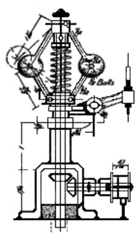

The NEMES Gazette

NEW ENGLAND MODEL ENGINEERING SOCIETY INC.

No. 237 January 2016

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Dues. It's that time of year again. We will start collecting the 2016 dues at the November meeting. Please bring your $25 check or you can try out our credit card system.

Next Meeting

Thursday, January 7, 2016 7PM

Charles River Museum of Industry & Innovation

154 Moody Street

Waltham, Massachusetts

Directions are Here.

We will have a Show and Tell meeting on January 7th. Bring in what you've been working on, got for Christmas or something you are trying to identify.

Membership Info

New members welcome! Annual dues are $25 (mail applications and/or dues checks, made payable to "NEMES", to our Treasurer Richard Baker) Annual dues are for the calendar year and are due by December 31st of the prior year (or with application).

Deadline for submitting articles is two weeks prior to the next meeting.

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Editor's Desk

Dan Eyring

Peter Sevier, a man who clearly likes his stir fry, was frustrated at not being able to make it taste as good at home as in an Asian restaurant. So frustrated that he invented a "hot wok" stove fueled by propane. If you visited Rollie's shop a couple months ago, the hot wok was on display. Peter received so many inquiries about his invention, he graciously contributed a descriptive article to this month's Gazette.

And since the world really IS a small place, Peter also offered comments, based on personal experience, regarding Max's Radar article last month.

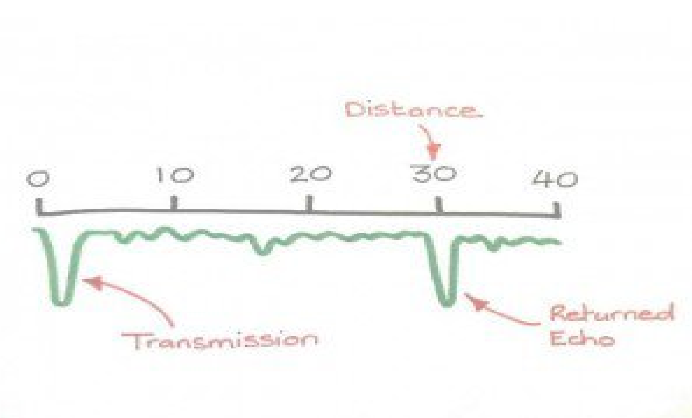
Shop Talk

Max ben-Aaron

In the late 1860's James Clerk Maxwell predicted that oscillating electric charges would produce electromagnetic radiation. Heinrich Hertz demonstrated this experimentally in 1888. Radiation occurs because setting an electron in motion through the action of an electromagnetic field accelerates it and, in response, it emits photons – quanta of radiation.

As early as 1900 Nikola Tesla pointed out the utility of radio echoes in detecting moving objects, such as ships. In 1904 a German engineer, Christian Hulsmeyer, took out patents in many countries for a radio-echo device to help prevent ship collisions. As ship collisions do not happen often, little was done to develop the device.

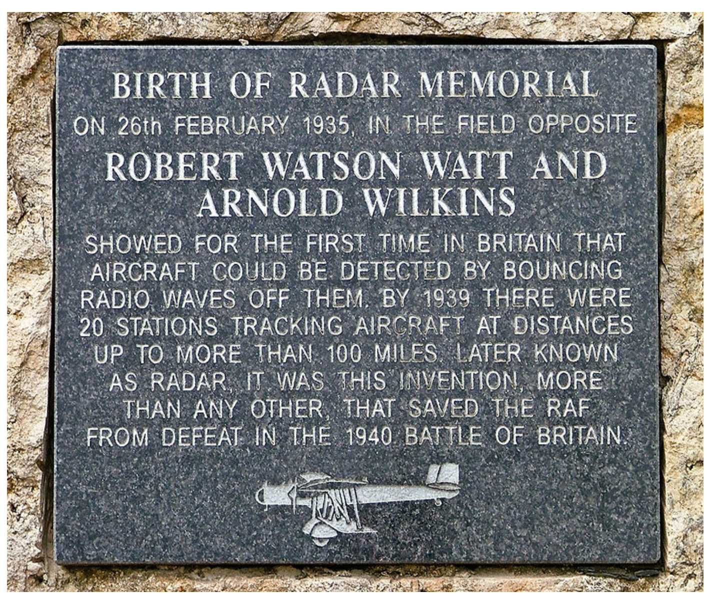
Two Americans, in the mid-nineteen-twenties, Gregory Breit and Merle Tuve, conceived of 'pulse-ranging', sending out short bursts of radiation with a relatively long quiet interval in between pulses, leaving the apparatus is free to pick up echoes between pulses.



