MAPLE SYRUP DIGEST

Vol. 22, No. 3

October 1982

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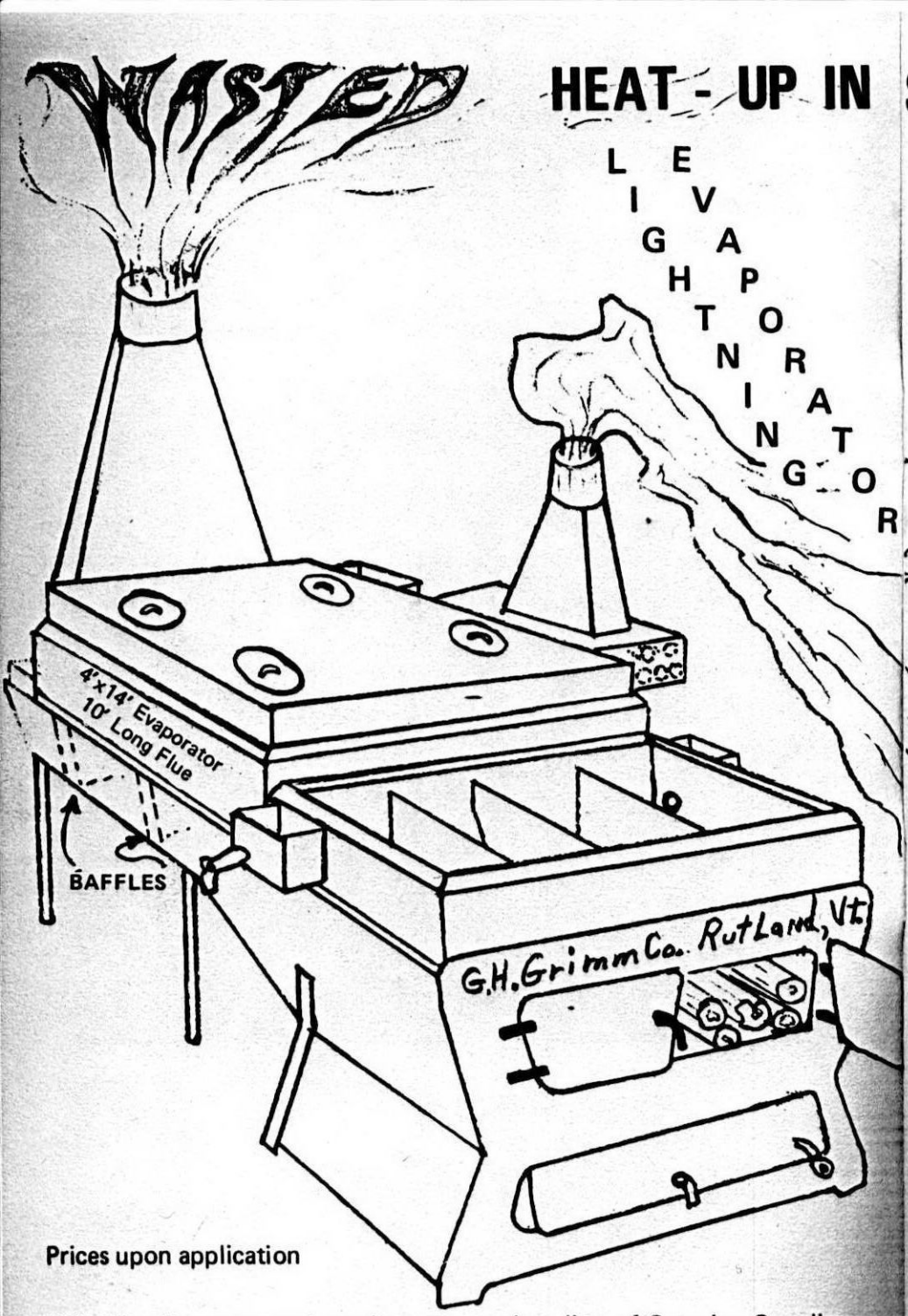

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COVER PICTURE

Tom and Carol French-Corbett finishing syrup last February at their summer kitchen. See story on page 15.

Editorial

According to the crop reporting service the northeastern states produced from 10% to 25% less syrup this year than last. The "Grapevine" tells me the midwestern states and Ontario fared in about the same manner while Quebec was much lower, producing less than half of it's 1981 crop.

This reduced production along with the good sales this summer should substantially reduce the surplus before the next crop is made.

Aside from this, our biggest problem seems to be the cost of producing syrup, especially the energy requirements. Reverse Osmosis and Vapor Compression units are being used more and more by those who are willing to invest a large sum of money. For those who do not want to spent that much, I've got some good news!

The New York State Department of Agriculture and Markets, the New York State Energy Office and the New York State Maple Producers Association have been working together on ways to conserve energy in all sizes of maple operations, especially the small to medium volume producers. They've found a whole lot of little things that we can all do to save energy – and money – in our operations and the cost is very little if anything.

What I'm most pleased about is this: The Maple Syrup Digest has been selected to print the results of this study. The first chapter appears in the centerfold of this issue. You can remove one sheet – four pages – save it and put it with other chapters which will appear in each issue for future reference.

More good news; Both the G. H. Grimm Co. and Berliner Plastics are working on permanent glass syrup grading kits, the kind that last forever and won't fade out after one or two years. We hope one or both of them will be ready for the coming season. It's been a long time since something like this has been available.

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FROM THE CHAIRMAN

This has been a tough year for all types of agriculture. Too wet, too dry, too cold, too hot. We should have realized from the past sugar season that the weather still determines our course of action. Farming is the biggest "crap shoot" occupation to be in. Still, in the long run, I guess that is why most farmers stick to it. Sugaring is no exception. Just when we think we have it figured out something different happens.

As I travel the maple producing areas the most prominent problems seem to be the health of our sugar maple trees. The bugs are raising havoc in many areas. We think the maple tree is a sturdy, strong, resiliant being but they are dying and being killed at an alarming rate. In parts of New York I observed mature trees killed in one season by forest tent caterpillars and gypsy moth caterpillars. This combination is deadly as are others when they follow each other. The tree hasn't a chance. Substantial emphasis will be placed on these problems during the 23rd annual meeting of the North American Maple Syrup Council to be held in Ohio, October 25 and 26, 1982.

