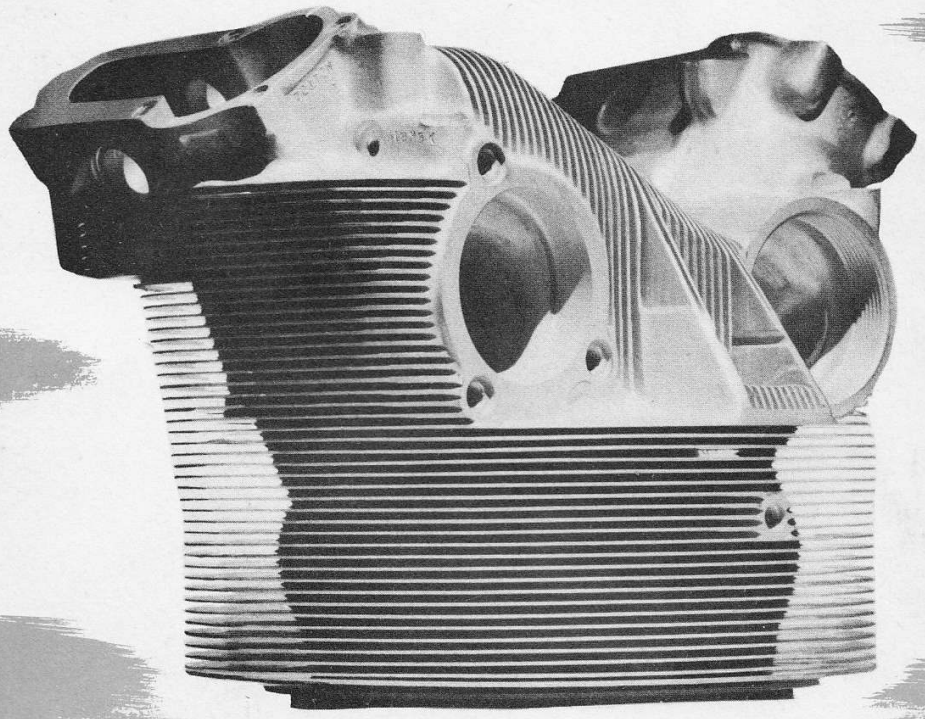
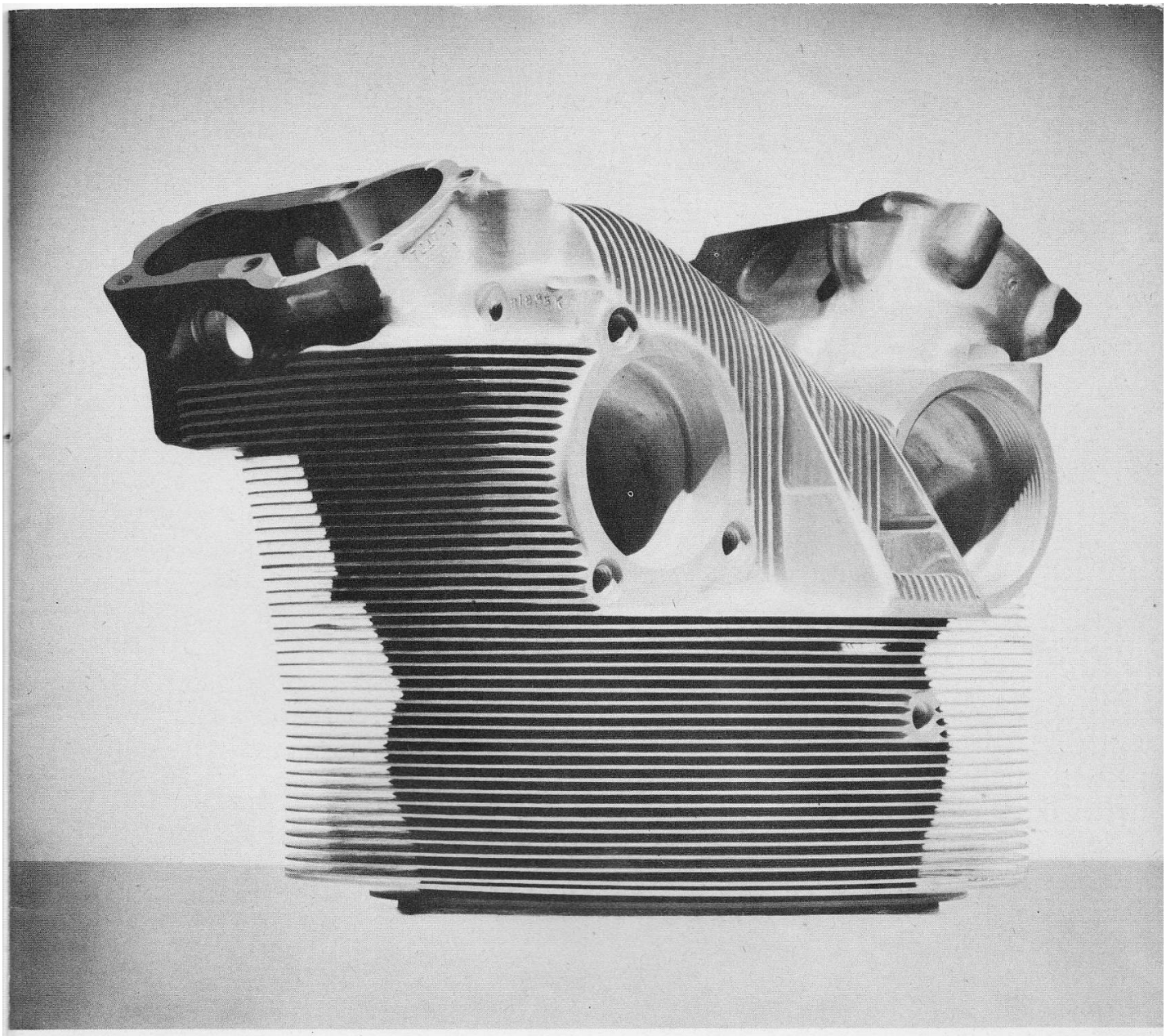
General Motors –
1940's
10-4

OPEN HOUSE



CHEVROLET-ANDERSON

JUNE 4, 1945



☆ ☆

This is what we make

☆ ☆

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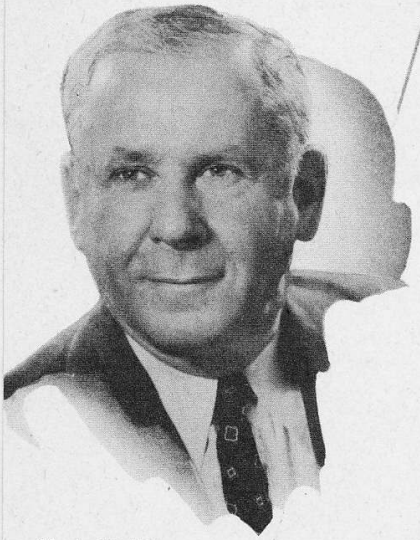


H. A. LEARY
General Manager

It is a pleasure to welcome you to our Open House. We are particularly happy that it comes so close to Victory Day in Europe, as our work has helped speed the final victory there.

Most of you will be surprised to see that the greater part of our work is concerned with the actual machining of cylinder heads, since the original plans for Chevrolet-Anderson called only for the manufacture of aluminum forgings.

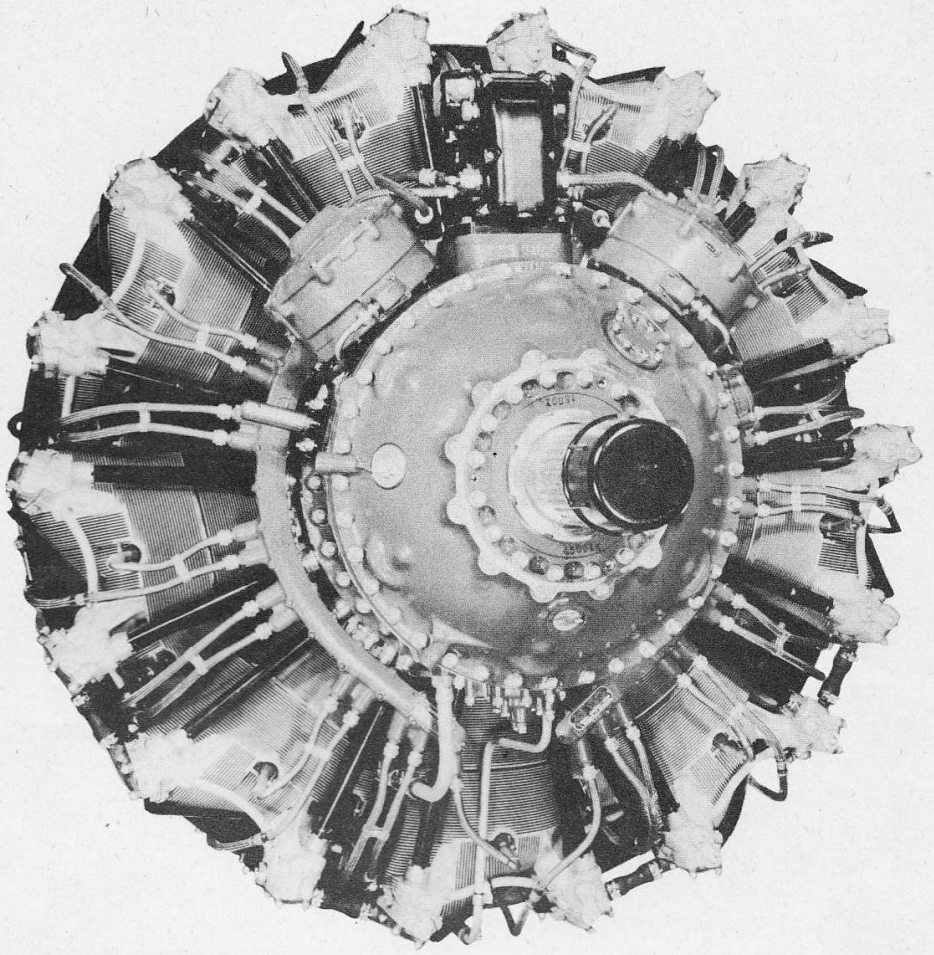
We have many interesting processes, and you are invited to ask questions of the guides who will assist you during your trip. You will see hundreds of complicated machines, most of which were designed especially for this type of work. As you walk through the plant you will see how we convert a rough piece of aluminum into the graceful part that you see on the opposite page.

