



MAPLE SYRUP DIGEST



Holiday Greetings

Vol. 22, No. 4

December 1982

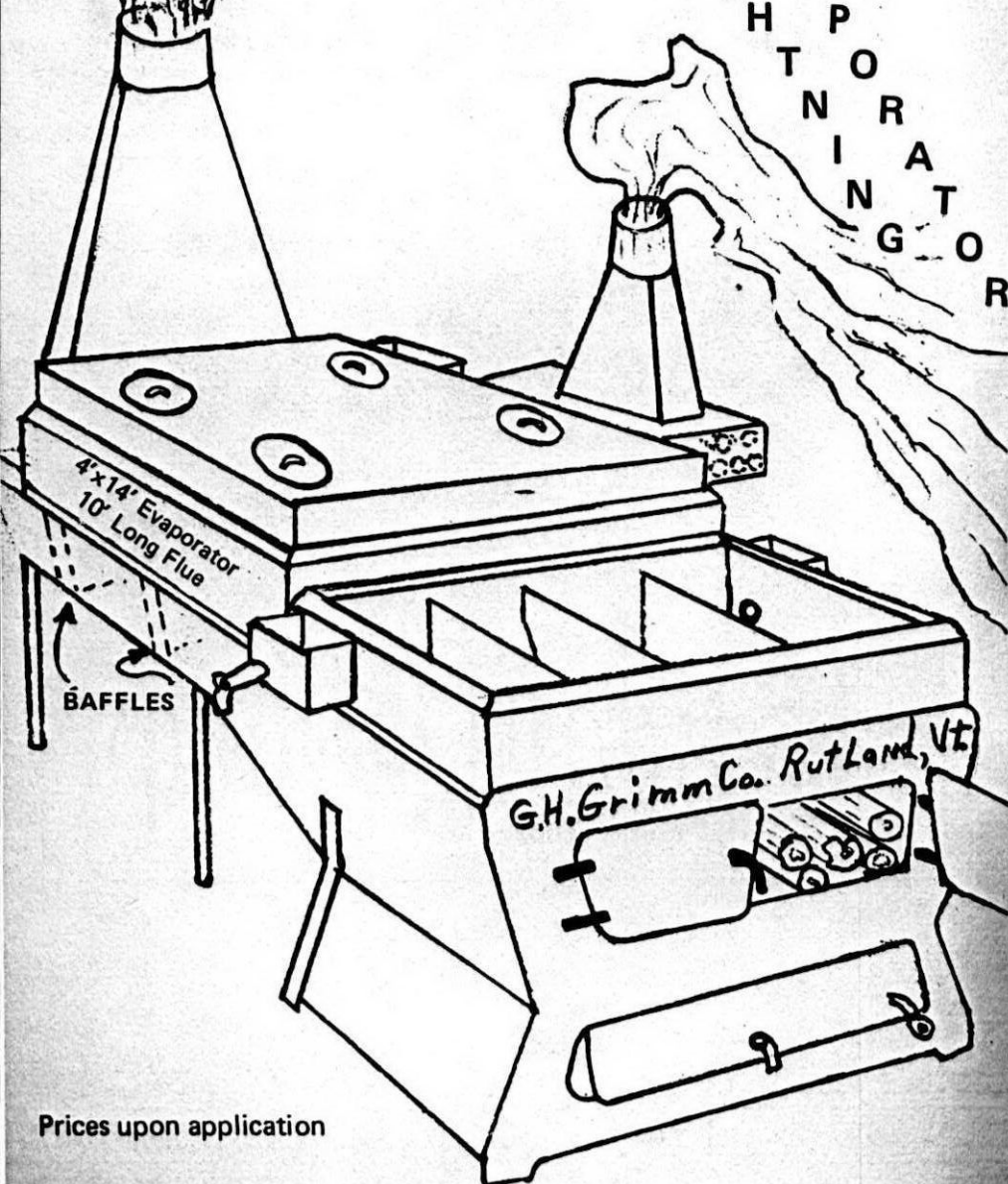
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THE MAPLE SYRUP DIGEST

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Editorial

Two things happened at the North American Maple Syrup Council Meeting this October that I want to pass along to you.

First, according to the report of Council activities by secretary Michael Girard, an anonymous fund was set up to finance the cost, now and for years to come, of plaques to give recognition to past Council chairmen and others deserving of the honor as approved by a committee which was also named at this meeting. At the risk of being shot in the back at close range with a scatter load, I'm going to tell you Bob and Florence Lamb made it all possible. I firmly believe credit should be given where credit is due and I'm sure everyone will thank them for their thoughtfulness and generosity.

Also, Susan E. Kirby, of Shirley, Ill., who used to work in her family's sugarbush, has written a book "The Maple Princess". It is a romantic novel with a maple sugar background and is published by Avalon Books, 22 East 60th Street, New York, N.Y. 10022. The best part was, her parents, Mr. and Mrs. Stephen C. Funk, attended the Council meeting and gave me an autographed copy. Thank you so much.

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In an attempt to promote New York's #1 industry, Agriculture, Senator Alfonse D'Amato sponsored the New York Farm Harvest Day on September 29, 1982 at the Russell Senate Office Building in Washington, D.C., in an attempt to inform his other Congressional colleagues of the importance of New York's agriculture. Representing the New York State Maple Producers Association were John and Ellen Adams of Smada Farms, Greene, NY.

A display of NYS Pure Maple products were set up and the highlight of the display was the real maple leaves which were taken from home. People were amazed at the color we had at that time of the year. Samples of syrup, sugar and cream were passed out — some having never tasted — Maple — were impressed.

We had a noon luncheon with Senator D'Amato and his staff along with other representatives of agriculture from around the state. Senator Paula Hawkins of Florida was guest speaker. From 5-7 p.m., the reception was held and Secretary of Agriculture John Block spoke briefly as did other Senators and Congressmen. Each congressman that attended the reception was given a basket containing various NYS products, including samples of Pure Maple Sugar furnished by the NYSMPA.

The event was termed a success and Senator D'Amato has tentative plans to hold another next year.