Syrup seems to be moving quite well. This is important as there is still a great deal around. It behoves us all to do a good job of promotion and salesmanship.

The Council is only as strong as the persons who participate in it. Each state association must take part in it's work through their director. "Don't hesitate – participate."

Russ Davenport

MASSACHUSETTS SUMMER PICNIC

The well attended picnic sponsored by the Massachusetts Maple Producers Association was held at the sugar camps of Boyden Brothers and the Don Burnetts, both of Conway, Mass.

Primarily a social party where barbequed chicken and sweet corn were enjoyed, much of the talk concerned the energy savings equipment available.

Ray Boyden, Scott Ewen and Russ Davenport reported on their experience with Memtek RO systems used during the 1982 season. All were very enthusiastic.

A walk through the Burnetts maple orchard made many envious. A nice, clean, well managed orchard all to be set to tubing was truly enjoyable.

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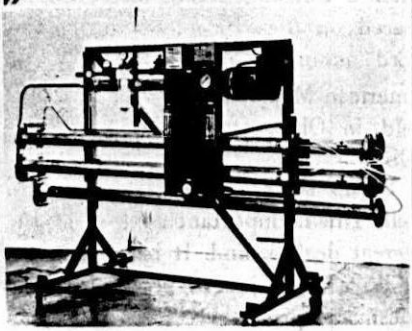

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Energy Seminars

October 5, 1982
Champlin Hall
Catering Dining Laboratory
State University of New York
Agricultural and Technical College
Cobleskill, N. Y.

October 19, 1982
American Maple Museum
Croghan, N. Y.

October 21, 1982
Vineyard Motel
Thruway Exit 59
Fredonia, N. Y.

WHO SHOULD ATTEND:

- New York State Maple Producers
- Producers from other states
- Extension Workers
- Others interested in Maple Energy Conservation and the Techniques/tools required.

9:30 a.m.	Coffee and Registration
10:00 a.m.	Introduction
10:10 a.m.	EASI* Survey of Maple Producers & Discussion of findings of the Surveys
10:40 a.m.	How to do an Energy Survey
11:00 a.m.	Combustion Efficiency of Oil Burning Evaporators A. Elements of Combustion B. Warning Signs of Poor Efficiency
12:00	How to Perform a Combustion Efficiency Test
12:30 p.m.	LUNCH
1:15 p.m.	Steam Hood and Combustion Chamber A. Steam hood design for energy efficiency B. Arch design for oil burning evaporators
1:45 p.m.	Waste Heat Recovery A. Sap preheater B. Combustion air preheater
2:30 p.m.	Energy Management A. Energy consumption monitoring B. Evaporator maintenance
3:00 p.m.	Closing Remarks

*Energy Advisory Service to Industry (EASI), a program of the New York State Energy Office.

REGISTRATION

Registration Fee: $9.00. Make checks payable to the New York State Maple Producers Association and mail to: Gary Hollen, New York State Department of Agriculture & Markets, Building 8, State Office Building Campus, Albany, N. Y. 12235, and indicate the number of persons attending and the date of the conference for which you are asking reservations. Registration fee is not refundable and includes the seminar, coffee/pastry, and lunch.

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TENTATIVE AGENDA

23rd Annual Meeting
North American Maple Syrup Council
Quail Hollow Inn (Jct. I-90 & Ohio 44)
Painesville, Ohio
October 25 & 26, 1982
International Maple Syrup Institute
Annual Meeting
October 27, 1982

Monday-October 25

7:00 a.m. – on	Registration
8:00 a.m.	Business Session
	Committee Reports
	Chas. Bacon - Mississippi Fake Syrup
	Mike Berliner - USDA, Grading Kit
	Russ Davenport - Mass. Label Law
	Bob Lamb - Proposal
10:00 a.m.	Break
10:30 a.m.	Technical Session
	Large Scale RO - Frank Majszak, Producer
	Small Scale RO - To be named, Producer
	Sterilization of Sap - Bill Langenberg, Ontario
Noon	Lunch
1:00 p.m.	Acid Rain - Lyle Raymond, Cornell
	Gypsy Moth Film - Lew Staats, Cornell
	Pest Control - Joe Szymujko, New Hampshire
2:30 p.m.	Energy - Grow Your Own - Fred Laing
	Marketing - Ohio Producers
4:30 p.m.	Adjourn to exhibits and chat with old friends

Tuesday-October 26

8:30 a.m.	Continue Business Meeting
10:00 a.m.	Break
10:30 a.m.	Technical Session
	An attempt to predict sugar content of sap. Bob Morrow, Cornell
	Economizer - Did it pan out. Bill Langenberg, Ontario
	Determining Syrup Adulteration, M. Moreselli. UVM
	Profile of Maple Research. A Panel of research people discuss where we must go.
Noon	Lunch
1:30 p.m.	Tour
	Davies Can Company - Chagrin Falls, Ohio
	Richards Maple Products - Chardin, Ohio
	Saw Mill & Woodworking Complex
6:00 - 7:00 p.m.	Attitude Adjustment
7:00 p.m.	Banquet
	Master of Ceremonies - James (Jim) Patterson, County Commissioner, Geauga County
	Speaker - Janet Henry, Author "The Beat Goes On"
	Presentations

Wednesday-October 27

8:30 a.m.	Meeting
	International Maple Syrup Institute. Charles Bacon-President

NEW YORK MAPLE TOUR

The New York State Maple Tour held August 9 and 10th drew a large crowd of 225 or more for the 2 day and six stop tour. Cool cloudy weather did not hamper the turnout as people from all of New England, Canada, Ohio, Wisconsin, Pennsylvania, and from all directions of New York attended.

The tour was very informative with both new machinery and equipment and equipment personally designed, along with discussion of production practices and marketing methods.

I feel it's important to thank the six participating maple producers for their time and involvement in making the tour run smoothly. They were Bert Jump, Masonville; Cornelis Van Buren, Walton; Tom Barnes, Treadwell; Dennis Hill, Shaver Farm, Harpersfield; Bruce Norton, Morris and Winfred Arnold, Burlington Falls, both in Otsego County.