In modern radar, microsecond pulses are common Pulsing the radiation allows the time delay between the emission of the pulse and the receipt of the echo to be measured with great accuracy. The velocity of the pulses (as with light) is known with great precision, so the delay indicates the distance of the target. The U.S. Navy coined the acronym 'Radar' (Radio Detection and Ranging) to describe the process. Even the name 'Radar' was a military secret until 1942. The first application of radar was to measure the height of the ionosphere.

In the nineteen thirties, radar for military purposes was being developed, both here in the U.S and in Europe, to increase the power and to provide directional accuracy. To pinpoint the target, the transmitting antennas must focus the pulses into a narrow beam. The longer the wavelength being transmitted, the longer the antenna needs to be to focus the beam sharply. At a fifty-centimeter wavelength, a gigantic antenna tower is needed – totally unsuitable for installation in ships or planes.

In Britain, in the mid-thirties, conventional wisdom was "The bomber will always get through". Hugh Dowding, Britain's air marshal doubted that dogma. Experiments with sound-wave detection lagged, but Radio Detection Finding (RDF) showed exceptional promise. An RAF committee consulted Robert Watson-Watt (a direct descendant of James Watt, inventor of the steam engine), a noted electronics authority. In 1935 Watson-Watt's team demonstrated that 'aeroplanes', passing through a radio beam interrupted the signal strength, suggesting that radar could identify aircraft from a considerable distance.



Soon, this distance rocketed from 16 miles to 60. The Air Ministry was convinced. The first three of the "Chain

Home” network were operational in 1937. Eventually the network grew to 21 stations.

Chain Home was set on masts 360 feet tall, with a transmitter and receiver mast at each site. High and low altitude radars were integrated to give coverage roughly from 2000 feet upwards to about 35 miles, a quantum leap in technology.

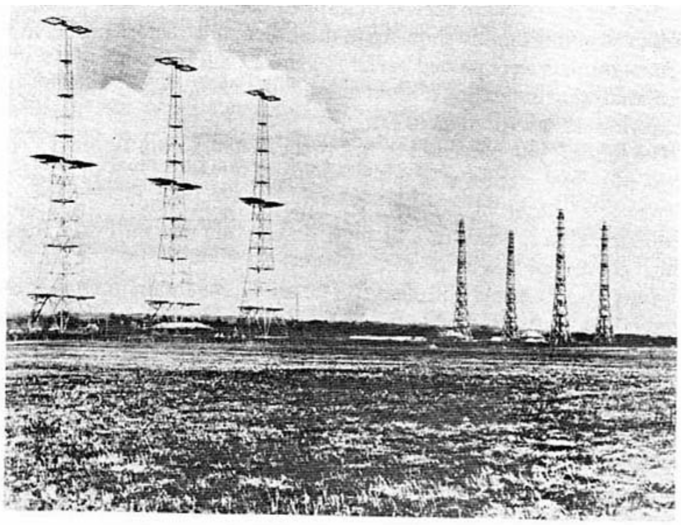


PLATE 7.1 **Chain Home** Chain Home provided the world's first strategic air defence radar network, erected along the east and south coasts of Britain (later extended to the west coast). It used High Frequency and consequently demanded large installations. 360-foot-high transmitter masts are seen on the left of the photograph above and 240-foot receiver masts on the right (*Photo: By courtesy of GEC-Marconi*)

Radar was only one element in the air defense strategy envisaged by Dowding. Recognizing the potential of merging multiple technologies, he wedded radio, telephones, radio and high-performance monoplane fighters (Hurricanes and Spitfires) into the world's first true air-defense network.

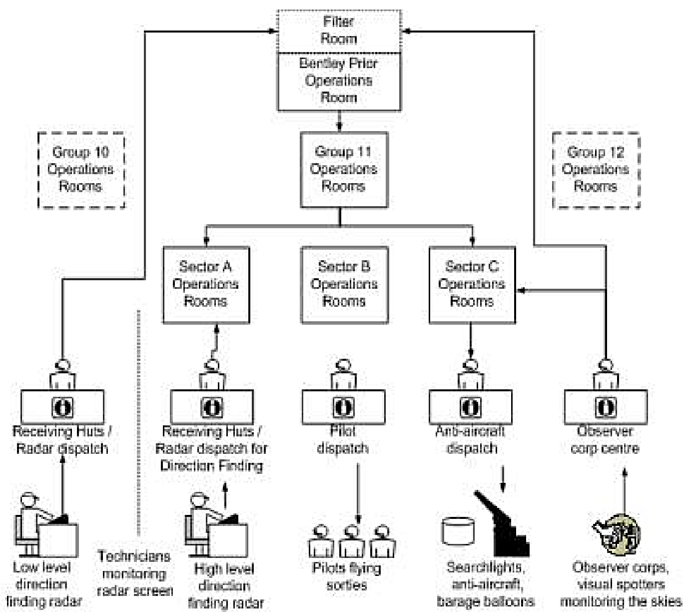
Controlling airborne fighters was essential to a successful defense. Reliable voice radio was critical for effective fighter direction. Defenders needed to make interceptions at distances beyond the 35-40 mile range then available. Although The RAF had initiated short-wave direction finding tests in 1928 the technology lagged. In the late 30’s the Royal Aircraft Establishment began working on Ultra High Frequency (UHF) radio. An operational date in 1942 was set but the project went better than expected and early sets were deployed early in 1937.