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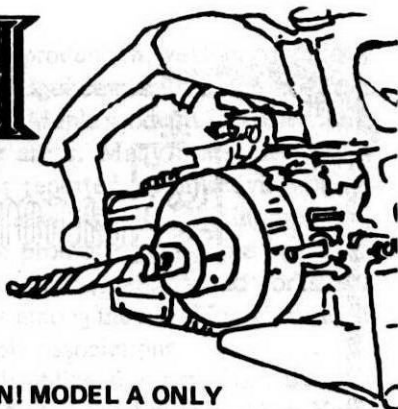
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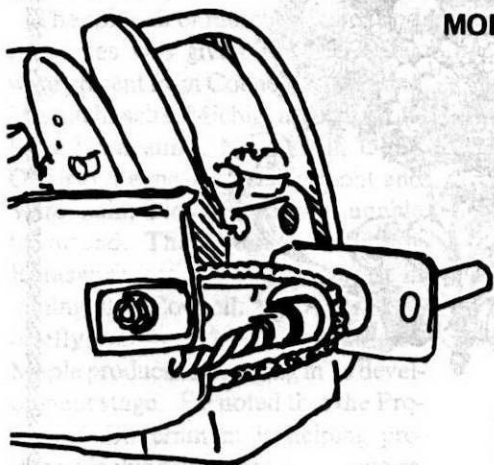
Do NOT run either model with excessive speed. Run your saw at a fast idle. Stop the tapper from turning with your gloved left hand. Then place against the tree and let go. Rev the motor just enough to cut the hole. Hold with the gloved hand and remove.

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Season's Greetings



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NORTH AMERICAN MAPLE SYRUP COUNCIL 1982

**By Michael Girard, Secretary,
N.A.M.S.C.**

This year's North American Maple Syrup Council meeting was held at the Quail Hollow Inn, in Painesville, Ohio.

The 23rd Annual Meeting was called to order Monday, October 25 at 8:15 a.m. by Chairman Russ Davenport, Shelburne, Mass. Chairman Davenport welcomed all Delegates, Alternates and guests to the combined meetings of the N.A.M.S.C. and I.M.S.I.

The roll call of member States and Provinces was given and Delegates were present from Connecticut, Maine, Massachusetts, Michigan, Minnesota, New Hampshire, New York, Ohio, Ontario, Pennsylvania, Vermont and Wisconsin. Nova Scotia was unable to attend. The Province of New Brunswick has shown an interest in joining the Council. Mr. Jean Cyr briefly outlined New Brunswick's Maple production as being in its development stage. He noted that the Provincial Government is helping producers in this new commercial venture.

Lloyd Sipple reported that the financial position of the Digest is excellent. Lloyd reminded member States and Provinces to keep mailing lists current and to continue sending State reports and articles of interest to the Digest.

Each State and Provincial Delegate gave a report on last season's average

syrup production, weather conditions affecting that production and average prices Maple products brought within their areas. Many States and Provinces reported much activity within their associations. Building membership, promoting of Maple products, Maple tours, meetings and workshops were among the activities within their Maple associations.

Mr. Mike Berliner, from Berliner Plastics, Lake Luzerne, New York, presented a new permanent Syrup Grading Kit, which will be available for sale on December 1, 1982, through your State Associations. Mr. Berliner reported that this kit was approved by the I.M.S.I. Board members. The U.S.D.A. has approved all color standards for manufacture, and licensing procedure has been initiated. A formal letter and copy of the U.S.D.A. results will be sent to all State Associations, U.S. and Canadian organizations, I.M.S.I. and N.A.M.S.C. and State and Federal authorities. The cost of the Permanent Syrup Grading Kit is expected to be between \$60.00 and \$70.00.

A proposal to honor past N.A.M.S.C. Chairmen and individuals who have served and contributed so much to

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maple was presented.

An anonymous donation of \$2,000. was made and is to be used exclusively to recognize and honor past N.A.M.S.C. Chairmen and individuals dedicated to Maple. The appointed committee of Russ Davenport (Mass.), Ron Shaw (Ont.), Lloyd Sipple (N.Y.), Ed Curtis (Pa.), Adin Reynolds (Wisc.), Gordon Gowen (N.H.), Ture Johnson (Ohio), and Michael Girard (Conn.), will oversee the N.A.M.S.C. Honorary Fund.

Frank Majszak, a Michigan producer, described his 16,000 tap operation in Traverse City, Michigan. The use of an Osmonics 1100 Series Reverse Osmosis unit, and a wood fired 6' x 16' Small Brothers evaporator, make a good combination for an efficient sugaring operation.

Mr. Majszak gave a slide presen-

tation explaining the daily log which is kept on the R.O. Unit and also explained Permeate Flushing and Chemical Cleaning procedures used in his operation.

Russ Davenport, a Shelburne, Massachusetts producer, gave a presentation on his experiences and how he became involved with the use of Reverse Osmosis in his sugaring operation.

Previously using two 6' x 14' oil fired evaporators to process the sap from 6,000 taps, Russ found he had to replace one of the older evaporators. The cost of the new R.O. was close to the cost of a replacement 6' x 14' conventional evaporator. The decision was to purchase a Memtek model 200 R.O. unit.

Rearranging the sugarhouse to accommodate the R.O., as well as some

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modification to sap storage, was all part of getting ready for a completely different procedure of making Maple Syrup.

Statistics for the 1982 season proved a savings in Syrup production costs and a greater savings in time spent in the sugarhouse boiling sap.

Bill Langenberg, Kemptville College Ontario, gave a presentation on the use of Ultra Violet Lights to sterilize sap. Bill recommended that U.V. Lights be sized to the individual operation. The flow rate of sap through the U.V. unit and exposure time to the U.V. light, is important to the proper sterilization of sap.

Bill stressed the importance of clean sap storage tanks and that most of the sap deterioration took place in the storage tanks.

Dr. Mariafranca Morselli, UVM,

reported on a study of Permeate Water from Reverse Osmosis machines. Dr. Morselli noted that Permeate Water can be disposed of freely and contains nothing harmful to the environment.

Lyle Raymond, Cornell University, gave a report on the causes and effects of Acid Rain.

