

INVENTING BY THE NCMR METHOD

COURSE CONTENT

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By: John R Andrew, P.E. 23 February 2011

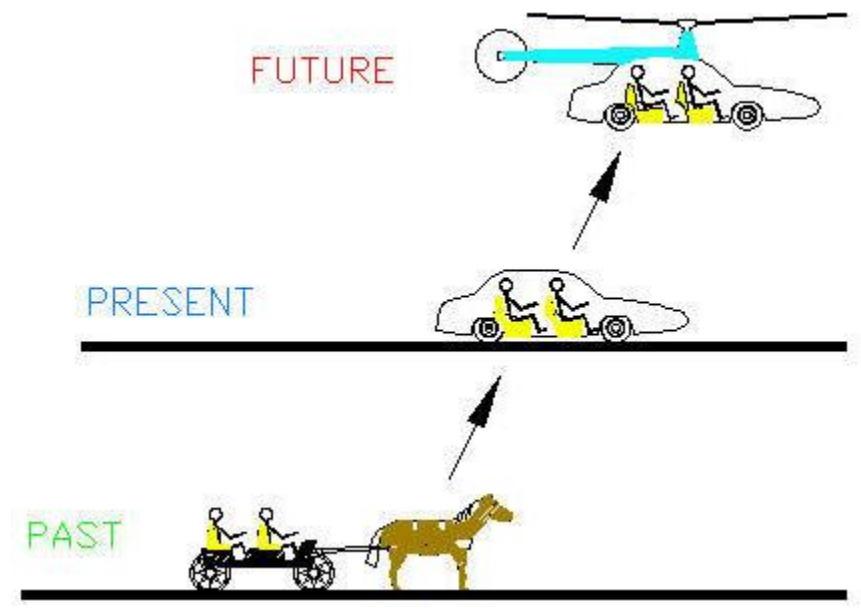
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1. Innovation Paths

I have heard that need is the mother of invention and war is the father



An innovation path is shown above: Horse drawn cart > Car < Car-Copter.
All inventions combine items that exist in the past.
Components are modified to function together in the present.
The new invention formed by this process becomes available for future use.

Almost all products and enterprises must progress along an innovation path or they will become obsolete.

Sales of the Model-T Ford dropped after 15 million were sold. All Ford cars were painted black.
Competing auto makers offered other colors, improved comfort, and reliability.

High volume standardized products can be very profitable.

The increase in cost did not prevent the public from purchasing competing products that had improved features.

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Corporations that innovate improvements to their products that satisfy the needs are usually successful.

1. DISNEY: Imagineering
2. LOWES: Improving Home Improvement
3. Proctor and Gamble 21 New Products Released in 6 Months
4. Dupont 1000's of Products Have Their Origin at DuPont
5. 3M 60,000 Products 44 Divisions
850 Products beginning with the Letter (S)
6. 11 Year old Richie Stachowski
50,000 WATER-TALKIES Invented and Sold to TOYS-R-US

7. Ford Motor Company - \$3 Billion Debit

The Ford Motor Corporation management changed their management style when they were \$3 billion in debit. Suggestions were allowed from all employees as to the design and manufacture of the new model to be called "Taurus". After implementing many of the new ideas the new Taurus changed the largest loss to the greatest profit in the company's history.

8. DANA Corporation

The Dana corporation has 80,000 employees and each is requested to give 2 new ideas per month. 80% of the suggestions are implemented resulting in improved quality, quantity, and profitability.

9. The president of the United States has urged industry to innovate and develop new energy sources for cars and trucks.

2. The First Inventions

The history of innovation, in any area, reveals the method of innovation.

Primitive people were inventive when they chipped one stone against another to form cutting tools.

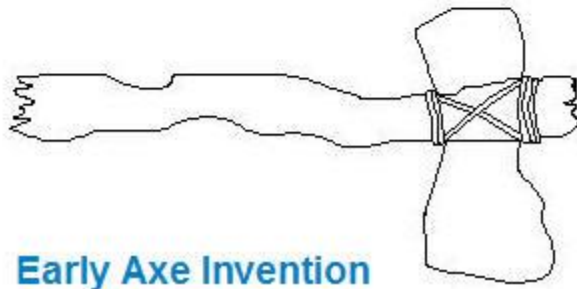
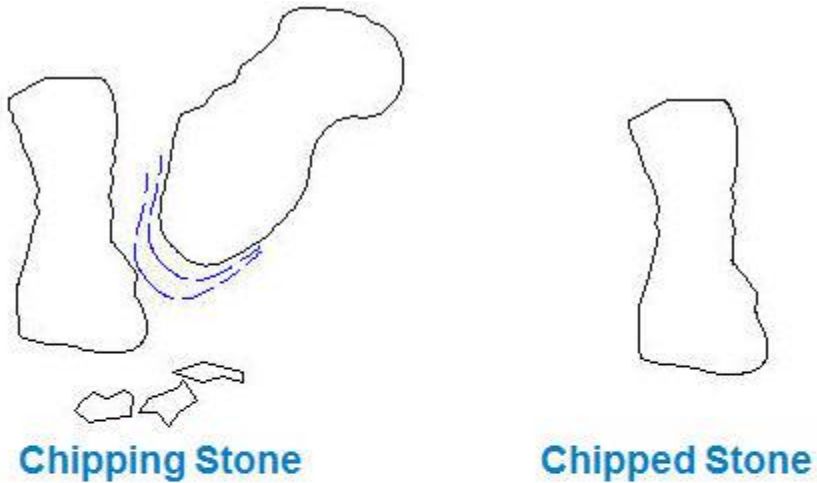
They Combined two rocks together and Modified them to become a new invention.

In this case a cutting tool. The cutting tool could be used to remove a branch from a tree.

The branch was Modified, using the new cutting tool, to form a club.

The club satisfied the Need for a weapon to kill game for food.

The cutting tool could then be used to Modify the hide of animals to form clothing and leather thongs, two more inventions.



The club was Modified by splitting it at one end, and the sharp rock Combined with the club by inserting it into the split end and secured with the leather thongs to form an axe.

As more inventions were created, so more items could be Combined and Modified to form more inventions.

Today we have many millions of items that can be Combined and Modified to function together and unnecessary parts Removed to form new inventions that satisfy Needs.

3. Recent Inventions

The innovation path from chipping stones to laser surgery is one of increasing complexity. Compare the simplicity of the horse driven carriage with the modern computerized automobile that communicates with satellites to obtain a moving map location display on the dashboard.

There was a **Need** to draw water from a well.

Below generic manual water pump is illustrated with a handle at the top connected to a piston in a cylinder that is immersed in water at the bottom end.

Water is lifted as shown on the right of this diagram when the pump handle and piston are raised creating a vacuum above the water.

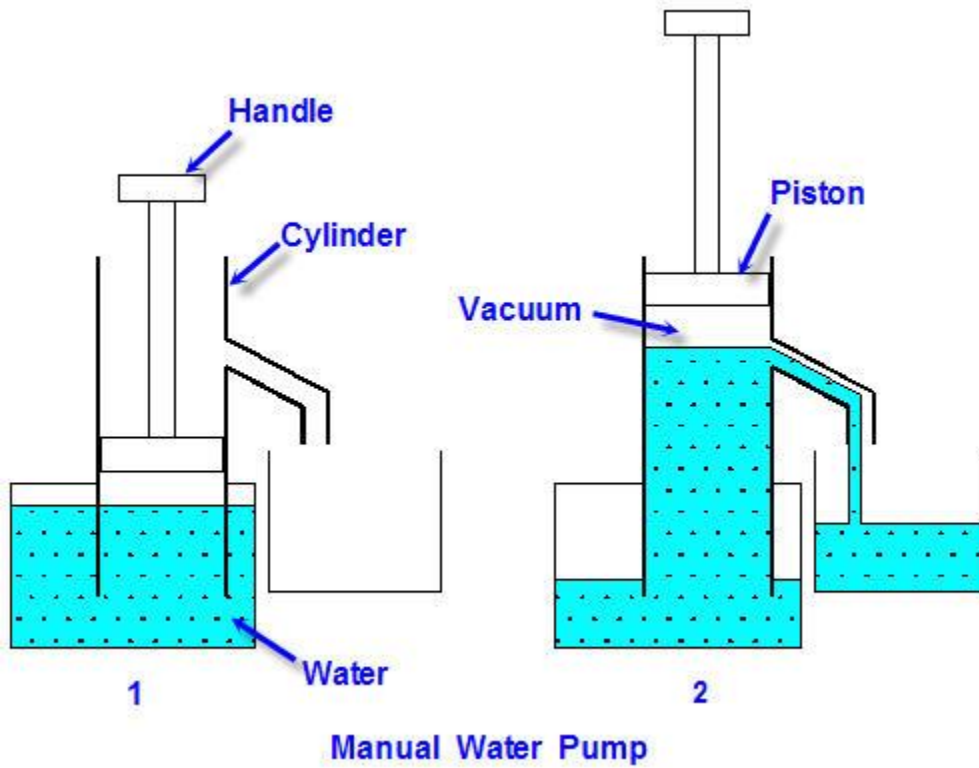


Diagram (1)

Water above the discharge spout pours out under the force of gravity.

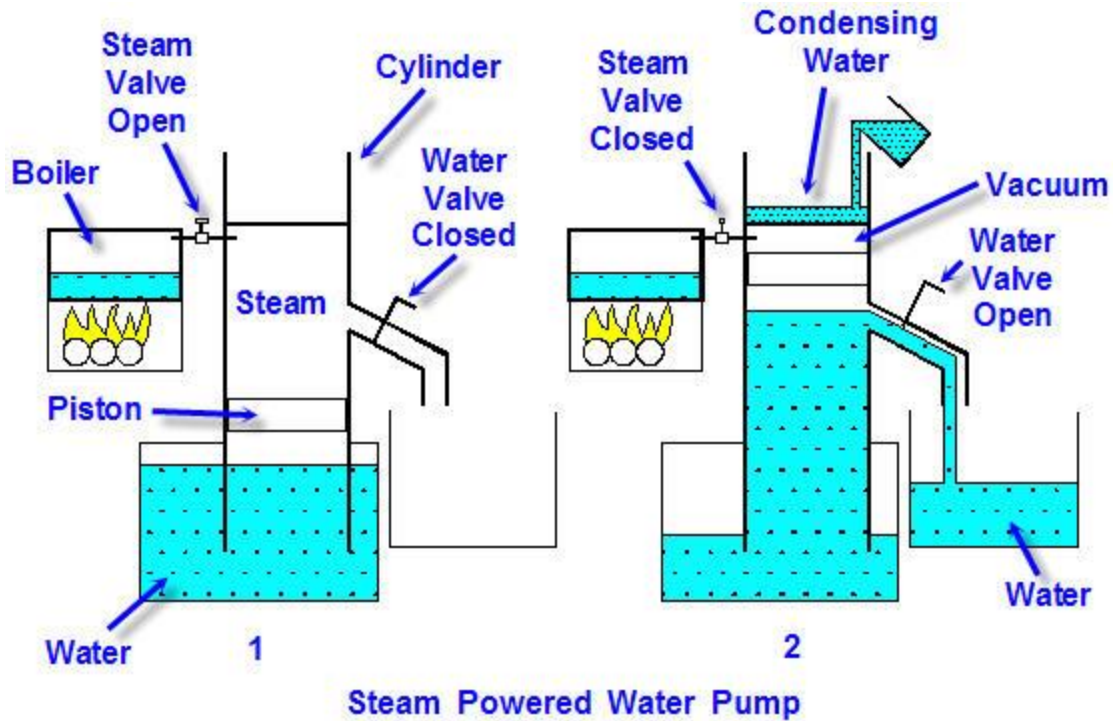


Diagram (2)

A steam powered water pump. Burning wood or coal fuel provided the heat energy to boil water creating pressurized steam in an external boiler.

Eventually there was a **Need** to pump huge quantities of water out of the coal mines.

On the left diagram the valve in the pipe between the boiler and the cylinder is open and steam pressure has forced the counter balanced piston down.

In the right diagram the steam valve is closed and cooling/condensing water creates a vacuum above the piston causing it to rise. The vacuum created allows the water to rise by the force of atmospheric pressure.

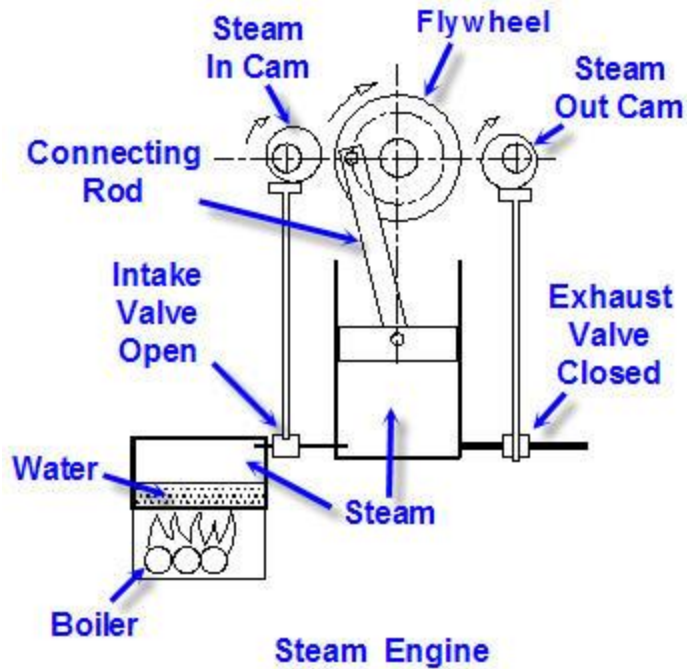


Diagram (3)

The steam engine was invented by James Watt in 1800. The steam engine has a piston in a cylinder connected by a pipe with a valve to a boiler similar to the steam driven water pump.

There was a **Need** to rotate the wheels of trains and ship propellers.

However the connecting rod from the piston is now pivotally attached to a rotating flywheel.

Cams on the flywheel shaft push valve rods up and down opening and closing the inlet and outlet valves each rotation cycle.

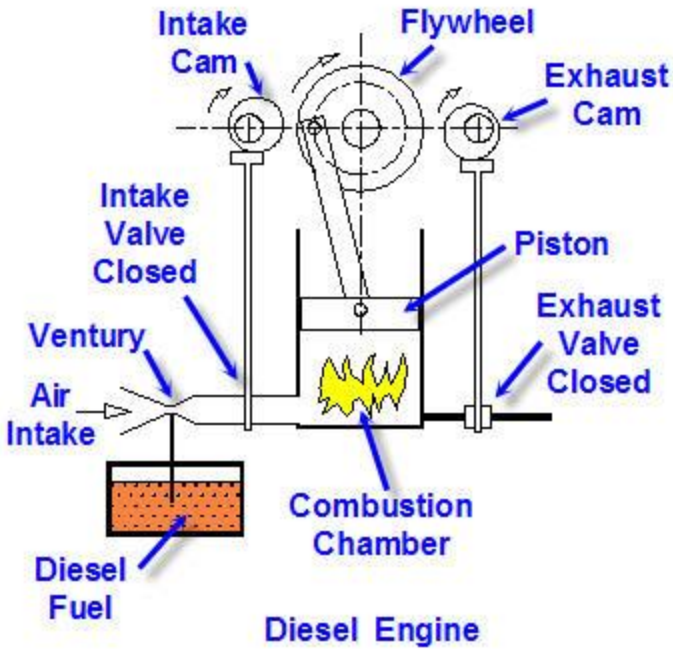


Diagram (4)

Rudolf Diesel published a paper describing an engine with combustion within a cylinder, the internal combustion engine and in 1894 filed for a patent for his new invention, dubbed the diesel engine.

Diesel saw a need for individual craftsmen to have a motor to drive their machine tools. By 1898 he was a millionaire because his engines were used to power automobiles, trains, and ships.

The diesel engine is a modified steam engine. Air and diesel vapors are drawn into the cylinder by the vacuum created by the rising piston.

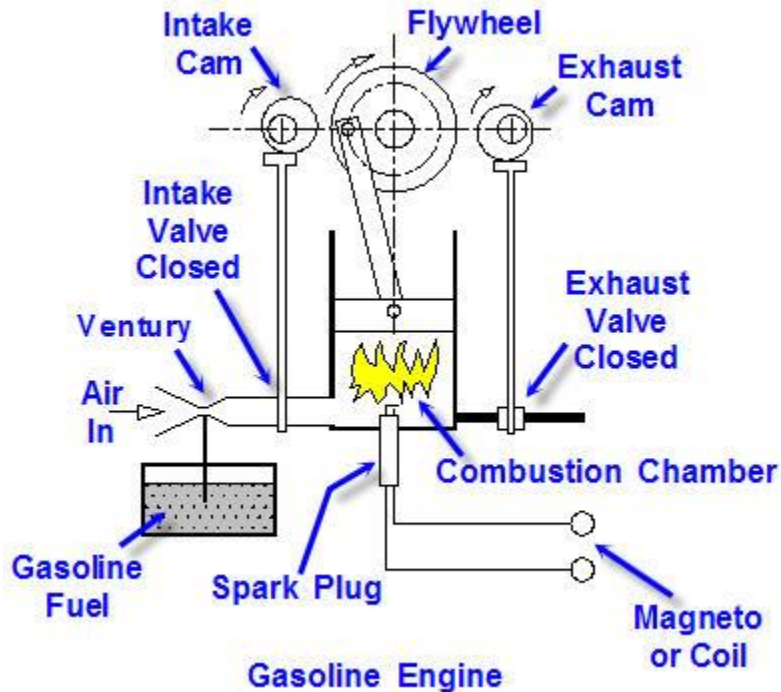
The rotating potential energy in the flywheel forces the piston down, compressing the air and diesel vapor.

The compression was sufficient to raise the air-diesel mixture temperature above the ignition point.

The fuel exploded forcing the piston up the cylinder which rotated the flywheel.

Diagram (5)

Steam engines were used in mining operations and to power factories and required an expensive boiler.



Gottlieb Daimler in 1885 invented what is often recognized as the prototype of the modern gas engine - with a vertical cylinder, and with gasoline injected through a carburetor (patented in 1887).

Daimler first built a two-wheeled vehicle the "Reitwagen" (Riding Carriage) with this engine and a year later built the world's first four-wheeled motor vehicle.

The gasoline engine is a modified steam engine. Gasoline vapors are drawn into the cylinder by the vacuum created by the rising piston.

Then the rotating potential energy in the flywheel forces the piston down, compressing the air gasoline mixture.

A spark plug, invented by Edmond Burger in 1839 that could be used to light gas lamps, is used here to ignite the compressed fuel vapor.

4. From Idea to Market Place

All stages from invention idea to market place require innovation. The inventor needs to be aware of: Decision Theory, Utility, and the steps from invention idea to marketplace listed below. New products require new tools and manufacturing facilities to make them.

Decision Theory

Decision theory is based on values and probability including:

1. Stated objectives.
2. Known facts, similar systems, and data.
3. Alternate courses of action.
4. Related physical laws.
5. Analysis of individual parts of the objective.
6. Risk factors: money, time, experience, etc.
7. Math models: stress analysis, statistical probabilities, etc.
8. Comparison tables.
9. Attribute comparison factors.
10. Calculation of highest value choice.

Utility

A number of choices are given values. Utility is the ratio of the outcome value of a given choice divided by the outcome value of the base Choice A. See tables below.

Some values are:

- a. Cost in dollars.
- b. Return on Investment at the end of period of time.
- b. Useful Life in months or years
- c. Strength in lbs per square inch
- d. Endurance in stress reversal cycles to failure.
- e. Performance in: degrees centigrade, revs per minute, hp, etc.

Step 1. Idea Conception

Use the **NCMR** process specified in this document to create a new and useful, apparatus or method.

Step 2. Patent Disclosure

You or your Patent Attorney should make a search of the Patent Office files at the U.S. Patent and Trademark Office web address: www.uspto.gov to see if your invention has been patented. If not any citizen may apply for a US patent on the internet as described near the end of this document.

Step 3. Patent Protection

Write a patent specification yourself (page 91) or employ a patent attorney to write it.

The U.S. patent examiners critique applications from private individuals and patent attorneys and grant a patent or make suggestions as to corrections needed to qualify for a patent. The Patent process can take 3 years or more.

Step 4. Prototype Drawings

Make or employ a drafts person to make assembly and detail dimensioned drawings to scale of your invention.

Step 5. Manufacture Prototypes

Send copies to local machine shops and/or industrial electrical contractors to obtain their price for manufacturing a prototype (page 69).

Step 6. Manufacturing Plan

Make a layout drawing of a factory showing the: raw materials area, workbenches, machine tools, aisle ways, material handling equipment, assembly-line, and finished product warehouse for producing your invention.

Step 7. Contract out Manufacturing and Sales

Obtain a contract from a manufacturing firm to produce and sell you invention.

Bring your invention to the market place!

5. Inventions Create Wealth

All of the following inventions from the past are continuously being improved by a new army of Inventors.

Everything from the automobile to jogging shoes, are becoming more user friendly. Think about the wealth represented by the following products that came into being through the creativity of a diverse range of people.

Item	Needs Satisfied
Aluminum	Aircraft - Engines - Car Parts
Automobile & Truck	Transportation - Cargo Delivery
Battery	Car - Radio - Flashlight - Calculator - Watch Camera
	Photograph –Video
Computer	Internet - Typing - Databases - Spread Sheets - Drawings
Diesel Engine	Cars - Buses - Trucks - Ships
Electricity Generator	Lighting - Heating - Cooling
Electric Motor	Machinery - Car Starter + Power Windows & Seats
Gasoline Engine	Cars - Buses - Trucks – Boats
Heat Resistant Glass	Cookware - Chemical Industry
Laser	Measurement - Manufacturing - Surgery - Weapons
Loom	Cloth - Fabrics – Carpets
Man Made Fibers	Clothing - Aircraft - Heat / Sound Insulation
Paper	Copy Paper - Writing Paper - Book Pages

Printing Press.....Books - Education - Magazines – Newspapers
PlasticBottles - Containers - Cabinets - Furniture - Packaging
Radio.....Communication - Entertainment - News - Sports - Music
Refrigerator.....Food Storage - Food Processing
Robots.....Assemble, Weld, Paint, Test
Satellite Radio - TV - Computer - Telephone
Sewing Machine.....Clothing – Upholstery
Solar Cell.....Calculators – Roof Top Power Supply
Solenoid.....Car Power Locks - Valves
Stainless Steel.....Cutlery - Utensils - Food Processing - Chemical Industry
Steam Turbine.....Electrical Power - Trains - Ships
Telephone.....Cell Phone - Security 911
Transistor.....Radio - TV - Computer - Telephone
TV.....Communication - Entertainment - News - Sports – Music

The creativity of inventors and entrepreneurs are the root source of our wealth. Their innovations have changed the United States from a relatively poor farming country 100 years ago, into an extremely wealthy industrialized nation today.

Every: new car, cell phone, or other product sold increases wealth. Each product requires a service to sell and maintain it.

The poverty seen in under developed areas is due to the lack of goods and services found in more prosperous regions.

Millions of Model-T Fords were planned to be produced in the early 1900's but there was not enough money in circulation for people to buy them.

Henry Ford divided the manufacture of the automobile into hundreds of small operations that could be performed on an assembly line by unskilled labor. The motor company was able to show the value of cars to be manufactured in the coming years in their accounting books.

Banks provided the funds based on these numbers. More inventions manufactured by new businesses continue to generate increasing wealth.

New wealth had been created but was on paper in the accounting books of the manufacturing company.

In this way new wealth appears in the accounting books of manufacturing companies today.

Cars and other products allow a government agency to print money, loan it to banks who, in turn, loan it to industry. Some of the new currency is paid in wages to workers who use the money to buy cars and other products.

6. Money Machine

A small business of 4 friends working in a garage manufacturing the new telephone invention by Alexander Bell in 1900, would buy \$100 worth of raw materials. These workers would make, say 40 telephones during the following week and pay themselves a total of \$200 in wages.

Overhead expenses of \$100 would include the lease on buildings, the cost of tools and coal for the furnace, taxes, etc. In this case the total cost to manufacture the 40 telephones in one week is \$400, or \$10 for each phone.

The phones would be offered for sale at a price buyers were willing to pay, say \$20 each. Before the first of the phones were sold, the general ledger would show a profit of 100% and a \$400 increase in wealth on paper.

In this way new wealth appears in the accounting books of manufacturing companies today. As companies increase production to meet rising demand for products, they request loans from banks to purchase buildings, new equipment, and raw materials, increasing our nation's wealth and providing more jobs.

The manufactured goods are warehoused and distributed by other companies who buy these products at wholesale prices, mark them up, and sell at higher values to retail businesses.

This process increases the value or wealth also. Retail shops add their profit and overhead to the wholesale price, increasing total wealth once more.

Businesses of all kinds borrow money from banks in proportion to the wealth shown on their accounting books. Banks borrow money from the Federal Reserve. They pay a low interest to the Federal Reserve. Banks receive a higher interest from loans to businesses.

Undeveloped countries have a lower standard of living because they do not do what we do, invent new and improved products, manufacture, distribute, sell, and buy them in large quantities.

7. Profit Sharing

“Profit sharing, when used as a special term, refers to various incentive plans introduced by businesses that provide direct or indirect payments to employees that depend on company's profitability in addition to employees' regular salary and bonuses.”

“In the United States, a profit sharing plan can be set up where all or some of the employee's profit sharing amount can be contributed to a retirement plan. These are often used in conjunction with 401(k) plans.” (Wikipedia)

“A representative survey conducted by the Cologne Institute for Economic Research reveals that companies have implemented profit-sharing schemes mainly in an attempt to boost employee efforts, creativity and willingness to adapt. However, only 11% of companies in manufacturing and affiliated industries share their profits directly with the majority of staff.