By late 1939, the new TR1133 sets provided a 140 mile range at 20,000 feet and an ipressive100 miles air-to-air. When RAF squadrons were sent to France at the beginning of the war in late 1939, obsolescent TR9 sets were installed in the fighters to avoid the risk of RAF communications being compromised by captured aircraft

After the Munich Conference on September 30, 1938, (in which Czechoslovakia was thrown to the wolves) Britain gained badly-needed time to prepare for the approaching war. After war was declared in September 1939, another ten months passed before the onslaught. Those 21 months, purchased at the expense of Czech independence, proved to be crucial for the RAF’s preparations.

Far-sighted RAF officers, realized that German bombers would inevitably penetrate British airspace. In a matter of days, Squadron Leader Raymond Hart established the first ‘filter room’ with a large plotting board, at Bentley Priory, in greater London, establishing the format for others to come. Phone lines, dedicated to the air-defense mission were installed, connecting fighter headquarters at Uxbridge, west of London, to outlying sector offices.

A sector controller, Lt Charles MacLean explained the system:

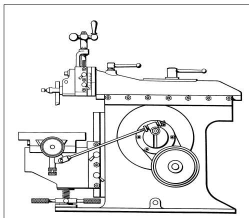


“The whole theory of fighter defense was created to avoid standing patrols. If you were guarding the country by having aeroplanes up all the time, you ran out of engine hours and you were on the ground when the attack occurred So Dowding developed a system of reporting incoming raids. First, he used radar to plot the aircraft as they were approaching Britain and then he used the Observer Corps to spot them when they crossed the coast All the information was fed to a filter room where you got a picture of the developing raids plotted on a table. That picture would be three or four minutes old, but it was sufficiently up to date to get the fighters off when they were really needed.”

Despite some limitations, the system worked well enough to win the Battle of Britain, though 'only just'.

From: Peter Sevier
Subject: Comment on Max ben Aaron's article in the December "Gazette" .

I was interested to read the description of Chain Home (CH) radar. I spent my 2 years National Service (1951-1953) in the RAF. I was trained as a radar fitter in an intense 9-months course, with emphasis on centimeter search equipment. The RAF had plenty of radar mechanics, but not enough fitters. At the time of my training, CH radar was viewed as quaintly old-fashioned, and headed for the scrap-heap (it had out-of-date features like 4-volt heater tubes, for example). At the end of my first year at Imperial College, London, I had to do 2 weeks reserve training. I did this at RAF Ringwood, near Weymouth, Dorset, which was an old CH radar station. We had to learn how to operate this ancient gear for a NATO air exercise! What had changed in the last year? Apparently the realization had dawned on the Air Marshals that centimeter search radar, with it's approximately 2 degree wide beam, and pinpoint accuracy, could not track a ballistic missile moving at well-over the speed of sound - at least, not with the equipment of that time. CH radar however, floodlit the target with the main lobe from the transmitter aerial, so you always got a return signal. The receiving aerial signals were fed into an inductive goniometer (like RDF on ships). This did not have the directional precision of the 10 cm. radar, but you didn't lose the target. My final comment: the 300 ft. high wood transmitter towers (built like little Eiffel towers), were great fun to climb, with a superb view out over the sea. Later the huge, high-powered radars, like Filingdales, which looked out over Russia, were built on the same principle as CH.