So far, Acid Rain effects on trees have not been observed other than under simulated laboratory conditions. Forest effects from Acid Rain under natural conditions that can be directly traced to Acid Rain have not been found. It can only be said that effects observed in laboratory experiments *might* occur under natural conditions.

Mr. Raymond's conclusions are as follows:

No direct proof of forest effects from acid rain under natural conditions has been found. This does not

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mean that none will be found in future studies, of course.

Available evidence of harmful effects to trees from acid rain has been extrapolated from experiments under controlled conditions with simulated acid rain and assumed processes affecting trees.

Scientists say that it will probably take years to develop verifiable answers as to whether acid rain is adversely affecting the trees.

"Where does that leave us? It appears that whether 'something should be done now about acid rain' may depend upon other observed effects — such as to lakes and streams — than upon demonstrated forest effects, and upon how we feel about acid rain generally as an environmental issue."

Dr. Mariafranca Morselli, UVM, reported that the judicious use of bleach in a sugarbush will avoid adverse changes in Maple Syrup color

and flavor. Dr. Morselli noted that flushing tubing with clean water is mandatory after using clorox to clean tubing. Also, off flavors (salty or undefinable) will result with dilution of sap and clorox.

The N.A.M.S.C. business meeting reconvened on Tuesday morning with the election of Officers. Chairman, Russ Davenport, Vice Chairman, Gordon Gowen and Secretary-Treasurer, Michael Girard, were re-elected to serve for the coming year.

A list of Life and Associate Members was presented by the Nominating Committee and it was voted to accept their recommendations.

Michigan will host the 1983 N.A.M.S.C. meeting to be held in Traverse City, Michigan. Delegate Terry Healey, reported that the meeting will be held at the Grand Traverse Hilton on October 23 through 26, 1983.

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Connecticut formally invited the N.A.M.S.C. to their State in 1984.

There has been much talk on adulterated and mislabeled Maple syrup. Ken Bascom (New Hampshire) suggested that all States take a stand against Mississippi "fake" Maple syrup, and work to get this adulterated syrup off the shelves on a local level.

Everett Willard and Bill Clark (Vermont), presented a resolution to the Council, petitioning the Food and Drug Administration to take immediate action to halt illegal marketing of adulterated Maple syrup, being marketed as "Pure Maple". After a brief discussion, it was voted by the N.A.M.S.C. to support this resolution.

"Whereas - The entire Maple syrup industry is being subjected to severe, unfair competition by adulterated and/or imitation Maple products being sold

all across America as "pure" maple syrup, and

Whereas - Consumers are paying for products which are not as represented on the label, and

Whereas - Scientific methods of analysis are now available to accurately identify imitation or adulterated products, and

Whereas - The Food and Drug Administration (FDA) is presently aware of the production of adulterated syrups from an area close to Philadelphia, Mississippi, which are being marketed under several different names, and

Whereas - This production has continued for several years and we believe this illegal marketing should be stopped, therefore,

Be It Resolved - That the North American Maple Syrup Council, pet-



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ition the Food and Drug Administration to take immediate action to halt the marketing of the adulterated products as "pure" Maple syrup products.

Be it further resolved that a copy of this resolution be sent by all Delegates of the North American Maple Syrup Council, to their respective U.S. Senators and Representatives, requesting them to take appropriate action to see that the Food and Drug Administration has available the necessary resources to deal with the illegal activity and further that the agency be directed to fulfill its responsibility.

Our Tuesday afternoon tour included a visit to a modern sawmill and

woodworking complex, a guided tour of the Davies Can Company, and everyone enjoyed a visit to Richard's Maple Products in Chardin, Ohio.

The annual banquet was held Tuesday evening and following an enjoyable meal, guest speaker, Janet Henry, Author, spoke on her book "The Beat Goes On."

The business meeting reconvened on Wednesday morning to finalize N.A.M.S.C. business.

Dr. Mariafranca Morselli closed the meeting with a report of the research she has done on a method of detecting adulterated maple syrup.

She described the procedure with a slide presentation and noted that a



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paper was being presented in Washington for the method to be accepted and published.

It is expected that after March of 1983, the Food and Drug Administration will be able to use this method to prove the adulteration of pure maple syrup.

Following the close of the business meeting, the International Maple Syrup Institute held their meeting.

I have had to condense many interesting presentations and items of interest here, to give you a brief outline of our annual meeting. If there is something that you would like more information on, contact me and I will try to get your questions answered.



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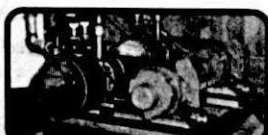
A double fork is used to connect the 5/16" secondary lines to the main line.



The main lines convey the sap to the sugar house.



In the sugar house, the sap flows into a vacuum release tank, which is connected to a pressure regulating tank.



Vacuum pumps are used to create a suction in the release tank. This vacuum action causes the sap to flow through the tubing to the sugar house at increased flow.



A float device either electronic or mechanical is needed inside the release tank to determine when it is full. The sap is then transferred into a large reservoir for storage, until fed into the evaporator.

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New threaded spigot, equipped with grooves at the intake, serves to draw the sap from the new growth layers of the tree. As a result of numerous tests conducted at our experimental sugar bush, we have determined that spigots with grooves at the intake will increase flow rate by 20 to 30% over ungrooved spigots.

New spigot cap, threaded to fit the spigot. After sap flow ceases, this completely closes off the spigot, allowing the system to be easily cleaned and flushed in the bush.

New hardness controlled 5/16" tubing, reinforced with lateral ribbing which prevents its collapse, such as when sharply bent around a tree or used under high vacuum pressure. It will also withstand high pressure needed during cleaning.

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FLAT LAND TUBING

by Lloyd Sipple

In the late 1950's we were using about 4500 buckets, all on roadside trees, that we couldn't begin to keep up with in a good run. To add to this problem we still wanted to increase our production.

About that time tubing came into the picture and we thought "here's the answer." We used the sealed system and tried to push it here and there with no success. On slopes, vapor locks raised havoc and on level land, where roadside trees like to grow best, it was even worse. We heard of using vacuum pumps to cover up our mistakes and force them to work, but how can you afford to install a pump, with a gasoline engine for power every place you want to put in 50 to 100 taps?

