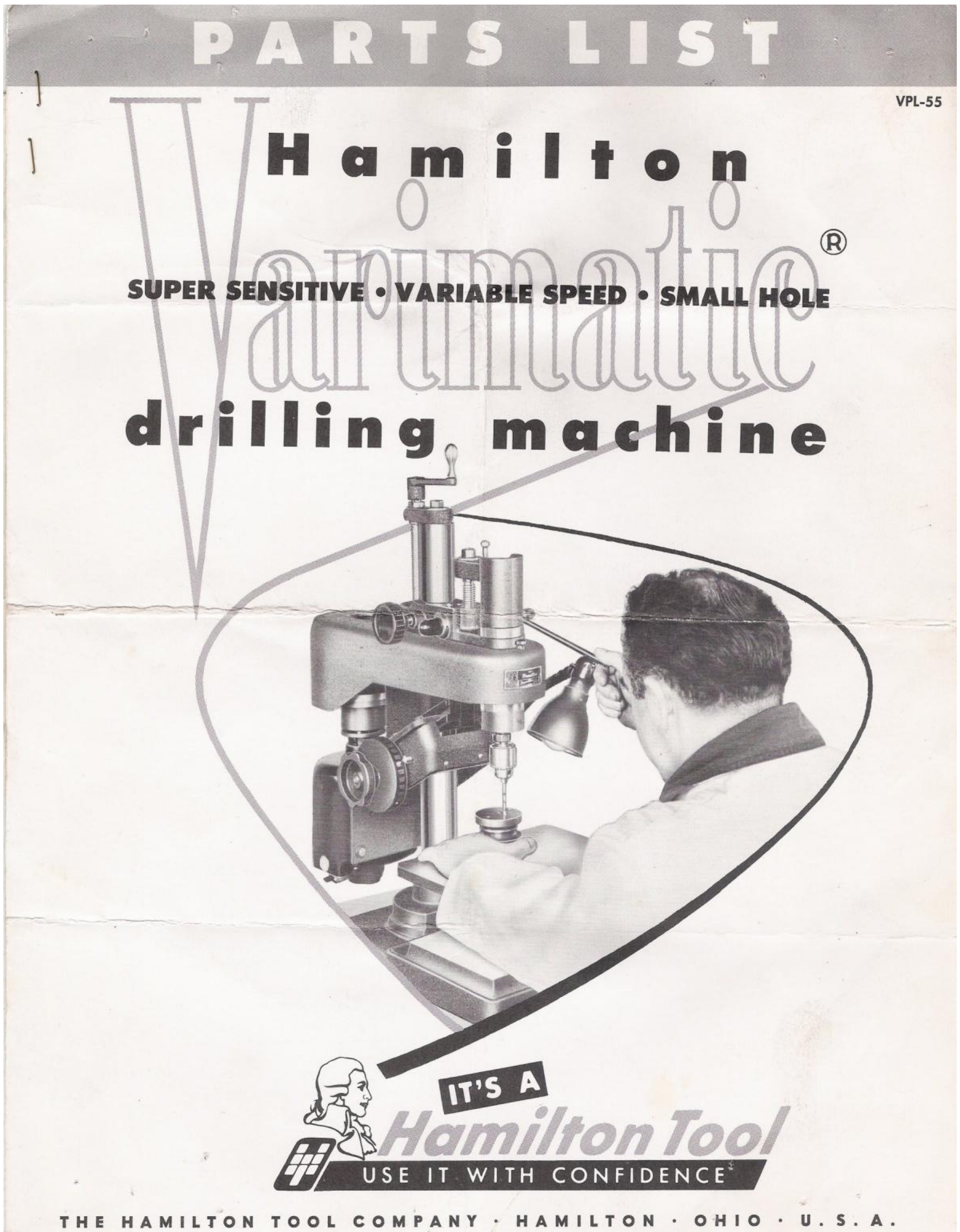

**Cup / Cone Speed Ratio**




Based on the standard fixed step-pulleys installed and the standard cone size provided, the following speeds can be generated at the spindle on the Varimatic:

- Low Range: 880 – 2700 rpm
- High Range: 2850 – 9350 rpm

The machine runs very quiet and exhibits very little vibration throughout both the high and low speed ranges. Note the Cone is truncated on the bottom which is the reason for not providing a speed setting of ~150 rpm between the Low and High Speed Ranges.




*Cover Sheet for a Varimatic Parts List marked VPL-55. Because of this Version Number of the Parts List, it is assumed this particular Parts List was published in 1955.*

# Appendix B: The Hamilton Tool Company Tapping Machine

## General
At the same time the Varimatic was being developed by the Hamilton Tool Company, they were also developing a tapping machine utilizing the same cup & cone design concept.


*The A-M Model was the production model first patented by Adolph Muehlmatt.*
*See Patent 1497579, June 1924*

Thread: A "YouTube" video showing a demonstration of tapping a hole using a Hamilton Tapping Machine.
www.youtube.com/watch?v=9yXLG8xwfF4

The tapping machine appears to have been developed by incorporating the cup & cone design used in the Varimatic, into the original drill press patented by A. Muehlmatt (prior to the Varimatic). The overall design of the drill press is very similar to that of the tapping machine (see above). A comparison of the two patents indicates the primary difference was in the tapping head design. Instead of the Cup/Cone being incorporated between the drive/driven pulleys, it was incorporated into the spindle head. Unique to the tapping machine was the ability of the Cup/Cone mechanism to disengage (stopping spindle rotation under power, neutral position), and to also reverse direction while under power (rotation of the spindle).

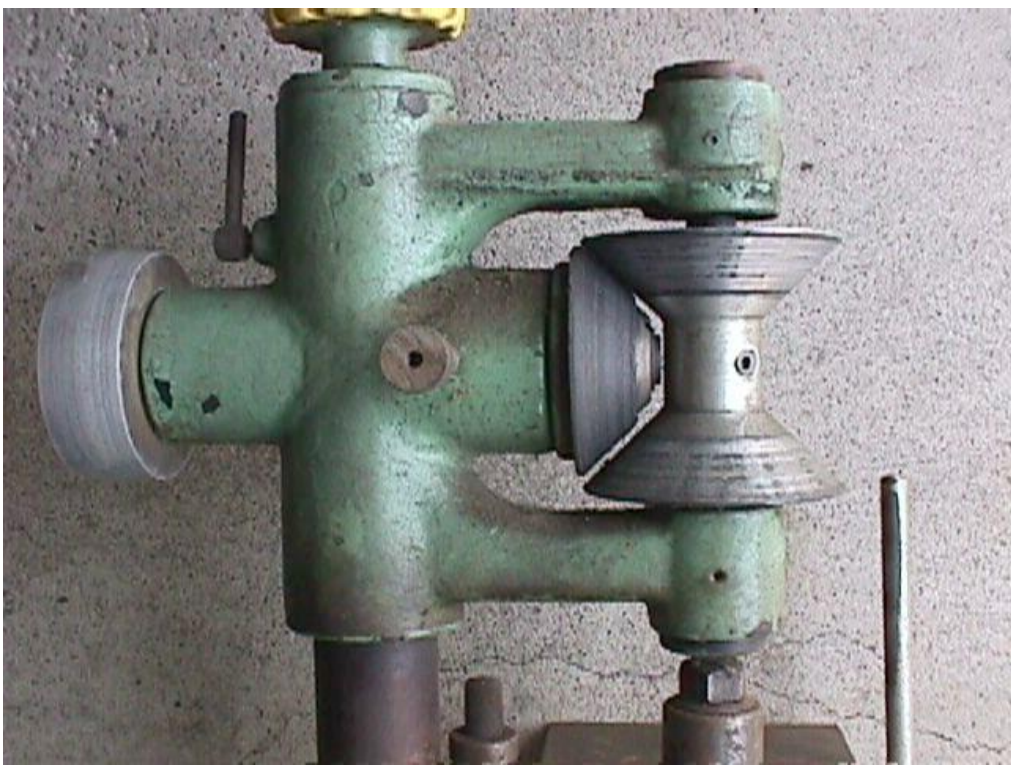
Of interest is the fact that W. W. Delano was involved in both patents (ie, he held the patents for the 1960 improvement to the Varimatic and to the Tapping Machine in concert with another person). It is noted from the patents that the submittal for the improvements to the Varimatic Drilling Machine dated August 1958, while the patent for the Tapping Machine was submitted in July 1958, only 30 days apart. The patents were actually awarded in 1960 and 1963 respectively.


*This is a picture of the front name plate on a Muehlmatt model drill press built prior to 1942. Note the Patent Number is that awarded to A. Muehlmatt in 1924. Also note that Muehlmatt established his own company in 1892 which he later sold which became a division of the Hamilton Tool Company. This machine was the precursor of the Varimatic (1942). Also note the symbol used to identify the "Adolph Muehlmatt Division of the Hamilton Tool Company".*


*This is a picture of the front name plate on a Muehlmatt model Tapping Machine built after 1963.*

*The tapping cutter, or tap, used in a tapping machine, is equivalent to a drill bit in a drill press. The tap cuts threads into the sidewall of a bored/drilled hole whereas the drill bores the hole which is to be tapped.*

The following pictures show a complete Hamilton Tapping Machine (less drive belt between the Motor drive pulley and the Tapping Machine's drive shaft pulley). Below it is a close-up picture of the mounted cone / cup mechanism. In the tapping machine the cup is in the shape of a spool fixed to the spindle. Note that the work table holding the work-piece is outfitted with an elevating mechanism (pinion lever), and a work-piece clamping assembly. The Spindle is held relatively fixed between the frame (head) arms. The spindle is allowed to move independently and vertically within a very limited range due to the force of the work-piece moving into or away from the tap. The movement of the Spindle is provided by a compression spring which also restricts the travel of the Spindle to an upper and lower limit. When the work-piece exerts no force on the tap, the spring also balances the Spindle in such a manner as to bring the cup (spool) into a neutral position whereby the cone disengages from the spool. When the cone engages the top of the spool the spindle rotates in one direction, when engaging the bottom of the spool the spindle rotates in the opposite direction. When the cone is disengaged (does not touch either the upper or lower parts of the spool), the spindle does not turn. In the following picture the cone is engaged with the upper part of the spool.



***Top Photo***: *Complete Hamilton Tapping Machine without drive belt.*
***Bottom Photo***: *Spindle head showing Cone and Spool engaged on top of spool.*
***Size***: *To appreciate the scale of the machine, the hollow pedestal is ~ 1.5" Diameter.*