Metal Shapers

Kay Fisher

R. G. Sparber's Gingery Shaper - Part 69

Motor Support and Belt Tensioner

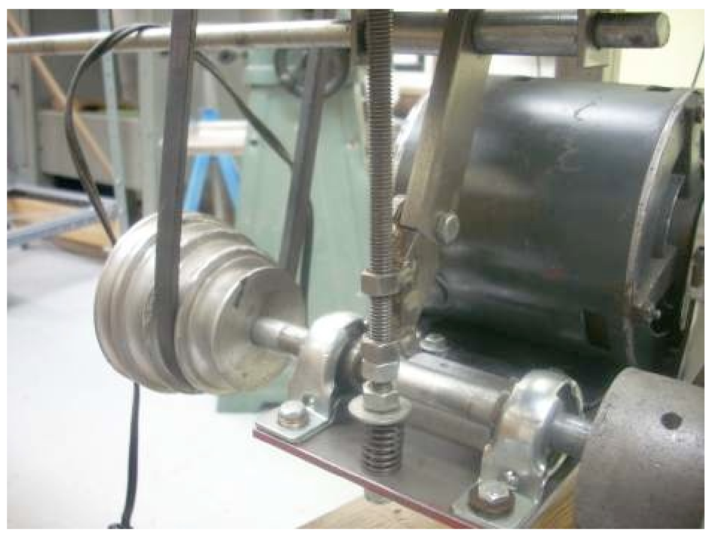
Construction of the motor support and belt tensioner was through trial and error. I will mostly present what I ended up making. It isn't completely finished but the loose ends must wait until other parts are designed and built.

I call the motor plus jack shaft mounted on a common plate my power module. This picture shows the power module but was taken while I was still figuring out what to do. The original idea was to use the weight of the power module to tension the cone pulley belt. This did not work well because the load is discontinuous as the ram moves from cutting to retracting. The pulsating load caused the power module to bounce up and down. A test cut on aluminum showed a washboard effect.

Last Layout   Photo by R. G. Sparber

After a few false starts, I ended up with an "over the center" belt tensioner. This removed the washboard effect and it is now much smoother.

Most of the belt tensioner is done and shown here but I have not tested it under heavy load.



Belt Tensioner Photo by R. G. Sparber

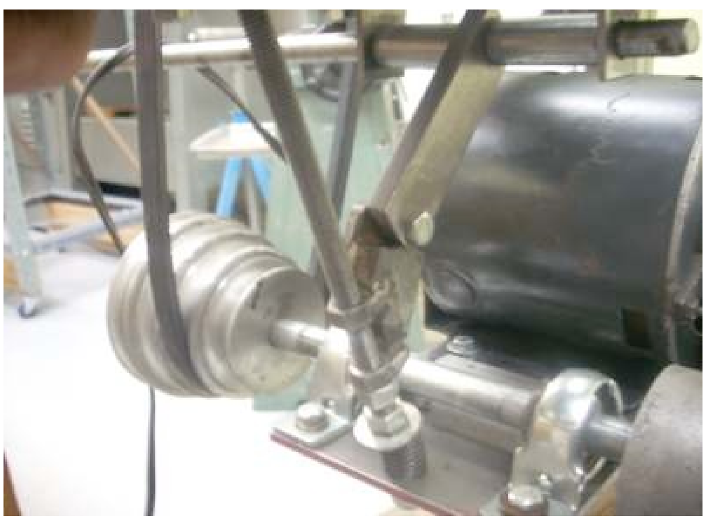
The spring has two purposes. It permits some give in the pulley tension but more importantly, it enables the belt tensioner to hold in the locked position. A nut under the horizontal plate limits how low the plate can swing. The hole in the plate is drilled $^{7}/_{16}$" to permit the threaded rod to tilt forward when the belt tensioner is unlocked.

The upper arm of the belt tensioner is able to pivot on a piece of ½" CRS. Two pieces of electrical conduit flank the upper arm to keep it centered. This pivot rod may be helpful in supporting the cone pulley belt guard so I have not cut it to fit yet.

Similarly, I have not cut the $^3/_8$”-16 threaded rod to size either. I may add a linkage to it so I can unlock the belt tensioner from the front of the stand.

Top View Photo by R. G. Sparber

Looking down from the back of the shaper you can see parts of the belt tensioner better. The ½” rod is supported by 1” pieces of angle stock that share bolts with the mounting flanges of the column. I hope to bolt an oil pan down here. It would go between the bottom of the top stand rails and these pieces of angle stock.



Belt Tensioner Relaxed Photo by R. G. Sparber

Here you see the belt tensioner in the released state. I can roll the belt along the cone without too much trouble but the task is made easier if I pull the threaded rod forward a bit as shown here.

Most of the belt tensioner was MIG welded. As usual, only my last few beads look good. Even so, welding sure speeds up construction.

My next step will be to make the two belt guards. Then I will start to track down problems with the shaper's operation. I've noticed a few things that aren't right but so far none are show stoppers.

Belt Guards and Electrical Control

I've spent two weeks designing, building, redesigning, and rebuilding the belt guards and electrical control. I may have to do more on it but will show you where I am now.

You can also go onto Youtube.com and find 3 videos of this shaper working in various stages of completion. Just search for “rgsparber1”.

Shaper Rear View Photo by R. G. Sparber

The sheet metal box below the shaper protects the motor from chips and also encloses the belt that goes from motor to jack shaft. The angled box on the right encloses the belt that goes between cone pulleys. You can also see the start and stop buttons in the upper left. The black start button is partially enclosed to minimize accidental power up. The red stop button kills power with a single jab of my finger. Power is also removed when the horizontal feed hits one of the two limit switches. The box in the bottom right contains the power control circuit.