The part we make is the aluminum cylinder head for a 2200 horsepower Pratt and Whitney airplane engine. You may think that this is a pretty big plant for just one item, but when you have seen all the work that is necessary you will wonder how we accomplish so much in such little space.

We are proud of the job we are doing. We hope that you will enjoy your visit with us. Certainly we enjoy having you. And we are glad to present you this souvenir booklet as a memento of your tour.

Jack L. Coyle

J. L. COYLE
General Superintendent



THE ENGINE you see here is an 18-cylinder air-cooled engine developed by the Pratt & Whitney Company and which Chevrolet is manufacturing under license. Earlier engines were much smaller, but as the years advanced more and more cylinders were added to make the engine increasingly powerful. This engine is the latest model, and develops more than 2,200 horsepower.

Nine of the eighteen cylinders can be seen in this picture. The other nine cylinders are behind them. Those in front are slightly different from the ones behind, but we make both of them.

To date Chevrolet has made more than 60,000 Pratt and Whitney engines. At first they had only 14 cylinders and developed only 1200 horsepower. But last year the Army Air Forces requested Chevrolet to build this newest model, so the Government arranged to purchase this property and under the auspices of the Defense Plant Corporation these buildings were converted to make cylinder heads.

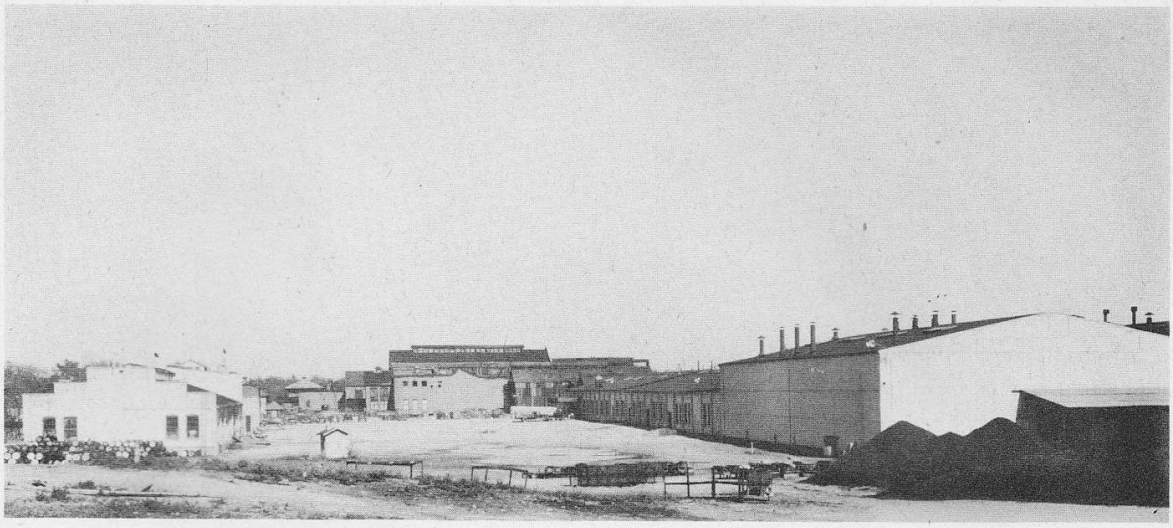
It hasn't been an easy job to design, purchase and install all the hundreds of machine tools necessary, but it has been done. Now you are going to see the machines in operation. And as you walk through the plant and see the process of manufacture you will understand how important the work is when you remember that the lives of our pilots and their crews depend upon the quality of work we do.

IN THE LIGHT of what you are seeing today, it is rather difficult to remember what sort of buildings stood on this ground when the first snow fell back there in the winter of 1943. They were pretty old and dilapidated and hadn't been used for anything but storage for a long time. But even before that first snow fell the United States Army Air Force officers and the management of Chevrolet were discussing plans which led to great activity here.

In March, 1943 men and materials moved onto the property which you see pictured here. Some of the old structures were torn down. The usable buildings were repaired. Railroad tracks were torn out and new ones put in. Floors were torn up and relaid. By July the buildings were finished as you see them, and then a parade of specially designed forging tools began to move in. By November the plant was ready for the production of forgings.

Due to the changing fortunes of war, however, the Army decided not to use the forging capacity at Chevrolet-Anderson. So for several months there was little activity. Then, late in 1943, the Army began to make plans for D-day in Europe.

The United States Army needed airplanes, thousands of them. And because airplanes meant engines, and because Chevrolet was famous for its ability to manufacture in large volume, Chevrolet was asked to undertake the manufacture of Pratt and Whitney 18-cylinder radial engines.



The first conference took place as early as December, 1943. The first definite order followed in January, and because it was found that even Chevrolet's enormous capacity was not large enough to build engines along with all the other war material it had been asked to make, Chevrolet and Defense Plant Corporation officials arranged to alter the forging buildings here and create a new factory for machining engine parts as well.

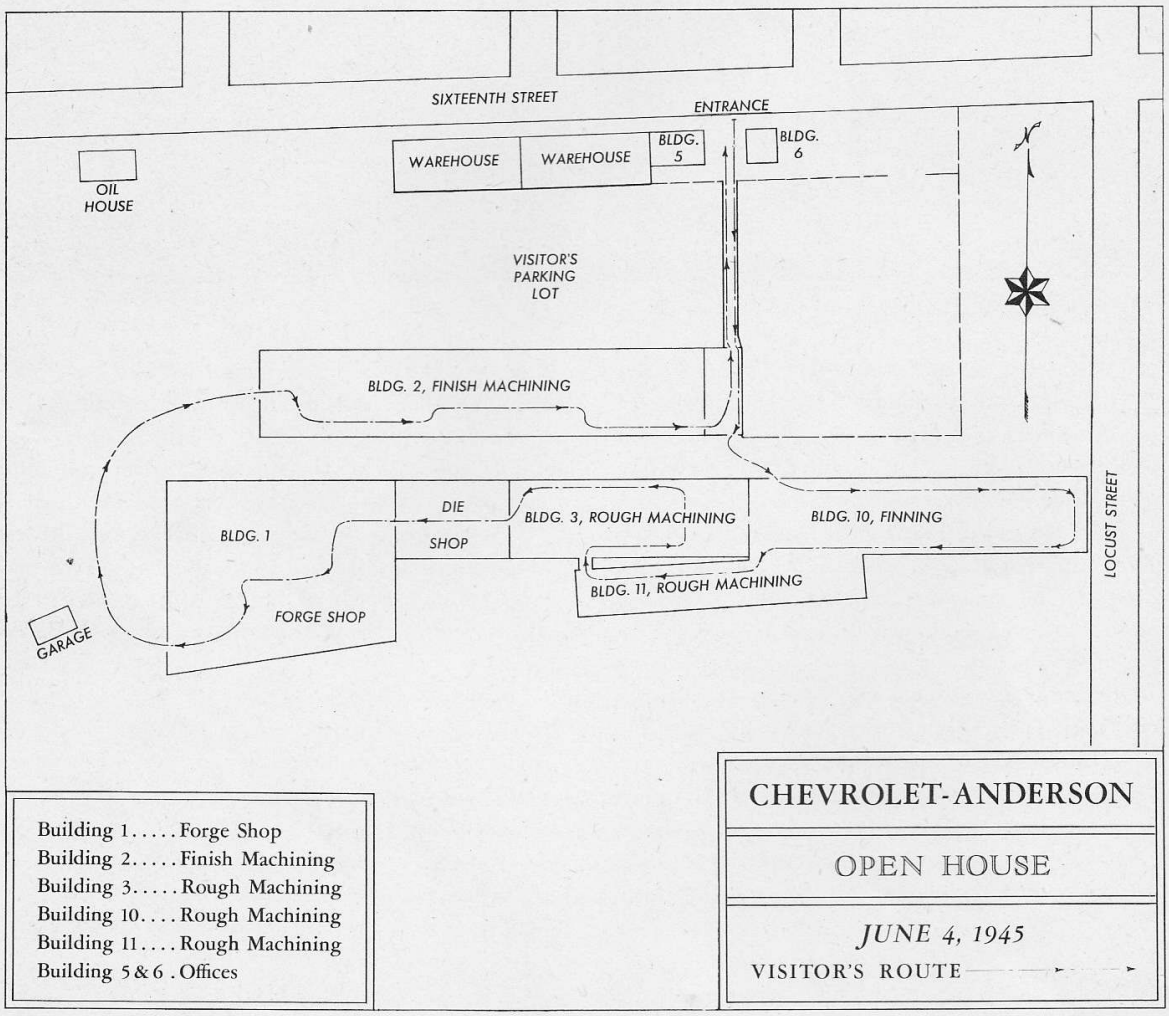
Early in May the machine tools began to arrive, to be installed as fast as they came in. The first finished cylinder left the plant August 29, 1944, but that was only the beginning.

"Production!" was the cry of the Army Air Force officials. "We have to make more!" So even as production went on, greater production was planned and put into effect. Other old buildings were repaired and new machine tools were installed. It wasn't until February, 1945 that the new plant could be considered as finished—until it looked like it does today. That is why you haven't been invited to visit us before—because we weren't ready to ask you to come in. But now you are about to start a tour through buildings that were once like the picture on the left but now look like the one above.

