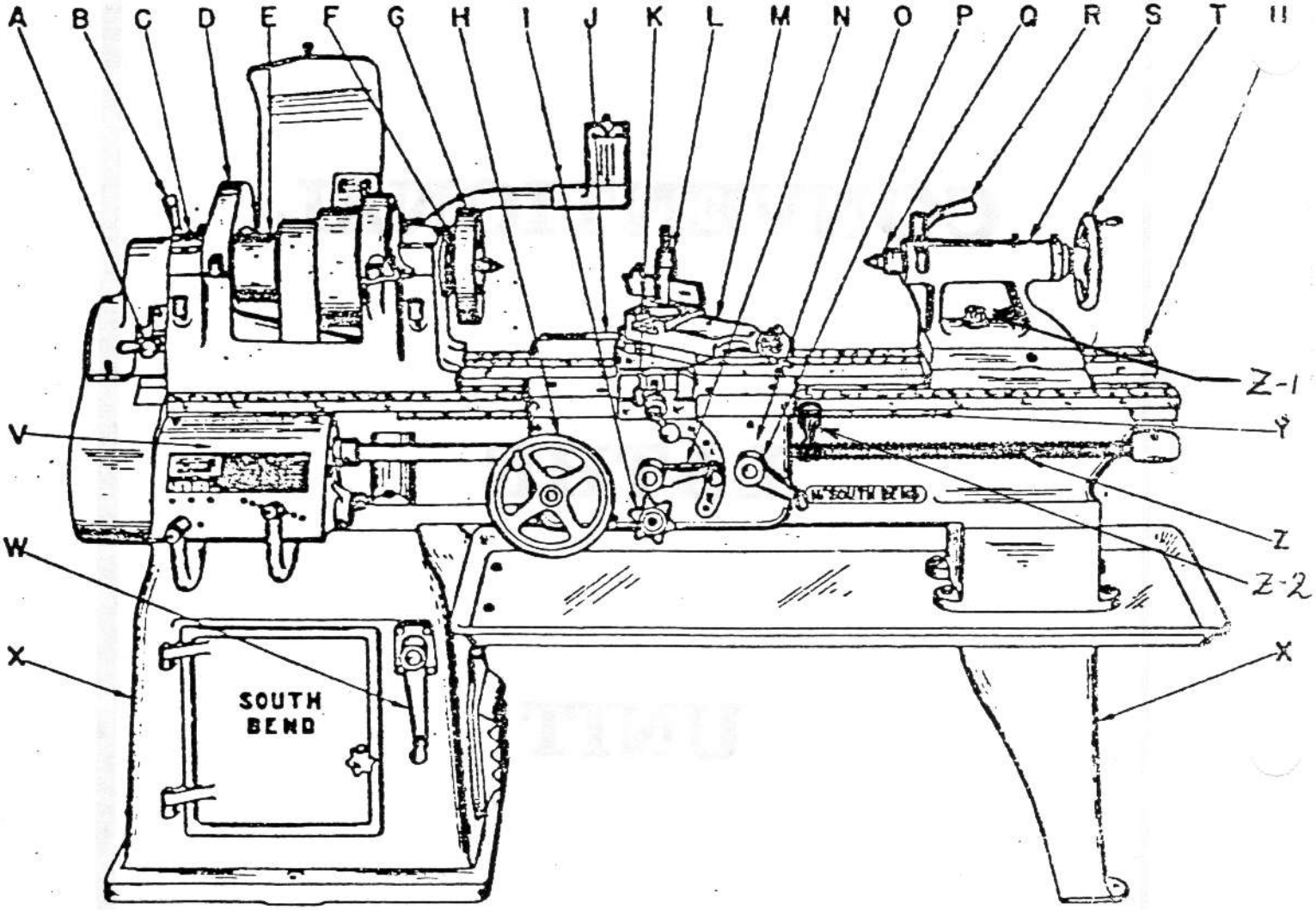
CONVENTIONAL

LATHE

UNIT



PRINCIPAL PARTS OF LATHE

NAME _____ DATE _____ PERIOD _____

A	FEED REVERSE LEVER	J	SADDLE	S	TAILSTOCK
B	BACK GEAR LEVER	K	CROSS SLIDE	T	
C		L	TOOL POST ASSEMBLY	U	WAYS
D		M	COMPOUND REST	V	QUICK CHANGE GEAR BOX
E	CONE PULLEY	N	FEED SELECTION LEVER	W	BELT TENSION
F		O	APRON	X	
G	FACE PLATE	P	HALF NUT LEVER	Y	RACK
H	HAND WHEEL	Q	DEAD CENTER	Z	LEAD SCREW
I	FRICTION CLUTCH LEVER	R	TAILSTOCK SPINDLE CLAMP	Z-1	TAILSTOCK CLAMP
				Z-2	CHASING DIAL

CONVENTIONAL ENGINE LATHE

For Quiz Purposes:

Read Units 33, 36, 37, and 38 (also 9-5 to 9-10), handouts and demonstration notes.