Right Limit Switch   Photo by R. G. Sparber

Here is the right side limit switch. If the table moves too close to the end of its range, power is cut. This feature is most useful when using the automatic feed. I don't intend to operate the shaper without being present but have already focused too much attention on the cutter action and missed the fact that the automatic feed was slowly destroying my machine.

I can still manually crank the table into one of the hard stops but that would be very obvious.

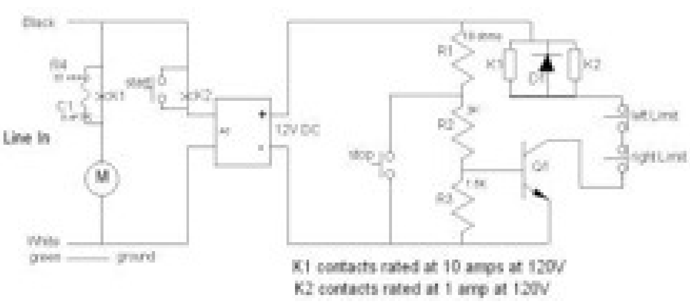
Left Limit Switch   Photo by R. G. Sparber

This is the left limit switch as viewed from the back. The limit switch wiring is partially exposed but this is a 12V circuit so there is no risk of receiving a shock.

Relay Box   Photo by R. G. Sparber

A key feature of this circuit is that the limit switches run on floating 12V DC. If either wire going to the limit switch shorts to ground, nothing will happen. If either wire breaks, power to the motor is removed.

One quirk of this circuit is that the stop button is a momentary-on style. I had to invert its logic to make it work.



Limit Switch Schematic Drawing by R. G. Sparber

This should have been a simple circuit but in the end had a real challenge. Originally I didn't have R1 and the stop button was across R3. Push the stop button, turn off Q1 which removes power from the relays. No power to the relays means contacts K1 and K2 open. That should kill power to the 12V converter. It doesn't... right away. The problem is that the converter has a large output filter capacitor and the load does not draw much current. So if I just jab at the stop button, the motor would stop and then start back up. By moving the stop switch connections and adding R1, I am able to dump enough of the capacitor's energy to prevent a restart

A simpler solution would have been to use the stop button to just short out the converter. It would have worked and eliminated all resistors, transistor, and diode but was just too crude for me to accept.

Diode D1 prevents the inductive kick from the relays from damaging Q1. C1 and R4 form a “snubber network” that prevents an arc from forming on the relay contacts. This arc can cause the relay contacts to weld shut as they start to open.

Stay Tuned for part 70 from R. G. Sparber next month.

Keep sending me email with questions and interesting shaper stories.

My email address is:
KayPatFisher@gmail.com

Kay

A Burner for Stir-Frying

Peter Sevier

Recipe books on the subject of Asian cooking all call for a high heat output burner under a wok. Few domestic stoves have enough heat flux for this according to the cook-book authors, because what they require is “Fierce Heat” to avoid soggy, oil-soaked food.

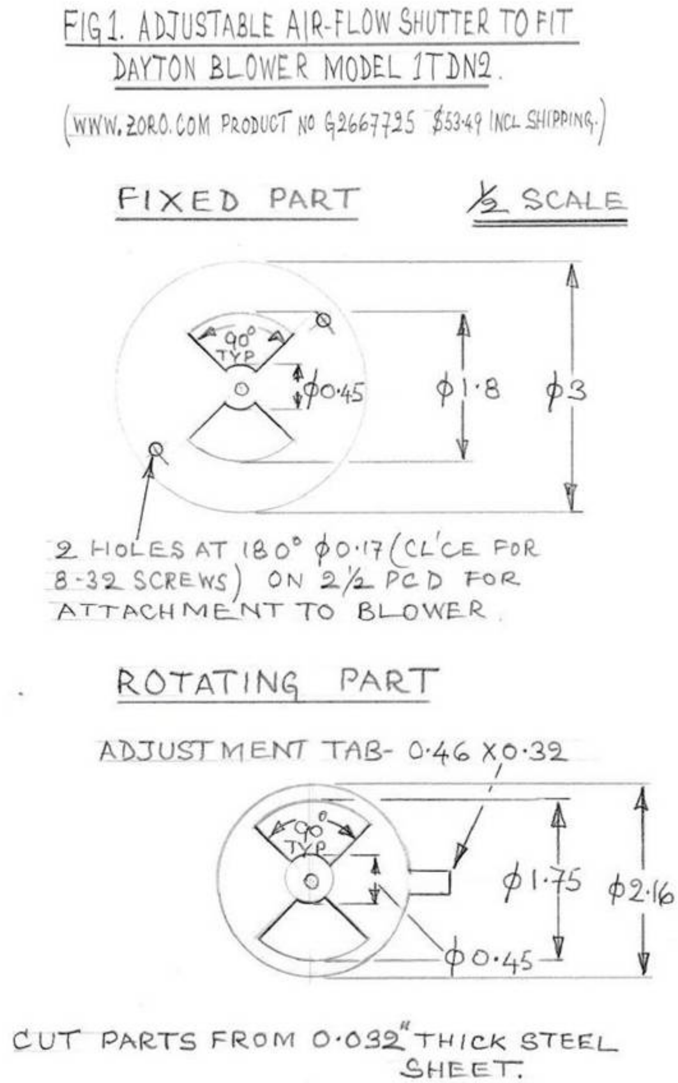
The burner described here provides an estimated heat flux under the wok of 150-200 W/cm sq. and cooking proceeds at a speed that gives crisp food and preserves the individual flavor of the ingredients. With everything prepared beforehand, a stir-fry meal for 4-6 people can be cooked in 10-12 minutes.