<http://www.eurofound.europa.eu/eiro/2008/01/articles/de0801039i.htm>

“Oct. 8 (Bloomberg) -- Wal-Mart Stores Inc., the largest U.S. private employer, plans to end profit-sharing contributions in February, replacing them with matches to employee 401(k) retirement plans to bring down benefits costs.

The retailer will match contributions up to 6 percent of eligible employees' pay, according to a memo obtained by Bloomberg News. Previously, Wal-Mart automatically put up to 4 percent of pay into the profit-sharing plan, according to spokesman David Tovar.” Bloomberg,
<http://www.businessweek.com/news/2010-10-08/wal-mart-to-end-employee-profit-sharing-in-february.html>

Question: Did Wal-Mart's profit sharing contribute to the astounding success of this company?

8. The NCMR Inventing Method

As far as the author knows, it is not possible to study for a degree in inventing in the U.S. today. The NCMR method specified here is one small step toward understanding the inventing process. Inventing is the mental process which innovates:

- * using the emotion of Need,
- * Combining existing items,
- * Modifying them to fit, form and function together,
and Removing Unessential Items.

Inventing is: Need + Combine + Modify + Remove (NCMR)

Fit, Form, and Function Definitions

Fit : to conform correctly to shape or size in order to mate to adjacent objects.

Form: structure, material, surface finish and color.

Function: quality, performance, endurance.

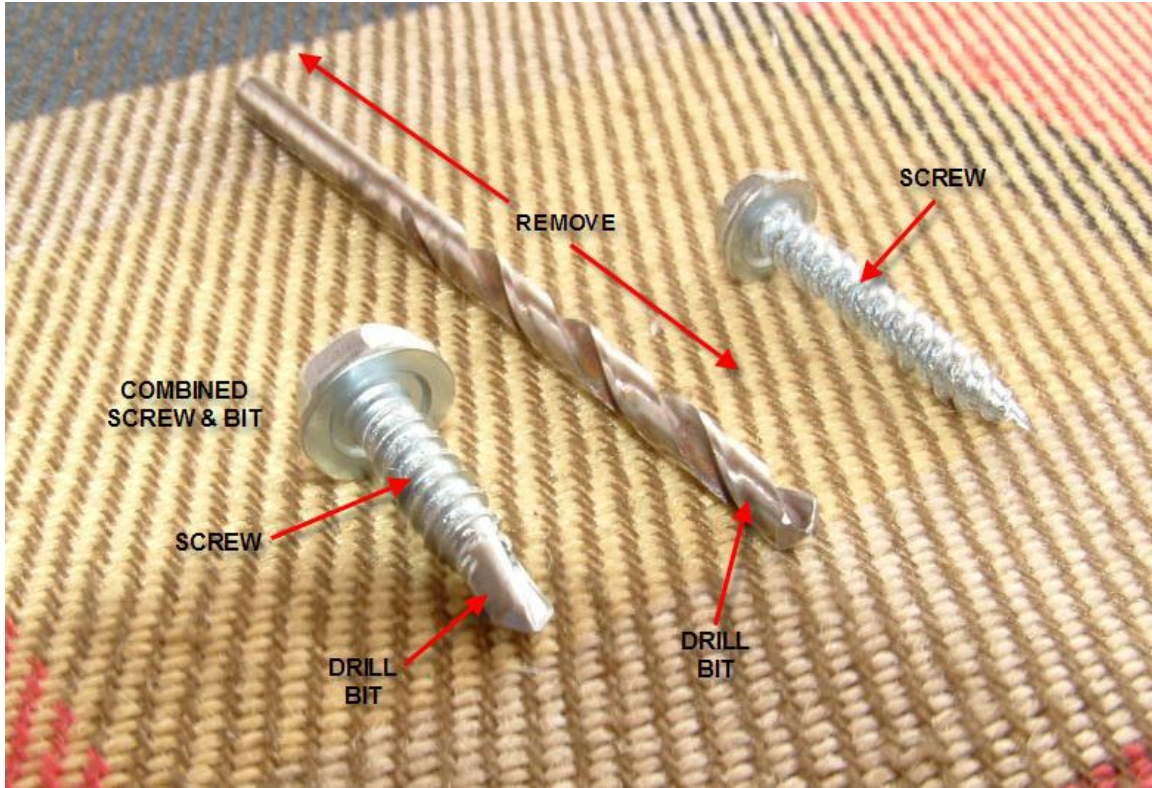
Inventors do not create something out of nothing.

Motivated by **Need** they: **Combine** existing items.

Modify the items to fit, form, and function together.

Remove unnecessary items.

Find a need and invent something that meets that need.



Screw-Drill Example

Two operations are required to fasten sheet metal roof and wall panels.

A hole must be drilled through the metals being joined with a drill bit (center).

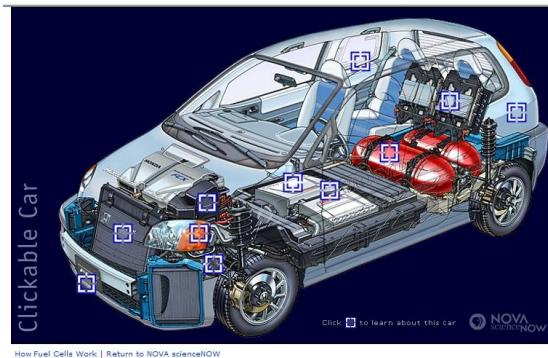
Then the screw (right) must be driven into the two parts.

The “Screw-Drill” invention (left) attaches a drill bit on the end of a screw.

This invention combines a drill bit with a screw.

Unnecessary portions of the screw and bit are removed to fit, form, and function together

INVENTING A NEW CAR



For more about the above HONDA hydrogen powered car go to the “Clickable Car” at:
<http://www.pbs.org/wgbh/nova/tech/fuel-cell-car.html>

We rely on the automobile, powered by a gasoline engine, to get us from place to place. However, the price of gasoline, which has been rising, is largely controlled by foreign interests.

Car Needs List:

1. Car that does not run on gasoline.
2. Reduced pollution.
3. Reduced noise.
4. Reduced operating costs.
5. Increased reliability.

We shall apply the **Need + Combine + Modify + Remove** method of inventing to a car that will satisfy the above needs list.

Combine a non gasoline powered engine or motor with an existing car:

1. Solar powered electric motor.

Advantage: Clean energy from the sun.

Disadvantage: Maximum solar energy is 1,000 Watts per square meter. A solar panel 3 feet square in direct sun light will drive a one horsepower electric motor. Small cars need at least 100 horsepower. This option would require 100 solar panels, each 3 feet square.

2. Ethanol power internal combustion engine.

Advantage: Energy from renewable fuel: corn, sugar beet, other vegetation.

Disadvantages: Polluting and Less energy per pound than gasoline.

3. Battery powered electric motor.

Advantages: Energy from batteries, less polluting and less noise.

Disadvantages: Batteries invented to date are heavy causing slow acceleration and limited range.

4. Coal fired boiler / steam engine.

Advantage: Energy from renewable fuel wood and other vegetation.

Disadvantages: Bulky hard to handle fuel, requires a long warm-up period, and high maintenance.

5. Nuclear heated boiler, steam turbine.

Advantage: Long lasting energy from small fuel pellets. Nuclear powered submarines and aircraft carriers.

Disadvantage: Radioactive, health hazard.

6. Linear magnet powered car driven on rails.

Advantages: Vehicles running on rails can travel at higher speeds and can be automated.

Disadvantage: High cost of rails.

7. Fuel Cell powered electric motor driven car.

Advantage: Adequate electrical power and endless supply of hydrogen fuel in water.

Disadvantage: More energy needed to separate hydrogen from water than obtained from the hydrogen produced.

Companies and individuals have designed and built prototypes of all 7 of the above vehicles.

Best Choice is number 7.

Fuel Cell powered electric motor driven car.

The fuel cell is the best choice if a cost effective method is found to separate hydrogen from water such as solar or nuclear energy.



The GM Hy-wire Fuel Cell car is pictured above and below

Larry Burns, GM's vice president of research and development and planning, said, "We are driving to have compelling and affordable fuel cell vehicles on the road by the end of the decade. With Hy-wire, we have taken the technology as it exists today and packaged it into an innovative drivable vehicle comparable in size and weight to today's luxury automobiles.

"All of the touring sedan's propulsion and control systems are contained within an 11-inch-thick skateboard-like chassis, maximizing the interior space for five occupants and their cargo. There is no engine to see over, no pedals to operate - merely a single unit called X-drive that is easily set to either a left or right driving position."

The major automobile manufacturing companies are concentrating their efforts on:

- A. Fuel cell electric motor driven vehicles and
- B. Hybrid battery / gasoline powered cars.

The fuel cell is the only power supply that does not require oil, gasoline, or any organic fuel, if solar or nuclear energy is employed in the production of hydrogen.

9. Solving the World's Energy Needs

The worldwide demand for electrical power is expected to double between 2000 and 2020. The 377 million people in North America use 949 mega-watts of installed electrical power service or 2.52 kilo-watts per person.

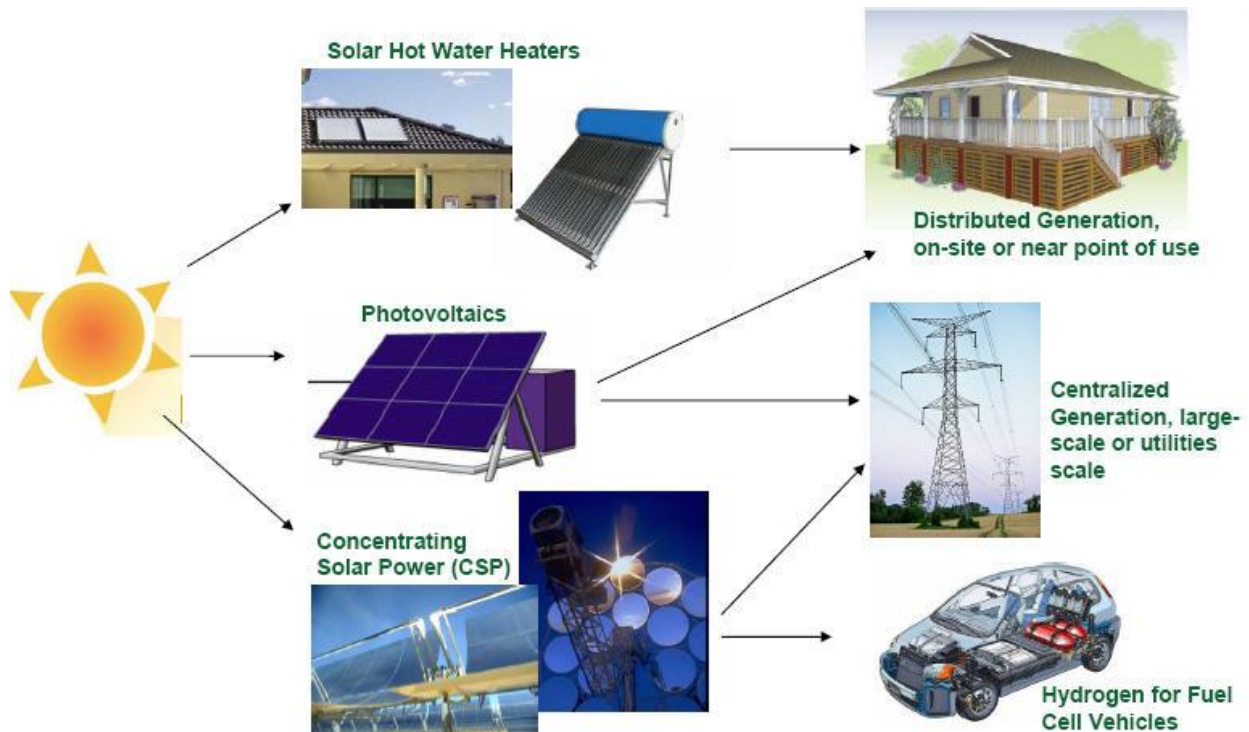
That is equivalent to a 4 horsepower engine running 24 hours a day, continuously for each man, woman, and child. Installed power service in China is much less at 0.15 kilo-watts per capita. South Asia and sub-Saharan Africa are the least with 0.09 kilo-watts per capita. (Data is based on the year 2000).

Solar Energy - Renewable, Clean, and potentially Low Cost

Most countries have enough solar energy to meet their heating, cooling, and power needs.

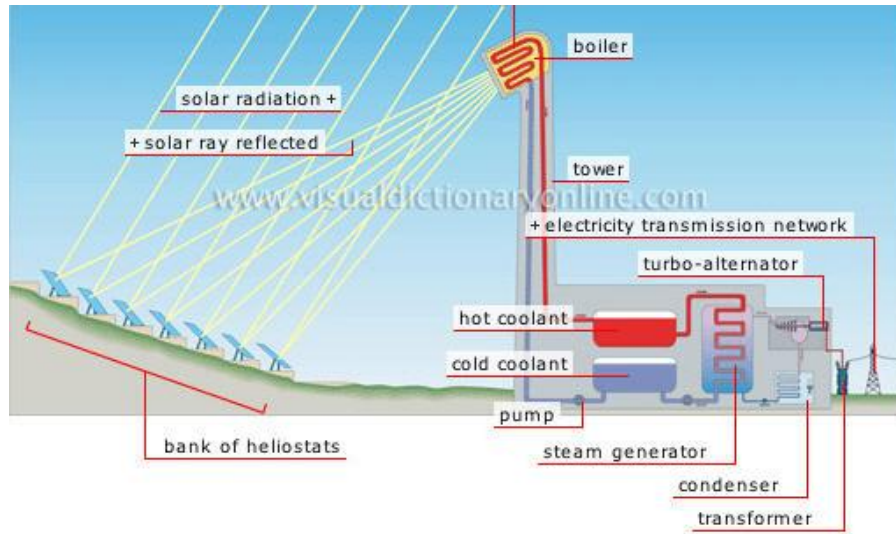
A pilot solar electric generating plant has been invented, built, and operated in the United States. Many mirrors, each mounted on computer controlled gimbals, track the sun as it moves across the sky and focus the heat radiation onto a steam turbine system that powers an electricity generator. Unfortunately the engineering and equipment proved to be too expensive. The cost of electricity from this system would not be competitive with existing systems.

DOE SOLAR ENERGY:



http://www1.eere.energy.gov/solar/solar_america/pdfs/solar_energy_comp_overview_0807.pdf

DOE's Solar Program's high-performance and cost-competitive solar energy systems.



Concentrating Solar Power

Mirrors focus solar radiation to heat fluids that are used to drive electric generators.



For more about the above: www.tawafoundation.com

A small part of Texas would be able to supply the total energy needs for the continental United States. Solar energy captured with concentrating mirrors can be stored for distribution at night several ways. Pumping water up a mountain, storage batteries in every home, etc.

There is an urgent need for someone to invent and continue the development of low cost domestic solar energy systems.

10. World's Greatest Needs

Inventions in the past: the wheel, wonder drugs, the computer, etc. have improved the quality of life for many. However there is room for much more improvement.

Social and material needs of today can be satisfied by innovations

A prosperous economy

Find cures for diseases.

Build strong families

Reduce crime.

Improve education

Solve the world energy problem

Feed the hungry

Solve the world pollution problem

Think about the above needs.

Combine existing social systems and objects that will meet the needs.

Modify them to function together.

Remove unnecessary items.

And you will make one or more solutions.

Write a book called “Solving the Worlds Problems”

Publish your book at: www.createspace.com for under \$40 and it will be sold at www.amazon.com .

11. The professions Innovate

THINK HOW VALUABLE THE PROFESSIONS ARE

We see continuing change and improvement in the professions:

Inventor _____ **Invention**

Architect.....Buildings

Artist.....Paintings / Sculptures

Author..... Books

Banker.....Monitory Services

Chef.....Recipes

Chemist.....Chemicals

Engineer.....Buildings, Bridges, Machines, & Electronics

Entrepreneur.....Businesses

Factory Manager.....Production Systems.

Farmer.....Growing Systems
 Lawyer.....Legal Advocacy
 Mathematician.....Formulas
 Musician.....Music / Songs
 Photographer.....Still and Motion Pictures
 Psychologist.....Mental Therapies
 Physicist.....Theories of the Universe
 Poet.....Poems
 Politician.....Social Systems
 Physician.....Physical Therapies
 Pharmacist.....Medications
 Tailors..... Clothing

12. Innovation Area-1, FOOD

1. Jot down on a note pad, an unsatisfied need in the above area:
2. Allow time to think of an innovation that will satisfy this need.
3. Describe the new idea with words and labeled sketches.

Possible improvements:

- * **Faster**
- * **Tastier**
- * **Healthier**
- * **More Convenient**
- * **Home Grown**

13. Combining and Modifying

Boeing Aircraft Example

- * Current high speed machining spindle speed is 15,000 revs per minute.
- * Current state of the art spindle speed is 40,000 revs per minute.
- * The Boeing Aircraft Company asked a machine tool manufacturer to build a Hyper Machine tool with a spindle speed of 60,000 revs per minute.
- * The principle Modifier of the new machine tool invention is **SPEED**.

MODIFYERS

Practice applying the list of: X and Y Modifier words below to the components of the device you are inventing.

ITEM	X-MODIFIER	Y-MODIFIER
Components	Simple	Complex
Connection	Fixed	Pivot
Control	Manuel	Automated
Cost	Low	High
Device	Fixed	Changeable
Dimensions	Non-critical	Critical
Dimension Tolerance	Smaller	Larger
Direction	Forward / Backward	Up / Down
Elevation	Lower	Higher
Finish	Paint	Plate
Fit	Loose	Tight
Flow	Less	More
Force	Push / Pull	Linear / Rotary
Friction	Lower	Higher
Function	Single	Multiple
Height	Lower	Higher
Length	Shorter	Longer
Load	Smaller	Larger
Location	Internal	External
Magnitude	Small	Large
Material	Metal	Plastic
Motion	Linear	Rotary
Movement	Sliding	Rolling
Orientation	Horizontal	Angle
Parts	Join	Divide
Performance	Slow	Fast
Power	Manuel	Motor
Pressure	Low	High
Quality	Accept	Reject
Quantity	Fewer	More
Reliability	Short Term	Long Term
Shape	Flat	Curved
Side	Left / Right	Top / Bottom
Size	Smaller	Larger
Sound	Quieter	Louder
Speed	Slower	Faster
State	Stationary	Moving
Stiffness	Flexible	Rigid
Strength	Stronger	Weaker
Stress	Lower	Higher
Temperature	Lower	Higher
Time	Shorter	Longer
Torque	Lower	Higher
Weight	Lighter	Heavier
Width	Narrower	Wider

14. Modify Exercise-1

1. Select an item from the list below and improve it with one or more X or Y Modifier from the list of modifiers above:

Toaster	chair	Motor Bike
Table lamp	Chest of drawers	Car
Dining table	Dishwasher	Pick-up Truck

2. Jot down how you would modify the item.
3. Add your name and date to your, "new to you" invention.

15. Performance Modifiers

The inventor should know or learn the physical laws governing the functions and parameters of a new invention. These laws are defined by equations that can be calculated to find unknown parameters. Some examples are given below:

Tensile Strength = Allowable Stress x Area

Shear Strength = Allowable Stress x Area / Shape Factor

Power = Force x Distance Force moves / Time

Flexibility = Applied Force / Deflection

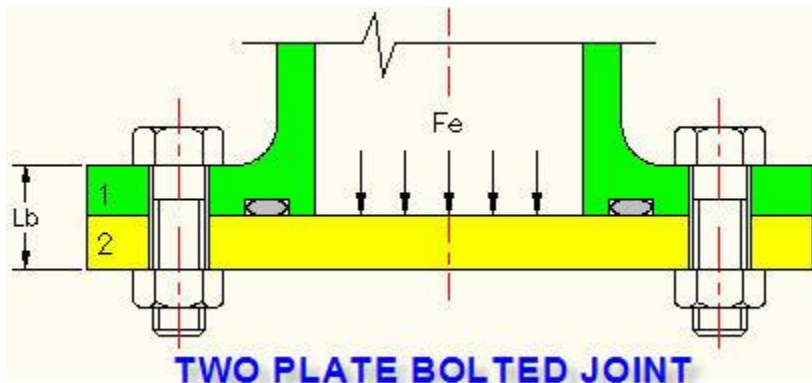
Endurance = Number of Load Cycles to Failure

Friction Force = Load on Surface x Coefficient of Friction

Temperature = Degrees Centigrade or Fahrenheit

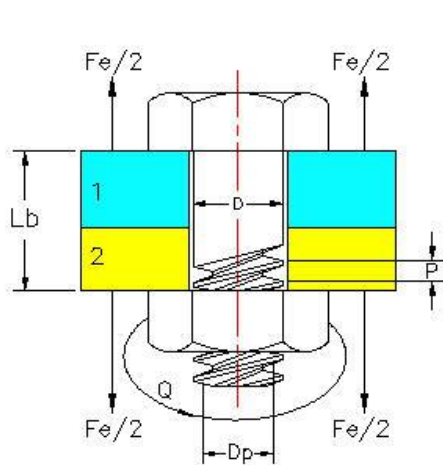
Quality = Allowable Dimensional Tolerance

Bolted Connection Example

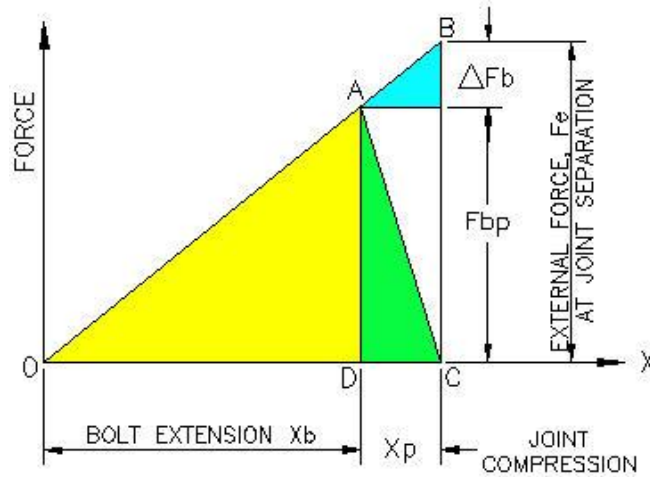


ANALYSIS OF BOLTED JOINTS

The bolts pictured above are used to secure the cover plate on the pipe flange. Pressure in the pipe is resisted by tension in the bolts. A gasket or O-ring is usually inserted between the two plates.



BOLTED JOINT



BOLT AND PLATES FORCE DIAGRAM

ANALYSIS OF BOLTED JOINTS

As the bolt above is tightened, the tension in the bolt increases, the plates compress, and the extension of the bolt increases. This is represented as line OAC in the graph above.

The joint plates are compressed along line CA.

If nut tightening is stopped at A, the preload tension in the bolt, F_{bp} will equal the compressive force on the connected plates. At point A, bolt elongation is X_b and the compression of the plates is X_p .

As long as the bolt and plates are elastic, they act as springs with stiffness K .

The nut is turned until bolt tension, F_e is equal to the load required to separate the joint plates.

The calculations below may be copied and pasted into an active spreadsheet that will perform the calculations automatically.

	Input	
Guess bolt preload per bolt, F_{bp} =	8699	lbs
Bolt nominal size, D =	1.000	in
Bolt stress area, $A_b = A_s$ =	0.7854	in ²
Bolt allowable tensile stress, St_a =	40	ksi
Bolt modulus of elasticity, E_b =	29000000	psi
Plate 1 thickness, X_1 =	0.500	in
Plate 2 thickness, X_2 =	0.750	in
Modulus of elasticity of plate-1, E_1 =	29000000	psi
Modulus of elasticity of plate-2, E_2 =	29000000	psi
	Calculation	
Plate effective area, A_p =	$3.1416 * (1.5 * D)^2 / 4$	

	=	1.767	in ²
Plate-1 stiffness: K1	=	E1 * Ap / X1	
	=	102494700	lb/in
Plate-2 stiffness: K2	=	E2 * Ap / X2	
	=	68329800	lb/in
	1 / Kp	= 1 / K1 + 1 / K2	
	=	0.00000002439	
Stiffness of 2 plates, Kp	=	40997880	lb/in
Compression of 2 plates, Xp	=	Fbp / Kp	
	=	0.000212	in
Bolt length, Lb	=	X1 + X2	
	=	1.250	lb/in
Bolt stiffness, Kb	=	Eb * Ab / Lb	
	=	18221280	lb/in
Bolt extension, Xb	=	Fbp / Kb	
	=	0.000477	in
Bolt load for joint separation, Fe	=	Fbp * [(Xb + Xp) / Xb]	
	=	12566	lbs
Bolt tension stress, Sb	=	Fe / Ab	
	=	15999	psi
Safety factor, SF	=	Sta / Sb	
	=	2.50	

Some advantages of spreadsheet calculations over hand written include:

1. easier to read.
2. better recall from archives.
3. greater accuracy.
4. faster with repeat use.
5. graphs are created automatically.
6. numerous useful formulas.
7. "Goal Seek" enables optimization.
8. solve any equation with, "Solver".
9. solve sets of linear and non-linear equations.
10. calculations and graphs may be pasted into documents and slide shows.