## The Cup / Spool Design Concept

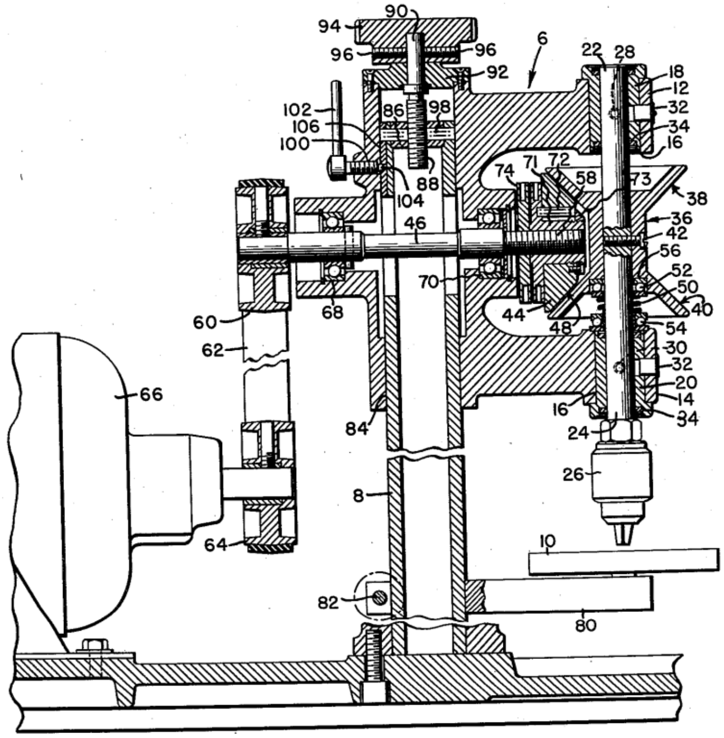



Fig.1

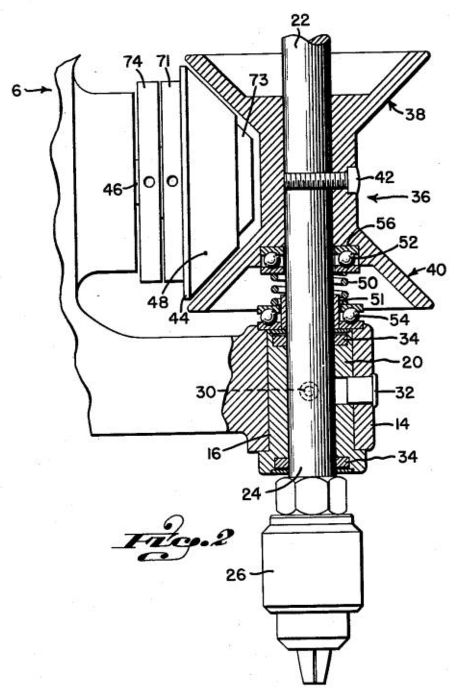
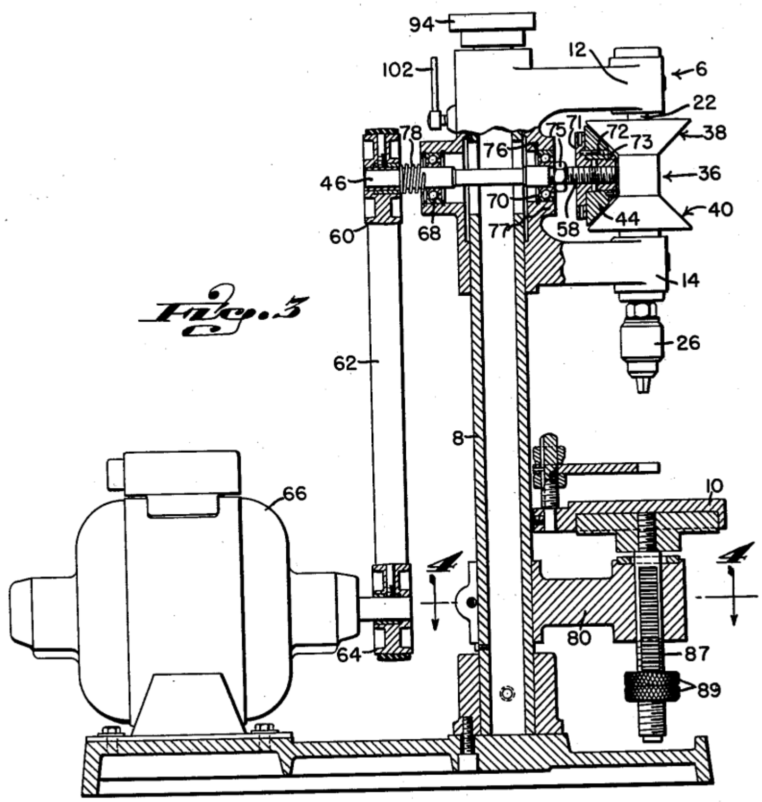



Fig.2



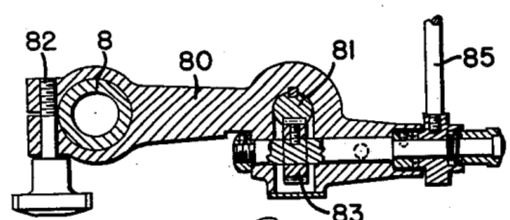




Fig. 4

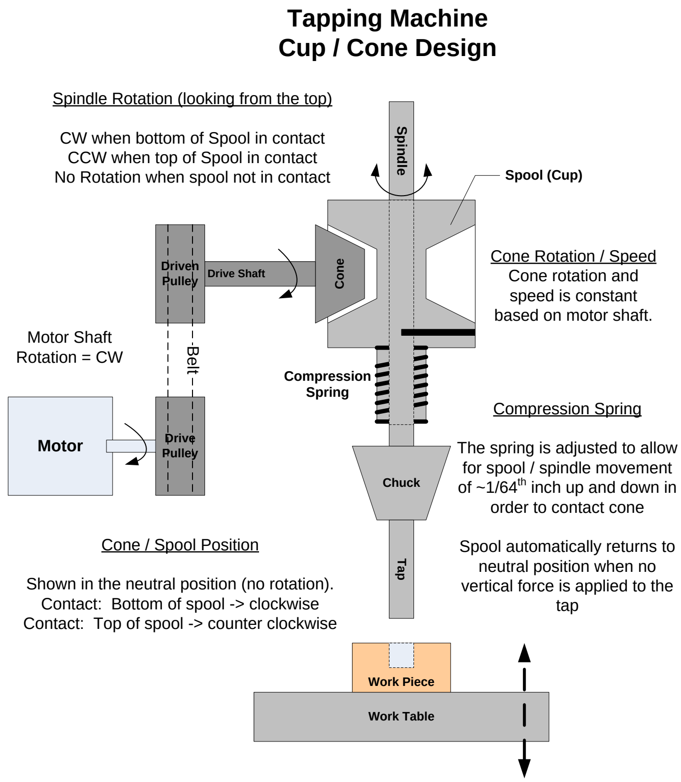
*The above drawings were extracted from the tapping machine patent (US 3,105,982; 1963).*
*The following table represents a parts list extracted from the above drawings.*

| Part # | Name | Remarks |
|---|---|---|
| 6 | Frame (or Head) | total one-piece machined casting |
| 8 | Pedestal (or Post) | |
| 10 | Table | |
| 12 | Upper Frame Arm (or Finger) | |
| 14 | Lower Frame Arm (or Finger) | |
| 18 | Upper Spindle Bearing | for Spindle alignment |
| 20 | Lower Spindle Bearing | for Spindle alignment |
| 22 | Spindle | limited vertical travel ~1/16" |
| 26 | Chuck | |
| 32 | Lubrication Points (Oilers) | one per Finger |
| 34 | Oil Seals | one per Finger |
| 36 | Spindle Spool | |
| 38 | Upper Friction Face | |
| 40 | Lower Friction Face | |
| 42 | Spool Set Screw | fixes Spool to Spindle |
| 44 | Driving Wheel (or Cone) | |
| 46 | Drive Shaft | |
| 50 | Compression Spring | surrounds spindle, purpose is to force spindle to neutral (or home position), and to carry weight of spindle and its attachments such as chuck, etc. |
| 51 | Spacer Sleeve | |
| 52 | Upper Thrust Bearing | |
| 54 | Lower Thrust Bearing | |
| 58 | Drive Shaft Threaded End | |
| 60 | Fixed Pulley (Drive Shaft Pulley) | |
| 62 | Drive Belt | |
| 64 | Motor Drive Pulley | |
| 66 | Electric Motor | |
| 68 | Rear Drive Shaft Bearing | |
| 70 | Front Drive Shaft Bearing | |
| 71 | Threaded Adapter | |
| 72 | Cone Pin | fixes Cone to Adapter |
| 73 | Nut | secures 71 and 44 (cone assembly) against axial separation |
| 74 | Lock Nut | Locks down the Cone assembly |
| 76 | Retaining Ring | |
| 77 | Boss Groove | to accept Retainning Ring |
| 80 | Table Arm Mount | mounts Table to Pedestal |

| | | |
|---|---|---|
| **81** | Table Elevation Rack | |
| **82** | Table Arm Clamp | fixes Table position on Pedestal |
| **83** | Table Elevation Pinion | |
| **84** | Frame Bore (hole) | |
| **85** | Elevation Lever | connected to pinion |
| **86** | Stationary Nut | |
| **87** | Stop Shaft | limits upward table travel |
| **88** | External Threads | |
| **89** | Stop Shaft Stop Nuts | |
| **90** | Stud | |
| **92** | Apature Cap | |
| **94** | Frame Elevation Knob | |
| **96** | Set Screw | |
| **98** | Pin | Secures Nut (#86) |
| **100** | Clamp Screw | Secures Frame to Pedestal |
| **102** | Clamp Screw Handle | Secures Frame to Pedestal |
| **104** | End of Clamp Screw | Secures Frame to Pedestal |
| **106** | Friction Shoe (or Pad) | Secures Frame to Pedestal |

In comparison to the Varimatic Drill Press, the Hamilton Tapping Machine utilized the cup/cone design for totally different purposes. The Varimatic employed the Cup/Cone design for the purpose of varying the speed of the spindle, operating the spindle at unusually high speeds, and limiting vibration and noise; all being accomplished through operator control (even while the drive motor was under power). In this specific configuration the cup was always engaged with the cone and the spindle always rotated in the same direction. In addition, as the point where the cup engaged the cone was changed by the operator, the speed of the spindle could be varied within a given speed range whether the drill was under power or not.

The Tapping Machine however, is operated at a constant spindle speed (relatively low rpm having significant torque). In a tapping operation, the tap moves into a hole, cutting threads as it advances. When the tap reaches the bottom of the hole or at a predetermined distance, the tap is stopped and rotated in the opposite direction to withdraw the tap from the hole, cleaning out the threads as it withdraws. In addition, in a drill press the drill bit advances into a work-piece by moving the spindle in the direction of the work-piece, whereas in a tapping operation the work-piece is advanced into the tap by securing the work-piece to a work table that can be moved both toward and away from the tap. Simply put, in a drill press a lever is used to lower and raise the spindle and the work table is fixed: in a tapping machine the spindle is fixed and a lever is used to raise and lower the table. In both instances the work-piece is always secured to the table. The following graphic illustrates the basic concept noted above.




As shown, the rotation and speed of the cone is fixed based on the motor rpm and direction of rotation of the motor output shaft. The pulley diameters and direction of rotation are also fixed. Assuming the motor output shaft rotates in a clockwise direction looking from the back of the motor, so also does the cone.

Unlike the cup in the Varimatic that is only engaged on one side of the cone continuously; the spool which is fixed to the spindle, acts as a double cup in the tapping machine which permits the cone to engage the spool on either side (the upper and lower parts) of the spool. When the cone engages neither side of the spool, the spool being fixed to spindle, it is disengaged and no rotational force is applied to the spindle through the spool.

The spool is only allowed to independently move a very short vertical distance through the application of a compression spring. The force used to compress the spring is the force applied to the tap by the work-piece. When the work-piece is raised into the tap the force is directed upward; when the work-piece is withdrawn the force is directed downward. In the event no force is applied to the tap, the compression spring is installed in such a manner as to position the spool in a neutral position where cone and spool are disengaged. At neutral (or disengagement) the cup and cone faces do not touch thus no rotational force is applied by the cone to the spool / spindle. In accordance with the patent, the distance between cup and spool mating surfaces will be initially set from 1/64 inch to 1/16 inch.

This arrangement also permits a reversing rotation of the spindle as the cone is engaged on either side of the spool, all forces being eliminated as the spool passes thru the neutral position. Again, assuming the cone rotates clockwise when looking from the motor end of the drive shaft, if the spindle moves upward vertically, the cone will engage the lower part of the spool. When looking from the top of the spindle, the spindle will also rotate in a clockwise direction. Likewise when the spindle moves downward the cone contacts the top of the spool causing the spindle to rotate in the opposite direction (counter clockwise). In actual practice as the operator “feels” the bottom of the hole he/she releases the table elevation lever thus stopping the spindle from rotating and then moves the lever in the opposite direction causing the spindle to rotate in the opposite direction. All right-hand thread taps are designed to cut threads when the tap is rotated clockwise into the work piece hole.