My burner uses a nominal 1 ¼ in. diameter steel pipe, supported on a triangular base fabricated from ½ in. square steel tube. A small 110VAC electric blower is attached to the bottom of the 16 in. long pipe to provide combustion air and gas/air mixing. Other sizes of pipe could be used for the burner tube, provided that the following design factors are kept in mind:-

1. An adjustable shutter on the air input to the blower must be provided to enable the air volume to be set, and hence the velocity of the gas/air mixture in the burner tube.

2. The top of the burner tube must be fitted with an anti-flashback screen to prevent the fuel/air mixture from “striking back” to the blower.

Propane is used as a convenient fuel in my case, although butane or propane-butane mixtures could also be used (“Calor gas”), which could possibly be more convenient in the UK and Europe. A stoichiometric propane/air mixture is 5% fuel, 95% air, and has a low flame propagation velocity of 1 ½ ft./sec. There is thus a small range of stability for the flame at the top of the burner tube; if the velocity of the gas/air mixture is too high the flame lifts off from the burner surface and goes out, if too low it tries to strike back down the burner tube. The first is controlled by an air shutter on the blower (see Fig. 1), and the second by a brass top cap which has concentric circles of 17/64 (0.266 in.) holes, and an anti-flashback screen, providing 18 small flames (see Fig. 2).



Propane is fed into the blower input for good mixing in my case, but could be fed through a tube fitting at the bottom of the burner tube, with greater convenience and safety.

FIG 2. BURNER CAP (BRASS)

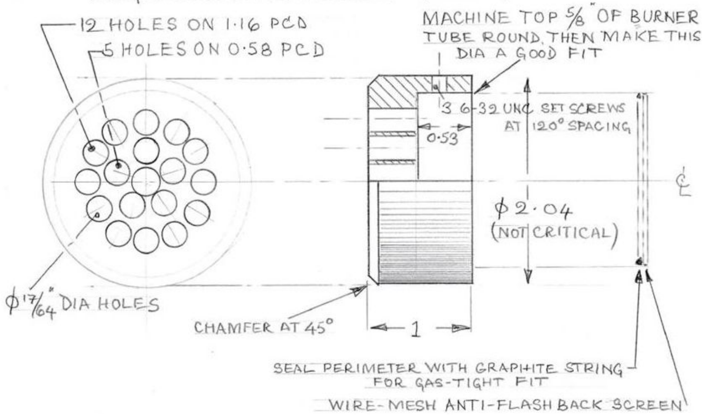
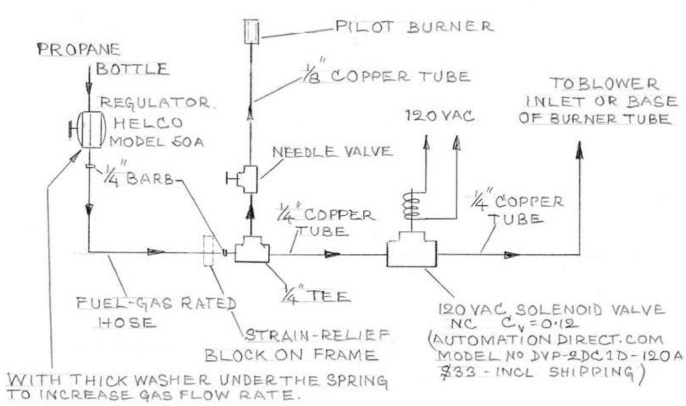


Fig. 3 shows the gas connections; there is a small pilot burner near the top cap which is always alight when the system is in use.