• • •

Turn the pages as you go along and see what we have done.

This is the tour you are about to make



Building 1.....Forge Shop
Building 2.....Finish Machining
Building 3.....Rough Machining
Building 10....Rough Machining
Building 11....Rough Machining
Building 5 & 6 . Offices

CHEVROLET-ANDERSON

OPEN HOUSE

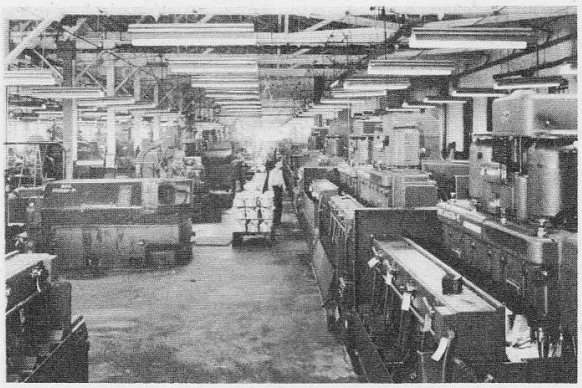
JUNE 4, 1945

VISITOR'S ROUTE

For your safety the aisles have been roped off

Please stay within their bounds

The Finning Building



YOU are now in the Finning Building. (Is it possible that this building looked like that old wreck shown up there in the left hand corner? Yes indeed. Both pictures were taken from the same position.)

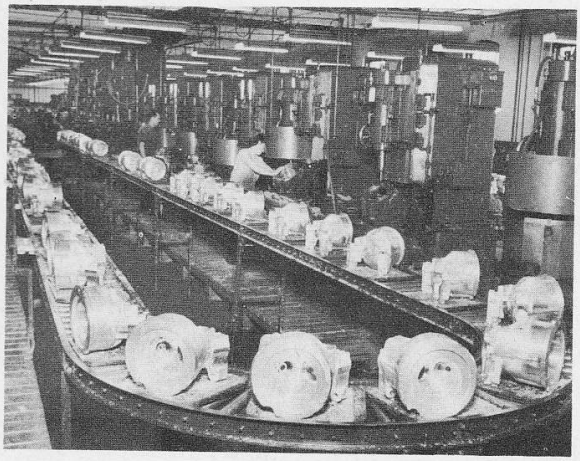
This is where the air cooling fins are "sliced" into the cylinder head. The slicing is done by a saw which rotates at high speed. The cylinder head rotates at the same time, but very slowly. And as the head rotates the saw is moved in and out, its motion guided by a rotating template. (You can see the template, which looks like an odd shaped layer cake, at the right of the machine.)

The fins are cut one "slice" at a time—by a mechanical man who has been created and equipped with a mechanical brain. All the operator has to do is to change the cylinders; the machine does the rest. Note the way the machine moves, all by itself. Note how the saw moves in and out as the cylinder turns. (And the way the layer-cake template turns at the same speed as the cylinder.) If you watch closely you will see the saw come all the way out, move over a space, and begin the next "slice."

This operation is shown in the picture on the left. The picture on the right shows another machine, which operates in the same manner but which cuts the fins across the top of the cylinder head.

The finning operation slices 83 fins on each cylinder head, a total of more than 23 pounds of metal being cut away by the whirling saws.

The Rough Machining Building

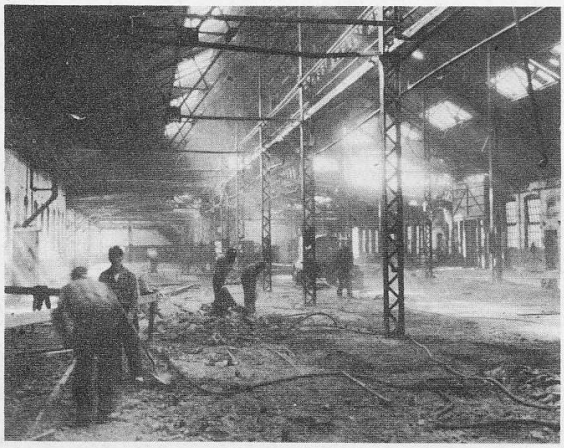


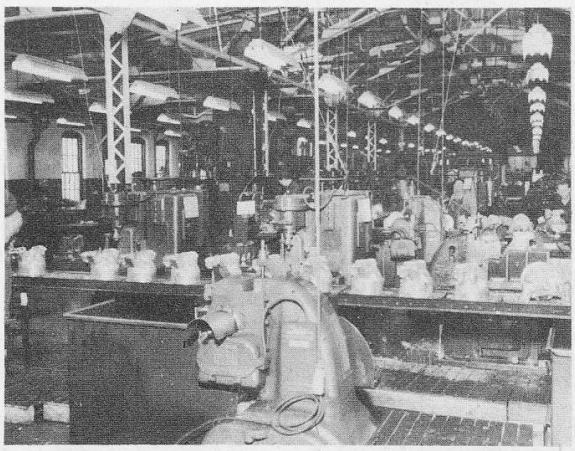
ANOTHER EXAMPLE OF BEFORE AND AFTER

THIS is the Rough Machining Building, so called because it is the place where metal is "hogged out," or cut away in chunks to prepare the cylinder head for the highly accurate finish machining which comes later. The operation might be compared to the work of a woodman, who chops away big chips of wood with his axe to get down to the place where he can finish with a plane. In going through the various operations in this building, each cylinder head loses more than 10¼ pounds of its weight.

The picture across the top of the next page illustrates one of the specially designed machines that have been made for this work. In operation it resembles a merry-go-round. The rough pieces are fastened in a special fixture by the man at the left. The machine is in the form of a square, and the fixtures move around in a clockwise direction. The motion is not a steady one, however. It is a case of move and stop, move and stop. At each stop, or station, as it is called, tools move forward and remove excess metal.

The machine shown above has 20 stations, or stops. At each station is an electrically driven tool, or spindle, which moves forward, rotating as it moves, to perform an operation. (Five of the electric motors may be seen along the right-hand side of the picture.) There are 21 spindles on this machine, some of which have more than one tool. The result is that a total of 41 cuts are made on the cylinder head as it moves around the square, making 20 stops before getting back to the starting point.