The tour started Monday August 9 at 12:00 noon and concluded Tuesday August 10 at 1:00 p.m. A dinner banquet was held Monday night with 191 in attendance. A short program was held with comments from Wanda Bush, New York State Maple Queen; Gordon Brookman, past president of New York Maple Producers Association; and Roger Sage, President of New York Maple Producers Association. Lou Staats, Extension Specialist from Cornell University, was also present and made the entire tour more interesting handling technical questions on production.

A short film on "Gypsy Moth" was shown along with an audio slide set on "Birds of Prey in the Northeast", to complete the nights program.

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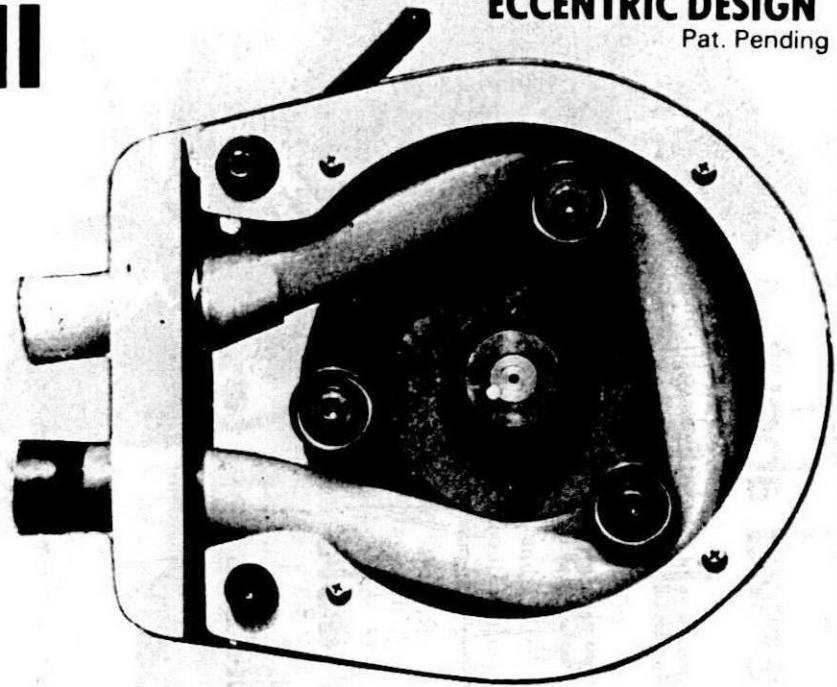

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KENTUCKY MAPLE SYRUP

This summer Bob and Florence Lamb took a trip to Kentucky. Someone down there had purchased some tubing and fittings last fall and they wanted to find out what they were being used for. You guessed it – for maple sap production.

The folks they visited were Tom and Carol French-Corbett and their son, Sebastian, who live on Happy Top Mountain in Estill County, Kentucky. To get there, you drive through the hills as far as you can go and then walk another two miles or so through the woods. They had lived in Cincinnati, where Tom was a member of a religious teaching order for 25 years, and both he and Carol had taught for 10 years at the Montessori school. In their mid-fifties, and never having had a job that secured their future with pensions, they decided to buy some land and try to become self sufficient.

They settled on Happy Top surrounded by Daniel Boone National Forest and commuted for two years. During that time they built a house and began experimenting with maple syrup, tapping the maple trees which were so abundant. They had read Helen and Scott Nearings book, "Living the Good Life" and that is one way the Nearings survived in the Northeast. They had never heard of anyone making syrup in Kentucky but decided to give it a try.

The first year they used 16 gallon plastic milk jugs, tending them only on weekends. They were always overflowing. The second year they had 22; last year they did 200 and this year about 350.

Their new dimension this year was the blue tubing, stretched like veins through the forest from tree to tree to eliminate the untold steps to gather milk jug after milk jug and carry it in five gallon pails to be boiled. "It takes us about 60 gallons of sap to make a gallon of syrup because we tap the red maples too," Tom explained.

Last year they netted 98 quarts of syrup and figured their pay per hour was about 30 cents.

"Normally people boil down in a sugar house, centrally located. These hills make it so forbidding we boil down in three groves so we have three evaporators. All we have to carry up the hill to the final boiling at the outdoor kitchen is the half syrup," Tom said.

The French-Corbetts are kind of unusual folks. How many people would move to the woods after having always lived in the city, cut trees, make boards, split shakes, build a house with their own hands and live without the "modern conveniences"?

And not many folks would get up before dawn and walk two and a half miles with their son to catch a school bus and then two and a half back.

"We only want to make the money we need," Carol said. And looking around the forest that surrounds their home, she added, "Young maple saplings - - everywhere. The future is just terrific here - - there are so many trees we haven't even begun."

Vacuum tubing system ...for maple sap gathering

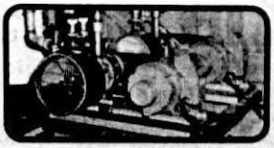
the system which can **double** the **yield** of your sugar bush

The sap is taken from the tree with use of a 5/16" threaded spigot. The sap then flows through 5/16" tubing to the main lines.

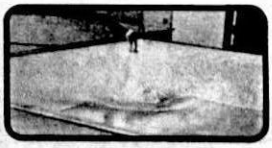
A double fork is used to connect the 5/16" secondary lines to the main line.

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.

Exclusive features

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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Tapholes Close Slowly

by

Russell S. Walters
USDA Forest Service Northeastern
Forest Experiment Station
Burlington, Vermont 05401

Sap collection tapholes sometimes close very slowly because the adjacent cambial tissue dies. This results in elliptical-shaped wounds (Fig. 1) much larger than the original tapholes (Gibbs and Smith 1973). To determine possible causes of this cambial damage I drilled tapholes and inserted sap spouts when tree tissues were frozen. I used high-speed drills, such as a gasoline-powered chain saw equipped with a drill chuck.

WHAT WE DID

The study was conducted in a

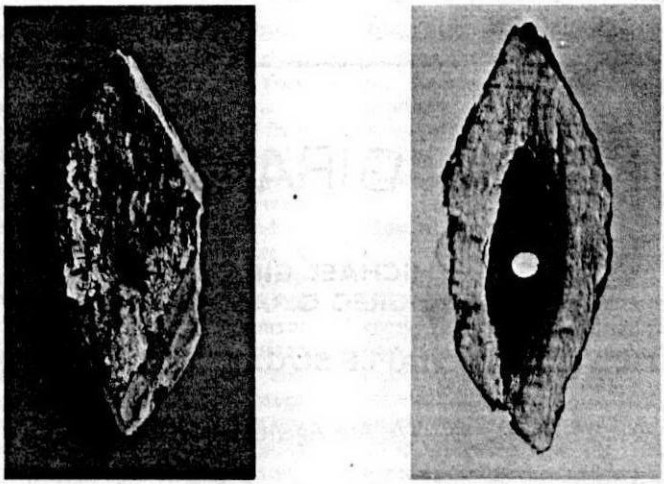

Figure 1. A section of bark and wood from a sugar maple tree shows dieback of cambial tissue adjacent to a taphole. Left: the bark side. Right: the underside.

sugarbush located in the town of Jericho, in northern Vermont[1]. Four tapholes locations were selected on each of 50 trees with two tapholes drilled on a very cold day, and two more drilled on a day when the temperature was higher. On each day, one taphole was drilled with a high-speed tapper, and one was hand-drilled with a brace and bit. The tapholes were drilled 7/16 inch in diameter, 2½ inches deep, and spaced at least 6 inches apart. A plastic sap spout was inserted in each taphole after it was drilled.

The gasoline-powered tapper was an ordinary, small chain saw with guide-bar and chain removed; a special drill chuck was attached to the drive shaft. Its speed was approximately 6,600 rpm. The brace and bit was a regular

Figure 2. Cambial dieback can be seen through the drill hole and crack in the bark.

MAPLE ENERGY CONSERVATION . . . Notebook

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Chapter One: Saving Energy - Maple Syrup

Introduction - Gary Hollen, N.Y.S. Dept. of Agriculture
How to Conduct An Energy Audit of a Maple Syrup Operation
Clifford Wassel, New York State Energy Office

In the spring of 1982, 15 maple syrup producers in New York State received on-site energy audits of their operations and process equipment. These audits were conducted by four industrial engineers provided by the New York State Energy Office, in conjuction with personnel from the New York State Department of Agriculture & Markets and the cooperation of the New York State Maple Producers Association.

These audits were carried out in four different sections of the state covering the major concentrations of maple syrup producers. Twenty-five evaporators were involved and the audits were geared to the small-to-medium size producers in the range of 300 to 2,000 gallons of syrup per year. The purpose of these audits was to examine the maple syrup operations in the field, analyze the energy usage requirements of the operations and identify opportunities to cut energy usage and reduce operating costs. The findings and recommendations from these audits have been given to the 15 participating maple house operators, and information and general results will also be used to publish a How-To-Do-It-Manual. Three one-day seminars have also been scheduled for October in the Western, Central and Capital District areas of New York State. The dates are: October 5, 1982, Cobleskill, NY; October 19, 1982, Croghan, NY; and October 21, 1982, Fredonia, NY.

The following is one of a series of articles that presents some of the major findings from this project. The articles will first start with the importance of conducting an energy audit and then run through typical energy conservation actions that maple syrup producers can implement in their operations.

How to Conduct An Energy Audit of a Maple Syrup Operation

Energy auditing and establishing an energy management program is an opportunity available for every business to decrease energy use and save money without hindering production. This article will help you audit your maple syrup operation for the purpose of reducing energy costs and to establish an ongoing energy management program.

CHART 1

Month	Fuel Oil			Maple Syrup Production Gallons	Energy Cost Per. Gallon Syrup
	Gallons	Price	Per Unit Energy Cost		
February					
March					
April					

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.

STEPS TO ENERGY SAVINGS
ASSEMBLE DATA

One: The first step in conducting an energy audit is to gather as much data as possible pertaining to energy consumption. This can be done by collecting fuel, gas and electric bills or estimating portions of bills for product production. The energy bills should be assembled for one or more production seasons using Chart 1, page 1. If several years of data can be assembled so much the better. Keying energy units (e.g. gallons of fuel) to production units may give you an idea of efficiency trends. In most evaporators, it takes 3 to 5 gallons of fuel oil to produce one gallon of maple syrup. Using this fuel oil to maple syrup ratio you can compare different production periods.

Care must be given to use energy units such as gallons of oil, cords of wood, cubic feet of gas or Btu's instead of dollar costs because varying fuel cost will distort your findings. Tracing the energy units consumed in proportion to production units will provide a handle on efficiency changes. An example of this would be if February's energy to syrup unit proportion changed when compared to March's. This would indicate either a change in efficiency or that the sap sugar content has changed. A conversion table to convert volumes of standard fuels to BTU's is included at the end of this article for your use. (See Chart 5)

LIST ENERGY USING EQUIPMENT

Two: After assembling your costs and production data, next inspect all energy consumption equipment used in syrup production. List each piece of equipment and how much fuel it uses in energy units on some type of basis, perhaps hourly. This will help you to determine the relative importance of each in your energy bill and the amount of consideration you should give each item. Don't forget to include lighting in your analysis. (See Chart 2)

LIST WAY TO PREVENT HEAT LOSSES

Three: After you have a good idea of what energy costs you are incurring and which pieces of equipment are costing you the most to operate, you can start looking for ways to cut energy waste. In the production of maple syrup most of the major energy losses occur in the form of waste heat. Since you are taking a relatively cold liquid and putting it in a pan to evaporate, heat going out to the atmosphere must be an acceptable part of the process. Methods to reuse this heat and insure that the losses are minimal to begin with, will insure that you are not wasting more energy than is necessary. It is important to critically evaluate ways to minimize energy losses thereby reducing energy consumption. Always look at energy saving opportunities with the following thoughts in mind:

1. How much money will I save by implementing a new idea?
2. How much of an investment must I make to accomplish a given project for a given amount of energy saved?
3. How much time will it take to regain my investment in dollar savings?
4. What effects will implementation of this action have on production rate and equipment life?
5. Do I need outside help to advise me on the merits of doing a given energy conservation action?