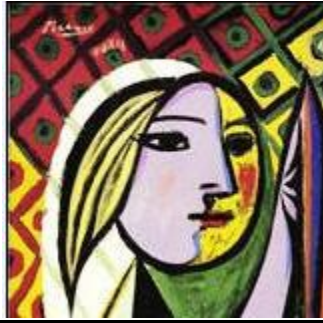
Engineering & Spreadsheet Courses Available at <http://pdhonline.org/>

Course	Title	PDH
G186	Inventing by the NCMR Method	10
G206	AutoCAD 2-D Basics	6
G209	AutoCAD 3-D Basics	8

G218	Engineering Sketching for Design and Communication	2
G230	Technology in Society	6
G235	Applying For a Patent Online	3
G236	How to Invent by the NCMR Method	4
G237	Microsoft ACCESS Database Basics	1
G280	AutoCAD Inventor - Solid Modeling, Stress and Dynamic Analysis	15
G321	Green Engineering Spreadsheets: Section-1 Insulation	4
G323	Green Engineering Spreadsheets: Section 2 - Dust and Pollution Collection	4
G350	CATIA-5 PART-A: 3D CAD, Parts, Assemblies and Drawings	8
G351	CATIA-5 PART-B: 3D CAD, Mechanisms and Finite Element Analysis	10
M236	Machine Design Excel Calculations	8
M237	Heat Transfer Excel Calculations	4
M240	Automation and Robots	5
M241	Belt Conveyor Engineering and Specification	5
M257	Metal Fatigue Excel Calculations	5
M258	Manufacturing Operations Spreadsheets	5
M259	Weldment Strength Excel Calculations	2
M260	Screw Conveyors, Feeders, and Mixers	2
M261	Jigs and Fixtures for Automation	5
M262	Bulk Material Belt Conveyor Specification	2
M263	Belt Conveyor Capacity and Power	3
M264	Excel 6-Sigma Quality Tools Part-1	8
M265	Excel 6-Sigma Quality Tools Part-2	8
M266	Excel 6-Sigma Quality Tools Part-3	8
M271	Bolted Joint Excel Calculations	3
M275	Chain Drives and Drag Chain Conveyor Excel Spread Sheets	2
M315	Bucket Elevator Excel Calculations	1
M363	Steam & Combustion Power Cycles Spreadsheet	10
M369	Earth Moving Equipment Spreadsheet Engineering Elements	4
S239	Beam & Truss Excel Calculations	5

16. Art Music and Literature

The NCMR method can be applied to creativity in; art, music, and literature.



Picasso's "Girl Before a Mirror" combines the face front with the face side.

In art as in engineering, items are combined in the creativity process.

Musicians combine words and musical notes and modify their arrangements to invent new songs.

Authors combine people, places, and things in literature and modify events to meet the need to inform and entertain.

17. Innovation Area-2 Housing

1. Jot down on a note pad, an unsatisfied need in the above area:
2. Allow time to think of an innovation that will satisfy this need.
3. Describe the new idea with words and labeled sketches.

Possible improvements:

- * Lower cost
- * Faster construction / assembly
- * Better security
- * Computerized controls
- * Lower maintenance

18. Inventions of the Future

The world needs the following inventions:

Better mobility aids for the disabled.

Bobbin-less Sewing Machine.

Phone Implants

Cost Effective Solar Energy.

Fuel Cell Powered Cars.

Light Weight Battery to Power Cars.

Low Cost Moving Map Display

Domestic Robot Butler with Vision.

Monitory System that Accommodates New Wealth

More Effective Food Quality and Safety Testing Systems

Practical Vehicle Traveling on Land, Sea, and Air.

Recycle Everything.

Self Cleaning Home, Windows, Gutters, and Cars

Sensible Toxic Waste Disposal.

Smart House.

Smarter Air-Bag.

Better Teeth whitener for general use.

19. Innovation Area-3 CLOTHING

1. Jot down on a note pad, an unsatisfied need in the above area:
2. Allow time to think of an innovation that will satisfy this need.
3. Describe the new idea with words and labeled sketches.

Possible improvements:

- * Lower cost
- * Assemble with adhesive
- * Wrinkle free
- * Fasten with Velcro
- * Rent rather than own

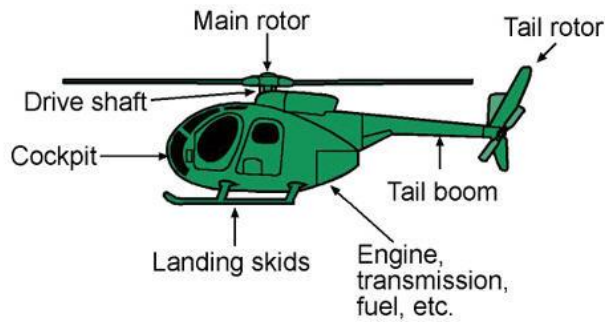
20. Car-Copter Invention

- * We have a natural tendency to put things into categories or boxes.
- * There is the car-box and the airplane-box.
- * Using the Need-Combine-Modify-Remove, **NCMR** method we begin to think outside of the box.

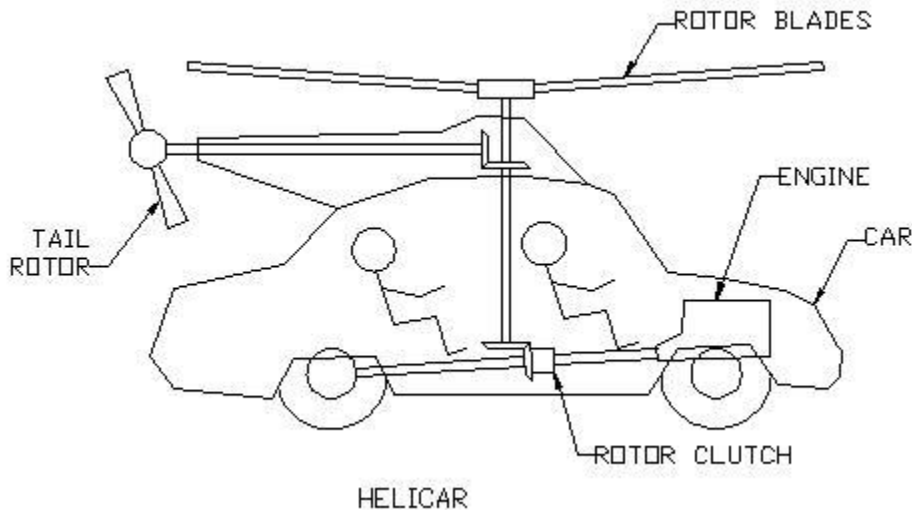
- * There is a need to drive where there are roads and fly where ground travel is not possible.
- * A car is combined with a helicopter.

The two items are modified to fit, form, and function together.

Non-essential parts are removed to invent the "Car-Copter".



The helicopter above is combined with the car below to form a new invention.



The "Car-Copter" above uses a bevel gear and rotor clutch on the car drive shaft to power the copter rotor blades. The inventor does not have to know how to engineer and design automobiles and helicopters. He can seek help from experts who may become partners in a new manufacturing enterprise.

21. Innovation Area-4 TRANSPORTATION

1. Jot down on a note pad, an unsatisfied need in the above area:
2. Allow time to think of an innovation that will satisfy this need.
3. Describe the new idea with words and labeled sketches.

Possible improvements:

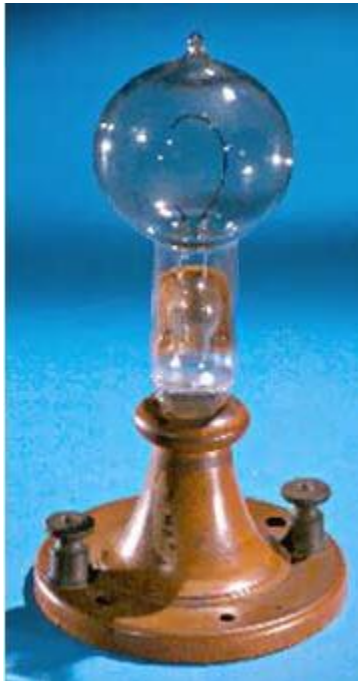
- * Lower purchase and operating cost
- * Drop-on base platform alternate body shells
- * Faster assembly
- * Better security
- * Lower maintenance

22. Thomas Edison

Thomas Edison created the electrical power industry and patented 1,093 inventions including:

- * the Light Bulb
- * Recorded Music
- * Motion Pictures

The US Patent Office (www.uspto.gov) honored Edison by using a light bulb as their logo for many years.



The above innovations have grown into multi-billion dollar industries today.

However the world's greatest inventor, Edison, did **not** know how he invented.

He wrote in his diary one Valentine's Day, "My wife Mary, dearly beloved, doesn't know how to invent worth a dam!"

If Edison knew how he invented, he would have been able to teach his wife.

His strong sense of people's needs drove him to invent.

He stated, "I want to see a phonograph in every American home".

He wanted everyone to be able to enjoy listening to music.

Edison's Business Method

The first light bulb Edison invented, required high electrical current because it had low resistance, about 2 Ohms. The first electrical system required high cost large diameter copper wires over long distances.

He allowed cost to direct invention.

Edison said he would not invent anything people would not buy.

A high resistance light bulb would illuminate connected to low cost, small diameter wires.

Hundreds of hours were devoted to testing different materials for the filament in light bulbs. Eventually, he and his three faithful associates, succeeded in making a bulb with 100 Ohms resistance, that would burn for many hours and that could be manufactured and sold at a profit.

Thomas Edison became a multimillionaire because he owned and managed the manufacture of his inventions.

In 1885, Edison was the only person in the world capable of calculating the cost of electric lighting, a fraction of one penny per hour.

He announced in a newspaper that he could illuminate a large area in Manhattan with electric lighting.

The Westinghouse Company had paid him large sums of money for his telegraph patents which he used to manufacture: dynamos, switches, fuses, light bulbs, and all equipment required for the world's first electrical power and light, distribution system.

By 1915 Edison had 3,600 workers in his factories manufacturing 30 different products with \$25 million in annual sales in the USA and Europe.

Edison's Team

Three men worked long hours for many years with Edison.

Christopher Bachelor converted Edison's sketches into patent and working drawings. John Cruzy made working models.

Edward Johnson wrote patent applications, payrolls, and contracts.

Edison's Inventing Method A

Edison's journal for 1872 has 100 sketches which developed into 34 patents that year.

Edison felt deeply that people everywhere around the world, had needs that could be satisfied by inventions. If he tried to invent something and got a mental block, he would leave it and go on to another invention idea.

He wrote in his notes, "The first thing I knew, the very idea I wanted would come to me".

Note:

* The fact that he waited for ideas to pop into his head is evidence that Edison did not know how he invented.

* I believe that most innovators do not understand the creativity process.

The Subconscious Mind

Your subconscious mind works day and night to solve your most urgent problems.

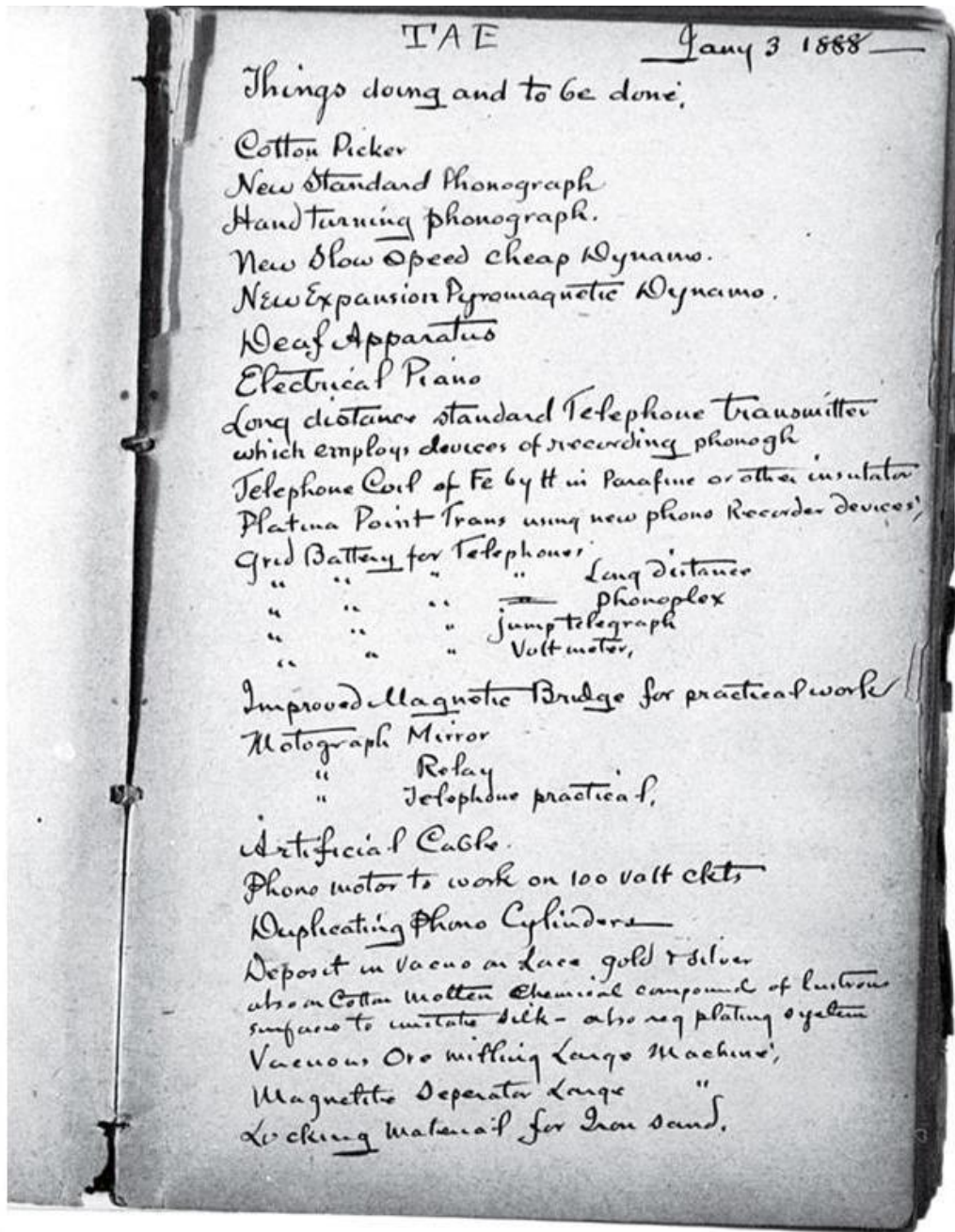
You open the door of your car and suddenly an idea comes to you.

Borrow the money you need from the equity in your home.

Your conscious mind was concerned with the immediate need to get to work on time while the subconscious found a solution to a long term need.

We should allow our subconscious mind time to process things that concern us.

The answer to a design problem will come to us when we least expect it.



One of Edison's daunting to-do lists, from January 1888

Credit: The Thomas A. Edison Papers at Rutgers University

Edison's Inventing Method B

If Edison could not solve a complicated invention problem, he would sketch a parallel device or build a model. His quadruplex invention is an example.

There was a need to transmit 2 telegraph messages from station A to B at the same time, 2 other messages were being sent from station B to A on the same wire. Edison built a model of tubes and valves that would allow pumped fluids to represent electrical telegraph signals which gave him the solution.

Edison's Inventing Method C

Cost directed research.

Andrew's NCMR Inventing Method

Inventing is: Need + Combine + Modify + Remove (NCMR)

Motivated by need the inventor combines existing items, modifies them to fit, form, and function together, and removes unnecessary parts.

23. Lessons from Past Inventors

Consider what Inventors from the past have done to improve the economy and the quality of life. What can we learn from them?

Johann Gutenberg.....Printing Press

Observed wood blocks were used to transfer designs to paper.

Learned how to cast metal while working in the Mint.

Modified wood block prints to become cast metal type.

James Watt.....Steam Engine

Combined a flywheel with Newcomen's steam pump to become the first steam engine.

Henry Ford.....Low Cost Car

Modified the disassembly line of poultry by reversing it to become an assembly line. His invention was mass production.

Wilbur and Orvil Wright.....Airplane

Combined a glider with an engine to become an airplane.

William Shakespeare.....Literature

Combined English history and stage plays.

Ludwig van Beethoven.....Music

Modified music to suite the new piano invention.

Modified the piano so he could hear it when he was going deaf.

Leonardo deVinci.....Inventor / Artist / Scientist

Modified small weapons to become large war machines.

Alexander Graham Bell.....Telephone / Sound Recorder

Modified the sounds transmitted by a telegraph transmitter to become a telephone.

George W. Carver.....Chemicals / Printers Ink / Soap / Varnishes / etc.

Modified peanuts to become 325 different chemicals.

Louis Dagurre.....Camera.

Accidentally spilled mercury onto a silver plate with silver iodide to become the first photograph.

Guglielmo Marconi.....Radio

Combined an electric coil invented by Hertz with an instrument for recording electromagnetic waves called a coherer which became the first wireless

transmitter.

Charles Babbage.....Calculator

Combined a machine with gears and punched cards to do mathematical calculations and store the information.

24. Needs

Need is the driving force behind creativity.

Maslow's hierarchy of needs is a theory in [psychology](#), proposed by [Abraham Maslow](#) in his 1943 paper *A Theory of Human Motivation*. (Wikipedia)

Physiological Needs

These are biological needs. They consist of needs for oxygen, food, water, and a relatively constant body temperature. They are the strongest needs because if a person were deprived of all needs, the physiological ones would come first in the person's search for satisfaction.

Safety Needs

When all physiological needs are satisfied and are no longer controlling thoughts and behaviors, the needs for security can become active. Adults have little awareness of their security needs except in times of emergency or periods of disorganization in the social structure (such as widespread rioting). Children often display the signs of insecurity and the need to be safe.

Needs of Love, Affection and Belongingness

When the needs for safety and for physiological well-being are satisfied, the next class of needs for love, affection and belongingness can emerge. Maslow states that people seek to overcome feelings of loneliness and alienation. This involves both giving and receiving love, affection and the sense of belonging.

Needs for Esteem

When the first three classes of needs are satisfied, the needs for esteem can become dominant. These involve needs for both self-esteem and for the esteem a person gets from others. Humans have a need for a stable, firmly based, high level of self-respect, and respect from others. When these needs are satisfied, the person feels self-confident and valuable as a person in the world. When these needs are frustrated, the person feels inferior, weak, helpless and worthless.

Needs for Self-Actualization

When all of the foregoing needs are satisfied, then and only then are the needs for self-actualization activated. Maslow describes self-actualization as a person's need to be and do that which the person was "born to do." "A musician must make music, an artist must paint, and a poet must write." These needs make themselves felt in signs of restlessness. The person feels on edge, tense, lacking something, in short, restless. If a person is hungry, unsafe, not loved or accepted, or lacking self-esteem, it is very easy to know what the person is restless about. It is not always clear what a person wants when there is a need for self-actualization.

<http://honolulu.hawaii.edu/intranet/committees/FacDevCom/guidebk/teachtip/maslow.htm>

from Psychology - The Search for Understanding
by Janet A. Simons, Donald B. Irwin and Beverly A. Drinnien
West Publishing Company, New York, 1987

25. Subconscious Computer

* If you cannot answer a question or solve a problem, give yourself time to think about it. Some people give up trying instantly if they don't know the answer to a problem.

* Concentrate more on asking questions than on finding answers. Good questions produce benefits, poor questions do not.

* Jot down your most compelling needs and look at them morning and night. Your subconscious mind works 24 / 7 searching and finding solutions to those things that concern you most.

* The subconscious mind is a vast library of valuable information. Almost everything you have seen and heard is stored there in categories. There is a place for music, motor skills, and every other talent and experience. ("Think and Grow Rich" by Napoleon Hill)

26. Innovation Blockers

Innovations in medicine and medical treatments have improved in the last one hundred years. Who would want to prevent further improvements? Here are four innovation blockers:

1. SATISFACTION: Being satisfied with the way things are.

Answer: It is good to be satisfied but other people may have needs.

2. DISSATISFACTION: Being afraid of change and disappointed with the stress of modern living.

Answer: There are people who to ride in horse drawn buggies and use no electricity in our society today. However, the majority prefer the progress achieved so far.

3. FAILURE: Having your ideas and suggestions ignored or rejected.

Answer: Study the NCMR method within this document and give yourself time to think of new ideas and improvements. It has been said that persistence is stronger than education and money.

4. PASSIVE:

Edison said inventing is 1 percent inspiration and 99 percent perspiration. Inventing and bringing a patent to reality in the marketplace takes a lot of physical and mental effort.

Please consider spending more time doing (being creative) and less time observing (passive).

<u>Passive</u>	<u>Creative</u>
<u>Drive a car</u>	<u>Build a kit-car</u>
<u>Read books</u>	<u>Write books</u>
<u>Look at pictures</u>	<u>Paint pictures</u>
<u>Listen to music</u>	<u>Compose music</u>
<u>Watch games</u>	<u>Play games</u>

27. Research

Education

Consider the vast amount of research and development that has gone into the form and function of the various elastomers:

rubber tires

adhesives

latex gloves

sealing compounds

flexible hose

vibration dampers

The governor of Michigan has appropriated funds for a \$4.6 million National Elastomer Center for undergraduate technical training for even more research and development. Surely we know everything about the science and manufacturing of elastomers don't we?

No. **We don't know everything about anything.**

Research and development must continue in all areas of human endeavor in order to improve the quality of life for as many as possible. This is one example in the field of education that demonstrates why the innovator is so vital to a society.

Industry

Consider the numbers of inventors whose efforts produced over 5,000 new computer related products displayed at the annual Comdex Exposition in Las Vegas.

One company that manufactures conveyors is adding a 200,000 sq ft research and technology center this year. If this effort to facilitate innovation is being applied to conveyors, we can be reasonably certain that similar efforts are applied to advance and improve many other products.

28. Wheelbarrow Project

Invent a better wheelbarrow



Web site for above: www.urbantilth.org

When the wheelbarrow was invented, production doubled.
One person could do the work previously done by two.

Needs satisfied by this wheelbarrow:

1. Carry material to be moved.
2. Dump material at chosen locations.
3. Contain materials to be mixed such as cement, sand, and water.

Needs not satisfied by this wheelbarrow:

- | | |
|-------------------------------------|------------------------|
| A. Move loads without lifting them. | D. Tip over stability. |
| B. Provide a place to sit. | E. Collapsible. |
| C. A cover. | F. Convenient storage. |

Invent a better wheelbarrow by Combining, Modifying, and Removing

Make a simple sketch of a, new to you, wheelbarrow invention by:

Combining: One or more wheels to increase stability of the wheelbarrow.

A larger rectangular tub.

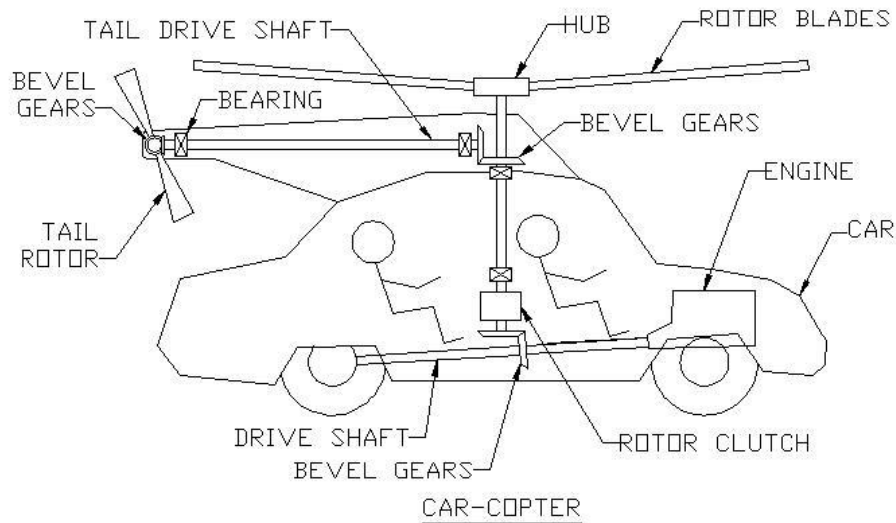
Removing: The existing tub.

Modifying: Combine the new parts to fit together.

Make a simple sketch: Combining existing items, Modifying them to fit, form, and function together, and Remove unnecessary items so that some or all of the above Needs are satisfied.

Each component in a freehand sketch of new invention idea should be labeled.

29. Sketching



Labeled Sketches

The simple freehand sketch above illustrates all the essential components of a relatively complex invention.

The components of inventions sketches should be labeled. Naming parts establishes and confirms their identity.

Each component in a freehand sketch of new invention idea should be labeled.

Inventors communicate graphically with drawings and verbally with words.

Most of the Devices invented, and in use today, have been described by drawings.

Drawings show:

Fit (size and position dimensions and allowable variations in dimensions)

Form (shape, material, and color)

Function (purpose, performance, capacity, motions, and quality)

Drawings specify the material and dimensions of each part and show how the parts fit together. Drawings are the guide needed to direct the manufacturing process.

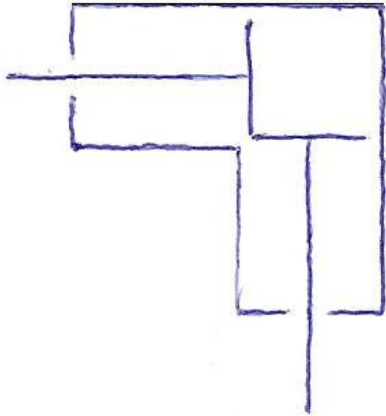
Drawings are used to communicate novel ideas to others.

Drawings describe, define, and specify the design.

PRACTICE SKETCHING

Most inventions begin with an unsatisfied need and simple labeled sketches that illustrate apparatus that meet the need

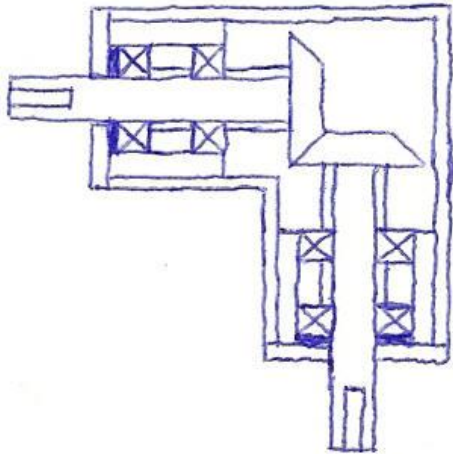
Many objects may be represented by combinations and modifications of the basic: rectangle, circle, and wedge shapes



Concept Sketch to Assembly Drawing

The progression from: initial concept sketch, to functional diagram, to assembly drawing is illustrated below.