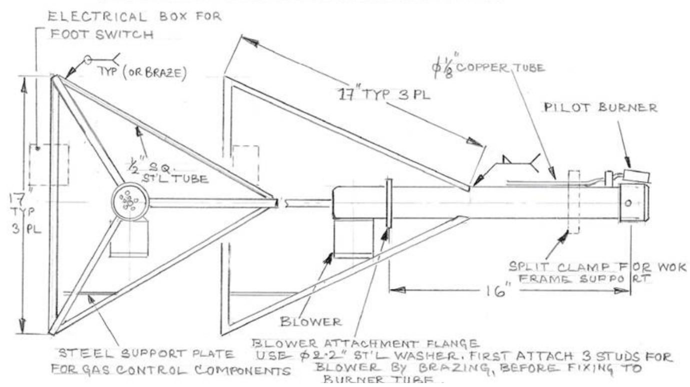
FIG 3. PROPANE GAS CONNECTION SYSTEM



The size of the pilot flame is adjusted by a needle valve in the gas supply line, and that of the main burner by an adjustable gas regulator on the propane tank, and the setting of the blower air shutter. System safety is assured by a solenoid valve in the gas supply to the burner, controlled by a foot switch, which also supplies power to the blower. The solenoid valve that I used is not rated by the manufacturer for use with fuel gas, because it is constructed from molded plastic. I have not had any problems with it yet, and do not anticipate any, because of the low duty cycle of the heater.

The supporting frame for the wok heater can take many forms. I made a triangular-based one because of its inherent resistance to being accidently tipped over (see Fig.4). A split clamp around the burner tube supports a wire frame on which a single–handle wok can rest; when making this; beware of diameter variations in commercial steel pipe if this is used for the burner tube, and "make to fit".

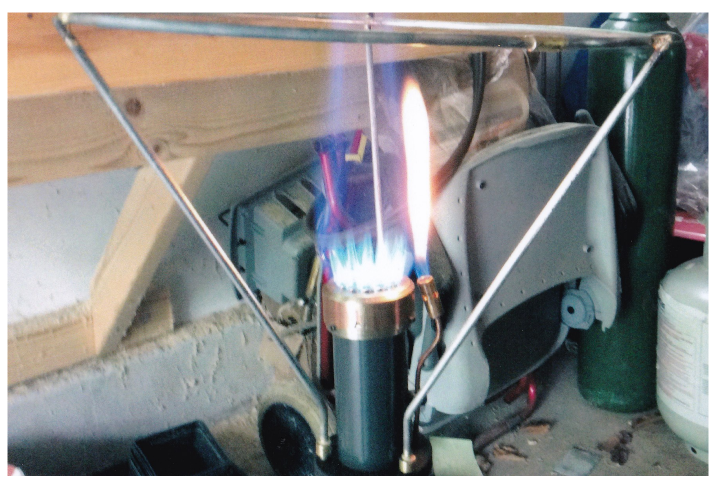
FIG 4. THE WOK-HEATER BASE



Figs. 5 and 6 show the finished device and the "fierce heat" flame respectively. If you have never tried to cook Chinese stir-fry at home before, you will be surprised (as I was) at how good it tastes. Happy cooking!

Figure 5

Figure 6



CHARLES RIVER MUSEUM OF INDUSTRY & INNOVATION

From the Museum

Dan Eyring

Flather Model 14 Engine Lathe

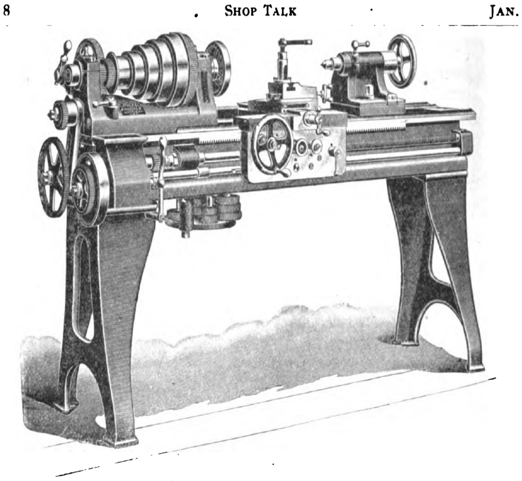
Flather and Company, Inc.,

Nashua, New Hampshire

The lathe on display in this exhibit is a Flather Model 14 Engine Lathe, introduced in 1901 by Flather and Company. The January 1902 issue of the industry trade magazine “Shop Talk” provides an overview of the Model 14's features and a high resolution lithographic image of the lathe you see in the exhibit.

The Flather Model 14 was also shown in an advertisement in the February 1902 issue of the engineering journal Machinery Magazine, as shown below. The ad indicates that, circa 1900, Flather was selling its lathes through a number of distributors.