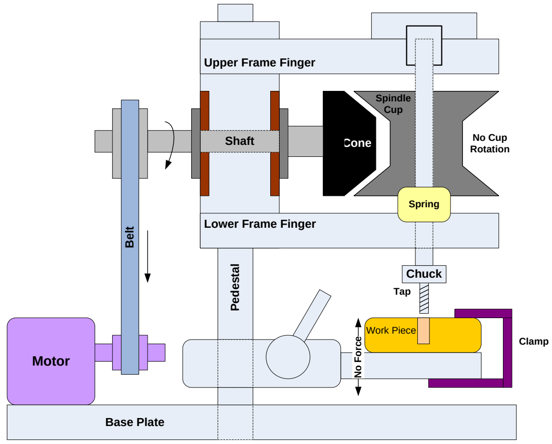



*Figure 1: Neutral*

*Figure 1: When the work piece exerts no pressure (force) on the tap, the cone is not engaged with the spool at any point. When this condition exists the spool is said to be in the "home" or Neutral position and the spindle does not rotate.*

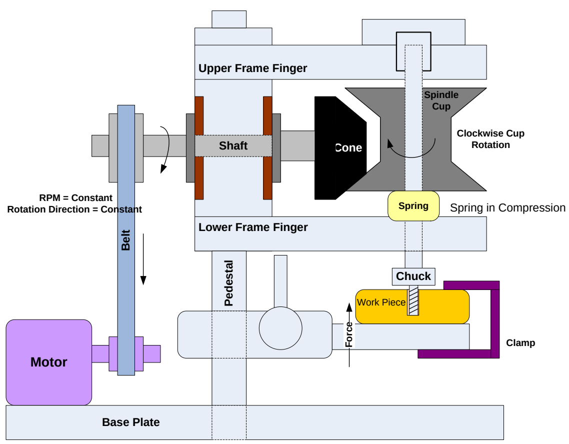



*Figure 2: Tap Engagement*

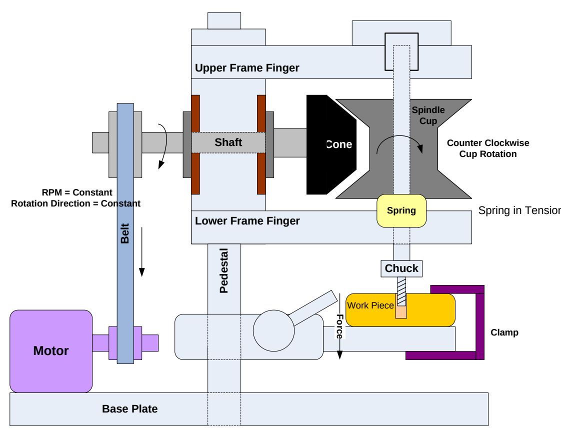



*Figure 3: Tap Disengagement*

*Figure 2: As the table is elevated the work piece engages the tap with an upward force causing the tape to cut into the hole in the work piece (thus cutting the threads). As upward force is applied the tap pushes the spindle upward, overcoming the compression spring, causing the spool to engage the cone on the bottom of the spool. This causes the spool to rotate in a clockwise direction.*

*Figure 3: As the tap reaches the bottom of the hole (or a pre-determined depth), the operator moves the table elevation lever to the home position (stopping tap rotation). Then the operator moves the table elevation lever downward to withdraw the tap from the hole, thus exerting a downward force on the tap/spindle. This causes the spool to engage the cone on the top of the spool which will cause the spool to rotate in the opposite direction (counter-clockwise) until the tap is removed from the work piece. At that point the spool is returned to the neutral position and the tapping operation is completed.*

# Appendix C: The Original Adolph Muehlmatt Precision Bench Drill

### Background

Adolph Muehlmatt patented one of the first generation US manufactured precision bench drills primarily intended for use in the jewelers' trade. They were very precise and sensitive for their day; sensitive in terms of operator feel for the action of the tool or drill bit. They were precise for their day in that they consistently drilled very accurate and very small holes in metal materials. His patent was submitted on April 23, 1920 and the patent itself was awarded on June 10, 1924 (US 1,497,579). Apparently, again according to the patent document, the patent was held only by Muehlmatt until such time as the drills were produced by the Hamilton Tool Company. It is known that Muehlmatt had his own company (est. 1898) for some time prior to it becoming a full but separate Division of the Hamilton Tool Company. It has yet to be determined when and how this merger occurred. There is also no debate however as to his bench drill being the precursor of the Varimatic version patented in 1942 as manufactured and produced by the "Muehlmatt Division of the Hamilton Tool Company".

### Purpose

The purpose of this Appendix is to describe Muehlmatt's Precision Bench Drill in detail, relative to and partially extracted from, the actual patent awarded to Adolph Muehlmatt.

### Current Work Issue(s): pre-1920s

"My invention relates to drills, which are employed upon relatively fine work and known as bench drills. For drilling operations such as are required of the jeweler, for example, I know of no small drill press which is calculated to take care of the work, the usual practice being for the operator to hold the work in his hands, and advance it bodily against the revolving drill, rather than to employ a drilling machine with a movable head."

### Invention's Objective(s)

In general, this invention is developed for the purpose of making a bench drill press an instrument of precision suitable in every detail for the very finest and most delicate of manufacturing work.

- Provide a bench drill press having all of the delicacy of operation required by the bench worker, laboratory worker, jeweler and the like.
- Provide for an operating lever which permits of the operator sensing the movement of the drill into the work.
- Provide a work support element which permits of special uses in bench work and jewelry work.
- Provide against the chances of oil splattering while providing a complete and effective lubricating throughout.
- Provide for a stop for the movement of the drilling head which is of micrometer nature.

### Pictures of an Actual Drill Press Configuration

The following pictures show the manufactured configuration of Muehlmatt's Precision Drill Press. These pictures were extracted from an e-bay auction of a drill press which sold for $124.99 on June 12, 2013. The buyer and seller are unknown. The seller described the drill press as weighing ~60 pounds, with an overall height of 18 inches. The circular work table's diameter was 5.5 inches and the base was 16 x 7 inches. The seller claimed the drill press was in working condition.

*Perspective: from the left of drill press, the motor being to the rear of the machine*.

Note that the idler pulleys are fixed on a common shaft and are the same size. The common shaft is allowed to rotate in a hinged assembly which is adjustable via a set screw against the frame, thus providing belt tension. The motor output shaft contains a set of different size pulleys. The spindle pulleys (hidden by the cover in this picture) are a two step pulley which slide in the vertical on a spindle spline. This arrangement allows for two different speed settings (spindle rpm). The support column (pedestal) is hollow and also fixed to the base plate. The lower frame member is also fixed to the support column. Within the column is a shaft that can be moved up and down via a ratcheted elevation lever. The top frame is fixed to the shaft. The top frame is also fixed to the spindle through a fixed bearing arrangement. In between is a stop rod the operator utilizes to restrict the up and down limits of the spindle movement.

A bracket (split collar type) secures the various types of work tables to the support column. The patent addresses various types of work table mechanisms to provide for precise work piece positioning.


*This picture shows the name plate brass riveted to the front cover. The plate is brass with raised polished brass lettering on a black painted background.*

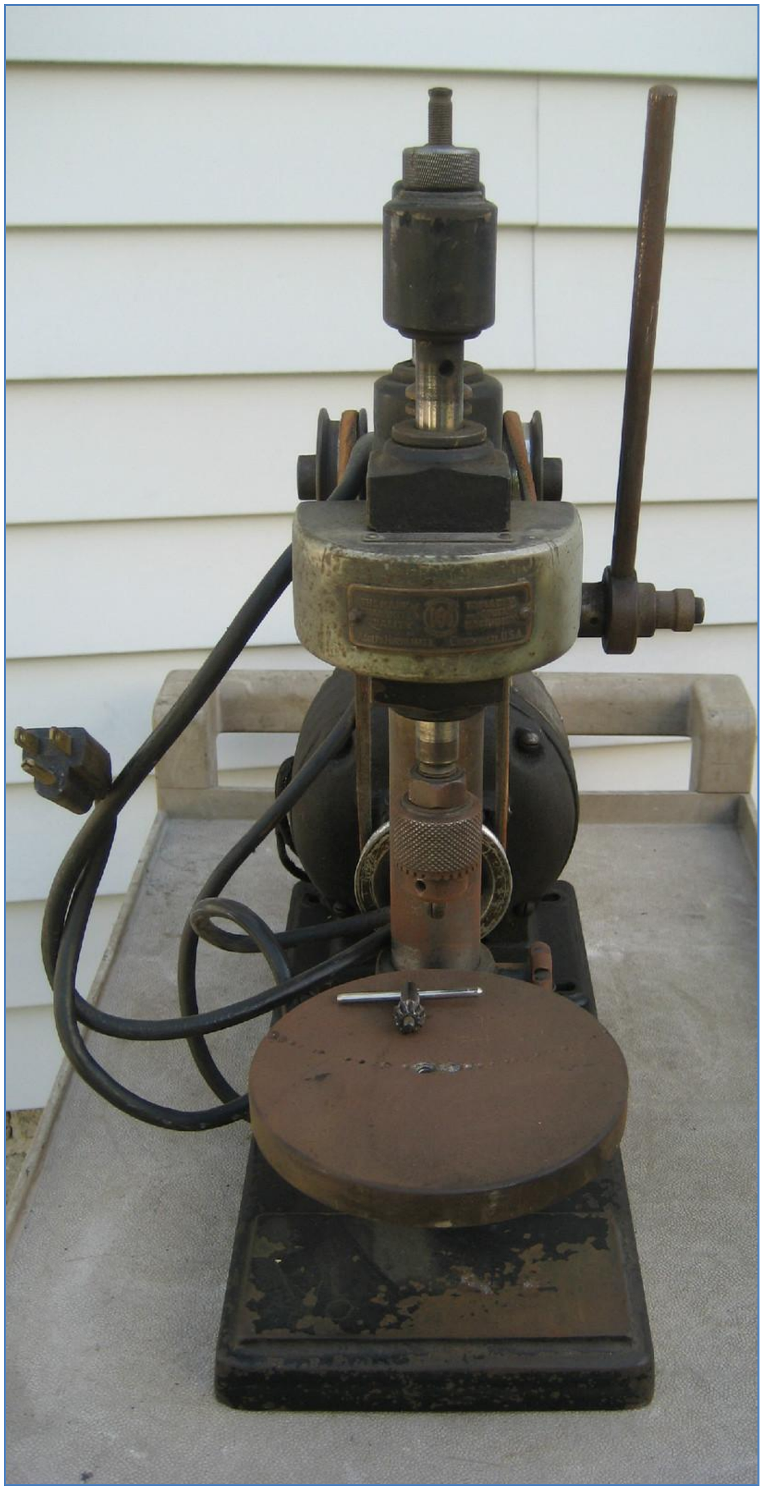
*Left side of plate*: "The Mark of Guaranteed Quality"

*Right side of plate:* "Tools, Dies & Specialty Machinery".

*Bottom of plate*: "Adolph Muehlmatt Cincinnati, U.S.A."
This may explain the fact that Muehlmatt's company was probably located in Cincinnati although he listed his residence in Newport, Kentucky. This declaration was made in one of his patents.

*Center Medallion / Symbol:* The symbol appears to be the letter "M" superimposed on the letter "A" both being surrounded by a circle. The top of the circle is printed with "Sensitive Drill Press", and "Patented 1924" being printed on the bottom. Obviously this particular machine was produced after 1924 or it would either: (a) have been marked "patent pending", or it would have another separate badge located under the name plate indicating the patent number and date awarded [see picture on page 70 of this paper].