We were lucky. We happened to try venting a few taps by our house where we could watch them and they worked perfectly. They were on level land, too. Oh, we had to trim up the system a little — shorten the drop lines and eliminate any extra tubing in the laterals, making it a semi-suspended system without the increased labor and problems of stretching up an aerial system and keeping it that way.

We developed a system where we could tap on level land, without pumps and produce more sap than with buckets because there was no loss from overflowing or back pressure from vapor locks. Also, there's no chance of lowering the sugar content since we use no vacuum. Our production of syrup per tap, has always been as high

as anyone using either natural or induced vacuum. Here's how it works:

1. USE 4 FOOT DROP ASSEMBLIES AND VENT ALL SPILES.

Drops are assembled the same as in all other installations and all spiles are vented. This is very important. At least one distributor offers a vented spile. The drops may be made shorter or longer to suit various installations. (Note items 4 and 5)

2. USE ALL 5/16 INCH DIAMETER TUBING.

Tubing that has an inside diameter less than 5/16 will not allow proper venting. Larger diameter tubes (1/2" or 3/4") should not be used; the tubes below the tank level will always be full of sap and will not thaw fast enough after freezing. The regular round, dark colored, 5/16" diameter tubing thaws quickly enough to give satisfactory results.

3. LOCATION OF TANK.

The collecting tank should be positioned as low as possible near the center of the area to be tapped. The actual location will be governed by the length of the lateral lines (see item number 7). It may be advantageous to dig a depression for the tank. In any case, the spot should be marked with a stake for locating next year.

4. HEIGHT OF TAP HOLE.

This is very important. If the collecting tank is 2 feet high, the trees

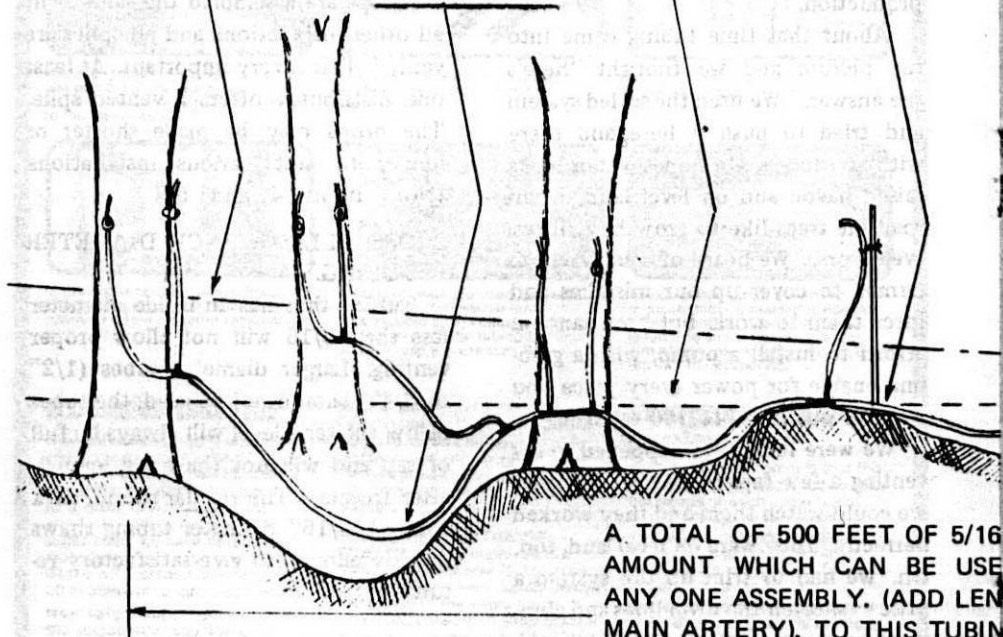
RESISTANCE OF FLOW WILL HOLD SAP UP TO THIS HEIGHT WHEN SAP IS RUNNING. TAPS MUST BE HIGH ENOUGH TO ALLOW AT LEAST 6" OF FREE SPACE ABOVE THIS LEVEL.

LEVEL OF TOP OF COLLECTING TANK. TUBES WILL BE FULL OF SAP TO THIS HEIGHT AT ALL TIMES.

4 FO
THIS
TO
LEV
ED.

FLOW OF SAP WILL NOT BE RESTRICTED IF TUBES FOLLOW DEPRESSIONS AS LONG AS HIGH POINTS OF TUBES ARE ALWAYS AT TEES WHERE VENTING CAN BE ACHIEVED.

IF LATERAL HAS TO GO A KNOLL CAUSING A SPOT BETWEEN TREES, BE VENTED THE SAME SPILE.



A TOTAL OF 500 FEET OF 5/16" AMOUNT WHICH CAN BE USED IN ANY ONE ASSEMBLY. (ADD LENGTH OF MAIN ARTERY). TO THIS TUBING

nearest the tank should be tapped about 5 feet high. The farther you go from the tank, the higher they should be tapped; those farthest away at a height of 7 feet if possible. In effect, this is creating the "hill" you lack on level land. On land that is generally level but contains some knolls and gullies, the same system can be used as long as the top of the collecting tank and the height of the tees and tap holes are kept in the same relative location as indicated in the sketch.

A lateral line may be dropped in a gully without restricting flow, but when a knoll or any other rise is encountered which will cause a high spot in a lateral between trees, the lateral should be either laid around the high spot or vented to eliminate any possibility of vapor locks. Venting can be done with a tee and a short piece of tubing attached to a stake or small tree to a point as high as the other vents on that particular line. Be sure the side opening of the tee to which

