NCRS
NATIONAL CORVETTE RESTORERS SOCIETY

New England Chapter
Founded 1996

VETTEFORMATION

VOLUME 20 NUMBER 2
March April May 2014

Contents:

New England Chapter 2014 Spring Events

The numbers ……..

2015-Z06-625-635-6.2L-LT4

May 9th & 10th – **chapter judging meet**

Paul Masse
RI'S #1 CHEVROLET DEALER

Route 44 1111 Taunton Ave
East Providence, RI 02914
Online registration is open

June 8th 2014
Museum of Transportation
Brookline MA

National Corvette Restorers Society (NCRS) New England Chapter sponsors Corvette Day. All generatios onf Corvettes are invited to attend. Sunday, June 8, 2014 The show starts at 9am and runs until 3pm. Car registration is $20 per car and includes the driver and one passenger.

More events and details in this issue ----

NOTE: Please check in on the web page for updated and time sensitive information
http://newenglandchapterncrs.homestead.com

Build Your Own Distributor Test Machine for Under $100 – Part 1

By Joe Randolph

Introduction

Many people have heard of the famous Sun distributor machine that was ubiquitous in repair shops and speed shops from the 1940's to the 1970's. These machines allowed a mechanic to remove the distributor from the engine and test it independently outside the car. Several key characteristics of the distributor could be tested, including the mechanical advance, vacuum advance, and dwell.

Of these, the two parameters of most interest to engine builders are mechanical advance and vacuum advance. In addition to simply verifying that the distributor is performing as designed by the manufacturer, changes can be made to the mechanical advance and vacuum advance to better match the distributor to an engine that has been modified, or to better match the engine to today's fuels.

Distributor machines became unnecessary as cars evolved to using computer-controlled ignition, and few repair shops have them today. Some speed shops and engine builders still have them, especially if these shops specialize in vintage engines. A used Sun distributor machine in good working condition typically sells for $1000 to $2000.

For owners of Corvettes that have a traditional points-style distributor, a distributor machine remains the preferred way to test or modify the advance characteristics of your distributor. However, the high cost of a Sun machine means that most Corvette owners can not afford to add one to their tool collection.

Figure #1

Figure 1 shows an old Sun distributor machine that I acquired a few years ago in non-working condition. My plan was to repair it so that I could have my very own working Sun distributor machine. While attempting to resolve the various problems this machine had, I realized that I could probably build my own distributor machine faster and cheaper than I could repair the Sun machine.

The subject of this two-part article is the low cost distributor machine that I built. Just to be clear at the outset, the $100 cost mentioned in the title assumes that you already own a dial-back timing light with built in tachometer. If you want to test the vacuum advance, you will also need a hand-operated vacuum pump. The machine described in this article is simply a fixture that is used in conjunction with these two devices.

Summit #G1059
$65.97 Timing light

Summit Actron # ANM-CP7835
Hand Vacuum pump / brake bleeder

Figure 2 shows the complete test setup with a distributor installed, including the dial-back timing light and hand operated vacuum pump. This fixture is intended for use with the points-type distributor used on Chevy V8's from 1955 to 1974, including those where the owner has installed an electronic points elimination device such as those sold by Pertronix and Lectric Limited. For HEI distributors used from 1975 to 1991, only minor changes to the fixture's wiring are needed, since HEI distributors have no external coil or ballast resistor.

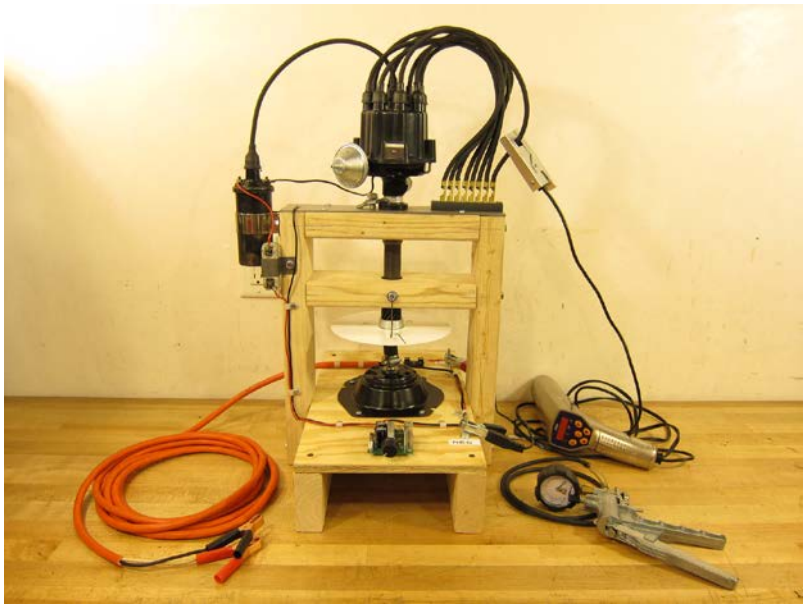


Figure #2

Ignition 101

For a properly running engine, the firing of the spark plug has to be carefully timed so that it occurs at exactly the right moment.