The initial concept is constructed using simple single lines.



Function Diagram

The components of the new gearbox design below are defined more clearly with blocks in the function diagram.

The concept sketch and function diagrams are used to communicate the design intent from the CAD operator lead engineer.

The interaction between components can be seen more clearly in the function diagram.

Interaction between components

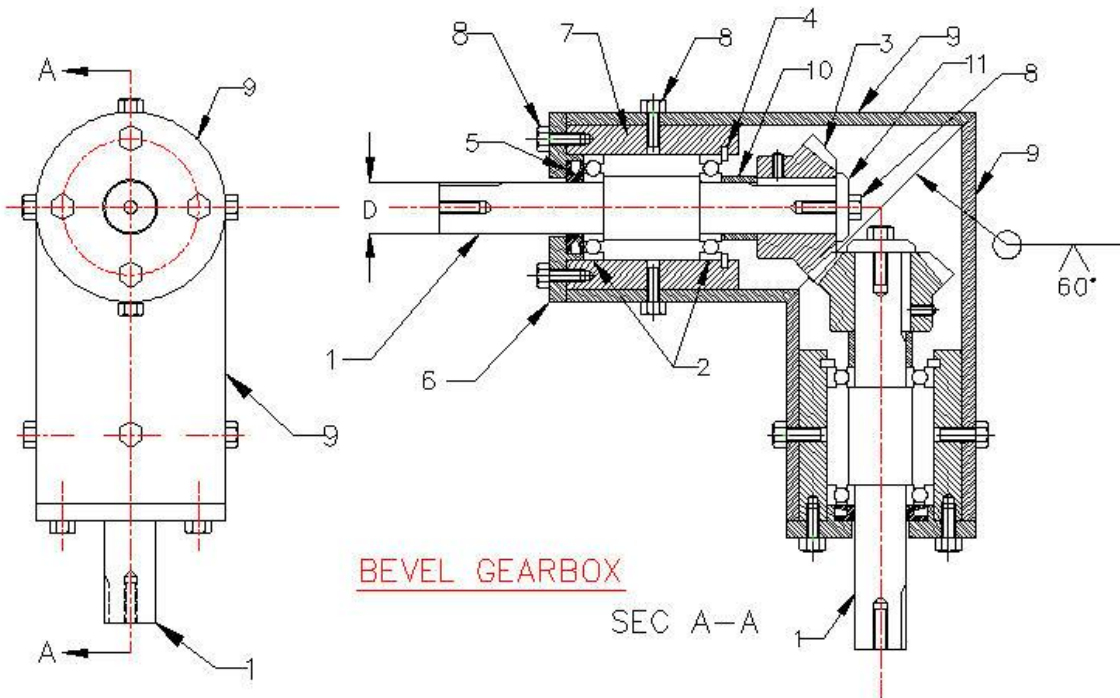
- a. The drive bevel gear connected to a motor will mesh with the driven bevel gear is used to change the axis of rotation.
- b. Each bevel gear is mounted on a shaft.
- c. Each shaft is free to rotate in bearings.
- d. Bevel gears need to be prevented from rotating on shafts by key.
- e. Each bevel gear will be prevented from sliding toward the bearings by collar.
- f. The bearings are positioned against the sleeve on the common shaft.
- g. Shafts, bearings, and gears are contained in a chamber containing lubricating oil or grease.
- h. Bearings housings are attached to the chamber.
- i. Each end cap needs to hold an oil seal.

Assembly Drawing

The assembly drawing below is drawn to scale using CAD software.

Detail dimensioned drawings of each part are next made after the assembly drawing is completed.

AutoCAD, MicroStation, Solid Works, Catia, and Pro-Engineer are widely used software systems in use today.



Bill of Materials (BOM)

The components in the assembly drawing are identified with numbers. The, "Bill of Materials." shown below, is a list giving: quantity, brief description, and material of each part of the assembly.

BILL OF MATERIALS			
ITEM	QTY	DESCRIPTION	MATERIAL
1	4	SHAFT	1.000" DIA 304 SS
2	2	BALL BEARING	SKF 25.40
3	2	BEVEL GEAR	25 T, 20 DEG. 10 PITCH
4	2	INTERNAL RETAINING RING	MC 25-A-563
5	2	OIL SEAL	OS-100-5
6	2	END CAP	M0011865
7	18	BEARING HOUSING	STAINLESS STEEL PIPE
8	2	MACHINE SCREW	CH-25-150
9	2	GEARBOX HOUSING	STAINLESS STEEL PIPE
10	2	COLLAR	C-1040
11	2	SEAL RETAINER	303 SS
12	2	SQUARE KEY	303 SS

Make or Buy Decision

Some of the gearbox parts will be purchased.

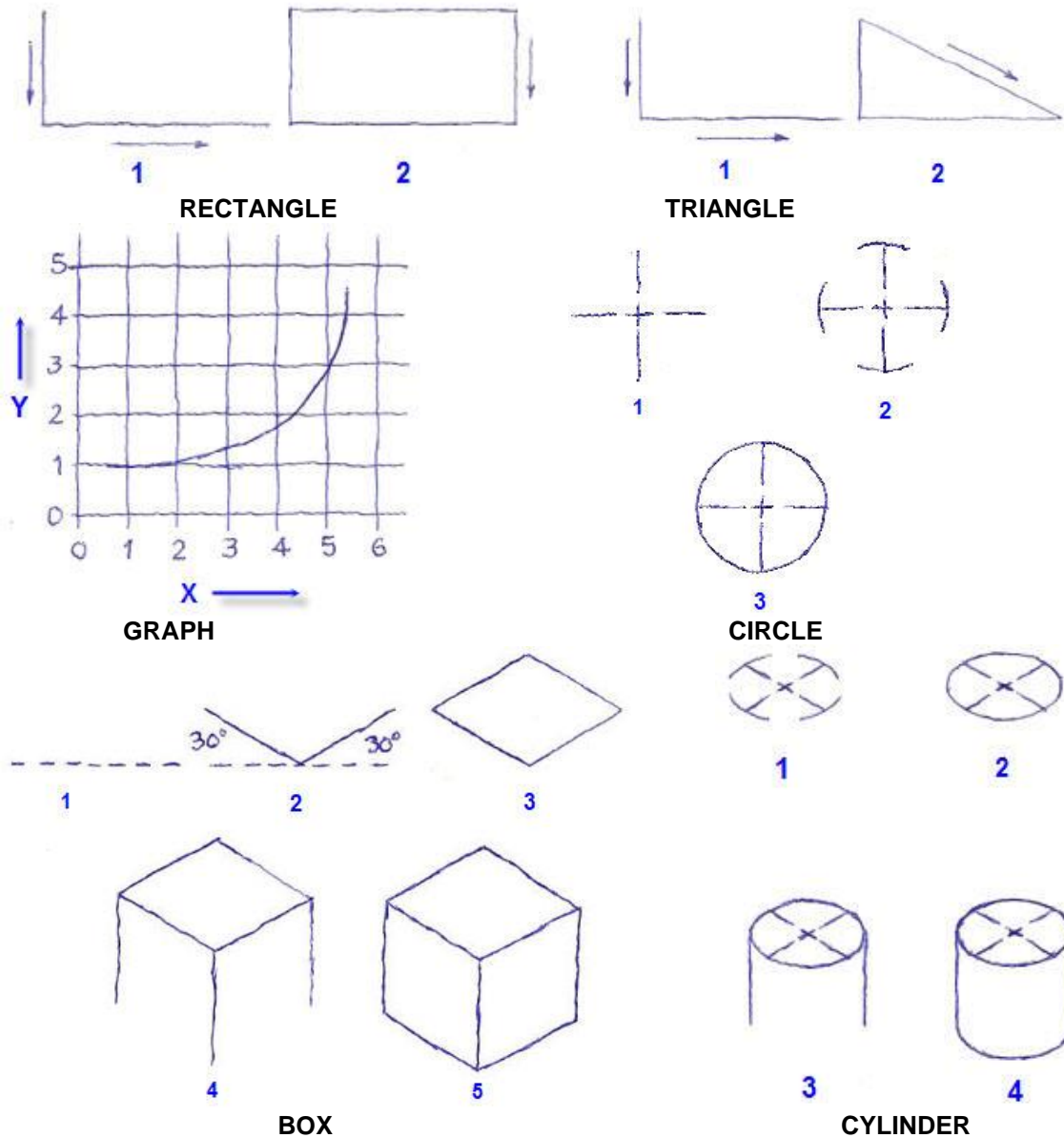
Bearings, gears, retaining rings, seals, keys, and machine screws are readily available and will be purchased.

Freehand Sketching

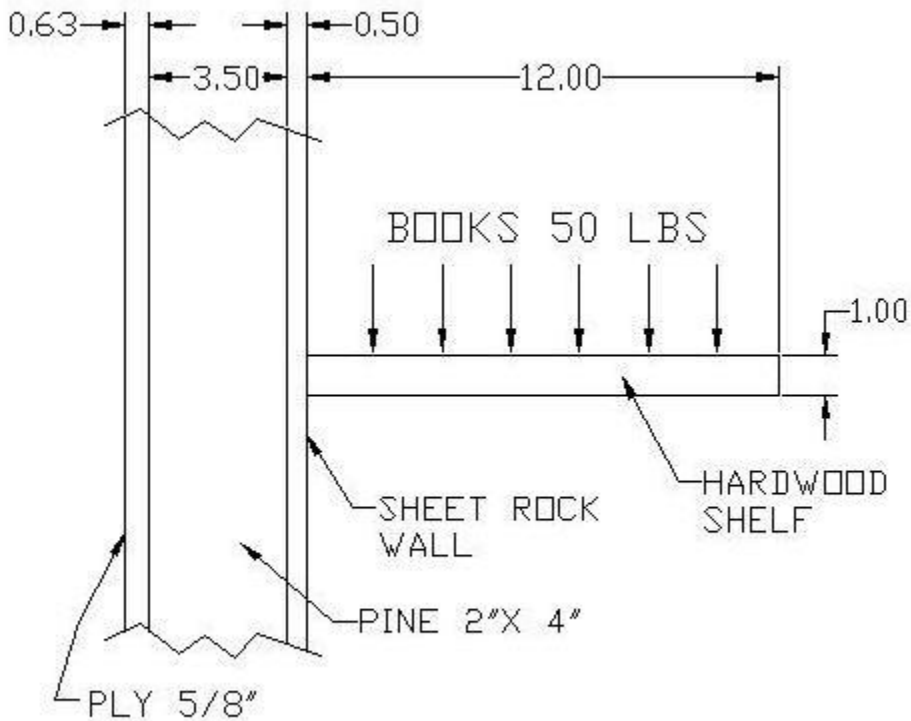
Sketches are used to: communicate engineering: ideas, solve problems, innovate, and plan activities.

Graphics is a universal language. A picture is still worth a thousand words.

Make pencil or pen sketches of 2 and 3D objects below:



30. Bookshelf Project



BOOK SHELF DESIGN

This Book Shelf Design Project, like all other Design-Build projects, must be defined by a Specification.

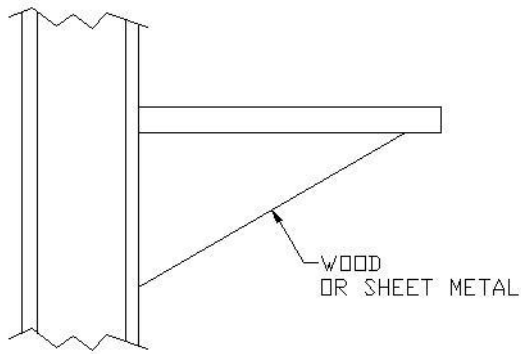
A specification is a document that includes text and graphics describing the desired form and function of the: process, parts, assemblies, machines, buildings, etc., to meet the needs of the client.

From Art to Part

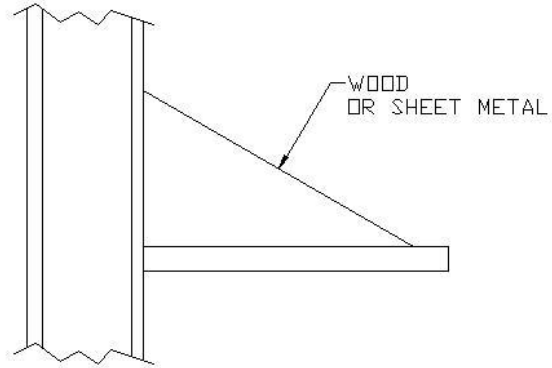
Several more steps are required before manufacturing the book shelf brackets, can begin. The overall design objective is robust performance.

Step 1. Design Specification

- The book shelf will be 6 feet long mounted on a wall.
- 3 brackets or chains will support the shelf.
- Each bracket will support 50 pounds of books.



DESIGN PROPOSAL 1



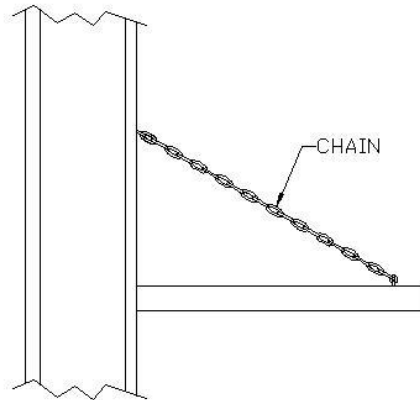
DESIGN PROPOSAL 2

Step 2. Alternate designs are sketched.



Step 3. Research Competition:

Above at web: www.thisnext.com



DESIGN PROPOSAL 3

Step 4. Design Factors

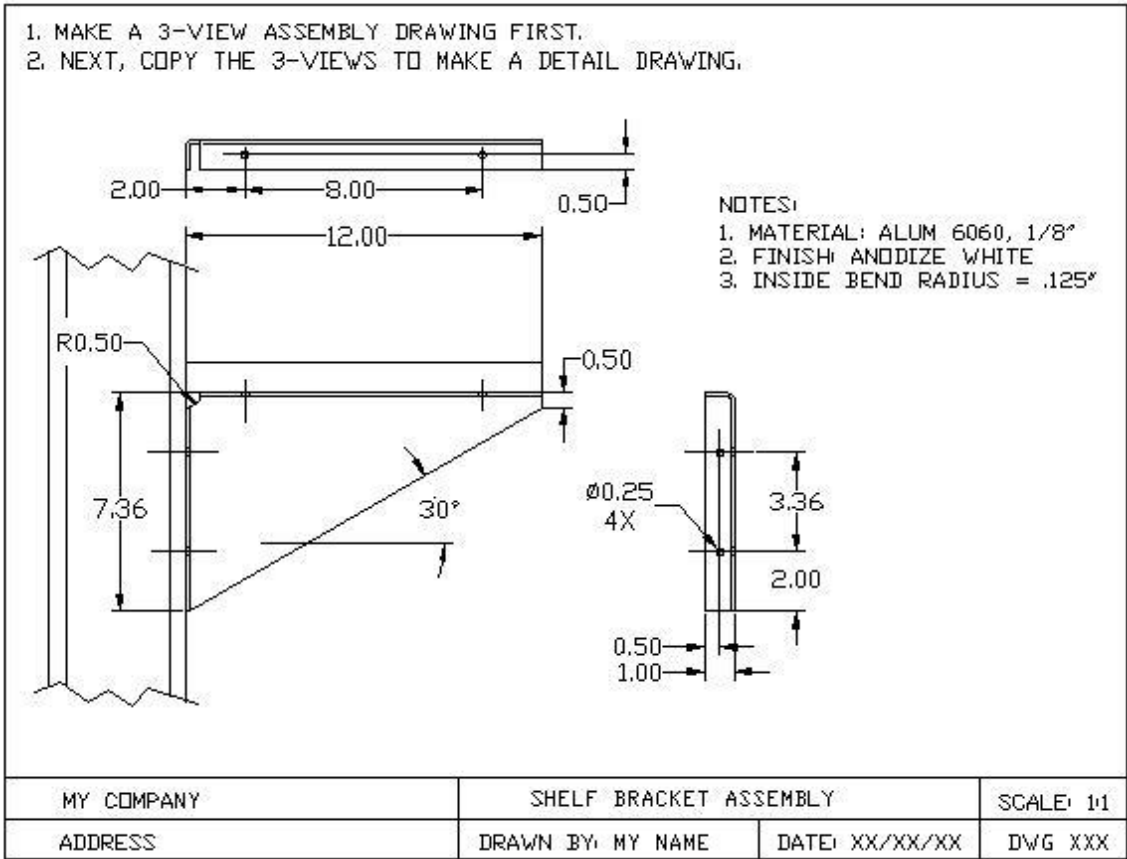
1. Markey research.
2. Better than competing book shelves.
3. Personnel with skills available.
4. Cost of materials.
5. Manufacturing equipment available.
6. Short assembly and packaging time.
7. Contracts with sales outlets.
8. Start-up cost.

Step 5. Choose Best Design

The sheet metal book shelf satisfies the design factors for one manufacturing company.

Step 6. Dimensioned Manufacturing Drawings

Make a 3-view dimensioned CAD drawing of the chosen bracket design shown above. Add notes that define: Material, Finish, and Manufacturing instructions.



31. Toyota Total Production System (TPS)

The inventor will have a better idea about the value of a “Book Shelf” or other design if the Design-Manufacture Process is more fully understood. The Toyota Total Production System is considered by many to be the highest standard of “World Class” design and manufacturing.

“TOYOTA PRODUCTION SYSTEM (TPS)”

“Also known as the flexible mass production, the TPS has two pillar concepts:

1. Just-in-time (JIT) is an inventory strategy that strives to improve a business's return on investment by reducing in-process inventory and associated carrying costs.
2. "intelligent automation" or "automation with a human touch."

Just-in-time (JIT) or "flow", and "autonomation" (smart automation).

Adherents of the Toyota approach would say that the smooth flowing delivery of value achieves all the other improvements as side-effects.

If production flows perfectly then there is no inventory; if customer valued features are the only ones produced, then product design is simplified and effort is only expended on features the customer values.

The other of the two TPS pillars is the very human aspect of automation, whereby automation is achieved with a human touch.

The "human touch" here meaning to automate so that the machines/systems are designed to aid humans in focusing on what the humans do best.

This aims, for example, to give the machines enough intelligence to recognize when they are working abnormally and flag this for human attention.

Thus, in this case, humans would not have to monitor normal production and only have to focus on abnormal, or fault, conditions.

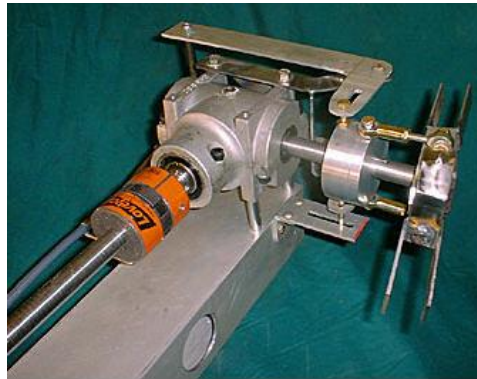
The muda of waiting, correction and movement.

The original seven *muda* are:

- Transport (moving products that is not actually required to perform the processing)
- Inventory (all components, work in process and finished product not being processed)
- Motion (people or equipment moving or walking more than is required to perform the processing)
- Waiting (waiting for the next production step)
- Overproduction (production ahead of demand)
- Over Processing (resulting from poor tool or product design creating activity)

Defects (the effort involved in inspecting for and fixing defects)" (Wikipedia)

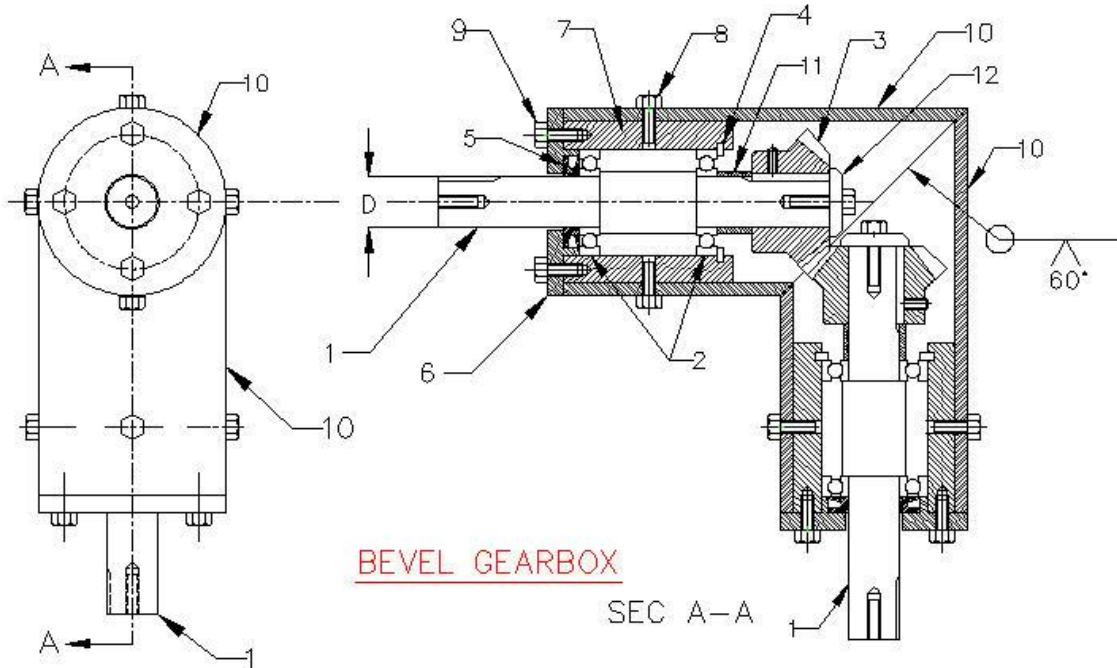
32. Bevel Gearbox Project



Anti-torque helicopter tail rotor gear box www.vortechonline.com

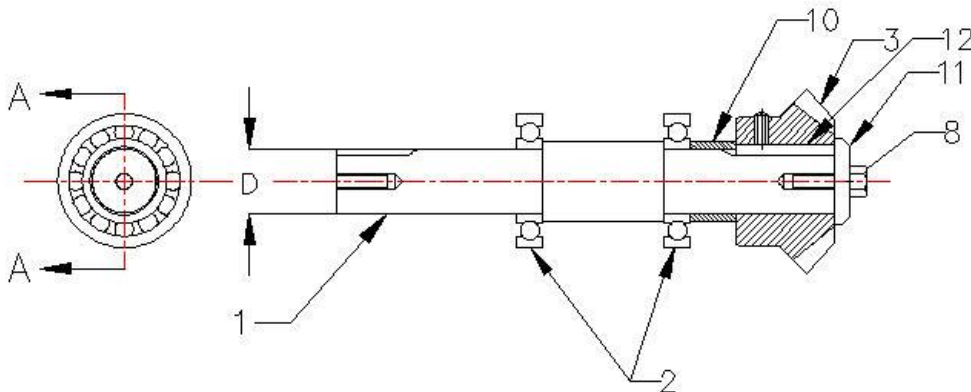
The **tail rotor**, or **anti-torque rotor**, is a smaller rotor mounted so that it rotates vertically or near-vertically at the end of the tail of a traditional single-rotor helicopter. The tail rotor's position and distance from the center of gravity allow it to develop thrust in the same direction as the main rotor's rotation, to counter the torque effect created by the main rotor. (Wikipedia)

32. Bevel Gearbox Design and Manufacture

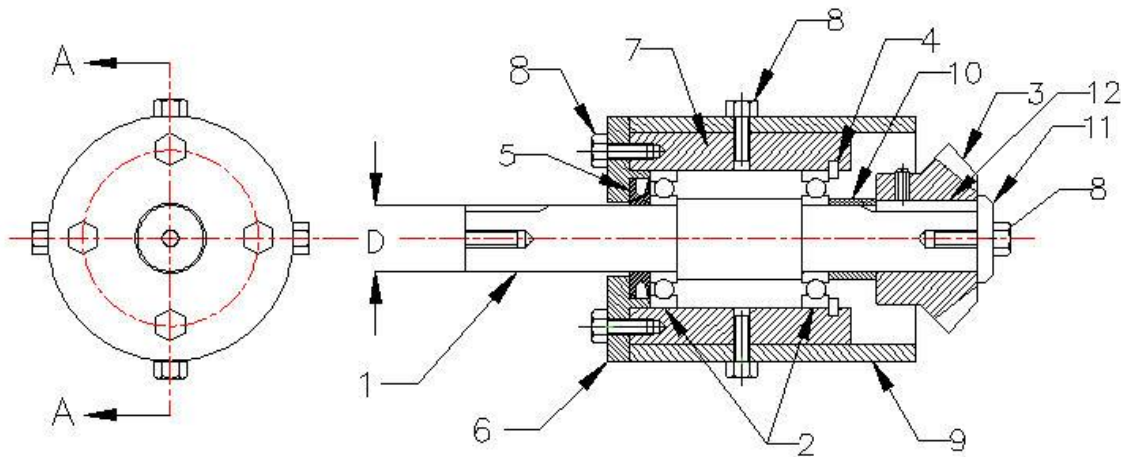


The bevel gear box above is used to change the orientation of the axis of shaft rotation. The tail rotor shaft of a typical helicopter shown above is an application of the bevel gear box.

Inter-Action Between Components



1. Bevel gear (3) is mounted on a shaft (1) above.
2. Shaft (1) is free to rotate in ball bearings (2).
3. Bevel gear (3) is prevented from rotating on the shaft by key (12).
4. Key (12) is held in place by the grub screw in the bevel gear hub.
5. Bevel gear (3) is prevented from sliding toward the bearing by collar (10).
6. The bearings (2) rest against the shoulders on shaft (1).