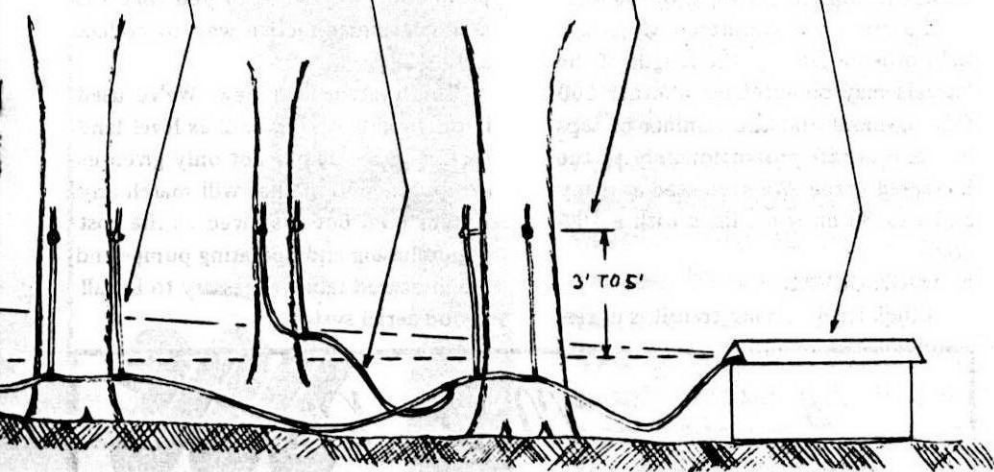
NOT DROP TUBES ARE USED.
S WILL SUSPEND TEES $1\frac{1}{2}$
2 FEET ABOVE GROUND
EL. ALL SPILES ARE VENT-

ALL TAPS SHOULD BE FROM
3 TO 5 FEET HIGHER THAN
THE TOP OF THE COLLECTING
TANK.

D OVER
A HIGH
T MUST
S EACH

BRANCH LINES MAY BE TEE'D
IN AS NEEDED.

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2 GAL. PER TAP AND EQUIPPED
WITH INSULATING (HOMOSOTE)
COVER MAKES AN EXCELLENT
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' DIAMETER TUBING IS THE MAXIMUM
D SUCCESSFULLY FOR LATERALS IN
GTH OF BRANCH LINES, IF NEEDED, TO
G UP TO 50 TAPS MAY BE CONNECTED.

the vent tube is attached is in a vertical
position.

5. HEIGHT OF THE TEE.

All tees should be suspended from
 $1\frac{1}{2}$ to 2 feet above ground level. This
will allow proper venting of gas and air
in the lateral lines and eliminate vapor
locks. The tees should not be suspended
higher than the level of the top of the
tank except the last two or three trees
farthest from the tank where increased
height of the tees is permissible and
possibly advantageous.

6. LATERAL LINES "DRAPED".

Cut lateral lines the correct length
so there is no excess and they are par-
tially suspended or "draped" between
the trees. Care should be taken when
laying lateral lines to be sure no brush,
rocks, knolls or anything else causes a
high spot between trees. If a high spot
is unavoidable, it must be vented (see
item 4.)

7. LENGTH AND CAPACITY.

You may use up to a total of 500

feet of 5/16" tubing for each assembly of laterals. This includes the main artery plus any branch lines attached to it. To this 500 feet of tubing you may attach up to 50 taps. Using straight lines with no branches, you will be able to bring in all trees within a radius of 500 feet of the tank.

Always install tees for branch lines in such a way that the sap from the larger number of taps flows straight through the tee and sap from the lesser number of taps on the branch line flows into the side opening of the tee.

If a grade is encountered which will help provide gravity, the length of the laterals may be extended another 200 feet or more and the number of taps can exceed 50 proportionately to the increased grade. We have used as many as 75 to 80 on some lines with a 10% grade.

8. LOCK LEVEL

A lock level or hand transit is neces-

sary to do a good job of installation on level land. Held at the top of the collecting tank you can sight through it and a helper can mark that height accurately on trees 500 feet or more away. Then you know exactly how high above the tank level you are tapping.

I don't expect you to convert your entire system this year. I do urge you to try at least one or two lines even if they are of only 25 or 30 taps each. Close observation and measurement of production will prove to you that it is a simple and effective way to collect sap.

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Chapter Two: Saving Energy - Maple Syrup

Improving Combustion Efficiency in Maple Syrup Production Clifford Wessel, New York State Energy Office

SAVE FUEL DOLLARS

Burning fuel efficiency is the best way to reduce production costs for the maple syrup producer. The intent of these articles on combustion efficiency is to provide the maple syrup producer with some extensive information about fuel combustion and efficiency. Combustion efficiency means getting the most heat out of burning a fuel. Most maple syrup producers burn oil or gas to concentrate maple sap to produce maple syrup. The production process should result in a high quality product at a good profit margin. Efficient burning of fuel will increase profits for the producer because efficient burning means less fuel is needed to carry out the process and saving fuel means saving money.

Since most maple producers are not dealing with oil burners on a full time basis, the first question to ask is, "How do I know if my evaporator set-up is burning fuel efficiently." You can determine the efficiency of your evaporator process by answering these questions.

1. What is the combustion efficiency of the burner?
2. What is the temperature of the exhausted flue gases?
3. What is the amount of carbon dioxide or oxygen in the flue gas?
4. Do I have the proper burner nozzle to give the highest efficiency at the lowest fuel use rating?
5. Is the burner causing smoke, if so, how much?
6. Is the pan clean on the fire side (no soot build up) and sap side?

7. Is the fuel burner efficiency routinely checked by a maintenance person; do I know what was measured and what it means?

These questions deal with topics which will give you a good understanding of the fuel efficiency of your evaporator, and ways to improve your operation and save money. Lets talk about them.

EXHAUST FLUE GAS TEMPERATURE

Exhaust flue gas temperature is one of the first items to look at to judge how efficiently your evaporator is working. I use the term "efficiently" because your evaporator can be effective, producing maple syrup from sap, but may be taking more fuel than it should to do the job thereby costing you money. Generally, a temperature above 500 degrees F. (considered to be a high exhaust gas temperature) will tell you that something can be done to improve your operation. The place to measure this temperature is the point where the exhaust gases leave the evaporator arch. This location is used because beyond this point the hot gases are considered wasted heat being exhausted to the outside air. See the following diagram for this point.