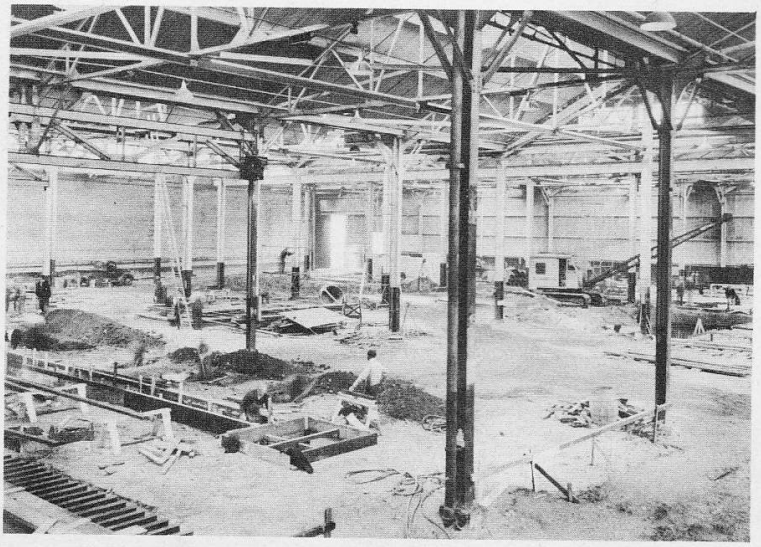


NOTICE THE WAY WE HAVE CHANGED THIS BUILDING

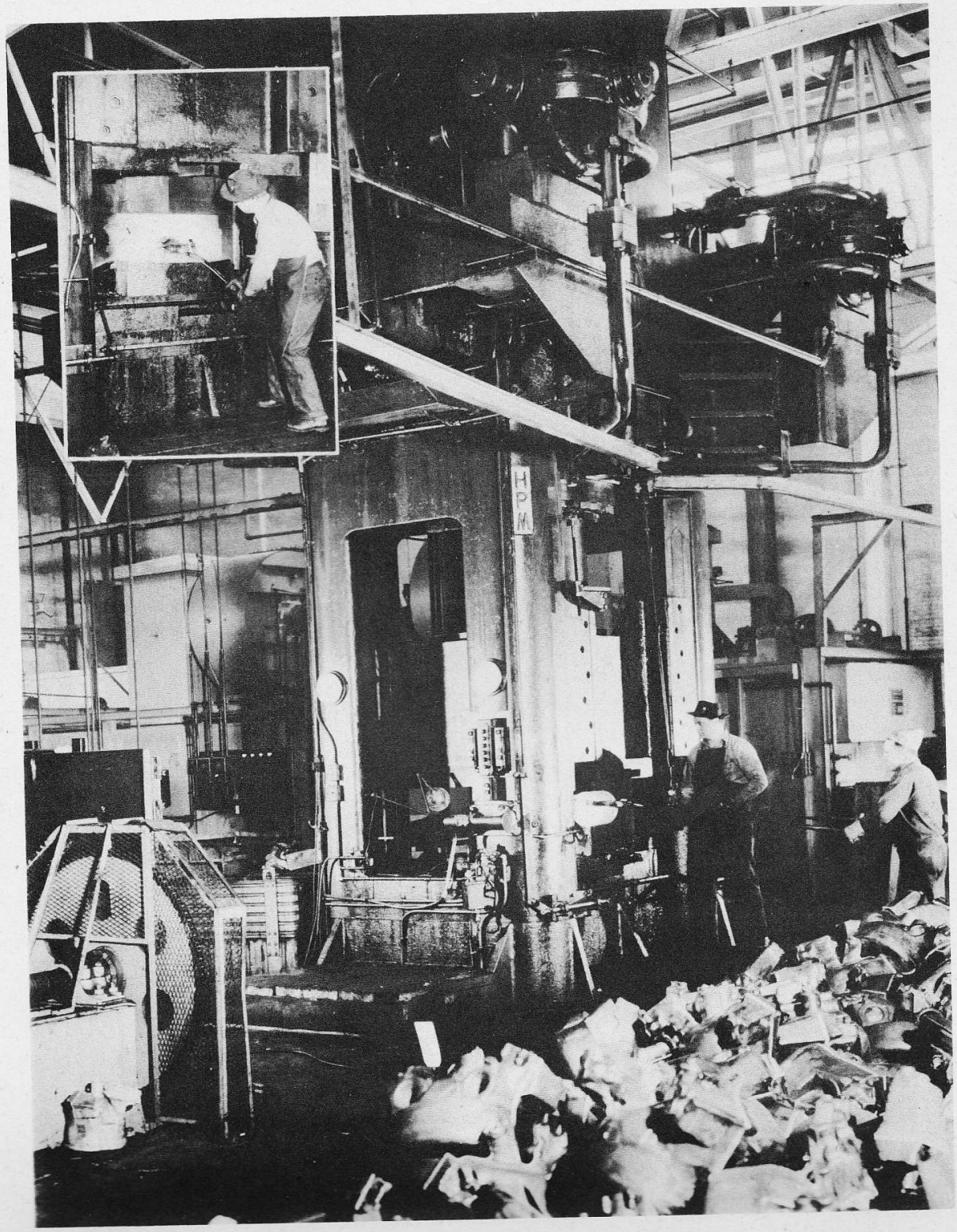
Now you are in the Forge Shop

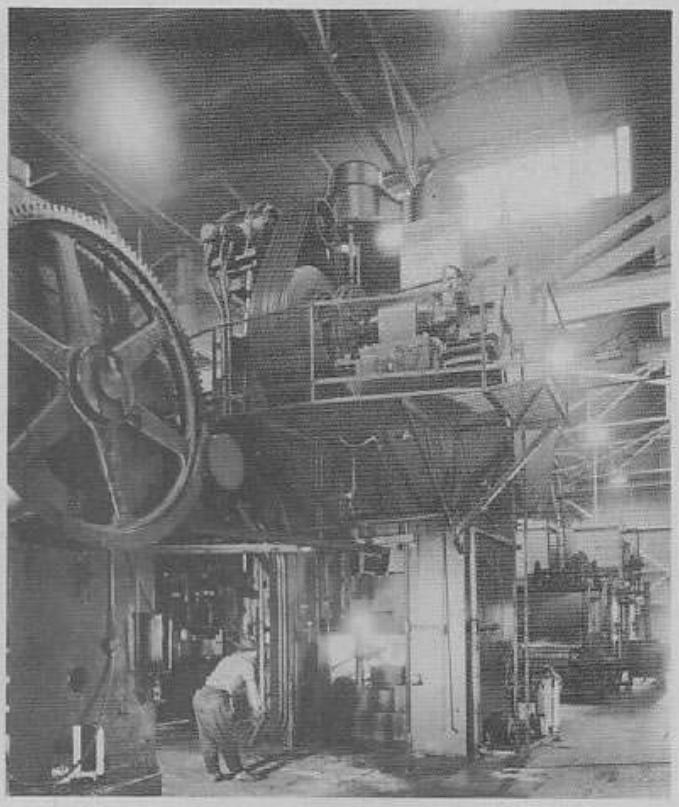
THIS is where the cylinder head really begins—as a round billet of aluminum which, heated to a temperature where the metal is soft, is formed between two dies brought together by an enormous hydraulic press. (The picture on the opposite page.)

The operator of this huge machine controls the tremendous power by pressing his foot on the pedal. (Note the way he does it in the small insert.) When the top die comes down it exerts a pressure of 4 million pounds—and that hot aluminum simply has to flow into place. It is something like kneading a batch of dough, for the hot aluminum flows in the dies just like dough would squeeze around your fingers. When the top die lifts again the cylinder head is formed.

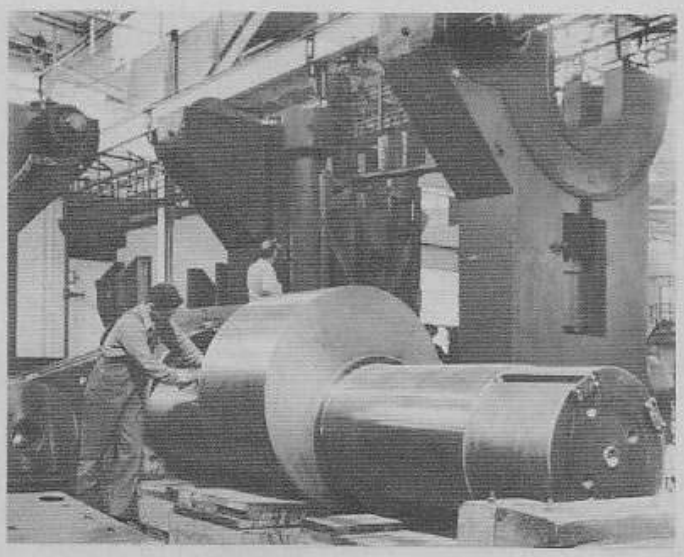


A FEW MONTHS AGO THE SHOP LOOKED LIKE THIS

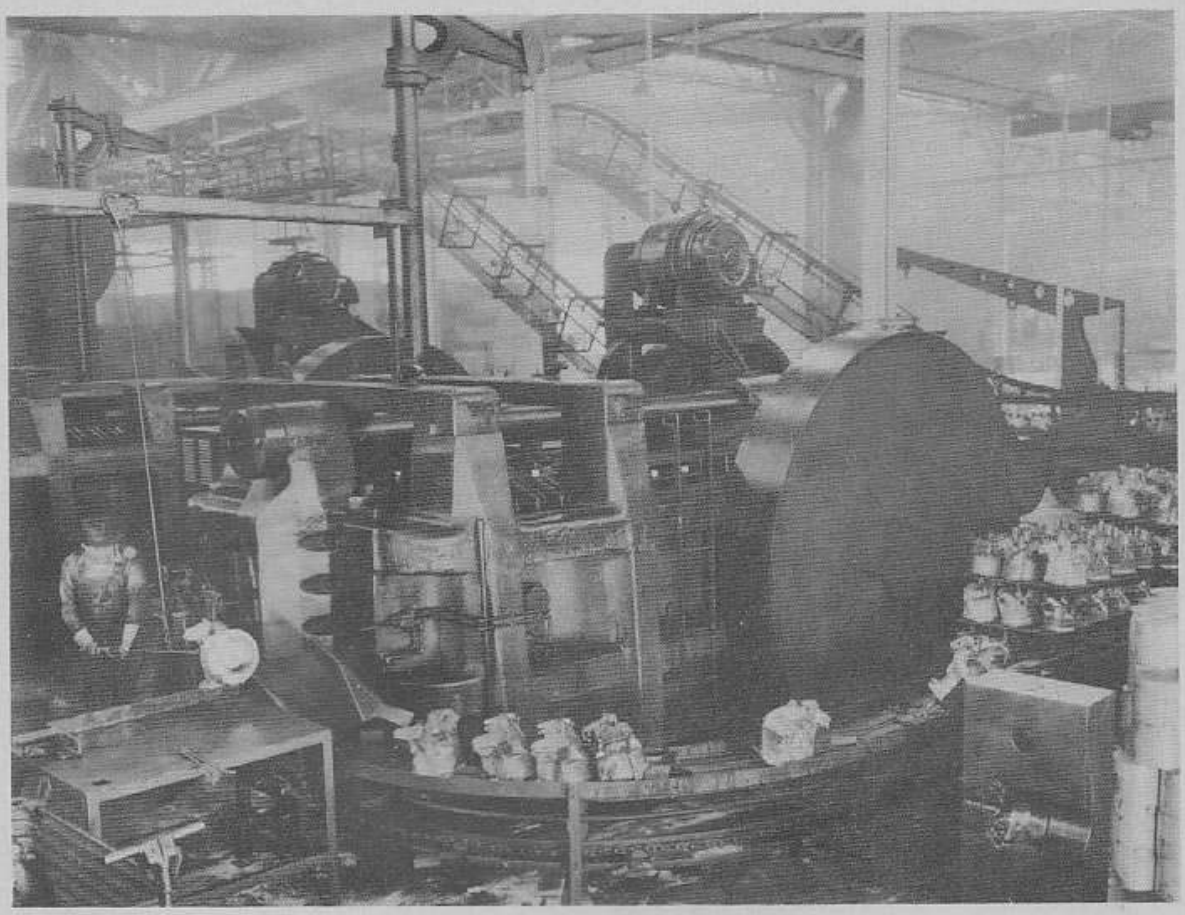

HPM



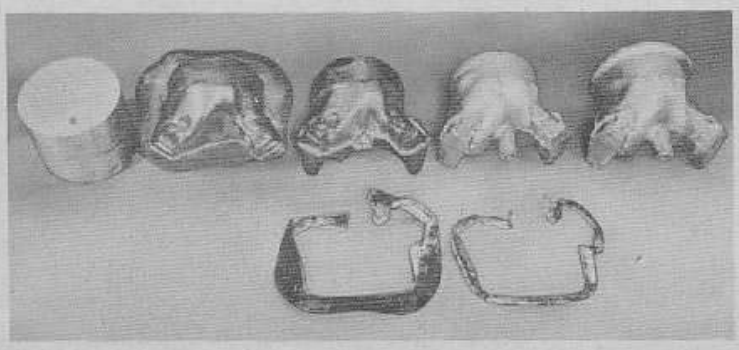
STILL another press is visible on your right. This is not a hydraulic press, it is mechanical; but it is so massively built that it is capable of exerting a pressure of 4,000 tons—8 million pounds, and it is used for the same kneading purposes. To give you an idea of how it is made, notice the picture in the lower left hand corner. The huge piece of steel you see there is called an eccentric, and when it is assembled its ends fit into the two uprights you see behind it. The finished press, which you see in the other picture, weighs a total of 400 tons!