7. Bearings (2) are held in housing (7) which provides a chamber for lubricating oil.
8. Bearing housing (7) is supported by a standard steel pipe (9) and secured by machine screws (8).
9. Internal retaining ring (4) holds the right bearing (2) in place.
10. End cap (8) clamps the left bearing (2) and holds oil seal (5) in place.
11. Bevel gear (3) will mesh with another bevel gear to change the direction of rotation.

Product performance and reliability depends on the inter-action between components.

The inventor will have a better idea about the selling price of an invention if aware of the manufacturing cost.

1A. Make a CAD drawing of your invention, similar to the two view Bevel Gearbox assembly shown above. Add dimensions and geometric tolerances for each part required for manufacturing.

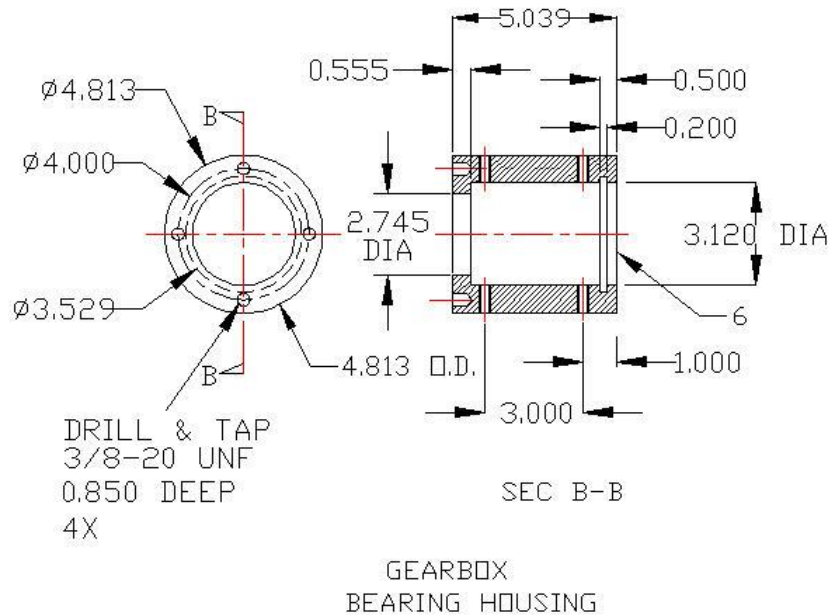
Or **1B.** Obtain a time and price quotation from an engineering design company to make an assembly and detail workshop drawings of the invention you wish to manufacture.

2. Look up the items listed in your "Bill of Materials" (B.O.M.) on the internet at: (www.mcmaster.com)

Here you will find descriptions and prices for 435,000 products ranging from nuts and bolts to manufacturing equipment.

3. Obtain a time and price quotation from a machine shop in your area, to make one or more prototypes and quantities of 100, 1,000 or any quantity you estimate you can sell.

Detail Dimensioned Drawings



The detail dimensioned drawing above is an example of the separate dimensioned drawings needed for each component.

These drawings are required for manufacturing the gearbox.

Size of hole diameters, and other feature locations will be measured from these reference planes.

The fit and function of any assembly is affected by the variation or tolerance allowed on each dimension of each part.

Quality will be improved if the total tolerance the designer allows on each dimension is small. A total allowable tolerance of 0.001 inch on is the largest amount for machined parts.

The cost to machine a part to an overall tolerance of 0.001 inch is much higher than if the tolerance were 0.010 inch.

The most cost effective design will have small tolerances only where they are absolutely necessary, such as:

- * Shaft diameter in a bearing.
- * Bearing in a housing.

The machine designer must define and specify on the drawings the dimensional tolerances of off-the-shelf items such as: nuts, bolts, bearings, gears, drive chains, V-belts, etc.

The quality is determined by the allowable variations or tolerances in each dimension needed in order for the manufacturing machining operations required to make the parts.

Bevel Gearbox Manufacture

An **assembly line** is a manufacturing process in which parts (usually interchangeable parts) are added to a product in a sequential manner using optimally planned logistics to create a finished product much faster than with handcrafting-type methods.

a. Unit Assembly is the time to assemble one Gear Box.

The unit has 12 parts and each part takes 2 seconds to assemble.

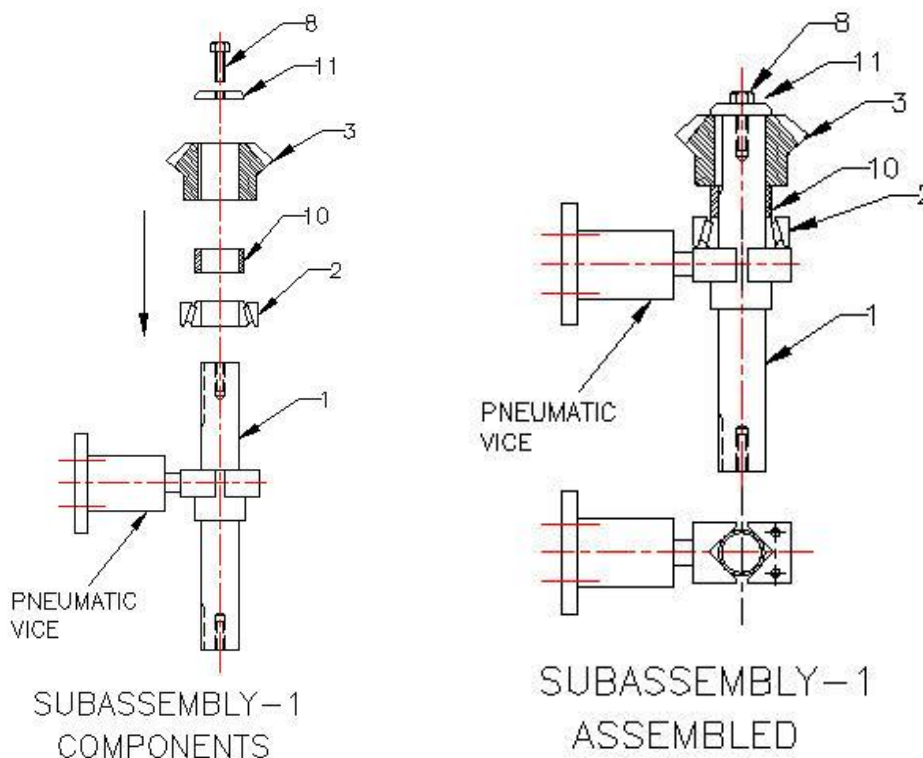
Time to assembly one Gear Box is 12 parts x 2 seconds per part = 24 seconds

b. Continuous Assembly in an assembly line.

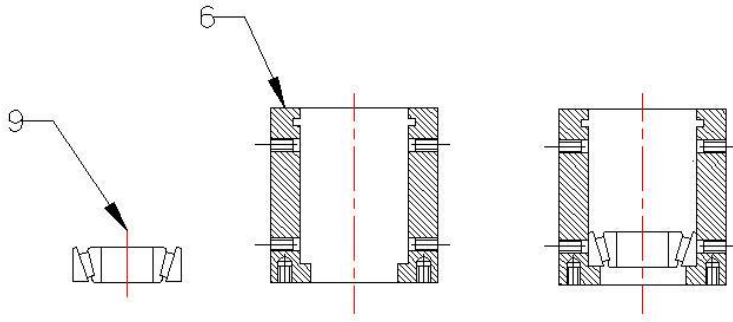
A different part is assembled every 2 seconds in each of 12 assembly cells in an assembly line.

One Gear Box is completely assembled every 2 seconds.

Conclusion: Assembly line is $24 / 2 = 12$ times faster than unit assembly

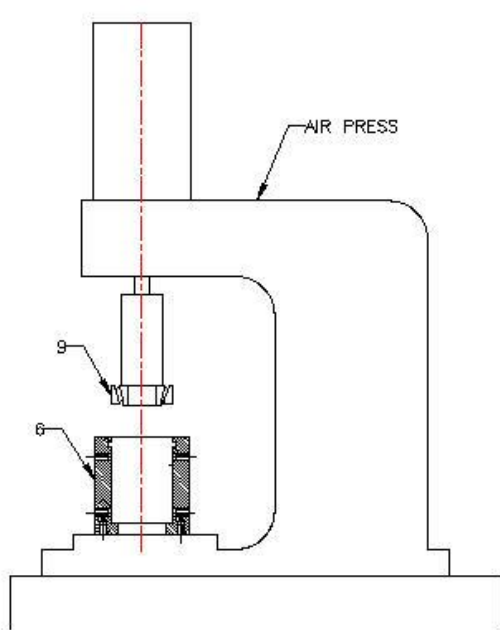


An assembly fixture power clamp secures the subassembly above.

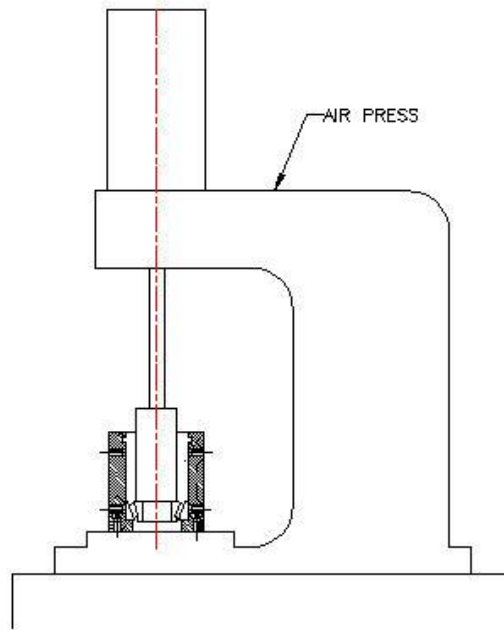


BEARING HOUSING ASSEMBLY JIG-1

The bearing-9 will be pressed into the housing-6 above.

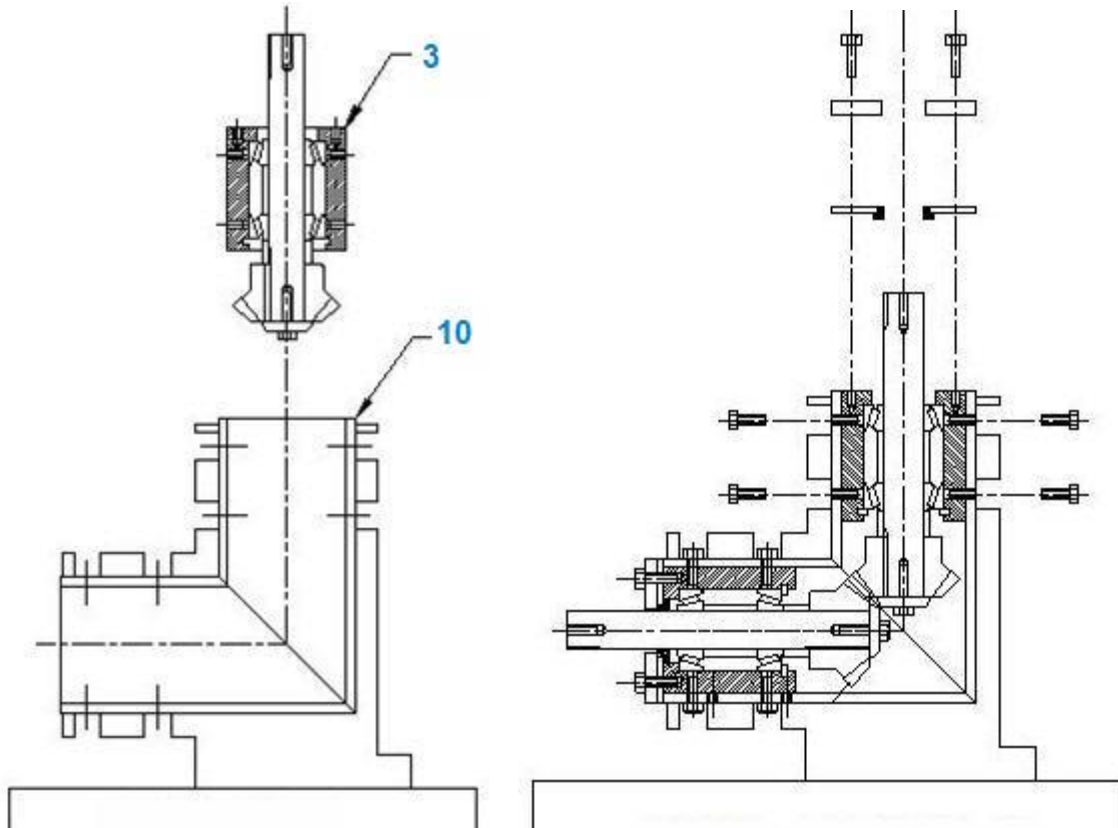


BEARING HOUSING ASSEMBLY JIG-2



BEARING HOUSING ASSEMBLY JIG-3

An air powered press is required to force the bearing into its housing. The bearing is said to be seated when placed correctly.



Two sub-assemblies form one assembly above.

33. Jigs and Fixtures

In general terms, fixtures hold parts firmly while being machined or assembled, and jigs guide or position cutting tools.

It is likely that Swiss watch makers originated the use of fixtures.

Jigs and fixtures are used today in manual and Numerically Controlled (N/C) machine tools.

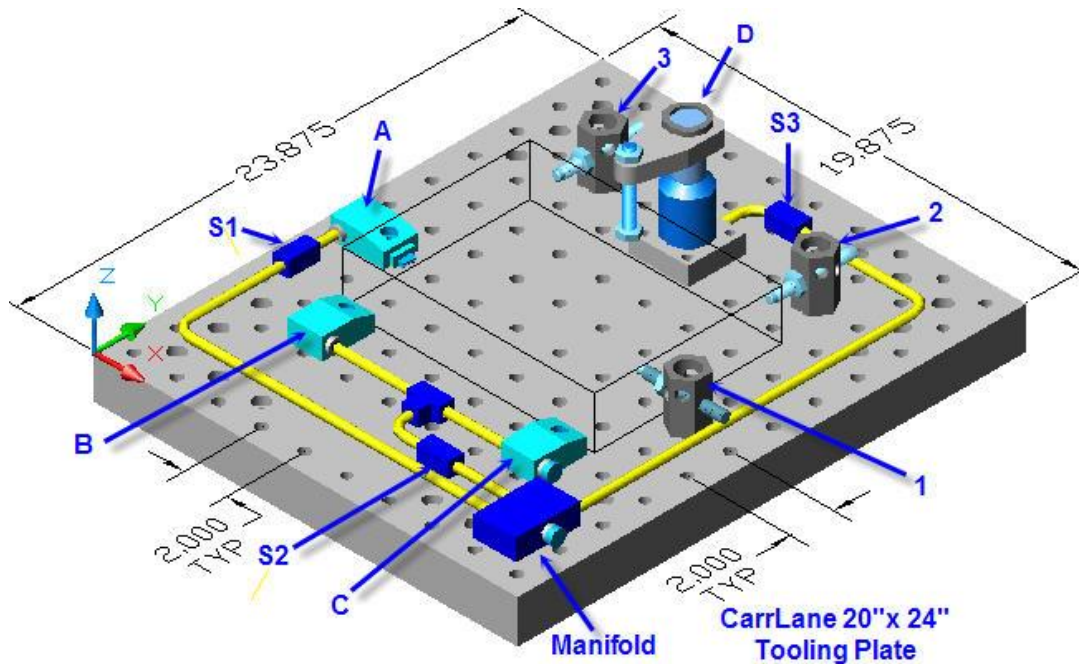
Fixtures

are designed to:

- a. locate and clamp parts quickly and accurately.
- b. release and / or eject parts safely.
- c. improve quality and interchangeability of finished parts.
- d. allow unskilled labor to perform machining operations formerly done by skilled workers.
- e. reduce machining set-up time and cost.

Jigs

Drilling jigs are equipped with bushings that position and guide drill bits. A gage plate on a steel block serves to position a single point lathe cutter or a multiple point milling machine cutter.



Power Clamping Components

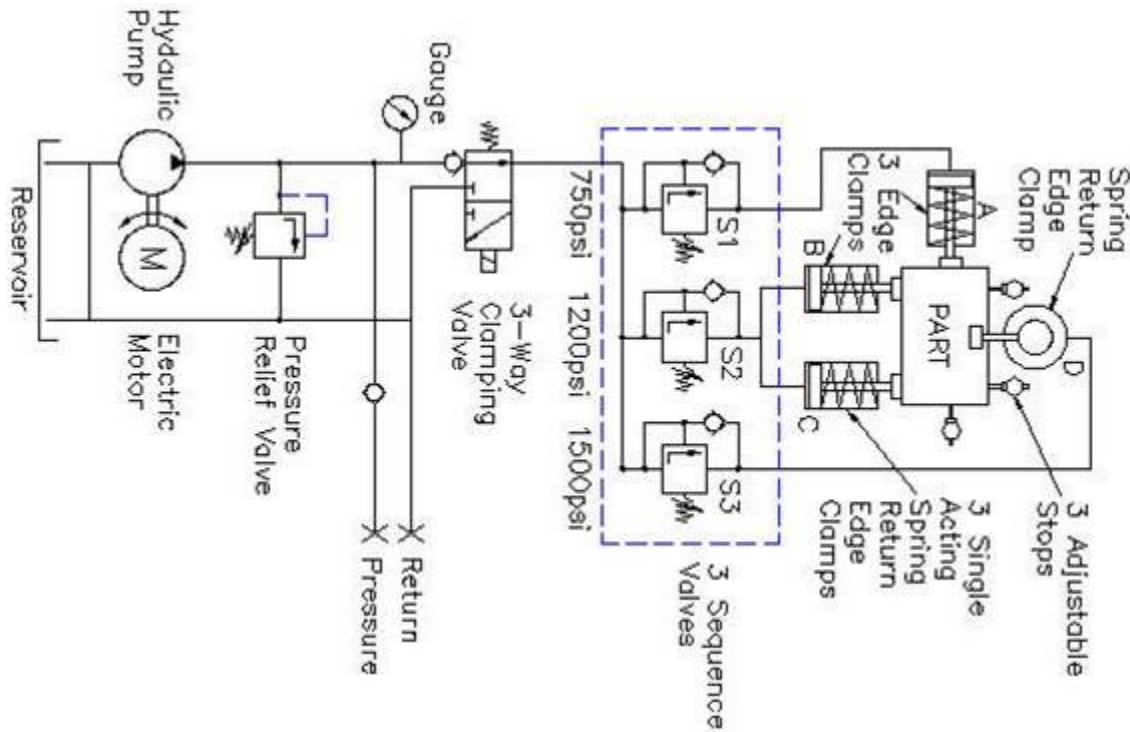
Adjustable locators 1, 2, and 3 above are directly opposite edge clamps A, B, and C.

Four hydraulically operated clamps close in sequence after placing the part to be machined, shown in outline, into the above fixture. See hydraulic circuit, right, for above clamping fixture.

Steps:

1. Sequence valve **S1** opens first at 750 psi, extending edge clamp **A**. The part moves against stop **1**.
2. Sequence valve **S2** opens second at 1200 psi, extending edge clamps **B** and **C**. The part moves against stops 2 and 3.
3. Sequence valves **S3** opens next at 1500 psi, causing the swing clamp **D** to rotate 90 degrees over the part and clamp down pressing it against the tooling plate.
4. After machining has been completed the control valve reverses flow direction and all three sequence valves allow free flow of hydraulic fluid to the reservoir.
5. Each edge clamp opens by the force of the internal return spring.
6. The swing clamp lifts up and rotates 90 degrees anti-clockwise to allow the finished part to be removed.
7. Addition actuators could be added to eject the part.

Power Clamping Hydraulic Circuit



Industrial Component Suppliers

DeStaCo

Web: DeStaCo.com

Manual and power clamps.

CarrLane Manufacturing Co.

4200 Carr Lane Ct

PO Box 191970

St Louis, MI 63119-7970

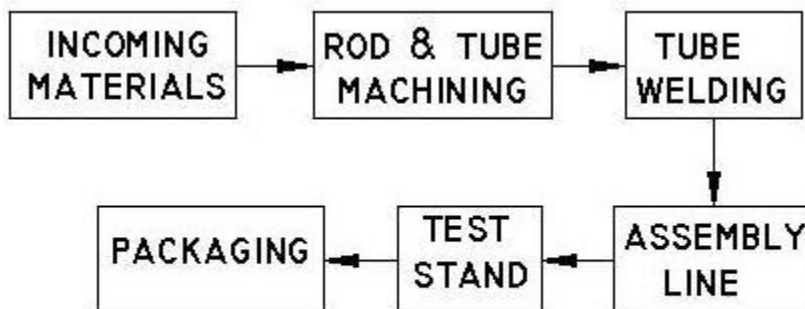
Web: www.carrlane.com

McMaster-Carr

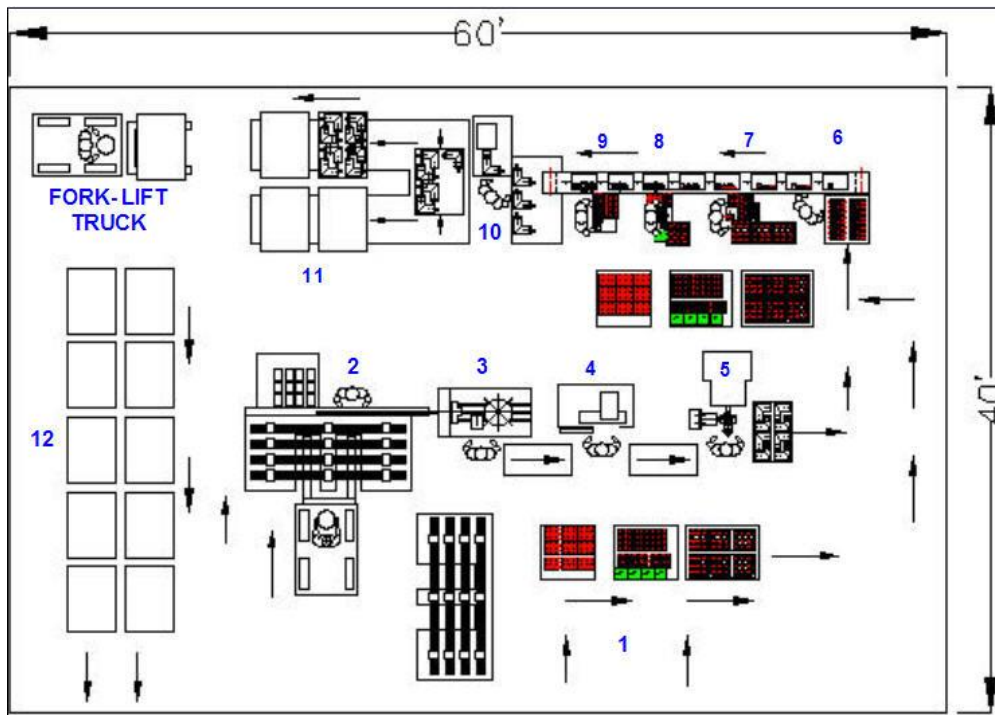
Web: mcmaster.com

440,000 industrial materials and components including manual and power clamps.

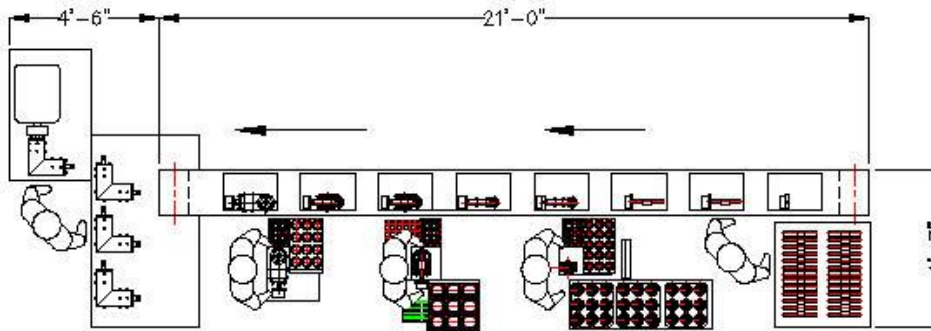
34. Gearbox Manufacturing Plant



PRELIMINARY MANUFACTURING FLOW



A proposed Gearbox manufacturing plant layout is illustrated above. Arrows show the flow of raw materials through machining and welding cells, assembly cells, and finished good output area.



The flow is from right to left through 4 assembly cells and checking performance of each gear box on the Test Stand above left.

Balancing the Assembly Line

The manufacturing system is at maximum efficiency when the machining and assembly lines are in balance.

If there are 3 subassembly cells; A, B, and C requiring the following cycle times;

A = 1 minute, B = 2 minutes, and C = 3 minutes

A is idle 2 minutes and B is idle 1 minute out of every three minutes.

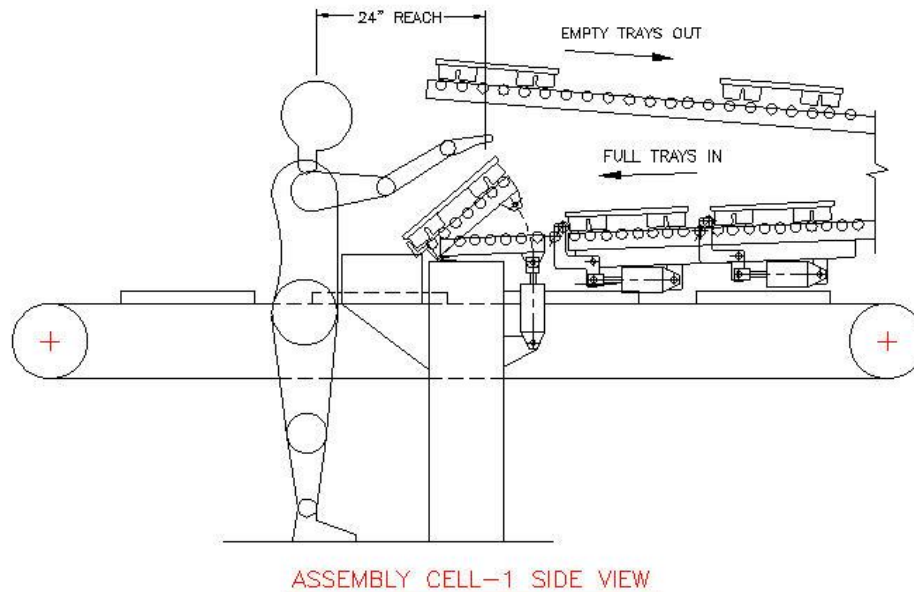
The sum of these cycle times is 6 minutes.