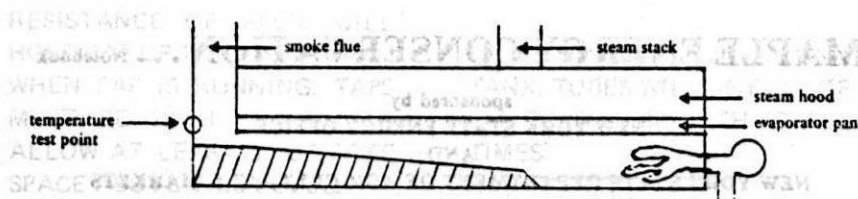


Figure 1

In general, you will lose 1% to 2% in combustion efficiency for every 50 degrees F. above 500 degrees F. of heat that is lost through the smoke flue.

High exhaust gas temperatures in an evaporator are caused by four operating circumstances:

1. Too much air entering through the burner;
2. severe leakage in the combustion chamber;
3. soot or mineral deposits insulating the bottom of the pan; and
4. evaporator over-firing.

Lets take these cases one at a time.

1. Too Much Combustion Air

If too much combustion air is passing through the oil burner, beyond the need of the flame, high stack temperatures will occur. This excess air will not allow the hot gases produced by the burning process to transfer all the heat through the pan to evaporate the maple sap. The heated gases, will pass along the bottom of the pan at a rate too fast for proper heat transfer and this usable heat will be exhausted and will be lost to the evaporation process.

2. Leaks

Leaks in the fire chamber will also increase the rate at which the hot gases pass through the combustion chamber much the same as excess air flowing through the burner. Cracks in the combustion chamber around the burner, along with evaporator pan-fire box seal and between evaporator pans should be plugged with fireproof material. Air leaks introduce "tramp air" into the combustion chamber thereby providing excess air into the burning process increasing the velocity of the gases so that heat is exhausted up the flue rather than transferred to the evaporator pan.

3. Soot and Mineral Deposits

Fouling of the heat transfer surfaces of the evaporator pan can also cause increases in the stack temperatures. Both soot and mineral deposits act as insulators which slow down heat transfer from the burned fuel through the evaporator pan. Soot deposits are caused by incomplete combustion of the fuel and the result is fouling of the evaporating pan on the fire side. A simple smoke test can be taken of the flue gas. The burner should be adjusted so that the smoke test reading is 0 or 1. In the same way that soot insulates the fire side of the evaporator pan, mineral deposits on the sap side will also slow down the heat transfer to the sap. Clean pans on both the fire and sap sides will reduce fuel usage significantly.

4. Evaporator Over-firing

Evaporator over-firing can also cause high flue gas temperatures by burning more oil than can be used by the evaporator. Actually, this is a sizing problem caused by a high fuel firing rate and a lack of surface area on the evaporator pan. The heat that is not absorbed by the pan exhausts through the flue to the outside air.

If the flue stack temperature remains high after adjusting the air-fuel mixture and cleaning the fire and sap sides of the pan then decrease the firing rate of the burner by installing smaller nozzles in the burner. When installing smaller fuel nozzles, also decrease the air entering the burner so as to maintain the same air-fuel mixture. Test for smoke to ensure that sooting does not occur. Be mindful of the fact that cold sap is continually entering the pan for evaporation so don't reduce the input of oil into the fire chamber to the point of interfering with the boil rate or production.

COMBUSTION GASES

Carbon dioxide (CO₂) or oxygen (O₂) gas is measured in exhaust flue gases to show if the fuel has been efficiently burned. It is not necessary to measure both gases since measuring either one will determine combustion efficiency in conjunction with stack temperature.

COMBUSTION EFFICIENCY

The most important procedure that maple syrup producers should be familiar with is the determination of combustion efficiency. The procedure is simple to learn, and can considerably increase the efficiency of your combustion equipment by giving you specific information to work from. The four tests required to determine efficiency are:

1. Carbon dioxide (CO₂) measurements (sometimes oxygen (O₂) is measured instead);
2. Stack temperature measurement;
3. Smoke readings; and
4. Draft measurement.

The test procedures do not take a lot of time and require inexpensive equipment.

Efficient combustion occurs when the proper fuel and air mixture is achieved. Usually the air-fuel adjustment is made by looking at the flame but this method is highly inaccurate. By using combustion efficiency test instruments the burner can be balanced for high efficiency.

EXCESS AIR

"Excess Air" is defined as that quantity of air beyond the amount required to achieve complete combustion when mixed with the fuel. Any amount of air drawn into the combustion chamber that exceeds fuel combustion requirements is excess air. This excess air absorbs heat and increases the velocity of the hot gases decreasing their time in the combustion chamber. It seriously impedes the amount of heat transferred through the evaporator pan because the increased gas velocity shortens the time to extract the heat from the combusted gases.

The way to test for the amount of excess air is to perform a carbon dioxide (CO₂) test. The amount of CO₂ present in the flue gas is related to the amount of excess air present in the sample taken at the test point.

During the combustion process, oil and air are ignited to produce heat which does useful work to boil sap. The burner sprays the oil into the combustion chamber through a nozzle, vaporizing the liquid oil, and mixes it with air forced through the burner head by a fan. If the nozzle and fire box are well matched with the turbulence created by the forced air, efficient combustion occurs upon ignition of the mixture.

	Percent CO ₂	Percent Excess Air
	5	200
	6	155
	7	120
	8	86
	9	66
	10	51
	11	37
	12	26
	13	17
	14	9
	15	0
A low CO ₂		
A fair CO ₂		
A good operating CO ₂		
A high CO ₂		
An excellent but critical CO ₂		

Figure 2

To eliminate smoke and soot, evaporators must run with some excess air.

The balance between the incoming air, the shape of the oil spray and the fire box shape are critical to good combustion. The best way to measure how well your equipment is matched, is to test the flue gases leaving the combustion arch. A poor air/fuel mixture will produce low levels of carbon dioxide when the burner is tuned to a 0 to 1 smoke level.

The figures below show various oil spray to air flow patterns that may cause a poor air to fuel mixture which results in poor combustion efficiency.