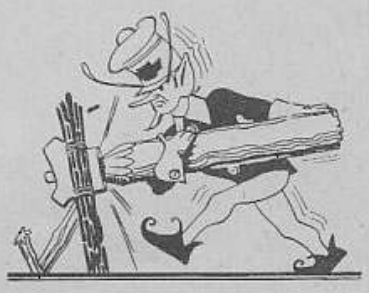
Here the forging which you saw being made in the hydraulic press is given its final shape—we call it "blocking" and "finishing." Notice how quickly the head is formed by the fast action of these presses. Finally we trim away the excess metal, called "flash," and the forging is ready to be cleaned up and inspected for surface defects.

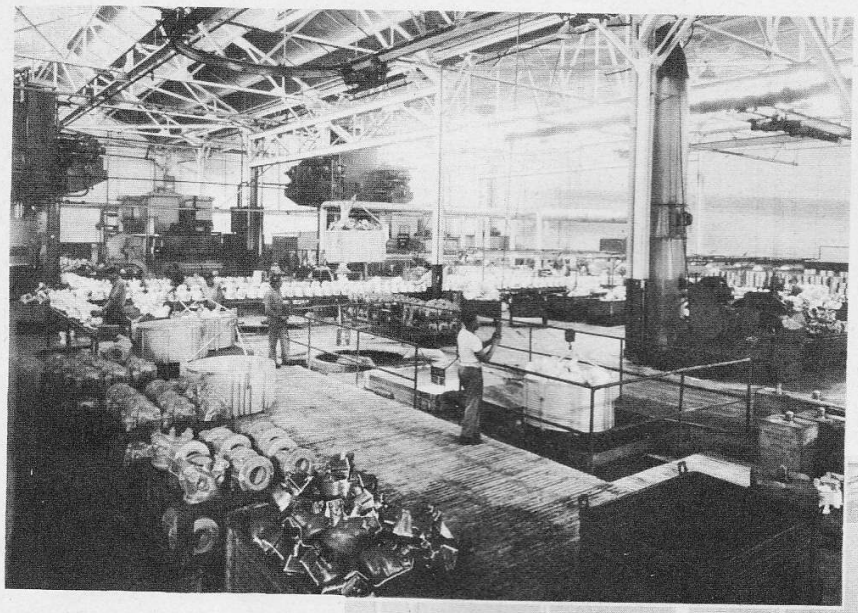


BUT the cylinder head isn't done yet. It is nearly shaped now, but it must be completely formed, so it is sent over to the huge Upsetting machine (the picture immediately above) where it is held firmly by a pair of gripper dies while a big punch comes forward and makes the hole. You can see the hole in the bottom of the cylinder head that the operator is holding. Once more the enormous pressure exerted by this machine is controlled by the operator's foot on a pedal.



THE VARIOUS STEPS IN THE FORGING OF A CYLINDER HEAD

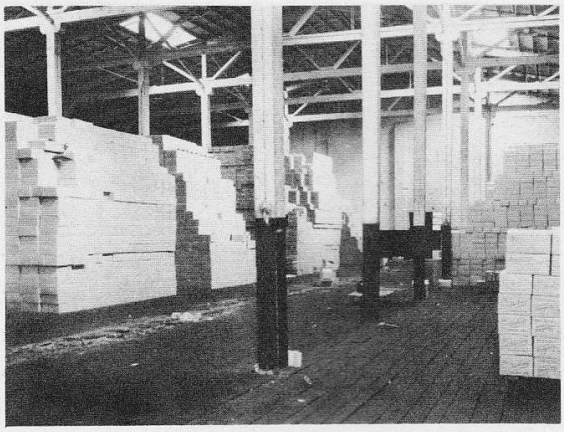


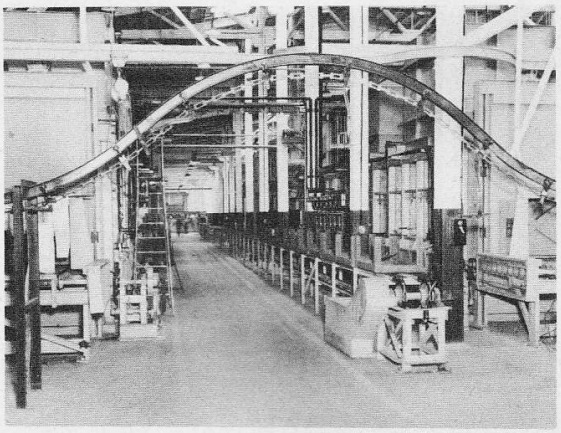


AND NOW our aluminum "dough" has been molded into a finished forging. It has been squeezed between the dies of the huge presses. The flash—the waste metal that comes out between the dies—has been trimmed off in smaller presses. But the forging is not yet ready to be machined, for it is not as strong as it should be.

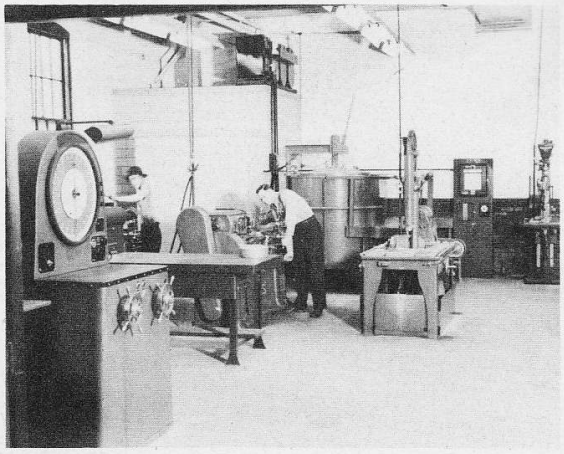
First we must heat treat, or bake the forgings in huge furnaces. (You will see the heat treating furnaces in the next building.) Then they are given another hot bath, as pictured at top, after which they are loaded onto a conveyor and sent over to the filing benches, pictured below. (Imagine having to carry them all!) Here they are "cleaned up" by filing all the rough edges off. And then, and not until then, the forgings are ready to go into the machine shops.

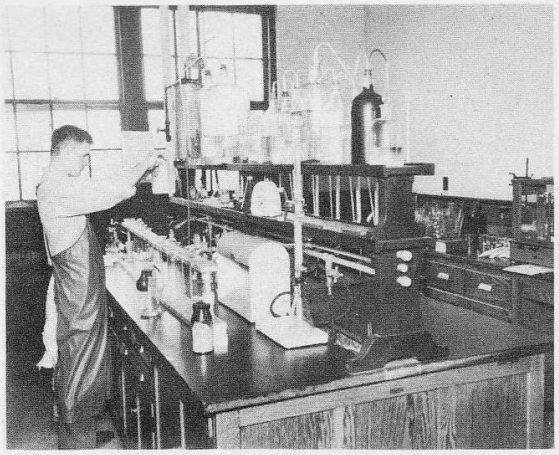
The cylinder head, which at the start weighed close to 70 pounds, has lost 8 pounds in the forging process. Most of the weight of the finished forging is removed in the subsequent machining operations, which result in a finished head weighing only 25 pounds.



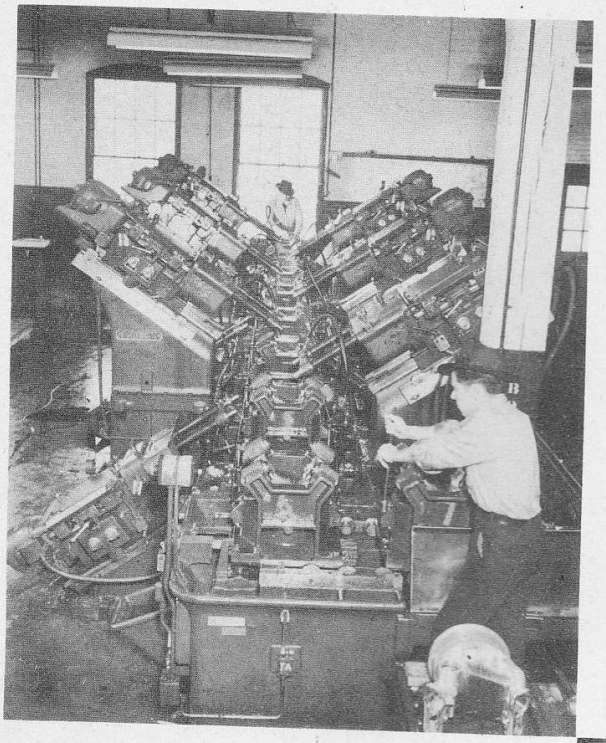


UPON ENTERING the Finish Machining building, which comes next, you will walk beneath the arch made by a conveyor and move along between two long heat treating furnaces. (See the picture on the right above—and compare it with the picture on the left, which shows how the building looked at first.) These furnaces are the ones that put the forgings in proper condition for machining, and believe it or not, the temperature behind those walls is 950 degrees! This is the baking process to which we referred a moment ago, and we have to treat all the forgings this way in order to insure uniform strength throughout the cylinder head. We don't do any guessing about the strength, either, for out of each batch we take a sample and send it back to the laboratories shown below, where we check the condition of the metal for the same reason that the housewife sticks a straw in her cake—to be sure that it is thoroughly baked.