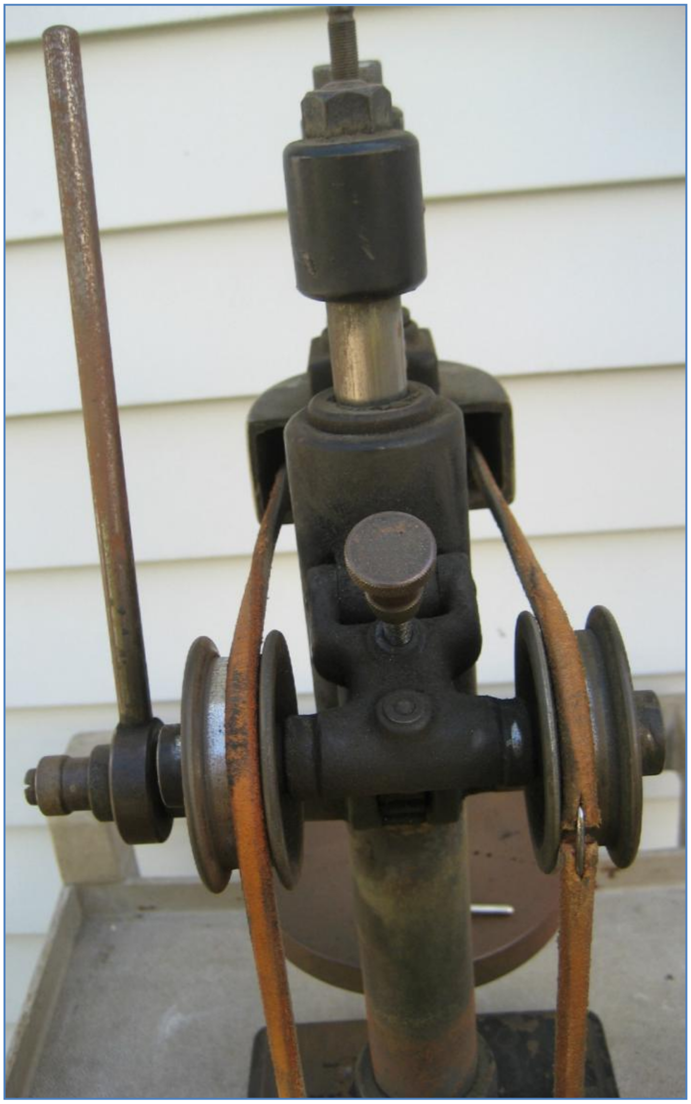
*This symbol is very similar to the stamping on the base plate of the Varimatic Drill Press. This symbol appears just preceding the Serial Number stamped on the base plate of the Varimatic. It is suspected that this symbol, or one similar to it, was used to stamp all machinery produced by Muehlmatt's own company or during the time his company was a division of the Hamilton Tool Company.*



*Perspective: from the front. Note that the circular working plate is about 5.5 inches in diameter and the total height of the machine is approximately 18 inches.*

*Perspective: from the left side. Note the routing of the "round" drive belt from the motor output pulley over the 90 Degree pulleys then on to the spindle pulley (a two-step pulley). The name plate cover hides the spindle pulley and acts as a safety guard. It is unknown as to the chuck size or manufacturer. Note the motor switch is located on the right side of the base plate, the wiring being routed underneath.*

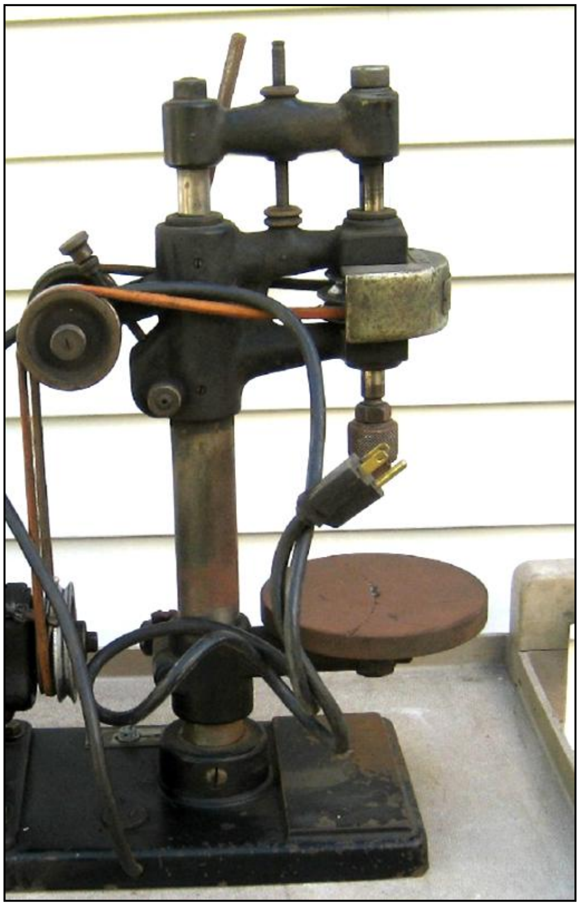
*This particular drill press was powered by an Emerson Electric Manufacturing Company electric motor. Interestingly the specifications noted on the data plate similarly mimic those found on Howell motors found on most Hamilton drilling machines relative to rpm, amp draw, voltage, etc.*

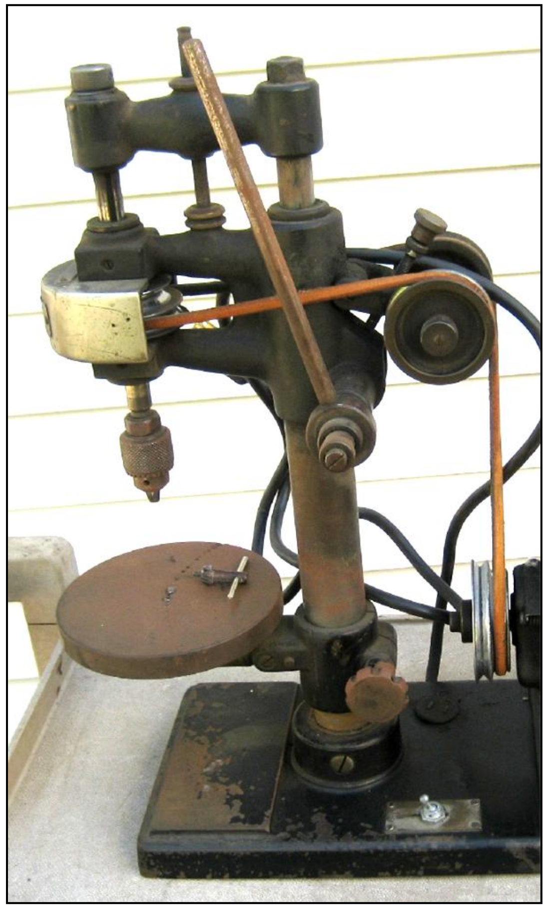



*Perspective: from the rear of the drill press. Note how the drive belt (round leather) is connected end to end with a machine staple. The knob above and between the two idler pulleys provides for adjusting the drive belt tension. The knob is used to move both pulleys which are connected to a hinged assembly toward or away from the frame, thus placing or relieving tension on the belt.*

**Movements**

The Basic movements of the drill press spindle are primarily governed by a shaft that rides vertically inside of the pedestal (or support column) and rotationally by a set of pulleys located in vertical splines that surround the spindle. The pedestal is hollow and fixed to the base plate. Inside of the pedestal is a solid shaft (the rack-bar) that is controlled in a vertical direction by a rack and pinion arrangement located internally to the lower frame member. The rack is machined into the rack-bar and the pinion is held in a fixed position within the lower frame. An elevation lever that is connected to the pinion engages the rack section of the internal shaft to raise or lower the entire rack-bar. The lower frame is also fixed to the top of the pedestal and allows for the rack bar to extend through and move vertically through the top of the lower frame and pedestal. Fixed to the top of the rack-bar is another frame member (the upper frame) that holds a stop screw and a set of bearings that secures the spindle axially but permits spindle rotation. The stop screw mechanically limits the vertical movement of the rack-bar and consequently the upper frame in either direction. Elevating the rack-bar also elevates the spindle in proportion to each other as a result of this arrangement. This configuration, in effect, fixes the spindle vertically to the rack-bar but also allows the spindle to freely rotate in the upper frame member.



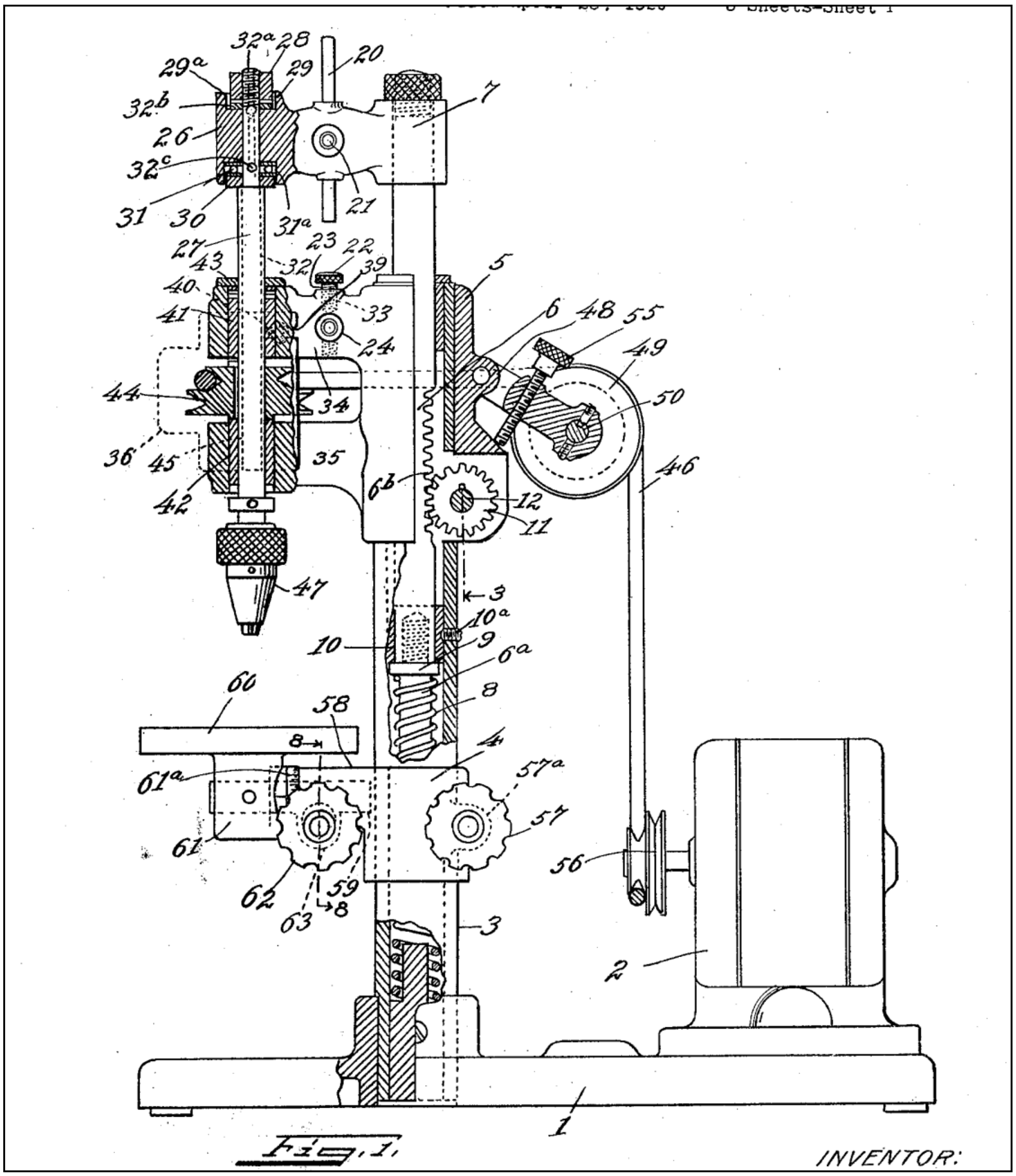


The lower frame member contains two horizontal fingers that project forwards. Each of the fingers contains bearing assemblies that permit the spindle to extend downward from the upper frame through both fingers. The spindle is machined in such a way as to provide a set of matching vertical splines to those machined inside of the spindle pulleys. However, the spindle pulleys are held in place vertically by the fingers which let the spindle move vertically relative to the spindle pulleys. The lower frame also provides a mounting point for a hinged set of idler pulleys that can be adjusted by a set screw to tension the drive belt. The pulley system contains a pair of step pulleys with a set of idlers in between; therefore the drill press can operate at one of two fixed spindle speeds; those two speed ratios currently being unknown.

**Patent Drawings**

The Patent concept drawings consisted of a set of eight figures.

- Figure 1: side elevation.
- Figure 2: plan view of the idler pulley attachment
- Figure 3: section view of the gear and ratchet shaft for operating the head supporting rack.
- Figure 4: perspective view of the guard for the driving pulleys (on the spindle).
- Figure 5: detail perspective of the working parts for the drill shaft.
- Figure 6: detail view of work holding chuck.
- Figure 7: a like view of another form of special work holding device, Figures 6 and 7 being substituted for the plain work supporting table in Figure 1.
- Figure 8: a sectional view of line 8-8 of Figure 1.