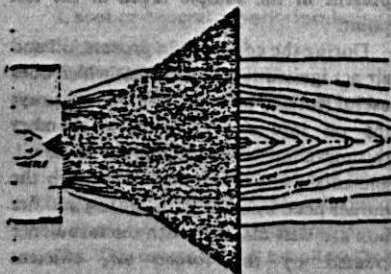


Figure 3
Fuel Spray Angle Too Wide

Since rebuilding the fire chamber requires considerable time and know-how, interchanging oil nozzles is an alternative that can be done with little effort. If after tuning the burner to a 0 to number 1 smoke spot, the carbon dioxide level is less than 10%, changing nozzles should be considered. Carbon dioxide measurements must also be taken to determine if the new nozzle has improved performance.

Questions concerning combustion and energy can be directed to me through the New York State Energy Hotline at the toll free number, 800-342-3722. I'll be waiting to hear from you.

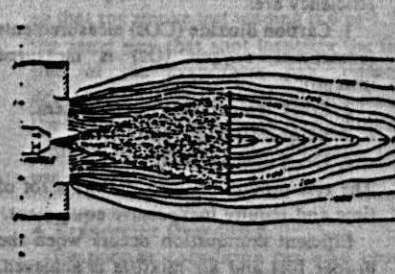
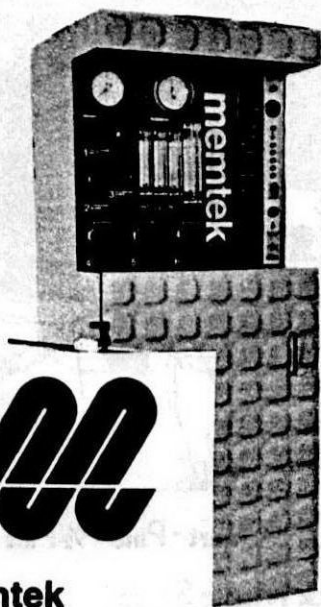


Figure 4
Fuel Spray Angle Too Narrow

Remove and save this centerfold. Use it as a maple energy conservation how-to-do-it manual. New chapters will be published periodically in the Maple Digest. Contact the Department of Agriculture and Markets for reprint permission or prints.

This project was funded and carried out through the cooperation of the New York State Energy Office, New York State Department of Agriculture and Markets, the Agway Foundation, the A. Lindsay and Olive B. O'Connor Foundation, the Richard and Rebecca Evans Foundation, the Maple Digest and the New York State Maple Producers Association.

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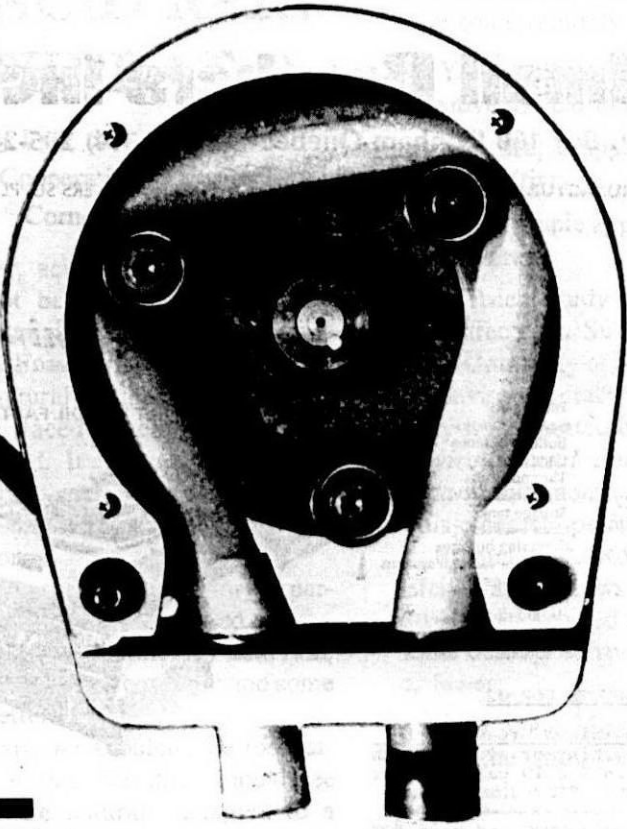
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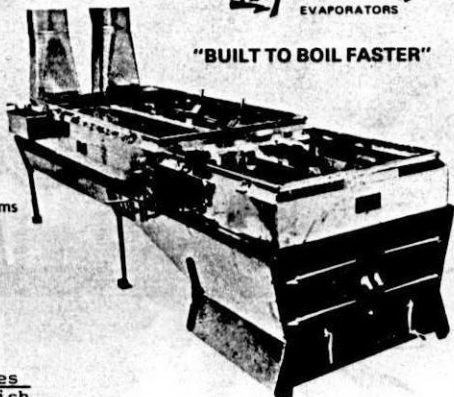
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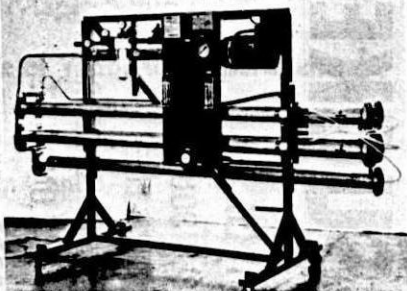
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IS ACID RAIN A THREAT

by Lyle S. Raymond, Jr.
Cooperative Extension,
Cornell University

So far, acid rain effects on trees have not been observed otherwise than under simulated laboratory conditions. Forest effects from acid rain under natural conditions that can be directly traced to acid rain have not been found. It can only be said that effects observed in laboratory experiments *might* occur under natural conditions.

Furthermore, the laboratory experiments have produced mixed results. Some trees are harmed by acid rain; others show no effect at all; and some grow better.

Perhaps we shouldn't be too surprised at this, for the various tree species are naturally adapted to a wide range of growing conditions, including natural variations in soil acidity. Observed effects also differ according to the stage of growth of the tree, and the specific amounts of simulated acid rain applied at these different growth stages.