Definition:

Function of a Lathe: A stationery single pointed tool bit is fed against a revolving workpiece.

Background:

The engine lathe was first designed and developed by Henry Maudslay in 1794. John Wilkinson improved the lathe for boring purposes in 1796 for James Watt and his steam engine. Maudslay's adaptation of the lead screw to his lathe in 1810 made it possible to begin producing engine lathes and other machine tools. The first "engine" lathes in large production shops were driven by a single steam, water, or diesel powered engine found in the corner or outside the machine shop. The power was usually transmitted by pulleys and shafts overhead in the shop to the vicinity directly above the lathe. Belts would transmit the power from the overhead pulley down to the headstock spindle pulley.

Basic Orientation:

According to the location of the motor on a lathe, there are two different categories of engine lathes:

- bench lathe (motor is mounted on the bench with the lathe)
- floor lathe (motor is mounted in footing underneath headstock of lathe)

There are three major sections of an engine lathe:

- headstock (to the operator's left)
- tailstock (to the operator's right)
- carriage (between the headstock and tailstock)

There are four different systems of driving a lathe from the motor to the headstock spindle:

- flat belt
- "V" belt
- geared head
- variable speed
    - mechanical (using a cam working against a spring.)
    - hydraulic (using hydraulic cylinders to activate speed changes.)

- electrical (using different amounts of electrical current to provide different speeds.)

There are four different methods of holding the workpiece for turning on an engine lathe:

- Faceplate with centers and a bent lathe dog - system is old fashioned, but extremely accurate.
- 3 jaw universal chuck - as the chuck key is turned, all jaws move. Most chucks are accurate within .003 - .005 of turning round. This chuck can be used for holding cylindrical and hexagonal material for machining.
- 4 jaw independent chuck - as the chuck key is turned, only one jaw moves. This chuck with the aid of a surface gauge and indicator can be adjusted to turn within .0005 with a little time and effort. Therefore it is extremely accurate. It can be used to hold irregular and square objects for machining.
- Collet Chuck - Will turn a cylindrical part very accurately, but slips easily.

Parts of Engine Lathe:

Feed Reverse Lever - Three Positions - Determines the direction of rotation of the Lead Screw; therefore, it determines the direction of "X" and "Z" axis movement on the carriage.

Back Gear Lever - Two positions - This lever or knob with the aid of a separate pin allows for the Back Gear (reduction gear) system to be engaged for **slow spindle speeds** that are used for knurling, threading, and parting operations.

Cone Pulley - Three or four steps - This allows for either six or eight spindle speeds. Each step will provide a speed in "Open Belt" and "Back Gears."

Face Plate - Used in conjunction with a **bent lathe dog**, and **dead centers.** It can be used to bolt irregular shaped castings to its surface for machining or turning a part between centers.

Hand Wheel - Used to move the Carriage in the "Z" direction manually.

Friction Clutch Lever - A lever to control one of two power feeds systems on a lathe. The friction feed system will slip as it is being used. This works in conjunction with the Feed Reverse Lever and the Feed Selection Lever. It is the most common feed system used on the lathe for all operations **except threading.**

Saddle - Heavy casting shaped like a large Roman numeral "I" that straddles the ways. It supports the Cross Slide and the Apron hangs from it.

Cross Slide - Responsible for the "X" axis movement on the Carriage.

Tool Post Assembly - Is composed of the tool post, the tool post square for extra gripping surface in the compound rest, the tool post wedge for elevation of the tool bit point to the workpiece, a choice of three tool holders, and the tool bit itself.

Compound Rest - Holds the tool post assembly. It is mounted on top of the Cross Slide. The Compound Rest has a protractor head that allows for exact angular set-ups. This is a way of machining a blunt taper, but must be fed manually as there is no power feed available to the compound rest.

Feed Selection Lever - Three positions - "Up" allows for the Carriage to move in the "Z" direction toward the headstock or away. "Down" allows for the Cross Slide to move in the "X" direction toward or away from the operator. "Middle" allows for the engagement of the half nut lever for threading.

Apron - Hangs from the Saddle and supports many of the controls for moving the Carriage.