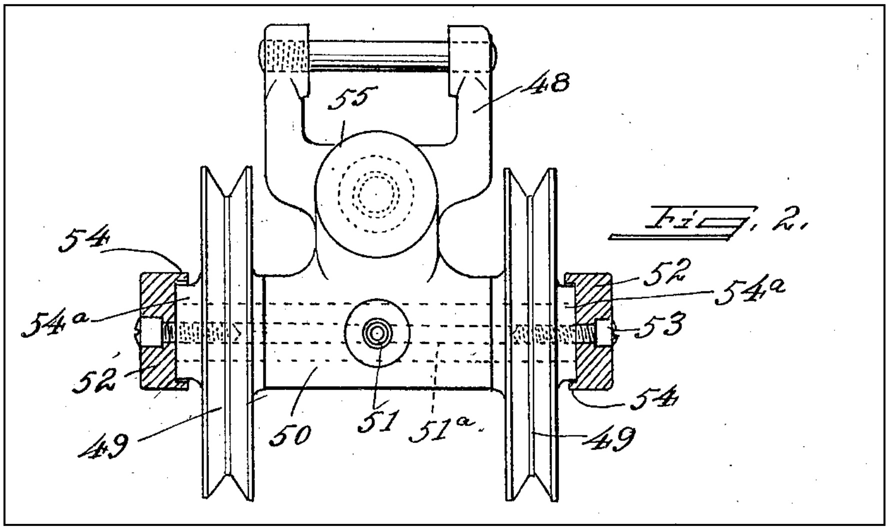



*Fig 2. Plan View of the Idler Pulley Assembly*

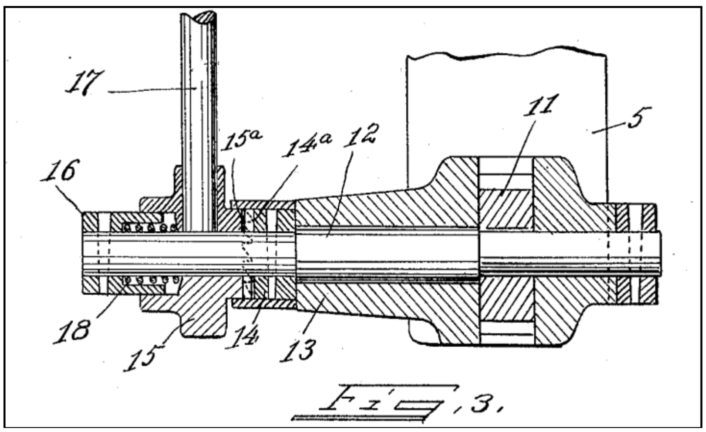



*Fig 3. Elevation Pinion & Ratcheted Lever*

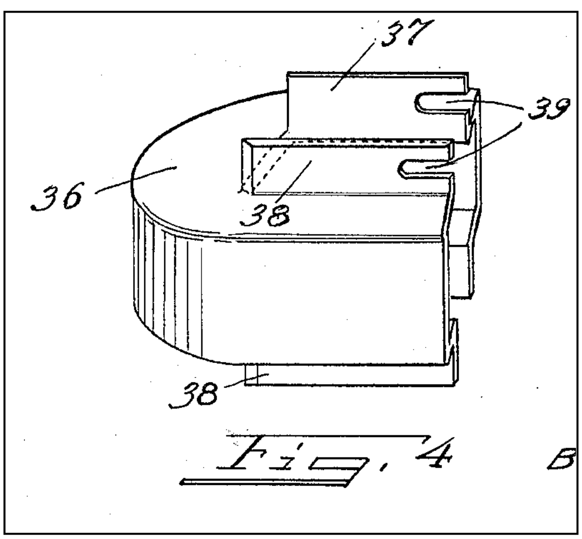
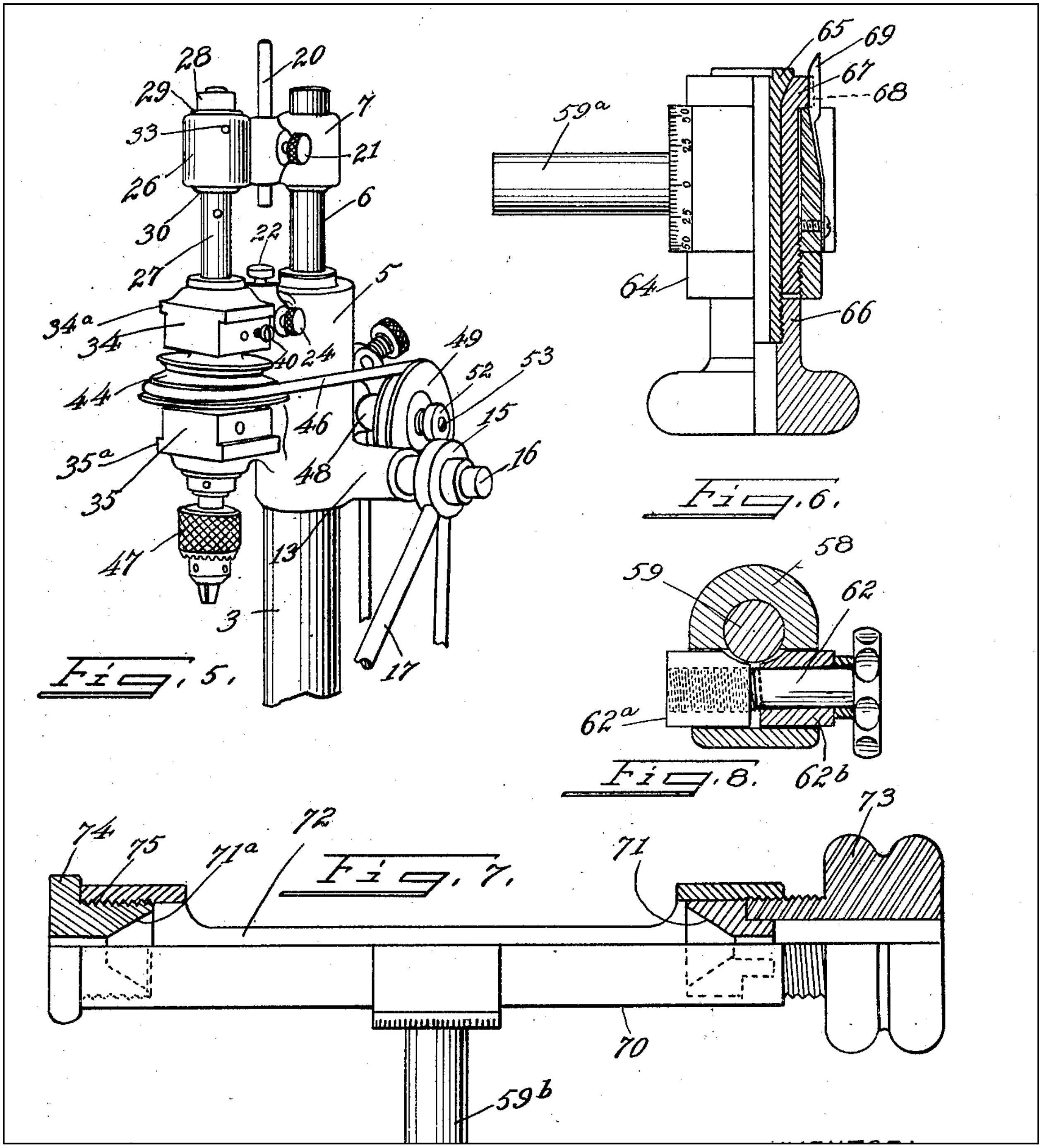



*Fig 4. Spindle Pulley Guard / Cover*




*Figures 6, 7, and 8 are alternative proposals noted in the patent for configuring the circular work plate on the bracket that is attached to the pedestal (support column). These proposals allowed for the movement of the work table in and out (or front to rear), and in a rotational direction to permit the drilling of angled holes.*

| Assembly Nomenclature | | |
|---|---|---|
| Key # | Name | Remarks |
| 1 | Base Plate | single casting |

| | | |
|---|---|---|
| 2 | Electric Motor | Emerson, K-C, Howell, etc |
| 3 | Pedestal or Support Column | hollow containing the Rack-Bar |
| 4 | Work Table Bracket | split ring, single casting |
| 5 | Lower Frame | single casting |
| 6 | Rack-Bar | $6^b$ rack teeth machined into the bar |
| 7 | Head (Upper Frame) | single casting |
| 8 | Spring | surrounds lower end of Rack-Bar $6^a$, provides sensitivity |
| 9 | Rack-Bar Collar | limits vertical movement of spring |
| 10 | Spring Stop Bushing | $10^a$ Bushing Set Screw |
| 11 | Pinion | |
| 12 | Pinion Shaft | CW rotation = Rack-Bar vertically upward |
| 13 | Pinion Journal | |
| 14 | Ratchet Disk | w/ $14^a$ ratchet teeth |
| 15 | Ratchet Collar | w/ $15^a$ ratchet teeth tha mesh with $14^a$ |
| 16 | Pinion Cap | |
| 17 | Elevation Lever | |
| 18 | Pinion Spring | |
| 19 | - | |
| 20 | Stop Pin | |
| 21 | Stop Pin Set Screw | |
| 22 | Stop Pin Seat Screw | Top of Screw |
| 23 | Stop Pin Seat Screw | Adjustable vertically |
| 24 | Set Screw | Secures Stop Pin Seat Screw |
| 25 | - | |
| 26 | Head Spindle Bearing Assly. | |
| 27 | Head Spindle Bearing Assly. | |
| 28 | Head Spindle Bearing Assly. | |
| 29 | Head Spindle Bearing Assly. | |
| 30 | Head Spindle Bearing Assly. | |
| 31 | Head Spindle Bearing Assly. | |
| 32 | Lubrication System | 32 a, b, c |
| 33 | - | |
| 34 | Upper Finger | |
| 35 | Lower Finger | |
| 36 | Spindle Guard / Cover | |
| 37 | Spindle Guard / Cover | |
| 38 | Spindle Guard / Cover | |
| 39 | Spindle Guard / Cover | |
| 40 | Cover Clamping Screws | |
| 41 | Bushing | |

| | | |
|---|---|---|
| 42 | Bushing | |
| 43 | Felt Washer | |
| 44 | Double Spindle Pulley | |
| 45 | Spline Groove | |
| 46 | Drive Belt | round leather secured end to end w/ metal staple |
| 47 | Chuck | |
| 48 | Idler Hanger | |
| 49 | Idler Pulleys | |
| 50 | Idler Pulley Shaft | |
| 51 | Lubrication point and rail | |
| 52 | Idler Assembly | |
| 53 | Idler Assembly | |
| 54 | Idler Assembly | |
| 55 | Idler Assembly Tension Screw | |
| 56 | Drive Pulley | |
| 57 | Work Table Assembly | Various proposed configurations |
| 58 | Work Table Assembly | Various proposed configurations |
| 59 | Work Table Assembly | Various proposed configurations |
| 60 | Work Table Assembly | Various proposed configurations |
| 61 | Work Table Assembly | Various proposed configurations |
| 62 | Work Table Assembly | Various proposed configurations |
| 63 | Work Table Assembly | Various proposed configurations |
| 64 | Work Table Assembly | Various proposed configurations |
| 65 | Work Table Assembly | Various proposed configurations |
| 66 | Work Table Assembly | Various proposed configurations |
| 67 | Work Table Assembly | Various proposed configurations |
| 68 | Work Table Assembly | Various proposed configurations |
| 69 | Work Table Assembly | Various proposed configurations |
| 70 | Work Table Assembly | Various proposed configurations |
| 71 | Work Table Assembly | Various proposed configurations |
| 72 | Work Table Assembly | Various proposed configurations |
| 73 | Work Table Assembly | Various proposed configurations |
| 74 | Work Table Assembly | Various proposed configurations |
| 75 | Work Table Assembly | Various proposed configurations |

## Appendix D: Hamilton Tool Company Trademark Registration

# United States Patent Office

**761,277**
**Registered Dec. 10, 1963**

**PRINCIPAL REGISTER**
**Trademark**

**Ser. No. 130,068, filed Oct. 17, 1961**

The Hamilton Tool Company (Ohio corporation)
9th and Hanover Sts.
Hamilton, Ohio.