The average is $6 / 3 = 2$ minute cycle time.

If some of the work done by cell C is shifted to cell A so that each of the three cells has a cycle time of 2 minutes, the efficiency will be improved and the number of gearboxes assembled will increase from 20 to 30 per hour, an increase of 50%.

60 mins / 3 mins = 20 per hour

60 mins / 2 mins = 30 per hour

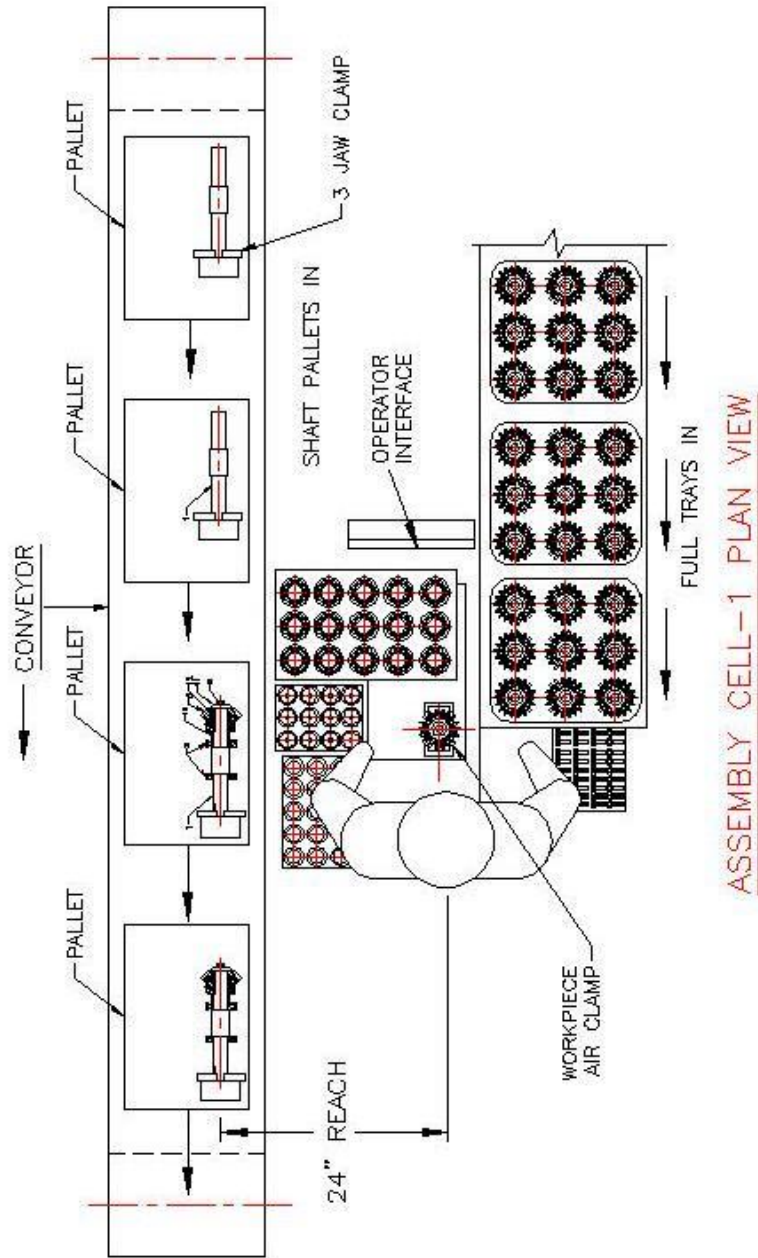


A side view of Gearbox Assembly Cell 1 is shown above.

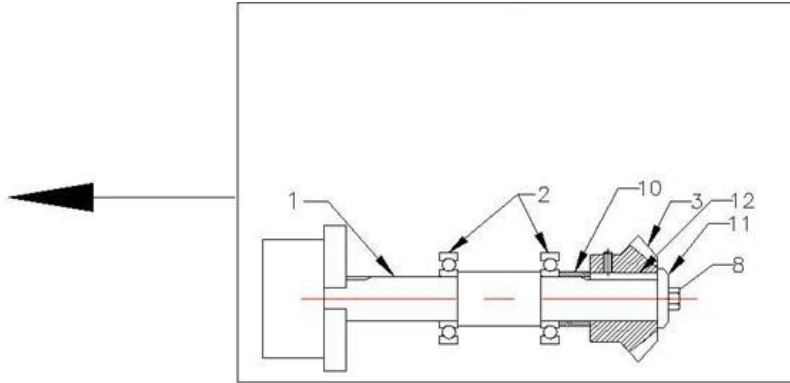
“**Cellular Manufacturing** is a model for workplace design, and has become an integral part of lean manufacturing systems. Cellular Manufacturing is based upon the principals of Group Technology, which seeks to take full advantage of the similarity between parts, through standardization and common processing. In Functional Manufacturing similar machines are placed close together (e.g. lathes, millers, drills etc). Functional layouts are more robust to machine breakdowns, have common jigs and fixtures in the same area and supports high levels of demarcation. In Cellular Manufacturing systems machines are grouped together according to the families of parts produced. The major advantage is that material flow is significantly improved, which reduces the distance travelled by materials, inventory and cumulative lead times. Cellular Manufacturing is most suitable for batch manufacturing.”

“The goal of lean manufacturing is the aggressive minimization of waste, called *muda*, to achieve maximum efficiency of resources. Cellular manufacturing, sometimes called cellular or cell production, arranges factory floor labor into semi-autonomous and multi-skilled teams, or work cells, who manufacture complete products or complex components. Properly trained and implemented cells are more flexible and responsive than the traditional mass-production line, and can manage processes,

defects, scheduling, equipment maintenance, and other manufacturing issues more efficiently.”
(Wikipedia)



Plan view of the Gearbox Assembly Cell 1

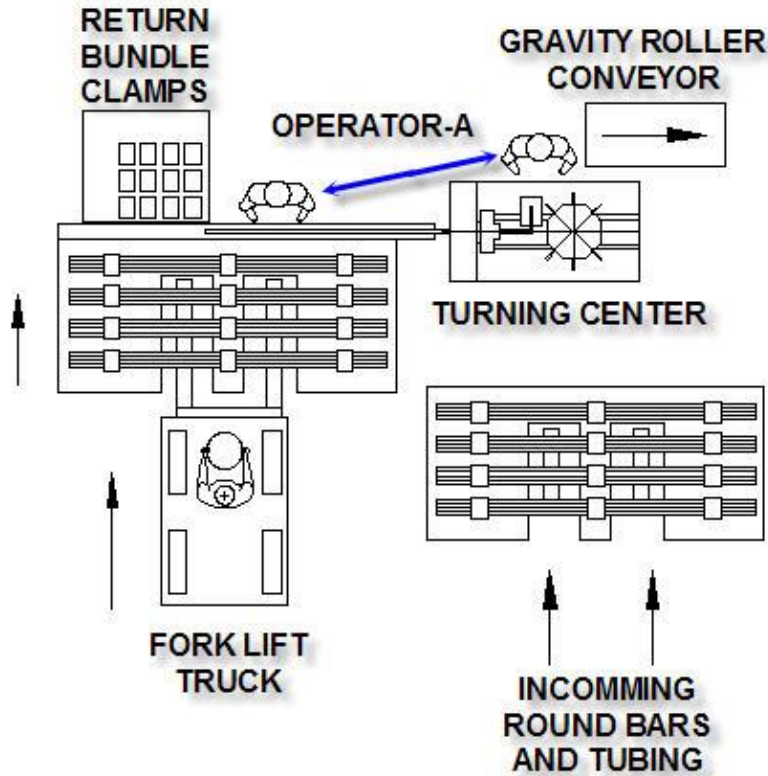


Subassembly 1 is shown above mounted in a clamp on a Pallet on the conveyor.

GET OBJECT	
10"	0.50 SEC
20 "	0.75 SEC
30"	1.00 SEC
GRASP	
	0.50 SEC
MOVE OBJECT	
10"	0.50 SEC
20"	0.75 SEC
30"	1.00 SEC
PLACE OBJECT	
	0.75 SEC
POSITION OBJECT	
	1.00 SEC
WITHDRAW HAND	
10"	0.50 SEC
20"	0.75 SEC
30"	1.00 SEC

Typical times to: Get, Grasp, Move, Place, Position, and Withdraw the hand are given in the above table.

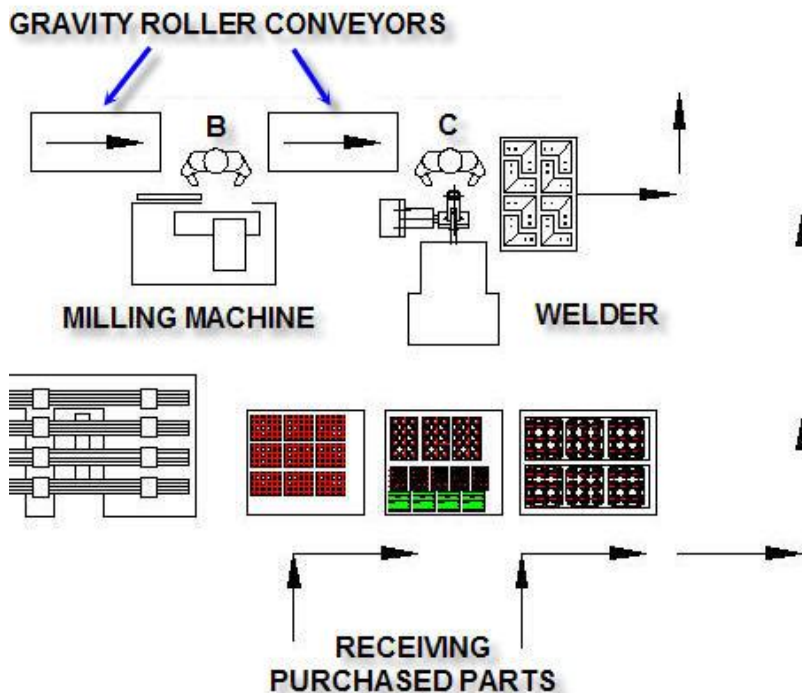
Assembly cell cycle times can be estimated quite accurately thanks to the pioneering work of Taylor, in time and motion studies, whose motto was:
"MORE – BETTER – FASTER"



Operator-A picks one round bar or tube and places them into the turning center where they are cut to length.

The fork lift truck operator inspects incoming materials for quality and moves them to the turning center.

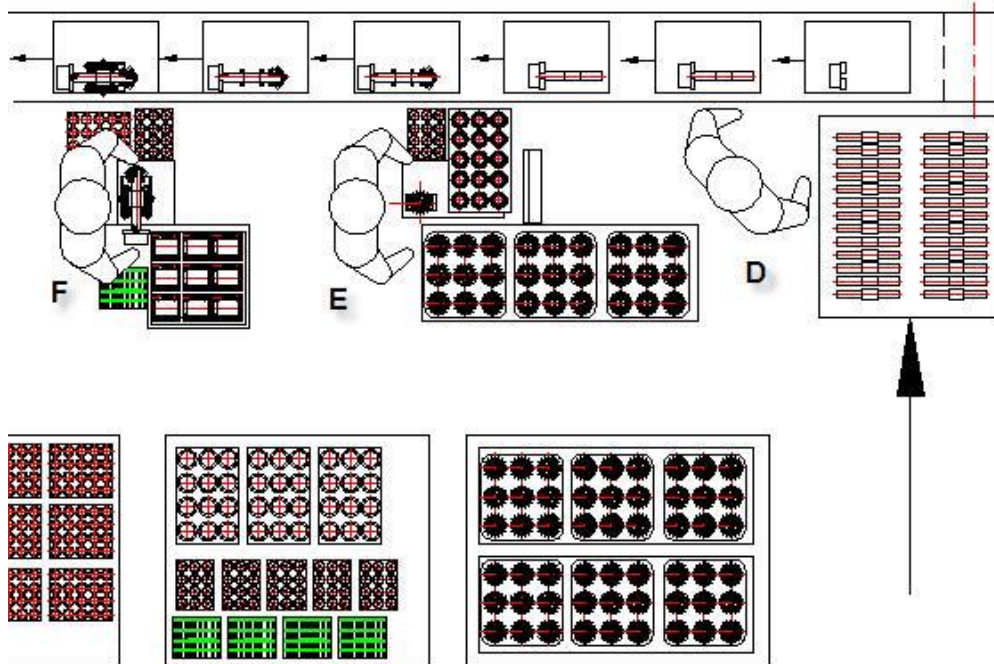
A gravity roller conveyor transports baskets of parts to the next manufacturing cell.



Operator-B machines one bar or tube in the milling machine.

Operator-C Welds two tube sections in the welder.

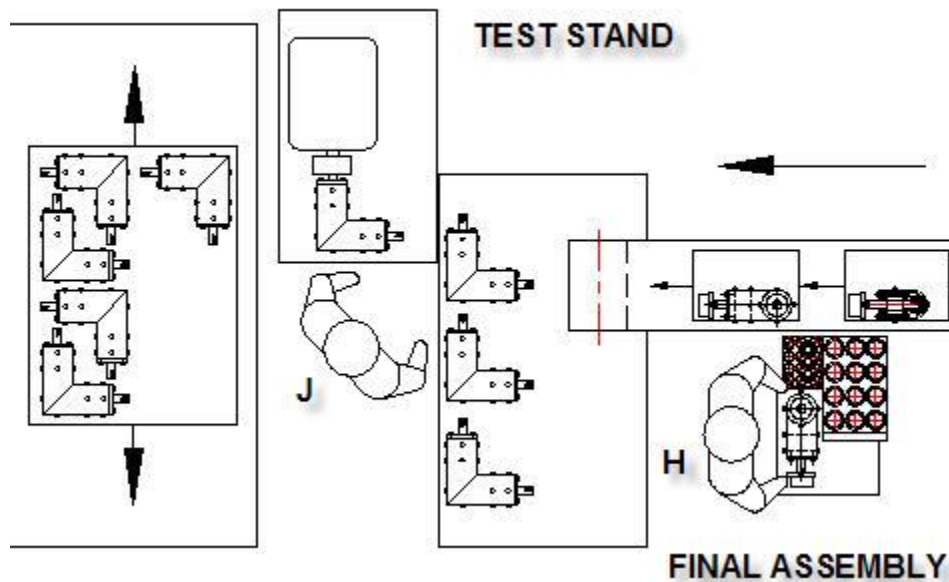
Gravity roller conveyors transport baskets of parts from one cell to the next.



Operator-D inserts one gearbox shaft at a time into the clamp on each pallet.

Operator-E assembles two bearings and a gear on each shaft.

Operator-F inserts one bearing and a gear subassembly into a housing.



Operator-H inserts a second bearing and a gear subassembly into a housing.

Operator-J connects a gear shaft to a motor and runs the unit.

35. Request for Price Quotation

Manufacturing of components and assembly of products should be outsourced if improved: cost, quality, and delivery are obtained.

An Iphone manufactured in China cost \$200 in the United States.

The cost to the consumer for a US manufactured Iphone would be \$1,800.

REQUEST FOR QUOTE 2006-126

This is not a Purchase Order.

JOHN ANDREW, P.E.
PO BOX XXX
GREENVILLE, SC 29606

e-mail: company@provider.net
Phone: 864-XXX-XXXX
Cell: 864-YYY-YYYY

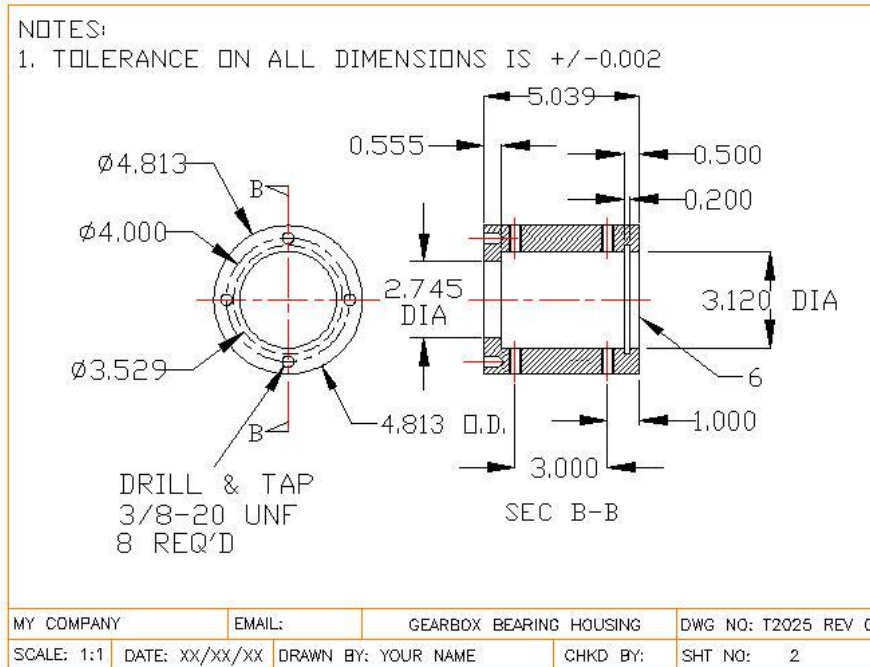
REQUEST TO: Horizon Machining & Manufacturing, Inc.
158 High Hope Road
Six Mile, SC 29682

Phone: 864-ZZZ-ZZZZ
rebel@carol.net

ATTENTION: Larry Alexander

ITEM	QTY	DRAWING	DESCRIPTION	DAYS DELIVERY	PRICE EACH
1	24	T2025 Rev C	Housing		
2	24	T2026 Rev D	Shaft		
3	24	T2027 Rev B	Collar		
4	48	T2028 Rev A	Sleeve		

Please see attached drawings.



Example drawing above.

36. Enterprise Resource Planning (ERP)

Every item and activity in the manufacturing plant can be planned, monitored, documented, and controlled with an ERP system.

ERP PROCESS FLOW

The process flow through a typical production facility:

Purchase - Raw materials and standard parts.

Receive - Materials and parts at the Receiving Dock.

Inspect / Document - All purchased items at the Receiving Dock.

Palletize - Groups of similar items are loaded onto pallets.

Transfer - These items, usually by fork-lift truck, to storage.

Park - Incoming materials on storage racks.

Transfer - These items, usually by fork-lift truck, to conveyors or production cells..

Convey - Materials to manufacturing and assembly lines.

Park - Pallet loads of materials at machine and assembly cells.

Machine Cells - Mill, drill, turn, grind, weld, and inspect.

Assembly Cells - Bolt, screw, rivet, and inspect parts to form sub-assemblies.

Inspection - Dimensions are gauged or measured and compared with a standard.

Rework / Scrap - Parts that do not pass inspection.

Park - Finished parts or finished assemblies in baskets or racks on pallets.

Shrink Wrap / Package - Finished product on pallets.

Transfer - These finished product on pallets, usually by fork-lift truck, to a warehouse.

Warehouse - Finished products on convenient storage shelves.

Inspect / Document - All finished product items at the shipping dock.

Sell - Products to distributors / customers.

Ship - Packaged products to distributors / customers.

Service - Returned products are repaired or replaced.

“**Enterprise resource planning (ERP)** integrates internal and external management information across an entire organization, embracing finance/accounting, manufacturing, sales and service, etc.

ERP systems automate this activity with an integrated software application. Its purpose is to facilitate the flow of information between all business functions inside the boundaries of the organization and manage the connections to outside stakeholders.”

“ERP systems can run on a variety of hardware and network configurations, typically employing a database to store data.”

“ERP systems typically include the following characteristics:

- An integrated system that operates in (next to) real time, without relying on periodic updates.
- A common database that supports all applications.
- A consistent look and feel throughout each module.
- Installation of the system without elaborate application/data integration by the Information Technology (IT) department.

“**Functional areas**”

Finance/Accounting

General ledger, payables, cash management, fixed assets, receivables, budgeting, consolidation

Human resources

payroll, training, benefits, 401K, recruiting, diversity management

Manufacturing

Engineering, bill of materials, work orders, scheduling, capacity, workflow management, quality control, cost management, manufacturing process, manufacturing projects, manufacturing flow, activity based costing, Product lifecycle management

Supply chain management

Order to cash, inventory, order entry, purchasing, product configurator, supply chain planning, supplier scheduling, inspection of goods, claim processing, commissions

Project management

Costing, billing, time and expense, performance units, activity management
Customer relationship management
Sales and marketing, commissions, service, customer contact, call center support
Data services
Various "self-service" interfaces for customers, suppliers and/or employees
Access control
Management of user privileges for various processes" (Wikipedia)

Work Flow Management

"A **workflow** consists of a sequence of connected steps. It is a depiction of a sequence of operations, declared as work of a person, a group of persons an organization of staff, or one or more simple or complex mechanisms.

Workflow may be seen as any abstraction of real work. For control purposes, workflow may be a view on real work under a chosen aspect thus serving as a virtual representation of actual work. The flow being described often refers to a document that is being transferred from one step to another.

A workflow is a model to represent real work for further assessment, e.g., for describing a reliably repeatable sequence of operations. More abstractly, a workflow is a pattern of activity enabled by a systematic organization of resources, defined roles and mass, energy and information flows, into a *work process* that can be documented and learned.^{[3][4]} Workflows are designed to achieve processing intents of some sort, such as physical transformation, service provision, or information processing.

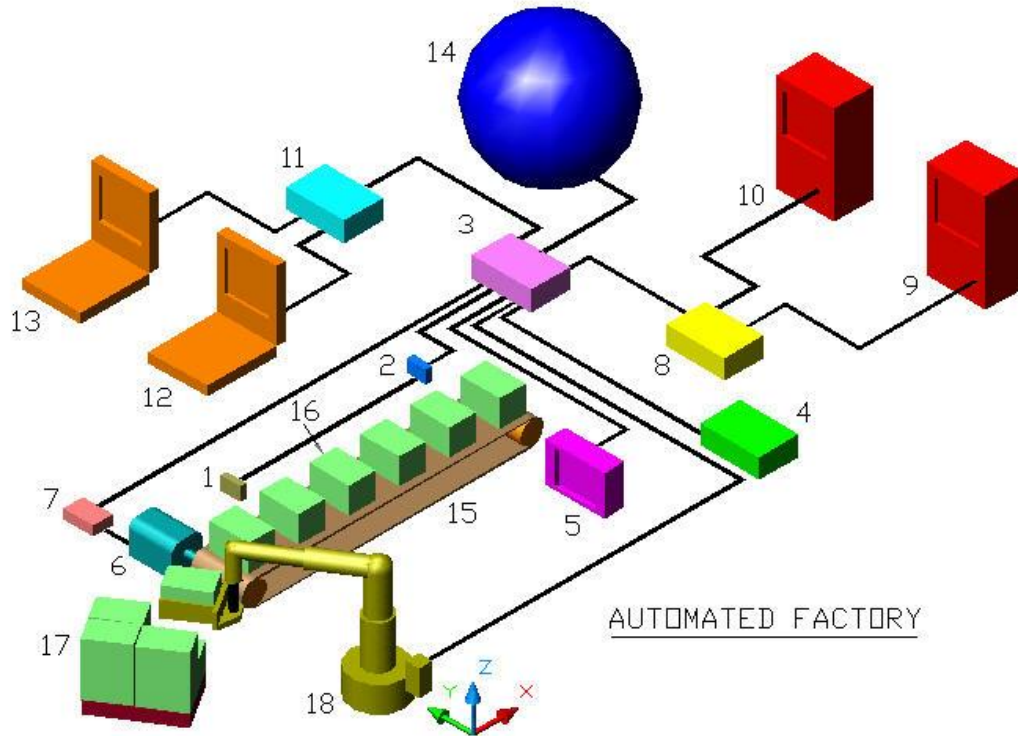
Workflow concepts are closely related to other concepts used to describe organizational structure, such as silos, functions, teams, projects, policies and hierarchies.

Workflows may be viewed as one primitive building block of organizations. The relationships among these concepts are described later in this entry.

The term *workflow* is used in computer programming to capture and develop human-to-machine interaction." (Wikipedia)

37. The Automated Factory

1. Laser sensor indicates part is present.
2. Laser sensor counts the number of parts produced.
3. Gateway router.
4. Programmable Logic Computer (PLC).
5. Human-Machine-Interface (HMI).
6. Direct current stepper motor.
7. Variable angle / speed controller.
8. Hub to servers.
9. Server.
10. Server



An automated manufacturing system

- 11. Hub to laptops.
- 12. Laptop.
- 13. Laptop.
- 14. World Wide Web (www).
- 15. Belt conveyor.
- 16. Finished product.
- 17. Shrink-wrap packaging on a pallet for shipment.
- 18. Pick-and-place robot moves packages from conveyor to pallet.

38. Contract out Manufacturing and Sales

SUMMARY

Machine and electrical shops can be found on the WEB that will make a prototype of almost any apparatus for a price or share in future sales.

* You have an invention and you would like a manufacturer to produce and sell it, providing you are compensated.