Coniferous trees have received the most attention in acid rain experiments. I will focus upon experimental results with deciduous trees, due to the interests of the people here. So far, these experiments have shown the following general results:

- Some leaf, seedling and germination damage to deciduous trees has been observed in some species with simulated acid rain at around pH 3.0 or lower. (Rainfall pH in the North-

east and eastern Canada is 4.0 to 4.5, with some rainfalls as low as 3.5)

- Yellow Birch seems to be quite sensitive to acid rain

- Red Maple appears to be somewhat sensitive

- Sugar Maple appears to be rather acid-tolerant

- A recent study of simulated acid rain effects on Sugar Maple at the State University of New York College of Environmental Science and Forestry was reported in the publication *Environmental and Experimental Botany* this month (October 1982). This research, performed by Dudley J. Raynal, J.R. Roman and W.M. Eichenlaub, shows little effect on Sugar Maple seed germination but some damage to seedlings at pH 3.0 or lower.

Since Sugar Maple seedlings start under the snow cover and Spring snow melt water contains the winter

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accumulation of acids from snow storms, the study recommends further investigation of possible low pH effects on Sugar Maple seedlings from snow melt runoff.

I'd like to mention a couple of current studies that I know about. Both include Sugar Maple and reports from both studies will be available next year.

The first is the FORAST study of tree ring cores in 10 eastern states to see if changes in growth rates can be detected over a 50-year period. Paired sites for obtaining tree cores are being used. One of each pair of sites is on acid soil and one on soil that is not acid. The paired sites are situated close enough together so that they receive the same rainfall.

The FORAST study is funded by the U.S. Environmental Protection Agency through the Oak Ridge National Laboratory. This is an attempt to obtain data under natural conditions, rather than by laboratory experiments. (FORAST stands for Forest Responses to Anthropogenic Stress.)

In the second study, funded by the U.S. Forest Service, the combined effects of acid rain and ozone on Sugar Maple are being investigated. This work is being done at the Boyce Thompson Institute for Plant Research at Cornell University.

Conclusions

No direct proof of forest effects from acid rain under natural conditions has been found. This does not mean that none will be found in future studies, of course.

Available evidence of harmful effects to trees from acid rain has been

extrapolated from experiments under controlled conditions with simulated acid rain and assumed processes affecting trees.

Scientists say that it will probably take years to develop verifiable answers as to whether acid rain is adversely affecting trees.

Where does that leave us? It appears that whether "something should be done now about acid rain" may depend more upon other observed effects — such as to lakes and streams — than upon demonstrated forest effects, and upon how we feel about acid rain generally as an environmental issue.

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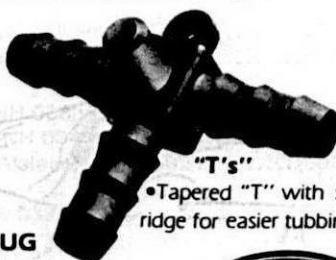


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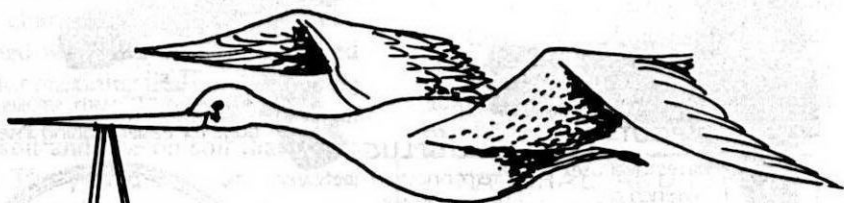


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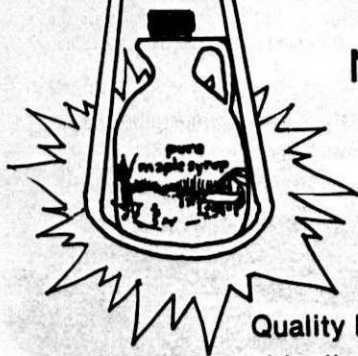
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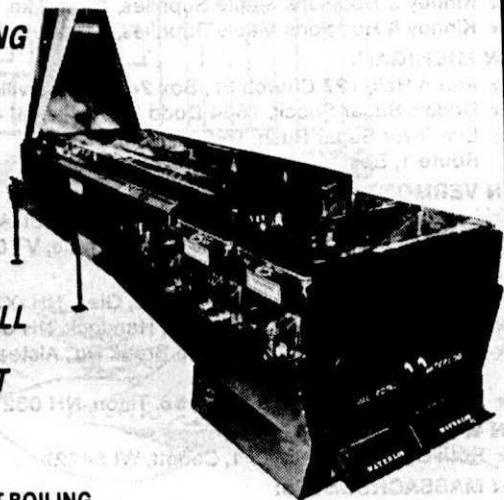
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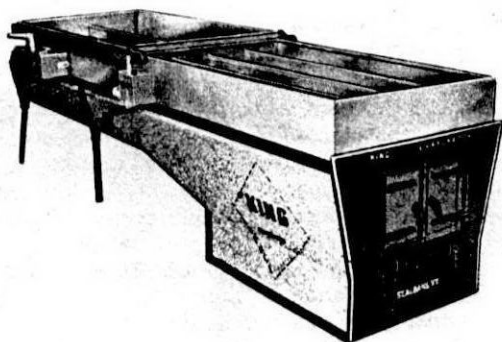
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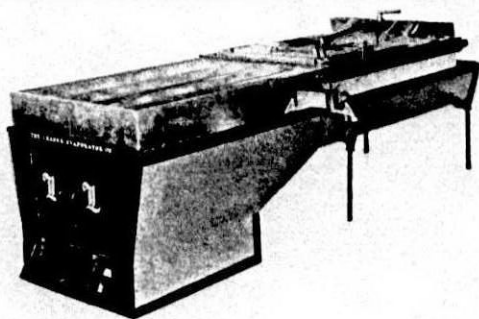
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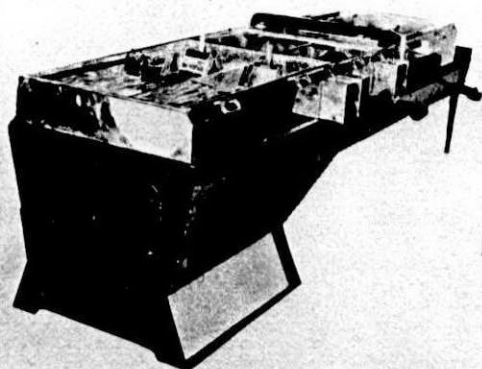
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