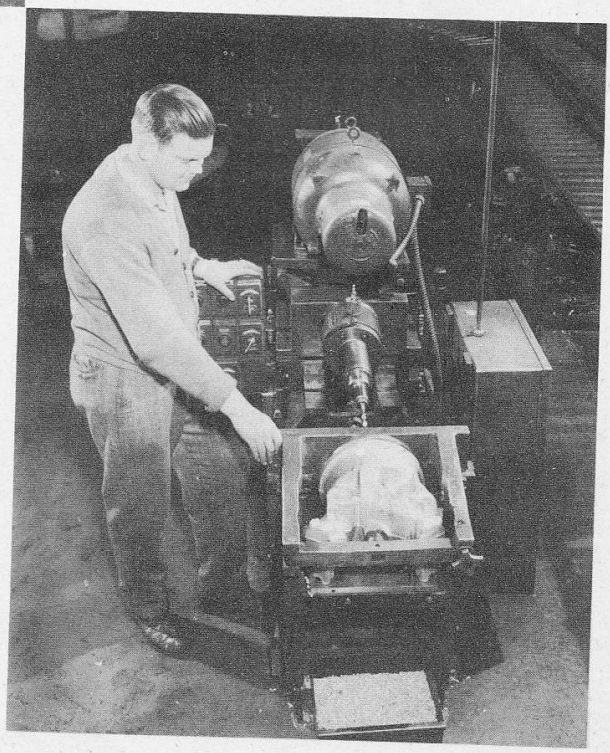


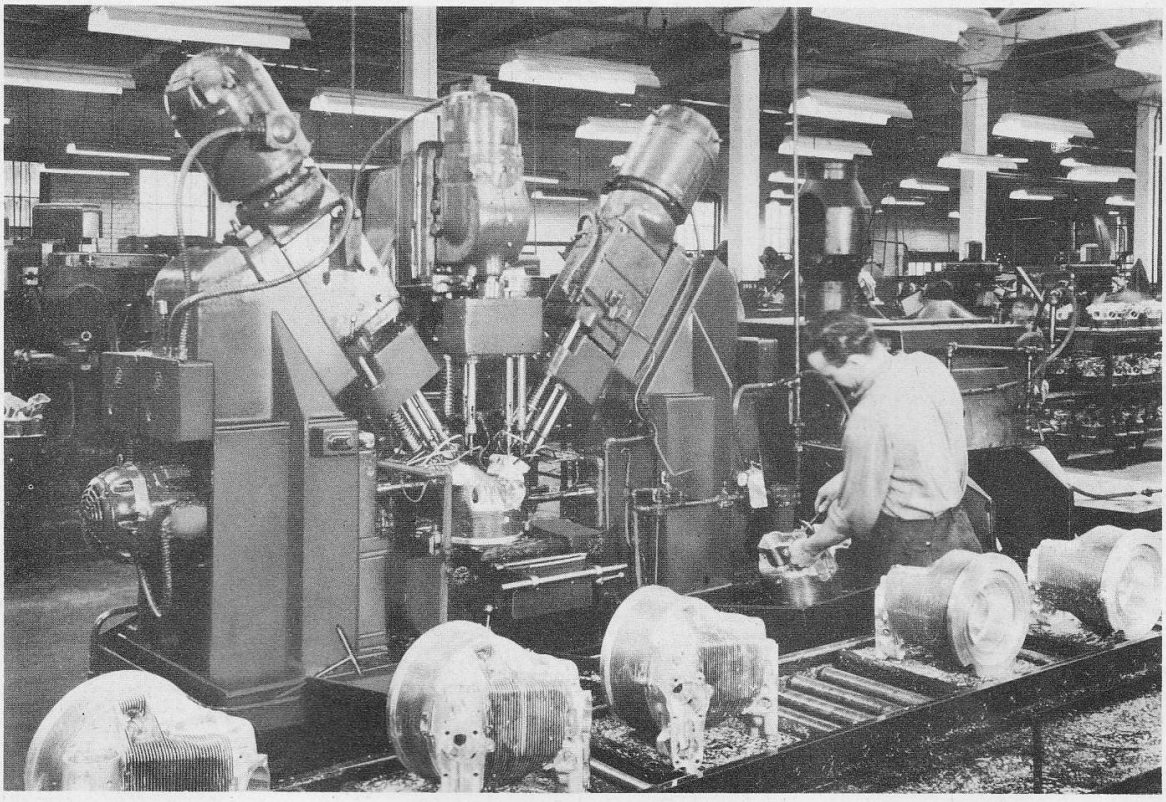
There is no guesswork here. The machines shown in the left hand picture actually pull the metal apart —and measure how much of a pull is required. They also tell you how hard the metal is. The man pictured on the right is using chemicals to check the ingredients of the metal.

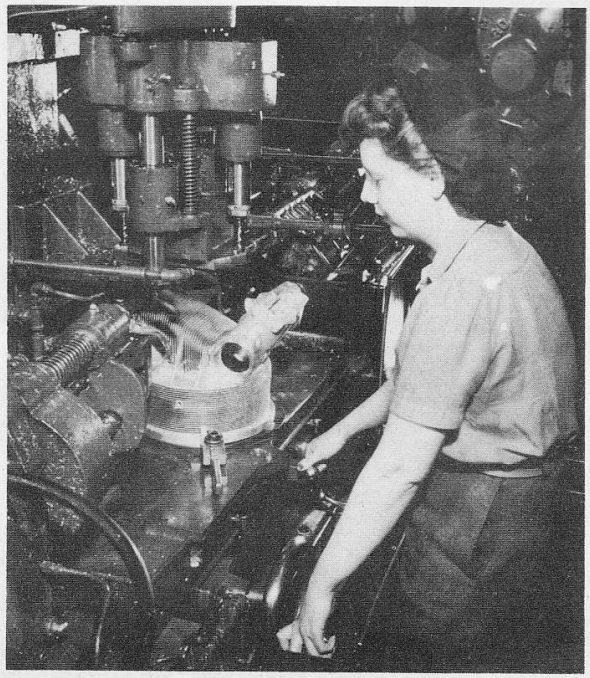


AND now you come to the Finish Machining, an operation through which all the cylinder heads must go before they are accepted by the Army Air Force inspectors and shipped out as completed products. Here is where the finest and most delicate machine work is done. Here is where an inch is split into thousandths and each thousandth assumes the importance of a mountain. For the cylinder head, like every other part of this high-powered engine, has to be as near perfection as man and machine can make it. The tolerances, or variations in size, are therefore held to plus or minus a thousandth of an inch in some instances—less than one-third the thickness of this page! In some cases there can be no variation at all in the dimensions.

The picture above shows another one of those intricate machines that performs many operations automatically. This machine is not as large as those you have already seen. It has only 18 stations and makes only 36 cuts on its 12 spindles. But each of these cuts is so fine that a split-hair dimension is very important. The picture on the right shows another operation which is known as reaming. In other words, it refinishes a hole that has already been drilled—just to make sure that the dimension is absolutely correct.

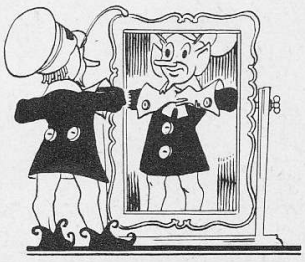




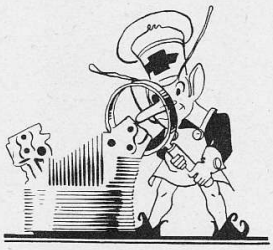


STILL another operation—or rather, group of operations—is done on the machine pictured above. Here the cylinder head is mounted on the machine and a total of 25 drilling and tapping operations are done without moving the piece.

You will doubtless notice other high precision operations as you continue down the aisle, any one of which could "make or break" the finished piece. The one pictured at the left is typical. And then you come to the place where all the work is accepted or rejected—the final inspection line.



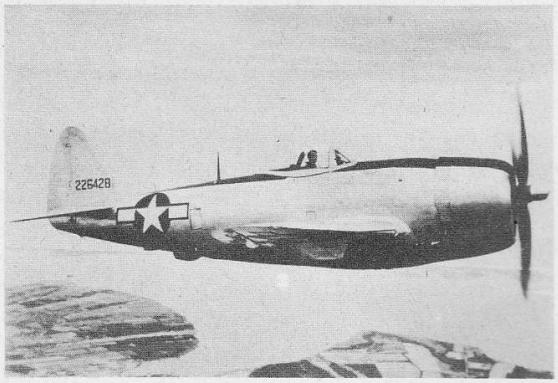
IT IS HERE that all the effort spent in transforming that first 70 pound chunk of aluminum into the 25 pound precision cylinder is found to be either good or bad. It is here that every dimension is checked for accuracy by our trained inspectors before the piece is packed in a box and sent on its way to another Chevrolet plant for final assembly into an engine. Notice the man on the left. He is testing a hole for size with a "Go and No Go" gauge. If the "Go" gauge fits and the "No Go" fails to fit, all is well. If this test fails the piece must be rejected.



Every head goes down that inspection line, every person there gives it a different inspection, and when it leaves there it is ready to ship. A total of 28 forging operations have been expended on the original chunk of aluminum, and to it have been added a total of 439 machine operations and 47 hand operations. The grand total of operations performed therefore reaches 514; the total number of inspections, not only during its machining but afterward, is 229, with the Air Force inspectors having the final say. The finished cylinder head is later assembled to something like 5,000 other parts to make the powerful engine shown on Page 3.

HAS THE WORK been well done? It has to be, otherwise the engine could not be assembled. Are we doing a necessary job? We must be, otherwise our Government would not have asked us to do more, and more, and more. The long line of assembled engines shown here is where the cumulative effort of several Chevrolet plants like ours is finally brought together.