CHART 2

Equipment	Hours of Use	Energy Used			
		Gal. oil/hr.	KWH	ccf	Cord of Wood
Lights					
Primary Evaporators					
Boilers					
Canning Heaters					
Other					

*In most operations, the primary evaporator will be the heaviest consumer of energy.

When analyzing energy savings, use a payback analysis to determine the number of years of energy savings necessary to equal the investment necessary to implement the action.

MAINTAIN COMBUSTION EQUIPMENT

Four: If you are paying for maintenance to be done on combustion equipment, insure that the maintenance person has the proper equipment to do the job. Insist that flue gas analysis and equipment adjustment be done as a part of the maintenance that is performed. A report of the analysis should state how the maintenance and equipment adjustment has effected combustion efficiency. Actual test equipment measurements are the only method to determine what is occurring in the evaporator. The human eye adjustment method cannot detect slight changes in the flame appearance that can mean energy savings of twenty percent and more. Chemical absorption or electronic flue gas analyzers are widely available to measure carbon dioxide and oxygen levels in stack gases to help determine combustion efficiency. Thermometers and smoke level testers should be used in conjunction with a flue gas analyzer to accurately measure combustion efficiency. If you are able to periodically sample temperature and flue gas composition, the following data tracking table will help you monitor your equipment combustion performance. Combustion efficiency and burner tuning will be covered in depth by articles later in this series because of their importance to energy conservation in maple syrup operations. (See Chart 3)

MONITORING AND MAINTAINING THE PROGRAM

Five: Keep track of all measurements and changes to equipment and use of fuel to effectively monitor your energy conservation effectiveness. There are two items which should be checked:

1. Improved maintenance and operating procedures. Things tend to return to the status quo if not periodically checked. Spot inspections will insure that this does not occur.
2. Keep track of your energy actions. The table below has been provided for this purpose. (See Chart 4)

In summary, saving energy in your maple syrup operation requires:
--making the commitment (Do I want to increase my profits?)
--conducting an energy audit
--identifying energy usage requirements
--evaluating the equipment
--examining the operation and maintenance procedures
--identifying heat losses and analyzing energy actions
--performing flue gas analysis and adjusting equipment
--implementing the economically feasible Energy Actions
--maintaining the program and monitoring performance

The articles in this series will deal with getting the most out of your energy dollar. Included in this series are articles on combustion efficiency and burner adjustment, waste heat recovery, arch design, sources for additional energy conservation information, and "new" maple syrup producing technology to name a few. These energy actions have been found to be appropriate in many maple syrup operations and should help you cut your energy bill and increase profits. There will also be a bibliography on maple energy conversion research.

CHART 3

Period (weekly or monthly)	1	2	3	4
Stack temp F°				
Percent Oxygen or Carbon Dioxide				
Smoke Spot Number				
Combustion Efficiency				

CHART 4

ENERGY ACTION CHECKLIST

Building: _____ Location: _____

Date: _____ Prepared by: _____

Action	Estimated Cost	Actual Cost	Implementation Date		Actual Energy Savings	Projected Energy Savings
			Planned	Actual		

CONVERSION FACTORS

The common unit of energy measure is the British thermal unit (Btu), which is the unit most commonly used to calculate and compare energy costs and savings. To convert between the common energy units, use the factors in Chart 5.

In order to keep each Energy Action calculation simple, and the results conservative, no efficiency factors have been applied to fossil fuel heating values.

CHART 5

TO CONVERT	INTO	MULTIPLY BY
Cubic feet, natural gas	therms	0.01
Cubic feet, natural gas	Btu's	1,020
Gallons, No. 2 oil	Btu's	138,000*
Gallons, No. 4 oil	Btu's	145,000*
Gallons, No. 6 oil	Btu's	150,000*
Gallons, kerosene	Btu's	135,000*
Horsepower-hours	Btu's	2,544
Horsepower-hours	kWh's	0.7457
Horsepower	Btu/min	42.4176
Horsepower (boiler)	Btu/hr	33,479
Kilowatt-hours	Btu's	3,413
Short tons, anthracite coal	Btu's	25,400,000*
Short tons, bituminous steam coal	Btu's	21,600,000*
Short tons, lignite, brown coal	Btu's	14,000,000*
Steam, saturated (lbs)	Btu's	970
Therms, natural gas	cubic feet	100
Therms, natural gas	Btu's	100,000

*These are average values. Since exact Btu content varies with type and source, contact supplier when extreme accuracy is essential.

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.

woodworking tool. Its estimated speed was 120 rpm.

RESULTS

Two years after drilling, half of the warm-day tapholes were fully closed with callus tissue. By contrast, only 5% of those drilled on the cold day were closed. After 3 years, the number of closed warm-day tapholes had increased to 80%, and only about 25% of those made on the cold day had closed. These results are statistically different. The percentage of closed tapholes for each treatment combination 2 and 3 years after tapping is shown in Table 1. In neither the second nor the third year was there a statistical difference in closure between power-and hand-drilled tapholes.

DISCUSSION

I found that drilling tapholes and inserting plastic spouts in frozen trees

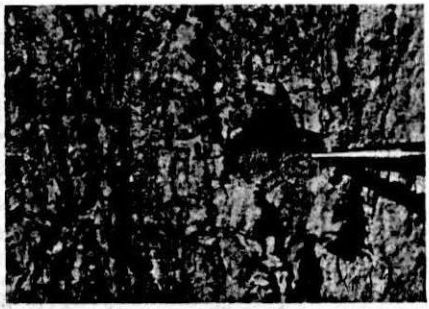

Figure 3. When cambial tissue does not die back from a taphole as a result of tapping, callus tissue quickly forms, closing the taphole.

usually results in slower taphole closure. A tapered spout driven into a taphole compresses the adjacent tissue. Because frozen tissues are brittle, this wedging action can rupture fragile cambium cells around the taphole, and often causes the bark to split longitudinally above and below the taphole (Fig. 2).

When tapholes close rapidly (Fig. 3), new layers of wood form over them, and the same area of the hole may be tapped again sooner. Rapid closure also tends to inhibit the advance of any aerobic decay organisms invading the taphole, and there is less chance of decay organisms invading the tree's tissues (Shigo and Larson 1969).