It turns out that this moment is not simply the point at which the piston has reached the top of the compression stroke.

Ignition Advance Terminology

Since there is a finite delay between the time the plug fires and the time that the fuel burn gets fully underway, the spark plug needs to be fired at some point slightly in *advance* of the piston's arrival at the top of the compression stroke. This is what is meant by the term "ignition advance." Ignition advance is always specified in degrees of crankshaft rotation.

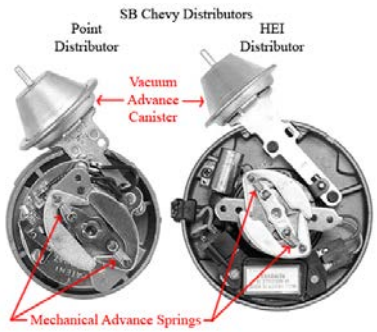
To complicate matters, the optimum amount of advance is not a fixed number. The required advance increases as the engine speed increases, and it decreases as the load on the engine increases. So, some means must be implemented for changing the advance in response to these two factors. When discussing ignition advance, there are three types of advance that need to be understood:

Mechanical Advance

Mechanical advance increases the ignition advance as a function of engine speed, with higher engine speed corresponding to greater advance. In vintage Corvette distributors, this is done with two spring loaded flyweights located under the rotor. Mechanical advance responds only to engine speed.

Vacuum Advance

Vacuum advance increases the ignition advance when the engine is lightly loaded, such as at idle and at cruising speeds. This is done with a small diaphragm that responds to intake manifold vacuum (intake manifold vacuum is highest when the engine is lightly loaded). The vacuum advance diaphragm is the familiar "can" mounted on the distributor just outside the distributor cap. It is connected by a hose to a source of intake manifold vacuum. Vacuum advance responds only to intake manifold vacuum.



It should be noted that most vacuum advance cans are connected directly to a source of intake manifold vacuum. However, some engines from the early days of emission controls use a source of "ported vacuum" that provides vacuum only when the carburetor throttle blades are open. This was used to reduce advance at idle to create higher combustion temperatures that led to lower emissions. A common "fix" for these engines if they run hot at idle is to change the vacuum source to direct manifold vacuum.

Initial Advance

Initial advance is the amount of advance provided without any contribution from the mechanical advance or the vacuum advance. Initial advance is the familiar parameter you set when you use a timing light to "set the timing" during a routine tune up. Initial advance is set by loosening the clamp at the base of the distributor and rotating the distributor body.

When setting the initial advance, it is important to eliminate any contributions from the mechanical advance or the vacuum advance. To prevent the mechanical advance from affecting the reading, initial advance is set with the engine running at idle. At idle speeds, a properly functioning mechanical advance is not adding any advance. To prevent the vacuum advance from affecting the reading, the vacuum hose to the vacuum advance can is disconnected and plugged.

Summing It Up

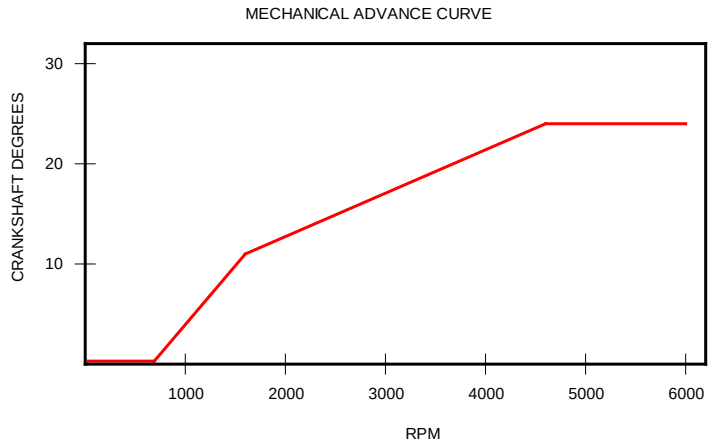
It is important to understand that when the engine is running, the actual advance the engine sees for a given combustion event is the instantaneous sum of all three of the above. In other words,

Instantaneous Advance = (Initial Advance + Mechanical Advance + Vacuum Advance)

Each of the three advance systems operates completely independently of the others, but what the engine sees is the sum of all three. When attempting to evaluate any one of these systems, it is important to keep the other two from affecting the measured results.