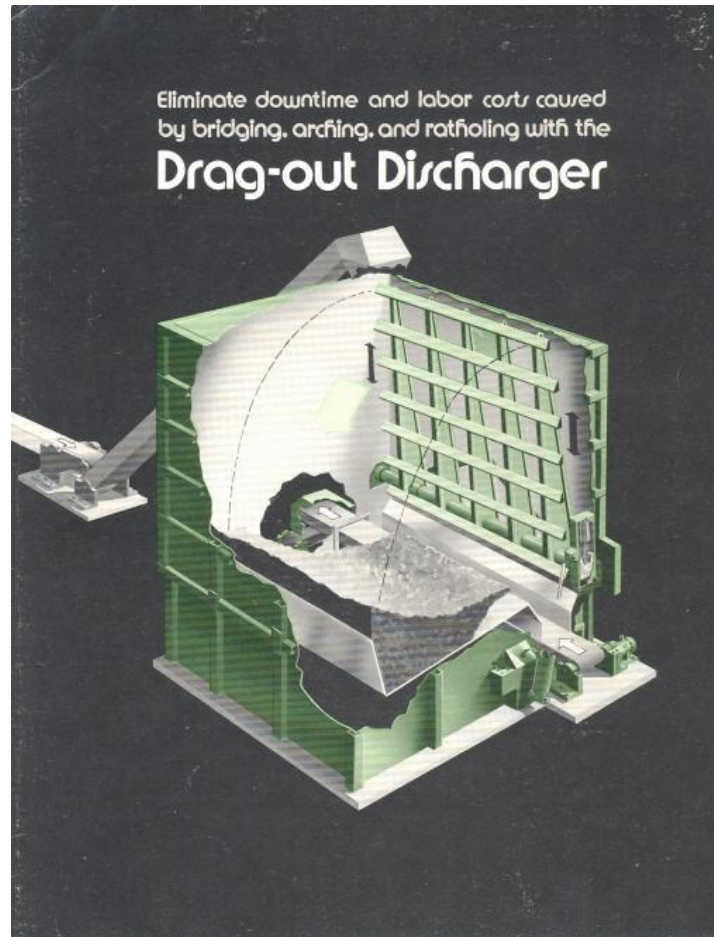
* You find a few companies on the WEB or in the phone book. Patent and manufacturing drawings are shown to the manager responsible for new products at each company.

* One company offers the best deal and agrees to, build a prototype, manufacture, and sell the invention and pay you royalties out of sales income.

CONTRACT EXAMPLE

I invented a bin discharging machine which I named the “Drag Out Discharger”, and entered into a license agreement with a company in Oregon. The company agreed to, build a prototype, manufacture, and sell the machine and to pay me royalties out of sales income. The contract is reproduced here as an example only.

You must allow your attorney to draft, oversee, and approve your contract, should you decide to grant a manufacturing company the right to produce and sell your invention. Note the Finders Fee clause. You receive a fee, above and beyond the Royalty, for those machines that you sell.



The “Drag-out Discharger”, invention is illustrated above and below. The bin is filled periodically by an input conveyor at the top with coal, wood chips and other bulk materials. A discharge conveyor at bottom right feeds the material at a constant controlled rate to a boiler, paper making or other process.

Conveyor feed interruption has been a costly and aggravating problem. Other bulk material handling bins have a tendency become jammed, stopping the discharge flow.

The Drag-out Disharger’s sturdy, hydraulically powered rake arms lower onto the top or side of the bulk material. The a powerful racking action pulls a portion of the material onto the dicharger’s conveyor.

The hydraulic drives speed is adjustable to give optimum performance with virtually any combination material and flow rate.

If your plant is equipped with rectangular storage and metering bins, a Drag-out Discharger can be retrofitted.

**The Transco Northwest Drag-out Discharger
in 2000 to 100,000 cubic foot bins.***

Capacity (Cubic ft.)	A	B	Model	Capacity (Cubic ft.)	A	B	Model
2000	12'-10"	23'-10"	DOD-2	24,000	28'-5"	43'-11"	DOD-24
3000	14'-7"	26'-1"	DOD-3	28,000	29'-11"	45'-10"	DOD-28
4000	15'-11"	27'-10"	DOD-4	32,000	31'-3"	47'-6"	DOD-32
6000	18'-2"	30'-8"	DOD-6	36,000	32'-6"	49'-1"	DOD-36
8000	19'-11"	32'-11"	DOD-8	40,000	33'-7"	50'-7"	DOD-40
12,000	22'-9"	36'-7"	DOD-12	60,000	38'-5"	56'-9"	DOD-60
16,000	24'-11"	39'-5"	DOD-16	80,000	42'-2"	61'-8"	DOD-80
20,000	26'-10"	41'-10"	DOD-20	100,000	45'-5"	65'-10"	DOD-100

*Other capacities available on special order.

CONTRACT ELEMENTS

Study the following important elements of this license agreement:

- * Start date.
- * Names of Licensor and Licensee.
- * Licensor's invention identified.
- * Licensee's proposed use of the invention.
- * Exclusive license.
- * Royalty to be paid to Licensor.
- * Finder's fee.
- * Prototype or test model.
- * Licensor's knowledge or intellectual property.
- * Patent validity.
- * Patent litigation.
- * Ownership of improvements to the invention.
- * Invention name tags.
- * Bankruptcy of the Licensee.
- * Term and termination of the contract.

- * Passing this contract onto other parties.
- * Illegality of any item does not invalidate the rest of this agreement.
- * Termination by mutual consent.
- * Addresses of Licensor and Licensee for correspondence.
- * Signatures of Licensor, Licensee, and witness.

LICENSE AGREEMENT

This agreement made between and entered into this _____ day of _____ by and between John Andrew, herein "Licensor", and Transco Northwest, Inc. an Oregon corporation, herein called "Licensee". In consideration of the mutual promises, agreements, and payments hereinafter set forth, it is agreed by the parties as follows:

Recitals

1. Licensor has invented a bin discharging machine for waste fuel, known as the "Drag Out Discharger". Licensor represents and warrants that he has made applications for letters patent of the United States, Serial Number 34,844 dated April 30, 20____, "Rake Discharger", covering such invention and that Licensor is the owner of such patent applications and any and all inventions disclosed thereby, and that the Licensor has full power and authority to enter into this agreement.
2. Licensee is of manufacturing, using, selling, licensing, and distributing products and the right to apply the same, embodying Licensor's invention.

Exclusive License

3.a. Licensor hereby grants to Licensee the sole exclusive right, privilege, and license for the full term of any patent or patents issued pursuant to the applications, unless sooner terminated as provided by this agreement to make, use, and vend products embodying said invention throughout the United States, its territories and possessions, but not elsewhere. Such grant shall also include the further right to make, use, and vend any improvements developed or discovered during the term of this agreement which are within the general scope of the invention. As used herein, the term, "products". includes "Drag Out Discharger", and spare parts or replacement parts therefore.

Royalty

Licensee agree to pay Licensor for this license, royalties measured by the, "Drag Out Dischargers", associated power units, controls, and spare parts sold as follows:

<u>Product Sales</u>	<u>Royalties</u>
First \$100,000	5%
Over \$200,000	4%

Volume of sales shall be gross sales price of all products sold, less applicable discounts allowed, i.e. net sale price received by Transco Northwest, Inc., but exclusive of sales, use or other taxes measured by the value of the goods sold. The forgoing schedule of royalties shall apply to sales made each calendar year. Sales shall be considered made when invoiced to the customer.

4.b. Royalty payments shall be due and payable on the 10th of January, April, July, and October for sales which have been made in the preceding calendar quarter. Licensee shall furnish Licensor with a

written statement at the time so specified for making each payment which shall show all manufacture and sales, including names and addresses of customers or consignees, made during the preceding calendar quarter. Licensee shall keep true and complete books of account to show its manufacturing and sales under this agreement, and Licensor shall have the right of inspection thereof for the purpose of verifying statements furnished by Licensee, such access to be at reasonable business hours.

4.c. If Licensee fails to sell any "Drag Out Dischargers", or spare parts for "Drag Out Dischargers", between the 10th of January and the 10th of July or the 10th of July and the 10th of January, a compensation of \$600 will be paid to the Licensor by the Licensee for the preceding six month period within 30 days thereof, said compensation to be deducted from royalties payable to the Licensor as a result of sales during the remainder of the term of this agreement.

4.d. This agreement will terminate if total sales of "Drag Out Dischargers", and spare parts are less than \$100,000 during any three year period after the date of signing this agreement.

Finder's Fee

5. A finder's fee of 1% of the gross sales price, less applicable discounts, will be paid to the Licensor by the Licensee for "Drag Out Dischargers", sold and for which purchase orders are obtained by the Licensor or others appointed by the Licensor.

Test Model

6. Licensee agrees to provide at its expense a test model functionally representative of the "Drag Out Discharger", within 6 months after the date of signing of this agreement because time is of the essence.

Know-How Applications

7. Licensor agrees to furnish Licensee all of the necessary information as to manufacturing, application, and other operating techniques and know-how which he now has or which shall come to his attention during the term of this agreement. Licensor shall pay all costs incurred in connection with said patent applications and in obtaining letters patent for said invention, and shall prosecute such applications diligently. Licensor agrees to supply Licensee promptly with copies of all papers filed in the Patent Office during the prosecution of the applications, including copies of office actions, and amendments, and otherwise keep Licensee reasonably informed as to the progress of the applications. Licensor further agrees to supply Licensee, at Licensee's request with copies of any drawings it has heretofore made with respect to the "Drag Out Discharger", its attachments and /or replacement parts herein licensed and to disclose to Licensee any models of said "Drag Out Discharger", as are available to Licensor at the time such request is made.

Non-Dispute of Patent Validity

Licensee acknowledges the validity of any patent or patents that may be granted pursuant to said applications, and Licensee will not dispute, take objections to or contest the validity of any patent which may be granted relating to the claimed invention which is the subject of this agreement, or any improvements thereto. In the event, however that all claims of the applications for letters patent shall be finally denied, or in the event that all such claims shall be determined by a court of competent jurisdiction to be void, this agreement shall automatically terminate, no further royalties shall be thereafter payable, however an engineering fee of one half of one percent of the gross sales price, less applicable discounts shall be paid by the Licensee for all "Drag Out Dischargers", sold.

Infringers; Claims

9.a. In the event the Licensor decides to bring suit against any infringer of patent or patentable feature or claim covered by this license, he shall first notify Licensee of his decision to bring suit. Licensee shall thereafter advise Licensor whether it desires to participate in such suit. If Licensee desires to participate in the suit, all costs and expense of the suit and any damages recovered therein shall be shared equally with the parties. If Licensee does not desire to participate in the suit, all costs and expenses thereof shall be paid by the Licensor, and Licensor shall be entitled to retain all damages recovered therein. Licensee agrees to bring to the attention of Licensor all instances of purported manufacture by unlicensed manufactures promptly upon learning of the same.

9.b. Licensor is to receive its royalties free and clear of any claim against the Licensee of any nature or kind whatsoever and it shall be the obligation of the Licensee to defend the Licensor against any and all claims, demands or causes which may be brought against the Licensor on account of faulty or negligent manufacture of the "Drag Out Dischargers".

Improvements

10. In the event the Licensee shall have issued to it any patent for improvement on the machine covered by the patent herein mentioned or shall make application for any such patent or shall make any invention affecting such machine patents, applications and inventions shall become and be the joint property of the parties and the Licensee shall execute and deliver to the Licensor upon written demand any assignments or other instrument or property to transfer to the Licensor any such patent, patent application, or invention.

Marking

11. Licensee agrees to mark all licensed machines manufactured and used or sold by it with the trademark "Drag Out Discharger", and Licensee further agrees to attach to a prominent part of each "Drag Out Discharger", supplied, a plate or its equivalent, to be supplied by Licensee, and bearing the following data "Drag Out Discharger", bearing United States Patent Application Serial No.34,844.

Licensee also agrees to mark all advertising, printed matter, and products, to the extent that limitations of space and format reasonably permit, with such legal patent notice as it may be advised to do by Licensor.

Bankruptcy

12. In the event the Licensee is declared a bankrupt or commits an act of bankruptcy or becomes insolvent, or in the event a receiver of its assets is appointed, this agreement shall automatically terminate and all rights herein granted shall immediately revert to and become the sole and exclusive property of the Licensor.

Term and Termination

13.a. In case Licensee fails to perform any of its obligations herein prescribed, Licensor may notify Licensee in writing of any such default, and Licensor shall have the option of treating this agreement in full force and effect and taking proper steps to recover any royalty payable hereunder, or of canceling this license agreement; provided however, that in case Licensor elects to cancel this agreement for such default, it shall first mail or otherwise send to Licensee a written notice of its intention, together with a statement as to the grounds on which the intended action is based. If Licensee shall have met the obligations presented by the Licensor and shall have complied with the provisions of this agreement within sixty (60) days after the receipt of such notice, then the notice shall become null and void and of no effect; otherwise, the notice shall remain effective and this license and agreement shall cease and terminate at the expiration of said sixty (60) days.

13.b. In the case of the termination of this agreement for any cause whatsoever, all rights and obligations of the parties hereunder shall cease, save that Licensee shall be liable for all royalties accruing up to the date of termination or otherwise payable.

13.c. It is also agreed that if the Licensee shall undertake to manufacture sell any other "Bin Discharger", to the detriment of sales of the "Drag Out Discharger", that the Licensor shall have the right to cancel this contract by giving ten (10) days notice of its intention to do so.

13.d. In the event of any such termination, Licensee or any customers, however, shall be entitled to sell or use any products on hand which have been manufactured pursuant to this license and to fill any orders contracted for prior to termination by Licensor, subject to payment of royalties provided in paragraph 4.

Assignment

14. This agreement shall insure to the benefit of and be binding on the successors, assigns, personal representatives, and heirs of the respective parties. In the event of assignment, the assignment shall not be effective until the assignee assumes the assignors obligations in writing and hereafter, the assignor shall be released from all liability.

15. The illegality of any specific provision in this agreement shall not invalidate the agreement as a whole but shall only invalidate the illegal provision. Reasonable efforts shall be made by the respective parties to perfect any defects in the agreement to the mutual satisfaction of the parties.

16. This agreement may be terminated by the mutual agreement of the parties as set forth in paragraph 13.

17. Any notice required to be given shall be in writing and may given by personally delivering the same or by mailing the notice to the party as follows:

John Andrew
P.O. Box XXXX
City State XXXXX

Company X, Inc.
P.O. Box XXX
City State XXXXX

Notice shall be deemed to have been delivered when such notice has been in the United States mails.

IN WITNESS WHEREOF, the parties have executed this day and year above written.

JOHN ANDREW

Licensor

TW, INC.

Licensee

ATTEST: This is the end of "Contract Out Manufacturing" example.

39. United States Patent

There are three types of patents:

- 1) Utility patents may be granted to anyone who invents or discovers any new and useful process, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof;
- 2) Design patents may be granted to anyone who invents a new, original, and ornamental design for an article of manufacture; and
- 3) Plant patents may be granted to anyone who invents or discovers and asexually reproduces any distinct and new variety of plant. “

Generally the term of a new patent is 20 years from the date on which the application for the patent was filed in the United States.

United States Patent and Trademark Office

“The United States Patent and Trademark Office (USPTO or Office) is the government agency responsible for examining patent applications and issuing patents. A patent is a type of property right. It gives the patent holder the right, for a limited time, to exclude others from making, using, offering to sell, selling, or importing into the United States the subject matter that is within the scope of protection granted by the patent. The USPTO determines whether a patent should be granted in a particular case. However, it is up to the patent holder to enforce his or her own rights if the USPTO does grant a patent.” (www.uspto.gov)

United States patent law was established "to promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries;" as provided in the United States Constitution. (Wikipedia)

Provisional Application for Patent

The U.S. Patent and Trademark Office eliminated the **Disclosure Document Program** on February 1, 2007. For more information, see the Federal Register notice. Inventors not ready to file a full patent application may file a provisional patent application which provides more benefits and protections to inventors than the disclosure document. See Provisional Application for Patent Brochure.

This brochure describes the features of the Provisional Application for Patent which is a U. S. national application for patent filed in the USPTO under 35 U.S.C. §111(b). The US Patent and Trademark Office has offered inventors the option of filing a Provisional Application for Patent since June 8, 1995.

PRINT PUBLICATION

Product Code: GIS-5160P-PP

Price: free

Use: USPTO Contact Center order form

For information or to order by phone, call 800-786-9199 or 571-272-1000.

Provisional Application for Patent Filing Date Requirements

The provisional application must be made in the name(s) of all of the inventor(s). It can be filed up to 12 months following the date of first sale, offer for sale, public use, or publication of the invention. (These pre-filing disclosures, although protected in the United States, may preclude patenting in foreign countries.)

A filing date will be accorded to a provisional application only when it contains:

- a written description of the invention, complying with all requirements of [35 U.S.C. §112](#) 1st paragraph and
- any drawings necessary to understand the invention, complying with [35 U.S.C. §113](#) .

If either of these items are missing or incomplete, no filing date will be accorded to the provisional application.

To be complete, a provisional application **must also** include the filing fee and a cover sheet identifying:

- the application as a provisional application for patent;
- the name(s) of all inventors;
- inventor residence(s);
- title of the invention;
- name and registration number of attorney or agent and docket number (if applicable);
- correspondence address; and
- any US Government agency that has a property interest in the application.

Form PTO/SB/16, available on the printable forms page of the USPTO website at <http://www.uspto.gov/web/forms/index.xml> may be used as the cover sheet for a provisional application.

40. Filing Fees

Fees are subject to change. The current fee for a provisional application for patent can be found on the [fee page](#) . USPTO Contact Center (UCC) customer service representatives are available Monday through Friday (except Federal holidays) at 800-786-9199 to provide fee information. Payment by check or money order must be made payable to "Director of the U.S. Patent and Trademark Office".












Fee Code	37 CFR	Description	Fee	Small Entity Fee (if applicable)
Patent Application Filing Fees				
1011/2011	1.16(a)(1)	Basic filing fee - Utility <i>filed on or after December 8, 2004</i>	330.00	165.00
4011 [±]	1.16(a)(1)	Basic filing fee - Utility (electronic filing for small entities) <i>filed on or after December 8, 2004</i>	n/a	82.00
1001/2001	1.16(a)(2)	Basic filing fee - Utility	850.00	425.00

		<i>filed before December 8, 2004</i>		
1201/2201	1.16(h)	Independent claims in excess of three	220.00	110.00
1202/2202	1.16(i)	Claims in excess of 20	52.00	26.00
1203/2203	1.16(j)	Multiple dependent claim	390.00	195.00

Mail the provisional application and filing fee to:

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

This information is general in nature and is not meant to substitute for advice provided by a patent practitioner. Applicants unfamiliar with the requirements of US patent law and procedures should consult an attorney or agent registered to practice before the USPTO.

PRODUCT TITLE To Catalog Price List	PRODUCT CODE	
Basic Facts About Trademarks	GIS-5020T-PP	
USPTO Fee Schedule	GIS-5030G-PP	
General Information About Plant Patents	GIS-5135P-PP	
General Information Concerning Patents	GIS-5136P-PP	
Guide to Filing a Design Patent Application	GIS-5130P-PP	
Guide to Filing a Utility Patent Application	GIS-5140P-PP	
Information Contacts	GIS-5045G-PP	
Provisional Application for Patent Brochure	GIS-5160P-PP	
Patent and Trademark Depository Library map and list	GIS-5002G-PP	
USPTO Public Search Facility Brochure	GIS-5150G-PP	

The following "Patent Process Flow" is copied from the United States Patent and Trademark Office website at: www.uspto.gov.

41. Patent Process Overview

Step 1, Applicant - [Has your invention already been patented?](#)

[Search the Patent Full-Text and Full-Page Image Databases](#)

If already patented, end of process

If not already patented, continue to Step 2

Step 2, Applicant - [What type of Application are you filing?](#)

[Design Patent](#) (ornamental characteristics)

[Plant Patent](#) (new variety of asexually reproduced plant)

[Utility Patent \(most common\) \(useful process, machine, article of manufacture, composition of matter\)](#)

Step 3, Applicant - Determine Filing Strategy

File Globally?

[Need international protection?](#)

File in U.S.? - continue to Step 4

Step 4, Applicant - Which type of Utility Patent Application to file?

[Provisional or](#)

[Nonprovisional](#)

Step 5, Applicant - Consider expedited examination

[Accelerated Examination Program](#)

[First Action Interview](#)

[Patent Prosecution Highway](#)

Step 6, Applicant - Who Should File?

[File yourself \(Pro Se\)](#)

[Use a Registered Attorney or Agent](#) (Recommended)

Step 7, Applicant - Prepare for electronic filing

[Determine Application processing fees](#)

[Apply for a Customer Number and Digital Certificate](#)

Step 8, Applicant - Apply for Patent using Electronic Filing System as a Registered e-Filer (Recommended)

[About EFS Web](#)

Step 9, USPTO - [USPTO examines application](#)

[Check Application Status](#)

Allowed?

[Yes, go to Step 12](#)

No, continue to Step 10

Step 10, Applicant - Applicant files replies requests for reconsideration, and appeals as necessary

Step 11, USPTO - If objections and rejection of the examiner are overcome, USPTO sends Notice of Allowance and Fee(s) due

Step 12, Applicant - Applicant pays the issue fee and the publication fee

USPTO Grants Patent

Step 13, Applicant - [Maintenance fees due 3 1/2, 7 1/2, and 11 1/2 years after patent grant](#)

[Download the Utility Patent Application Guide](#)

<http://www.uspto.gov/patents/resources/types/utility.jsp>

<http://www.uspto.gov/patents/resources/types/utility.jsp>

42. Filing A Patent Application

The following information originated at: <http://www.uspto.gov/patents/resources/types/utility.jsp>

“A Guide to Filing A Non-Provisional (Utility) Patent Application”

(Excerpted from *A Guide to Filing A Utility Patent Application* print brochure)

- [Introduction](#)
- [Nonprovisional Utility Patent Application Requirements](#)
- [Utility Patent Application Transmittal Form Or Transmittal Letter Fee Transmittal Form And Appropriate Fee](#)
- [Application Data Sheet](#)
- [Specification](#)
- [Title Of Invention](#)
- [Cross-Reference To Related Applications](#)
- [Statement Regarding Federally Sponsored Research Or Development](#)
- [Reference To A Sequence Listing, A Table, Or A Computer Program Listing Compact Disc Appendix](#)

- [Background Of The Invention](#)
- [Brief Summary Of The Invention](#)
- [Brief Description Of The Several Views Of The Drawing](#)
- [Detailed Description Of The Invention](#)
- [Claim Or Claims](#)
- [Abstract Of The Disclosure](#)
- [Drawings \(When Necessary\)](#)
- [Oath Or Declaration](#)
- [Sequence Listing \(When Necessary\)](#)
- [Obtaining A Receipt For Documents Mailed To The USPTO](#)
- [Drawing Requirements](#)
- [Identification Of Drawings](#)
- [Graphic Forms In Drawings](#)
- [Paper](#)
- [Views](#)
- [Exploded Views](#)
- [Partial Views](#)
- [Sectional Views](#)
- [Alternate Position](#)
- [Modified Forms](#)
- [Arrangement Of Views](#)
- [Front Page View](#)
- [Scale](#)
- [Character Of Lines, Numbers, And Letters](#)
- [Shading](#)
- [Symbols](#)
- [Legends](#)
- [Numbers, Letters, And Reference Characters](#)
- [Lead Lines And Arrows](#)
- [Copyright Or Mask Work Notice](#)
- [Numbering Of Sheets Of Drawings And Views](#)
- [Security Markings](#)
- [Corrections](#)
- [Holes](#)
- [Patent and Trademark Depository Library \(PTDL\) Program](#)

43. Making a Patent Search Online www.uspto.gov

“Inventors are encouraged to search the USPTO’s patent database to see if a patent has already been filed or granted that is similar to your patent. Patents may be searched in the USPTO Patent Full-Text and Image Database (PatFT). The USPTO houses full text for patents issued from 1976 to the present and TIFF images for all patents from 1790 to the present.”

Make a search of the U.S, Patents to see if your idea or invention has been patented already.

Inventors are encouraged to search the USPTO’s patent database to see if a patent has been filed or granted that is similar to their patent.

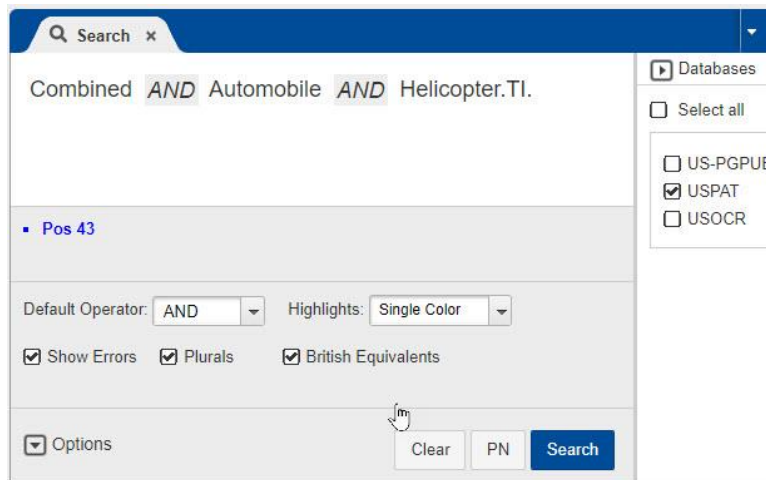
**Example: Combined Automobile Helicopter
Patent US 10967692**

Go to the U.S. Patent Office web site at: www.uspto.gov. The front page of the Patent Office web site will open.

*Select, “**Patents**”.