High-speed drilling did not affect taphole closure, and indicated that such equipment can be used safely for

tapping maple trees. This conclusion is further supported by an earlier study (Smith and Lamore 1971) showing that high-speed drilling did not affect the subsequent sap yield from a taphole.

Drilling tapholes in frozen maples can damage their tissues, so I suggest tapping only on very mild days, when temperatures are above freezing, or perhaps even waiting for the sap-flow season to start. Our experience indicates that tapping is successful when temperatures are no lower than about 25°F. However, care should always be exercised in setting the spouts: driving spouts too hard into the taphole can severely damage the tree, even under very mild weather conditions.

For a more detailed account of this study see Walters, Russell S. 1978, "Tapholes Drilled into Frozen Sugar Maples Close Slowly." U.S. Dept of Agriculture, Forest Service Research Note NE-265.

References: Gibbs, Carter B., and H. Clay Smith. 1973. Cambial dieback and taphole closure in sugar maple after tapping. U. S. Dept. Agric. For. Serv. Res. Note NE-155.

Shigo, Alex L., and Edwin vH. Larson. 1969. A photo guide to the patterns of discoloration and decay in living northern hardwood trees. U. S. Dept. Agric. For. Serv. Res. Pap. NE-127.

Smith, H. Clay, and Richard J. Lamore. 1971. Speed of tapping does not influence maple sap yields. U. S. Dept. Agric. For. Serv. Res. Note NE-132.

Footnotes: 1. The sugarbush is located within the boundaries of the Ethan Allen Test Firing Range and is available for forestry research by permission of the Adjutant General, Vermont National Guard.

Table 1. Percentage of closed tapholes 2 and 3 years after tapping with a gasoline-powered tapper and by hand on a cold day and a warm day.

Tapholes drilled by:	Temperature when taphole drilled	
	After 2 years	
	Low	High
Power	8	57
Hand	2	43
	After 3 years	
Power	31	80
Hand	20	82

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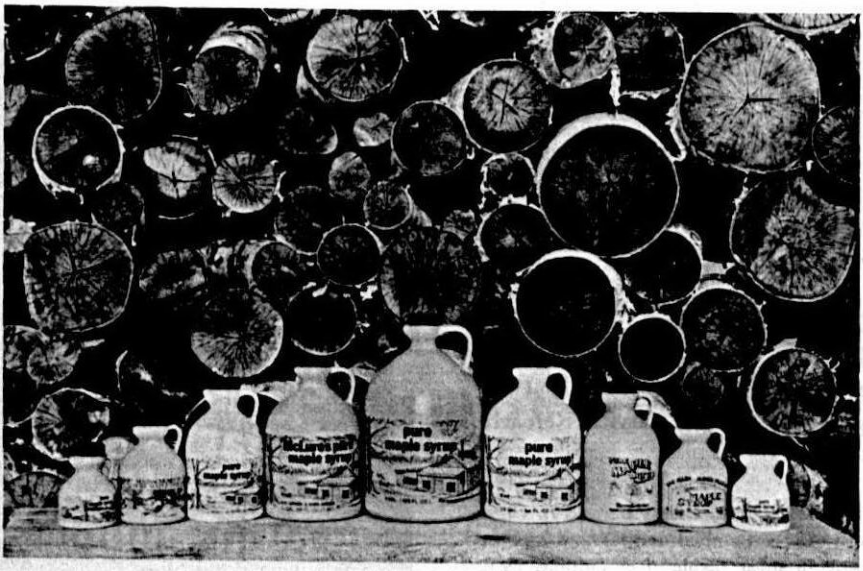

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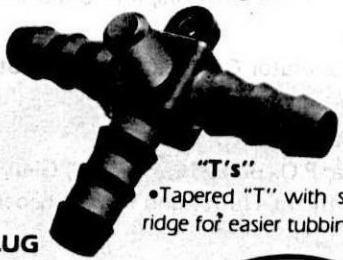

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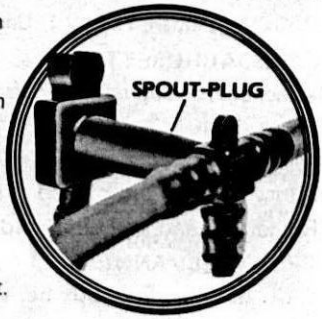

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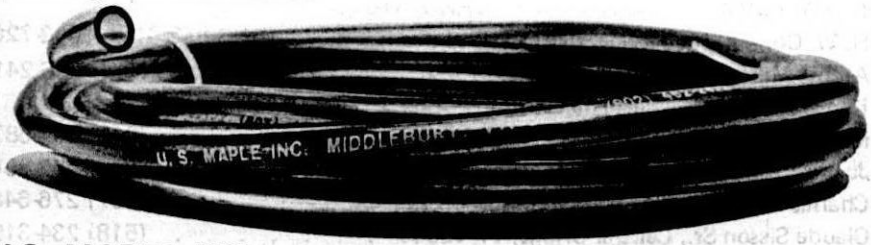

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Installation of Pipeline Correctly

by
Russell S. Walters & Harry W. Yawney
USDA Forest Service
Northeastern Forest Exp. Sta.
Burlington, Vermont 05401

Collecting maple sap with an improperly installed pipeline may result in dark, low-grade syrup. We compared the grades of syrup made from sap collected by several techniques. These included properly and improperly installed tubing, galvanized buckets with covers, and a special aseptic tree tapping and sap collecting procedure.

WHAT WE DID

During two successive maple sapflow seasons, we collected sap samples daily from sterilized taps and standard bucket taps from each of three trees 1. In addition, we collected sap samples from 10 trees each day, from a plastic tubing line installed properly, and from a tubing line that was installed improperly. The sloppily installed tubing had sags and sharp switchbacks that inhibited sap flow and provided places where sap would stand and remain after a flow period ended (Fig. 1).

The sterile or aspetic tapping and sap collecting procedure was used to establish a standard for comparison with the samples collected by the other procedures. Prior to drilling, the tree bark was scraped with a sterile chisel, saturated with alcohol, and ignited. As the alcohol burned, the hole was drilled with a sterilized bit and a sterilized spout was inserted quickly. The sap was collected in glass gallon jugs sterilized by alcohol dip (Fig. 2).

The daily sap collections were taken to the laboratory and concentrated by

Figure 1. Sap was collected from a group of trees by each of two parallel plastic tubing pipelines. One was hung properly while the second was installed sloppily, allowing excessive sags and sharp switchbacks.

Figure 2. Glass jug and apparatus for collecting maple sap under sterile conditions.

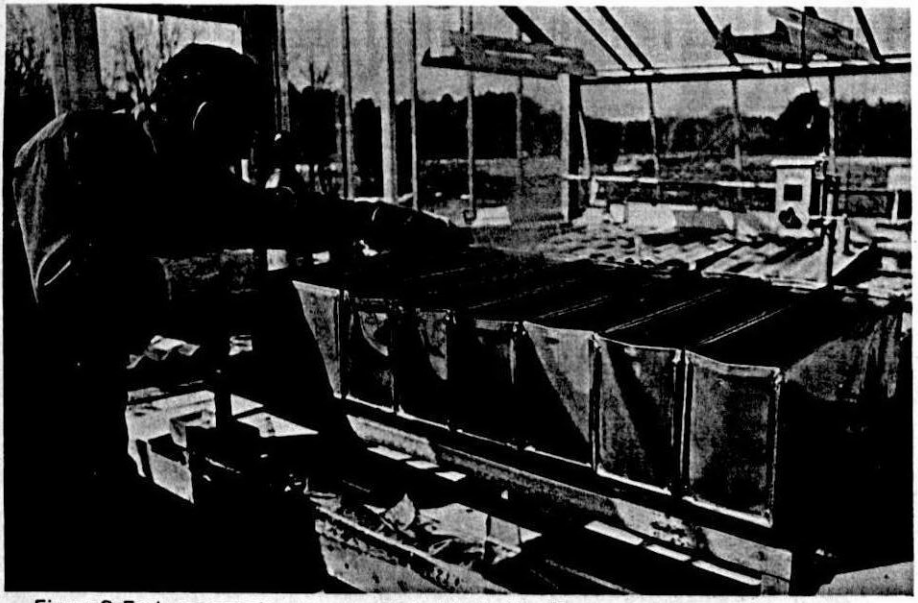

Figure 3. Each sap sample was concentrated by boiling in a separate open stainless-steel pan.

boiling in an open stainless-steel pan (Fig. 3) to standard density syrup, which is 66.0° Brix (at 20°C). We graded syrup samples by comparing them with a glass maple-syrup-grading set that was developed by the U.S. Department of Agriculture (Brice and Turner 1956). Samples made from

"buddy" sap collected in the late spring are omitted from the results because their off-flavor makes them unacceptable as table syrup.

RESULTS AND DISCUSSION

During the entire season, light-colored syrup was produced from all sap collection when the sap was collected by either buckets or properly installed tubing. Only at the end of the season, just before the development of buddy flavor, did the color grade change from light amber to medium amber, the accepted minimum for table use. Every sap collection in the sterile tap produced light-amber syrup. On the other hand, the syrup made from sap collected by the poorly installed tubing system varied greatly from dark to light color during the season. Twice, the poor tubing produced syrup so dark that it graded below medium amber. One of these dark samples was collected from the first sap run of the season and graded substandard.

Light transmittance readings showed a general trend toward darkening syrup color as the season progressed. The bucket and good tubing samples followed a similar pattern: high readings until just below the development of buddy flavor, when both dropped. The poor tubing ranged from high to low throughout the season, while the sterile taps continued to produce light-colored or light-amber grade syrup even throughout the buddy sap period. A possible explanation for the erratic color pattern of the poor tubing syrup is that sap collected, remained, and fermented in the sagging portions of the pipeline. When a sapflow did occur, the fermented sap then contaminated the sap collection. Fermentation can re-

sult in dark-colored syrup. (Naghski et al. 1957).

SUMMARY & RECOMMENDATIONS

We found that maple syrup color (grade) differed very little whether it was made from sap collected by a properly installed pipeline system, or by frequently emptied, clean galvanized buckets with covers. However, maple syrup made from sap collected by an improperly installed plastic pipeline varied widely in color from day to day during the season. Our sterile tapping procedure demonstrated that it is possible, through sanitary measures, to produce light-colored syrup during the entire season, including syrup made from buddy sap.

We have shown that a satisfactory maple-syrup grade can be produced by using plastic pipeline for sap collection. But it is extremely important that it be properly installed, without sags and low points, and that it have adequate slope for complete drainage. Our results also show the value of and need for careful sanitation of sap collection equipment before the season. Following proper sanitary measures during the season would be beneficial.

We conclude that the sap run-to-sap run variation in the color of syrup from the poorly installed pipeline was most likely caused when sap, trapped in the low points, fermented between runs. Sap stored and unprocessed for two or more days could cause the syrup made from the next sap run to be dark. For this same reason, buckets should be emptied after runs that are too short to produce enough sap to warrant collection (as we did in this study), even though this is time consuming and expensive. Failure to do this could cause the syrup from the next sap flow to be dark, perhaps off-flavored, and be graded lower.

For a more detailed account of this study see Walters, R. S. and H. W. Yawney, 1978, "Plastic Tubing and Maple Syrup Quality." U.S. Dept of Agirc. For. Ser. Re. Paper NE-409.

References: Brice, G. A. and A. Turner, Jr. 1956. Glass color standards for maple sirup. J. Opt. Soc. Am. 46 (4):293-299.

Naghski, J., L. L. Reed, and C. O. Willets. 1957. Maple sirup. X. Effect of controlled fermentation of maple sap on the color and flavor of maple sirup. Food Res. 22 (2):176-181.

Footnotes: 1. This sugarbush is located within the boundaries of the Ethan Allen Test Firing Range, and is available for forest research by permission of the Adjutant General, Vermont National Guard.