For: PRINTING PRESSES, INCLUDING PRINTING PRESS EQUIPMENT; COLLATORS AND COLLATING EQUIPMENT; AND PORTABLE ELEVATING TABLES, in CLASS 23.

First use May 6, 1960; in commerce May 6, 1960; 1927 as to Hamilton; Sept. 10, 1952, as to the profile of Alexander Hamilton, as shown on the composite mark.

The word "Tool" is disclaimed apart from the mark as shown on the drawing.

*The trademark was apparently assigned from the Hamilton Tool Company to the Hamilton-Stevens Group when Hamilton Tool's assets were sold to Stevens Graphics.*

- ***US Serial Number:*** *72130068*
- ***Application Filing Date:*** *Oct. 17, 1961*
- ***US Registration Number:*** *761277*
- ***Registration Date:*** *Dec. 10, 1963*
- ***Register:*** *Principal*
- ***Mark Type:*** *Trademark*
- ***Status:*** *Registration cancelled because registrant did not file an acceptable declaration under Section 8. To view all documents in this file, click on the Trademark Document Retrieval link at the top of this page.*
- ***Status Date:*** *Sep. 11, 2004*
- ***Date Cancelled:*** *Sep. 11, 2004*

# Appendix E: Key Personnel in the History of the Varimatic

## Purpose

The purpose of this Appendix is to provide and preserve some level of historical insight into the people who influenced the development and evolution of the Hamilton Varimatic Drill Press. Where associated information was available, it has been included in this appendix. Specific additional information on a particular individual may also be found in the body of this paper.

## Patents and Patent Holders

A **patent** is a set of exclusive rights granted by a sovereign state to an inventor or their assignee for a limited period of time (usually 20 years), in exchange for the public disclosure of the invention. The exclusive right granted to a patentee in most countries is the right to prevent others from making, using, selling, or distributing the patented invention without permission. The following table summarizes the patent holder of inventions assigned to the Hamilton Tool Company. It is noted that those patents awarded by the US Patent Office (USPO) list the inventor and/or co-inventors. In some cases the patent may be awarded to an individual but later the individual holder may assigned it to, licensed it to, or sell the patent rights to another individual or company. The table also identifies the particular Patent Number, the date it was awarded, the patent holder(s), and the patent holder's residence. In most cases, when the patent is assigned to a company, the address block identifies the company's address. As shown the number of patents assigned to the Hamilton Tool Company throughout the company's history totals fifty-two separate (52) patents.

The date identified in this table is the date on which the USPO awarded the patent. The average time from the individual's submittal to the USPO's final award lasts approximately 2 years. The date of submittal can be found on each individual patent awarded and subsequently published by the USPO.

| | Patents - Hamilton Tool Company & Associated Companies | | | |
|---|---|---|---|---|
| | Patent Number | Date | Name | City |
| 1 | 481,238 | Aug. 23, 1892 | Adolph Muehlmatt | Newport, KY |
| 2 | 497,809 | May. 23, 1893 | Adolph Muehlmatt | Newport, KY |
| 3 | 911,667 | Feb. 09, 1909 | Adolph Muehlmatt | Newport, KY |
| 4 | 973,542 | Oct. 25, 1910 | Adolph Muehlmatt | Newport, KY |
| 5 | 985,536 | Feb. 28, 1911 | Adolph Muehlmatt | Newport, KY |
| 6 | D42,397 | Apr. 09, 1912 | Adolph Muehlmatt | Newport, KY |
| 7 | 1,057,762 | Apr. 01, 1913 | Adolph Muehlmatt | Newport, KY |
| 8 | 1,064,759 | Jun. 17, 1913 | Adolph Muehlmatt | Newport, KY |
| 9 (A) | 1,497,579 | Jun. 10, 1924 | Adolph Muehlmatt | Newport, KY |
| 1 (B) | 2,297,078 | Sep. 29, 1942 | Frederick W. Schlichter | Hamilton, OH |
| 2 | 2,632,510 | Mar. 24, 1953 | Herman A. Doppleb | Hamilton, OH |
| 3 | 2,643,827 | Jun. 30, 1953 | William H. Franzmann | Hamilton, OH |
| 4 | 2,659,306 | Nov. 17, 1953 | Walter W. De Lano | Hamilton, OH |
| 5 | 2,664,821 | Jan. 05, 1954 | Harold W. Huffman | Hamilton, OH |
| 6 | 2,729,982 | Jan. 10, 1956 | Harold W. Huffman | Hamilton, OH |
| 7 | 2,736,380 | Feb. 28, 1956 | Robert A. Dillenburger | Cincinnati, OH |

| | | | | |
|---|---|---|---|---|
| 8 | 2,761,631 | Sep. 04, 1956 | William H. Franzmann | Hamilton, OH |
| 9 | 2,766,984 | Oct. 16, 1956 | William H. Franzmann | Hamilton, OH |
| 10 | 2,829,886 | Apr. 08, 1958 | William H. Franzmann | Hamilton, OH |
| 11 | 2,829,887 | Apr. 08, 1958 | William H. Franzmann | Hamilton, OH |
| 12 | 2,859,035 | Nov. 04, 1958 | William H. Franzmann | Hamilton, OH |
| 13 | 2,863,387 | Dec. 09, 1958 | Harold W. Huffman | Hamilton, OH |
| 14 (C) | 2,961,899 | Nov. 29, 1960 | Walter W. De Lano | Fairfield, OH |
| | | | James E. Grove | Hamilton, OH |
| 15 | 2,990,171 | Jun. 27, 1961 | John E. Chamberlain | Middletown, OH |
| | | | James E. Grove | Hamilton, OH |
| 16 | 3,067,893 | Dec. 11, 1962 | James E. Grove | Hamilton, OH |
| 17 | 3,084,449 | Apr. 09, 1963 | Harold W. Huffman | Fairfield, OH |
| 18 | 3,096,949 | Jul. 09, 1963 | Harold W. Huffman | Hamilton, OH |
| 19 (D) | 3,105,982 | Oct. 08, 1963 | Walter W. De Lano | Fairfield, OH |
| | | | Kenneth J. Yost | Oxford, OH |
| 20 | 3,124,349 | Mar. 10, 1964 | Harold W. Huffman | Hamilton, OH |
| 21 | 3,124,350 | Mar. 10, 1964 | Harold W. Huffman | Hamilton, OH |
| 22 | 3,219,202 | Nov. 23, 1965 | Harold W. Huffman | Hamilton, OH |
| 23 | 3,228,273 | Jan. 11, 1966 | Harold W. Huffman | Hamilton, OH |
| 24 | 3,231,261 | Jan. 25, 1966 | Harold W. Huffman | Hamilton, OH |
| 25 | 3,237,556 | Mar. 01, 1966 | Harold W. Huffman | Hamilton, OH |
| 26 | 3,241,411 | Mar. 22, 1966 | Harold W. Huffman | Hamilton, OH |
| 27 | 3,268,136 | Aug. 23, 1966 | Harold W. Huffman | Hamilton, OH |
| 28 | 3,280,679 | Oct. 25, 1966 | Harold W. Huffman | Hamilton, OH |
| 29 | 3,298,353 | Jan. 17, 1967 | Harold W. Huffman | Hamilton, OH |
| 30 | 3,298,684 | Jan. 17, 1967 | Charles P. Crampton | Hamilton, OH |
| 31 | 3,304,102 | Feb. 14, 1967 | Harold W. Huffman | Hamilton, OH |
| 32 | 3,373,666 | Mar. 19, 1968 | Charles P. Crampton | Hamilton, OH |
| 33 | 3,391,863 | Jul. 09, 1968 | Robert W. Morner | Hamilton, OH |
| | | | Harold W. Huffman | Hamilton, OH |
| 34 | 3,476,631 | Nov. 04, 1969 | Harold W. Huffman | Hamilton, OH |
| 35 | 3,555,767 | Jan. 19, 1971 | Harold W. Huffman | Hamilton, OH |
| 36 | 3,651,724 | Mar. 28, 1972 | Harold W. Huffman | Hamilton, OH |
| 37 | 3,761,300 | Sep. 25, 1973 | James A. Wilmer | Fort Thomas, KY |
| | | | Harold W. Huffman | Hamilton, OH |
| 38 | 3,841,216 | Oct. 15, 1974 | Harold W. Huffman | Hamilton, OH |
| 39 | 3,977,621 | Aug. 31, 1976 | Harold W. Huffman | Hamilton, OH |
| 40 | 4,270,743 | Jun. 02, 1981 | Charles P. Crampton | Hamilton, OH |

| | | | | |
|---|---|---|---|---|
| 41 | 4,848,202 | Jul. 18, 1989 | Charles P. Crampton | Hamilton, OH |
| 42 | 4,934,838 | Jun. 19, 1990 | Robert W. Morner | Hamilton, OH |
| 43 | 4,991,503 | Feb. 12, 1991 | Robert W. Morner | Hamilton, OH |
| **52** | The data in this table was extracted directly from the Patent submittals as awarded by the USPO. | | | |
| | (A) First Precision Bench Drill Press - Muehlmatt<br>(B) First Varimatic Model Drill Press - Schlichter<br>(C) Improved Varimatic Drill Press – Grove & De Lano<br>(D) Tapping Machine - Yost & De Lano | | | |

As stated in the body of this paper, Adolph Muehlmatt operated as a separate company (probably in Cincinnati, Ohio); but maintained a residence in Newport, Kentucky. It is assumed that the first nine patents listed in this table were issued directly to Adolph Muehlmatt (as an individual) but were later assigned to the Hamilton Tool Company when the two companies merged about 1920 - 1924.

The following table shows the distribution of the patents in the above table. One thing to note is the most patents awarded were primarily centered on three people; Adolph Muehlmatt, Harold Huffman, and William H Franzemann who together accounted for 38 of the 52 patents issued (~73%). As will be discussed later these three men were also prominent in the growth, management, and history of the Hamilton Tool Company

It is not known whether all of the listed patent holders were full-time payroll employees of Hamilton at the time the patent was awarded. It is a possibility that when co-inventors are identified, one may have been a consultant engineer under contract. In the following table the "number of patents" represents all of the patents with which the holder was associated. The number on the right identifies the number of patents a particular holder was also identified as a co-holder. As an example Harold W Huffman held 23 patents. In addition to those 23 he was listed as a co-holder on 2 of them. Thus of the total 52 patents held by the company, 5 were listed with co-holders.

| # of Patents | Patent Holder | Co-Holder |
|---|---|---|
| 9 | Adolph Muehlmatt | |
| 1 | Frederick W. Schlichter | |
| 1 | Herman A. Doppleb | |
| 1 | Robert A. Dillenburger | |
| 6 | William H. Franzmann | |
| 1 | John E. Chamberlain | 1 |
| 3 | James E. Grove | 2 |
| 3 | Walter W. De Lano | 2 |
| 1 | Kenneth J. Yost | 1 |
| 1 | James A. Wilmer | 1 |
| 23 | Harold Walter Huffman | 2 |
| 4 | Charles Phillip Crampton | |
| 3 | Robert W. Morner | 1 |
| ***57*** | ***Totals*** | ***10*** |

- *Five of the patents were attributable to two people (co-holders).*
- *The most patents were attributable to Harold W Huffman between 1954 and 1976 (over 22 years).*

- *The last patent (52nd) was awarded after the Hamilton Tool Company was dissolved (in 1990) because it was submitted in 1989. It was never known to have been manufactured or used in production.*
- *Of the patent holders, as a group, Huffman, Grove, Franzmann, Schlichter, and Muehlmatt were known to have been officers of the Hamilton Tool Company, in some capacity, at some point in the company's history.*

### Secretary of State Filings

In addition to the known dates identified on the Hamilton Tool Company patent awards, some additional dates were identified in the legal filings submitted to the Ohio Secretary of State's Office. The filings are summarized in the following table. It is not known whether this list constitutes all filings ever made.