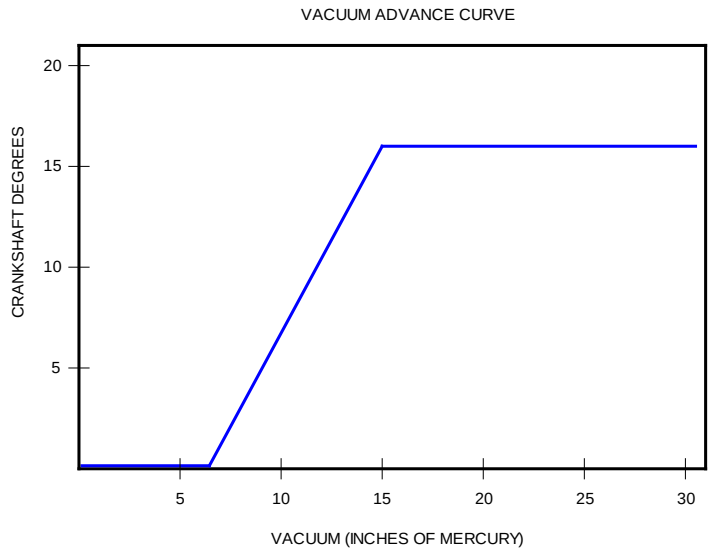
What a Distributor Test Machine Does

The most basic function of a distributor test machine is to allow you to spin the distributor at any desired speed and measure the amount of mechanical advance the distributor is generating. Mechanical advance is tested by leaving the vacuum advance disconnected and spinning the distributor over the full range of speeds at which it is designed to operate.



Mechanical advance increases as a function of engine speed, so the speed at which the distributor is spinning will influence the measured advance. A graph of the mechanical advance as a function of engine speed is the so-called “advance curve” that is the most frequently sought output from a distributor machine. Figure 3 shows a representative mechanical advance curve.

Vacuum advance is measured with the distributor spinning at idle speed so that the mechanical advance is not active. A calibrated source of vacuum is applied to the vacuum can and the resulting advance is measured. Figure 4 shows a representative vacuum advance curve.



So, how does the Sun machine measure the amount of advance? It does so with a strobe light that flashes on a degree wheel, and the operator reads the result manually. This is pretty much the same process used during a routine tune up when the initial advance is set using a timing light.

The “Distributor Machine” You Already Have

It is worth pointing out that if your car runs, you already have a “distributor machine.” Your “distributor machine” is the car itself!

By marking the harmonic damper with degree marks, such as using a pre-printed tape available from speed shops, you can use a conventional timing light to measure the instantaneous total advance at any engine speed. Better yet, using a dial-back timing light eliminates the need for the degree marks on the damper. By isolating the initial advance, mechanical advance, and vacuum advance as described above, you can measure all three of them using the engine itself.

This sounds very nice in principle, but the reality is less than ideal. Holding your head under the hood to use a timing light while simultaneously running the engine at various speeds up to 5000+ RPM is pretty unpleasant. Having tried this, my conclusion is that this method should only be used as a quick diagnostic test to verify that the mechanical advance and vacuum advance appear to be working.

This method is not very suitable for fine-tuning the mechanical and vacuum advance, which might involve dozens of detailed sweeps of the RPM range. For any kind of extensive tuning of the mechanical and vacuum advance, it is far preferable to test the distributor off the car.

Designing an Inexpensive Distributor Machine

Based on the above description of using the car itself as a distributor test machine, it should become apparent what has to change to get the distributor off the engine while retaining the ability to use a timing light to measure advance. All that is needed are the following ingredients:

1) A method for spinning the distributor at controlled speeds.

2) A method for generating a trigger signal for a conventional timing light.

3) Some sort of rotating disc that replaces the harmonic damper as an item to watch with the timing light.

4) Power supplies for the trigger signal circuit, motor speed control, and timing light.

That’s it. Just these ingredients and you can test your distributor in relative comfort and quiet, rather than putting your head into a roaring engine compartment. In Part 2 of this article, I will describe how to build the low cost machine shown in Figure 2. Joe Randolph

The NCRS FOUNDERS Award

New England chapter members may never get a better opportunity than now to qualify for this prestigious award. --- Beginning in 2013 or 2014 New England Chapter members have a perfect opportunity to earn this award because a local regional in 2014 and the National in 2016 are all scheduled within New England. Don’t let the opportunity pass you by ……. Read on for the details …….