Scroll to the bottom until you see >>

uspto UNITED STATES
PATENT & TRADEMARK OFFICE



Default Operator **AND**

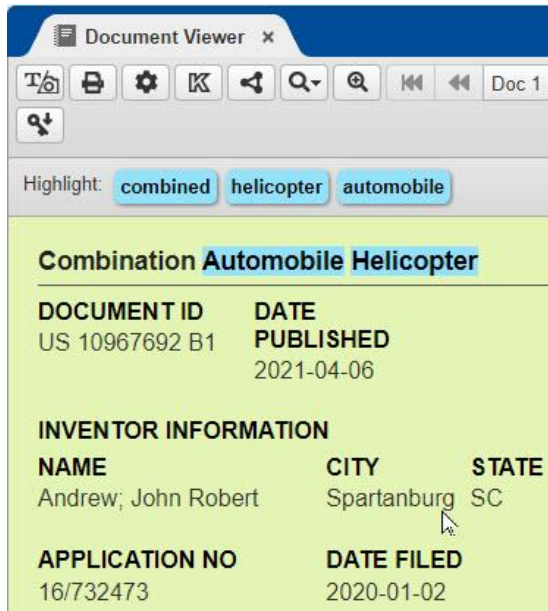
Type “**AND**” between each word in the invention title.

Check **USPAT** box only.

Add a period at end of invention title.

Type “**TI.**” (Two periods are required)

Select “**Search**”



The desired invention patent will open as shown.

Abstract

An **automobile** equipped with helicopter flight apparatus capable of travel on public roads or flight in any direction. The conversion from ground travel mode to flight mode and vis-versa is automatic.

Background/Summary

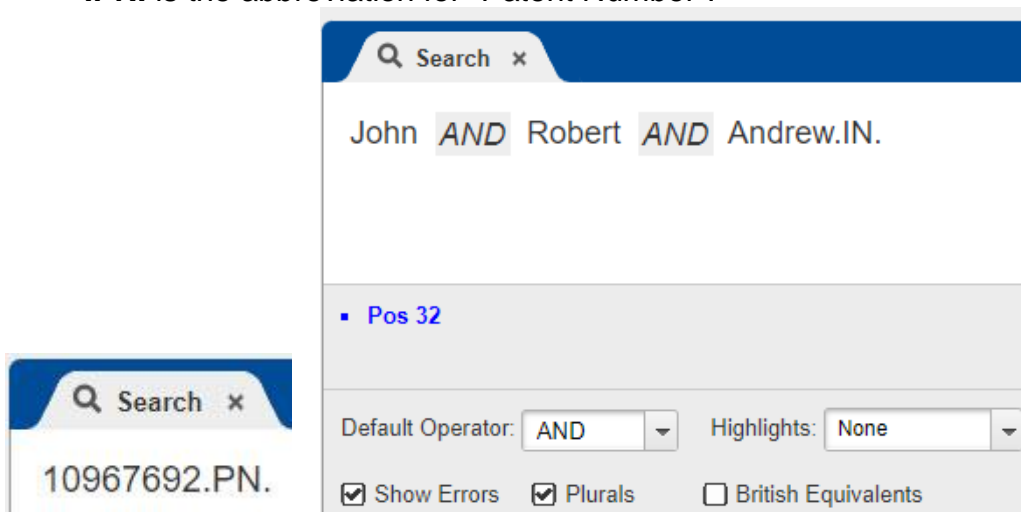
BACKGROUND

(1) Helicopter type vehicles capable of vertical takeoff and landing as well as travel on roads have been proposed but none are of wide spread use. One such transport vehicle has counter rotating rotor blades, each of which fold in half. Far more complicated than the design offered herein. Another combination **automobile-helicopter** has two engines increasing complexity. Other vehicles of this type require manual conversion from ground travel to flight while the present vehicle converts from ground mode to flight mode and vise-versa automatically.

SUMMARY OF THE INVENTION

(2) A primary object of the invention is to combine a conventional **automobile** and conventional helicopter with minimum modifications to both road and flight vehicles. A secondary objective is that said vehicle's rotor column axis be fixed and not hinged and that the tail boom be fixed and not hinged.

.PN. is the abbreviation for “Patent Number”.



The image shows a search interface with a search bar at the top containing the query "John AND Robert AND Andrew.IN.". Below the search bar, the results are displayed as "John AND Robert AND Andrew.IN.". A section labeled "Pos 32" is visible. At the bottom, there are search options: "Default Operator: AND", "Highlights: None", and checkboxes for "Show Errors", "Plurals", and "British Equivalents".

10967692.PN.

.IN. is the abbreviation for the inventor’s name.

44. EXISTING PATENT

(12) **United States Patent**
Andrew

(10) **Patent No.:** US 10,967,692 B1
(45) **Date of Patent:** Apr. 6, 2021

(54) **COMBINATION AUTOMOBILE
HELICOPTER**

(71) Applicant: **John Robert Andrew**, Spartanburg, SC (US)

(72) Inventor: **John Robert Andrew**, Spartanburg, SC (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **16/732,473**

(22) Filed: **Jan. 2, 2020**

(51) **Int. Cl.**
B64C 37/00 (2006.01)
B60F 5/02 (2006.01)
B64C 27/78 (2006.01)
B64C 27/06 (2006.01)
B64C 27/02 (2006.01)
B64C 27/12 (2006.01)

(52) **U.S. CL.**
CPC *B60F 5/02* (2013.01); *B64C 27/022* (2013.01); *B64C 27/06* (2013.01); *B64C 27/12* (2013.01); *B64C 27/78* (2013.01); *B64C 37/00* (2013.01)

(58) **Field of Classification Search**
CPC . *B60F 5/02*; *B64C 37/00*; *B64C 27/78*; *B64C 27/12*; *B64C 27/022*; *B64C 27/06*; *B64C 1/063*; *B60P 3/42*
See application file for complete search history.

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7,815,144 B2 *	10/2010	Molnar	B64C 35/008 244/17.11

* cited by examiner

Primary Examiner — Medhat Badawi

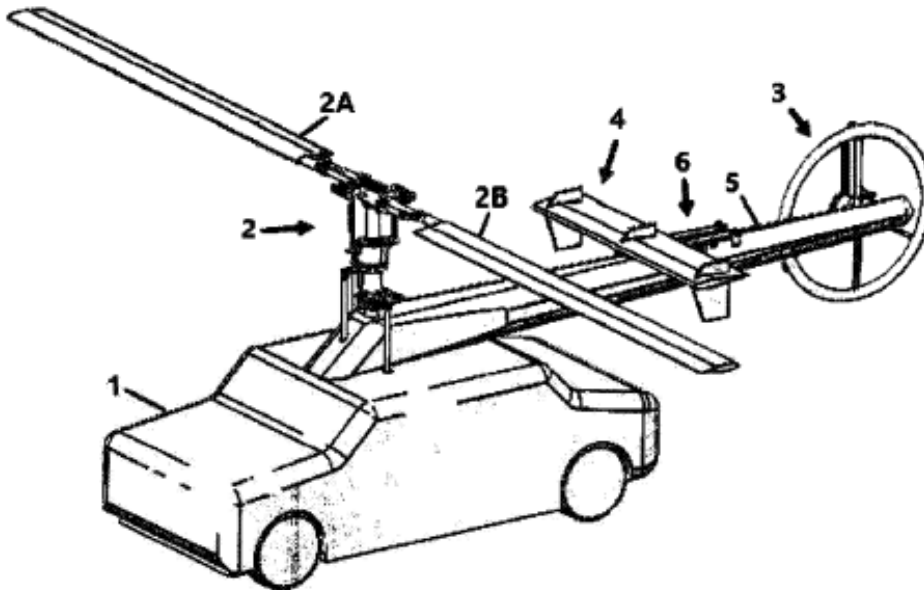
Assistant Examiner — Vicente Rodriguez

(74) *Attorney, Agent, or Firm* — J. Bennett Mullinax LLC

(57) **ABSTRACT**

An automobile equipped with helicopter flight apparatus capable of travel on public roads or flight in any direction. The conversion from ground travel mode to flight mode and vis-versa is automatic.

6 Claims, 7 Drawing Sheets



45. A PATENT APPLICATION EXAMPLE

DISHWASHER BASKETS METHOD AND APPARATUS

As below named inventor, I hereby declare that my residence, post office address, and citizenship are as sighted below next to my name and I believe that I am the original, first, and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention, the specification of which is attached hereto under the following title:

“Dishwasher Baskets Method and Apparatus”

I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to in the oath and declaration. I acknowledge a duty to disclose information which is material to the examination of this application in accordance with Title 37, code of the Federal Regulations, Section 1.56 (a). I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Title 18, United States Code, Section 1001, and that such willful false statements may jeopardize the validity of application or any patent issued thereon.

Please send correspondence and make telephone calls to the inventor below:

Signature: Sole/First Inventor: _____

Printed Name: John Robert Andrew

Citizen of: The United States.

Date: 16 May 2006

Postal Address: PO Box 16611, Simpson, SC 29730

All correspondence must be sent to the above PO Box.

Residence: XXXX Highway 21, Simpson, SC 29730

DISHWASHER BASKETS METHOD AND APPARATUS

Inventor:	Andrew; John R. (Simpson, SC)
Assignee:	None
Appl. No.:	XXXXX
Filed:	Date
Current U.S. Class:	312/301 ; 312/311
Current International Class:	A47L 15/50 (20060101)
Field of Search:	312/301,311,334.21,298,299

Existing U.S. Patents That Relate to the Present Application

2648588	August 1953	Ruspino
2739025	March 1956	Stoddard
3124251	March 1964	Guth
3126098	March 1964	Geiger et al.

Below is the “Abstract”, a short one paragraph summary of the invention, on a separate page. Note the double line spacing.

DISHWASHER BASKETS METHOD AND APPARATUS

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46. ABSTRACT OF THE INVENTION

[0001] The invention is directed to reduce the time and effort to unload dishwashers by providing baskets for holding all of the dishes, cups, glasses, knives, forks, spoons, and utensils to be washed and dried. The same baskets filled with washed and dried items are carried by hand to and placed on conventional kitchen cupboard shelves. A duplicate set of empty baskets replace the full baskets removed from the dishwasher. The duplicate baskets may be used to collect dishes, glasses, etc. at a table, carry them, and load them more quickly and conveniently into a dishwasher.

“The Prior Art” refers to the list of similar patents above. The unique features of each of these existing patents must be described. The features which make the present application novel or improved are also described. Note that each paragraph is numbered.

47. THE PRIOR ART

0002] U.S. Patent No. 5,462,348, entitled “Dishwasher Utensil Tray,” relates to a utensil tray or basket for holding long utensils in a dishwasher. The utensil rack is supported on the upper perimeter edge of a conventional dish rack. The primary objective of the utensil tray is to hold spatulas and other long objects that a silverware basket will not conveniently hold. Another objective is the provision of a utensil tray that is slidably or rollably supported. Yet another objective is to provide a utensil tray that is easily removed from the dishwasher when it is not needed.

[0003] The present invention also provides a removable dishwasher tray or basket supported by a rack. However the method and apparatus of the present invention allows the basket filled with washed and dried items to be removed from the dishwasher and placed by hand quickly and conventionally on a shelf and provides a second empty tray or basket to replace the aforesaid filled basket in the dishwasher rack. Furthermore the present invention provides a plurality of baskets for unloading all of the: dishes, cups, glasses, cutlery, and long utensils completely, quickly, and conveniently and place them on a

conventional kitchen shelves and provides a duplicate plurality of empty baskets that replace the filled baskets removed from the racks of a dishwasher.

[0004] U.S. Patent No. 3,556,625, entitled "Rack for a Front-Opening Dishwasher" provides an upper dishwasher rack having one removable basket hooked on each side of the rack. The two removable baskets are vertically adjustable up and down. It is an object that each of the removable baskets may be removed, carried by hand to a dining table, filled with dishes or glasses, and carried back to the dishwasher and the two aforesaid baskets hooked to opposite sides of the rack.

[0005] The present invention also provides removable dishwasher baskets supported by a rack. However the method and apparatus of the present invention provides removable baskets filled with all washed and dried items to be removed from the dishwasher and the same baskets filled with washed items placed by hand quickly and conventionally on a shelf. The present invention provides a second set of empty baskets to replace the aforesaid filled baskets in the dishwasher racks. The duplicate baskets of the present invention may be used to collect dishes, glasses, etc. at a table, carry them, and load them more quickly and conveniently into a dishwasher.

The "Background of the Invention" below, describes the present state of the art listing needs that are not satisfied by existing patents. Note that each topic in the application begins on a separate page.

48. BACKGROUND OF THE INVENTION

[0029] Conventional dishwashers have a plurality of dish racks. The racks typically are of rectangular lattice structure adapted to hold dishes, cups, glasses, cookware, utensils, and cutlery. One of the racks is usually equipped with a removable silverware basket for holding knives, forks, and spoons. Sometime after the dishwasher has completed its washing and drying process, each dish, cup, glass, cookware, utensil, and cutlery item is carried by hand to cupboards and placed on shelves. Typically the removable silverware basket for holding knives, forks, and spoons is removed from the dishwasher and carried by hand and placed near to a storage drawer. Each knife, fork, and spoon is then removed from the silverware basket and inserted into the storage drawer. Unloading dishes, cups, glasses, cookware, utensils, and cutlery, knives, forks, and spoons from a conventional dishwasher and placing them in storage cupboards and drawers is very time consuming. The present invention provides a method and

apparatus for reducing the time and effort required to unload a dishwasher and place the washed items in storage areas rapidly.

The “Summary of the Invention” describes in words, not drawings, the “embodiments” or “objects” of the present invention.

49. SUMMARY OF THE INVENTION

[0030] The first embodiment of the present invention is a plurality of removable rectangular open baskets resting on and filling the floor of upper and lower racks within a front loading dishwasher washing chamber holding items to be washed and dried and the same removable baskets transport and continue to hold all of the washed items on conventional kitchen cupboard shelves.

[0031] The second embodiment of the present invention is the provision of a second plurality of empty removable baskets of lattice construction for holding: dishes, glasses, cups, cutlery, utensils, and other washed items, the second set of baskets, stored temporarily within adjacent conventional cupboards, for replacing the first set of removable baskets within the washing chamber of the aforesaid dishwasher.

[0032] The third embodiment of the present invention is an improved front loading dishwasher having removable baskets hanging on at least one telescoping tube assembly in the washing machine washing chamber.

A brief description of the drawings is given below. Figure 1 should be an assembly drawing including all or most of the novel features. It will appear on the first page of the patent. The drawings, bring to practice or practical application the invention and replace the need for a prototype or working model.

50. BRIEF DESCRIPTION OF THE DRAWINGS

[0039] FIG. 1 is an isometric view of a conventional dishwasher having upper and lower racks supporting removable baskets and an adjacent conventional cupboard holding baskets full of washed items and empty baskets in accordance with the present invention.

[0040] FIG. 2 is an enlarged isometric view of cupboard of FIG. 1 holding baskets full of washed items and empty baskets.

[0041] FIG. 3 is an isometric view of a second embodiment of the present invention, a front loading dishwasher having removable baskets each hanging from telescoping tube assemblies in the

uppermost portion of the washing chamber and additional removable baskets supported by a conventional rack in the bottom of the washing chamber.

[0042] FIG. 4A is a partial side section view of the dishwasher of FIG. 3 taken along line A-A.

Each component of the invention is numbered in the figures or drawings and the FIT, FORM, and FUNCTION are given in words below in the "Detailed Description of the Preferred Embodiments". The improvements and needs satisfied are described also. The wording should describe each item so completely that the figures are not required.

51. THE PREFERRED EMBODIMENTS

[0061] In the drawings of the present invention, the reference numeral 1 generally designates a conventional front loading dishwasher improved by the addition of removable baskets of FIGURES: 8A, 10A, 10A, 12, 13, 15, 16A, 16b, and 16C, and a telescoping tube assembly FIG. 4C for supporting the hanging baskets in the dishwasher of FIG. 3 and the cupboard of FIG. 2 described herein and in the attached figures.

The claim or claims are next. "I claim", "We claim", "What is claimed" are typical headings for this part of the patent application. Each claim is a single sentence specifying the benefits, improvements, and needs satisfied by the apparatus in this Utility Patent Application. The apparatus is also described in words, not drawings.

52. CLAIMS

I claim:

[0086] 1. In a conventional front loading dishwasher having a washing chamber containing upper and lower racks movable outside and inside the washing chamber, for reducing the time and effort to unload the washed and dried items comprising:

(a) upper and lower racks, each of open rectangular lattice structure comprising a plurality of welded wire members having a flat bottom and upstanding walls on four sides, each of said upper and lower racks essentially filling the horizontal cross section of the washing chamber.

(b) a first plurality of removable baskets for holding all: dishes, cups, glasses, cutlery, and utensils to be washed, said baskets filling said upper and lower racks,

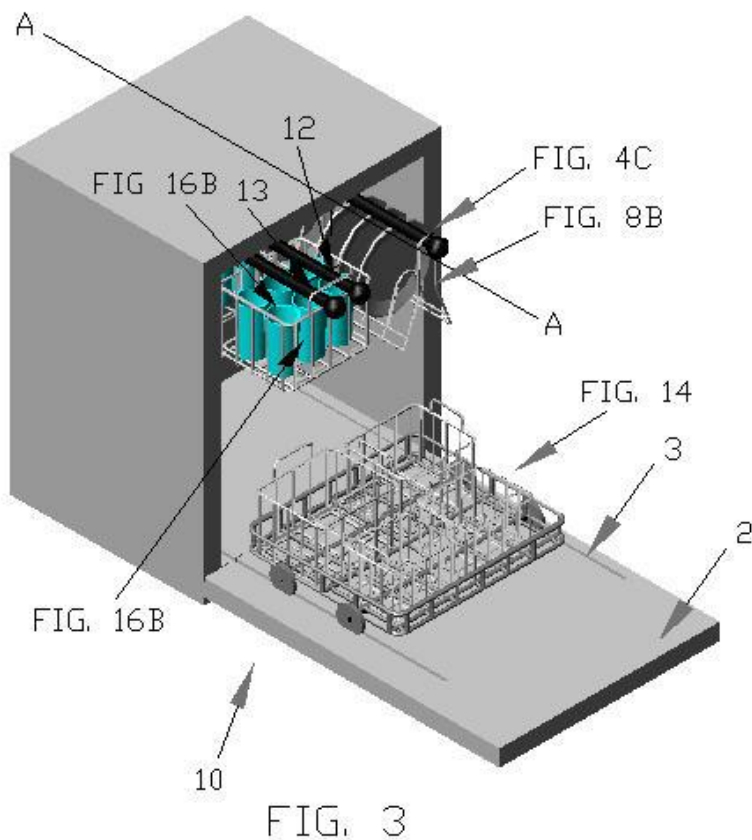
(c) a second duplicate plurality of empty removable baskets for replacing said first plurality of filled removable baskets in the aforesaid dishwasher upper and lower racks.

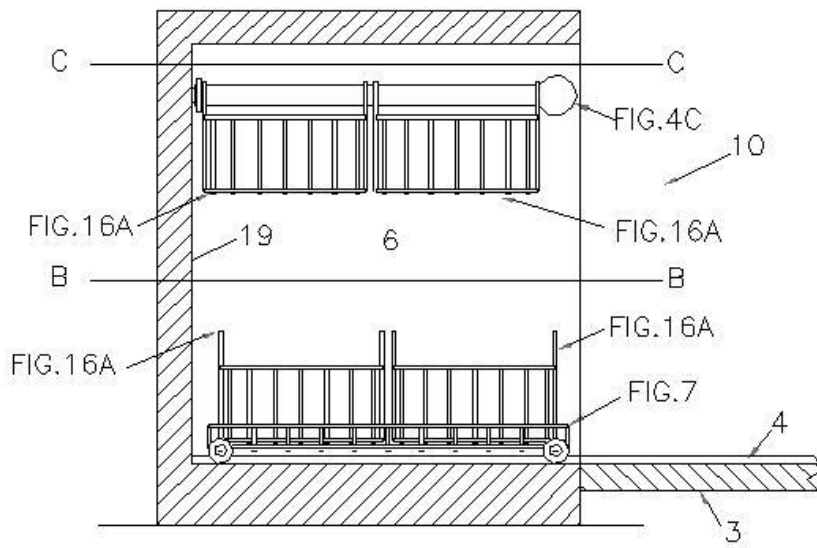
[0087] 2. The plurality of removable baskets of claim 1 wherein one or more of the removable baskets have handles or hooks for carrying by hand and hanging on hooks or rods.

The figures or drawings, "Reduce the invention to Practice" and are the last part of this patent application. Each figure, abbreviated "FIG." illustrate the apparatus and number each component. Arrows point "in general" to assemblies and short lines with numbers identify individual parts. The drawings or figures may be two or three dimensional. Cross sectional views are hatched and their location must be specified in other figures. Multiple figures of the same apparatus are used to illustrate door open, door closed, etc.

53. FIGURES AND DRAWINGS

Inventor: John R. Andrew, 2119 Easley Highway, Piedmont, S.C. 29673, 5 May 2006. Customer Number: XXXXX.





SECTION A-A
FIG.4A

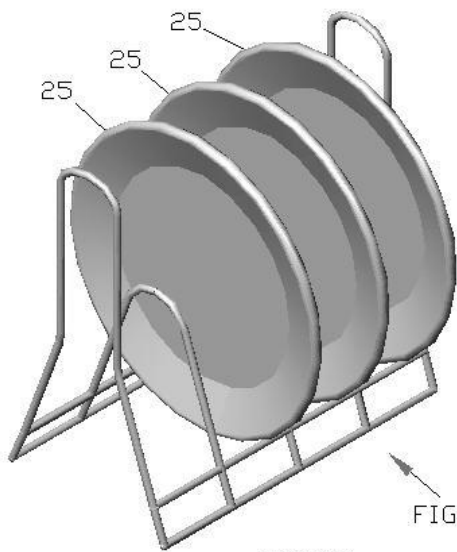


FIG.8B

FIG.8A

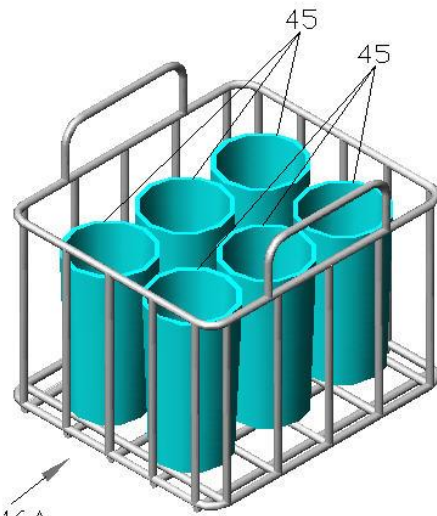


FIG.16B

FIG.16A

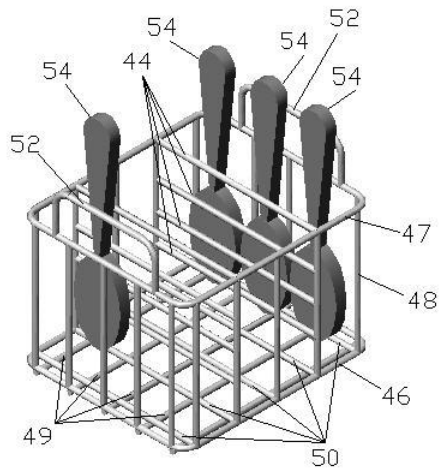


FIG.16C

All patent drawings must show every feature of the invention specified in the claims, and is required by the Patent Office Standards to be in a particular form.

No names or other identification will be permitted within the “sight” of the drawing, and applicants are expected to use the space above and between the hole locations to identify each sheet of drawings. This identification may consist of the attorney’s name and docket number or the inventor’s name and application number and may include the sheet number and the total number of sheets filed (for example, “sheet 2 of 4”).

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INVENTIONS - CRONOLOGICAL					
Printing Press	1440	Gutenberg	Light Bulb	1910	Edison
Barometer	1643	Toricelli	Phonograph	1910	Edison
Air Pump	1650	Guericke	Air conditioner	1911	Carrier
Clock, pendulum	1657	Huygens	Automobile self starter	1911	Kettering
Balloon	1763	Montgolfier	Cellophane	1911	Brandenberger
Bifocal lens	1780	Franklin	Geiger Counter	1913	Geiger
Gas Lighting	1792	Murdoch	Filament, tungsten	1915	Langmuir
Cotton gin	1793	Whitney	Gun, Browning	1916	Browning
Electric Battery	1800	Volta	Elevator, push button	1922	Larson
Steam Engine	1800	Watt	Gasoline, lead ethyl	1922	Midgley
Gun, breechloader	1811	Thornton	Circuit breaker	1925	Hilliard
Calculating machine	1823	Babbage	Gasoline, high octane	1930	Ipatieff
Electromagnet	1824	Sturgeon	Computer	1939	Aiken
Sulfuric Acid	1831	Phillips	Aerosol Spray	1941	Goodhue
Elevator Brake	1852	Otis	Camera, Polaroid	1948	Land
Glider	1853	Cayley	Laser	1958	Townes
Burner, gas	1855	Bunsen			
Flatiron, electric	1862	Seely			
Dynamite	1866	Nobel			
Air Brake	1868	Westinghouse			
Celluloid	1870	Hatt			
Engine, gasoline	1872	Brayton			
Carburetor	1873	Daimler			
Rail car coupler	1873	Janney			
Carpet Sweeper	1876	Bissell			
Cathode ray tube	1878	Crookes			
Cultivator, disc	1878	Mallon			
Cash register	1879	Ritty			
Engine, automobile	1879	Benz			
Cream separator	1880	Delaval			
Electric Fan	1882	Wheeler			
Bicycle	1884	Starly			
Paper, sulfite process	1884	Dahl			
Adding Machine	1885	Burrougs			
Gas Mantle	1885	Weisbach			
Camera, Kodak	1888	Eastman			
Acetylene Gas	1892	Wilson			
Automobile, electric	1892	Morrisson			
Automobile, gasoline	1892	Duryea			
Diesel Engine	1895	Diesel			
X-Ray	1895	Roentegen			
Automobile magneto	1897	Bosch			
Telephone	1900	Bell			
Airplane with motor	1903	Wright Brothers			
Bakelite	1907	Baekeland			
Radio	1907	Marconi			
Glass, laminated, safe	1909	Benedictus			

NOTES: