

these plants fell from 175,000 tons in April to 5,000 tons in September. In the same period stocks of motor and aviation gasoline fell by two-thirds, and only drastic curtailments in consumption kept them from falling still further. As in the case of ball bearings and aircraft, the Germans took the most energetic steps to repair and reconstruct oil plants. As many as 350,000 men were engaged in reconstruction projects and the building of underground plants, but these measures proved of little value. Reconstructed plants were soon re-attacked, while underground plants even at the end of the war produced but a fraction of Germany's then minute oil supply.

The attacks on the synthetic oil plants were found to have cost Germany a considerable part also of her synthetic nitrogen, methanol and rubber supply. These products were either produced in conjunction with synthetic oil or their manufacture required by-products of oil production. By the end of the year synthetic nitrogen output was reduced from a pre-raid level of over 75,000 tons to 20,000 tons monthly. The Germans were forced to curtail the use of nitrogen in agriculture, and then to cut supplies used for the production of explosives. Methanol production also necessary for explosives manufacture was similarly cut. These shortages were largely responsible for the 20 percent loss of ammunition production in the last half of 1944.

By the end of 1944 synthetic rubber production had been reduced to approximately 15 percent of the January-April average. Had the war continued, Germany's rubber position would have become critical. No indication was found, however, that the rubber shortage was a limiting factor on German war production or on the movement of the German army before the war ended.

The raids on the aircraft industry continued in the summer months of 1944, and their center of gravity shifted from assembly plants to engine production. This was more vulnerable than assembly owing to the greater difficulty of dispersal and the lack of excess capacity in the industry. Aircraft production in December was only 60 percent of what it had been in July and the total loss of output for the period due to both direct and indirect effects of bombing can be put at about 25 percent.

The attacks on panzer production set back an ambitious expansion program and caused a 20 percent loss of output in the latter half of 1944. The motor vehicle attacks also caused a 20 percent loss in production, but reduced the total stock of trucks and

passenger cars by only 4 percent. Motor transport was undoubtedly more limited by the gasoline shortage than by this reduction in the vehicle supply.

The heavy attack on the Ruhr area in the last quarter of 1944 reduced its steel output by 80 percent. Total German steel production (including that of the occupied territories) declined from 2 million tons in September to 1 million tons in December. Approximately 80 percent of this decline was due to air attack. Although production continued to fall to the end of the war, the steel shortage—overshadowed by the transportation breakdown—was not a significant causal factor in the decline of munitions output.

The attack on transportation beginning in September 1944 was the most important single cause of Germany's ultimate economic collapse. Between August and December freight car loadings fell by approximately 50 percent. The progressive traffic tie-up was found to have first affected commodities normally shipped in less than full trainload lots, finished and semi-finished manufactured goods, components and perishables. The effects of the attack are best seen, however, in the figures of coal transport, which normally constituted 40 percent of rail traffic. Shipments by rail and water fell from 7.4 million tons in August to 2.7 million tons in December. By March coal shipments were scarcely adequate even for the needs of the railroads. The operation of Germany's raw material industries, her manufacturing industries, and her power supply were dependent on coal. By January their stocks were becoming exhausted and collapse was inevitable.

The index of total munitions output reached its peak in July 1944 and fell thereafter. By December it had declined to 80 percent of the July peak, and even this level was attained only by using up stocks of components and raw materials. Air raids were the main factor in reducing output, which in their absence would probably have risen. A loss of armaments output somewhat above 15 percent can be credited to bombing in the last half of 1944. This compares with a 5 percent loss for the last half of 1943 and a 10 percent loss for the first half of 1944.

By the third quarter of 1944 bombing had succeeded in tying down a substantial portion of the labor force. This diversion amounted to an estimated 4.5 million workers, or nearly 20 percent of the nonagricultural labor force. This estimate includes 2-1/2 million workers engaged in

debris clearance, reconstruction and dispersal projects and in other types of activity necessitated by bombing, 1 million workers engaged in replacing civilian goods lost through air raids, and slightly less than 1 million workers in the production and manning of anti-aircraft weapons. Air raid casualties were not numerous. By the middle of 1944 they had reduced the labor force by not more than 250,000 or less than one percent. Late in 1944, the diversion of laborers due to bombing began to lose importance because the disintegration of the economy had reached a point at which the full utilization of the total labor force was no longer possible.

As to the effects of bomb damage on the civilian economy, there is no evidence that shortages of civilian goods ever reached a point where the German authorities were forced to transfer resources from war production in order to prevent disintegration on the home front. It was not until the end of 1943 that the area raids of the RAF had caused important shortages in certain segments of the civilian economy; and even for the whole of 1944, the output of manufactured consumer goods was only slightly below that of 1943. The most that can be said is that bombing destroyed a substantial part of the consumer goods cushion and thereby prevented the further conversion of the civilian economy to war production in 1944.

THE COLLAPSE

From December 1944 onwards, all sectors of the German economy were in rapid decline. This collapse was due to the results of air raids working in combination with other causes. The armament index fell from 322 in July to 263 in December and 145 in March (the last month for which records are available).

These figures fail to show, however, the full extent to which the situation had deteriorated. During the process of contraction the shrinkage in final output always lags behind the shrinkage in productive activity. Some production of finished munitions could be temporarily maintained because of the relatively large stocks of semi-finished products, at least for as long as the minimum coal and power requirements of the munitions industries could be covered. After the end of March this was no longer possible. Even in February 1945, coal deliveries, partly through the loss of Silesia and the Saar, fell to 25 percent of normal. In March they fell to 16 percent and, by the end of the month, to only 4 percent of normal.