| Known Year | Co. President | Co. Secretary | Co. Asst. Secretary | Other |
|---|---|---|---|---|
| 9/16/1926 | Unk | Unk | Unk | Incorporation **Founders**: Charles M. Lyle, Charles A. Cammerer, Oscar A Koogler, Pearl Koogler, May W. Lyle, Martha M. Cammerer: Initial Capital= $50,000, 500 Shares @ $100/share. |
| 12/28/1942 | F. W. Schlichter | J. E. (James) Grove | Unk | |
| 1/4/1955 | F. W. Schlichter | Unk | W. Franzmann | |
| 1/2/1958 | F. W. Schlichter | J. E. (James) Grove | Unk | |
| 12/31/1962 | Calvin W Jung | J. E. (James) Grove | Unk | |
| 4/29/1965 | Calvin W Jung | Unk | Eleanor Grove | wife of James E. Grove |
| 12/31/1969 | Harold Huffman | J. B. (Jack) Grove | | |
| 11/29/1973 | Harold Huffman | J. B. (Jack) Grove | | |
| 12/31/1986 | Fredrick H. Harding | J. B. (Jack) Grove | | Hamilton Tool Company Merger |
| | Fredrick H. Harding | Richard I Stevens | | Hamilton Acquisition Corp Merger |
| | Fredrick H. Harding | Richard I Stevens | | Merger Agreement [Hamilton / Stevens] |
| 3/30/1990 | Fredrick H. Harding | Richard I Stevens | | Merger Hamilton - Stevens Group |
| 5/31/1990 | Unk | Unk | | Dissolution of Hamilton Tool Company |

*Source: Office of the Ohio Secretary of State. The above table identifies the various corporate filings the Hamilton Tool Company submitted to and approved by the Ohio Secretary of State during the period of time the company was in business.*

### Personnel Information

The following information is a compendium of personnel data found during a search of the life events of the key people involved in the historical evolution of the Varimatic. However, information regarding the period of the sale of the Hamilton Tool Company drill and tapping machine product lines and subsequent continued production has yet to be fully researched. It is known that the Precision Drilling Machine Company (later REBB Industries Inc.) of Yadkinville, North Carolina continued the production line for a period of time.

- ***The Hamilton Tool Company***

*Adolph Muehlmatt*

- See appropriate section in this paper.

*Harold Walter Huffman*

- mother Emma Pauline (Horning)
- father Jonas Huffman
- wife Anna Wehr
- children none
- 1922: Born (Jan 13)
- 1940: Started at Hamilton Tool Company
- 1960-1967: Vice President
- 1967-1974: President
- 1974-1991: Engineering Consultant
- 1991: Retired
- 2009: Died

*William H Franzmann*

- 1896 Born
- 1960 Died
- SSAN 277-01-6597
- Wife Louise Schlichter
- Son Albert Wilhelm 1938-2009
-

*Robert W Morner*

Age 87, died Monday November 10, 2008
Born in Hamilton, Ohio December 6, 1920, son of John Ernst and Margaret (Smith) Morner.
He studied engineering at Miami University and retired as the Head of the Research and Development Department of the Hamilton Tool Co. where, while leading a variety of projects he was granted several U.S. patents. He continued as a consultant with that firm for another five years. A very compassionate, proud, and caring man, Bob leaves to cherish his memory his loving wife of 64 years: Elaine (Kolbenstetter) Morner; his three children: Rick W. (Jo Anne) Morner, Lynne Harrison, and Don C. Morner and son-in-law: Dan E. Harrison; grandchildren: Eddie Harrison, Karla (Bill) Fishburn, Ryon (Katherine) Morner, Jami (Bryan Geckeler) Harrison, Derek (Lindsey) Morner, Robert S. Morner, Andrew J. Morner; great grandchildren: Joiya Fishburn, Samantha Geckeler, and William Morner. He is survived by 4 sisters-in-law, 3 brothers-in-law, special friends and his Elks golf and card buddies. He was preceded in death by both parents, sister June (Clyde) Chamberlin, and brother John (Madeline) Morner. The family extends special thanks to the staff at Hospice of Hamilton on Eaton Ave. In lieu of flowers, a memorial donation may be made to Hospice or any charitable organization of choice. Funeral services will be at the convenience of the family. Condolences may be sent to Avance Funeral Home at: www.avancefuneralhome.com

*J. E. (James) Grove*

*TBD*

*J. B. (Jack) Grove*

*TBD*

*Frederick W. Schlichter*

*TBD*

*Herman A. Doppleb*
*TBD*

*Charles Phillip Crampton*
*TBD*

*John E. Chamberlain*
*TBD*

*Walter W. De Lano*
*TBD*

*Kenneth J. Yost*
*TBD*

*James A. Wilmer*
*TBD*

*Robert A. Dillenburger*
*TBD*

*Calvin W Jung*
*TBD*

*Fredrick H. Harding*
*TBD*

- ***The Precision Drilling Machine Company (REBB Industries) – ViewRiver Machine Corp.***

The Viewriver Machine Corporation was incorporated on or about June 15, 1978 as a North Carolina Corporation with an initial capitalization of $1,000 and 200 shares @ $0.00/share.

*Initial Board Members*
- *Richard Jacobson, President, Viewriver Machine Corporation*
- *Glen A Jacobson, Secretary, Viewriver Machine Corporation*
- *Burton Jacobson, Viewriver Machine Corporation*

*Lee Wilmoth, Gen Mgr, REBB Industries*

*David Brown, Dir Sales, REBB Industries*

*Doug Phoenix, Dir QC, REBB Industries*

# Appendix F: The Evolution from the Muehlmatt Drilling Machine to the Hamilton Tapping Machine

## Background

From a review and analysis of the patents assigned to the Hamilton Tool Company over the history of the company, it is apparent that the patent issued for the Tapping Machine was a logical outgrowth of the first Muehlmatt Precision Drilling Machine. Between the developments of these two machines, the Varimatic was developed. However, the cone/cup design concept employed in the Varimatic turned out to be the key design element that allowed for the final design of the powered Tapping Machine. Given that objective it should be noted that the cup/cone design concept was utilized for different engineering purposes between the two machines.

In the Varimatic the primary purpose of the cup/cone design was to allow for continuously operator controlled variable spindle speeds from very low to very high rpm ranges. Drilling operations requiring very small precise holes necessitates correspondingly high spindle speeds in order to maintain a stable drill bit path. Once the speed of the spindle is selected, it is generally held constant throughout the operation for particular bit (or hole) sizes and work piece material. The “cutter” in a drilling operation is primarily a drill bit.

Tapping operations do not require a high spindle speed, but do require a high torque reversing spindle that can be closely controlled in-so-far as the travel of the tap relative to the work piece. The cup/cone design concept also allowed for the reversing rotation of the tap with a closely controlled travel path. The tap is required to travel a given distance while cutting threads in the sides of a previously drilled hole. At the maximum travel, the tap must stop rotating in the work piece then reverse motion in order to extract the tap and clean out the threads. The spindle speed for a tapping operation is generally accomplished at a low spindle rpm, but at a constant speed. In the Hamilton Tapping Machine the cup/cone was used to: (1) reversed spindle rotation, (2) eliminate spindle rotation at a specific pre-determined depth of spindle travel, and (3) allow for both high torque and constant speed of the tap during travel. The “cutter” in a tapping operation is a tap the cuts threads in a previously drilled hole.

From and engineering perspective, the cup/cone design concept permitted the transfer of very high torque ratios as well as positive (non-slip or low friction loss) speed ratios between the drive and driven machine parts.

Detailed discussion of the employment of the cup/cone design concept in each of these machines has been provided in the body of this paper in the appropriated sections, and is not intended to be restated in this appendix.

## Purpose

The purpose of this appendix is to provide a view into the differences between all of these machines regardless of the power and drive system employed. In addition, it is intended to show the historical and logical engineering development of the drilling and tapping machines manufactured over time by the companies involved.

## Power, Drive Systems, Parts, and Mechanical Assemblies

The power and mechanical drive systems are very similar between all machines. It is obvious that Hamilton Tool Company considered the interchangeability of parts and the employment of similar mechanical assemblies when considering the manufacturing processes and assembly operations. Only a quick inspection of all of these machines would conclude that they all look very similar in construction. It would be difficult that having seen one, the rest would not be easily recognizable as being manufactured by the same company. As a consequence this line of discussion will not be addressed in this appendix.

## Noise and Vibration

Many of the design characteristics noticeable among the different machines is the design intent of minimizing both noise and vibration. The types of drive mechanisms, motion transfer parts and assemblies, and bearing assemblies were all similar among machines. All are obviously intended to reduce vibrations at high spindle speeds and during cutting operations (drilling and tapping).

## Focus Point

The primary focus point of this appendix is to document the mechanical movement of the machine assemblies that actually perform the work for which the machine was designed and manufactured. The following could be thought of as an attempt to answer the basic question of “how does it work” and what’s the difference between them.

## Graphics

Four concept sketches are presented in this appendix:

- Figure 1: The original (first) Precision Drill Press
- Figure 2: The 2nd generation Precision Drill Press
- Figure 3: The Varimatic Precision Drill Press
- Figure 4: The Hamilton Tapping Machine

Each of these illustrations depict the basic structure (or framework), the work piece, and the assemblies that provide movement of a tooled cutter relative to the work piece. Note in all cases the spindle rotates and holds a fixed chuck that grips the appropriate cutting tool.

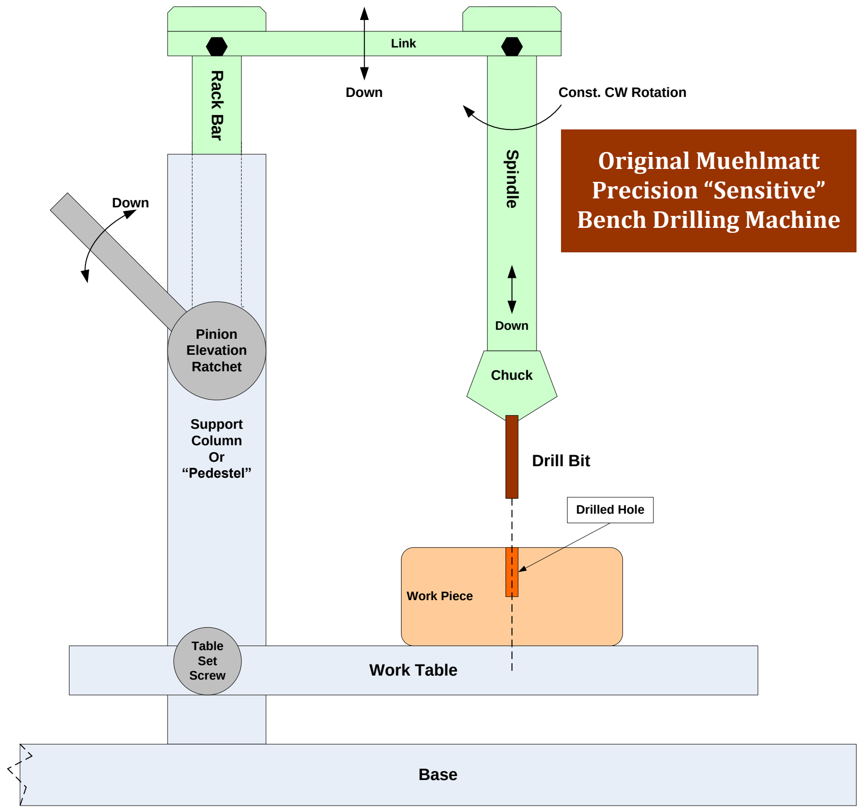



*Figure 1*

The part of the machinery common to the drill press or the tapping machine is that part which moves the cutter relative to the work piece. This relative movement insures the machine accomplishes the task (work) for which it is intended. For drilling operations, the bit always moves in an intended or pre-determined motion into the work piece.

In the Original Muehlmatt Drill Press, the assembly that accomplishes the machine's intended purpose is the Rack Bar, Link, Spindle, and Chuck; all of which are fixed and connected to each other. These parts taken together act as one single assembly. This assembly moves only in the vertical direction; that movement provided by the movement of the Rack Bar. The remainder of the connected parts act concurrently with the Rack Bar. A pinioned lever that meshes with rack teeth machined into the Rack Bar provides the operator input into the control of the movement of the bit in a vertical direction.

