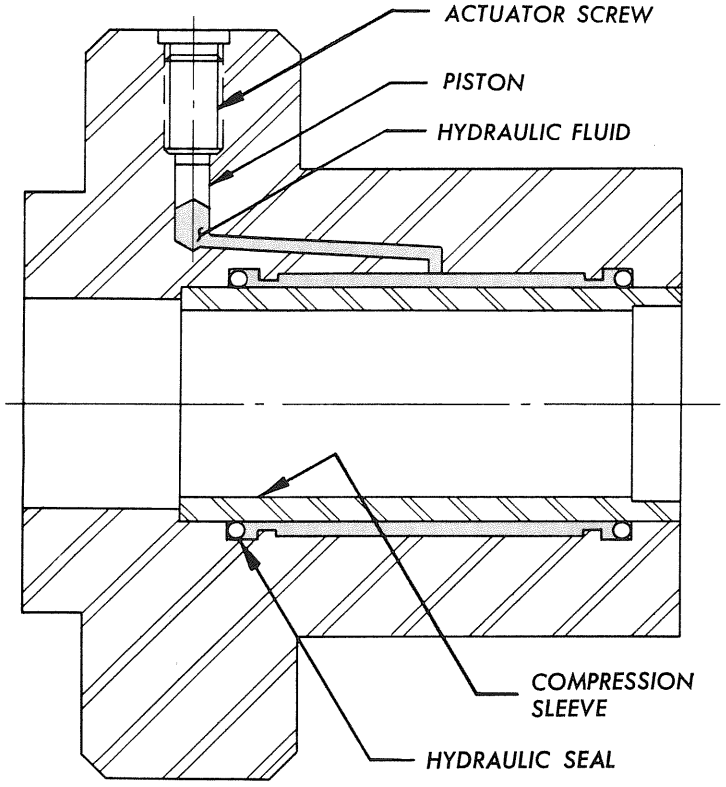
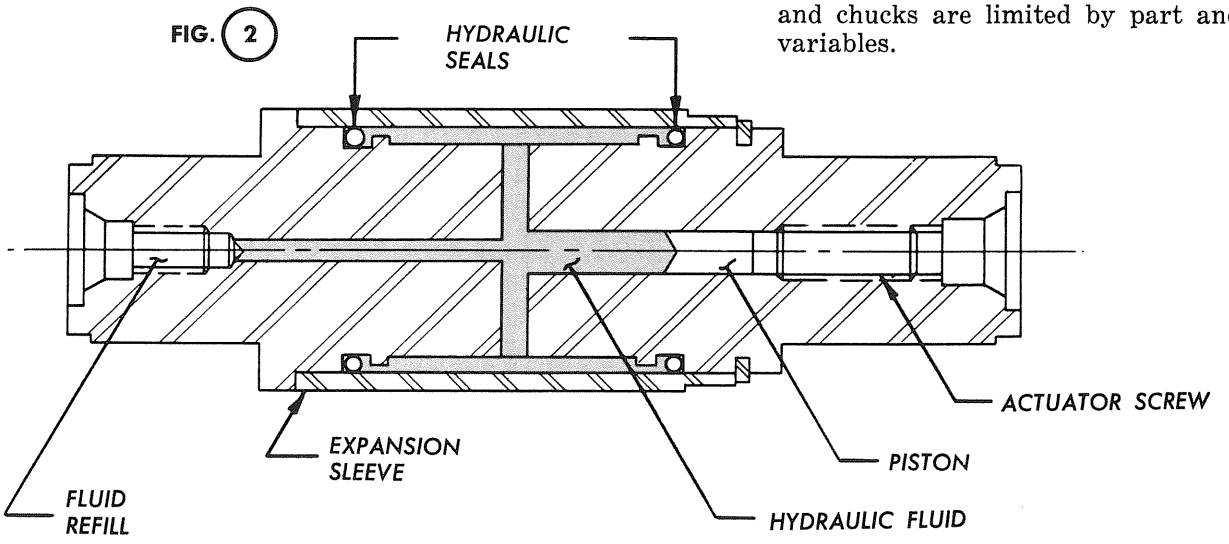
CHUCK

FIG. 1



ARBOR

FIG. 2



HOW THEY FUNCTION

Davis ARBORS and CHUCKS function on the principle of expanding or compressing metals within their elastic limits under hydraulic pressure. The self contained hydraulic system may be manually or power actuated.

Explanatory drawings of a typical manually actuated chuck and arbor are shown to illustrate the basic principles upon which Davis hydraulically expanded chucking devices function. The actuator screw is turned clockwise, advancing the piston which places the hydraulic system under high pressure. In the case of a CHUCK shown in Figure (1) the compression sleeve is compressed over the full chucking area located between the hydraulic seals. Figure (2) illustrates how the expansion sleeve of a Davis ARBOR is expanded, under hydraulic pressure, on the gripping area between the hydraulic seals. There is no expansion of the gripping sleeve beyond the hydraulic seal area. The gripping or chucking area of the sleeves, under equalized fluid pressure, expand or compress uniformly from their geometric centerline assuring extreme accuracy in part positioning.

TOLERANCE RANGE

Davis hydraulic arbors and chucks are guaranteed to function within the tolerances specified. These may range—according to part variables—from .0005 T.I.R. to .00002 T.I.R.

CHUCKING — SIZE RANGE

ARBORS—Minimum chucking diameter—$\frac{1}{4}$"
CHUCKS—Minimum chucking diameter—$\frac{1}{16}$"

MAXIMUM chucking diameters for both arbors and chucks are limited by part and tolerance variables.

EXPANSION LIMITS

Expanding or compressing metals under hydraulic pressure is accomplished by working within the tested elastic limits of the metals being used. The general rule for expansion is .003 for the first full inch of chucking diameter and .001 for each additional inch of diameter. The following table lists typical expansion limits but these may vary somewhat due to the many variable factors for each specific application.

CHUCKING DIAMETER	NORMAL EXPANSION LIMIT	SPECIAL MAXIMUM EXPANSION LIMIT
.250	.00075	.002
.500	.0015	.005
.750	.0022	.007
1.000	.003	.010
2.000	.004	.015
3.000	.005	.020

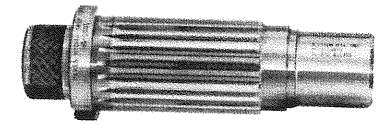
WORK HOLDING FORCE

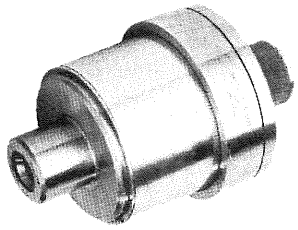
Davis hydraulically expanded arbors and chucks are custom engineered to embody the correct gripping force for each application. The gripping power may range from only a few pounds to several thousand pounds per square inch. They withstand rugged production operations—turning, hobbing, boring, grinding or "you name it"—and handle the most delicate inspection operations over long periods.

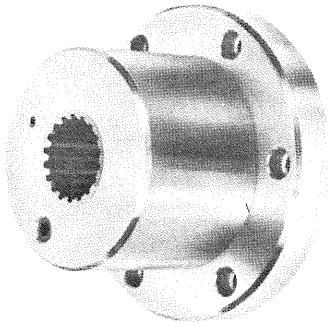
NEED FOR GREATER ACCURACY

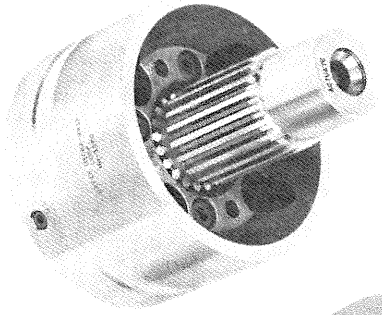
Manufacturing tolerances throughout industry have been greatly reduced in recent years. In many instances conventional work holding devices are no longer capable of functioning within required production limits. In the manufacturing of precision parts the work or tool holding device must locate the part with consistent extreme accuracy so that the machine tools have the full benefit of the part tolerance. This must be accomplished without complicating the processing of machining operations whereby many non-critical part dimensions must be held to closer than necessary limits.

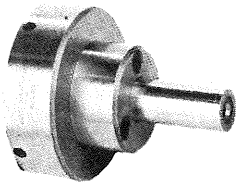
It is illustrated in this catalog how Davis hydraulic expanding arbors and chucks compensate for "intolerance" piece part variations such as size, taper, "bell-mouth", "out-of-round", etc. It is explained how concentricity, squareness, and parallelism tolerances are easily held even when chucking from surfaces whose allowable tolerance limits would make it impossible using conventional taper arbors, selective fit arbors or mechanical chucking devices.

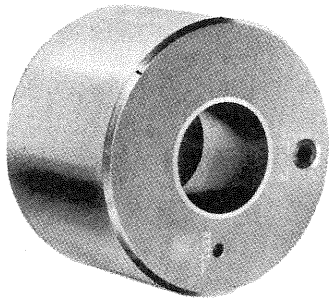


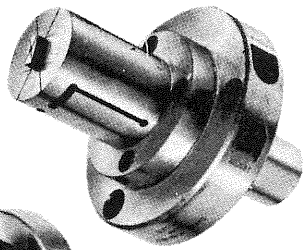


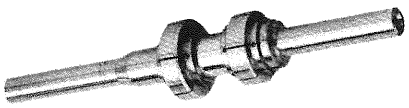


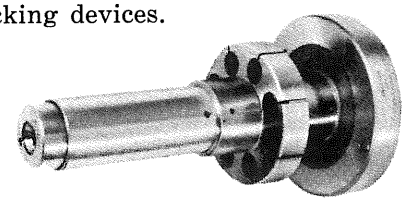


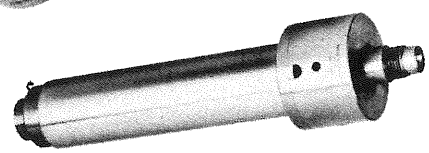










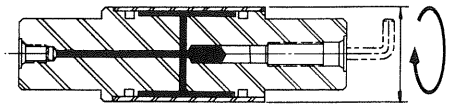


VERSATILITY OF ACTUATING

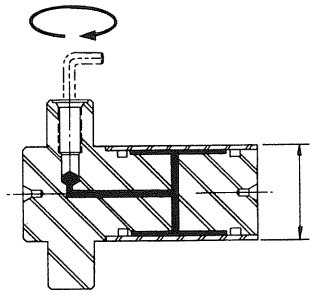
LOCATION OF ACTUATOR MECHANISM IN THE ARBOR OR CHUCK IS DETERMINED BY:

I —THE METHOD OF ACTUATING THE SELF-CONTAINED HYDRAULIC SYSTEM—MANUALLY OR BY POWER.

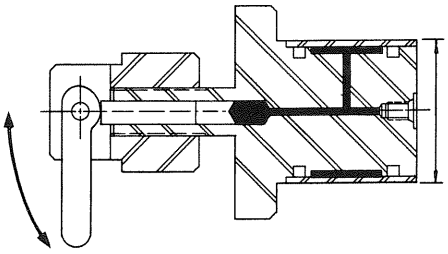
II—THE TYPE MACHINE SPINDLE, FACE PLATE, SPECIAL ADAPTER OR FIXTURE WITH WHICH IT IS USED.



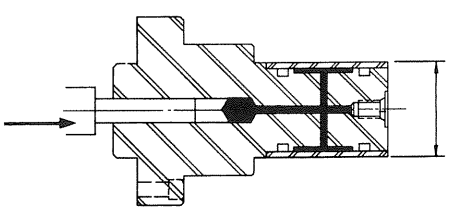
ARBOR
MANUALLY SCREW ACTUATED FROM END



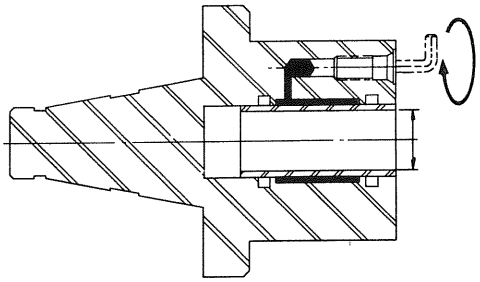
ARBOR
MANUALLY SCREW ACTUATED FROM FLANGE



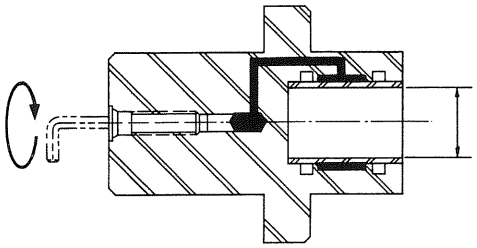
ARBOR
CAM ACTUATED FROM REAR



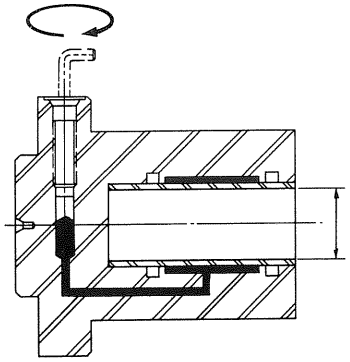
ARBOR
POWER ACTUATED THRU MACHINE SPINDLE



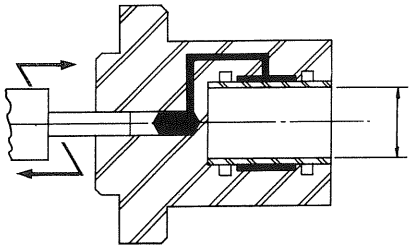
CHUCK
MANUALLY ACTUATED FROM FRONT FACE



CHUCK
MANUALLY ACTUATED FROM REAR



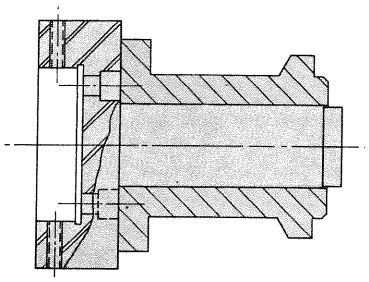
CHUCK
MANUALLY ACTUATED FROM OUTER FLANGE

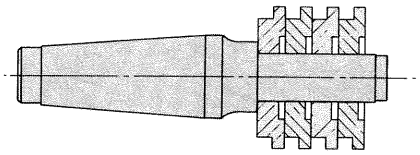


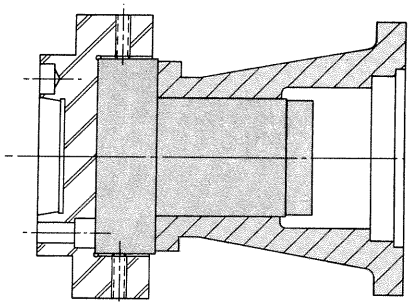
CHUCK
POWER ACTUATED THRU MACHINE SPINDLE

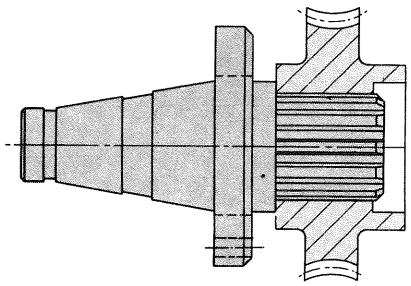
MACHINE ADAPTABILITY

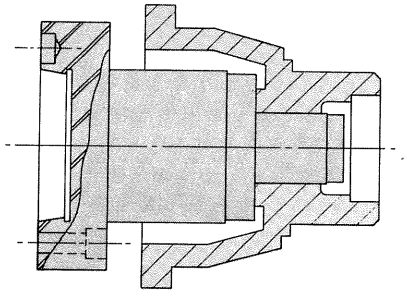
DAVIS HYDRAULICALLY EXPANDED ARBORS AND CHUCKS MAY BE ADAPTED TO ANY MACHINE SPINDLE, ADAPTER PLATE OR FACE PLATE TO WHICH CONVENTIONAL CHUCKING DEVICES ARE MOUNTED.

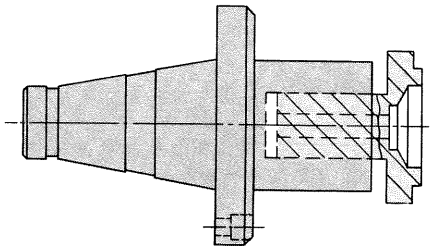


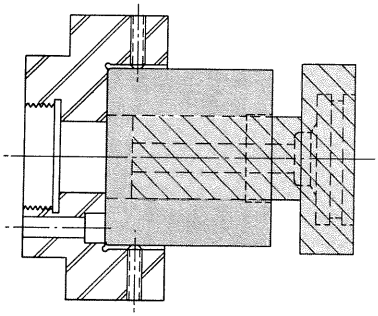


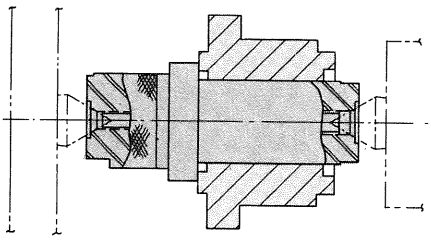






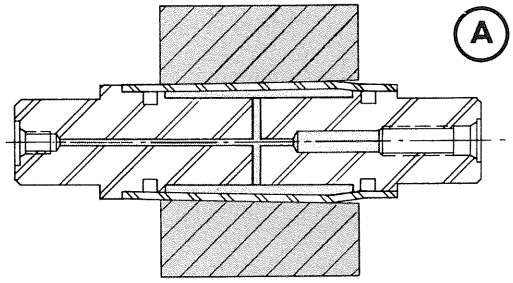


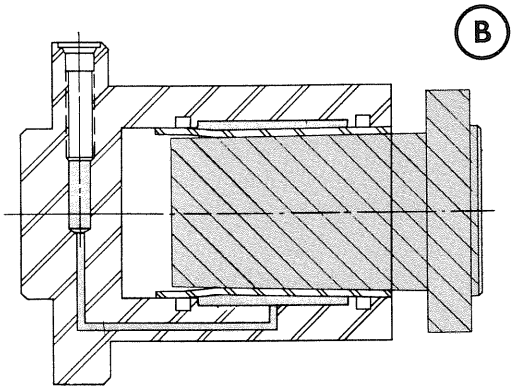




Positive

Correcting for Taper

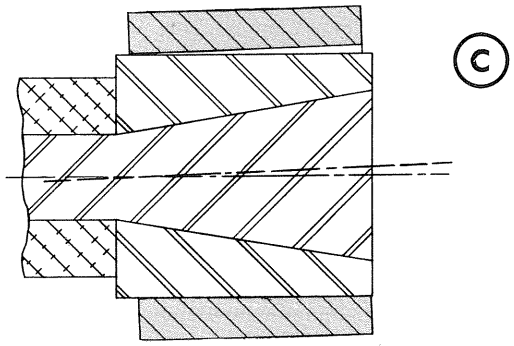


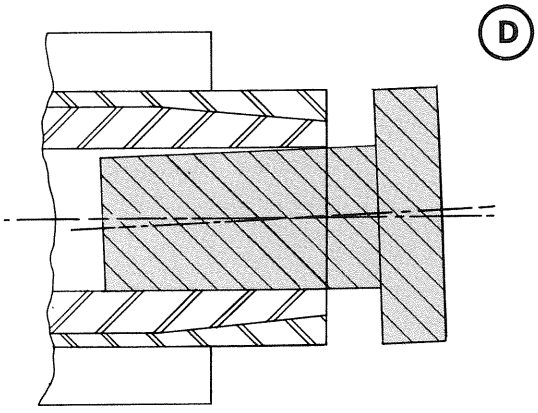


Drawings (A) and (B) illustrate how the gripping surface of hydraulically expanded arbors and chucks conform to the chucking surface of the part. Uniform hydraulic pressure assures part positioning on the true centerline, compensating for allowable taper. For example a part with a .002 tolerance on the chucking diameter could have a possible .002 taper, and still be within the allowable part tolerance. Subsequent machining operations from this chucking surface using Davis hydraulic tools, eliminates possible stack up of "in-tolerance" part variations which could result in scrap or marginal quality.

To hold non-critical part chucking diameters completely free from taper, or to very close size limits to facilitate holding related concentricity and squareness requirements, adds unnecessarily to production costs.

Maximum gripping power is always effective, irrespective of taper within the allowable part tolerance.





OUT-MODED CHUCKING METHODS

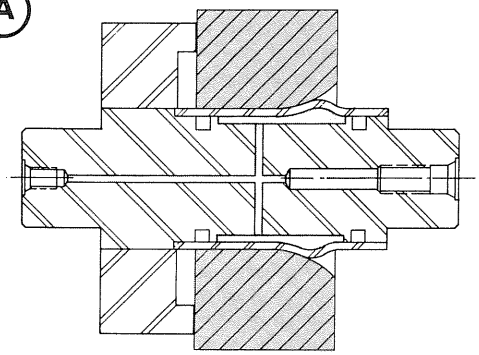
Conventional mechanical type arbors and chucks depend on metal to metal line contact on the chucking surface of the part. The gripping or chucking surfaces of mechanical chucks do not compensate for "in-tolerance" part taper. In Examples (C) and (D) chucking on the true part centerline is restricted by the minor diameter of the taper in the case of an arbor, and the major diameter of the taper in the case of a chuck. Part movement and vibration is likely as maximum gripping force cannot be equalized on the full locating surface of the part.

It is not unusual that a large part of the manufacturing tolerance must be allowed for the inability of conventional mechanical chucking devices to consistently locate the part accurately.

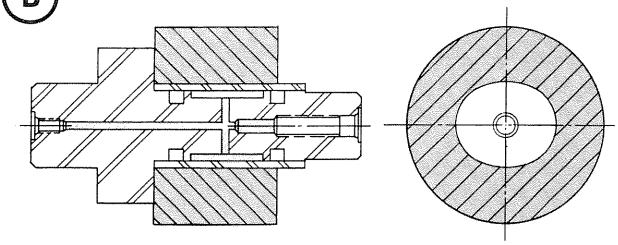
Centering

• Bell-Mouth • Out-Of-Round

(A)

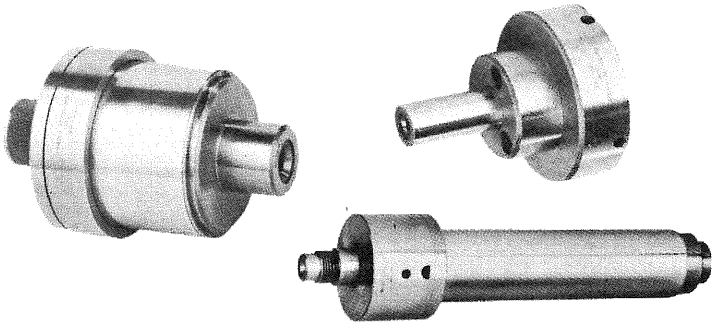


(B)



Drawings (A) and (B) illustrate how Davis hydraulically expanded arbors and chucks conform to the chucking surface of the piece part to compensate for "in-tolerance" variations such as "bell-mouth" or "out-of-round".

Where a sequence of operations are performed, locating from the same chucking surface, it is important to consistently locate the part on its true centerline. Davis hydraulic expanding tools meet this requirement.



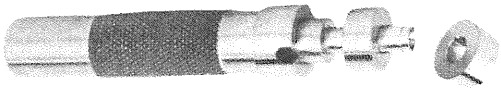
Engineering Data Required For Quoting

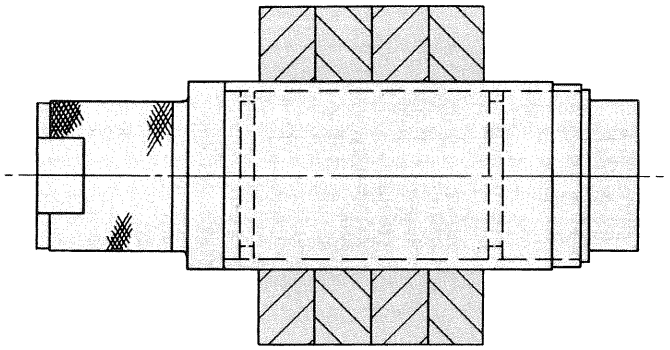
Davis Hydra-Grip arbors and chucks are custom engineered to meet your most critical job requirements. To make certain that A. G. Davis engineers have all the facts for a complete analysis...

1. Send print of workpiece or tool being chucked, showing:
   a. Chucking diameter and tolerance.
   b. Length of chucking diameter.
   c. Stop face, if any.
   d. Number of pieces to be run.
   e. Type of material.

2. Send operation sheets and number where applicable, showing:
   a. Operation(s) to be performed.
   b. Surfaces to be machined.
   c. Amount of stock removal, RPM and feed rate.
   d. Any tool or part obstructions.
   e. Cycle time of operation(s).
   f. Machining fixture, if any. Send detailed print.
   g. If arbor or chuck is to be power operated, specify size of cylinder and oil/air pressure available.
   h. If arbor or chuck is for inspection, show how it will be supported—V blocks, centers, etc.
   If for fixture, please send fixture print.

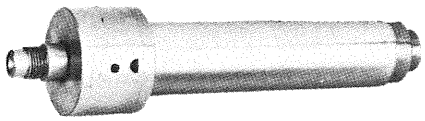
3. Specify how arbor or chuck will be secured in machine. Include make and model of machine.
   a. If spindle mounted, specify spindle size and type.
   b. If mounted to face plate or special adapter, send print.
   c. If mounted between centers, so specify.
   d. If otherwise mounted, specify and send print or sketch.

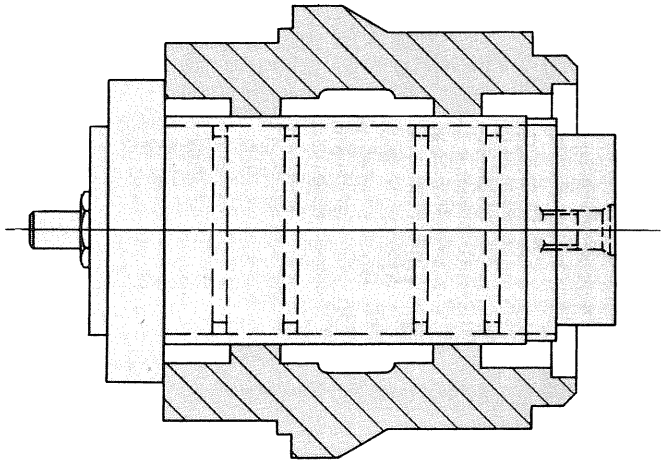




● MULTIPLE PART CHUCKING

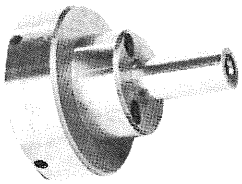
Considerable economy may be effected by machining several parts simultaneously using Davis hydraulic chucking devices. Chucking diameters may vary within the established part print tolerances. All pieces will be positively gripped for whatever machining or inspection operation is required.

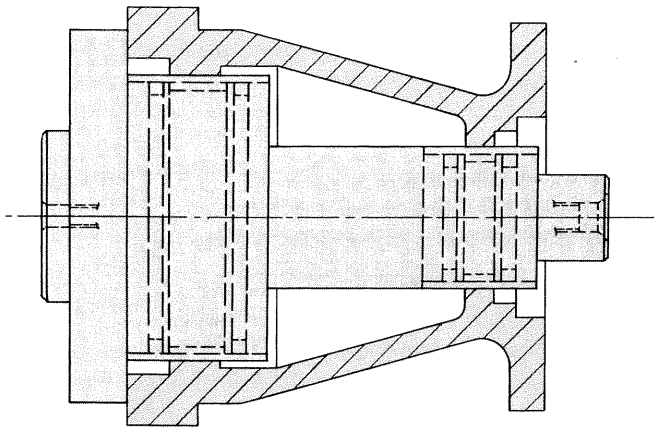




● INTERRUPTED-BORE CHUCKING

Chucking parts with an interrupted bore having short bearing areas, can best be accomplished using Davis hydraulic arbors. The hydraulic system assures uniform concentric expansion under equalized pressure at both chucking surfaces. Variation of bore diameters, within part tolerances, will not affect accurate positioning of the part on the true centerline of the interrupted bore.





● TWO DIAMETER CHUCKING

Chucking parts locating in two different bore diameters is often necessary. Length of either bore may be too limited to locate the part accurately for machining from a single bore. Both chucking diameters are expanded concentrically to position the part on the common centerline of both bores.

PRECISION
SPLIT-SLEEVE ADAPTERS

FIG. 1

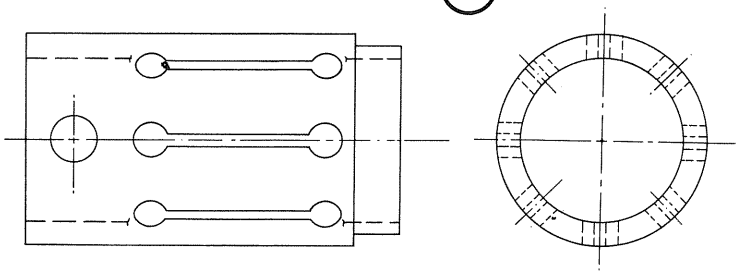
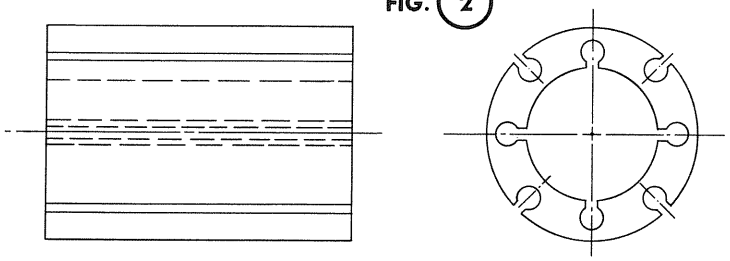


FIG. 2



Figures (1) and (2) illustrate typical split sleeve adapters.

Where expansion is required beyond the range of solid steel sleeves, use of split sleeve adapters may be recommended.

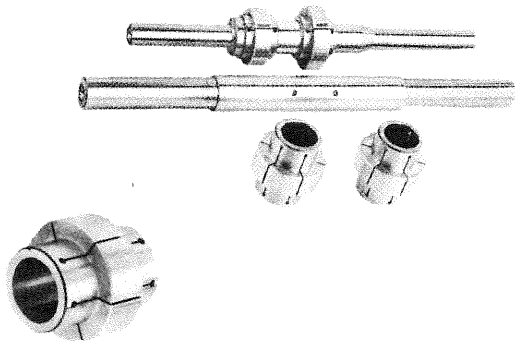


FIG. 3

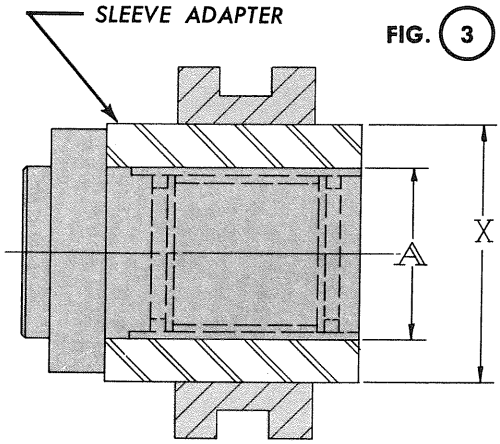


Figure (3) illustrates how chucking diameter (A) may be extended by adaption of a split sleeve, to chuck part having (X) chucking diameter. The tolerance on (X) diameter must in this case be equal to, or less than part tolerance on (A) diameter.

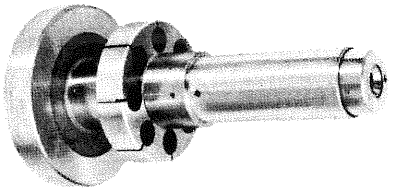


FIG. 4

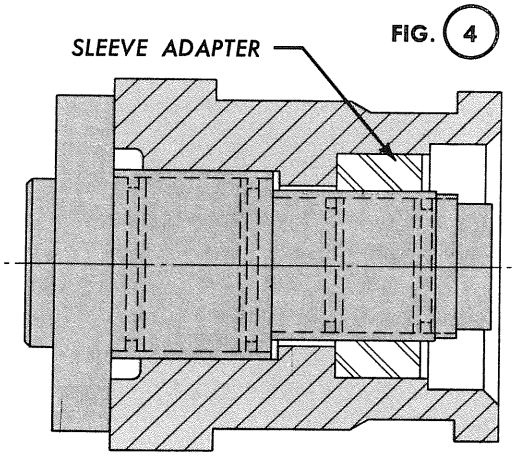
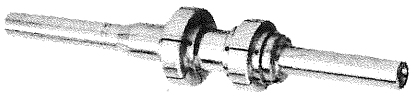


Figure (4) illustrates the use of a separate split sleeve adapter where restricting factors make it otherwise impossible to chuck in two bores.

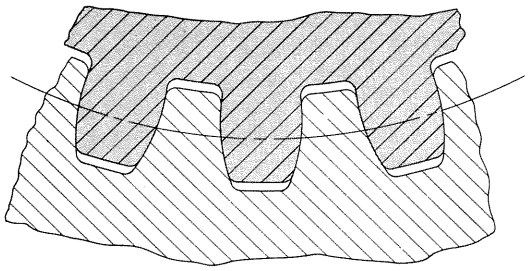


INVOLUTE CHUCKING

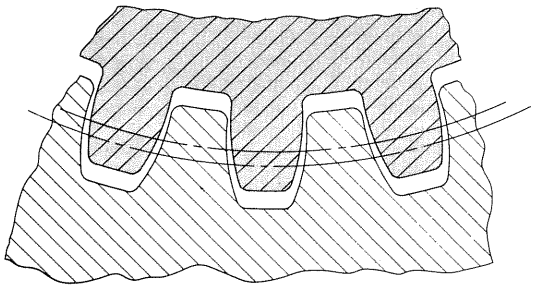
- **INTERNAL**
- **EXTERNAL**

SPUR OR HELICAL GEARS
SPLINES
SERRATIONS

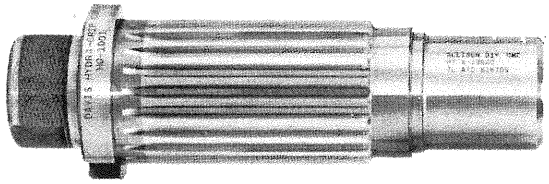
Davis hydraulically expanded arbors and chucks have proven to be the most accurate method for locating parts on the true centerline from either internal or external involute forms. Visualize a "GO" spline gage expanding each tooth radially from center and you will conceive the basic principal upon which Davis hydraulically expanded involute arbors and chucks function.

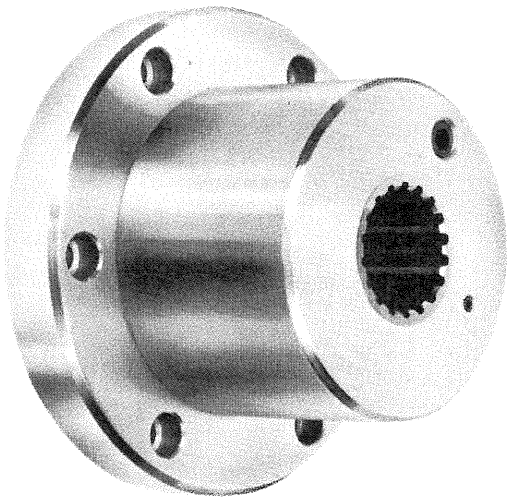


INVOLUTE TOOTH FORM EXPANDED



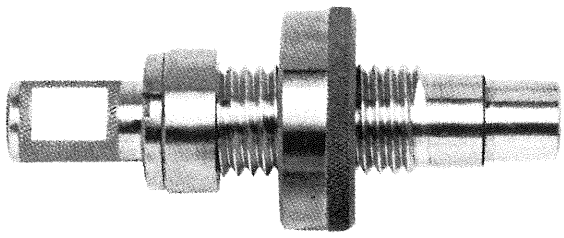
INVOLUTE TOOTH FORM RETRACTED





CHUCKING THREADS

- **INTERNAL**
- **EXTERNAL**



Davis hydraulically expanded thread arbors and chucks make possible true chucking on the thread P.D. The principal of operation is to expand a "GO" thread form radially from center to compensate for the thread tolerance.