In [16]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt

from statsmodels.tsa.arima.model import ARIMA
from statsmodels.stats.diagnostic import acorr_ljungbox
from sklearn.metrics import mean_absolute_error, mean_squared_error
```

In [17]:
```
df = pd.read_excel(r"C:\Users\HP\OneDrive\Desktop\NLP\Data\ML470_S3_Diabetes_Dat

col = df.select_dtypes(include=np.number).columns[0]
series = df[col]

print("Using column:", col)
```

```
Using column: Fasting blood
```

In [18]:
```
series.index = pd.date_range(
    start="1988-01-01",
    periods=len(series),
    freq="M"
)
```

```
C:\Users\HP\AppData\Local\Temp\ipykernel_18336\2715841663.py:1: FutureWarning:
'M' is deprecated and will be removed in a future version, please use 'ME' instea
d.
  series.index = pd.date_range(
```

In [19]:
```
train_size = int(len(series) * 0.8)

train = series.iloc[:train_size]
test = series.iloc[train_size:]
```

In [20]:
```
model = ARIMA(train, order=(2, 1, 2))
model_fit = model.fit()

print(model_fit.summary())
```

```
                                SARIMAX Results
==============================================================================
Dep. Variable:          Fasting blood   No. Observations:                  601
Model:                 ARIMA(2, 1, 2)   Log Likelihood                -861.663
Date:                Fri, 30 Jan 2026   AIC                           1733.327
Time:                        11:48:41   BIC                           1755.311
Sample:                  01-31-1988   HQIC                          1741.885
                       - 01-31-2038
Covariance Type:                 opg
==============================================================================
                 coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------
ar.L1         -0.9065      0.251     -3.611      0.000      -1.399      -0.415
ar.L2          0.0477      0.040      1.193      0.233      -0.031       0.126
ma.L1         -0.0480      0.250     -0.192      0.848      -0.537       0.441
ma.L2         -0.9501      0.249     -3.809      0.000      -1.439      -0.461
sigma2         1.0250      0.069     14.886      0.000       0.890       1.160
===================================================================================
==
Ljung-Box (L1) (Q):                   0.00   Jarque-Bera (JB):                28.
82
Prob(Q):                              0.99   Prob(JB):                         0.
00
Heteroskedasticity (H):               1.05   Skew:                             0.
51
Prob(H) (two-sided):                  0.74   Kurtosis:                         2.
69
===================================================================================
==

Warnings:
[1] Covariance matrix calculated using the outer product of gradients (complex-st
ep).
```

In [21]:
```
ljung_box = acorr_ljungbox(model_fit.resid, lags=[10], return_df=True)
print("\nLjung-Box Test:\n", ljung_box)
```

```
Ljung-Box Test:
      lb_stat  lb_pvalue
10  4.388176   0.928142
```

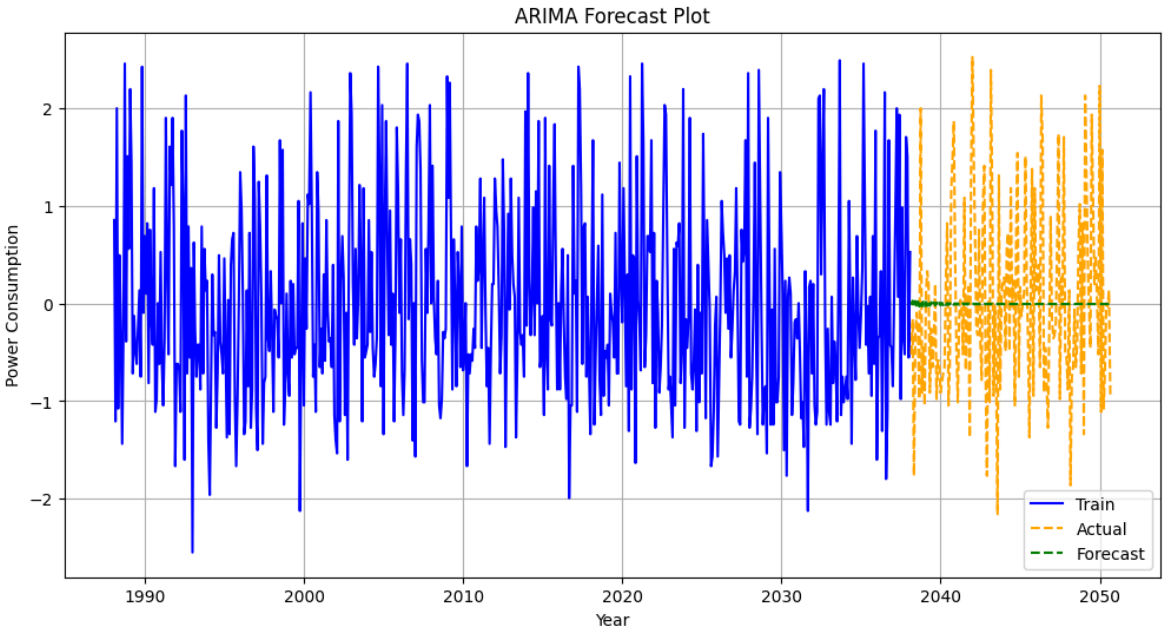
In [22]:
```
forecast = model_fit.forecast(steps=len(test))
forecast.index = test.index
```

In [23]:
```
mae = mean_absolute_error(test, forecast)
rmse = np.sqrt(mean_squared_error(test, forecast))
mape = np.mean(np.abs((test - forecast) / test)) * 100

print("\nMAE :", mae)
print("RMSE:", rmse)
print("MAPE:", mape)
```

```
MAE : 0.751340875531347
RMSE: 0.9491135087979957
MAPE: 103.94448416657988
```

In [24]:
```
plt.figure(figsize=(12, 6))

plt.plot(train.index, train, label="Train", color="blue")
plt.plot(test.index, test, label="Actual", color="orange", linestyle="--")
plt.plot(forecast.index, forecast, label="Forecast", color="green", linestyle="-
```

```
plt.title("ARIMA Forecast Plot")
plt.xlabel("Year")
plt.ylabel("Power Consumption")
plt.legend()
plt.grid()
plt.show()
```



In [25]:
```
residuals = test - forecast

plt.figure(figsize=(12, 4))
plt.plot(residuals.index, residuals)
plt.axhline(0, linestyle="--")

plt.title("Residuals")
plt.xlabel("Date")
plt.ylabel("Residuals")
plt.grid()
plt.show()
```