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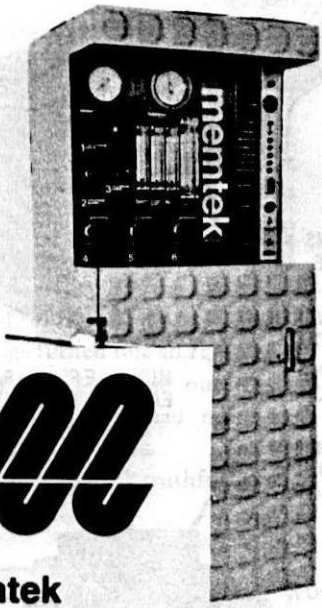

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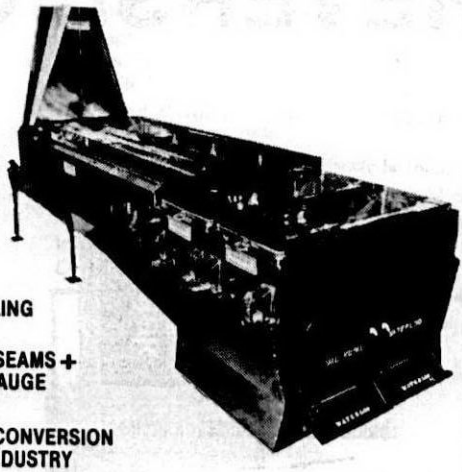

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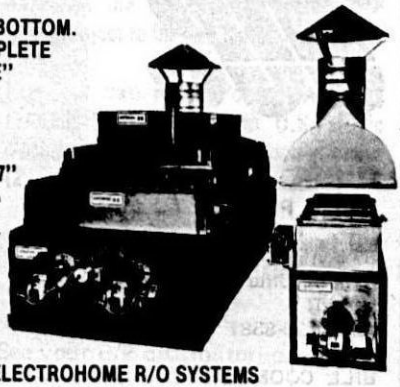

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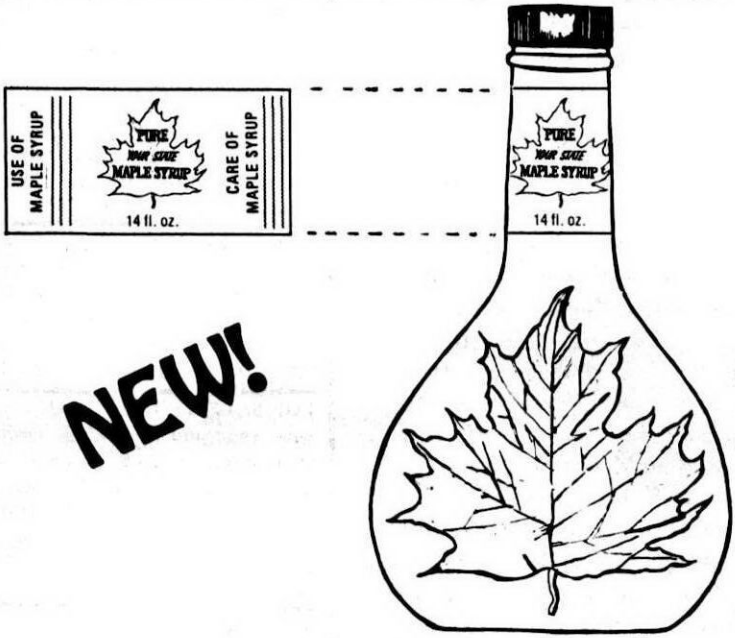

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Neil C. Wright, 28 Liberty St., Camden, NY 13316	(315) 245-1519 (315) 245-1434
Northeastern Pennsylvania Maple Producers Association Court House, Honesdale, PA 18431	(717) 689-2353 (717) 253-5970
Potter-Tioga Maple Prod., Assn., Coudersport, PA 16915	(814) 274-8540
Robert McConnell, Coudersport, PA 16915	(814) 274-9143
H. W. Russell & Sons Maple Farms, Rome, PA 18837	(717) 247-7361
Somerset County Maple Producers Association % Dale Jeffrey, Box 15, Wagners Rd., W. Salisbury, Pa. 15565	(814) 662-2904
Sugar Bush Supplies, 2611 Okemos Rd., Mason, MI 48854	(517) 349-5185
Kinney & Hodgkins Maple Supplies, Thorndike, ME 04986	(207) 568-3683
Kinney & Hodgkins Maple Supplies, Yarmouth, ME 04096	(207) 846-4570
Maine Maple Products, Inc., Titcomb Hill, Farmington, ME 04938	(207) 778-3803
Wyman W. Manes & Son, East Orwell, Ohio 44034	(216) 583-2388
Richards Maple Products, 545 Water St., Chardon, OH 44024	(216) 286-4160
O. C. Stevens & Son, Maple Lane Farm, Mt. Gilead, OH 43338	(419) 946-3300
Reynold's Sugar Bush, Inc., Aniwa, WI 54408	(715) 449-2057
Ivan Puffenbarger, Rt. 637, Blue Grass, VA 24413	(703) 474-2771
Bacon Jugs Canada, Box 152, St. Andrews East, Que. JOV 1XO	(514) 562-2237

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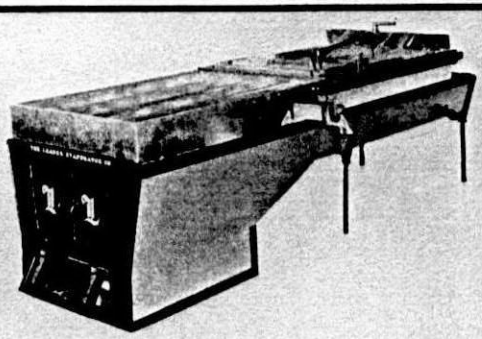

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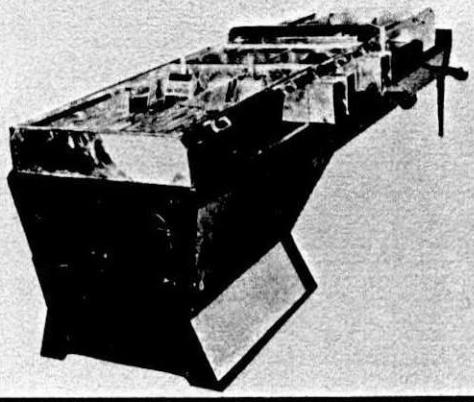

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