The spindle rotates via a belt connected to an electric motor. The motor is either on or off. In addition, the motor turns a belt that drives a set of pulleys ending at the spindle. Thus, once the machine is set up as to the pulleys selected, the spindle rotates at a constant rpm and direction when the motor is turned on even though the spindle is operator controlled in the vertical direction.

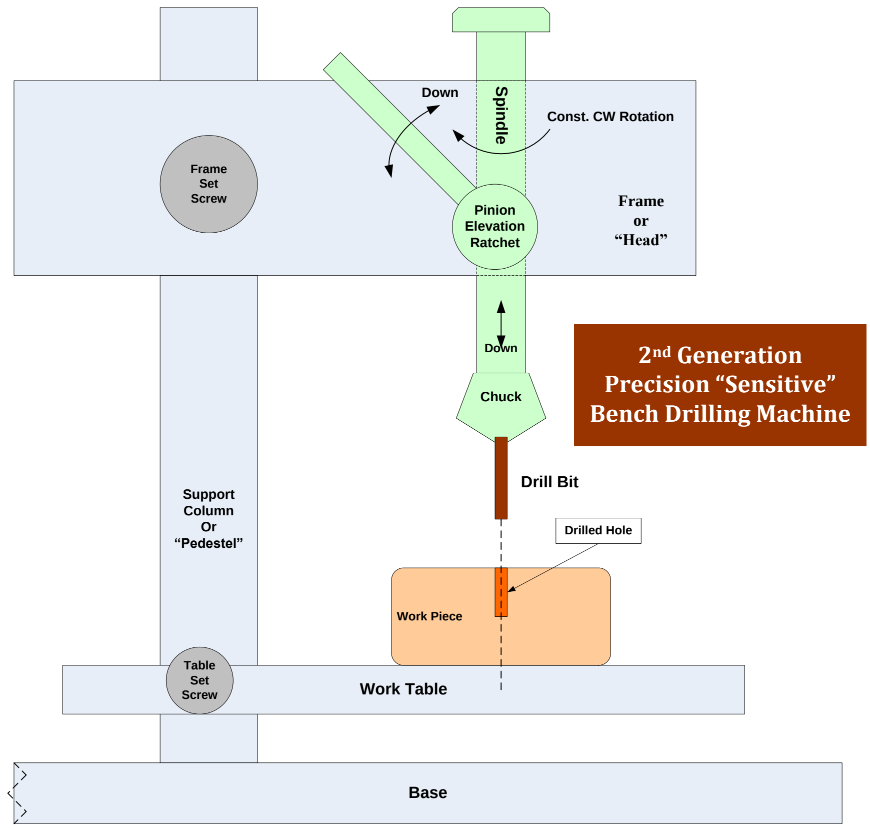



*Figure 2*

The difference between the Original and the 2nd Generation (my words) is the fact that the Rack Bar arrangement which was supplanted by moving the rack and pinion to the spindle itself. This configuration allowed for the removal of all of the mechanicals (weight) out of the Pedestal, and to fix the spindle into the Frame. The operator only had to move the weight of the spindle versus the entire machine head. This allowed for better operator sensitivity regarding the cutting forces on the bit. Additionally it permitted fixing the location of the spindle for more consistent alignment. As a sidebar, this arrangement also permitted the relocation of the drive motor to the back of the frame which simplified the belt drive. The result was a quieter and more vibration free assembly.

The end result was the spindle rotated at a constant rpm depending on the positioning of the drive belt on a set of pulleys between the motor and the spindle. The spindle always rotated in the same direction.

It is not known at this point whether this configuration was manufactured before the Varimatic was developed in 1942. It does not seem far afield to believe that it was the basis of design for the Varimatic. As illustrated in Figure 3 (below), this configuration and that of the Varimatic was almost a duplication with little modification.

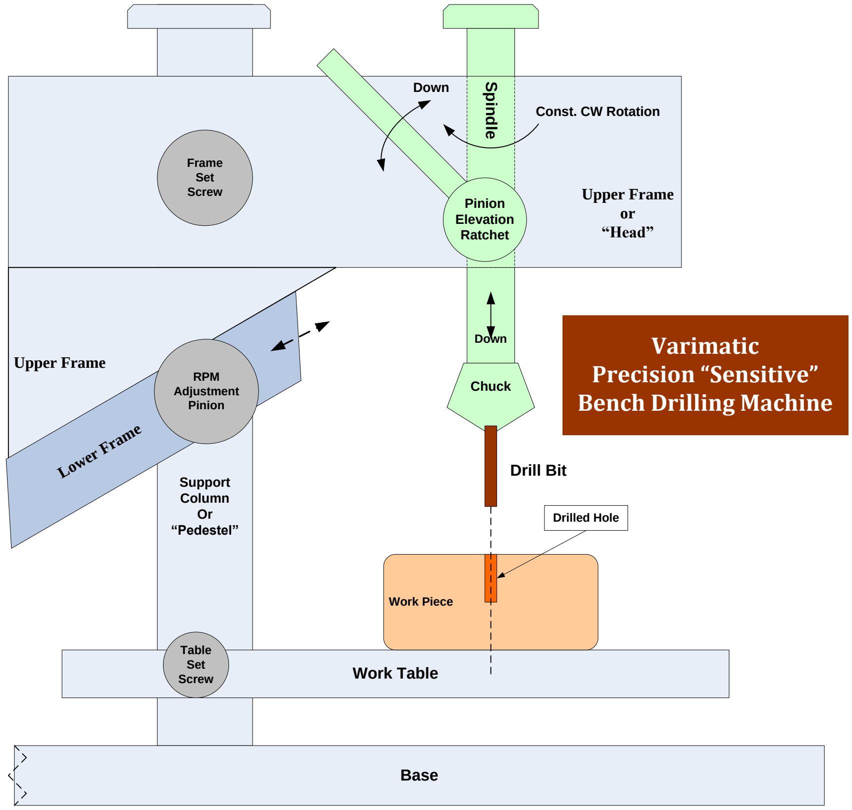



*Figure 3*

The Varimatic was easily identifiable by the triangular shaped lower frame added to the upper frame which was common to the 2nd Generation model. Unlike the 2nd Generation Drill Press, the motor on the Varimatic was mounted on the lower frame. The lower frame then moved in such a manner as to engage the motor having a cup fixed to its output shaft with the cone fixed in position by the upper frame. This arrangement allowed for varying a virtual set of pulleys relative to a set of pulleys fixed to the spindle. This assembly allowed the operator to select any spindle speed within the design limits of the pulley geometry. Other than being able to operate the spindle at higher speeds, and to adjust the spindle speed by the operator in a convenient manner (thus reducing set-up time), both models appear the same. Like the 2nd Generation model the spindle on the Varimatic always rotated in the same direction.

Again the benefits and improvements available in the 2nd Generation were all duplicated in the Varimatic.

In all of the above drills it was noted that a quill was not provided to secure the spindle. The spindle was secured through the application of various types of bearing assemblies. The spindle was a machined part that contained a Morse Taper machined integral to the chuck end. The chucks were all Morse Taper types. This was probably done in order to reduce vibration and noise, along with the ability to maintain a true and consistent alignment of the spindle itself.

Various improvements were made to the Varimatic in as patented in 1960, and it is assumed these improvements were also incorporated in the 2nd Generation models as a matter of course.

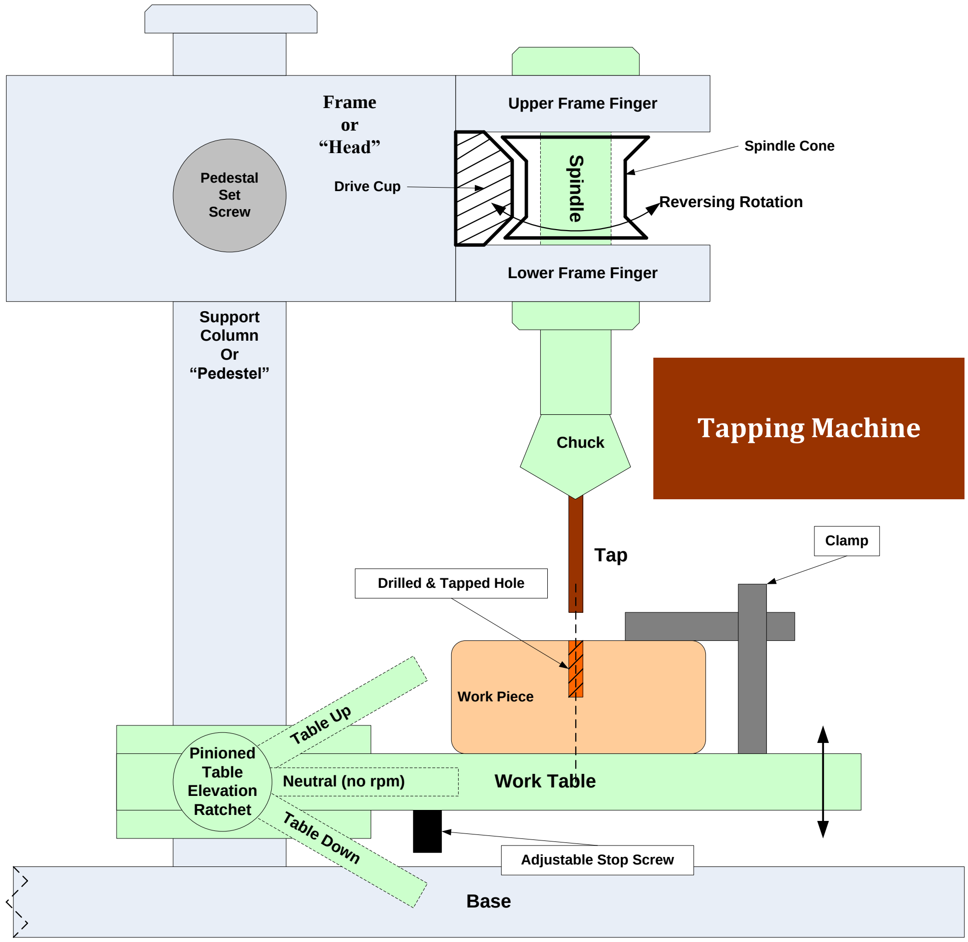



*Figure 4*

In appearance, the Hamilton Tapping Machine looked more like the original Muehlmatt Drill Press than a distinctly designed machine. The electric drive motor was again mounted on the base plate connected to a vertical drive belt which drove a set of pulleys on the back of the frame. This set of pulleys drove a shaft on the opposite end of which was mounted a drive cup that engaged the spindle cone. On the front of the frame was a safety guard that covered these components. The biggest deviation in appearance with the guard in place was the work table configuration and the fact that there was no lever mechanism to move the spindle in the vertical direction. The spindle did not move appreciably (only ~1/16" in total) in the vertical direction.

The tapping machine was unique in the fact that the work piece (clamped to the work table) moved vertically to the tap versus the other way around as in a drill press: ie, the table moved, not the spindle. Again, the main difference in this arrangement was the placement of the pinion lever; it was no longer located on the frame or on the pedestal but on the work table.

Because the work piece moved into the cutting tool, generally it had to be clamped to the work table to engage the appropriate part of the spindle cone when the tap was extracted from the pre-drilled hole. Of interest is the utilization of the cup/cone design and its employment in this particular machine. In reviewing the patents, the cup/cone design was utilized in the Varimatic as well as the Tapping Machine. Both patents were submitted within one month of each other in the summer of 1958. The Improved Varimatic patent was granted in 1960, but the Tapping Machine took longer in that it was granted in 1963. This begs the question of which came first. It is possible that as the original Varimatic (patented in 1942) was undergoing reengineered improvements in 1958, it served as the genesis for the development of the

Tapping Machine. In either case one probably could not have been developed without the other. In addition to the above, the details of the influence of the cup/cone concept applied to the tapping machine are explained in the appropriate section of this paper, and are therefore considered beyond the scope of this appendix.