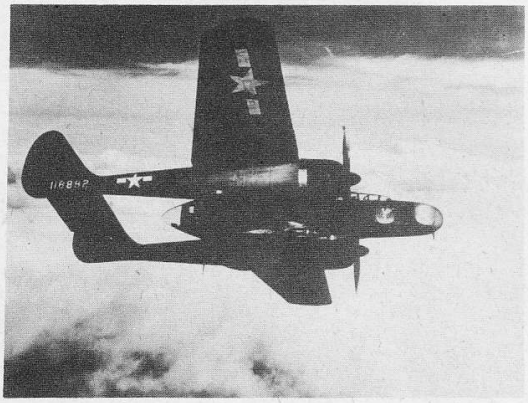
And the engines into which our cylinder heads go are supplying power for these



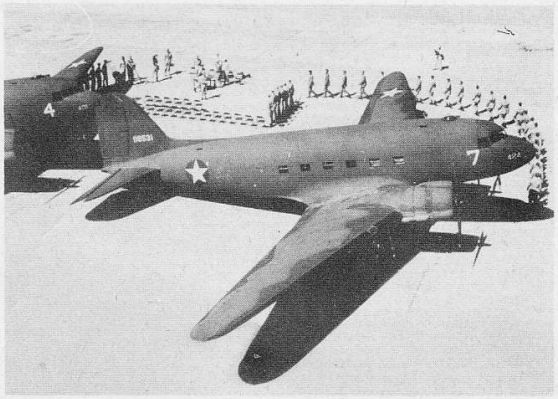
P-47 Thunderbolt; a fighter which can carry a 1,000 pound bomb under each wing.

C-82 Packet; called the "Flying Boxcar" because it can carry heavy and bulky equipment.

A-26 Invader; with an all-purpose nose allowing complete interchangeability of armament to adapt the plane to various missions.



P-61 Black Widow Night Fighter.

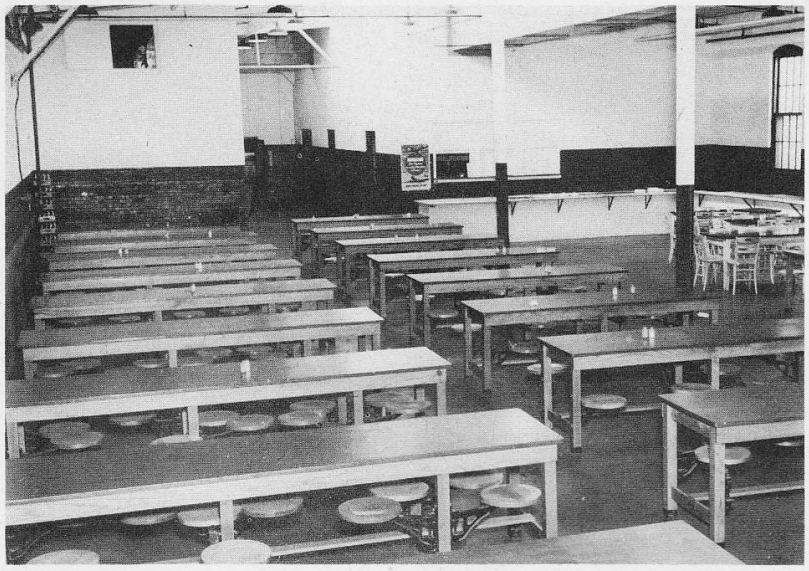


C-46 Commando; carries men and materials wherever they may be needed.

And now about us

We've been busy, of course. We've worked hard. A lot of us have worked overtime. Especially during those hectic days when we were remodelling buildings, laying out manufacturing processes, and designing machine tools. We had to order them, get them rushed to us and finally put them in place. There were also many times when, because schedules were stepped up, we had to reorganize our buildings in order to expand production lines and meet the calls for more and more.

During this period we installed some facilities that you have not seen:



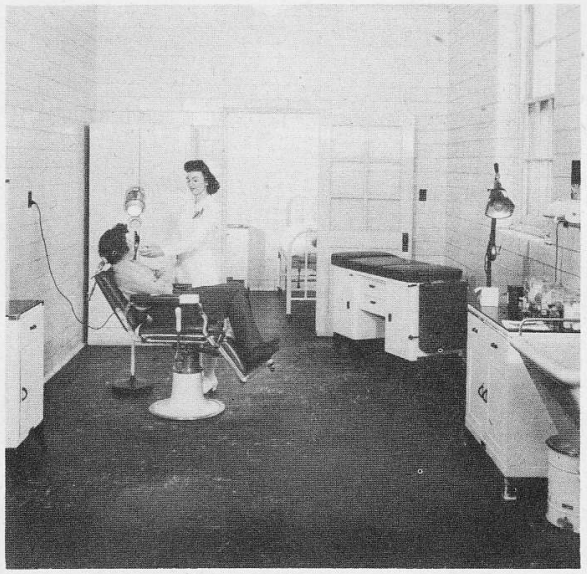
One of them is

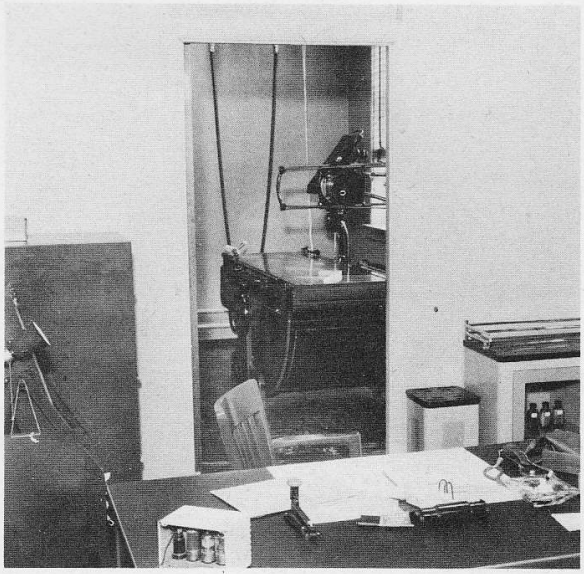
The Plant Cafeteria

Another is

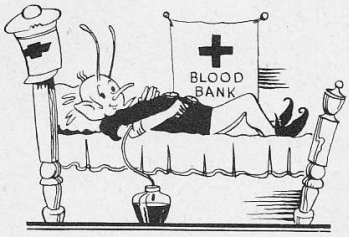
The Plant Hospital

with its first aid room (lower left) . . . and the x-ray room (below).





We've been busy at other things, too



We've taken part in the Y. M. C. A. membership drive, having donated junior memberships for poor children who are selected by the principals and superintendents of Anderson schools.

We have been blood donors since the plant's inception.

We have contributed to the War Chest of 1944, achieving third place in total contribution in our county.

We subscribed 110% of our quota in the 4th War Loan. We followed that with a 144.83% subscription in the 5th War Loan, to achieve 3rd place among the 120 divisions of the General Motors Corporation. On the 6th War Loan we beat that record with 156.12% of our quota, maintaining our 3rd place position in General Motors. And the 7th War Loan—well, it's not all in yet but we're mighty proud of our record thus far.

There's the recently completed Red Cross Drive, too. We contributed an average of $2.61 for each employe in the plant, to place us first in Anderson on that basis.

THE GIRLS BOWLED IN THE CLASSIC LEAGUE

And we've had time for fun, too

We've had a basket ball team in the Industrial League, a team which was in second place when the season ended. Unfortunately it was camera shy so we cannot reproduce its picture here. We've had three bowling teams competing regularly.

We eat our lunches in the plant cafeteria, which has not been included in your tour but is conveniently located. For medical attention we go to the plant hospital, which has also been left out of the tour but which has the facilities pictured. We also have an x-ray room for further examinations.

THESE TEAMS KNOCKED 'EM OVER IN THE INDUSTRIAL LEAGUE

Then there's the soft ball team, already formed and ready to go when the summer schedule starts in the Industrial League.

AND NOW you've seen our plant.

We have marked out the tour to save steps rather than to follow the cylinder heads from start to finish. But you have seen practically everything we have from the chunky aluminum billet that we purchase all the way to the finished cylinder head which, carefully packed in paper cartons, is shipped away to Buffalo and final assembly.

We are proud of the way everybody has pitched into this job. We are glad to have you see what fine work our folks are doing. We hope you will want to keep this book as a souvenir of your visit.