8 SHOP TALK JAN.

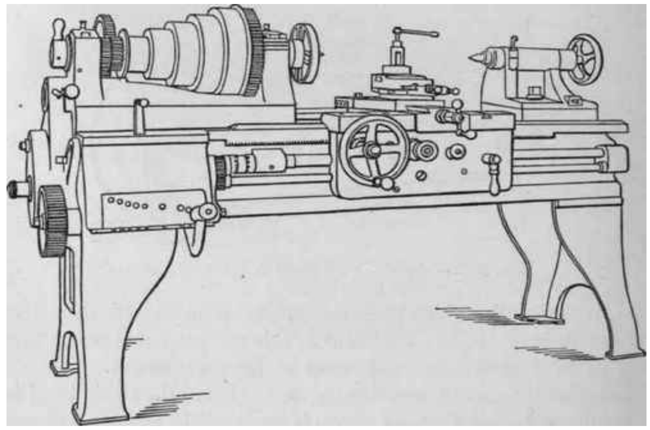


Flather & Co.'s New 1901 Model.

The lathe in the exhibit was sold through Hill, Clarke and Company of Boston, MA. “This firm was a maker and seller of "steam engines, pumps and boilers, iron and wood working machinery, shafting, belting supplies". It seems unlikely that they actually manufactured woodworking machinery, but theirs is often the only name appearing on the machines they sold.”

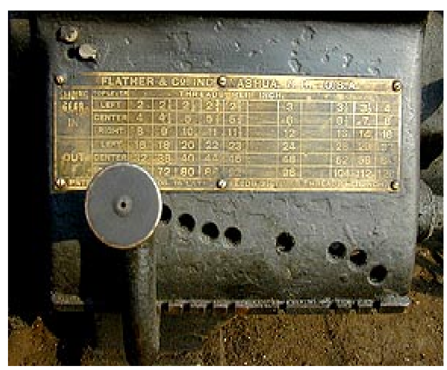
The Flather lathe in the CRMII collection utilized a novel means, a swing out shelf, to keep the lathe’s change gears handy for the operator. This is shown in the image above. Flather also sold a version of its lathes with quick change gear boxes, as shown in the image below, taken from the classic 1916 text"Modern American Lathe Practice", by Oscar E. Perrigo.

A quick change gear box operates very much like (and no doubt presaged) the manual transmission of an automobile, allowing numerous gear ratios between the lathe spindle and leadscrew to be easily selected by merely positioning one or two shift levers.

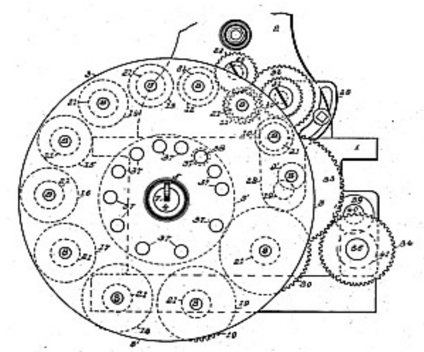


If you would like to look over a Model 14 with quick change gearbox, there is one at the New England Textile Museum in Lowell, MA. The lathe was donated to the Textile Museum by Charles Flather, great-grandson of Joseph Flather, the founder of Flather and Company.

Flather investigated, patented and sometimes manufactured a variety of innovative lathe design innovations, including at least two implementations of a quick change gear box. An excellent description of the Flather single lever gear box is provided in chapter 10 of Perrigo’s book, starting on page 211. Most competing gear box designs at the time required position two levers, a design that won out in the long run due to lower manufacturing cost.



Another even more unique Flather gear box design is described in US Patent 536,615 filed by Flather in 1895 envisions “gears [located] on short shafts arranged in a circle:



It is said that upon seeing this patent, Henry Ford was inspired to develop his planetary transmission concept for the Model T.

"Flather lathes tend to be a bit larger and sturdier than their 19th century competitors, a selling point at the time and an advantage today with the use of modern carbide tooling which tends to require additional stiffness and horsepower to drive it. Thus Flather has survived and is still useful even to the present day, although it can be a trifle slow for production work having been designed originally for carbon steel tooling, usually not a problem for the small shop or homeowner."

Upcoming Events

Errol Groff

Jan. 1 New Years Day Run at Waushakum Live Steamers, Holliston MA

Directions:

The Waushakum Live Steamers is at the end of Arthur St. in Holliston, Massachusetts.

http://www.waushakumlivesteamers.org/

Jan. 7 Monthly meeting of NEMES

Check website (http://neme-s.org/) for meeting location

Jan. 15-17 Cabin Fever Expo, Lebanon PA

http://www.cabinfeverexpo.com/

Jan. 30-31 Amherst Railway Society Railroad Hobby Show

The Eastern States Exposition Fairgrounds
1305 Memorial Avenue
West Springfield MA. 01089

GPS Coordinates, use the following info: 875 Memorial Avenue, West Springfield, MA

http://www.railroadhobbyshow.com/#

Show flyer HERE