Half Nut Lever - Two positions and is used for threading. The Feed Selection Lever must be in the middle position. Threading operations should be done in back gears so it is easier to control the threading operation.

Dead Center - Can be mounted in the headstock spindle when using a face plate; nevertheless, is most commonly found in the tailstock to support the end of a long workpiece. There are no moving parts in this unit. (There are live centers that have a ball or roller bearing as an integral part of their makeup.) Dead centers are more accurate than live centers as there are no moving parts.

Tailstock Spindle Clamp - **Do not tighten to tight** (just bump it). Prevents the tailstock spindle from backing off during operation.

Tailstock - Supports tooling such as drills, centerdrills, reams, and centers while in use.

Ways - Keep the Headstock, Tailstock, and Carriage in near perfect alignment. The heart of the accuracy in a lathe are the "ways." They should be accurate in parallelism from diagonal corners within .0002 of an inch.

Quick Change Gear Box - Determines the ratio of movement between the carriage and the spindle of the lathe. The large sized print numbers on the quick change gear box chart indicate the threads per inch that will be cut when the half nut lever is engaged. (Line up the levers to correspond with the column and file indicated. The small sized print numbers indicate the advancement that will occur if the friction

clutch system is used.

Belt Tension - Remember to release this tension lever when finished using the lathe each day.

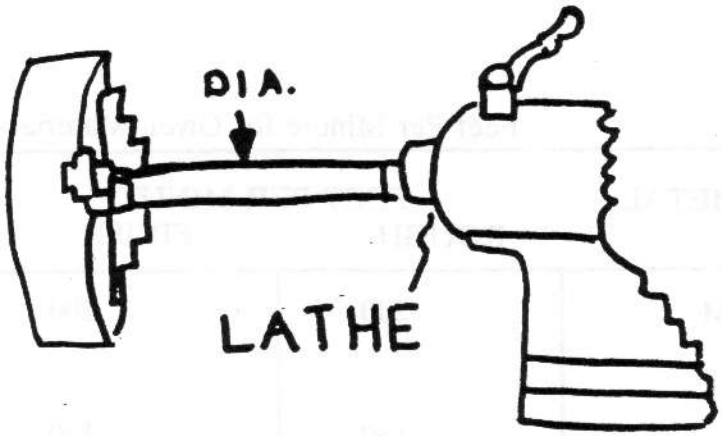
Rack - Used in conjunction with the Hand Wheel for manual "Z" axis movement of the carriage.

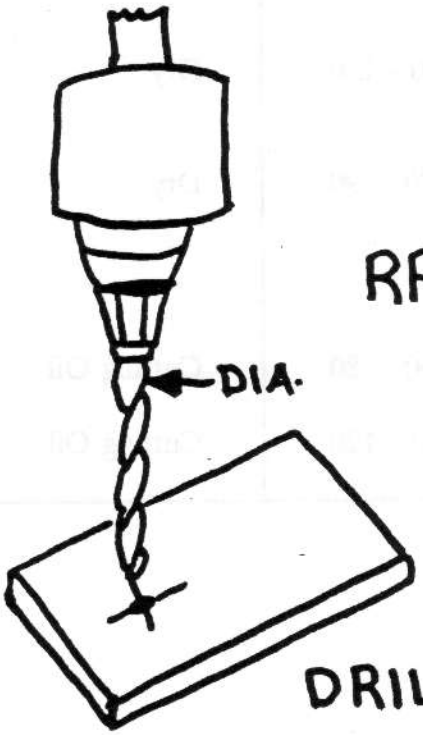
Lead Screw - Responsible for delivering power to the carriage from the quick change gear box. The direction can be reversed by using the Feed Reverse Lever.

Tailstock Clamp - Like the Tailstock Spindle Clamp - **Don't tighten to tight** (just bump the wrench or lever.)

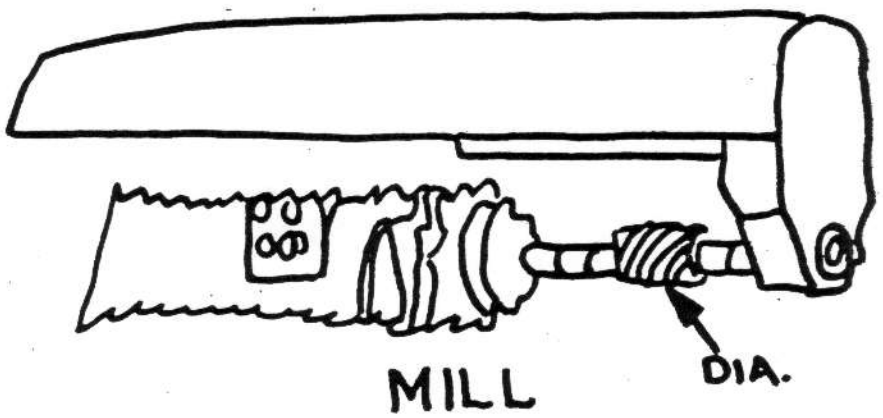
Chasing Dial - A visual way to know the exact location for engaging the Half Nut Lever for each cut during the threading operation. For even number threads (4,6,8, etc.) engage the Half Nut Lever when the chasing dial lines up on the even number - either 2 or 4. For odd number threads, engage on odd numbers, and for half threads (like 4 1/2, 6 1/2, etc.) engage on a particular half mark and that exact same half mark each repeated cutting pass.

SPINDLE SPEED=RPM





$$RPM = \frac{4 \times \text{CUTTING SPEED}}{\text{DIAMETER}}$$



Manufacturing
Level II
Mr. Cassel

Feet Per Minute for Given Material

TYPE OF METAL	FEET PER MINUTE ROUGH	FEET PER MINUTE FINISH	COOLANT
ALUMINUM	200	200	**Special Cutting Fluid sometimes - check with instructor.**
BRASS	150	150	Dry
BRONZE	100 - 150	100 - 150	Dry
CAST IRON	45 - 60	70 - 90	Dry
STEEL SAE 1020 (Coarse Feed)	60 - 80	60 - 80	Cutting Oil
(Fine Feed)	100 - 120	100 - 120	Cutting Oil

LATHE CUTTING SPEEDS

Feet per Min.	40	50	60	70	80	90	100	120	140	160	180
Diam. in Inches	REVOLUTIONS PER MINUTE										
1/4	611	764	917	1070	1277	1375	1528	1833	2140	2444	2769
3/8	408	509	611	713	815	916	1016	1212	1420	1630	1832
1/2	308	382	458	535	611	698	764	962	1070	1222	1373
5/8	244	306	367	428	489	550	611	733	856	973	1100
3/4	204	254	308	357	407	458	500	611	714	814	913
7/8	175	218	262	306	349	393	433	523	612	698	788
1"	153	191	229	267	306	344	382	458	531	612	688
1 1/8	138	170	204	238	275	305	339	407	476	544	610
1 1/4	122	153	183	214	244	275	305	368	428	488	550
1 3/8	111	139	166	194	222	249	277	332	368	444	498
1 1/2	102	127	153	176	204	229	254	305	356	408	456
1 3/4	87	109	131	153	175	196	218	262	306	350	392
2	76	95	114	138	158	172	191	229	263	305	344
2 1/4	68	85	102	119	136	159	170	204	233	272	306
2 1/2	61	76	92	107	122	137	153	183	214	244	274
2 3/4	55	69	83	97	111	125	130	168	194	222	250
3	51	64	76	89	102	115	127	153	178	204	230
3 1/4	47	59	70	82	94	106	117	141	164	188	212
3 1/2	44	54	65	73	87	98	109	131	152	174	196
3 3/4	41	51	61	71	81	92	102	128	142	162	184
4	38	48	57	67	76	86	95	114	134	152	172
4 1/2	34	42	51	59	68	76	85	102	118	136	152
5	30	38	46	53	61	69	70	92	106	122	138
5 1/2	28	35	42	49	55	62	69	83	98	110	124
6	25	32	38	44	51	57	64	76	88	102	114
6 1/2	23	29	35	41	47	53	59	70	82	94	106
7	22	27	33	38	44	49	54	65	76	88	98
7 1/2	20	25	31	36	41	46	51	61	72	82	92
8	19	24	29	33	38	43	48	57	66	76	86
8 1/2	18	22	27	31	36	40	45	54	62	72	80
9	17	21	25	30	34	38	42	51	60	68	76
9 1/2	16	20	24	28	32	36	40	48	56	64	72
10	15	19	23	27	31	34	38	46	54	62	68
11	13	17	20	24	28	31	35	42	48	56	62
12	12	15	19	22	25	29	32	38	44	50	58
13	11	14	17	20	23	26	29	35	41	46	52
14	10	13	16	19	22	24	27	33	38	42	48
15	10	12	15	17	20	23	25	30	35	41	46
16	9	11	14	16	19	21	24	29	33	38	43
17	9	11	13	15	18	20	22	27	31	36	40
18	8	10	12	14	17	19	21	25	30	34	38

DEMONSTRATION NOTES AND THOUGHTS