HONOR ROLL

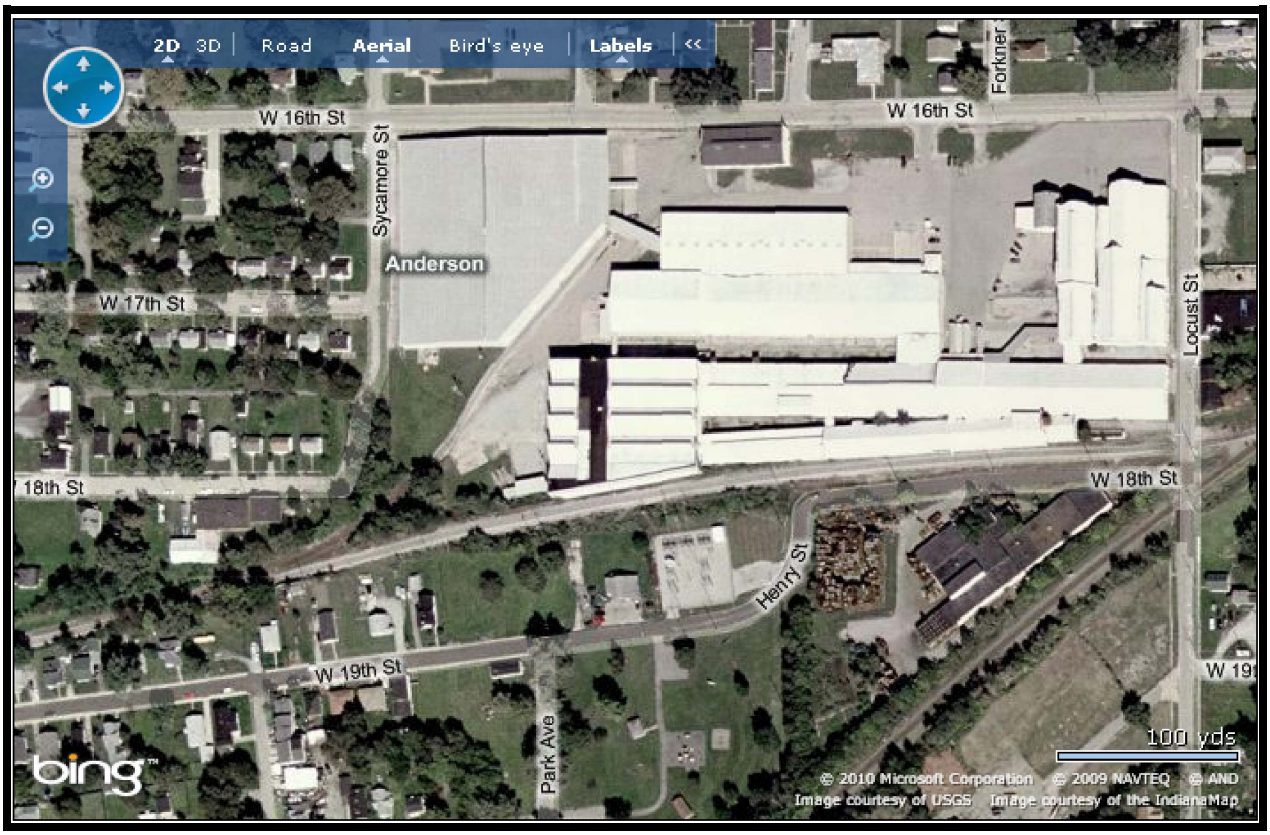
★

ALVA C. SHEPARD
(Gold Star)

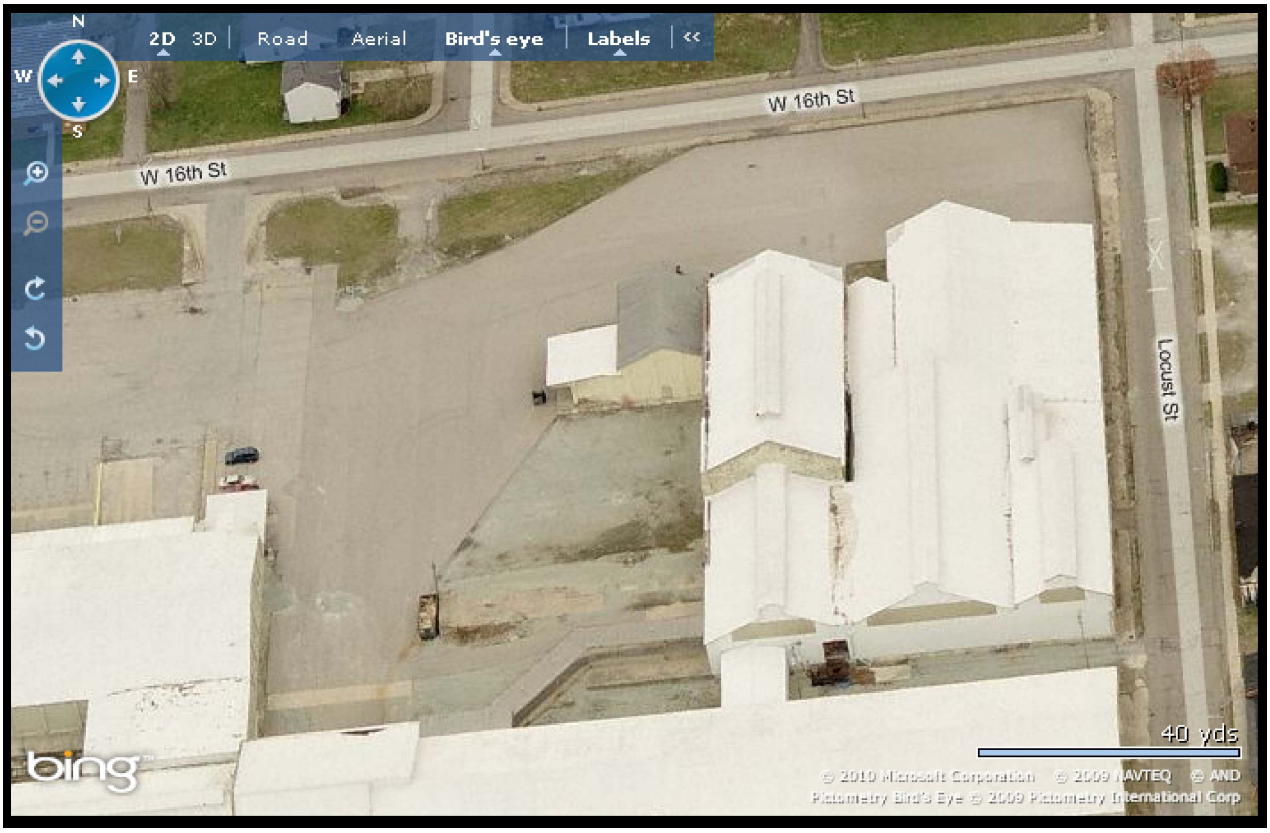
★

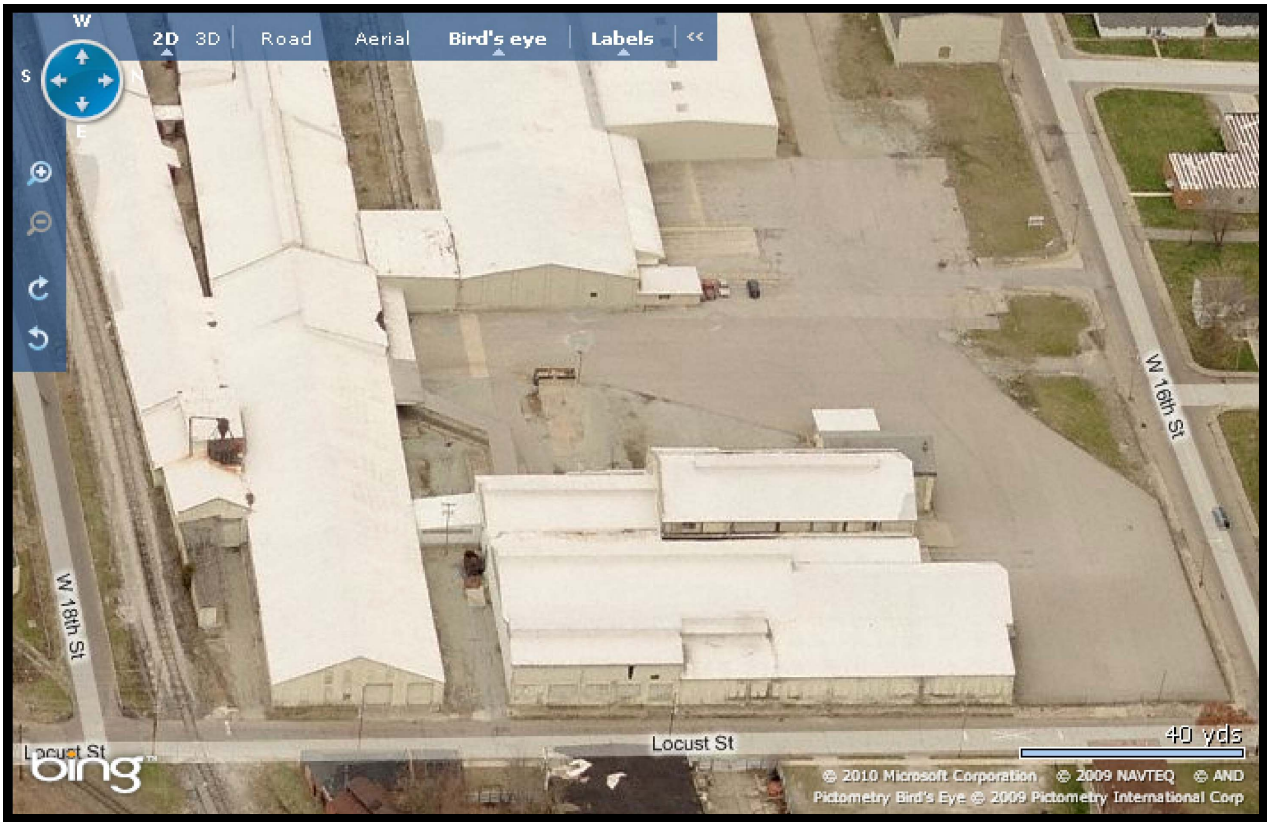
ROBERT E. BOERNER
FOWLER E. BOYD
JAMES H. COMBS
SHERMAN E. EULER
ROBERT M. FIFER
WINTFORD G. FOSTER
CARLOS W. FRANCE
MAX E. GAMBREL
JAMES C. HEDGE
MEREDITH S. HUGHES
WILLIAM R. HUNTER
HARRY S. JACKMAN
ROBERT E. JACKSON
J. D. JOHNS
VIRGIL E. LANNING
JOE F. LEWIS
JACK R. MARTIN
SAMUEL F. MITCHELL
KENNETH W. MYERS
WILLIAM L. RETZ
GARLAND A. RIX
CLARENCE E. ROSS
LOWELL M. STONE
JACK H. STOUT
WILLIAM E. TAYLOR
FRANKLIN G. TOBIN
REUBEN A. WHITE
JAMES W. YOUREE
HAROLD W. ZIRKLE

End of Flyer



Pictures of some of the buildings that exist tody - copied 2/13/2010 from Microsoft bing site





Pictures of some of the buildings that exist tody - copied 2/13/2010 from Microsoft bing site